

**EPA Superfund
Record of Decision:**

**TAR CREEK (OTTAWA COUNTY)
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OU 02
OTTAWA COUNTY, OK
08/27/1997**

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
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AUGUST 1997

RECORD OF DECISION
CONCURRENCE DOCUMENTATION

FOR THE

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

**DECLARATION
TAR CREEK SUPERFUND SITE
OTTAWA COUNTY OKLAHOMA
RESIDENTIAL AREAS
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:

- S** Excavation of lead-contaminated surface soil in residential areas;
- S** Replacement of excavated soil with clean soil and restoration of the remediated areas;
- S** 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;
- S** Covering or replacement of mining waste in traffic areas located near residences;
- S** Restriction of access to mining waste areas located near residences by use of physical barriers (e.g., fences and warning signs); and,
- S** 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.

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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 1939 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 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 (eg., 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 (eg., 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/m³ (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)1. 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 1-61. 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 $\circ$ 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) at mining sites have tended to increase. 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 this 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 than 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 900 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 if 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 shear 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 an 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 ^o 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 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 implementability, 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 these 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 POD, 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 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 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 than 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 contracting 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 another 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.

TABLES
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.]

Media	Study Group (PPM 1)			Reference Area (PPM)		
	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	\$50,000	\$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**

Requirement	Citations	Prerequisite
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 archaeological 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.
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		

FIGURES

APPENDIX A

THE RESPONSIVENESS SUMMARY

Tar Creek Superfund Site Ottawa County, Oklahoma Residential Areas

This Responsiveness Summary has been prepared by the U.S. Environmental Protection Agency (EPA) to provide written responses to comments submitted regarding the Proposed Plan of Action for the residential areas of the Tar Creek Superfund Site (the "Site"). The summary is divided into two sections as follows:

Section I: Background of Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during the remedial planning activities at the Site.

Section II: Summary of Major Comments Received. The comments, both oral and written, are summarized and the U.S. Environmental Protection Agency's (EPA) responses provided. Section II is divided into Part A and Part B. Part B consists of responses to major written comments from mining companies that formerly operated at the Site (or their successors) and the U. S. Department of the Interior (DOI). Part A consists of responses to all the other major comments both oral and written.

I. Background of Community Involvement and Concerns

Interest in the residential response actions at the Tar Creek Superfund Site on the part of the residents, local communities, and local government officials has been moderate compared to other Superfund sites. Community relations activities at the Site have a long history. The Site was proposed for the National Priorities List (NPL) in July 1981. The Site was included on the NPL in September 1983. Community relations activities supporting the Operable Unit 1 Record of Decision, were scaled back after completion of construction related to Operable Unit 1 in December 1986. Community relations activities were increased again in 1994 because EPA began new response actions at a new operable unit at the Site. The new response actions were based on investigations which were recommended in the Five-Year Review which was issued by EPA in April 1994. A Community Relations Plan (CRP) was published and released to the public in June 1995. The CRP was prepared in order to identify and address community concerns. Copies of the CRP are located in the information repositories at the Miami Public Library in Miami, Oklahoma, and in the EPA Region 6 Office in Dallas, Texas. The public may review the CRP at those locations during normal business hours. The CRP identified found that the primary interest in the Tar Creek Superfund Site lies mostly with the residents and local community leaders who live on or near the Site.

II. Summary of Major Comments Received, Part A

The EPA conducted an open house public meeting on February 27, 1997, to inform the public of the findings of the Residential Remedial Investigation and Feasibility Study (RI/FS) reports including the results of the Baseline Risk Assessment. A public notice announcing the public comment period regarding EPA's Proposed Plan for the remedial action at the residential areas of the Site, and announcing an opportunity for a public meeting was published in 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. The Proposed Plan Fact Sheet was distributed to all the parties listed on the Site mailing list on March 13, 1997. The EPA conducted a

public meeting on March 27, 1997, to inform the public about the Proposed Plan of Action. Also, at this meeting, representatives from EPA solicited comments and answered questions about the Site, the remedial alternatives under consideration, and the Proposed Plan. The EPA held a 30-day public comment period regarding the Proposed Plan for the residential areas, the Remedial Investigation (RI) Report, the Feasibility Study (FS) Report, and the Administrative Record. A public comment period was held 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 News-Record, on April 16, 1997 and April 17, 1997.

Approximately fifty people were in attendance at the March 27, 1997, public meeting. The public was given the opportunity to make comments or ask questions at the meeting. Twenty-three people made comments or asked questions. A full account of the public meeting can be found in the public meeting transcript, which is contained in the Tar Creek Superfund Site Administrative Record. Written comments were received from three citizens groups, two Indian Tribes (Quapaw and Wyandotte), the Inter-Tribal Council of Oklahoma and the Oklahoma State Department of Environmental Quality (ODEQ), six companies that formerly mined at the Site (or their successors), and the U.S. Department of the Interior.

a. Verbal Comments

The verbal comments/questions received during the public meeting on March 27, 1997, are as follows:

1. Comment: For farm homes how will the size of the yard to be remediated be determined?

Response: The areas, adjacent to or near a residence, that are actually being used for residential yard purposes (e.g., lawn areas, children's play areas, garden areas), will be considered the yard for remediation purposes. Sizes of areas remediated will vary based on property-specific considerations. Adjacent pasture land or agricultural field areas will not be considered residential yard areas and will not be addressed during this remedial action unless they are a potential source of recontamination of the remediated residential areas.

2. Comment: Is EPA satisfied that the air quality is pretty good in the immediate mining area?

Response: Yes. Air quality, based on air monitoring of metals in recent years, is generally good.

3. Comment: If air quality is pretty good, then how did the residential areas become contaminated?

Response: While air deposition of mining waste may have been a more significant contributor during the active mining years, air monitoring in recent years indicates that air deposition now is a much less significant source of ongoing contamination to residential properties. The main source of contamination of properties, other than residences built on mining waste areas and other than fugitive dust and spillage during transport during the active mining years, was by human transport, for example the use of chat for driveways and other purposes.

4. Comment: Are the chat piles remaining in the area any danger to the public?

Response: The potential for contamination of residential properties via the air deposition route is small for most of the properties. For some properties, the potential for

recontamination from nearby chat piles may need to be controlled by appropriate dust and erosion control measures. However, we have found that even areas with nearby chat piles generally have good air quality. Additional evaluations will be needed to determine if there are other potential risks to the area's population related to chat piles at the Site.

5. Comment: Is water runoff from chat piles a source of contamination to people's yards?

Response: In general it is not a significant problem. However, for individual properties it may be a significant contributor to contamination. Each property will be evaluated during remediation. If water deposition is a problem, then measures such as rerouting drainage will be conducted to address the recontamination potential.

6. Comment: What will the long-term remedial action consist of?

Response: Basically, the proposed remedial action will consist of the same kind of work (e.g., excavation and replacement of lead-contaminated soil) that is being performed by the removal action that is currently underway at the Site. The removal action is addressing approximately 300 homes on the Site by excavating lead-contaminated soil wherever lead is found in concentrations of 1,500 parts lead per million parts soil (ppm) or greater. Wherever those lead concentrations are found, the soil is excavated until no soil lead concentrations exceed 500 ppm. Excavated areas are backfilled with clean soil. The follow-up remedial action will address all residential areas where soil lead is found at concentrations which exceed 500 ppm.

7. Comment: Are there any plans to try to eliminate the contaminated water from Tar Creek flowing into the Neosho and eventually into Grand Lake? What impact is metal loading from Tar Creek having on Grand Lake?

Response: Previous investigations by the Governor of Oklahoma's Tar Creek Task Force (Tar Creek Task Force, Health Effects Sub-Committee, March 1983, Environmental Health Evaluation of the Tar Creek Area) concluded that the Neosho River and Grand Lake can safely be used as a raw water source for public water supplies and that fish from the Neosho and Grand Lake are safe for human consumption. Most of the metals present in the acid mine water are precipitated out of the water, and deposited in the Tar Creek stream sediments before the confluence of Tar Creek and the Neosho River. The Tar Creek Task Force concluded that the Neosho has received little impact from Tar Creek other than aesthetic alteration at the confluence. Additional investigations of the water quality and fish in the Neosho River and Grand Lake, related to impacts from Tar Creek, are not considered necessary.

8. Comment: Are there any plans for additional remediation to try to eliminate the discharges of acid mine water to the surface?

Response: Approximately 25 billion gallons of water are contained within the old subterranean mine workings. There are technologies that might work on a small scale, but an application that would be economically feasible on the scale necessary to address the Tar Creek problems has not been identified.

9. Comment: Are there any plans to test sediment in the bottom of Grand Lake?

Response: Studies by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service, National Reservoir Research Program, 1983, "Effects of Acid Mine Drainage from Tar Creek on Fishes and Benthic Macroinvertebrates in Grand Lake, Oklahoma") and more recent studies by the Oklahoma Water Resource Board and Oklahoma State University as part of the Clean Lakes Project (Oklahoma Water Resources Board, Water Quality Programs Division and Oklahoma State University, Water Quality Research Lab, March 10, 1995, Phase I of Clean Lakes Project, Final Report,

"Diagnostic and Feasibility Study of Grand Lake O' the Cherokees") indicate that the metals at the upper reaches of Grand Lake, where possible impacts of mining would be expected to be the greatest, are bound in the sediments and do not significantly impact fish or water quality. Also, the concentration levels of hazardous metals in the sediments are below levels which are a risk to humans. No further studies of Grand Lake, related to the impacts of Tar Creek, are recommended by EPA.

10. Comment: How does the Neosho River as influenced by Tar Creek and Spring River compare as sources of metal loading to Grand Lake?

Response: Samples of sediment indicate that Spring River is a much greater source of metal loading than the Neosho River.

11. Comment: If the chat piles are so full of heavy metals, why are they still being allowed to be sold and transported out of the area?

Response: CERCLA generally addresses uncontrolled releases of hazardous substances that pose a threat to human health or the environment. The Resource Conservation and Recovery Act (RCRA) generally provides a "cradle to grave" control of hazardous wastes ensuring that such wastes are properly stored, transported, treated and ultimately disposed. The EPA has not identified an uncontrolled release that poses a threat to human health or the environment at the loading facilities where chat is shoveled into trucks for commercial use; consequently, EPA has not identified a situation in which CERCLA authority applies at the loading facilities (further investigations may identify such a threat). Moreover, since the chat is a solid waste from the extraction, beneficiation, and processing of ores and minerals, it is not classified as a hazardous waste under RCRA; therefore, RCRA's hazardous waste regulations do not apply. If the chat is washed to eliminate fine material, and then used in an application in which it is fixed within another material (e.g., where it is used as an ingredient in asphalt or concrete) it should not pose a threat; consequently, it can be sold for industrial use. Other Federal environmental laws do not generally apply to the chat. The EPA does caution the public about potential liabilities with regard to improper uses of the chat or other mining waste material. The EPA has provided, and will continue to provide information regarding the types of uses that can have safe applications and which types of uses are considered unsafe.

12. Comment: Have the alleyways, streets, and driveways been tested?

Response: As part of the residential response action within the mining area, the driveways are tested. If they are contaminated, the driveways are remediated. The alleyways, streets, and other traffic areas are not generally being tested. For these areas, if they are surfaced with chat, the plan is to replace or surface the chat with road base material, typically crushed limestone.

13. Comment: When will the remediation of the traffic areas other than driveways begin?

Response: The EPA is planning to begin providing crushed limestone to the local cities within the mining area starting in the Fall 1997.

14. Comment: What is the average yard remediation costing under the removal actions?

Response: Approximately \$15,000 to date. As remediation continues into areas such as the City of Picher, with some larger yards, this average figure could go up. An average remediation cost per yard of \$20,000 has been estimated for the long-term remedial action.

15. Comment: What is the volume of soil material that will be excavated during the remedial

action?

Response: The volume to be excavated during the remedial action is estimated at approximately 364,000 cubic yards.

16. Comment: What will the long-term remediation cost for the residential areas?

Response: The cost of the remedial action for the residential areas is estimated at \$29,440,840.

17. Comment: How will the remediation be funded?

Response: The cost of the remedial action will be funded by EPA's Superfund unless potentially responsible parties agree to fund or conduct the work. Also, for Superfund financed projects the State is required to pay a 10% cost match. For the Tar Creek Superfund Site the State would not cost match on the Indian-owned properties. For the Indian-owned properties, the 10% cost match for Superfund-financed remediation is not applicable.

18. Comment: Which properties will be remediated?

Response: All residential properties are proposed for remediation, Indian and non-Indian.

19. Comment: Would it not be cheaper to relocate the residents rather than clean up the residences?

Response: No. Relocation is estimated to be approximately ten times more expensive. Also, even if the residents were relocated, EPA would have to address the contamination so that the area could be used in the future.

20. Comment: Has not the Federal government relocated towns before?

Response: Yes. A remedial action may include the costs of permanent relocation of residents and businesses and community facilities where EPA determines that alone or in combination with other measures such relocation is more cost-effective than, and environmentally preferable to, the transportation, storage, treatment, destruction or secure off-site disposition of the hazardous substances in question, or if relocation is otherwise necessary to protect the public health or welfare. Since relocation would be ten times more costly than the remedial action selected in the ROD, and since EPA has successfully performed soil lead cleanups in other residential areas, EPA has decided that relocation is not an appropriate response action for the Site.

21. Comment: What percent of the residential area is Indian?

Response: Approximately 20% of the residential properties are Indian-owned.

22. Comment: Has funding been provided by the State for the 10% State match for the non-Indian properties? Has the State agreed to pay the operation and maintenance (O&M) costs?

Response: The State has expressed its intention to provide the required cost match. The State does not have to provide the money prior to the start of the remedial action. The State will provide the required assurances through a Superfund State Contract to cost match, and to assume the responsibilities for Operation and Maintenance (O&M) of the remedy.

23. Comment: Have the EPA attorneys looked into the Indian land liability issue at the Site and will EPA be placing its policy in writing with regard to the liability issues at the Site?

Response: The EPA has absolutely no plans to pursue private Indian landowners or private non-Indian landowners for reimbursement of EPA's costs at the Site. Moreover, EPA does not anticipate that it will ever have such plans in the future. Although EPA has no plans to pursue private Site landowners, EPA may obtain information in the future under which EPA may pursue such landowners on the Site. For example, EPA may learn of a landowner who contaminated a neighbor's property (e.g., midnight, dumping). Moreover, EPA may pursue any landowner who learns of a release or threat of release after acquiring property, and then transfers the property without disclosing this information. Accordingly, EPA must make the following reservation of its rights: Nothing in this document constitutes, nor should be construed as, a covenant not to sue or waiver of prosecutive discretion concerning this matter. In addition, nothing in this document is intended to waive any rights the United States may have at law or in equity concerning the Tar Creek Superfund Site against any parties associated with the Site.

24. Comment: Are the O&M costs, particularly the \$60,000 shown for several of the alternatives, a State cost?

Response: Yes. The O&M costs are costs to be borne by the State (except on Indian lands).

25. Comment: When the work is completed on the properties, will notices or restrictions be placed in the deeds? Will notices or restrictions be placed in the deeds of properties of those who do not grant EPA permission to remediate their property?

Response: The EPA can give a property owner a letter or certificate that states that the property in question has been cleaned up, but EPA has no intention to place notices or restrictions in the deeds of privately owned property.

26. Comment: Will test results be available somewhere like the county courthouse for review by interested persons?

Response: The EPA will maintain the test results, identified by property location, at the Site as long as EPA maintains a field office at the Site (probably for at least six years). At the completion of the project, EPA will furnish the test results to the State and to the Bureau of Indian Affairs. The EPA will also maintain the test results at its offices in Dallas, Texas until EPA's filing procedures call for the documents to be archived or destroyed.

27. Comment: What percentage of the owners of Indian land are not cooperating and allowing EPA access to conduct response activities?

Response: The EPA has access to about 40% of the Indian land so far. The Bureau of Indian Affairs (BIA) is continuing to assist EPA in obtaining access from the remaining owners of Indian properties for the EPA response activities. The EPA hopes to have access to most of the properties by the time the remedial action begins.

28. Comment: Are the Indian properties included in the estimated 1,300 properties to be cleaned up under the remedial action?

Response: Yes. The EPA was able to get access to the Indian residential properties in order to test them, and to determine the number needing remediation.

29. Comment: Do the 1,300 properties also include those properties for which access was not

granted?

Response: Yes. The 1,300 figure consists of the properties that were actually tested, and it also includes a portion of the untested properties that would require remediation. The portion of untested properties requiring remediation is an estimate based on findings gathered from tested properties located in the same area as the untested properties.

30. Comment: Will EPA continue to try to obtain access to properties that have not yet been sampled?

Response: Yes. However, once we complete the cleanup of the residential properties for which we have access, we intend to demobilize the residential response contractors. At that point we intend to stop our efforts to obtain access to residential properties.

31. Comment: What will be the outcome of properties for the owner(s) who do not grant access?

Response: The EPA cannot clean up properties without first obtaining legal access. We are attempting to obtain voluntary access to all the residential properties.

32. Comment: Will water runoff from an adjacent property that is not cleaned up contaminate the cleaned up properties?

Response: As properties are remediated, the drainage situation will be evaluated on a case-by-case basis. Grades will be sloped to drain away from residences. Also, properties will be graded to prevent or minimize any potential for runoff from adjacent properties to cause recontamination.

33. Comment: How contaminated are lands along Tar Creek as a result of flood waters that stand there for some time?

Response: Sampling of lands in the Tar Creek flood plain to date, indicates that lead concentrations caused by flooding are below the health-risk-derived level of 500 ppm. Additional sampling is planned for the remedial action phase to further investigate the levels of metals in the Tar Creek flood plain.

34. Comment: Why was not Miami included in the study area?

Response: Miami was not included in the study area because it is not in the area which was historically a mining area. However, EPA's selected remedy will remediate areas in Ottawa County (including Miami) which are located outside the mining area if those areas are found to be contaminated with soil lead concentrations above the action level of 500 ppm. The reason that the study area included only parts of the mining area is that the degree of contamination in the historical mining area is generally much greater than for areas outside the mining area (including Miami), and because blood lead studies found much fewer children with elevated blood lead in those areas outside the mining areas.

The blood lead survey conducted by the Oklahoma State Department of Health indicated that, for the Miami area, the percentage of the target population (i.e., children 6 years old or less) with elevated blood levels [i.e., blood lead concentration levels less than 10 micrograms per deciliter (ug/dL)] is near the EPA goal of 5% or less. Since the percentage of the target population in Miami with elevated blood lead levels is relatively small and close to EPA's 5% goal, EPA expects that yard-soil excavation will generally not be required in Miami. For the smaller portion of the target population reported to have elevated blood lead levels in Miami, compared to the larger portion of the target population reported to have elevated blood lead

levels in the mining area, appropriate actions generally will include blood lead monitoring and health education accompanied by some limited remediation of lead sources (e.g., vacuuming of house dust with high-efficiency vacuum cleaners and covering or replacement of chat covered traffic areas).

35. Comment: What is the percentage of children in Miami with elevated blood leads (i.e., blood lead concentration levels greater than or equal to 10 ug/dL)?

Response: The Oklahoma State Department of Health ((OSDH) indicates that the percentage of children in Miami with elevated blood lead levels is close to 5% based on limited screening. OSDH has indicated plans to do a more comprehensive screening of the children in Miami.

36. Comment: How many of the residential properties owned by Indians, actually have Indians living on them and how many have children living there?

Response: The EPA does not have that information.

37. Comment: Is it not true, that, if a residential property is contaminated, that it does not make any difference whether the residents are Indian or non-Indian with regard to which properties are cleaned up?

Response: Correct. The EPA's intent is to cleanup all the contaminated residential properties.

38. Comment: If the main obstacle to owners of the Indian lands granting access to EPA is concern about the liability for repayment of cost for remediation, then why does not EPA waive this liability and any future cost reimbursements?

Response: See response to question number 23 in this section of the Responsiveness Summary [Section II(a)].

39. Comment: Will vacant residential lots be cleaned up?

Response: Yes. Vacant residential lots will be cleaned up, but they will be given a lower priority than lots with people living on them.

40. Comment: Will information on how to deal with contaminated soil that is disturbed below 18-inches as a result of excavations, such as for utilities, be provided?

Response: Information with regard to this subject will be provided as part of the health education component of the remedy. Also, a marker consisting of a geotextile fabric or other suitable material will be placed in the bottom of excavations that reach the 18-inch depth. The marker will serve to alert the residents or others of the contamination remaining below.

b. Written Comments from Citizen's Groups and the General Public

1. Comment: The EPA waived or did not include Community Protective Measures (CPMs) in the preferred alternative.

Response: The comment is not correct. Although CPMs are not the primary component of the remedy they are included as a supplemental component in order to address uncertainties associated with implementing the remedy such as inability to secure access to all lead-contaminated residential properties. CPMs are also included in the remedy to help address lead contamination in communities in Ottawa County which do not have soil lead concentrations at a level which warrants comprehensive yard excavation.

2. Comment: Provide high efficiency particulate vacuum cleaners (HEPA VACs) in every home remediated to protect future generations until all sources of lead and cadmium contaminated soil are eliminated.

Response: HEPA VACs will be made available at no cost to local citizens. A supply of HEPA VACs will be made available at a central location(s) for check out. Providing an adequate supply of HEPA VACs for time-shared use by the general public is much more cost effective than providing HEPA VACs for every home.

3. Comment: Cardin and Picher are surrounded by chat piles and polluted water. Drainage and wind blown dust from nonremediated areas will provide opportunity for recontamination of remediated yards. Remediation of yards in those areas will not stop the lead and cadmium exposures to the populations of those towns until all chat piles are removed and the surface water cleaned up. The residents of Cardin and Picher should therefore be relocated.

Response: Although, the residential yards in Cardin and Picher are more heavily contaminated than the other communities in the area, this does not mean that the residential areas of Cardin and Picher cannot be cleaned up to health protective levels. Moreover, based on EPA air monitoring, the potential that yards would become recontaminated by air deposition from chat piles, from polluted water, or from other sources of lead or cadmium in the area is either controllable or else it is not significant. During the remediation of individual properties, if it is determined that there is a significant potential for recontamination, for example from surface water transport or even possibly from air deposition for specific properties, then appropriate measures will be taken to prevent recontamination. A list of measures to be used at source areas to prevent recontamination is as follows: (1) vegetating poorly vegetated or unvegetated areas; (2) capping with soil; (3) capping with base coarse material or paving (4) applying dust suppressants; (5) controlling drainage; (6) consolidating source materials to minimize recontamination potential; (7) containment of source materials; and (8) abating lead sources to prevent releases into the environment that would recontaminate remediated areas. Also, to provide additional protection to the population, physical barriers (e.g., fences and warning signs) will be used, as appropriate, to restrict access to mining waste which is located near residences. Due to the unique nature 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. The EPA's experience at other lead-contaminated residential areas has shown that the contaminated residential yards in Picher and Cardin can be remediated and made safe for residential use. Relocation is, therefore, not necessary. Moreover, restoring the existing residential yards in Picher is more cost-effective than relocation.

4. Comment: Tar Creek flows through the City of Miami and has, on several occasions, flooded nearby neighborhoods, parks and vacant lots where children play. Neighborhoods in the flood zone of Tar Creek should be studied.

Response: Sampling along Tar Creek will be conducted to determine the risk in neighborhoods in the flood zone as part of the residential response action selected in this ROD. The Tar Creek flood zone residential areas will be addressed as part of the remedial action.

5. Comment: If the contamination of Tar Creek is irreversible, warning signs should be placed along the creek up to its entry into the Neosho River.

Response: Warning signs would be an appropriate option, if it is determined that the contamination in Tar Creek poses an unacceptable risk to humans. Sampling of lands in the Tar

Creek flood plain to date, indicates that lead concentrations caused by flooding are below the health risk-derived level of 500 ppm. Additional sampling along and in Tar Creek to be conducted in the remedial action phase will further determine if levels pose a risk to humans.

6. Comment: Chat from the same chat piles that are of concern in the towns studied in the mining area were spread in Miami. In the remedial investigation and feasibility study (RI/FS) for residential areas, why was not the City of Miami studied?

Response: See response to question 34 in Section II(a) of this Responsiveness Summary.

7. Comment: The RI/FS suggests eating locally grown produce could be a source of exposure to contamination.

Response: Even though locally grown produce was investigated as a source of exposure, the results of the investigation indicated that consumption of locally grown produce did not pose a significant risk.

8. Comment: Are agricultural fields contaminated? Are cattle fish and other meat sources contaminated?

Response: Agricultural areas and local fishing areas were not within the scope of the residential area investigation. These areas and concerns will be addressed in future investigations. Due to the size of the historical mining area, the primary lead-source area of the Site--over 40 square miles, EPA has decided to divide the remediation of Operable Unit 2 into several phases. The ROD is intended to address the residential phase of Operable Unit 2. Other areas will be investigated in future actions.

9. Comment: The FS assumes that the soil from the remediated areas will be disposed of in dry mill ponds where soil meets or exceeds the 500 ppm action level for lead. What evidence is there that mill ponds have been tested and that a proper site has been chosen?

Response: The current disposal area near the old Eagle- Picher Central Mill site was an old mill pond filled with tailings with lead levels in excess of 500 ppm based on EPA testing. Plans are to use this same disposal area for the remedial action. Any new dry mining waste areas required for disposal will be investigated prior to disposal. However, lead levels in tailings in mill ponds, which would be the most likely candidates for disposal areas, typically are much higher than 500 ppm lead. The disposal area which EPA has selected is remote, approximately 1 mile from the nearest residences. The EPA will contour the soil in the disposal area so that erosion is minimal. Moreover, the disposal area will be covered with a layer of topsoil with lead levels below the 500 ppm remediation goal.

10. Comment: Provide assurances that proper caps, preferably clay, then topsoil, and then vegetation, will prevent transport of waste material from waste areas from wind erosion and surface water erosion of lead and cadmium.

Response: The disposal area will also be capped with clean soil from a borrow source prior to vegetating, unless the surface of the disposal area already has soil lead concentrations less than 500 ppm. (Soil excavated from the yards, generally in 6-inch layers, usually contains some soil with lead concentrations less than 500 ppm. Concentrations greater than 500 ppm are reduced as mixing (during normal handling of the contaminated soil) occurs with lower concentration soil.) In addition, the final layer of soil covering the disposal area will be required to have a sufficient clay content and will be required to readily support vegetation in order to prevent the disposal area from being a source of wind-blown dust, and to prevent erosion from water.

11. Comment: The Agency for Toxic Substances and Disease Registry (ATSDR) 1983-84 health assessment was conducted without the knowledge that is now available. Direct involvement of ATSDR is recommended, including door-to-door surveys of the population to ascertain health information, as well as traditional sources. Studies of local foods, including fish, meats and wild game should be conducted. The 1983 and 1984 assessments showed a need for a full health study. It should be conducted, and serve to inform Superfund cleanup plans.

Response: This comment recommended specific actions by ATSDR. Therefore, EPA has furnished the commenter's recommendations to ATSDR for its consideration. The EPA believes that sufficient data has already been developed to address the cleanup of contamination at the residential areas of the Site.

12. Comment: If the chat piles are the major source of contaminants in the area, why are they not being removed? Exposures in the community will continue until the chat piles are covered or removed.

Response: The ROD calls for measures to prevent chat piles from recontaminating remediated residential areas in situations where recontamination potential exists. Except for these situations, the ROD generally does not address chat piles because chat piles are not within the residential areas which are being addressed by the ROD. The non-residential properties, including the chat piles, will be addressed as a part of future response actions. Removal of the chat piles, or covering the chat piles are among the options that will be considered in future studies.

13. Comment: Why are the chat piles not classified as a hazardous waste? Why are the chat piles treated as a commodity rather than a waste? Why are they not covered under the Resource Conservation and Recovery Act (RCRA) via a permit with the local chat processor and asphalt companies?

Response: See response to comment number 11 in Section II(a) of this Responsiveness Summary.

14. Comment: Not all areas where children play have been remediated.

Response: All children's play areas, including any High Access Areas not addressed by the removal program, will be addressed in the residential response action selected in this ROD.

15. Comment: Three and four wheeler tracks are still visible on the chat piles and people still climb them. As long as the chat piles exist, the public should be prevented from entry and warning signs should be up.

Response: The chat piles and associated problems will be addressed as part of the non-residential area response actions. As residential response actions are conducted, fences and warning signs will be used as appropriate to restrict access to mining waste in proximity to residential areas.

16. Comment: Warning signs should be used in unremediated public areas, vacant lots and areas which show evidence of children's play or adult recreation.

Response: All children's play areas and adult recreation areas within the residential areas will be remediated including vacant lots. Warning signs will be used as appropriate for residential response actions and considered as an alternative in future response actions for non-residential areas.

17. Comment: The number of homes being remediated in this action does not match the amount of money allocated for the project.

Response: Based on experience with average cost per yard for residential soil remediation, EPA believes that the amount of money estimated for the project (\$29,440,840) is adequate to address the number of houses estimated (1,312).

18. Comment: With regard to Five Year Reviews, in light of the other concerns at the Site not addressed by Alternative 2, this investigation should remain open.

Response: There are future investigations planned for the Site to address remaining contamination. However, for the residential areas where lead contamination above the health-risk-derived concentration level is removed, a Five-Year Review is not considered appropriate. Five-Year Reviews will continue for other portions of the Site.

19. Comment: The water quality of the Neosho should be tested along with the fish, especially, the popular sport fish, spoonbill, white bass and catfish.

Response: See response to question 7 in Section II(a) of this Responsiveness Summary.

20. Comment: Lead is a problem, but the other toxins are of equal concern, and have many health risks associated with exposures.

Response: With regard to human health, EPA's risk assessment identified lead as the only Site-related chemical of concern, and identified oral ingestion as the only significant route of exposure. Cadmium and zinc are also Site-related chemicals, but the concentrations in the different media (e.g., soil, air, drinking water) for cadmium and zinc were not high enough to present a risk to the population. However, as lead is remediated, the other metals associated with it in the soil will also be remediated.

21. Comment: The cleanup does not match the risk.

Response: The risk from the Site is posed by the ingestion of lead contaminated soil. The selected remedy is an appropriate response for the identified risk and will remediate the lead contaminated surface soil in the residential areas where it exists in concentration levels that are above health-risk-derived concentration levels.

22. Comment: The millions spent on cleaning up yards in the most contaminated areas could be jeopardized by cave-ins which are continuing to occur.

Response: When the mines were dewatered the frequency of cave-ins was greater. The buoyancy of the water now filling the mines has substantially increased the forces resisting cave-ins. The tendency for cave-ins is now greatly reduced.

23. Comment: No community-needs assessment has been conducted. ATSDR needs to conduct a health consultation and health assessment.

Response: This comment recommended specific actions by ATSDR. Therefore, EPA has furnished the commenter's recommendations to ATSDR for its consideration. The EPA believes that sufficient data has already been developed to address the cleanup of contamination at the residential areas of the Site.

24. Comment: Northeastern Oklahoma A & M College has a walking trail, baseball field, and football field that Tar Creek floods. These areas have not been tested.

Response: Sampling of lands in the Tar Creek flood plain, to date, indicates that lead concentrations caused by flooding are below the health-risk-derived concentration level of 500 ppm. Additional sampling will take place during the remedial action phase in order to further investigate the levels of metals in the Tar Creek flood plain.

25. Comment: Wildlife in the mined area includes deer and rabbits that are often consumed by residents. With contamination of plants suspected, these animals feeding on the vegetation could pose a risk to consumers.

Response: Investigating wildlife in the mined area was not within the scope of the residential area investigation. These areas and concerns will be addressed in future investigations. Due to the size of the historical mining area, the primary lead-source area of the Site--over 40 square miles, EPA has decided to divide the remediation into several phases. The ROD is intended to address the residential phase of Operable Unit 2. Other areas will be investigated in future actions.

26. Comment: Yards where children live are being targeted first. With Ottawa County having such a high rate of teen pregnancy, a home with no child now, could easily have one soon.

Response: Homes where pregnant women live are also a highest priority for EPA with regard to scheduling yard cleanup work.

27. Comment: Tar Creek runs through the neighborhood and children still play in and around it. Should we? If it is dangerous, who will warn us? Parents plant gardens in soil that has been flooded with the water from Tar Creek.

Response: Sampling of lands in the Tar Creek flood plain to date, indicates that lead concentrations caused by flooding are below the health-risk-derived level of 500 ppm. Additional sampling is planned for the remedial action phase to further investigate the levels of metals in the Tar Creek flood plain.

28. Comment: One of our members (Cherokee Volunteer Society) has tested high in blood lead. The yard and grandparent's yard were tested. Who did those tests and will other yards in Miami be tested? When will the rest of our members be tested? Miami has been left out of health studies thus far.

Response: As explained in the ROD, lead can be a serious health problem. The blood lead level of a person who has experienced elevated blood lead levels should be monitored on an ongoing basis until levels are in the safe range. Your associate should contact the Ottawa County Health Department at 918-540-2481 or the Oklahoma State Department of Health at 405-271-4471 or his or her family physician. The EPA can also provide literature which explains how to avoid lead contamination and how to deal with lead contamination in the home. Contact the EPA Tar Creek Field Office at 918-673-1173.

As explained above in our response to verbal comment 34, Miami lies outside of the heavily contaminated mining areas. Moreover, as explained in that response, blood lead levels in Miami have been found to be close to the range which EPA targets. Accordingly, EPA expects that yard-soil excavation will generally not be required in Miami. For the smaller portion of the target population reported to have elevated blood lead levels in Miami, compared to the larger portion of the target population reported to have elevated blood lead levels in the mining area, appropriate actions generally will include blood lead monitoring and health education accompanied by some limited remediation of lead sources (e.g., vacuuming of house dust with high-efficiency vacuum cleaners and covering or replacement of chat covered traffic areas).

29. Comment: A community protective measures (CPMs) program should be implemented, not in lieu of other cleanup strategies, but as an important and integral component of an effort to manage and abate lead exposure, particularly from multiple sources.

Response: Although CPMs are not the primary component of the remedy they are included as a supplemental component to address uncertainties associated with implementing the remedy such as inability to secure access to all contaminated residential properties. CPMs are also included to address communities near the mining area where community- wide residential lead contaminated yard-soil excavation is not considered appropriate.

c. Written Comments from the State and Tribes

1. Comment: The Quapaw Tribe concurs with EPA's preferred remedy (Alternative #2) as the most appropriate alternative and concurs with the residential soil lead remediation goal of 500 ppm.

Response: The EPA acknowledges the Quapaw Tribe's concurrence with EPA's preferred remedy.

2. Comment: With regard to the Indian lands, a comment by a representative of the Quapaw Tribe stated that the Tribe is most concerned that EPA will not put into a contract that it will never try to recoup costs of remediation from the land owners or heirs. The commenter also stated that an EPA representative had stated this policy, but not in writing. The commenter also expressed that assurance was needed in writing that the costs of EPA's response actions will never be borne by the allottees or their heirs. The commenter also stated that without this "guarantee" that the Tribe will be unable to advise its members to allow the remediation. A representative of the Inter-Tribal Environmental Council of Oklahoma (ITEC) also emphasized the need for written assurances to the Indian land owners that they will not be held liable for cleanup costs, to allay reluctance to grant access to EPA for response actions.

Response: Please see Response to Comment 23 in Section II(a) of this Responsiveness Summary. Please also see the Transcript of Public Meeting on Proposed Plan for the Tar Creek Superfund Site, March 27, 1997, page 33. The EPA is greatly concerned that it has been unable to obtain access to all Indian properties targeted for response actions. The EPA is working diligently along with the Bureau of Indian Affairs to try to resolve these issues.

3. Comment: A representative of the Quapaw Tribe recommended that the mining companies' Community Health Action and Monitoring Program (CHAMP) summary data (the conclusions and overall findings) that were presented at the CHAMP meeting at the Picher Elementary School, Picher, Oklahoma on April 15, 1997, should be made a part of or at least referenced in the Administrative Record.

Response: The EPA was furnished a summary packet of the CHAMP data from a representative from ITEC who attended the meeting. The EPA has reviewed the summary packet and will include it in the Administrative Record.

4. Comment: A representative of the Quapaw Tribe and a representative of ITEC made similar comments that the flood plain of Tar Creek in the Miami area should be tested as part of the response actions for the residential areas.

Response: Additional sampling along Tar Creek will be conducted to determine areas of potential risk in neighborhoods in the flood plain as part of the residential response action. The Tar Creek flood plain area will be addressed as part of the remedial action. The EPA does note that sampling of lands in the Tar Creek flood plain to date, indicates that lead concentrations

caused by flooding are below the health-risk-derived level for lead in soil of 500 ppm.

5. Comment: A representative of ITEC stated that if the flood plain is contaminated from the flooding of Tar Creek with metals above levels of concern, that EPA should evaluate the use of constructed wetlands to control flooding and contaminant loading along the lower reaches of Tar Creek and that these actions should be included as part of the response actions for the residential areas.

Response: If EPA determines that the levels of metals caused by the flooding poses an unacceptable risk to the population living in the flood plain, then EPA will conduct appropriate remediation as part of the response for the residential areas. Also, if measures are needed to prevent recontamination of any remediated areas in the flood plain, then EPA will also consider alternatives, including constructed wetlands, to prevent possible recontamination.

6. Comment: A representative of ITEC, stated that the Quapaw Tribe is interested in the possible economic development of two non-residential Indian-owned properties (the former Eagle-Picher field office site and the former Childress Chemical Company site) located in Cardin, Oklahoma. The commenter stated that timely remediation of these two properties will promote their economic development.

Response: The EPA is also concerned that properties be remediated in a timely manner. The EPA is also sensitive to the needs for economic redevelopment in the area. Due to the scope of the Tar Creek Superfund Site, all the possible remediation needed must be spaced out over time. The most important factor guiding prioritization of response actions at the Site is the sensitivity of the human population exposed. For this reason, the cleanup of the residential areas, which are extensive, are being given priority over industrial areas and other areas. The non-residential properties, including the two properties referenced by the commenter, will be addressed later as part of the non-residential response actions.

7. Comment: A representative of the ITEC, which is a consortium of 31 tribes in the State of Oklahoma, stated that ITEC member Tribes favor EPA's preferred remedy (Alternative #2) with the 500 ppm soil lead action level. The commenter stated that since it may not be possible for the EPA to obtain access to all of the Indian owned property, that at least some of the CPMs outlined in Alternative #3 will probably have to be included in the overall remedy.

Response: The EPA acknowledges ITEC's support for EPA's preferred remedy. Although CPMs are not the primary component of the remedy, they are included as a supplemental component to address uncertainties associated with implementing the remedy such as inability to secure access to all lead-contaminated residential properties, and to address lead contamination in communities in Ottawa County, particularly those outside the mining area where community-wide residential lead contaminated yard-soil excavation is not considered appropriate.

8. Comment: With regard to the access to Indian land issue, a representative of ITEC stated that EPA, the Bureau of Indian Affairs, and Tribal governments should make efforts to educate reluctant property owners about the benefits of remediation on their neighbor's properties by hosting open houses and field trips to properties where remedial work is in progress or has been completed. The commenter also recommended that testimonials from owners satisfied with the remediation of their properties should also be included in these presentations. The commenter also recommended that EPA, BIA, and the Tribal governments should publicize the favorable comments from residents and local government officials about the success of the residential response actions already being conducted under EPA's removal program.

Response: The EPA concurs with the need to educate reluctant property owners about the benefits of remediation in an effort to encourage those individuals to grant access to EPA so that EPA can conduct response actions. The EPA and BIA are already undertaking considerable efforts in this regard. Specifically, EPA, BIA and DOI have entered into a memorandum of agreement (January 1997) regarding efforts which will be made to secure access to Indian lands. Under this MOA, BIA and EPA officials are contacting each reluctant land owner over the telephone and in person if possible. We think that the commenter's ideas are good ones, and we will try to incorporate them into our future actions as appropriate.

9. Comment: An ITEC representative asked if any studies are being conducted, or will be conducted, to document the nature of any lead-related health problems among residents of the Site. The commenter recommended that the results of such studies, past and present, be made known to the public.

Response: The EPA's task under Superfund is generally to clean up uncontrolled releases of hazardous substances that may pose a risk to human health or welfare or to the environment. Whenever we can, we hope to clean up hazardous substances before they cause health problems. Accordingly, our investigations are generally targeted toward locating dangerous concentrations of these materials. We generally do not conduct health surveys as such, though sometimes that data is helpful. The EPA believes that sufficient data has already been developed for the purpose of addressing the cleanup of contamination at the residential areas of the Site under Superfund. Results of health studies of metal contamination that are in EPA's possession are placed, as a normal practice, in the Site repository at the Miami Public Library, Miami, Oklahoma. Only confidential portions of such health studies, like personal medical data, names, or addresses, would be withheld to protect privacy. Health studies, such as the commenter refers to, are normally the purview of health agencies rather than EPA. Therefore, EPA has furnished the commenter's recommendations to ATSDR for its consideration. The EPA is aware of, though not a participant in, two lead exposure studies by the University of Oklahoma, Health Sciences Center. These two studies include monitoring of blood lead levels, but to EPA's knowledge, they do not include investigation of other health problems or effects. These two studies are the recently completed CHAMP study which was funded by certain mining companies (or their successors), and the Native American Lead Exposure Study, funded by National Institute of Environmental Health, which is currently in progress.

10. Comment: The Oklahoma State Department of Environmental Quality (ODEQ) concurs with EPA's preferred remedy (Alternative #2) and concurs with the residential soil lead remediation goal of 500 ppm.

Response: The EPA acknowledges the ODEQ's concurrence with EPA's preferred remedy.

**TAR CREEK SUPERFUND SITE
OTTAWA COUNTY, OKLAHOMA
RESPONSIVENESS SUMMARY, SECTION II, PART B**

SUMMARY OF RESPONSES TO MAJOR COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD FOR THE PROPOSED PLAN FOR THE RESIDENTIAL AREAS FROM MINING COMPANIES (OR THEIR SUCCESSORS) THAT FORMERLY OPERATED AT THE SITE, AND FROM THE U.S. DEPARTMENT OF THE INTERIOR

The U.S. Environmental Protection Agency (EPA) received comments in a letter of May 22, 1997, from Gary D. Uphoff on behalf of ASARCO Inc., Blue Tee Corporation, Childress Royalty Company, Inc., Gold Fields Mining Corporation, and the Doe Run Resources Corporation (Uphoff, May 22, 1997). The EPA also received comments in a letter of May 9, 1997, from Lisa G. Esayian on behalf of NL Industries, Inc. These companies (or their successors) formerly conducted mining operations at the Tar Creek Superfund Site (the "Site"), and are referred to collectively in this document as the "Companies." Comments were also received in a letter of May 15, 1997, from Edward B. Cohen of the U.S. Department of the Interior (DOI, May 15, 1997). This document addresses the comments received from the Companies and the U.S. Department of the Interior (DOI). It should be noted that this document is only a part (Part B) of the Responsiveness Summary attached to the Record of Decision (ROD) for the Tar Creek Superfund Site, Residential Areas. Another part (Part A) of the Responsiveness Summary addresses additional comments received from other parties.

After reviewing and assessing the comments provided by the Companies and DOI, EPA has determined that the comments do not provide any new information that would change EPA's initial determination, as set forth in the Proposed Plan, that the Preferred Alternative (Alternative 2) best meets the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan, 40 CFR Part 300. DOI and the Companies, in their comments, have requested or recommended that EPA perform certain additional tasks. These tasks are listed below. The EPA's review of the comments submitted by DOI and the Companies has found that the comments do not provide any significant information that supports the performance of the following tasks as requested or recommended by the Companies or DOI:

- S** Revising the Remedial Investigation (RI) to include other data on sources of lead;
- S** Revising the Feasibility Study (FS) to include an additional alternative for detailed analysis;
- S** Revising the FS to include additional discussion of Community Protective Measures (CPMs);
- S** Revising the Remedial Action Objective (RAO);
- S** Obtaining additional scientific data to serve as the basis for remedy selection, or revising the existing scientific data upon which remedy selection is based;
- S** Revising the FS to provide additional justification for the selected remedy; and
- S** Selecting a remedial action alternative other than alternative 42 which is the Preferred Alternative described in the Proposed Plan.

In their comments, the Companies and DOI have recommended or requested that EPA perform the above list of additional actions. The additional actions are not warranted, and EPA's position is supported by EPA's responses to comments provided below in this document. The EPA's responses address the significant issues raised by the Companies and DOI.

The documents that EPA relied upon in preparing this response include without limitation the following:

Agency for Toxic Substances and Disease Registry (ATSDR), 1995, Ottawa County Blood Lead Summary (informal), Memorandum from Jennifer Lyke (ATSDR Region 6), December 18, 1995.

Bornschein, R.L., C.S. Clark, U.W. Pan et al., 1990, Midvale Community Lead Study, Department of Environmental Health, University of Cincinnati Medical Center.

Centers for Disease Control, October 1991, Preventing Lead Poisoning in Young Children.

Chappell, W. et al., 1990, Leadville Metals Exposure Study, Colorado Department of Health (Division of Disease Control and Environmental Epidemiology), University of Colorado at Denver (Center for Environmental Sciences), and U.S. Department of Health and Human Services (ATSDR/PHS).

Chrostowski, P.C. and J.A. Wheeler, 1992, A Comparison of the Integrated Uptake Biokinetic Models to Traditional Risk Assessment Approaches for Environmental Lead, In: Superfund Risk Assessment in Soil Contamination Studies (K.B. Hoddinott, ed.), ASTM STP 1158, American Society for Testing and Materials, Philadelphia, pp. 151-166.

DOI, July 24, 1996, Draft-Final Site Evaluation Findings Report, Tar Creek NPL Site, Oklahoma City Field Area, Oklahoma, Report by C.C. Johnson & Malhotra, P.C. for the Bureau of Land Management.

Hogan, K.A., R.W. Elias, A.H. Marcus, and P.D. White, 1995, Assessment of the U.S. EPA IEUBK Model Prediction of Elevated Blood Lead Levels, The Toxicologist, Vol. 15, No. 1, pp. 36-37.

Malcoe, L.H., 1996, Quarterly Report, CHAMP Program, July 1996-October 1996.

Malcoe, L.H., 1997, Quarterly Report, CHAMP Program, January 1997-March 1997.

Malcoe, L.H., et al., April 15, 1997, Meeting Handout Data Summary, CHAMP Public Meeting, Picher High School, Picher, Oklahoma.

Renner, R., 1995, When is Lead a Health Risk?, Environmental Science & Technology, Vol. 29, No. 6, pp. 256-261.

Sedman, R.M. and R.J. Mahmood, 1994, Soil Ingestion by Children and Adults Reconsidered Using the Results of Recent Tracer Studies, J. Air & Waste Manage. Assoc., Vol. 44, pp. 141-144.

Stanek, E.J. III and E.J. Calabrese, 1995, Daily Estimates of Soil Ingestion in Children, Environmental Health Perspectives, Vol. 103, No. 3, pp. 276-285.

EPA, March 1990, Exposure Factors Handbook, Office of Health and Environmental Assessment

EPA, April 1992, Guidance for Data Useability in Risk Assessment (Part A), Final

EPA, 1994a, Memorandum from Elliott P. Laws (Assistant Administrator) to Regional Administrators I-X, Re: Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive # 9355.4-12, July 14, 1994.

EPA, 1994b, Validation Strategy for the Integrated Exposure Uptake Biokinetic Model for Lead in children, Prepared by the Technical Review Workgroup for Lead, Office of Emergency and Remedial Response, EPA 540/R-94-039.

EPA, 1994c, Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in

Children, Office of Emergency and Remedial Response, EPA/540/R-93/081.

EPA, April 1996, Urban Soil Lead Abatement Demonstration Project, Volume 1: EPA Integrated Report

EPA, September 1996, Preliminary Remediation Goals, Residential Exposures, Tar Creek Superfund Site, Ottawa County, Oklahoma

EPA Region 6, (Revised July 10, 1996), Tar Creek Superfund Site, Technical Reply Document, Residential Area Response Actions (Included as Attachment 2 to Section II, Part B of this Responsiveness Summary)

EPA Region 6, May 15, 1997, Tar Creek Superfund Site, Detailed Response to Comments Received During the Public Comment Period for the Removal Action for the Residential Areas (Included as Attachment 1 to Section II, Part B of this Responsiveness Summary)

Uphoff, G.D., October 22, 1996, Comments on EPA's Removal Action on behalf of ASARCO Inc., Blue Tee Corporation, Childress Royalty Company, Inc., Gold Fields Mining Corporation, and the Doe Run Resources Corporation.

COMMENTS ON THE QUALITY OF THE DATA

1. Comment: The EPA's soil lead data for the Tar Creek Superfund Site are inconsistent with data previously collected at the two other mining related Superfund sites in the Tri-State Mining District, Cherokee County (Kansas) and Jasper County (Missouri). Specifically, the mine and milling wastes for all three sites should be similar, since they are all part of the same geological ore deposit zone and they employed similar processing methods, yet the soil lead levels found in the Oklahoma portion of the district (i.e., the Site) were significantly higher than in the Kansas and Missouri portions.

Response: The wastes for all three sites are similar in most characteristics, but there is great variation in concentrations of lead in the various waste across the Tri-State Mining District. There is also considerable variability in the concentrations of lead in chat in the piles around Picher. The concentration in some of the chat found in Ottawa County is quite sufficient to account for the lead concentration levels found in residential soil at the Tar Creek Superfund Site.

2. Comment: The yard soil data collected by Ecology and Environment (E&E), EPA's environmental engineering contractor, at the Tar Creek Superfund Site are extremely biased and unrepresentative because of sampling and compositing procedures used. The mean soil lead concentration for eight Picher residences reported by Dames & Moore (D&M), an engineering consultant hired by the Companies (Uphoff, October 22, 1996), based on their follow-up soil sampling investigation, was less than half the mean soil lead concentration that was reported by E&E for the same properties.

Response: The information provided in the comment is not correct. The EPA has responded in detail to a previous similar comment. (See EPA Region 6, May 15, 1997: Comment 41, and issue "A" in the Response to Issues in the D&M, Report.) Briefly, the differences in soil lead concentrations reported by E&E in the Tar Creek Superfund Site Residential Remedial Investigation (RI) and D&M in its follow-up study were due to differences in what was sampled, not to bias or unrepresentativeness in E&E's sampling and compositing procedures. The D&M follow-up study samples included a much lower proportion of dripline samples. Also, the D&M samples were collected from a different depth than the E&E samples (0 to 2 inches for D&M versus 0 to 1 inch for E&E). The soil sampling methodology used by E&E at the Tar Creek Superfund Site

is commonly used at Superfund sites and is very similar to methodology that was used by D&M in its investigation of the Jasper and Cherokee County portions of the Tri-State Mining District.

3. Comment: The EPA's estimates of average yard soil concentrations were biased because the individual strata were not weighted by relative stratum size. [The term stratum as used by the commenter is a physically defined area (e.g., frontyard, backyard, or driveway) that was sampled and is consistent with EPA usage in the sampling design (EPA, April 1992, Exhibit 44).]

Response: The EPA typically uses the arithmetic average concentration of a contaminant within an exposure area to estimate exposure based on the assumption that contact with the contaminant anywhere in the exposure area is equally likely. This is a useful and reasonable default assumption.

In deriving an estimate of long-term exposure point concentrations, two important factors that will affect exposure to soil contaminants, other than the relative size of an area, are the amount of time a receptor spends in different portions of an exposure area and the accessibility of the contaminants in those areas. For example, a child might spend more time in a small play area, like a swing set, a sandbox, or a driveway, than in a large front yard. The presence or absence of ground cover also affects the accessibility of soil contaminants. Front yard and back yard areas are usually covered with grass which reduces a receptor's contact with the soil in those areas and reduces the amount of soil tracked into the house from those areas. Thus an area weighted average concentration does not necessarily provide the best estimate of exposure to yard contaminants.

4. Comment: Appropriate stratum weights for obtaining an unbiased estimate of the lot average concentrations cannot be derived from the relative stratum areas alone, but should also be based upon the relative proportion of fine material in the soil.

Response: An additional weighting factor based on the amount of fine material in a stratum does not necessarily provide a better estimate of exposure to soil contaminants. As already noted, the presence or absence of ground cover may greatly affect the accessibility to soil contaminants. Exposure to soil from a lawn-covered yard area, with a higher fraction of fine material, could be less than from an unpaved driveway. The soil sampling program used by EPA for the Tar Creek Superfund Site has been commonly employed by EPA at other sites with favorable results.

5. Comment: As documented in the "Review of the Soil Sampling Approach . . . " by Key Environmental (Uphoff, May 22, 1997, Attachment 1), the individual stratum means were themselves biased.

Response: The main thrust of the discussions about stratum average estimates in Attachment 1 is that the variability of contaminant concentrations within each stratum has not been defined and that the number of samples and the amount of material collected per sample may not be sufficient to capture the full range of variability that may exist in these areas and that failure to capture all of the variability could lead to concentration estimates that are not perfectly representative of the area (i.e., that may not have captured all of the variability - not that they deliberately misrepresent the true concentrations).

The commenters have not provided any evidence that these hypothetical issues have had any real effect on the data in this case or shown what the magnitude of any effect might be. Neither have the commenters shown that their recommended methods would significantly improve the accuracy of the estimates of potential exposure to soil contaminants to justify the additional time and expense. That is, although the issues raised in this comment have only recently

emerged in the arena of environmental sampling, and were not addressed in the EPA sampling guidance documents available when the Tar Creek Sampling Plan was being developed, the commenters have provided no evidence that the hypothetical issues raised would have any real effect on the data gathered at the Site.

6. Comment: A previous EPA response that "any reasonable weighted average is likely to be numerically similar (+ or -10 to 20%) to the simple average" is without justification.

Response: The EPA statement was based on comparison of the simple average of the average concentrations measured in the various subareas investigated with weighted averages based on several different weighting schemes. Accordingly, the different weighing schemes produced similar numerical results.

7. Comment: Exclusion of the garden areas from the property average effectively assigned a weighting factor of zero to garden soil.

Response: As explained in the BHHRA, exclusion of garden soil from the property average was based on an exposure assessment decision that direct contact with garden soil was not likely to be a complete exposure pathway for young children. For this reason, it did not assign such a weighting factor.

8. Comment: It cannot be determined whether the sampling design provided sufficient data for remedial decision making in accordance with EPA guidelines.

Response: Before the start of the residential soil sampling program for the Tar Creek Superfund Site, some 1,500 samples were collected from High Access Areas in the Study Area and analyzed for lead. These samples were log normally distributed and the log transformed results had a coefficient of variation (CV) of 25.4%.

According to EPA guidance, which is consistent with generally accepted scientific practice, the minimum statistical performance required for risk assessment is a confidence level of 80%, statistical power of 90%, and a minimum detectable relative difference (MDRD) of 10% to 20%. With a coefficient of variation of 25%, 29 samples would be required to achieve a MDRD of 10% and 8 samples would be required for a MDRD of 20%. The average yard soil concentrations for individual properties were based on 15 to 25 separate soil aliquots depending on whether a driveway and a play area existed at a property. Therefore it appears that the residential sampling program provided data of sufficient quality for risk assessment purposes even at individual residential properties. However, no statistical inferences were based on sampling results for individual properties. The decision about whether remedial measures were required was based primarily on the predicted risk of blood lead levels greater than 10 micrograms per deciliter (ug/dL) for the Study Group Homes as a group. This estimate of community risk was based on more than 400 composite soil samples and more than 2,000 separate soil aliquots, many more than were needed to ensure adequate data quality for risk assessment purposes.

9. Comment: The soil sampling procedure described in the Remedial Investigation Report (Brown and Root 1997) indicates an error in the selection of sampling locations: "Sampled locations included those areas deemed by the sampling team as being obvious signs of chat."

Response: The statement in the RI Report prepared by Brown and Root has been misinterpreted. Locations showing obvious signs of chat may have been included among locations sampled; however, such locations were neither deliberately selected nor were they avoided because of the presence of chat. The sampling plan, which was developed and carried out by E&E, was neutral with respect to chat, neither deliberately selecting nor deselecting locations exhibiting signs of

chat. The statement quoted from the Brown and Root RI Report appears nowhere in E&E's Sampling Plan, Data Evaluation Summary Report, or Baseline Human Health Risk Assessment Report.

10. Comment: Drying the soil samples prior to particle size fractionation by sieving may have introduced sample preparation error by altering the physical size distribution from that found in situ.

Response: Particle size fractionation was accomplished using gravity and mechanical agitation of the sieve. Some minor incidental drying may have occurred during these processes. However no significant sample preparation error was introduced by the size fraction process, because any particle size reduction as a result of the drying accompanying soil sample preparation is not likely to have been significantly more than the size reduction that already occurred naturally as a result of repeated wetting and drying cycles and weathering forces in nature.

11. Comment: It would be interesting to assess the decision error risks associated with the use of as few as 15 sites sampled in the Reference Area.

Response: The comment has inadequate basis. The EPA's decision as to whether remedial measures were required was based primarily on comparison of the blood lead levels predicted for current and future residents of the Study Group homes to EPA's lead exposure management goal (EPA's goal is that a typical child or group of similarly exposed children should have no more than a 5% chance of having a blood lead level greater than 10 ug/dL), not on a comparison of predicted blood lead for residents of Study Group and Reference Area homes. The Reference Area was used to help EPA evaluate the effect of lead exposures unrelated to mining wastes on predicted blood lead levels, not as a basis for EPA's decision to take remedial measures.

12. Comment: There was too great a difference in the number of samples collected from the Reference Area (15) and the Study Area (>1900) to justify comparison of the two data sets.

Response: The Reference Area was established primarily to provide a reference data set for comparison with the Study Group data set that included 100 residences, not for comparison with all of the more than 2,000 residences in the Study Area as a whole. When formal statistical comparisons were made between the contaminant concentrations in various environmental media from the two areas (i.e., the 100 compared to the 15), well established statistical methods, including t- tests and Mann-Whitney U-tests that take sample size differences into account, were used.

13. Comment: It is not clear that the Reference Area was selected in accordance with EPA guidance which indicates that a reference area should not differ from a cleanup area in physical, chemical, or biological characteristics. The Reference Area for the Tar Creek Superfund Site was selected based on its similarity to Picher with respect to the characteristics of its housing stock.

Response: The main purpose of the Reference Area was to help EPA evaluate the effect of lead exposure factors other than exposure to mining related wastes on predicted blood lead levels. Therefore, the main requirements for the Reference Area were that it be outside of the mining area, and have housing stock similar to that in the mining area to control for possible lead paint exposure. The chosen Reference Area fulfilled these main requirements because it is outside the mining area, but contains homes which are similar to the homes in the mining area with respect to age, type, and size--primary factors in determining the likelihood of lead paint contamination.

14. Comment: The soil particle size fractionation methods used in preparing samples for analysis may have biased EPA's selection of an action level and the Preferred Remedial

Alternative. The minus-250 micron fraction does not provide an appropriate basis for selection of Preliminary Remedial Goals or remedial alternatives.

Response: The EPA selected the remedial goals, action levels and remedial alternatives for the Tar Creek Superfund Site utilizing blood lead levels predicted by the IEUBK model. The soil samples used as input to the IEUBK model were prepared in accordance with EPA Region 6's standard procedures which include sieving the samples through a 60-mesh screen. The minus 60-mesh fraction includes particles approximately 250 microns in size or smaller and is the fraction most likely to adhere to the skin and be ingested through hand-to-mouth contact. Since ingestion is of primary concern, this screening method is appropriate. The EPA Technical Review Workgroup for Lead recommends that lead concentrations measured in this fraction of soil be used in the IEUBK model because it is the fraction most likely to adhere to the hands of a small child and be ingested. Therefore, it was entirely appropriate to base remedial decisions on this soil particle size fraction.

15. Comment: Comparison of soil lead results obtained by X-ray fluorescence (XRF) for the minus 10-mesh fraction with results obtained by EPA Contract Lab Program (CLP) methods for the minus 60-mesh fraction is inaccurate and inappropriate.

Response: Because of the large number of samples that needed to be analyzed and the rapid turnaround required, it was necessary to analyze most of the soil samples collected by XRF. The empirical relationship between the XRF and CLP results was determined by linear regression analysis on the log-transformed data, and the regression equation was used to convert the XRF concentrations to the corresponding CLP values.

The p-value for the slope of the regression equation (the probability that the observed correlation is a statistically rare occurrence) was less than 0.0005 and the data were uniformly distributed from high to low. These results indicate that the correlation was very strong. However, there was some scatter about the regression line due to measurement errors associated with both the XRF and CLP data. Because the linear regression is based on log-transformed data, back transformation magnifies the scatter. The regression line predicts for any given XRF concentration, log-transformed, the expected value of the log of the CLP concentrations (which would be the average over many trials). However, because of measurement errors, individual observed values from the CLP data may differ from the predictions. That does not mean that the regression equation is wrong.

COMMENTS ON LEAD SOURCES OTHER THAN MINING WASTE

16. Comment: Paint is a primary contributor of lead to Site soil based on the large proportion of older homes in Picher with peeling exterior lead-based paint, the higher lead concentrations in dripline soil compared to other soil strata, and the presence of soil lead levels similar to those found at the Tar Creek Superfund Site in older urban areas where lead-based paint is the primary source of lead.

Response: The EPA has responded to these points when they were made in previous similar comments. (See EPA Region 6, May 15, 1997: Comment 20, and issue f in the Response to Issues in the D&M Report.) The EPA acknowledges that lead-based paint may be an important source of lead at some residences; however, the weight of evidence indicates that lead-based paint is not the primary source of the elevated soil lead levels found at most of the residential properties in Picher. While lead levels at drip lines tended to be higher than in other yard areas, they were substantially higher at fewer than 20% of Study Group homes. Furthermore, the available paint chip data show no discernable difference in the prevalence of lead-based paint between the Study Group and Reference Area homes; therefore, paint cannot account for the order of magnitude difference in soil lead concentrations between the two areas. Moreover, the risk from yard soil

containing lead-contaminated mining waste is, by itself, enough to warrant cleanup of that soil as called for in the ROD.

17. Comment: Lead speciation analyses conducted by Dr. Burke Burkart for EPA and Dr. John Drexler for DOI indicated that the primary sources of lead in residential soil at the Site were paint and smelter wastes. The results of the analyses by Burkart and Drexler are discussed in a report prepared by Geomega (Uphoff, May, 22, 1997, Attachment 2), which also presents new data for 4 waste samples from the Hockerville smelter and 3 samples from chat piles. According to Geomega's report, the forms of lead found in the smelter waste are identical to the forms identified in yard soil from Picher, and this confirms that smelter wastes are the principal source of lead in the soil. Further the lead content of the smelter wastes, in the 2 to 7 percent range, can credibly explain the lead concentrations in residential soil at the Site. Also, the DOI electron microprobe analysis indicates that up to 66 percent of the lead in residential soil is attributable to smelter emissions. It also indicates that lead paint may contribute up to 17 percent of lead in soil at the Site. The microprobe work is described in DOI's report titled "Draft Final Site Evaluation Findings Report, Tar Creek NPL Site" dated July 24, 1996.

Response: Previous EPA responses have addressed similar comments with regard to the Burkart and Drexler reports. (See EPA Region 6, May 15, 1997: Comment 29, and issue e in the Response to Issues in the D&M Report.)

The figures for paint and smelter emission contributions to soil lead are misleading. The 17 percent figure for paint is the mean of the paint percentages listed for soil samples in Table 4.5.2.1 of DOI's report (DOI, July 24, 1996) based on Drexler's electron microprobe results. For three of the soil samples (044, 379, and 502), the bulk of the "Paint" Percentage shown in the table was actually reported by Drexler as "cerussite (paint?)," which meant that the source of the cerussite could not be identified but that paint was a possible source. Cerussite is also a weathering product of galena, which is often found in chat. Cerussite was positively attributed to paint in only one soil sample (396). The 66 percent figure for smelter emissions, which also comes from the soil results in Table 4.5.2.1., is the mean percentage of lead reported as Pb(M)O and Mn/FePbO. However, the lead in Mn/FePbO is not necessarily related to smelter emissions. Moreover, MnPbO and FePbO are secondary weathering products formed in soil when soluble lead compounds react with iron and manganese oxides that are naturally present in soil, so they are not necessarily due to smelter emissions either.

The findings of the Geomega Report are not a "finger print" for smelter waste as the comment implies. The Geomega Report, states in a discussion of two of the four smelter waste samples from Hockerville that "Lead was present as lead (metal) oxides and antimony (metal) oxides phases identical to those identified in yard soils in the in the 1996 Drexler report, corroborating the conclusion that there is a substantive contribution of smelter lead to the lead pool in the residential yards." The EPA acknowledges that lead(metal)oxides were identified in the soil samples analyzed, along with a number of other lead mineral forms. However, the mere presence of lead(metal)oxides does not prove that smelters are the principal source of lead in the soil. Lead (metal) oxides have not been proven to be a "finger print" of smelter waste.

No smelter has been identified that could account for the lead levels found in soil at the Tar Creek Superfund Site. The Ontario Smelting Company smelter near Hockerville is the only smelter known to have operated on the Site. It was located 3 miles east of Picher in a generally crosswind or downwind direction under prevailing wind conditions, too far away to account for the soil lead levels found in Picher soil. Furthermore, the highest soil lead concentrations were generally found in Picher and Cardin. There is no evidence of an area-wide gradient in soil lead concentrations centered on the Hockerville smelter that would be expected if emissions

from that smelter were a major source of soil lead levels in the Study Area and particularly in Picher and Cardin, the areas most affected by lead contamination.

Historical information on the Tri-State Mining District indicates that there was a much greater concentration of large central milling operations in the Picher/Cardin area than there was elsewhere in the Tri-State Mining District. The size and abundance of former and existing chat piles in the Picher/Cardin area testify to this fact. The evidence shows that various releases, fugitive emissions, and wastes associated with the historical mining and ore processing operations were the major source of the elevated soil lead levels found in the Site area.

18. Comment: Omission of data concerning the potential sources of lead undermines the validity and reliability of the RI, Baseline Human Health Risk Assessment (BHHRA), the Feasibility Study (FS), and the remedy selection. The commenter repeatedly identifies the lead speciation data as the primary omission.

Response: The comment has no basis. No significant and reliable data on sources of lead were omitted. The RI, BHHRA, and FS contain sufficient reliable data which indicate that the lead contamination in the residential soil is primarily from mining waste. As explained above in our response to question number 17, the speciation data to which the commenter refers are inconclusive as far as the identification of the sources of lead in the mining area soil is concerned. It should be noted that the speciation data have been considered by EPA, and they are included in the Administrative Record File for the Site.

19. Comment: DOI and EPA have confirmatory information on three historic smelters that existed in the Picher area.

Response: The Ontario Smelting Company smelter near Hockerville is the only smelter confirmed to have operated on the Site (See Response to Comment 17 above). Information about the two other reputed smelter locations was apparently drawn from a DOI database. However, the locations identified are not confirmed locations of significant former smelter operations. There are no historical records or other data demonstrating significant smelting in the Picher/Cardin area.

COMMENTS ON THE IEUBK MODEL AND ITS APPLICATION AT THE SITE

20. Comment: The IEUBK model is flawed and, in its current form, does not provide a reliable and accurate basis for making decisions about children's health.

Response: The IEUBK model is the best tool currently available for assessing blood lead levels in children (EPA 1994a) and a good predictor of potential long-term blood lead levels for children in residential settings. The model has received extensive peer review from both the Science Advisory Board and the Technical Review Workgroup for Lead. In July of 1992, the Office of Solid Waste and Remedial Response (OSWER) convened a meeting to solicit comments on the original Uptake/Biokinetic (UBK) model from a wide range of interests, including environmental groups, citizens, and lead industry representatives, and incorporated comments from these groups into the current IEUBK model.

In 1994, EPA outlined its strategy for IEUBK model validation (EPA 1994b). Initial results of the validation effort were reported at the 1995 Society of Toxicology meeting by EPA representatives (Hogan et al. 1995). Validation was carried out with existing data sets relating environmental and blood lead levels on a per individual basis by using the IEUBK model to generate blood lead predictions from the measured environmental lead levels. These predicted lead levels were then compared with the measured blood levels, using geometric mean blood levels and proportions observed or expected to have elevated blood lead levels. All studies used for

the validation exercise had data of sufficient quality and quantity to characterize the environmental lead levels in each residential home and yard (i.e., blood lead levels of residents, as well as soil, dust, water, interior and exterior lead paint levels, and demographic/behavioral survey data covering other aspects of lead exposure). The modeled results and observed blood lead levels were reasonably concordant, with similar geometric mean predicted and observed blood lead concentrations (5.81 ug/dL versus 5.44 ug/dL, respectively) and similar population proportions with elevated blood lead levels (Renner 1995).

Comparisons of IEUBK model output to empirical blood lead data can contribute to an overall evaluation of the credibility of model predictions (EPA 1994b). Results of EPA's validation exercises provide confidence that the IEUBK model is a credible predictor of blood lead levels in environmentally exposed children.

21. Comment: The IEUBK model overestimates the impact of lead in soil on blood lead levels. The model overestimates absorption rates and ingestion rates. As a result, it overestimates exposure and predicts higher blood lead levels than are observed in communities.

Response: The commenter cites examples of other sites where the blood lead levels predicted by the IEUBK model were higher than the observed blood lead levels, possibly due to overestimates of the ingestion rates and/or absorption rates for lead in Site soil. However, the commenter has not shown that lead exposures or risks of elevated blood lead levels were overestimated for young children in the Study Group homes at the Tar Creek Superfund Site. In fact, the available evidence suggests otherwise. That is, blood lead data gathered on the Site has been consistent with IEUBK predictions.

It is unlikely that lead exposure from soil ingestion has been overestimated at the Site. Considering the relatively warm climate on the Site (which encourages outdoor play and the ensuing soil exposure), there is no reason to expect that soil/dust ingestion rates at the Site would be lower than model default values, which are based on estimates of average ingestion rates for national application. Similarly, the results from EPA Region VIII's study of bioavailability of lead in soil from the Jasper County, Missouri Superfund Site (Casteel et al. 1996) indicate that the 30% model default value for absorption of lead is at the low end of bioavailabilities (29 to 40%) measured for lead in soil from the Jasper County portion of the Tri-State Mining District.

Additionally, the observed blood lead data do not indicate that the model has over predicted blood lead levels. Results from the 1995 Oklahoma State Department of Health (OSDH) blood lead survey in Picher, where the Study Group is located, indicated that 10 of 48 (21%) tested children age 6 years or less had blood lead concentrations greater than 10 ug/dL. That percentage was consistent with community risk predictions Of the IEUBK model which were based on soil, house dust, homegrown produce, and tap water from Study Group homes.

A quarterly report (Malcoe, 1996) prepared at the request of the Companies by the University of Oklahoma as part of the Companies' Community Health Action and Monitoring Program (CHAMP) indicates that blood lead levels in young children from Picher are even greater than those reported by OSDH. In the first quarterly survey (July-October 1996; Malcoe 1996), it is reported that 38.3% of the 81 children tested in Picher (31 children) had blood lead levels greater than or equal to 10 ug/dL, and 13.6% had blood lead concentrations greater than or equal to 15 ug/dL. For comparison, this study indicated that, in the latest (1988-1991) United States population study of blood lead levels in children, only 8.9% of children 1 to 5 years old had a blood lead concentration greater than 9 ug/dL, and only 2.7% had a blood lead concentration greater than 14 ug/dL. The high percentages of elevated blood lead levels at the Site reported in the CHAMP quarterly report compares to the 2% of the general Oklahoma population with blood

lead levels greater than 10 ug/dL (Malcoe et al., April 15, 1997).

The CHAMP blood lead survey indicates that the model predictions may have underestimated, rather than overestimated, actual blood lead concentrations in Picher children. The higher observed blood lead levels are not inconsistent with the model predictions, as they may reflect additional exposures to lead from paint or other sources that the IEUBK model did not account for. The possibility of additional exposures to lead from other sources does not reduce the risks posed by lead in Site soil.

22. Comment: Reduction in soil lead levels leads, at best, to a small reduction in blood lead levels. The EPA's "Three Cities Study" found no reduction in blood lead levels in Baltimore and Cincinnati following soil remediation and a reduction of only 1 ug/dL per 1000 parts per million (ppm) lead in soil in Boston. Also, at the Bingham Creek mining waste site, a 0.6 ug/dL increase in blood lead was observed between 100 and 1,100 ppm lead in soil, and a smaller blood lead increase was observed at higher soil lead levels.

Response: The Three Cities Study Integrated Report (EPA April 1996) concluded that "(w)hen soil is a significant source of lead in the child's environment, under certain conditions, the abatement of that soil will result in a reduction in exposure that will cause a reduction in childhood blood lead concentrations." The seemingly small reduction of blood lead levels from reducing soil lead levels in the studies cited in the comment may not be directly comparable to the Tar Creek Superfund Site because of site-specific differences. The weak relationship between soil lead concentrations and blood lead levels in the studies cited may reflect the presence of other significant sources of lead exposure for children, relatively low bioavailability of lead in the soil, or other important site-specific differences. However, it should be recognized that any environmental lead abatement may be limited in its ability to quickly reduce blood lead concentrations in currently lead burdened children because blood lead levels reflect not just recent exposure, but also lead from accumulated body stores, which can be released to the blood. See Response to Comment 24 below.

23. Comment: The observed reductions in blood lead levels in the Boston Study portion of the Three Cities Study may be due to the general, national downward trend as well as natural reduction as a child gets older, rather than to soil remediation.

Response: The reported decline in blood lead levels associated with soil abatement in the Boston study is based on a comparison of a Study Group and a Control Group. The national trend cited would presumably effect both groups, therefore, they cannot explain the Study Group results.

24. Comment: The IEUBK model predicts a reduction of at least 3 to 6 ug/dL in the geometric mean blood level for each 1000 ppm in soil that is removed. Such dramatic reductions have not been achieved from soil remediation.

Response: Reductions in elevated blood lead levels may not be as great in the short-term as the IEUBK model predictions suggest, because the model does not take into account the existing body burden of lead resulting from previous exposures. Lead levels in the blood reflect not only recent exposures, but also the lead from accumulated body stores in bone and other tissues, which can be released by biokinetic processes to the blood. Because of this release from internal sources, there may be a component of blood lead levels in children that responds only slowly to any changes in environmental lead exposure. In the first year or two after abatement, this internal source of lead may cause a moderately elevated blood lead level to persist in a child. The effectiveness of lead abatement should not be evaluated only in terms of reducing existing high blood lead levels, but also in preventing future exposures and reducing risks of elevated blood lead levels in future residents.

25. Comment: The relationship between soil lead and blood lead ranges from nonexistent to weak. The commenter cites a number of studies of other sites in support.

Response: Reliable blood lead data are difficult to obtain, and the interpretation of the results is also often difficult because of small sample sizes and other confounding factors. Also, for a given site, soil may not be the main source contributing to increases in blood lead levels. Even at sites with very high soil lead concentrations, soil may not be the major contributor to blood lead if the bioavailability of the lead in soil is low. However, neither of these circumstances appears to apply at the Tar Creek Superfund Site.

26. Comment: Because of other sources that overwhelm the contribution from soil and because of the weak relationship between soil lead and blood lead, it is not clear that soil remediation will result in any observable reduction in blood lead.

Response: The commenter has not demonstrated that either premise applies to the Tar Creek Superfund Site.

27. Comment: Blood lead levels continue to decline nationwide in the absence of soil remediation, and this downward trend is observed at mining sites and other lead related sites.

Response: The EPA has responded to a previous similar comment. (See EPA Region 6, May 15, 1997: Comment 5.)

28. Comment: The IEUBK model has known errors in its absorption component. In the model, absorption of lead from food, water, soil, and dust actually increases as the child gets older, rather than decreases as would be expected.

Response: The IEUBK model calculates lead absorption from the gut as a function of two components, a passive component and an active component. The coefficient for passive absorption remains constant. However, the active component is affected by the concentration of lead in the gastrointestinal (GI) tract, that is, the coefficient for active absorption decreases as the lead concentration increases. The lead concentration in the GI tract depends on both the intake of lead and the GI volume, which is age dependent. As the child gets older, the GI volume increases, the lead concentration for any given intake decreases, and the coefficient of active absorption increases. Thus, when the lead intake rate is held constant, the total mass of lead taken up increases slightly with age, but when adjusted for the child's increasing body weight, the mass taken up per kilogram of body weight decreases as expected.

29. Comment: The IEUBK model probably overestimates soil ingestion rates; community-wide soil ingestion rates may vary substantially from the model assumptions. For example, in the risk assessment for California Gulch, Leadville, CO, EPA estimated soil ingestion rates to be about 40 percent of the IEUBK values based on the results of regression analysis of the soil lead and blood lead data.

Response: The EPA Exposure Factors Handbook (EPA March 1990) and the IEUBK Guidance Manual (EPA 1994c) reviewed soil ingestion rate data from a variety of sources and based their default ingestion rate recommendations on the weight of evidence that emerged from that broad based literature review. The EPA recognizes that there is uncertainty associated with the use of default soil ingestion rates in the IEUBK model, and acknowledged as much in the BHHRA report. However, there is no evidence that soil ingestion rates at the Tar Creek Superfund Site are significantly lower than the default rates. Ingestion rates estimated for the Leadville site are likely not applicable for the Tar Creek Superfund Site due to different conditions at Leadville (e.g., appreciable snow cover which may prevent soil contact for part of the year or

other site-specific factors).

30. Comment: Food lead intake rates are much lower than the IEUBK Model default rates, which are based on the 1986-1988 FDA Total Diet Study. The 1991 average dietary intakes of children two years old and infants 6-11 months old were 1.87 ug/day and 1.82 ug/day, respectively, much lower than the model default rates (Bolger 1996). Because dietary lead is overestimated, the remedial soil lead level predicted by the IEUBK model is lower than it should be.

Response: The 1991 intake rates reported by Bolger (1996), which were not available when the risk assessment was prepared in 1995, indicates that dietary lead intake has dropped noticeably since 1988, which suggests that the model default values for diet may be high. However, the Technical Review Workgroup for Lead has not completed its evaluation of the most recent data from the FDA Total Diet Study. Therefore, EPA Region 6 will rely on the model default values.

31. Comment: The IEUBK model does not completely or accurately account for paint exposure. Although the model has an option which allows the user to enter a daily intake of lead from paint chips, there is no guidance for estimating the amount of paint that might be ingested by a child. The default assumption of the model is no paint chip ingestion. Because of the high concentration of lead in some older paint, ingestion of tiny quantities of paint chips on a single occasion can cause serious lead intoxication and can cause greatly elevated blood lead levels. The EPA guidance for the IEUBK model states that the model is not intended to address the situation where a child ingests a large quantity of lead in a single episode, though it can be used to evaluate exposure to household dust contaminated by fine paint particles.

Response: The same points have already been made by EPA as part of the rationale for its decision to exclude paint chip data from the quantitative evaluation of lead in the BHHRA and instead to discuss the potential impact of paint chip ingestion in uncertainty sections of the BHHRA report. See Section 5.4.4.1 of the BHHRA report and Technical Reply Document (Revised July 10, 1996), page 17. The IEUBK model addresses paint ingestion for the vast majority of children (probably more than 90%) who do not deliberately eat paint chips, but inadvertently ingest house dust containing paint particles. Moreover, since the risk from yard soil containing lead-contaminated mining waste is, by itself, enough to warrant soil remediation, any additional lead intake from other sources such as paint would only increase the risk to the children on the Site, and, thus, provide additional justification for soil cleanup.

32. Comment: The IEUBK model requires a dust concentration and a percent of dust ingested that includes a paint source. There is no guidance for estimating these inputs. Also, the assumption used in the IEUBK Model for the dust-to-soil ratio is based on empirical data from sites which include contribution of lead from paint and other sources.

Response: The dust and percent of dust items appear on the Alternate Indoor Dust Entry screen which falls under the Multiple Source Analysis option for dust in the IEUBK Model (EPA 1994c). The contribution of soil to household dust is also an entry under the Multiple Source Analysis option. The Multiple Source option allows the user to use information about the contribution of lead from other sources such as paint to household dust, but is not required to run the model. The Multiple Source option was not used in the BHHRA for the Tar Creek Superfund Site. Instead concentrations actually observed in household dust on the Site were entered into the IEUBK model.

33. Comment: Similarity between observed blood lead levels and community-wide blood lead levels predicted by the IEUBK model does not prove causation. The model predictions are driven by assumed exposures to soil; however, actual blood lead levels may be affected by

paint. Failure to account for paint exposure in the model may result in under predicted blood lead levels.

Response: The EPA does not disagree with any of these statements. The IEUBK model was used in the BHHRA to evaluate the potential health risks associated with environmental lead exposures at residential properties, not to explain observed blood lead levels. The IEUBK model predictions indicated that elevated concentrations of lead in residential soil and dust could lead to unacceptably high blood lead levels in children. The model predictions did not account for potential exposures to lead from ingestion of paint chips and would not be directly comparable to the available blood lead data if paint chip ingestion is significant. Nevertheless, the model predictions are not inconsistent with the blood lead data generated by the Companies, which indicates that community blood lead levels are actually higher than the model predictions.

34. Comment: Validation of the IEUBK model has misleadingly indicated that the model predicts well. Cumulative frequency graphs appear to show a good match between predicted and observed blood lead levels. However, they do not compare the predicted and observed blood lead levels child by child, but rather by community as a whole. When specific children are examined, a low observed value often corresponds to a high predicted value and vice versa. Also, the model does not predict individual home or child risk reliably; it therefore should not be used for decision making for individual yards.

Response: Prediction of the blood lead level in a specific child is not one of the intended uses of the IEUBK Model; therefore, child by child comparisons of predicted and observed blood lead levels should not be used to evaluate model validity (EPA 1994b). The IEUBK model estimates a geometric mean blood lead concentration for a hypothetical child based on a given set of input values. Lack of agreement between the predicted blood lead concentration and the observed blood lead concentration for a specific child could be due to sources of variability that are not accounted for in the calculation (i.e., behavioral differences, biological differences, and measurement errors), and the use of model input values based on typical values that may not accurately describe the specific child.

The model should not be expected to reproduce an observed blood lead level exactly. The model prediction interval about the mean is wide. As long as the prediction interval includes the observed blood lead level corresponding to the same exposure inputs, the model's performance is considered satisfactory (EPA 1994c). Even when the predicted blood lead level seems unlikely to include the observed blood lead level, there may be a plausible explanation.

Aggregation of children lessens the impact of deviation from central tendencies in measurement and sampling errors and strengthens the observed relationship between environmental lead and blood lead. Demonstrations of concordance between model predictions and observed blood lead levels at several communities with varying environmental lead levels indicate that the model predictions are satisfactory, and that the model can be used for making decisions for individual yards.

35. Comment: The IEUBK model often systematically over predicts blood lead levels to a greater and greater degree as the soil lead level increases.

Response: At very high soil lead levels, the IEUBK model might not adequately account for saturation effects that limit lead absorption. Also, if the bioavailability factor used in the model was higher than the actual bioavailability, the IEUBK model would over predict blood lead levels for a site, and the effect would increase at higher soil concentrations. However, that does not appear to be the case at the Tar Creek Superfund Site.

36. Comment: The geometric standard deviation (GSD) of 1.6 used by the IEUBK Model (to

predict the blood lead distribution about the geometric mean) may be too large. If so, the predicted high end blood lead levels will be too high. Using a modified method which increases sample sizes within cells, EPA Region 8 has recently calculated smaller GSDs for Sandy and Bingham Creek, Utah (1.4 and 1.43, respectively).

Response: The EPA has responded to a previous similar comment. (See EPA Region 6, May 15, 1997: Comment 15.) The fact that a lower GSD was calculated at two sites using a modified approach does not justify a change in the default GSD. Evidence for the use of a lower GSD must be weighed against evidence that suggests a higher GSD may be just as appropriate. For example, Chrostowski and Wheeler (1992) report that GSD values obtained through community blood level measurements average around 1.7. And Chappell et al. (1990) and Bornschein et al. (1990) report GSD values of 1.63 and 1.69 for Leadville, CO and Midvale, UT, respectively.

37. Comment: GSDs calculated from empirical data may be overestimates due to exposure variations of children who visit yards where environmental lead concentrations are different from their homes. Since, remediation of soil reduces this source of exposure variation, post-remedial variation should be used to calculate the GSD and remedial levels.

Response: Empirical evidence suggests that the removal of a single primary source of lead exposure such as soil contamination may actually increase the GSD. The EPA's Technical Review Workgroup for Lead has calculated GSDs greater than 1.6 for groups of children with low lead exposure. When a single large source of lead exposure is removed, other lesser sources contribute greater percentages of the residual exposure and the greater variability in the remaining sources actually increases the GSD.

38. Comment: The recommended individual GSD is similar to the community-wide GSDs. This implies that variation in soil concentration throughout a community explains little of the variation in a child's blood lead level.

Response: The information provided in the comment is incorrect. The GSDs were calculated to estimate the interindividual variability of blood lead concentrations in children exposed to similar environmental lead levels. The sources of this variability include biological variability, behavioral variability, and measurement errors.

39. Comment: The EPA's stated goal, which is to have no more than 5% of children's blood lead levels be above 10 ug/dL, is arbitrary and not consistent with the Centers for Disease Control (CDC)(CDC, 1991).

Response: The EPA's policy is to attempt to limit environmental lead levels so that a typical child or group of children will have an estimated risk of no more than 5% of exceeding the 10 ug/dL blood lead level. That policy is not inconsistent with CDC guidelines. CDC has stated (CDC, 1991) that primary prevention activities including community-wide environmental interventions "should be directed at reducing children's blood lead levels at least to below 10 ug/dL."

40. Comment: The EPA should not use the lead concentrations measured in garden produce as inputs to the IEUBK model, since there is no apparent relationship with lead concentrations in soil at the Tar Creek Superfund Site.

Response: In the BHHRA, homegrown produce concentrations were entered in the IEUBK model for homes with gardens because produce consumption could contribute to the daily lead intake. This affected 27 out of 100 homes in the Study Group and 6 out of 15 homes in the Reference Area. Produce ingestion raised the predicted blood lead concentrations at those homes by approximately

0.2 to 0.3 ug/dL and, therefore, also raised the percent probability of concentrations above 10 ug/dL (by varying amounts). However, the effect on the community aggregate estimates was very small. Inclusion of produce data had no significant effect on the conclusion of the risk assessment. Note that produce consumption was omitted from the calculations of preliminary remediation goals.

41. Comment: Lead-based paint is ignored as a source of lead exposure. The condition of the lead-based paint was not accounted for in comparing the Reference Area to the Site or in estimating risk. The source of lead in soil is not clearly chat rather than paint. Lead-based paint is widespread and in poor condition and is likely to be the most significant source of lead at this Site. Also, although the BHHRA indicated that nearly every exterior paint sample contained large amounts of lead, it disregarded paint as a source of lead exposure.

Response: The EPA recognizes that deteriorated paint may have contributed to lead in soil and dust at some homes, affecting the measured concentrations of lead in soil and dust which were used as inputs to the IEUBK model. However, the evidence indicates that lead-based paint is not the primary source of the elevated lead levels in soil and dust found at the majority of residential properties in Picher.

Fewer than half of the exterior paint chip samples collected from the Study Group exceed the 5,000 milligrams per kilogram (mg/kg) standard used by the U.S. Department of Housing and Urban Development (HUD) for lead in paint. The available data indicate that the prevalence of lead paint is no greater in the Study Group than in the Reference Area homes. The EPA has discussed these issues previously. See Technical Reply Document (Revised July 10, 1996): second paragraph on page 9 through second paragraph on page 11, and the section titled "Lead in Paint as a Source" on pages 15 and 16. It should be noted that, even if other sources of lead on the Site pose a health risk, the risk from yard soil containing lead-contaminated mining waste is, by itself, enough to warrant cleanup of that soil.

42. Comment: The very small number of houses sampled in the Reference Area is entirely inadequate to make any meaningful comparison or conclusion regarding lead paint exposure at the Site.

Response: For EPA's reply, see Technical Reply Document (Revised July 10, 1996), pages 9 through 10. The EPA has acknowledged the limitations of the data, but the data that are available provide no indication of any significant difference in the prevalence of concentration of lead in paint chips found in the Study Group and Reference Area homes.

43. Comment: The recent CHAMP blood lead and environmental lead data do not indicate that chat is the dominant cause of elevated blood lead levels in this community. Of 45 children found to have blood lead levels greater than 9ug/dL, nearly all had other sources of exposure such as paint or home lead hobbies.

Response: The EPA cannot comment on these selected observations from the study without seeing all of the data. The BHHRA indicates that exposure to the elevated concentrations of lead in soil and dust that are present at many Study Group homes could lead to unacceptably high blood lead levels, and that the major source of elevated lead concentrations is mining waste. The EPA recognizes that there may be other sources of exposure. However, the possibility of additional exposures to lead from paint and other sources does not reduce the potential risks posed by Site-related (i.e., mining-waste-related) soil contamination. Moreover, since the risk from yard soil containing lead-contaminated mining waste is, by itself, enough to warrant soil remediation, any additional lead the risk to the children on the Site, and, thus, provide additional justification for soil cleanup.

44. Comment: The continuing nationwide downward trend in blood lead levels has been ignored in setting the remediation goal for lead in soil.

Response: Even if the nationwide downward trend continues, it is likely that the rate of decline in blood lead levels will decrease as general sources of lead exposure are eliminated. Also, the trend locally may differ from the national trend, especially when there is a major industrial source (e.g., mining waste at the Site).

45. Comment: The amount of lead in indoor dust that was derived from outdoor soil is overestimated. The dust-to-soil ratio assumed at Tar Creek Superfund Site to calculate the cleanup level is likely biased upward by contributions from other sources to indoor dust lead, therefore, the cleanup goal for soil is too low. Also, the Preliminary Remediation Goal (PRG) document (EPA September 1996) assumes that soil must be remediated to a level to account for a 200 ppm background level in house dust. This "background" level is the upper limit of house dust levels in the Reference Area, not an average as required for inputs to the IEUBK model.

Response: Post-remediation indoor dust lead levels cannot be predicted with certainty because they will be affected by other lead sources in addition to soil. Moreover, as soil lead levels drop, the relative lead contributions from other sources will likely increase, and the relationship between soil lead and dust lead will probably weaken. Therefore, any prediction based on the current relationship of dust lead to soil lead is, at best, an approximation of the relationship that will exist after remediation.

In the statistical approach presented in the PRG document, the current relationship between soil lead and dust lead was not expressed as a ratio. Rather, it was described by the regression line from the comparison of the log of dust lead concentrations to the log of soil lead concentrations for the Study Group homes, excluding four homes that had very high dust levels apparently from sources other than outdoor soil. The data were log-transformed for the regression analysis because both soil and dust concentrations were found to be log normally distributed. This shows the best statistical estimate of the current relationship between lead concentrations in soil and dust at most Study Group homes. Based on this regression line and IEUBK predictions, the PRG for lead in soil was determined to be about 500 mg/kg with an assumed indoor dust lead concentration of approximately 160 mg/kg.

The estimated 160 mg/kg post-remediation level for dust does not seem unreasonably high when compared to concentrations found in the Reference Area. Excluding one extremely high outlier, dust lead concentrations in the Reference Area ranged from 40 mg/kg to 221 mg/kg and averaged 114 mg/kg, approximately the same as the average lead concentration in the outside soil. With a soil remediation level of 500 mg/kg for the Study Area, there is no assurance that post-remediation dust concentrations will drop much below the estimated 160 mg/kg level.

On the other hand it is possible that dust lead levels in some cases will not drop all the way to the level predicted by the regression equation, due to other lead sources in the home. Because of the uncertainty, the empirical approach was included in the PRG document to show the effect that a higher dust lead concentration would have on the calculated PRG. The 200 mg/kg level was chosen as a reasonable upper bound estimate for dust lead in homes unaffected by soil contamination or other lead sources. Note that the resulting PRG (456 mg/kg) was not selected by EPA in the Proposed Plan for residential areas at the Tar Creek Superfund Site.

46. Comment: Comparison of blood lead levels and risks between the mining area and the Reference Area are invalid unless both communities are similar in socioeconomic conditions, age and condition of houses, education levels, and presence of lead paint and other sources.

Response: See Technical Reply Document (Revised July 10, 1996): section titled "Afton as a Reference Site" on page 20.

47. Comment: The BHHRA failed to demonstrate that mining wastes are the source of elevated blood lead levels that may exist at Tar Creek Superfund Site residential areas.

Response: The EPA has responded to this comment previously. See Technical Reply Document (Revised July 10, 1996): Second paragraph on page 24.

48. Comment: Because other sources of exposure are not considered, the cleanup level based on the risk assessment assumes that remediation of soil to this level will reduce children's blood lead levels to below the target goal. In reality, elevated blood lead levels will likely persist. The IEUBK model ignores the contribution of lead paint, thereby over predicting the magnitude of the contribution from soil. Consequently, lowering soil lead levels will not lower blood lead levels to the degree claimed by EPA.

Response: The IEUBK model predictions showed that risks of elevated blood lead levels from exposures to elevated lead concentrations in soil and dust at the Tar Creek Superfund Site exceed EPA's target, even without exposures from other major sources, and that reducing the soil concentration to 500 mg/kg would reduce the risk to the target level. The EPA expects that overall long-term blood lead levels will drop following soil remediation; however, EPA has made no claims with respect to declines in existing elevated blood lead levels. A factor that may slow actual declines in blood lead levels is the effect of the existing body burden of lead resulting from previous exposures (see Response to Comment 24 above). Also, EPA recognizes that lead paint may be a significant source of exposure at some homes, however, the evidence indicates that paint is not the primary source of lead exposure at most homes in the Study Area. Moreover, since the risk from yard soil containing lead-contaminated mining waste is, by itself, enough to warrant soil remediation, any additional lead intake from other sources such as paint would only increase the risk to the children on the Site, and, thus, provide additional justification for soil cleanup.

49. Comment: Most of the first draw tap water samples were actually flushed samples, because residents did not comply with the sampling protocol. Four of the five highest water concentrations came from first draw samples, presumably from the few residents who complied.

Response: Under sampling protocol, residents were asked not to run water from the tap for six hours before the first draw samples were collected. Although few residents complied fully with this request, meaning that some water was drawn from the tap during the six-hour period prior to sampling, it is not accurate to say that most of the first draw samples were actually flushed samples. A flushed sample is a sample which is collected after the tap was allowed to run for 2 or 3 minutes to replace all standing water in the pipe with fresh water. In most cases where residents failed to comply with the first draw protocol, the tap probably ran for a much briefer period--30 seconds or less (to fill a coffee pot, for example), still leaving mostly standing water in the pipe which would provide a valid sample. Moreover, pre-sample draws (e.g., for the coffee pot) might have occurred several hours prior to sampling. In short, it is unlikely that actual first draw concentrations would have been substantially higher than the concentrations measured in the samples actually taken. In any case, there is no basis for assuming that the four highest samples measured represent the only residents who complied with the sampling protocol. Finally, higher lead concentrations in tap water can only mean that the risk to children living on the Site is greater than predicted by the IEUBK model. That is, since the risk from soil lead alone is enough to warrant remediation, any additional lead intake from other media would only heighten the risk to the children.

50. Comment: The risk assessment calculates the estimated probability of children exceeding the 10 ug/dL target level in the Study Group to be 21.6 percent, using an assumption of one hypothetical child per home. This assumption is unrealistic since one child per household would equal a total of 2,055 children in the Study Area, which is far greater than the number of children who actually live there.

Response: The 21.6 percent probability is an estimate of the community risk for the 100 homes in the Picher Study Group and does not apply to the Study Area.

The 21.6 percent estimate is the aggregate of the risks for the 100 Study Group homes equally weighted (in other words, assuming one hypothetical child per home). Community risk was estimated in this way, despite the fact that many of the homes are not currently occupied by small children, because any residence could be occupied by children at some time in the future. Community risk was also estimated as the aggregate risk of the children actually living in the Study Group homes at the time of the study (37 children in 24 homes). The result was similar, 19.1 percent.

51. Comment: The EPA's use of the IEUBK model to set a 500 ppm cleanup level for residential soil is contrary to EPA's own guidance on the use of the model. The guidance manual (EPA 1994c) states that use of the model to assess trigger levels for soil abatement at the community, regional or state level "is discouraged because risks cannot be estimated adequately."

Response: This quote, taken out of context, has been misinterpreted by the commenter. Section 4.5.2.4 of the manual which is titled "Use of the Model to Assess Trigger Levels for Soil Abatement at the Community, Regional, or State Level" states "Use of the present version of the IEUBK model at this scale is discouraged, because risks cannot be estimated adequately." This statement means that the use of input data at the community, regional, or state level should not be used, because model predictions based on mean exposure concentrations at that scale may substantially underestimate risks from higher concentrations at some residences within the larger area. The model is intended to describe the exposure setting at a single residential level, therefore, input at the residence scale should be used.

Earlier statements in Section 4.5.2 make this meaning clear. Referring to community or neighborhood scale input, Section 4.5.2.1 states "We have little information on applications of the IEUBK model with larger scale input data, and we must caution the user against using the IEUBK model for this purpose." Further on in Section 4.5.2.3 which is titled "Use of the Model to Assess Risk of Elevated Blood Lead at the Regional or State Level," the manual states "There is no empirical basis whatever for using the present version of the IEUBK model at this scale. We have serious concerns that large scale input data may be totally inadequate characterizations of the spatially confined exposure for any individual child."

52. Comment: The use of the IEUBK model by EPA in connection with lead in soil sites is not discretionary. Because EPA's requirement that the model must be used to set cleanup levels constrains agency discretion, and because the model is used at every site where lead in soil is a concern, use of the model is subject to rulemaking requirements, including the requirements for public notice and comment. Since EPA has never taken the model through rulemaking, its use in this manner is not legal.

Response: This comment is incorrect. The use of the IEUBK model by EPA for lead in soil sites is discretionary and is not a requirement. Region 6 views the IEUBK model as a useful tool with sound scientific basis and computational correctness. Region 6 believes the IEUBK model is a good predictor of potential long-term blood lead levels for children in a residential setting, and that it can be used to support the establishment of remediation goals.

When EPA Region 6 was deciding what method to use to estimate the risk that lead may pose to the residential population at the Site, EPA Region 6 considered the following methods: slope studies, direct blood-lead measurements, and IEUBK modeling. However, EPA Region 6 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.

The remediation goal for lead in soil of 500 ppm was based not only on the IEUBK modeling, but also on the findings of the BHHRA and Region 6 experience with other soil lead remediation sites.

COMMENTS ON EPA'S EVALUATION OF REMEDIAL ALTERNATIVES

53. Comment: There appear to be an unduly large number of excavation related technologies (six of eight) among the alternatives that were evaluated by EPA. The FS provided little explanation of EPA's reasons for eliminating other technologies in the initial screening phase. For example, in situ lime treatment was eliminated with the explanation that the end product is a "solid nonleachable material considered impractical in residential areas." Particularly because many researchers have investigated the use of lime and phosphate amendment technology and EPA has used it in other regions, some discussion and a detailed evaluation of this technology would be prudent.

Response: Technologies for remediation of lead contaminated soil in residential yards that are effective, reliable, and acceptable to homeowners are limited. Lead, being an element, cannot be degraded like organic compounds, therefore, treatment technologies aim to alter the form of lead to reduce its mobility and/or bioavailability. Since young children, the segment of the population most sensitive to lead's toxic effects, would potentially be exposed to the soil in a residential setting, it is essential that the effectiveness of a soil treatment technology be proven before it is used in such a critical application. Existing treatment technologies for reducing the bioavailability of lead in soil have not been proven to be effective in in situ soil applications. Furthermore, in situ soil treatment technologies are often impractical in residential yard applications, because they often significantly alter the physical and chemical properties of the soil making it unsuitable for residential topsoil. Because requirements for residential yard application are more stringent, fewer technologies passed the initial screening and the subsequent screening phase than might normally have been, the case under a less critical

application. Based on Superfund program precedents, excavation has been the most common remedy selected to address soil in residential yards contaminated with lead which poses a health risk to young children.

The alternatives evaluated in the FS provide a range of technologies that are appropriate and practical for residential yard remediation applications. With regard to in situ lime and phosphate treatments, these technologies were screened out because they have not been shown to be practical and suitable for a residential application.

Although other EPA regions are considering these technologies, Region 6 is not aware that lime or phosphate treatment has actually been implemented at a Superfund site as a permanent remedy in residential yards where young children would be directly exposed. Region 7 reports that phosphate treatment has not been proven effective at reducing lead bioavailability (Region 7, Oronogo Duenweg Mining Belt Site, Operable Units 2 and 3, Jasper County, Missouri, Record of Decision, August 1, 1996). And because of an unsuccessful attempt to use phosphate treatment at a site in Bartlesville, Oklahoma (i.e., the National Zinc site), the State of Oklahoma does not support phosphate treatment as a remedy for residential yards where young children would be directly exposed. The State's lack of support for phosphate treatment is a significant factor, especially since the State must provide a cost match. Until research is able to demonstrate with assurance that lime or phosphate amendment technologies are effective in reducing bioavailability in situ where young children are directly exposed in residential yards, removing these technologies from further consideration in the initial screening phase is reasonable.

54. Comment: Alternative 4, capping in place, should have a similar degree of long-term effectiveness and permanence as the Preferred Alternative, which is also essentially a cap in place remedy. Also, if EPA believes the yellow barrier tape will protect the integrity of the cap in the Preferred Alternative, it should also protect the integrity of the cap in Alternative 4, with minimal additional cost.

Response: In Alternative 4, none of the contaminated yard soil is removed before placement of the soil cap. In Alternative 2, contaminated yard soil is removed to a maximum depth of 18 inches, which in most cases will remove all or most of the contaminated soil, before covering with clean soil. The soil barrier has a much more critical function under Alternative 4 than under Alternative 2, because breaching of the soil cap represents a much greater potential exposure risk from the remaining lead contamination. The commenter apparently misunderstands the purpose of the marker made of plastic material. The comment refers to the material as a yellow barrier tape, but it is a mesh fencing material (a geotextile barrier may also be used). The purpose of the plastic marker is simply to alert the resident or others of contamination remaining at lower depths in the event of any future digging or construction, not to protect the integrity of the soil barrier. That is, the marker will line the bottom of excavated areas. Whenever someone digs to that depth in the future, that person will be alerted by the barrier.

55. Comment: Fewer alternatives that mainly varied in the type of treatment technology should have been evaluated in detail. Alternatives 5, 6, 7, and 8 all involve treatment of excavated soil before final soil disposal. Carrying all four of these treatment remedies through the detailed analysis of alternatives was inappropriate. All but the least costly treatment alternatives should have been screened out early in the FS process.

Response: CERCLA, the National Contingency Plan (NCP)(40 CFR Part 300) and EPA policy encourages consideration of a variety and diversity of treatment technologies to address hazardous substances at Superfund sites. A different treatment technology is often the distinctive feature that forms the basis for a separate alternative. Properly evaluating treatment alternatives as distinctly different as the ones associated with Alternatives 5 through 8 requires more than just a consideration of cost. All the technologies considered by

EPA had distinct differences and merited consideration in the detailed analysis of alternatives phase.

56. Comment: More alternatives that incorporated CPMs should have been evaluated.

Response: CPMs were included in all the alternatives (see Proposed Plan Section, "Common Elements in All Alternatives"). CPMs are complementary to EPA's efforts to remediate the lead contaminated residential soil at the Site. However, CPMs (education, house cleaning, blood lead monitoring, etc.) do not provide the type of permanent remedy at the Site which is contemplated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see e.g., CERCLA Section 121, 42 U.S.C. § 9621). Given the CERCLA preference for permanent remedies, the inclusion of CPMs to the degree provided by Alternative 3 and as supplemental components of the other alternatives (the no-action alternative excepted) was considered appropriate.

57. Comment: The CHAMP is not mentioned in the RI/FS, or the Proposed Plan, and CPMs are included generically only as part of Alternative 3.

Response: CPMs, which are components of the CHAMP, were included as supplemental institutional controls, which are common elements in all the alternatives, the no-action alternative excepted. Alternative 3, included CPMs to a much greater degree.

58. Comment: The Companies' CHAMP should have been specifically evaluated and incorporated into several different remedial alternatives as part of the FS, and carried through to the detailed analysis stage.

Response: The remedy selection process normally evaluates remedy alternatives generically (i.e., evaluates kinds of alternatives and technologies). It is not necessary that special names that identify the technologies or programs locally be used. On the contrary, generic identifications are preferable because they are understandable by a broader audience with minimal explanation about local applications. It is not necessary for the Companies' CPM program to be identified by name. As a side note, the Companies' CHAMP is not a Site-wide program, because its full services are not provided to some communities in the mining area, Commerce, for example. Limiting EPA's evaluation to the Companies' CHAMP would have potentially restricted or limited the remedy.

59. Comment: The EPA indicated that if the CHAMP (the Community Health Action and Monitoring Program implemented by the Companies at the Site) were shown to be successful in reducing children's blood lead levels, it could be included as part of the remedy selected at the Site. The EPA did not uphold its part of the bargain with respect to the CHAMP.

Response: The EPA's Preferred Alternative does include CPMs as secondary components. The Companies' CHAMP, which is a CPM program, can be a complementary part of the remedy selected, as it has been a complementary part of the removal action supplementing permanent response actions. The EPA encourages the Companies to continue the CHAMP as this could help satisfy the requirements in the remedy for supplemental CPMs.

The EPA disagrees with the commenter's statement that it has not followed through on any commitments or promises it made to the Companies regarding their CHAMP. The EPA has continually stressed to the Companies that it encourages CPMs, including the CHAMP, as supplements and complements to engineering controls. The EPA has coordinated its Site response actions to facilitate implementation of the CHAMP. However, EPA has continued to express concerns about the use of CPMs at the Site, including the CHAMP, as a substitute for permanent response actions.

60. Comment: At the very minimum, a "no further action" alternative should have been developed and evaluated in the FS. It would consist of essentially no further soil excavation beyond the 1500 ppm soil lead action level and the ongoing remediation, monitoring, and education efforts being conducted as part of the CHAMP.

Response: The EPA's no-action alternative (Alternative 1) is essentially a "no further action" alternative. In EPA's no-action alternative, the residential areas are left "as is" at the completion of the removal action, without the implementation of remedial actions. The NCP expectation is that institutional controls (such as CPMs) supplement engineering controls, not that institutional controls be the dominant part of a remedy [see e.g., 40 CFR § 300.430(a)]. The EPA's Alternatives 2 and 3 include CPMs. CPMs play a bigger role in Alternative 3 than in Alternative 2, but dominate in neither of these alternatives.

The EPA has made no commitments to the Companies to develop and evaluate a primarily CPM remedy. The commenter's alternative (described above in the comment) is not adequately protective. The EPA has identified approximately 1600 residential properties with soil lead concentrations above the health-risk-derived level of 500 ppm. The lead contaminated soil at approximately 300 of these properties is being addressed by the removal program. The 1500 ppm action level, below which no excavation takes place in the commenter's alternative, is 3 times EPA's health-risk-derived level. The commenter's alternative would potentially leave children in approximately 1300 homes directly exposed to lead contaminated soil above safe levels. The risk associated with this level of potential exposure is considered excessive. The level of remaining risk posed by the commenter's alternative would place CPMs in the position of being the major component of the remedy. Also, the source(s) at the houses of documented cases of blood lead elevations would only be remediated after the source(s) are identified, which ignores the fact that EPA has already determined that soil lead levels in excess of 500 ppm may pose a health risk to children living there. The commenter's alternative, like EPA's no-action alternative, is not protective of human health, particularly children's health.

61. Comment: The Companies retained McCully, Frick & Gilman, Inc. (MFG) to evaluate four remedial alternatives using the IEUBK model. The four alternatives were: (1) FS Alternative 2, consisting of excavation of residential soil (500 mg/kg Action Level), (2) FS Alternative 2 modified to include CPMs, designated as Alternative 2a, (3) FS alternative 3, consisting of excavation of residential soil (800 mg/kg Action Level) and a CPM program, and (4) a No Further Action Alternative, consisting of no excavation beyond EPA's interim removal action (1500 mg/kg Action Level) and a continuation of existing CPMs. MFG used more realistic assumptions about residual lead concentrations. For example, for alternative 2, MFG used the average value calculated when homes above 500 ppm were excluded, rather than a residual lead concentration of 500 ppm. MFG concluded that, following implementation of Alternative 3 or the No Further Action Alternative, the probability of a blood lead level exceeding 10 ug/dL would be significantly less than 5%.

Response: MFG reached its conclusion, that Alternative 2 was overly conservative and the other alternatives were adequate, by using community-wide average soil lead concentrations as inputs to the IEUBK model to estimate community risks. That approach is faulty for at least two reasons. First, community-wide average concentrations should not be used as model input values to estimate community risks. The IEUBK model guidance (EPA 1994c) states "A common misinterpretation of the IEUBK Model is that it predicts community geometric mean blood lead and the fraction of children at risk when the input is the mean or geometric mean of household specific environmental lead concentrations." The guidance also states that such an approach "may substantially underestimate the real risk from the most contaminated parts of the neighborhood." Furthermore, EPA's risk criterion is not intended to be applied on a community-wide basis. Generally, EPA's policy is to attempt to limit environmental lead exposures so that a typical child or group of similarly exposed children will have an estimated risk of no more

than 5% of exceeding the 10 ug/dL blood lead level. Under the No Further Action Alternative, approximately 1300 residential yards would be left with soil lead concentrations that exceed the level at which children would have a greater than 5% chance of elevated blood lead levels.

The EPA's risk management decisions for remediation of residential lead contamination sites focus typically on reducing the risk at the residence level. Thus, cleanup goals at the Site are designed to reduce risk to a full time child resident receiving exposure at a residence to no more than a 5% chance of exceeding a blood lead level of 10 ug/dL.

The second problem with MFG's analysis was the overly optimistic assumption of indoor dust lead concentrations equal to zero for the alternatives that included CPMs (Alternative 2a, Alternative 3, and the No Further Action Alternative). In light of the uncertainties of the CPM program in reducing dust concentrations over the long-term, such a nonconservative and nonprotective assumption is not considered appropriate. Even if dust lead levels could be reduced to zero by "super cleaning," which is extremely doubtful, it is unlikely that they could be maintained at that level without a complimentary soil remediation program. MFG's report admits that "the estimation of zero for the dust contribution may be overly optimistic" (Uphoff, May 22, 1997, Attachment 4). This unrealistic assumption results in underestimates of total lead exposures.

62. Comment: MSG's experience at other sites suggests that the number of resident children with blood lead levels greater than 10 ug/dL may be zero under the No Further Action Alternative.

Response: While such an outcome would be most welcome, it is highly unlikely given the high percentages of children with elevated blood leads at the Tar Creek Superfund Site. The data from other sites cited by the commenter is inappropriately being applied to the Tar Creek Superfund Site which has different circumstances.

63. Comment: MFG evaluated the four remedial alternatives described above by comparing the incremental reductions in risk to the incremental increases in costs, environmental impacts and other short-term impacts. MFG concluded that the incremental reductions in risk achieved by Alternative 2a over Alternative 3 or the No Further Action Alternative was far outweighed by the incremental increases in cost and other impacts associated with Alternative 2a. MFG reached the same conclusion when comparing Alternative 3 to the No Further Action Alternative.

Response: The cost benefit analyses supplied by the commenter is invalid because the estimated incremental risk reductions rely on a community-wide averaging approach which may have substantially underestimated risk. Further, as discussed in the Response to Comment 62 above, the risk management goals typically apply at individual residences, not to the community as a whole. Moreover, the short-term impacts to benefits analyses supplied by the commenter are invalid because they rely on the same community-wide incremental risk estimates.

64. Comment: The volume of soil to be handled and the scope of the remedial activity increases by factor of approximately 18 for the 500 ppm action level for Alternative 2 compared to the No Further Action Alternative and increases by a factor of 9 for the 800 ppm action level for Alternative 3 compared to the No Further Action Alternative.

Response: Neither the No Further Action Alternative nor Alternative 3 adequately protect human health for reasons discussed in above responses to other comments and in the ROD. The increase in soil volumes and the increase in the scopes of Alternatives 2 and 3 are proportional to the increases in effectiveness of Alternatives 2 and 3. The EPA's Preferred Alternative, an excavation remedy which virtually eliminates residual risks, obviously removes and replaces much

greater volumes of contaminated soil compared to remedies that leave residual risk.

65. Comment: Based on the cost of a similar CPM program in Jasper County, Missouri the cost of CPMs associated with Alternative 3 should be \$100,000 per year rather than \$300,000 per year as estimated in the FS.

Response: The estimated annual CPM cost of \$100,000 conflicts with other information provided by the commenter. The Jasper County CPM program cost according to a reference from the Companies' consultant (Uphoff, May 22, 1997, Attachment 3) is \$67,000 annually plus staff time from the Jasper County Health Department and the City of Joplin Health Department. Also, according to this reference, personnel for the CPMs consists of two full time equivalents (FTE) plus assistance in testing. It's likely that cost for office space for the CPM personnel is not included in the \$67,000. This reference provided by the Companies' consultant also indicated that the Jasper County program is "constrained" by the level of funding. Therefore, a proper program, unconstrained by funding such as the one envisioned in the FS, including the cost for fully equipped offices would certainly cost much more than the \$100,000 estimated by the commenter. The estimated cost for CPMs in the FS is reasonable.

66. Comment: The EPA's Preferred Alternative is not cost effective.

Response: CERCLA mandates that remedies be cost effective. Alternative 2, the Preferred Alternative, 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 compared to Alternative 3 is proportional to the overall increased effectiveness of Alternative 2 compared to Alternative 3, because Alternative 2 addresses approximately 1312 residential properties with a permanent excavation remedy, which is effective over the long-term; whereas, Alternative 3 addresses only approximately 619 residential properties with excavation and relies on CPMs, which for the Site lack long-term effectiveness and permanence, to address the remaining residences.

The increased cost of Alternative 2 compared to Alternative 4 is proportional to the overall increased effectiveness of Alternative 2 compared to Alternative 4, because Alternative 2 addresses the residences with excavation which is permanent rather than capping, which for the residences at the Site lacks long-term effectiveness and permanence based on considerations of the likelihood of cap disruption and the likelihood of significant drainage problems as explained in the Proposed Plan in Section, "Long-term Effectiveness and Permanence."

Although, the no-action alternative is a no-cost alternative, it is not cost effective because it does nothing to actually reduce the risks at the Site, and is ineffective overall in protecting human health.

67. Comment: The Preferred Alternative (Alternative 2) does not address the risk of oral ingestion any more than less expensive and less time consuming Alternatives 3 and 4. The EPA acknowledges that Alternatives 3 and 4 also have high technical implementability.

Response: All the alternatives must be capable of satisfying the Remedial Action Objective which is as follows: Reduce ingestion by humans, especially young children, of surface soil in residential areas contaminated with lead at a concentration greater than or equal to 500 ppm. Selection of a preferred alternative consists of evaluation of all of the nine criteria [see 40 CFR § 300.430(e)(9)] in accordance with the NCP, not just the criteria (i.e., cost and implementability) referred to in comment. The EPA's evaluations of all nine criteria are

included in the Proposed Plan (and in the ROD). The following discussion highlights EPA's evaluation of cost and implementability referenced in the comment. Although Alternative 3 has high technical implementability, it poses significant problems with regard to administrative implementability and long-term effectiveness and permanence. Alternative 4 has high implementability, but is also lacking in long-term effectiveness and permanence. Alternative 2, EPA's Preferred Alternative, can be implemented without unacceptable short-term impacts to human health or the environment, even though it requires an estimated six years to complete (compared to 3 years for Alternative 3 and 4). The EPA's Preferred Alternative provides for readily implementable short-term measures to mitigate and control short-term impacts (e.g., spraying excavation areas with water to control dust), and thus allow the Preferred Alternative to be protective during implementation. Although Alternative 2 is more expensive, its increased effectiveness over Alternative 3 and 4 is proportional to its increase in cost as explained in response to Comment 66 (and in the Proposed Plan).

68. Comment: The EPA's evaluation of Alternative 3 does not adequately explain why this remedial alternative was rejected, especially in comparison to the Preferred Alternative (Alternative 2).

Response: The EPA disagrees. The EPA evaluated all the alternatives in accordance with the requirements of 40 CFR § 300.430 and documented its evaluation in the FS and the Proposed Plan. Each alternative was evaluated against the nine NCP criteria. Following this individual analysis, a comparative analysis was conducted to evaluate the performance of each alternative relative to the other alternatives, using the nine evaluation criteria. This comparative analysis identified the advantages and disadvantages of each alternative relative to the others so that the key tradeoffs could be identified. Alternative 2, the Preferred Alternative, represented the best balance of trade offs among the alternatives in terms of the five primary balancing criteria. In selecting the Preferred Alternative, the modifying criteria of State acceptance and community acceptance were also considered. The Preferred Alternative was properly evaluated in accordance with the requirements of 40 CFR § 300.430, and the Preferred Alternative best meets those requirements. The EPA's evaluation was documented in the FS and the Proposed Plan.

69. Comment: It is not clear why EPA considers an alternative with an 800 ppm action level and CPMS adequately protective for similar areas in the Region 7 portion of the Tri-State Mining District, but not for the Region 6 portion of the Tri-State Mining District. The EPA's concern appears to be related primarily to long-term effectiveness and implementability.

Response: As the comment pointed out, Region 6's concerns with the 800 ppm action level are primarily related to the balancing criteria of long-term effectiveness and implementability. Also, lack of state acceptance for CPMS, to the degree required for the 800 ppm action level, was an important consideration. A critical factor in implementability of CPMS is state government and local government support, particularly from the local health departments. State and local governments in Region 7 have demonstrated more support and ability to fund and implement CPMS for their portion of the Tri-State Mining District than the State and local governments in the Region 6 portion of the Tri-State Mining District. (See Response to Comment 87 below for additional discussion of this key factor.) Region 6 is also concerned about relying on institutional controls at the Site to address residual risk below 800 ppm. That is why Region 6 proposed a permanent engineering control (i.e., excavation) to address the residual risk rather than an institutional control (e.g., CPMS). Region 7 is also considering a permanent engineering control (i.e., phosphate treatment) to address the residual risk and has expressed some reservations about the long-term reliability of CPMS.

70. Comment: The EPA failed to adequately consider the environmental impacts (impacts on the

borrow areas) and other short-term impacts (such as truck traffic and industrial accidents) of an extensive residential soil removal and replacement remedy (i.e., the Preferred Alternative).

Response: The EPA disagrees. Region 6 has considerable experience implementing residential soil removal and replacement actions at other sites. The EPA Region 6 has carried out such actions without causing unacceptable short-term impacts to human health and the environment. Removal actions at this Site, which have been underway since 1995, and which are essentially the same as the soil removal and replacement components of the Preferred Alternative, are also being implemented without unacceptable short-term impacts to human health and the environment. A review of construction safety records from the start of the residential removal action in June 1996 to June 1997, shows no lost-time accidents or serious injuries, no injuries or illnesses to workers from exposure to any contaminants, and no accidents or injuries involving the public. Also, EPA's implementation of the Preferred Alternative will include readily implementable short-term measures (e.g., dust control measures, traffic safety measures, personal protective equipment for workers, environmental protection measures, borrow area restoration and erosion control measures, measures to address health and safety of workers and the community, etc.) to mitigate and control short-term impacts and thus allow the Preferred Alternative to be protective during implementation.

71. Comment: Alternative 4, capping in place, unlike the excavation alternatives would not risk remobilization of the lead. This should be considered a benefit in terms of protection of human health and the environment.

Response: Even though there is more potential for lead to be remobilized in an excavation alternative, potential dust generation, erosion, and other types of remobilization of lead are readily controlled through measures to mitigate any potential short-term impacts. For further discussion about control measures for short-term impacts, see Response to Comment 70 above.

72. Comment: In Section 5.2.9 of the FS, EPA appears to refer to relocation of certain residents in the area. Is EPA considering relocation as part of the remedial action?

Response: The EPA is not proposing to relocate residents as part of the remedial action. See section, "Common Elements in All Alternatives" of the Proposed Plan for further explanation. See also EPA's response to comments 19 And 20 in Part A of this Responsiveness Summary at Section II(a).

73. Comment: With respect to the Preferred Alternative, there is no indication which residences, if any, would be given priority for performance of the remedial actions. Precedence should be given to residences with children exhibiting elevated blood lead levels.

Response: Prioritization of cleanup actions is a detail that will be developed during the remedial design. However, residences of children with elevated blood lead levels will be given the highest priority.

74. Comment: Why did the Proposed Plan fact sheet indicate that no Five Year Review is required? Given that EPA is proposing a 30-year monitoring as part of the Preferred Alternative, and given historical experience with Operable Unit 1, a Five Year Review would certainly appear warranted.

Response: The 30-year monitoring period is the estimated period for operation and maintenance for cost estimating purposes. Monitoring associated with the Preferred Alternative is primarily related to the disposal area and not the remediated residential yards. As the commenter

recommended, based on experience with Operable Unit 1, a Five Year Review is warranted for parts of Ottawa County where contamination remains at concentration levels which may pose a health risk or an environmental risk. A Five Year Review for areas addressed by Operable Unit 1 has already been conducted and an additional Five Year Review is planned. However, for the residential areas addressed in the ROD, where soil contamination above the health-risk- derived level is removed, a Five Year Review is not necessary.

75. Comment: The EPA's use of the term "Indian owned lands" in the FS is confusing.

Response: The term "Indian land" or the term "Indian owned land" means the categories of Indian land as described in CERCLA § 104(c)(3). The terms "Indian land" and "Indian owned lands" are used generically.

76. Comment: Why is wind erosion considered a potential transport mechanism of lead particles from chat piles for the initial contamination in the RI, but not a factor with respect to potential recontamination of the remediated yards in the FS?

Response: During the active mining years, when earth-moving activity stirred up dust, the air deposition of lead contaminated particles was likely greater than during the post-active mining period. Wind erosion is still considered a potential transport mechanism; however, the rate of current air deposition with respect to recontaminating the remediated yards is small for most properties. For the other properties, the potential for recontamination will be controlled by appropriate dust and erosion control measures.

COMMENTS ON COMMUNITY PROTECTIVE MEASURES (CPM)

77. Comment: The EPA ignores its own guidance (EPA July 14, 1994), which states that development and promotion of public awareness programs focusing on the causes and prevention of lead poisoning in children should be considered in conjunction with other measures to reduce blood lead levels.

Response: The comment is not correct. The EPA has been encouraging and supporting public awareness programs at the Site concerning lead poisoning and prevention. The EPA's Preferred Alternative includes health education which provides for public awareness programs focusing on the causes and prevention of lead poisoning in conjunction with and supplemental to the active response activities (e.g., engineering controls) at the Site.

78. Comment: The sources of the observed elevated blood lead levels in Picher and Cardin do not appear to have been identified through an environmental assessment. The EPA assumes that the source of the elevated blood levels is lead in soil.

Response: From the context in which the comment was made it appears that the term "environmental assessment" is referring to environmental sampling and behavioral assessments in individual homes following the confirmation of blood lead poisoning of children living in those homes. While these "environmental follow-ups" are useful for managing cases of lead poisoning, they are not necessary to determine sources of lead on a community-wide basis. The EPA conducted its own extensive community-wide environmental assessment. The EPA investigations indicated that the primary source contributing to elevated blood lead levels in children at the Site is soil.

79. Comment: A CPM approach that directs that site assessments occur where elevated levels are identified, followed by remediating the identified sources(s), followed by monitoring is more comprehensive, site specific and cost efficient, while being more protective of children's health than EPA's soil excavation approach at the Site.

Response: The EPA disagrees. The approach described in the comment is not more comprehensive. The EPA's investigations at the Tar Creek Superfund Site indicate that the primary source contributing to elevated blood lead levels in children is soil. In fact, the soil is so contaminated that soil alone, without consideration of any other source of lead, poses an unacceptable risk to children living on the Site. Moreover, EPA's Preferred Alternative calls for investigation of every home in the mining area to determine if the soil is contaminated with lead above the health-risk- derived level. In addition to comprehensive primary prevention, EPA's Preferred Alternative includes supplemental CPMs such as health education and blood lead monitoring. The EPA works with and encourages the State and local governments and health departments to continue blood lead monitoring. The State and local health agencies normally conduct follow-up environmental testing for cases of elevated blood lead levels to identify sources, and these agencies normally conduct follow-up lead exposure reduction counseling. Also, EPA does work with and encourage others, including the State and local governments and health departments, to address the lead-based paint that may be contributing to elevated blood lead levels in some homes. The EPA's Preferred Alternative is cost-effective, because the increase in effectiveness is proportional to the increase in cost (see Comment 66).

The approach described in the comment is a case management approach that deals with individual cases and addresses sources of lead only after the children's blood lead levels have become elevated. It is unclear why the CPM approach discussed in the comment is described as being "site specific." In this context "site specific" appears to equate individual cases or homes with "sites." If this is the meaning, then the approach described by the comment, does not address all the "sites" or homes, but only the ones with cases of lead poisoning. Site specific in this context seems to be more of a deficiency than an advantage. Because the approach described in the comment does not include primary prevention on a community-wide basis, it is considered less comprehensive than EPA's Preferred Alternative and less protective of children's health. The EPA's approach addresses lead contamination levels that may pose a risk wherever these elevated concentrations are found in the residential areas. The EPA hopes, in this way, not only to reduce the risk to children who already have elevated blood lead, but to eliminate dangerous poisons in the environment before they affect other children's health.

This comment highlights the differences between the approach that EPA uses to address lead at Superfund sites and approaches used mainly by health departments. The focus of health agencies, with regard to lead is on addressing lead poisoning after it has occurred. Under CERCLA, EPA's main focus with regard to lead is to reduce environmental lead exposures that may pose a health risk, whether or not lead poisoning has actually occurred. This does not mean that EPA is not concerned about individual cases of lead poisoning, nor does it mean that there is not some overlap in responsibilities between EPA and health agencies. The overall best approach is a combined approach coordinating Superfund risk reduction activities, focused on primary prevention, with the health agency actions focused on managing cases of lead poisoning.

80. Comment: The CPMs described for Alternative 3 in the Proposed Plan do not include the following elements: institutional controls, targeted health education and training, environmental assessments, abatement of identified sources, and monitoring of the effectiveness of the CPM program.

Response: In EPA's Proposed Plan the CPMs for Alternative 3 provided for all these elements that the commenter indicates are missing. However, the Proposed Plan listed only the major elements of CPMs, and did not include many of the details specified by the commenter. Such details are usually specified during the design phase. The specific details of the CPMs can also be adjusted during implementation phase. The EPA has no expectation that proposed plans and RODs include all details of a remedial design. Also, some of the CPM items proposed by the commenter are items that would be provided for as part of lead poisoning and prevention programs by others including health departments.

81. Comment: The CPMs outlined in Alternative 3 should be broader. Blood screening and sampling of lead sources should not focus on residences with residual risk from lead contaminated soil, but should include all residences where there are children under 6 years of age. Also CPMs should address sources other than soil including paint, water pipes, hobbies, gasoline, etc. The communities can be badly misled if they believe soil removals addressed all sources causing elevated blood lead levels. A purely soil-based abatement program gives communities a false sense of safety.

Response: The EPA's investigations indicate that the primary source contributing to predicted elevated blood lead levels in children at the Site is soil. Therefore, focusing CPMs on residual risk from lead in soil is appropriate. This does not mean that other sources are not of concern to EPA. For example, lead paint may contribute to lead exposures at some homes and could be a major source of lead exposure at those homes; however, mining waste, and not paint, accounts for most of the soil lead and lead in dust found at most homes. The EPA does work with and encourage others, including the State and local governments and health departments, to address the sources other than soil. Community education efforts envisioned by the plan would not be limited to education about soil and would caution that for some homes other sources could pose a health risk.

82. Comment: If Superfund created CPMs were the basis of a more comprehensive community attack on lead exposure, and this was understood, the preferences of the State and Tribes would change.

Response: The State and Indian Tribes have been thoroughly involved and informed during the remedy development process. The State and Indian Tribes are familiar with the CHAMP CPM program at the Site and are conducting some of their own CPM activities. The State and Indian Tribes are also familiar with EPA's soil removal activities at the Site. It is speculation to presume what the State and Indian Tribes may or may not prefer under certain circumstances. The State and Indian Tribes are informed and it is best to let them speak for themselves with regard to their preferences.

83. Comment: A program focused just on yard cleanups is a short-term response which lacks permanency. CFM5 have permanence. Also, EPA has provided no support in the administrative record to substantiate its concerns that CPMs lack long-term effectiveness. There is considerable experience with CPMs at other Superfund sites which demonstrates that CPMs can be effective in the long-term.

Response: The EPA disagrees. Long-term effectiveness and permanence has specific meaning in the NCP (see 55 Fed. Reg. 8666, 8720, 8849, March 8, 1990). An evaluation of permanence focuses on the "magnitude of residual risk remaining" from hazardous substances remaining at the conclusion of the remedial action. This analysis includes consideration of the degree of threat posed by the hazardous substances remaining at the Site and the adequacy of controls used to manage the hazardous substances remaining at the Site. To the degree that remedies rely on CPMs to address risk rather than engineering measures (e.g., removal of contaminated soil from residential areas) concerns are raised about long-term effectiveness and permanence. If a primarily CPM remedy were used at the Site, significant residual risk would remain, as discussed in the Proposed Plan. CPMs, which are institutional controls, do not reduce the residual risk at the Site and correspondingly, raise concerns about long-term effectiveness and permanence. On the other hand, the soil removal component of EPA's preferred alternative does reduce to insignificant levels the residual risk to the population in the residential areas and, therefore, has high long-term effectiveness and permanence.

That soil removal is a "short-term" response is not a negative attribute, as the commenter seems to imply, but a positive one--soil removal is rapid and therefore effective in the "short-term."

That CPMs must be maintained in perpetuity is not a positive attribute, but a negative one. The comment seems to imply that a long-term program has permanency whereas a soil excavation remedy that is completed in the short-term would not. Permanency in the NCP has to do with how long the remedy is effective and not how long it takes to complete it. The EPA's Preferred Alternative is directed at removing the source of the lead poisoning and is not focused mainly on establishing a perpetual program to deal with the effects of lead in the environment. Although in EPA's Preferred Alternative, some CPMs will supplement the soil removal, CPMs are not the main focus. The commenters acknowledged that "it is certainly too soon to be able to demonstrate the permanence of any CPM created as part of a Superfund remedy . . . " (Uphoff, May 22, 1997, Attachment 5) to which EPA agrees.

An evaluation of long-term effectiveness and permanence also includes an evaluation of the "degree of certainty that the alternative will prove successful." Evidence from other Superfund sites regarding long-term effectiveness is mostly anecdotal. As the reference (Uphoff, May 22, 1997, Attachment 5) supplied by the Companies' consultant confirms, most of these CPM programs are relatively new having only been implemented in the early 1990's. This limitation provides little historical data upon which to evaluate long-term success. There is little scientific evidence to demonstrate that CPMs would be successful and reliable in the long-term. The EPA is unaware of published scientific studies that could be included in the administrative record on the success and reliability of CPMs. The lack of scientific evidence that CPMs would be successful over the long-term is a significant concern to EPA for the Site.

Finally, under the NCP, EPA expects to use institutional controls such as CPMs as a supplement to engineering controls, not as a sole remedy. Under the NCP the use of institutional controls shall not substitute for active response measures unless active response measures are determined not to be practicable based on the balancing of trade-offs that is conducted during the selection of the remedy. See 40 CFR § 300.430(a). As described in the Proposed Plan and in the ROD, the engineering controls (supplemented by CPMs) to be used under the Preferred Alternative represent the best balance of trade-offs. Moreover, EPA Region 6 experience with excavation of lead- contaminated soil and backfilling of excavated areas has found it to be a successful remedy.

84. Comment: If CPM were purely an educational program its results would unlikely achieve the Superfund intent (e.g., long-term effectiveness and permanence); but education with environmental assessment with intervention and monitoring is a different matter.

Response: The comment alludes to one of the inherent weaknesses of CPMs, which is reliance on education to affect behavioral changes on a sustained basis to control exposures to lead sources in the environment. A reference provided by the Companies (Uphoff, May 22, 1997, Attachment 4) provided additional insights by acknowledging that the effectiveness of education as a permanent solution is "not quantifiable due to lack of a study designed specifically to test the effectiveness of educational intervention." Rigorous statistical studies demonstrating the benefits of education programs in preventing lead exposure are lacking. The comment attempts to allay concerns about the effectiveness of education in preventing lead poisoning by suggesting that education with environmental assessment, intervention, and monitoring would be effective. However, such interventions would only occur after children developed elevated levels of lead in their blood. This approach does not prevent lead poisoning, but manages the cases after they occur.

Over a period of years, every home will likely have children living in it. Therefore, since education alone is unlikely to be effective in preventing lead poisoning, it is likely that the environment of every home with sources of lead above safe levels will potentially have to be addressed. When a major environmental source (e.g., yard soil) has lead above safe levels, it is more protective of health to abate the sources all at once up front rather than drag the

process out over years by abating only when a child becomes lead poisoned. Ultimately the soil at every home will likely have to be abated anyway.

85. Comment: The EPA's concerns about the uncertainties regarding the administrative implementability of CPMs are somewhat doubtful in light of the fact that the very types of activities proposed as CPMs in Alternative 3 are those recommended by CDC [Centers for Disease Control] guidelines to address elevated blood lead levels in the 10 ug/dL to 20 ug/dL range in children age 6 and under.

Response: The recommended responses based on blood lead ranges in the CDC guidelines in question are for medical management (i.e., health professionals conducting lead poisoning follow-up activities). They are not intended to guide environmental agencies that conduct primary prevention activities like abating communitywide lead sources (for further discussion see Technical Reply Document, Revised July 10, 1996, response #3 on pages 4 and 5). The fact that CDC recommends certain CPM-type actions does not mean that they are readily implementable, only that they are recommended. State and local government support, capability, and funding are major factors that make CPMs more or less administratively implementable at a given site. The EPA's reasons for its concerns about the administrative implementability of CPMs at the Site over the long-term are further discussed in Response to Comment 59 above.

86. Comment: The EPA has provided no support in the administrative record to substantiate its concerns that CPMs are lacking in implementability. In responding to EPA's concerns expressed in the Proposed Plan about the uncertainty of a permanent CPM program at the Site in future generations, a commenter stated that "EPA has ignored the likelihood that the current generation will educate the future generation."

Response: The EPA disagrees. Lead is an inorganic element that does not dissipate or degrade to an appreciable extent. In the absence of an engineering solution that permanently removes, detoxifies or isolates the lead, it will continue to pose unacceptable risks for many decades or even centuries. An expectation that an effective CPM program at the Site will be passed on from generation to generation is unrealistic.

In order for CPMs to be effective for a long period of time several elements are required:

- A high degree of support and participation by state and local governments and the community;
- A permanent source of funding; and
- Participation by an organization willing and able to organize, administer and implement the program on a permanent basis.

These elements are lacking at the Tar Creek Superfund Site.

The community, local governments, and the State have supported the CHAMP program as a supplement to primary remedial activities conducted by EPA, however, based on comments received on the Proposed Plan, they do not support reliance on CPMs to a significantly greater degree than proposed for Alternative 2.

Superfund generally cannot provide long-term funding for a permanent CPM program (see e.g., 40 CFR § 300.435). Based on the lack of support for a significantly increased role for CPMs at the Site, the State and local governments are unlikely to provide the funding. The Companies have funded the existing CHAMP program but have not offered a permanent or long-term funding commitment. Moreover, even if a source of long-term funding could be found for a permanent CPM

program, as explained in our response to comments 56 and 84, CPMs do not provide the type of permanent remedy at the Site which is contemplated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see, e.g., CERCLA Section 121, 42 U.S.C. § 9621).

The existing CHAMP program was implemented by the University of Oklahoma Health Sciences Center with funding from the Companies. The existing CHAMP program has been well received; however, the University of Oklahoma is primarily an educational institution and would not normally be expected to organize and operate a major long-term health education and monitoring program of the type that would be required. When the Indian Health Service, The Oklahoma Department of Health, and the Ottawa County Health Department, organizations that might be able to undertake such a long-term program, were approached by the Companies to implement the CHAMP program, none were able to do so because of various limitations of their programs.

Based on these considerations, EPA is justified in its concerns about the permanence and long-term effectiveness of a CPM program to the degree required for Alternative 3 at the Tar Creek Superfund Site.

87. Comment: Recommendations by the National Remedy Review Board (NRRB) regarding CPMs and inclusion of CPMs by Region 6 as part of the Preferred Alternative are clear endorsements of the efficacy, effectiveness and implementability of CPMs.

Response: With regard to the Tar Creek Superfund Site, the NRRB recommendations stated that CPMs are "likely to play an important supplemental role." The EPA still has concerns about the long-term "efficacy, effectiveness and implementability" of CPMs for the Site if relied on to a significantly greater degree than envisioned in the Preferred Alternative. The Companies are encouraged to continue the CHAMP to supplement the engineering controls planned for the Site.

Attachment I to Section II, Part B of the Responsiveness Summary

**TAR CREEK SUPERFUND SITE
DETAILED RESPONSE TO COMMENTS RECEIVED
DURING PUBLIC COMMENT PERIOD
FOR THE REMOVAL ACTION FOR THE
RESIDENTIAL AREAS**

May 15, 1997

INTRODUCTION

The U. S. Environmental Protection Agency (EPA) memorialized the selection of the response action for the removal in question in an action memorandum dated March 21, 1996. Pursuant to 40 CFR § 300.820(b)(2), in a letter of March 6, 1997, EPA responded to comments submitted during the public comment period regarding the residential removal action at the Tar Creek Superfund site (the "Site"). The EPA's March 6, 1997, letter addressed comments received from the following: Leslie C. Nellermeoe on behalf of ASARCO Inc. in a letter of August 16, 1996; Gary D. Uphoff on behalf of ASARCO Inc., Blue Tee Corporation, Childress Royalty Company, Inc., Gold Fields Mining Corporation, and The Doe Run Resources Corporation in letters of October 21, 1996 and October 22, 1996; and Lisa G. Esayian on behalf of NL Industries, Inc. in a letter of October 21, 1996. ASARCO Inc., Blue Tee Corporation, /Royalty Company, Inc., Gold Fields Mining Corporation, NL Industries, Inc., and The Doe Run Resources Corporation are referred to collectively in this document as the "Companies." This letter also addressed the comments of Edward B. Cohen of the U.S. Department of the Interior (DOI) which he submitted, in a letter of October 21, 1996.

As explained in EPA's March 6, 1997, letter, the comments submitted by the Companies and DOI during the public comment period had already been answered once by EPA, or else they did not provide information which warranted any action, accordingly, EPA did not believe that the comments were significant. Therefore, EPA did not need to reply to the comments submitted during the public comment period as part of the administrative record for the removal action called for in the March 21, 1996, action memorandum [see 40 CFR § 300.820(b)(2)]. Nevertheless, because there is public interest in the issues raised in the comments submitted by the Companies and DOI during the public comment period, EPA decided to provide this detailed response to those comments, and to include this detailed response in the administrative record for the remedial action for the residential areas on the Site.

The documents that EPA relied upon in preparing this detailed response to comments or other documents referenced in the text of this response include the following:

Agency for Toxic Substances and Disease Registry (ATSDR), February 1995, Lead and Cadmium, Exposure Study for the Jasper County, Missouri Superfund Site

Bornschein, R.L., Clark, C.S., Grote, J., Peace, B., Roda, S., and Succop, P., 1988, Soil Lead-Blood Lead Relationship in a Former Lead Mining Town. In Environmental Geochemistry and Health Monograph Series 4. Lead Soil: Issues and Guidelines. (B.E. Davies and B.G. Wixsons, Eds.), pp. 149-160, Science Reviews Limited, Northwood, England.

Bornschwin, R.L., Clark, C.S., Pan, U.W., et al 1990, Midvale Community Lead Study, Department of Environmental Health, University of Cincinnati Medical Center.

Burkart, Burke, July 6, 1995, Report of Analysis of Tar Creek Soil Samples for Ecology and Environment Inc.

Burkart, Burke, September 23, 1995, Report of Analysis of Tar Creek Soil Samples for Ecology and Environment Inc.

Casteel, S.W., Weis, C.P., Henningsen, G.M., Hoffman, E., Brattin, W.J., Hammon T.L., May 1996, Bioavailability of Lead in Soil Samples from the Jasper County, Missouri Superfund Site, Document Control Number 04800-030-0161

Centers for Disease Control (CDC), 1986a, Kellogg Revisited - 1983. Childhood Blood Lead and Environmental Status Report, Panhandle District Health Department and Idaho Department of Health and Welfare, Center for Environmental Health, Centers for Disease Control, U.S. Environmental Protection Agency.

Centers for Disease Control, 1986b, East Helena, Montana, Child Lead Study, Lewis and Clark County Health Department and Montana Department of Health and Environmental Science, Centers for Disease Control, Public Health Service, U.S. Department of Public Health and Human Services, Atlanta, Georgia.

Centers for Disease Control, October 1991, Preventing Lead Poisoning in Young Children

Chappell, W., et al., 1990, Leadville Metals Exposure Study, Colorado Department of Health (Division of Disease Control and Environmental Epidemiology), University of Colorado at Denver (Center for Environmental Sciences), and U.S. Department of Health and Human Services (ATSDR/PHS).

Community Health Action and Monitoring Program (CHAMP) Quarterly Report, July 1996 - October 1996, University of Oklahoma, Health Services Center

Dames & Moore, November 2, 1994, Residential Yard Assessment Report for Jasper County, Missouri and Cherokee County, Kansas

Drexler, John W., June 24, 1996, Laboratory for Environmental and Geological Studies, Department of Geological Studies, University of Colorado, Boulder, Colorado, Laboratory Report of Lead Speciation for Bureau of Land Management

EPA, April 1992, Guidance for Data Useability in Risk Assessment (Part A), Final

EPA, July 14, 1994, Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive No. 9355.4-12

EPA, February 1994, Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, OERR Publication No. 9285.7-15-1

EPA, 1995, Evaluation of the Risk from Lead and Arsenic, Sandy Smelter Site Sandy, Utah, Draft Final, July 1995.

EPA, Region 6, Technical Reply Document, Residential Area Response Actions, Tar Creek Superfund Site, (Revised July 10, 1996). Note: This referenced document can be found in the Administrative Record File which is located at the repositories including the Miami Public Library in Miami, Oklahoma.

EPA, Region 6, August 1996, Baseline Human Health Risk Assessment Report, Tar Creek Superfund Site, Ottawa County, Oklahoma, Prepared for EPA by Ecology and Environment, Inc.

EPA, 1989, Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual, (Part A), Interim Final

EPA, Region 6, May 5, 1995, Supplemental Region 6 Risk Assessment Guidance Draft

Oklahoma State Department of Health(OSDH),1995, Ottawa County Blood Lead Summary, Memorandum:
To: Jennifer Lyke (ATSDR), From Kim Quinn (OSDH). December 18, 1995.

U.S. Department of Housing and Urban Development(HUD), 1995. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

In responding to comments by the Companies and DOI, the following terms are used as indicated below:

- Study Area - means the mining area of Ottawa County which was the subject of the Baseline Human Health Risk Assessment(BHHRA);
- Study Group - means the 100 homes in Picher where multi-media environmental samples were taken;
- Reference Area - means the 15 homes in Afton, Oklahoma which are outside of the mining area where multi-media environmental samples were taken, these homes were used for comparison to homes within the mining area;
- OSDH survey - means the Oklahoma State Department of Health(OSDH)Picher blood lead survey unless the OSDH county-wide survey is specifically referenced.

EPA'S RESPONSE TO COMMENTS

1. A commenter stated that the median blood lead level of 3.8 ug/dL for children at the Tar Creek area, relative to the soil lead levels, is low. The comment was based on the Oklahoma State Department of Health (OSDH) blood lead survey conducted in Ottawa County in 1995, for the children ages 1-5 years old. This commenter also stated that the incidences of elevated blood lead levels are probably more influenced by socio-economic conditions and the presence of deteriorating lead paint than by lead in soil from chat.

Response: The median blood lead level of 3.8 ug/dL cited in the comment is based on the county-wide results from the OSDH 1995 blood lead survey. That value is not representative of blood lead levels in the mining area, which encompasses only a part of Ottawa County. Over one-third of the 232 children tested county-wide were residents of communities outside of the mining area. The OSDH survey results showed that blood lead levels of young children in the city of Picher, which is near the center of mining activities in the county, were substantially greater than in other communities and the county as a whole. The proportion of young children ages 1-6 years old found to have blood lead levels of 10 ug/dL or greater in Picher was 21% (10 out of 48) versus 4%(4 out of 105) in the rest of Ottawa County.

The results of EPA's 1995 investigation indicate that mining waste is the major source of elevated lead levels in soil and dust within the mining area, and therefore an important contributor to lead exposure. Lead concentrations in soil from the Picher Study Group homes exhibit highly significant correlations with the concentrations of cadmium and zinc, which along with lead are the elements primarily associated with area mining wastes. The correlation between soil and dust lead concentrations in the Study Group homes is also highly significant, with lead concentrations in soil accounting for 67% of the variability of lead concentrations in house dust. While lead paint may be present at some residences and a possible contributor to the lead concentrations in soil and dust at those residences, it cannot account for the major differences in soil and dust lead concentrations between the Study Area and the Reference Area. The available paint chip data show no significant difference in the prevalence of lead-based

paint between the Study Group and Reference Area homes.

2. A commenter noted that higher blood lead levels have been correlated with lower socio-economic conditions in a nationwide study and have been found higher in older cities. The commenter stated that some elevated blood lead levels would therefore be expected at the Site, regardless of past mining sources, due to lead from other sources.

Response: The commenter provided no evidence that socio-economic conditions are a significant factor affecting lead exposure or blood lead levels at the Site, especially in comparison with the prevalence of mining waste at the Site. The commenter does not explain why similarly aged communities near the historical mining area have significantly lower percentages of elevated blood lead levels compared to, for example, the community of Picher.

3. A commenter stated that the EPA lead model version 0.99 may highly overestimate the actual blood lead levels.

Response: The Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children (EPA, February 1994) could overestimate actual blood lead levels for a population if the population's actual exposures were less than that estimated from the exposure input assumptions and/or if the actual bioavailability of lead in environmental media at the site was less than the value used in the model. However, this has not been demonstrated at the Tar Creek Superfund site.

4. A commenter stated data from residential areas near some mining sites show little relationship between observed blood lead and soil lead concentrations, and that this is in contrast to the IEUBK model which predicts a direct relationship between soil and blood lead levels. The commenter also stated that EPA recognizes that dust and paint are possible major contributors to elevated blood lead levels in children, and that any strategy to reduce lead risk at a site needs to consider not only soil, but these other possible major sources.

Response: Reliable blood lead data are difficult to obtain, and the interpretation of the results is also often difficult because of confounding factors such as small sample sizes. Also, for a given site, soil may not be the main source contributing to increases in blood lead level. Even if there is a significant source of lead in the soil, if it is relatively nonbioavailable, then soil lead may not be a significant contributor, which is not the case for the Tar Creek Superfund site. The OSDH report of the results of the Ottawa County blood lead survey provided no information about the known or likely sources of lead exposure for the individuals who exhibited elevated blood lead levels. Lead-based paint is certainly one possible source. However, the relatively greater number of young children found to have elevated blood lead levels in Picher versus other parts of Ottawa County strongly suggests that there is a connection with mining-related contamination. Moreover, EPA studies have found that the mining waste lead found in the Tri-State Mining District is highly bioavailable. The EPA recognizes that site remediation should consider all significant sources of potential lead exposures; nonetheless, EPA's Baseline Human Health Risk Assessment (BHHRA) Report (EPA, August 1996) shows that the risk to human health from Site soil lead alone, without even considering other sources of lead (such as lead-based paint), is such that it poses an unacceptable threat to human health (especially the health of children).

5. A commenter noted that declines in blood lead levels have been observed in smelting and mining towns that mirror national declines associated with the decrease in lead sources such as leaded gasoline, house paint, lead soldered cans, and stricter controls on emission sources or closure of smelters.

Response: Leaded gasoline, lead-based paint, lead soldered cans, etc. historically have been

significant general sources of elevated blood lead levels. Lead exposure from these sources would have been superimposed upon any location-specific exposure - from mining and smelting wastes, for example. As these general sources have been reduced or eliminated, blood lead levels have declined throughout the population. Therefore, it is not surprising that blood lead levels in mining and smelter areas also have declined as part of the national trend. However, mining and smelting wastes alone can be a significant source of lead exposure, and blood lead levels in mining and smelting areas may still be higher than in similar areas without mining and smelting activities, despite the general decline in other sources of lead exposure. Also, the comment is a generalization. Blood lead levels can vary significantly from town to town. The EPA gathered site-specific data and analyzed it based on Site conditions. As documented in the BHHRA Report, the soil lead on the Site poses a significant human health risk--especially to children. Also, blood lead levels for specific towns may be different from the national trends, especially with regard to the magnitude of declines.

6. A commenter stated that EPA's OSWER lead directive (EPA, July 14, 1994) recognizes that remediating soil may provide limited risk reduction if other significant sources (e.g., lead-based paint or contaminated drinking water) are present.

Response: The EPA acknowledges that lead-based paint could be a major source of lead exposure at some homes, though lead-based paint does not appear to account for most of the lead contamination in soil and dust at the Site. It is much less likely that contaminated drinking water is a significant source at homes at the Site based on EPA sampling. The EPA recognizes that site remediation should consider all significant sources of potential lead exposures. Nonetheless, the BHHRA Report shows that the risk to human health from Site soil lead alone, without even considering other sources of lead (such as lead-based paint), is such that it poses an unacceptable threat to human health (especially the health of children).

7. A commenter stated that CDC believes the major source of lead in children nationwide is from paint applied to homes before 1978 (HUD, 1995).

Response: While from a nationwide perspective, lead paint applied to homes before 1978 is considered the major source according to the comment, from a site-specific perspective, other sources (e.g., smelters, mining, etc.) of lead can dominate. Such is the case for the Tar Creek Superfund site where EPA's studies indicate that mining waste is the major source.

8. A commenter noted that EPA guidance recommends that site-specific information should be used in the MLJBK model whenever possible so that the risk more accurately characterizes the site.

Response: A considerable amount of site-specific data, including lead concentrations in soil, house dust, and tapwater at individual residences, were collected for the BHHRA and were used in the IEUBK model. Model default values for exposure parameters were used in the absence of site-specific values.

9. A commenter stated that scientific data from other sites with metals in soil indicate that actual exposures at the Tar Creek Superfund site would be less than default exposure assumptions in the IEUBK model.

Response: There can be significant variation between lead exposure conditions and forms of lead from site to site that effect actual exposures. The commenter supplied no specific information indicating that the scientific data from another metal-contaminated site were comparable to data collected at the Tar Creek Superfund site with regard to the important specific parameters influencing blood lead levels. In short, there was no indication that these data would be applicable to the Tar Creek Superfund site.

10. A commenter stated that indoor dust-to-soil ratios have been found to be lower than the IEUBK model default at sites with no active or recently active lead emission sources or limited outdoor areas with elevated lead in soil. The commenter stated that a study at the Tacoma smelter, Tacoma, Washington, during smelter operations and shortly after closure, found that the indoor dust was more related to airborne dust from smelter emissions than to soil from the yard.

Response: The commenter supplied no specific information that the conditions at the Tacoma smelter or the other sites referenced were similar to the conditions at the Tar Creek Superfund site. That is, there was no indication in the comment, that indicated that the scientific data from the Tacoma smelter site or other sites referenced would be specifically applicable to the Tar Creek Superfund site. Also, with regard to the indoor dust-to-soil ratio at the Site, the indoor dust-to-soil ratio is one of the input variables entered under the multiple source option of the IEUBK model. This option is intended to be used when household dust data have not been collected. However, the multiple source option was not used in the BHHRA because household dust data were available for the Study Group and Reference Area homes.

11. A commenter stated that lead ingestion rates from dietary sources have been reevaluated and that lead levels in food continue to drop in correspondence to lead removal from food cans and lead in gasoline.

Response: The comment seems to be suggesting that the IEUBK model default assumptions for dietary lead may be an overestimate, given more recent studies that show lead levels in food are dropping. However, the comment provided no specific supporting information. According to the guidance manual for the IEUBK model (EPA, February 1994), "Because two major sources of lead in food (lead-soldered cans and air deposition on food crops) have been greatly reduced or eliminated, dietary lead is believed to be relatively constant since 1990, especially for children less than seven years." Using the current IEUBK model default assumptions for dietary lead intake, food already accounts for only a small portion of the total estimated lead uptake in the Tar Creek Superfund site Study Group. Therefore, small reductions in the dietary input values would likely have a small effect on the modeled blood lead predictions.

12. A commenter suggested that factors such as chemical form mineralogy, and particle size can reduce the absorption of lead through the gastrointestinal tract.

Response: The commenter presented no site-specific information on how these factors have affected bioavailability of lead in soil at the Tar Creek Superfund site. Findings from research conducted by EPA Region 8 (Casteel et al., 1996) indicate that lead in yard soil and milling waste samples taken from the Tri-State Mining, District has a bioavailability of 30% or possibly higher.

13. A commenter seemed to suggest that children's exposure to lead will be reduced because large chat particles will not adhere to their skin.

Response: At the Tar Creek Superfund site, high concentrations of lead and other metals from mining waste were found throughout the Site in fine soil particles which are more likely to adhere to skin and to be ingested by children than larger particles. The exposure and risk estimates for the Site were based on the concentrations of lead and other contaminants actually measured in the fine soil fraction that passed through a 60-mesh sieve.

14. A commenter stated that several recent studies of lead in soil at mining and smelter sites report lower than 30% absorption.

Response: There can be significant site-to-site variability in bioavailability and adsorption of lead due to the various forms of lead that may be present at any given site. The commenter supplied no specific information indicating that the forms of lead identified in the studies referenced were comparable to the forms of lead identified at the Site with regard to important parameters influencing blood lead levels. In short, there was no indication that the data were applicable to the Tar Creek Superfund site. While it is true that some forms of lead found at mining sites have bioavailabilities significantly lower than the IEUBK model's 30% default value for oral absorption, evidence suggests that the bioavailability of lead in soil in the Tri-State Mining District is not less than 30%. The EPA Region VIII's recent study of bioavailability of lead in soil samples from the Jasper County, Missouri Superfund Site (Casteel et al., 1996) reported absolute bioavailabilities for lead in the range of approximately 30% to 40%.

15. A commenter suggested that the IEUBK model default value of the geometric standard deviation (GSD) that was used for the Tar Creek Superfund site was too high. (Note: GSD is an expression of the variability of a set of data, in this case blood lead data.)

Response: There are no paired blood lead and soil and/or house dust lead data available for the Tar Creek Superfund site Study Area that would allow a site specific GSD to be calculated. Site specific blood lead GSDs, adjusted for all known lead exposure factors, have been calculated for at least six smelter and mining sites:

Kellogg, ID, 1983 (CDC 1986a), GSD = 1.60;
East Helena, MT, 1983 (CDC 1986b), GSD = 1.53;
Leadville, CO, 1987 (Chappell et al., 1990), GSD = 1.63;
Telluride, CO, 1986 (Bornschein et al., 1988), GSD = 1.49;
Midvale, UT, 1990 (Bornschein et al., 1990), GSD = 1.62; and
Sandy Creek, UT, 1995, (EPA 1995), GSD = 1.4

The adjusted GSDs for these sites range from 1.4 to 1.63 and average 1.55. While the activity patterns and potential lead exposure pathways for children living at these sites may be similar, which would lead to the assumption that the interindividual variability in blood lead levels, as measured by the GSD, should be similar, the empirical data indicate that there is still some variability in the GSD between sites. The site specific GSD of 1.4, calculated for Sandy Creek, falls at the low end of the range of GSDs for the six sites, three of the sites had GSDs, of 1.6 or higher. There does not appear to be any reason to believe that the GSD for Sandy Creek, which is primarily a smelter site, would be any more appropriate for the Tar Creek Superfund site, primarily a mine tailings site, than the site specific GSDs for any of the other sites. Since the data needed to calculate a site specific GSD for the Tar Creek Superfund site were not available, the decision was made to use the default GSD of 1.6 recommended in the IEUBK model user's guide rather than to arbitrarily adopt a GSD from some other site that might or might not be a better value for the Tar Creek Superfund site.

16. A commenter pointed out aspects of Community Protection Measures (CPM) (e.g., education, house cleaning with high efficiency particulate vacuum cleaners (HEPA VAC, etc.) that the commenter suggests have advantages over more conventional soil removal approaches. The commenter noted specific examples where CPMs have resulted in significant reductions in blood lead levels apart from soil removal.

Response: The EPA recognizes that in the short term CPMs, especially the education and intervention portions of these program, can play a supplementary role at reducing lead risk to children at the Site.

17. A commenter noted that EPA guidance recommends and allows for addressing lead sources other than soil as feasible.

Response: The EPA supports efforts to address other possible sources of lead exposure at the Site as feasible. However, at the Tar Creek Superfund site, EPA studies indicate 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. The EPA studies indicate that mining waste is the major source contributing to the elevated lead levels in the soil.

18. A commenter questioned whether Afton is an appropriate Reference Area for comparison with Picher because of obvious differences in ages and conditions of the homes and significant socio-economic differences.

Response: For EPA's reply, see Technical Reply Document (Revised July 10, 1996), page 20, section titled "Afton as a Reference Site."

19. A comment was made that the sample size from the Reference Area (15 homes) is too small to draw any statistically valid or supportable conclusions.

Response: The EPA disagrees. The test of whether a sample size is large enough to be "statistically valid" is whether it provides sufficient statistical power to detect differences between sample groups with the desired level of confidence given the variability of the sample sets and the magnitude of differences to be detected. The studies conducted by EPA revealed highly significant differences in the concentrations of cadmium, lead, and zinc, the principal contaminants associated with mining wastes, in yard soil and house dust between the Study Group and Reference Area homes using standard, well accepted statistical methods (t-test, Mann-Whitney U-test, and others). Highly significant differences were also found between the Study Group and Reference Area homes in the lead uptake from soil and dust, in the geometric mean blood lead levels, and in the probability of blood lead levels exceeding 10 ug/dL predicted by the DELTBK model. These results indicate that the sample sizes used provided more than enough statistical power, and, therefore, were "statistically valid."

20. A comment was made that EPA argues in the Technical Reply Document (Revised July 10, 1996) that lead-based paint is not a significant source of soil lead contamination of residential soil based on a comparison of the paint chip data for Picher and Afton.

Response: The commenter's statement is not an accurate description of EPA's position. The EPA believes that since the available data showed no significant difference in the prevalence or concentration of lead in paint chips found in the two areas, lead paint was unlikely to account for the order-of-magnitude difference in soil lead concentrations between the two areas.

21. A comment was made that paint data from the Reference Area (4 exterior samples and 1 interior sample) are inadequate to support EPA's conclusion that lead-based paint is not a significant source of exposure in Picher and that the principal source of soil lead contamination is mining waste.

Response: For EPA's reply, see Technical Reply Document (Revised July 10, 1996), pages 9-10. The EPA has acknowledged the limitations of this data, but EPA maintains that the data that are available provide no indication of any significant difference in the prevalence or concentration of lead in paint chips found in the Study Group and Reference Area homes.

22. A commenter pointed out that the Ottawa County blood lead investigation conducted by OSDH focused on communities in the northern part of the county, and complained that the Technical Reply Document implies that it was a county-wide study.

Response: The EPA acknowledges that the OSDH blood lead investigation focused on the northern part of Ottawa County, collecting samples in Picher, Quapaw, Commerce, Cardin, North Miami, and

Mami. Based on the percentages reported by OSDH the total number of children tested (232) broke down by community as follows: 84 from Picher, 72 from Miami, 32 from Commerce, 22 from Quapaw, and 22 from others (Cardin, North Mami, Afton, Grove, Fairland, Eucha, Wyandotte, and Welch). As the Technical Reply Document points out, more than one third of those children were from communities outside of EPA's Tar Creek Superfund site Study Area (72 from Miami plus at least 7 from the communities of North Miami, Afton, Grove, Fairland, Eucha, Wyandotte, and Welch). The OSDH memorandum titled "Ottawa County Blood Lead Summary" presented summaries of the blood lead results for all of the children tested, and a separate summary for Picher, where most of the elevated blood leads (10 out of 15) were found. In the Technical Reply Document, EPA applied the term "county-wide" to the blood lead results for all children tested to distinguish them from the results for the Picher subgroup, and to make the point that statistics based on all 232 children were not representative of blood lead levels in the mining area as the Companies and DOI had implied.

23. A commenter suggested that the OSDH data can be modified to include just the mining area communities.

Response: OSDH has not released the names and addresses of all blood lead survey participants. However, based on a summary of elevated blood lead results (10 ug/dL or greater) presented in the OSDH memorandum, 12 of the children were from mining area communities (10 from Picher and 2 from Commerce) while 3 were from outside the mining area (2 from Miami and 1 from Grove).

24. A commenter did not understand how EPA, if it regards the OSDH blood lead data as nonrepresentative and inappropriate for decision-making, can use the OSDH data to conclude that there is a positive relationship between blood lead levels and exposure to mining related contamination.

Response: The EPA has said only that the blood lead concentration levels found in children living on the Site are consistent with the findings in EPA's BHHRA. While not statistically representative of the sampled populations, the OSDH blood lead data showed that blood lead levels of young children living in Picher, which is located at the main part of the Oklahoma portion of the Tri-State Mining District, were clearly higher than in the other communities. Ten of the fifteen children reported to have elevated blood lead levels (10 ug/dL or greater) were Picher residents. Based on the results of the Tar Creek Superfund site remedial investigation, residential soil lead concentrations in Picher also tend to be higher than in other portions of the mining area, and much higher than soil lead concentrations outside the mining area. The soil lead concentrations in the Study Area showed highly significantly positive correlations with concentrations of cadmium and zinc, which indicate that mining waste is the major source of the contamination.

25. A comment was made that because the BHHRA evaluated only conditions in Picher, it is inappropriate to use the BHHRA to address other areas of the Tar Creek Superfund site.

Response: Picher, which is at the main part of former mining activities in Ottawa County, was intentionally selected for the BHHRA to determine whether high levels of environmental contamination on the Site could pose significant human health risks. The residential exposure assumptions that were used to estimate exposures and risks in Picher are appropriate to use in estimating the risk in other residential areas of the Tar Creek Superfund site. The results of the IEUBK modeling showed that the variables that were principally responsible for, the predictions of elevated blood lead were elevated lead levels in soil and house dust. There is no reason that the conclusions and risk-based cleanup goals based on the Picher Study Group should not be applied to homes in other parts of the Study Area where high levels of environmental lead contamination were found.

26. A comment was made that it is inappropriate to compare the predictions of the IEUBK model, which did not account for all potential sources of lead exposure [the commenter seemed to be referring to paint chips], to OSDH's blood lead survey results for Picher.

Response: The EPA has already explained in replies to previous comments why the OSDH blood lead survey results were included in the BHHRA Report, and EPA has already discussed the reasons the blood lead results and the IEUBK model predictions are not directly comparable. See Technical Reply Document (Revised July 10, 1996), page 7, first and second paragraphs; and page 17, third paragraph.

27. A comment was made that it is inappropriate for EPA to rely on the predictions of the IEUBK model when those predictions do not agree with the observational data [the commenter seemed to be referring to the OSDH blood lead results]. The commenter maintains that the similarity between the IEUBK model predictions for the Picher Study Group, which excluded possible paint chip ingestion, and the Picher blood lead results reported by OSDH which necessarily reflect lead exposure from all sources demonstrates that the model predictions were wrong. The commenter suggested that the observed blood lead levels should have been higher if the model predictions were accurate.

Response: The EPA does not agree that the predictions of the IEUBK model conflict with any of the measured blood lead data. The blood lead results reported by OSDH while not directly comparable, are not inconsistent with the predictions of the IEUBK model in the BHHRA. The blood lead test results reported by the OSDH do not demonstrate that the model results are invalid. There are other possible explanations as to why the observed blood lead levels from the OSDH survey were not higher than the IEUBK model prediction in the BHHRA. One possibility is that lead-based paint is not a major source of lead exposure at the Site. For discussion of this point, see Technical Reply Document (Revised July 10, 1996), page 9, second paragraph through page 12, second paragraph. Another possibility is that the lead levels in environmental media at the homes of the children in the OSDH blood lead survey were not comparable to EPA's Study Group homes.

Preliminary results from a blood lead study conducted in 1996 by the University of Oklahoma for certain mining companies (CHAMP, July 1996 - October 1996) indicate that blood lead levels of young children in Picher are actually higher than reported by OSDH. The blood lead study, which was a part of the mining companies' Community Health Action and Monitoring Program (CHAMP), reports that of 81 children tested in Picher, 38.3% had blood lead levels greater than or equal to 10 ug/dL and 13.6% had blood levels greater than or equal to 15 ug/dL. The percentages of elevated blood lead levels reported for nearby Cardin are even higher. The residential properties included in EPA's Study Group and the properties covered by the study may overlap, but they are not the same, therefore the results from the two studies are not directly comparable. However, both should be reasonably representative of the community as a whole. The blood lead levels found in the CHAMP study are higher than those predicted by the IEUBK model; as the commenter contends, they should be because the IEUBK model did not consider potential lead intake from lead paint. Therefore, the blood lead levels predicted by the IEUBK model are consistent with the levels measured in the CHAMP study.

Another possible reason for the blood lead levels estimated by the IEUBK model being lower than blood lead levels measured in Picher in the CHAMP study is that EPA may have used the low end of the range of bioavailability of the lead on the Site. The EPA ran the IEUBK model using the default bioavailability assumption of 30%. However, the information available regarding the types of lead present in samples from the microprobe results (Drexler, 1996) indicates that most of the lead actually found on the Site was in the form of various oxides and carbonates. Lead oxides and lead carbonates are among the most soluble and bioavailable forms of lead. Further, the microprobe results also showed that much of the lead oxides and lead carbonates present had

very small particle sizes which would further enhance their solubility and bioavailabilities of the EPA-assumed bioavailability of 30% possibly is on the low end of bioavailabilities of lead present in yard soil from Picher. Thirty percent is at the low end of the range of bioavailabilities (29 to 40%) measured for lead in soil from the Jasper County, Missouri portion of the Tri-State Mining District, using miniature swine (Casteel et al. 1996).

28. A comment was made that the available blood lead data demonstrate that there is no emergency risk to public health and welfare from lead and suggest that EPA's planned removal of residential yard soil is technically insupportable.

Response: Previously, the Companies and DOI had suggested that because most of the elevated blood lead levels reported by OSDH fell in the 10-14 ug/dL range, EPA's planned response action was unnecessary and inconsistent with CDC guidelines. The EPA disagreed and pointed out that CDC guidelines recommend community-wide lead poisoning prevention activities when many children have blood lead levels in the 10-14 ug/dL range. See Technical Reply Document (Revised July 10, 1996), pages 4-5, item 3.

The 1996 blood lead data, gathered by the Companies, indicate that blood lead levels are actually higher than were reported by the OSDH study. That investigation found blood lead levels above 10 ug/dL in more than 30% of the children tested: 38% of those living in Picher, 62% of those living in Cardin and 13% of those living in Quapaw. It also found blood lead levels above 15 ug/dL in many of the children: 11 children from Picher (13.6%), 3 children from Cardin (18.8%), and 4 children from Quapaw (6.0%).

The highest blood lead level, found in Cardin, was 32 ug/dL, a level at which the CDC recommends medical evaluation, environmental investigation and remediation, and medical follow-up. The data confirm that there is a significant public health risk from lead at the Tar Creek Superfund site.

29. A comment was made that EPA has presented no data to demonstrate that the bulk of environmental-media lead exposures are related to mining. The commenter pointed out that the mineralogy characterization conducted by Dr. Burke Burkart (Burkart, July 6, 1995 and Burkart, September 23, 1995) and the microprobe analyses conducted by Dr. John Drexler (Drexler, 1996) indicate that the two primary sources of lead in the residential soil are smelter wastes and lead-based paint, not mining waste.

Response: To support its position that Mining waste is the primary source of lead contamination in soil at the Tar Creek Superfund site, EPA has already made the following points in its Technical Reply Document (Revised July 10, 1996), pages 9-10:

Concentrations of lead in soil in the at the Site exhibited highly significant positive correlations with cadmium and zinc concentrations. Cadmium, lead, and zinc are the elements primarily associated with area mining wastes, and they serve as a signature for the presence of mining waste in environmental media at the Site.

The concentrations of lead in residential soil in the Study Area were proportionate to cadmium and zinc concentrations in the soil. Lead concentrations were not disproportionately elevated as would be expected if there were other major sources of lead contamination other than mining waste, such as lead-based paint.

The median and average concentrations of cadmium, lead, and zinc in residential soil were each approximately an order of magnitude higher in the

Study Group (near the center of former mining activities) than in the Reference Area (outside the mining area).

Lead-based paint was found in approximately the same proportion of Study Group and Reference Area homes, indicating that paint is not likely to account for a significant part of the difference in soil lead concentrations between the two groups of homes.

Further, when Dames & Moore (the Companies' environmental consultant) resampled 8 properties previously sampled by Ecology & Environment (E&E)(EPA's environmental contractor), Dames & Moore explicitly identified chat (i.e., the coarser fraction mining waste from milling operations) in a substantial number of soil samples, and noted that a number of these properties had driveways surfaced with chat.

Electron microprobe results for 12 samples from Picher were included in a report by Dr. John Drexler (Drexler, 1996). Two chat pile samples, one roadway sample and 9 composite soil samples from residential properties that included equal parts of soil from front yards, backyards, and drip lines were examined. Several groups of lead-bearing minerals were found:

Galena (PbS), the primary lead-bearing mineral in the ore mined in the Tri-State Mining District,

Cerussite (PbCO₃), a weathering product of galena and a lead compound used in lead-based paint;

Anglesite (PbSO₄), a weathering product of galena;

Lead Oxide (PbO), a weathering product of galena and a lead compound often used in lead-based paint;

Lead-Metal Oxides (Pb(M)O), oxides of lead and other metals - most often copper, occasionally antimony; associated with smelter operations at other sites,

Iron-Lead and Manganese-Lead Oxides (Fe-Pb and Mn-Pb Oxides), which are secondary weathering products formed in situ in soil by the adsorption of soluble lead compounds by iron and lead oxides naturally present in soil;

Other lead-bearing paint pigments (PbTiO₂, PbCrO₄)

On a relative mass basis, the lead in the chat pile samples was predominately cerussite (89 and 76%) with some galena (0 and 22%), Fe-Pb Oxide (5 and 1%), zinc oxide containing lead (4 and 1%), and anglesite (2 and 1%).

The soil samples averaged 44%(range: 18-59%)lead-metal oxides and 29% (range: 3-63%) secondary weathering products. Lead-metal oxides have been associated with smelter emissions at other sites; however, the only smelter confirmed to have operated at the Site, based on available historical information, was the Ontario Smelting Company/Eagle-Picher smelter, which was relatively small and which operated for only about 15 years (1918 until the early 1930s). It was located south of Hockerville, about 3 miles east of Picher in a cross wind or down wind direction under prevailing wind conditions, too far away to account for the average soil lead levels found in Picher soil. No smelter has been identified in the Picher area that could account for the lead levels found in soil at the Tar Creek Superfund site. Therefore, attributing the lead in soil at the Tar Creek Superfund site to a smelter source is inconsistent

with the available historical information.

Four of the samples contained cerussite(16, 33, 34, and 78%), however the cerussite was positively attributed to paint only in the sample containing 78% cerussite, The cerussite in 3 of the samples and the secondary weathering products in all of the samples is of a type that is known to be found in mining and/or milling wastes. The origin of the lead-metal oxides is presently unknown, but may be from milling waste altered in the environment. One of the yard soil samples (#502) contained galena (12%) and its two principal weathering products, anglesite (12%) and cerussite (16%), which is consistent with a chat source.

The single roadway sample was predominately galena (65%) with some cerussite (18%), lead-metal oxide (5%), PbSiO₄ (4%), PbCl₂ (3%), and Fe-Pb oxide(2%). The EPA understands that the roadway was surfaced with chat and the microprobe results are consistent with a chat source.

30. A commenter said that OSDH conducted an environmental assessment and collected environmental samples at each residence at which a child had a blood lead level greater than 10 ug/dL. The commenter requested that EPA obtain the data and quantitatively evaluate relationships between lead in the environmental media and blood lead levels.

Response: OSDH's environmental assessment follow-up in conjunction with its blood lead investigation was discontinued after the homes of only a few children were assessed. The OSDH environmental assessments were discontinued when the CHAMP study, which also included environmental assessments, was proposed. Also, the OSDH sampling locations were selected based on professional judgment rather than a more systematic sampling approach. The limited OSDH sampling that was conducted was not designed for the type of quantitative evaluation suggested by the commenter, nor would it likely be suitable for such use.

31. A commenter notes that as part of the CHAMP, the University of Oklahoma is collecting matched blood lead and environmental samples at more than 100 residences at the Tar Creek Superfund site. The commenter recommends that EPA forego planning and implementing additional remedial activities until the results of that investigation are available.

Response: While the pending results of the investigation are of interest, EPA believes that the residential soil lead contamination (which existing evidence indicates is primarily from mining waste) at the Site poses a significant public health hazard that warrants the planned remedial response action.

32. A comment was made that the second paragraph on page 7 of the Technical Reply Document attempts to use the IEUBK model-predicted results to support a conclusion that lead-based paint is not a primary source of lead exposure in Picher.

Response: The paragraph cited puts forth two possible reasons that blood lead levels reported by OSDH were not higher than the IEUBK model predictions, as would be expected if paint was a significant source of lead exposure. One possibility was that the children in the blood lead survey were not exposed to environmental (non-paint) lead concentrations as high as those measured at the Picher Study Group homes. The second possibility, if lead levels in environmental media at the OSDH survey homes and the BHHRA Study Group homes were comparable, was that paint chips were not a significant source of lead exposure. The more recent blood lead survey indicates that blood lead levels in Picher are actually higher than the IEUBK model predictions. That difference is not inconsistent with exposures to lead from other sources, such as lead-based paint, in addition to lead in environmental media. See Comment 27, above.

33. A comment was made that the BHHRA Report acknowledges that if the concentrations of lead-based paint measured in the 100 Study Group homes are included as inputs to the IEUBK

model, then lead-based paint becomes the primary cause of the predicted elevated blood lead levels and soil and dust are reduced to minor contributors.

Response: Outdoor paint was sampled from just 52 of the 100 Study Group homes, and the lead concentrations at 23 of those homes were below the 5000 milligrams per kilogram (mg/kg) criterion used by HUD for lead-based paint. The mean and median lead concentrations found in outdoor paint at the Study Group homes were approximately 20,000 mg/kg and 3500 mg/kg, respectively. For comparison, outdoor paint was sampled from 4 of the 15 Reference Area homes, and only one had a lead concentration less than 5000 mg/kg. The mean and median lead concentrations found in outdoor paint from the Reference Area were both greater than 35,000 mg/kg. These data indicate that the prevalence of lead paint and, therefore, the potential exposures to lead from this source are not significantly greater in the Study Group homes compared to the Reference Area homes. That is, lead paint on the Site does not explain the order of magnitude difference in soil lead concentrations between the Study Group homes and the Reference Area homes.

The BHHRA Report acknowledged that ingestion of paint chips could be a major route of lead exposure in homes where children have access to deteriorated or damaged lead-based paint. It also explained that there is a great deal of uncertainty about the amount of paint chips young children routinely ingest. Since paint chips can have very high concentrations of lead compared to the levels typically found in soil and house dust, the IEUBK model is very sensitive to the assumptions made about the quantity of paint chips ingested. Inclusion of this highly uncertain exposure pathway in the model would have a major impact on the total lead uptake estimated by the IEUBK model, potentially overwhelming the contributions from all other sources. For these reasons, the IEUBK model guidance manual (EPA, February 1994) recommends against including direct paint chip ingestion in the model unless site-specific information is available about the pathway. Therefore, the paint chip data were excluded from the quantitative evaluation in the BHHRA for both the Study Group and the Reference Area homes in order to focus on the potential health risks from environmental site-related contamination, not lead-based paint.

The BHHRA found that soil lead contamination on the Site was high enough that soil lead alone posed a significant risk to children's health. The above points are discussed thoroughly in the uncertainty section of the BHHRA Report (Section 5.4.1 1) and in the Technical Reply Document (Revised July 10, 1996), page 6, second paragraph and page 17, second paragraph.

34. A comment was made that it is inappropriate to ignore the lead-based paint data to make the IEUBK model predictions support EPA's position that mining related materials are the explanatory variable for the observed blood lead elevations at the Tar Creek Superfund site.

Response: See Technical Reply Document (Revised July 10, 1996), page 17, third paragraph through page 18, first paragraph, and items 33, and 47 of this response document.

35. A comment was made that the Lead and Cadmium Exposure Study for the Jasper County Site (ATSDR, February 1995) indicated that blood lead levels were positively correlated with parameters other than soil lead concentrations, and that follow-up investigations by the Jasper County and Joplin Health Departments found other primary sources of lead exposure including paint (Jasper County is not part of the Site). The commenter also stated that investigations of the Companies and EPA Region 7 have established that smelter emissions and lead-based paint are key contributors to lead in soil at both the Cherokee County, Kansas and Jasper County, Missouri sites. The commenter wondered how, in light of this evidence, EPA can continue to insist that mining waste is the primary culprit at the Tar Creek Superfund site.

The Jasper County study (ATSDR, February 1995) indicated that blood lead levels were significantly higher in the exposed group within the mining area compared to a control group outside the mining area, and that exposure to soil was the most important factor influencing the distribution of blood lead levels between the two groups.

At least three smelters were known to have operated in the Jasper County and Cherokee County portions of the Tri-State Mining District. These were located in Galena, Joplin, and Oronogo. The soil impacted by these smelters was found to be limited to properties within about 1-2 miles of these smelters. Smelters were not considered a source of lead for properties located greater distances from smelters. The only known smelter in the vicinity of Picher was the Ontario/Eagle-Picher smelter located south of Hockerville, about three miles east of Picher in a cross wind or downwind direction from Picher. Therefore, by the criteria used at the Jasper County and Cherokee County sites, smelters would not be considered a source of lead in soil at properties in Picher. The presence of elevated lead concentrations in the absence of correspondingly high cadmium and zinc levels was considered to be another indication that the lead for the Jasper County and Cherokee County sites might be from a smelter or lead-based paint. In contrast lead concentrations in soil in Picher correlated well with both cadmium and zinc concentrations, which means that the source of that lead is more likely than not to be milling waste and not smelter waste (or lead paint for that matter).

At the Jasper County and Cherokee County sites, lead-based paint was considered to be the suspected source of elevated soil lead levels if elevated lead levels were found without a corresponding elevation of cadmium and zinc levels. The property was more than one mile from the nearest smelter, Paint chips were observed in soil surrounding an older home.

Observation of paint chips in soil is circumstantial evidence, at best, of a lead source. The paint chips may not contain lead-based paint, and even if they do, there is no practical and certain way of knowing what fraction of the lead in the soil is from the paint chips. Lead-based paint has not been proven, to be a major source of elevated soil lead levels.

36. A commenter disagreed with the argument that elevated concentrations of lead in soil are attributable to mining waste because the associated elevated concentrations of zinc and cadmium cannot be attributed to paint. The commenter pointed out that zinc and cadmium have been used and are still used in various paints, and there are numerous other sources (not specified).

Response: Although there are numerous sources of lead, cadmium, and zinc, the highly significant positive correlations between the concentrations of these contaminants in Site soil indicates that they are from the same major source, and the most likely candidate is mining waste. Even if cadmium and zinc were used in paint (or other products), as the commenter suggests, the amounts of these metals in the products relative to lead would vary widely. And if many different paints were the major sources of environmental lead contamination, the relationship between cadmium, lead, and zinc concentrations in soil would also vary widely and, a significant correlation site-wide would be unlikely. The fact is that the correlation between lead, zinc and cadmium contamination is consistent throughout the Site and consistent with contamination from mining waste, and consistent with lead from paint.

37. A commenter questioned the validity of EPA's comparisons of average lead concentrations in indoor dust concentrations to lead concentrations in outdoor soil, contending that the outdoor soil averages are biased high by the inclusion of drip line samples which frequently had elevated concentrations, and EPA's conclusion that indoor lead paint was not the source of the lead measured in dust.

Response: The EPA's Technical Reply Document (Revised July 10, 1996), page 10, second paragraph

stated that 45 of the 50 Study Group homes with average dust lead concentrations greater than 200 mg/kg (the upper-end estimate for background) had even higher lead concentrations in yard soil, which suggests that soil, not indoor paint, was the source. The EPA acknowledges that some outdoor soil lead averages were increased by the inclusion of drip line soil results, but the effect is not as great as the commenter implies. Fewer than 20% of the Study Group homes showed drip line soil lead concentrations that were substantially elevated in comparison to the other yard soil samples (front yard, backyard, and play area). It should be noted that elevated lead concentrations at the drip line may reflect not only lead-based paint, but also deposition of airborne lead on the home. If the drip line results are excluded from the soil averages, then 43 of the 50 Study Group homes with average dust lead concentrations greater than 200 mg/kg had even higher lead concentrations in yard soil.

38. A commenter claimed that EPA attempts to discredit the ATSDR follow-up investigation to the 1993 Indian Health Service (IHS) blood lead data and ignores its conclusions because they are contrary to EPA's position on the causes of elevated blood lead levels in Native Americans.

Response: The EPA did not attempt to discredit the ATSDR study. The EPA simply laid out what the ATSDR study did and did not say. The EPA's position is that elevated blood lead levels may result from exposure to high concentrations of lead in soil related to former mining operations in the area. The ATSDR investigation does not conflict with that position. ATSDR identified significant sources of lead exposure at two houses: exterior paint and soil at one house, and exterior paint and house dust at another. No significant sources of lead were identified at the other seven homes investigated. However, as pointed out in the Technical Reply Document (Revised July 10, 1996), page 12, that does not mean that significant sources did not exist. For example, lead concentrations exceeding 400 mg/kg were detected in composite soil samples from four of the homes, and those composite results may substantially understate soil lead concentrations in some areas of the properties. Also, house dust with lead concentrations greater than 200 mg/kg was detected in 6 out of the 9 homes surveyed by ATSDR. House dust lead concentrations greater than 200 mg/kg can have a noticeable impact on predictions by the IEBUK model of children's blood lead levels.

39. A comment was made that the IHS blood lead data do not support the conclusion that 35 percent of the Native American children living at the Site have elevated blood lead levels, as implied by EPA.

The EPA has never claimed that the IHS blood lead data show that 35% of Native American children living at the Site have elevated blood lead levels. The EPA has stated in the Five Year Review Report, the BHHRA Report, and the Technical Reply Document that the IHS blood lead data indicated that 35% of the children tested had blood lead levels greater than or equal to 10 ug/dL.

40. A comment was made that EPA's site-wide response is based on the IHS blood lead data.

Response: The comment is not accurate. The EPA's time-critical removal actions were based on extensive removal site assessment investigations. The EPA used the IHS blood lead data as a "warning beacon." That is, EPA used the IHS blood lead data as a finding that indicated the need for more thorough follow-up investigations at the Site. It was the follow-up site assessment investigations which were the basis for the EPA removal actions at the Site, and not the IHS blood lead data which only indicated the need for further study.

41. A commenter alleged that the yard soil data collected by E&E at the Tar Creek Superfund site are extremely biased and unrepresentative because of sampling and compositing procedures used, and that the mean lead concentrations in soil reported by E&E are more

than twice as high as the "true" mean measured in the Dames & Moore resampling effort.

Response: A detailed comparison and discussion of the E&E and Dames & Moore studies is provided later in this detailed response document. A summary of a few of the more important points follows.

First, the mean result reported by Dames & Moore is not a "true" mean, because the true mean can never be determined by any sampling effort; rather, it is an estimate of the mean, as is the mean of the sample reported by E&E. Secondly, the two studies measured different things; the E&E study measured the lead concentrations in the top 1 inch of soil, while the Dames & Moore study measured lead concentrations in the top 2 inches of soil. This difference may account for part of the difference in the results of the two studies. The methodology used by E&E is commonly used in investigating Superfund sites, and, in fact, is very similar to the methodology used by Dames & Moore in its investigation of the Jasper and Cherokee Counties portion of the Tri-State Mining District on behalf of EPA Region VII. In that study, Dames & Moore concluded that the sampling methodology it employed was reproducible and gave representative results. At the Tar Creek Superfund site, C.C. Johnson & Malhotra, P.C. (CCJM) also resampled properties previously sampled by E&E using the same sampling design as E&E (0-1 inch composite samples). Composite samples are samples composed of subsamples from different locations combined and mixed together. CCJM's results were statistically indistinguishable from E&E's results and, like E&E's results, were statistically significantly different from Dames & Moore's results. This finding indicates that the sampling methodology used by E&E was reproducible and reliable, and suggests that there must be some other reason for the differences in the results obtained by E&E and CCJM, on one hand, and Dames & Moore on the other. The difference in the depth from which samples were collected is one reason, and difference in the sampling designs employed is another. In the E&E and CCJM studies, drip line area subsamples always comprised one quarter to one third of the total yard soil sample, depending on whether a property had an identifiable play area that was sampled in addition to the front yard, backyard and drip line areas. Drip line areas often have higher lead levels than general yard samples because particles deposited on roofs and paint chips from the house exterior tend to accumulate in these areas, therefore E&E's sampling plan was designed to ensure that these areas were always sampled. In contrast, drip line areas were not sampled at 3 of the 8 properties resampled by Dames & Moore and represented only 5 to 20% of the samples at the remaining 5 properties.

The EPA believes that the difference between the E&E and Dames & Moore results resulted from differences in what was sampled in the two studies, not from any bias or unrepresentativeness in E&E's sampling and compositing procedures.

42. A commenter agreed that another source other than lead paint and automobile exhaust is needed to explain why the lead in soil in the Study Group homes is approximately 10 times higher than in the Reference Area homes, but argued that mining waste is not the source because:

- Soil lead is 10-30 times higher in Picher than in Baxter Springs and Treece, Kansas;
- The average lead concentration in Picher yards is twice as high as the average lead concentration reported for chat at the Cherokee County, Kansas and Jasper County, Missouri sites; and
- Lead speciation suggests that the source is smelter emissions or smelter wastes and that is consistent with findings near other Eagle-Picher smelter locations.

Response: There is considerable variability in the concentration of lead in chat from the piles around Picher as the results of the Dames & Moore resampling study show (see the Lead in Chat

section of the discussion of the D&M study below). The lead concentrations in some of the chat are quite sufficient to account for the lead levels found in soil.

Some of the lead species found in soil at the Tar Creek Superfund site have been associated with smelters at other sites, however, no smelter has been identified in the Picher area that could account for the lead levels found in soil at the Site. Moreover, the lead species in question (i.e., the lead species which may be attributed to smelters) may also be attributable to other non-smelter sources such as weathering products of chat interacting with the soil at the Site. Therefore, attributing the lead in soil at the Site to a smelter source is not adequately supported and is inconsistent with the available historical information and the direct observation by many of significant quantities of chat in the yards.

43. A commenter noted that lead-based paint was identified as the principal source of lead exposure contributing to blood lead levels nation wide, and suggested that it also is a major source at the Tar Creek Superfund site.

Response: Lead-based paint may well be the major source of lead exposure in areas without a significant local industrial source of lead. However, at the Tar Creek Superfund site, there is a major local source, the mining and milling wastes that dominate the area. The weight of evidence from EPA's extensive environmental investigation indicates that the major source of lead exposure at the Tar Creek Superfund site is soil contamination resulting from the storage of mining and milling wastes in the area and the use of these wastes as fill and for surfacing local roads, driveways, and parking lots.

44. A comment was made that the blood lead levels observed in the OSDH investigation - where more than 60% of the children had very low blood lead levels - is not consistent with a widespread source of lead such as yard soil.

Response: The OSDH study and EPA's investigation of the Tar Creek Superfund site cover different geographical areas. A substantial portion of the subjects in the OSDH study live outside the mining area, thus their residences are not included in EPA's Study Group or Study Area, and, consequently, their blood lead levels would not be affected by lead levels in yard soil in the mining area.

45. A commenter stated that 80% of the Study Area properties have soil lead levels above the level that the IEUBK model indicates is a cause for blood lead levels to be above 10 ug/dL.

Response: This is not correct. About 80% of the Study Group homes have soil lead levels greater than 500 mg/kg. This 500 mg/kg soil lead concentration level is a level corresponding with a 5% chance of a child living at the residence in question having a blood lead level of 10 ug/dL or higher. The IEUBK model does not predict that a child currently living at a particular residence will definitely have a blood lead level above 10 ug/dL. As discussed in the BHHRA Report and shown in Table 5- 1, the soil lead concentrations measured at the Study Group homes are predicted by the IEUBK model to result in about 20% of the children living in the community having blood lead levels greater than 10 ug/dL, a prediction that is consistent with the measured blood lead levels of young children living in Picher.

46. A commenter noted that EPA's procedures for evaluating the Tar Creek Superfund site and selecting a course of action do not necessarily correspond to CDC's guidelines for addressing lead contaminated sites.

Response: The EPA disagrees that its activities are inconsistent with the CDC guidelines. For EPA's response to a previous similar comment, see Technical Reply Document (Revised July 10,

1996, page 4, Reply #3 to General Comments). The EPA's procedures also follow its own guidelines set forth in OSWER Directive 9355.4-12, revised July 14, 1994, for addressing CERCLA sites and RCRA Corrective Action Facilities having lead contamination. Three key elements of OSWER Directive 9355.4-12 are as follows:

- (1) OSWER will attempt to limit exposure to soil lead levels such that a typical (or hypothetical) child or group of similarly exposed children would have an estimated risk of no more than 5% of exceeding the 10 ug/dL blood lead level. The 10 ug/dL blood lead level is based on analyses conducted by the CDC and EPA that associate blood lead levels of 10 ug/dL and higher with health effects in children.
- (2) In developing Preliminary Remediation Goals (PRGs) for CERCLA sites, EPA recommends that soil lead concentrations be determined so that a typical child or group of children exposed to lead at this level would have an estimated risk of no more than 5% of exceeding a blood lead of 10 ug/dL. In applying the IEUBK model for this purpose, appropriate site-specific data on model input parameters, including background exposures to lead, would be identified.
- (3) A suggested decision procedure is recommended which includes collecting site-specific data, running the IEUBK model with the site-specific data if soil lead levels are greater than 400 mg/kg, and where risks are significant (greater than a 5% risk of blood lead levels exceeding 10 ug/dL), evaluating remedial options.

47. A commenter raised concerns about how potential exposure to lead that might ultimately be traceable to lead paint was dealt with in the IEUBK model used in the risk assessment.

Response: Samples of yard soil and indoor dust were collected from each of the Study Group homes and were analyzed for lead and other metals. The measured lead concentrations in these media were used directly as inputs to the IEUBK model. The yard soil concentrations were the arithmetic average of the concentrations found in the minus 250 μ m fraction of composite soil samples collected separately from the front yard, backyard, drip line, driveway, and play area. Since drip line soil, which often contains paint chips that have been scraped or have fallen from exterior surfaces, were explicitly sampled and included in the average value for yard soil as a whole, lead from any paint chips that had been incorporated into this soil was taken into account in the IEUBK model. Similarly, any lead from indoor paint that had become incorporated into the indoor house dust would be reflected in the lead concentrations measured in house dust and, thus, lead paint from this exposure mechanism would be taken into account in the IEUBK model,

In addition to standard inputs for lead concentrations in yard soil and house dust, the IEUBK model provides an optional input for lead concentrations in paint chips. According to the IEUBK model user's guide (EPA, February 1994), this input is provided to allow the user to incorporate lead exposure from direct, long-term ingestion of paint chips into the IEUBK model in addition to the standard inputs for yard soil and house dust. However the guide cautions that information on the amount of paint chips a child typically ingests on a long-term basis is sparse and highly uncertain, much more uncertain than estimates of the amount of soil/house dust a child might ingest. The user's guide concludes its discussion of the optional lead paint input as follows:

In view of the lower quality of information on paint chip intake than on intake of soil, dust, dirt, or drinking water, and the usefulness of providing baseline risk assessments in the absence of lead-based paint, we have used a default value of 0 ug/dL in the model.

Thus, EPA Region VI's decision not to include a separate input for ingestion of discrete paint chips (apart from paint that may have been incorporated into soil and house dust) is completely consistent with the recommended use of the IEUBK model. Moreover, it should be noted that, if EPA had entered estimated-paint chip consumption figures into the model, then the risk to children predicted by the model would increase.

48. With regard to the use of the minus 250 μ m fraction of soil in the risk assessment, a commenter stated that fine particles are more likely to be transmitted from hand to mouth and absorbed in the gut, but that the data should be corrected for skin adherence relative to whole soil, or else the percentage represented by whole soil should be used.

Response: The EPA disagrees. A soil adherence factor should be used in estimating exposure to a soil contaminant via dermal absorption, but should not be used in estimating exposure via incidental ingestion (hand-to-mouth contact). Dermal absorption is not considered a significant route of exposure for lead in soil. Soil ingestion is estimated directly as a certain amount (number of milligrams) of soil ingested per day. There is no intermediate calculation relating the amount of soil ingested to the amount of soil adhering to a certain skin area, therefore there is no need for a soil adherence factor. There is general recognition among scientists who study exposure to contaminants in soil that fine soil particles preferentially adhere to the skin (which the commenter acknowledges) and thus is the fraction most likely to be ingested. That being the case, the best estimate of the amount of contaminant ingested via hand-to-mouth contact would be obtained by directly measuring the concentration of the contaminant in the fine fraction that is being ingested as was done in the EPA study. Since the contaminant concentration was measured in the soil fraction being ingested (i.e., in the fines), no proportionality factor or percentage adjustment involving the whole soil is required.

49. A comment was made that EPA failed to follow its own guidance recommending that the multi-media/multi-source nature of lead contamination be considered in managing risks from lead exposures.

Response: The EPA disagrees. The EPA collected and analyzed samples of soil, house dust, tap water, home-grown produce, and air as part of its investigation of the Study Group homes. The lead concentrations found in each of these media (except air which had concentrations below its assumed default concentration) were used directly in the IEUBK model. The model results, therefore reflect the multi-media/multi-source nature of lead exposure. The estimated contributions of each of these sources were clearly identified in the risk assessment, and were considered in the risk management decisions that were made. Potential exposure to lead derived from paint was considered in accordance with the guidance on the appropriate use of the IEUBK model as discussed in EPA's response to item 47.

50. A comment was made that since some of the residents may not have fully complied with EPA's request not to use their tap water until a "first draw" sample could be collected, EPA may have overlooked a significant source of lead exposure.

Response: As the comment itself shows, EPA did not overlook the issue of first draw water, and in fact collected data on first draw water to the extent cooperation of the occupants of a residence allowed. Higher lead concentrations were found in many of the reputed "first draw" samples compared to the "flushed" samples indicating that most of the residents complied with the request. In any event, drinking water proved to be a very minor source of lead exposure, contributing only an estimated 2% to the total estimated exposure (see BHHRA Report, Figure 5-1).

51. A commenter asserted that nearly every exterior paint sample contained large amounts of lead.

Response: This is not correct, More than half of the samples (28 out of 52) from Study Group homes had lead levels below 5,000 mg/kg, the standard used by HUD for lead in paint.

RESPONSE TO ISSUES RAISED IN THE DAMES & MOORE REPORT ON LEAD IN YARD SOILS INCLUDED AS ATTACHMENT TO GARY UPHOFFS LETTER OF OCTOBER 22,1996

Synopsis of the Dames & Moore (D&M) Studies:

Dames & Moore is an environmental engineering consultant who was hired by a group of companies which once owed or operated mining or milling concerns on the Site. On behalf of the mining companies, D&M resampled eight residential properties that were previously sampled by E&E (E&E is EPA's environmental engineering contractor). C.C. Johnson and Malhotra, P.C. (CCJM) also resampled these properties on behalf of DOI's Bureau of Land Management (BLM).

E&E's sampling plan divided each property into up to six sampling areas, or "strata": The front yard, backyard, drip line, driveway, play area, and garden. Five or six subsamples were collected from a depth of 0 to 1 inch in each of the sampling areas. The subsamples were collected from the four comers and the center of each area except for drip he samples which were located in evenly spaced lines along the drip fine. The subsamples were composited to obtain a single composite sample for each area (compositing means combining subsamples from different locations). The composite samples were air dried and passed through a 10-mesh screen to remove pebbles and debris. The minus 10-mesh fraction was analyzed by using a Spectrace 9000 X-ray fluorescence (XRF) spectrophotometer. The samples were then passed through a 60- mesh screen to obtain a minus 250 micron fraction which was sent to a laboratory for standard EPA Contract Laboratory Program (CLP) Inductively Coupled Plasma (ICP) analysis. For risk assessment purposes, E&E calculated total yard soil lead concentrations by arithmetically averaging the laboratory results for all sampling areas, except gardens.

D&M used a stratified systematic grid sampling scheme in which grids were laid out in contiguous portions of the property: front, back, and side yards, driveways, play areas, and gardens; 45 to 75 discrete samples were then collected from a depth of 0 to 2 inches at grid nodes. Any grass, twigs, or rock fragments greater than 1/4-inch in diameter were removed by hand then each of the discrete samples was analyzed using a Metorex X Met 920 XRF spectrophotometer. Confirmatory laboratory analyses were performed on a randomly selected subset of the samples. Average yard soil concentrations were calculated by arithmetically averaging the results for the discrete samples from the yard and any play areas present.

C.C. Johnson and Malhotra, P.C. used a sampling scheme identical to that used by E&E except that a single composite sample was prepared from the subsamples collected from the front yard, backyard, drip line and play area. Whole soil, and minus 1 mm and minus 250 micron fractions were analyzed using standard laboratory methods.

Issues Raised:

a. Sampling Strategy

The D&M report suggests that differences in the sampling strategies used by E&E and D&M are responsible for significant differences in the results.

E&E's sampling plan employed a stratified systematic sampling design which is one of the common sampling designs described in EPA guidance (EPA 1992, Exhibit 44). Each of the strata had discrete properties that were potentially important in evaluation potential lead exposure at the properties, therefore specifically sampling each of these strata was one of the objectives of the sampling plan.

E&E's sampling plan was very similar to the sampling plan proposed by D&M and approved by EPA Region VII for investigating residential properties in the Kansas and Missouri portion of the Tri-State Mining District which is off of the Site and located in EPA Region VII. That plan also provided for separate composite samples from up to three yard areas (designated as front, back, and side), driveways, play areas, and gardens. The Region VII sampling plan provided for 3 or 4 subsamples; from each area generally laid out in a rectangle or a line depending on the geometry of the area being sampled. This also would be considered a stratified systematic sampling design. In the report presenting the results of Jasper and Cherokee Counties study, D&M observed that duplicate samples collected in this fashion gave relative percent differences of 0 to 22% and conclude that the subsampling and compositing method yielded representative results (D&M, 1994).

Comparison of the lead concentrations in similar soil samples collected at the Tar Creek Site and analyzed by E&E, CCJM and D&M using t-tests for paired samples showed that the E&E and CCJM results were not significantly different from one another, however the D&M result were significantly different from both the E&E and CCJM results. The agreement between the E&E and CCJM results indicates that the 5 or 6 point composite sampling strategy employed is reproducible and yields representative results. This finding also is consistent with D&M's conclusions about this type of sampling in the Cherokee and Jasper County portion of the Tri-State Mining District in EPA Region VII. Thus the differences between the E&E and CCJM results, on the one hand, and the D&M results, on the other, are not likely to be related to the number of samples collected from an area; they are more likely to be due to the different depths from which samples were collected and the proportion of drip line samples included in the D&M sample sets.

Some of the differences between the E&E and D&M results are due to the differences in the way the two studies dealt with drip lines. No drip line samples were collected from three of the properties resampled by D&M and only 2 out of 51 samples collected from another property were from the drip line. Ten to 20% of the D&M samples were from drip line areas at the other 4 residences. The E&E results show that at 4 of the 8 properties resampled by D&M the lead concentrations in the drip line samples were 2.5 to 4 times higher than in the general yard soil. The lead concentrations found in drip line soil significantly increased the estimates of average yard soil lead concentrations for these residences. However, the lead concentrations in just the front yards and backyards of these residences, excluding the drip line concentrations, still averaged about 1,500 mg/kg in the E&E study. Lead concentrations in just the front yards and backyards, excluding the drip lines, exceeded 500 mg/kg at all 8 of these residences, and exceeded 1250 mg/kg at 5 of the residences. In contrast the average lead concentration found in yard soil alone (excluding drip line samples) by D&M was about 870 mg/kg. The difference in the treatment of drip line areas contributes to the different results obtained but it does not appear to be the most important factor. In most cases, EPA would have made the same remedial decision to deal with the soil lead, even if the drip line areas were ignored because the lead concentrations in the yard areas alone (without including drip line samples) warrant remedial action (i.e., excavation and removal).

The eight properties selected for resampling had among the highest soil lead concentrations found at any of the Study Group properties. It is well known that drip line areas tend to have higher lead levels than general yard soil because lead-bearing particles deposited on roofs, as well as paint flakes tend to accumulate in these areas. Therefore it is not surprising that drip line areas are significant contributors to overall yard soil lead at some of these properties. However, the lead levels in the general yard soil at the properties sampled on the Site were still high enough to be of concern even if drip line areas are disregarded. When all 100 Study Group properties are considered, the average lead concentration in the drip line areas was only about 40% higher than the average level in front yard and backyard areas. A similar pattern was seen for the Reference Area properties. Lead in drip

line areas certainly contributes to the lead levels in yard soil as a whole, but it cannot be considered the major or predominant source.

b. Sample Depth

E&E used a sample depth of 0 to 1 inch to estimate lead concentrations in surface soil that young children are likely to contact while playing, and that children are likely to ingest via hand-to-mouth contact, and that are likely to be tracked into the house and become house dust. D&M used a sample depth of 0 to 2 inches in its study. The EPA's risk assessment guidance manual notes in discussing sample depths that assessment of surface exposures will be more certain if samples are collected from the shallowest depth that can be practically obtained. Given the exposure pathways of interest (i.e., soil tracked into the home and soil which is ingested during hand-to-mouth contact) the soil tracked into the home and/or handled by a young child is more likely to come from the upper 1 inch of soil than to come from the upper 2 inches; therefore, the 0 to 1 inch sample depth is more appropriate for the exposure pathways under consideration.

c. Differences in XRF Analytical Techniques

D&M argues that the Metorex 920 XRF spectrophotometer used in the D&M study is superior to the Spectrace 6000 XRF spectrophotometer used by E&E and that the Spectrace results above 1,000 mg/kg probably suffer from a gross lack of precision.

About 550 different samples from all of the sampling areas of the 100 Study Group properties were analyzed by both XRF spectrophotometry, using the Spectrace 6000, and by ICP using the standard EPA Contract Laboratory methods. The XRF and CLP results for these samples were compared using linear regression analysis. The regression of the lead concentrations measured by XRF on those measured by CLP was highly significant ($p < 0.0005$), the slope of the regression line was 1.08 with a standard error of 0.03. The correlation coefficient was 0.86 and the r^2 was 0.74 indicating that 74% of the variance in the XRF values was accounted for by the CLP values. A scatterplot showed that the relationship between the XRF and CLP values was linear up to at least 4,000 mg/kg. Comparison of the scatterplot of the Spectrace versus CLP results obtained by E&E to the Metorex versus CLP results reported by D&M in its Residential Yard Assessment Report for Jasper and Cherokee Counties shows that the Spectrace results were at least as linear and precise as the Metorex results obtained with their Model 5 soil shown in Figures 5 and 6, the best of the three model soils used.

Based on the comparison between the XRF and CLP results, EPA Region VI is satisfied that the Spectrace results are reliable and rejects assertions to the contrary.

d. Lead in Chat

D&M argues that the lead concentration in chat is not high enough to account for the lead levels observed in residential soil at the Site Study Area.

Many of D&M's arguments involve extrapolation of findings from the Jasper and Cherokee County studies, which may not apply to the Site which is in Ottawa County. According to D&M, CCJM sampled 4 of about 25 chat piles in Picher and found an average lead concentration of 838 mg/kg. D&M notes, in support of its argument, that the concentrations in two of these piles were below 400 mg/kg. However this means that the other two piles must have had lead concentrations that averaged more than 1,200 mg/kg, concentrations that could account for the lead concentrations found in most of the residential soil. Furthermore, D&M noted the presence of chat in a substantial number of the soil samples it collected during its resampling efforts.

e. Lead in Smelter Emissions

D&M suggests that the lead in soil from Study Group properties in Picher might have come from a smelter source based on findings from areas of Jasper and Cherokee Counties (Jasper and Cherokee Counties are not part of the Site) where smelters operated.

As noted in the D&M report, there was no known smelting activity in Picher. The Ontario Smelting Company smelter (later purchased by Eagle-Picher) is the only smelter known to have operated on the Site and it is located in the southeast part of the Hockerville area, about 3 miles east of Picher. The Ontario Smelting Company smelter was much smaller than the smelter located in Joplin, and it operated for only about 15 years. The smelting in Joplin continued for approximately 90 years. Investigation of the smelter in Joplin showed that the prevailing wind in the Tri-State Mining District is from the northwest and carries plumes mainly to the southeast. Elevated soil lead concentrations were detectable only up to 2 1/4 miles from the Joplin smelter. The Ontario Smelting Company smelter is located 3 miles east of Picher in a generally downwind or cross-wind direction. Therefore, at that distance, and in that direction, it is unlikely that emissions from the Ontario smelter could be responsible for the soil lead concentrations found in Picher.

Moreover, D&M bases its suggestion, that the lead found in Picher was from a smelter source, in part on certain samples submitted to Dr. Burke Burkart for X-ray diffraction analysis described in the D&M report. Dr. Burkart presented speciation results of ten samples in a July 1995 report (Burkart, July 6, 1995) (the "first report") and the results of another ten samples in a September 1995 report (Burkart, September 23, 1995) (the "second report"). However, the conclusions in the two Burkart reports, regarding a smelter source, are not consistent with some of the data presented in the reports, with the common observation of mining waste in yards at the Site, and also with historical information about the Site. In the first report, failure to observe galena (PbS) and sphalerite (ZnS) was a basis for concluding that "furnace products" and not "mine tailings" were the source of the lead and zinc in the samples. However, in the second report, upon reexamination of these same samples (the first ten samples), sphalerite was positively identified. Also, another investigator (Drexler, 1996) identified the presence of galena in soil from the Site. Since, according to Burkart, sulfide minerals (e.g., galena) at the Site would be expected to convert to oxidized phases, it is not surprising that little galena was found in the soil. Also, in the first Burkart report, chemical compounds that are known to be weathering products of ZnS and PbS that were present in the samples were apparently not recognized as possible indicators of a mine tailings source. This oversight was partially corrected in the second report as sulfide ores were recognized as a source of oxidized lead and zinc phases. Also, in the first Burkart report, furnace products were attributed to a "zinc metallurgical furnace," although no zinc smelters are known to have operated at the Site. The zinc oxide commonly observed in the samples was attributed to smelters in the first report. However, the second report explains that zinc oxide is a weathering product of sphalerite. Sphalerite was one of the two main minerals mined at the Site. The other main mineral that was mined was galena. The first report identified chert particles with ZnO coating and the second report identified ZnO present on the same sample grains with ZnS. Both of these observations are descriptive of weathered sphalerite. Weathering products of galena and weathering products of sphalerite, both in association with silicious chert fragments of the type commonly observed at the Site, are indicative of a chat source. The oxides of lead at the Site are likely the oxidized phases of sulfide minerals and products formed in situ in the soil of oxidized phases of sulfide minerals and various metals present in the soil. In the first report, the fine grained quartz fraction present in all of the samples was attributed to "furnace processes." In the second report, chat was identified as the "most likely origin" of the fine grained quartz fraction present in the samples, reversing the earlier conclusion that the fine grained quartz was from furnaces. In the second report, quartz, most likely from chat according to Burkart, was the primary component of the fine fraction. Light colored chert fragments were commonly

observed in the coarse grained fraction of the samples. Light colored siliceous chert fragments are commonly observed to dominate the coarse fraction in chat samples at the Site. Chat is a source for the type of chert fragments observed in the samples. The second report concluded that the transported products, as distinct from a natural soil material, appeared to be mill tailings and smelter products. Based on these considerations, EPA believes that Burkart's conclusion that mill tailings are indicated as a source of the samples is consistent with the overall Site data. However, EPA questions the conclusion indicating the smelter products are a source, as this is inconsistent with the overall Site data. The EPA believes that the steam furnaces associated with many of the mines and mills at the Site, are more likely to be a source of the slag-like and furnace like products observed in the samples than smelters. This belief is based upon historical information that steam furnaces used to power mining machinery were common in Picher, whereas only one smelter (which was small compared to smelters in Joplin, Missouri and Galena, Kansas) has been positively identified and it was located three miles east of Picher in a crosswind or downwind direction. For the reasons discussed above, the results of the Burkart reports, indicating that smelter products are a source is considered inconclusive by EPA.

f. Lead in House Paint

D&M argues that lead-based paint is a source of lead in soil in Picher. D&M notes that E&E found lead-based paint at a number of homes in Picher and that paint chips were observed in many drip line samples and some other soil samples. However, D&M makes no specific claim and offers no opinion as to the relative importance of lead paint as a source of the lead in soil.

The EPA has acknowledged the presence of lead-based paint at a number of residences both in Picher and in Afton, the Reference Area. The EPA has discussed the lead paint data in detail in responses to earlier comments (see e.g., 1, 4, 20, 21, 33, 36, and 47). Paint chips have been found in a number of soil samples, and lead-based paint may be an important source of lead in soil at some residences; however, EPA believes that the weight of evidence indicates that lead-based paint is not the primary source of the elevated lead levels found at the majority of residential properties in Picher.

g. Lead in Automobile Emissions

D&M notes that automobile emissions are a well known historic source of lead in soil, particularly near roadways, and observes that some of the lead in soil near highly traveled roads in Picher could come from this source.

The EPA acknowledges that automobile emissions were a historic source of lead released to the environment and may have contributed, to a degree, to the lead found in yard soil in Picher. Automobile emissions were also similarly a possible source in Afton, the reference area, where the lead in yard soils is at a level where less than 1% of the children are predicted (using the IEUBK lead model) to have elevated blood lead levels. Automobile emissions cannot account for the large differences in soil lead levels found between Picher and Afton, the reference area. Also, the speciation results (Burkart, July 6, 1995, Burkart, September 23, 1995, and Drexler, 1996) did not indicate automobile emissions as a source of lead.

Attachment 2 to Section II, Part B of Responsiveness Summary

**TAR CREEK SUPERFUND SITE
TECHNICAL REPLY DOCUMENT
RESIDENTIAL AREA RESPONSE ACTIONS
(Revised July 10, 1996)**

This document is the U.S. Environmental Protection Agency's (EPA's) reply to technical comments in Gary D. Uphoff's letter of January 25, 1996, on behalf of ASARCO Inc., Blue Tee Corporation, Childress Royalty Company, Inc., Gold Fields Mining Corporation, NL Industries, Inc., and The Doe Run Resources Corporation (the "Companies") responding to EPA's Special Notice of November 17, 1995, for the remedial investigation, feasibility study, and remedial design (RI/FS/RD) for the residential areas at the Tar Creek Superfund Site (the "Site"), Ottawa County, Oklahoma. This document also responds to additional technical comments from the Companies (with the exception of NL, Industries, Inc.) contained in Gary D. Uphoff's letter of May 21, 1996. Technical comments were also received in a letter of January 26, 1996, from Suzanne R. Schaeffer of the U.S. Department of the Interior (DOI) responding to EPA's Special Notice of November 17, 1995. EPA's responses to the technical comments received from the Companies and from DOI have been combined into this single Technical Reply Document because the issues raised by both DOI and the Companies are similar (hereinafter the Companies and DOI are referred to collectively as the Respondents). The documents EPA relied upon in preparing this technical reply include the following:

Draft Baseline Human Health Risk Assessment Report, Tar Creek Superfund Site, Ottawa County, Oklahoma, Prepared for EPA by Ecology and Environment, Inc., December 1995

Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual, Part A, OSWER, EPA, 1989

Supplemental Region VI Risk Assessment Guidance, EPA Region VI Draft Document, May 5, 1995

Revised Interim Soil Lead Guidance For CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive No. 9355.4-12, EPA, July 14, 1994

Guidance Manual for the Integrated Exposure Uptake Biokinetic Model For Lead In Children, OERR Publication No. 9285.7-15-1, EPA, February 1994

In the following analysis of the Respondents' comments, the following terms are used as indicated below:

- Study area - means the mining area of Ottawa County which was the subject of the Baseline Human Health Risk Assessment (BHHRA);
- Study group - means the 100 homes in Picher where multi-media environmental samples were taken;
- Reference area - means the 15 homes in Afton, Oklahoma which are outside of the mining area where multi-media environmental samples were taken; these homes were used for comparison to homes within the mining area;
- OSDH survey - means the Oklahoma State Department of Health (OSDH) Picher blood lead survey unless the OSDH county-wide survey is specifically referenced.

EPA'S REPLY TO GENERAL COMMENTS

1. The Respondents, focusing on the county-wide results from the OSDH blood lead survey, noted that 5.6% (13 of 232) of the Ottawa County children tested had blood lead levels exceeding 10Ig/dL. The Respondents state that even these results may be biased high because they include the results from the door-to-door survey in Picher. The Respondents have also expressed that additional bias is introduced by not using the latest results from followup retesting. The Respondents suggest that EPA use the county-wide results, rather than the results for Picher, as a basis for its decision-making regarding the remediation of lead contamination at the Site. In response, EPA would like to make the following points:
 - a. The OSDH county-wide statistics cited by the Respondents are not representative of blood lead levels in the mining areas of Ottawa County (the mining areas make up the Site); therefore, county-wide results are not important to EPA's decision-making regarding remediation of lead contamination at the Site. The OSDH county-wide blood lead survey was not conducted in a manner likely to produce statistically representative results. While the OSDH Picher results were based on a systematic door-to-door sampling effort, the county-wide results for areas outside of Picher were based on a self-selected sample of walk-in participants. The Respondents' description of the results of the OSDH county-wide blood lead survey is also potentially misleading, because the frequency, cited by the Respondents, of blood lead levels greater than or equal to 10 Ig/dl is for all of the children in the survey. This includes children of all ages, not just children 6 years old and under, who are most likely to have elevated blood lead levels because of their natural propensity to engage in hand-to-mouth behavior, and who are most sensitive to the effects of lead. Also, over one-third of the 232 children tested in the OSDH county-wide survey were residents of communities outside of the mining area, where lead-contaminated soils and mining wastes are not prevalent. EPA believes it is more pertinent to focus on results within the mining area, which is the subject of EPA's response action. The OSDH survey found that the proportion of young children with elevated (10 Ig/dL or greater) blood lead levels in Picher was substantially greater than outside the mining area. That finding suggests that there is a positive relationship between blood lead levels and exposure to mining-related contamination, and that blood lead levels within the mining areas of Ottawa County are likely to be higher than in the county as a whole.
 - b. The OSDH blood lead results for Picher are most relevant for comparison to the results of the Baseline Human Health Risk Assessment (BHHRA), because the Picher survey was conducted within the same geographical area as EPA's study group (100 homes in Picher) investigation. That is, the Picher survey was conducted in an area where mining waste is prevalent, whereas the county-wide OSDH survey includes areas where mining waste are not prevalent. The Picher blood lead survey found that 21% of the young children tested had blood lead levels of 10 Ig/dL or greater. These results are consistent with the predictions of the Integrated Exposure Uptake Biokinetic (IEUBK) model in the BHHRA, which were based on lead concentrations found in environmental media (i.e., non-paint media such as soil, house dust, tap water, and air) at the study group homes.
 - c. It is well know that lead exposure prevention education and increasing awareness about lead poisoning can produce a reduction in observed blood lead levels. Children who test high initially often retest lower, as reported by OSDH for some of the children at the Site, due to improved hygiene and other exposure reduction activities resulting from lead exposure prevention education and greater awareness

about lead poisoning.

- d. EPA does not use blood lead data alone as a basis for remediation decisions. Reliable blood lead data is difficult to obtain, and interpretation of the results is also often difficult because of confounding factors such as small sample sizes. Accordingly, no blood lead survey can serve as the sole basis for EPA's decision about whether a particular release of lead warrants a response. EPA will respond when it makes a finding that there has been a release of lead to the environment, and that the release may pose a threat to human health or welfare or the environment.
- e. EPA uses national surveys of blood lead levels, e.g., the National Health and Nutrition Examination Surveys (NHANES), for information purposes. However, EPA does not determine whether or not a response action is warranted at a given site by making comparisons to average blood lead levels obtained from national surveys such as NHANES III. EPA believes that it is more meaningful, in evaluating the significance of blood lead results from communities within the Site, to make comparisons with blood lead results from other similar communities within the Tri-State area, but outside of the mining district.
- f. EPA currently relies on the predictions of the IEUBK lead model to evaluate the potential risks. Generally, EPA's policy is to attempt to limit environmental lead levels so that a typical child or group of children will have an estimated risk of no more than 5% of exceeding the 10 Ig/dL blood lead level. EPA hopes to address releases of lead before the lead causes elevated blood lead levels in children.

- 2. The Respondents assert that the area-wide residential soils in the mining area have fairly uniform concentrations of lead; therefore, a uniform increase in blood lead levels of children in the mining area would be expected, rather than the type of distribution actually observed in the OSDH survey. However, it is not EPA's observation that the lead concentrations in soil in the study area are uniform. In fact, there is considerable variability in the lead concentration in soil in the study area as documented in the BHHRA. Figure E-1 from the BHHRA shows the cumulative distribution of lead concentrations in soil in the study area as a whole, in soils from the study group homes, and in soils from reference area homes. The large range of lead concentrations in soil samples from these areas illustrates the degree of variability of lead levels in soils within these areas. There is also variability in an individuals' exposure to the lead in soils due to differences in activity patterns among individuals. Therefore, EPA sees no reason why a uniform increase in blood lead levels should necessarily be expected if lead in soils was the major source of lead exposure for a population.
- 3. The Respondents assert that EPA's planned soil removal actions are inconsistent with and unwarranted by the CDC guidelines contained in the October 1991 CDC publication, "Preventing Lead Poisoning in Young Children" (the "CDC guidelines"). The Respondents suggest that since the blood lead levels in the area children, according to the OSDH blood lead survey, are found primarily in the 10-14 Ig/dL range, that the response, based on the CDC guidelines in Table 1-1 of Chapter 1 and the "Interpretation of Blood Lead Levels" Section of Chapter 4, should be limited to health education and follow-up blood lead testing. However, the Respondents, charge that EPA is inconsistent with the CDC guidelines overlooks the recommendation for community-wide childhood lead poisoning prevention activities made in Table 1-1 and focuses primarily only on Chapter 4 which describes the role of pediatric health-care providers. The guidelines in Chapter 4 are not targeted to the role of environmental programs like Superfund in addressing the environmental sources of lead in communities to prevent blood lead poisoning. Chapter 4

provides guidance to pediatric health-care providers in response to documented blood lead levels, i.e., a case management approach. However, if properly interpreted the CDC guidelines do not advise against the planned response actions proposed at the Site which are designed to address the environmental sources of the elevated blood leads in the community, but on the contrary, the CDC guidelines lend support to EPA's planned response actions. Even at the 10-14 Ig/dL range, community-wide childhood lead poisoning prevention activities are recommended by the CDC guidelines (see Table 1-1, Chapter 1) when many children are in this range. Based on the OSDH blood lead survey for Picher, many children, 21 percent, had elevated blood lead levels; this definitely triggers community-level intervention according to the CDC guidelines. Chapter 9 of the CDC guidelines explains that (i)n theory, primary prevention has always been the goal of childhood lead poisoning prevention programs. In practice, however, most program focus exclusively on secondary prevention, dealing with children who have already been poisoned. As programs shift the emphasis to primary prevention, their effort must be designed to systematically identify and remediate environmental sources of lead, including, most importantly, dwellings containing old lead paint.

The shift from case management to community-level intervention will require a fundamental shift in perspective. The focus must shift from the individual child to the population of children at risk and the environment in which they live. The purpose of community-level intervention is to identify and respond to sources, not cases, of lead poisoning.

From the foregoing excerpts from the CDC guidelines, it is clear that a community-level intervention, as planned for the Site, is the preferred approach rather than the secondary prevention, case management, approach that the Respondents recommend. It is also clear from the CDC guidelines that primary prevention activities that identify and remediate environmental sources of lead before the lead causes elevated blood lead levels in children are preferred.

EPA'S RESPONSE TO THE COMPANIES' COMMENTS ON THE BHHRA

[Note: This section of the Technical Reply Document attempts to respond point-by-point to the issues raised in the Dames & Moore comments enclosed with Gary D. Uphoff's January 25, 1996, letter. There is some redundancy in the responses because of overlap in some of the issues raised.]

EPA's Responses to Dames & Moore's General Comments:

The objective of the Tar Creek BHHRA was to evaluate potential risks associated with environmental site-related contamination (lead and other metals) at residential properties. The risk assessment was structured to address that question as directly and unambiguously as possible.

The risk assessment conforms to current EPA risk assessment guidance. Accordingly, potential health risks from lead were assessed using EPA's IEUBK model. As pointed out in the Companies' comments, it is well known that exposure to lead-based paint is a major source of elevated blood lead levels in young children. Inclusion of exposure of lead in paint chips in the IEUBK model has a major impact on the blood lead levels predicted by the model, overwhelming the contributions from all other sources. EPA was interested in determining whether environmental media alone, without the contribution of lead from lead-based paint, posed a health threat to children on the Site. Therefore, exposure to lead in paint chips was excluded from the BHHRA in order to focus on (1) exposures to lead in environmental media at residential properties (the bulk of these environmental-media lead exposures was likely to be due to site-related contamination), and (2) the potential impact of exposure to environmental

(non-paint) lead on blood lead levels in children).

The IEUBK model was used as an indicator of the range of blood lead levels in children that could result from exposure to the lead concentrations measured in environmental media at the study group residences. The BHHRA report clearly explains that a number of default exposure assumptions (based on national averages or observations at other sites) were used, and that those assumptions may differ from actual exposures.

The EPA investigation of residential areas of the Tar Creek Site focused on a detailed investigation of environmental contamination and relied on standard EPA risk assessment methods to evaluate the potential risks posed by the contamination. It did not include any blood lead sampling, partly because blood lead surveys were being conducted by other agencies (Agency for Toxic Substances and Disease Registry (ATSDR), OSDH, and the Indian Health Service (IHS)). Although those surveys provided useful information on blood lead levels in the area, matched environmental samples intended to measure lead in the environment in which the blood-sampling participants lived were not collected. Consequently, those blood lead surveys cannot be used to quantitatively evaluate relationships between lead in environmental media at area residences and blood lead levels. It should be noted that the OSDH data was not released to EPA until after the BHHRA had largely been completed. A summary of the results of the OSDH blood lead survey was included in the BHHRA, because the results could be considered evidence of a possible effect of environmental site-related contamination on human health. The OSDH survey, which shows a high percentage of children with elevated blood lead levels living in Picher is certainly consistent with the BHHRA's finding that environmental lead from mining waste poses a high risk to human health. The similarity between the percentage of young children found to have blood lead levels of 10 µg/dL or greater and the percentage predicted by the IEUBK model was noted, but this was neither intended nor represented as validation of the model.

The blood lead levels measured in the children 72 months of age and younger in the OSDH survey are not directly comparable to the blood lead levels predicted by the IEUBK model for at least two reasons. First, the children included in the OSDH survey were not randomly selected from the population of Picher, and their exposure levels were not measured; thus, there is no way of knowing whether the homes of the children in the OSDH survey are comparable, as a group, to the 100 randomly selected study group homes that served as the basis of the blood lead levels predicted by the IEUBK model. Second, the blood lead levels predicted by the IEUBK model reflect only exposure to lead in environmental media plus lead in the diet, whereas the measured blood lead levels necessarily reflect all of the lead exposures experienced by these children, including exposure to lead-based paint chips, if any. If the homes of the children included in the OSDH survey were reasonably comparable to the BHHRA study group residences, the measured blood lead levels would be expected to be higher than the levels predicted by the IEUBK model if lead paint chips were a significant source of lead exposure for these children. Since the measured levels were not higher, it is unlikely, assuming reasonable comparability between OSDH survey homes and BHHRA study group homes, that lead in paint chips is the primary source of lead exposure for these children.

The BHHRA report makes no statement about the factors that may be responsible for the observed elevated blood lead levels at the Tar Creek Site; it reports the possible sources suggested in studies it summarizes, but makes no statement of its own. The report does state that elevated blood lead levels predicted in the study group are due primarily to elevated levels of lead found in outdoor soil and indoor dust because soil and dust accounted for most of the total lead uptake estimated by the IEUBK model. To the extent that mining waste materials contribute to the elevated lead concentrations in soil and dust, they would also contribute to total lead uptake. The BHHRA explained that ingestion of lead-based paint chips, which could be a major source of lead exposure for some children, was excluded from the quantitative evaluation for the reasons discussed above. Even excluding possible paint chip ingestion, the IEUBK model

predicts that blood lead levels of children living in the study group homes could be unacceptably high due to lead in environmental media, notably soil. Predicted blood lead levels would be even higher if there were additional exposures from ingestion of paint chips. The possible impact of lead paint chips on blood lead levels is discussed in the uncertainty section of the risk characterization (Section 5.4.1), immediately following the risk characterization summary in the BHHRA report.

The Companies claim that EPA in the absence of any analytical or observational data to demonstrate, or even suggest, any real human health risks attributable to metals in yard soils, prepared a modeled risk assessment to support a preconception by EPA concerning systematic human health risk associated with mining wastes. This is not true. EPA did suspect that mining-related wastes were a major source of environmental contamination (i.e., non-paint contamination) in the study area (the mining area identified in Figure 1-1 of the BHHRA). This suspicion was appropriate, however, because the presence of large amounts of mining-related waste in the study area, and the contamination of groundwater and surface water by mine-derived contaminants were the reasons the area was originally listed as a Superfund site. Also, a blood lead study conducted for the Region 7, Jasper County portion of the Tri-State mining district, had indicated that blood lead levels were significantly higher in the exposed group within the mining area compared to the control group outside the mining area. These Region 7 studies also indicated that exposure to soil was the most important factor influencing the distribution of blood lead levels between the two groups. Due to similarities between the Region 7 and Region 6 portions of the Tri-State mining district, it was reasonable to suspect that similar problems related to mining waste might exist in both portions of the Tri-State mining district. The BHHRA describes the Site history, the occurrence and releases of potential source materials (mining wastes) in the area, and the potential exposure pathways that exist, in accordance with EPA risk assessment guidance. However, no assumptions were made about the source(s) of environmental contamination in preparing the quantitative risk evaluations for lead or any of the other chemicals of potential concern (COPC). For COPCs other than lead, observed concentrations in environmental media were used to calculate exposure point concentrations in accordance with the EPA guidance cited in the BHHRA. Likewise, for lead, observed concentrations or averages of the observed concentrations of lead in soil, house dust, and tap water from each individual study group and reference area (area of the 15 homes in Afton) residence were used directly as inputs to the IEUBK model. Mining wastes are responsible for the estimated risks and predicted blood lead distributions to the extent that they contribute to elevated contaminant concentrations in environmental media. As discussed earlier, lead in paint chips was omitted from the IEUBK model to determine whether the lead levels in environmental media alone were sufficient to result in blood lead levels high enough to be of concern, which was one of the main objectives of the BHHRA.

The Companies suggest that mining wastes are not the primary source of potential lead exposure; however, data collected during the extensive investigation of the Tar Creek Site indicate otherwise. Cadmium, lead, and zinc are the elements primarily associated with area mining wastes. Elevated levels of cadmium, lead, and zinc serve as a signature for the presence of mining waste in environmental media from the area. The site investigation showed that the concentrations of cadmium, lead, and zinc in soil from the study group homes were approximately 10 times greater than the concentrations of cadmium, lead, and zinc in soil from the reference area homes. The site investigation also showed that these elements had the greatest elevation of any of the metals measured. In addition, lead concentrations in soil from the study group homes exhibit highly significant ($p < 0.001$) positive correlations with the cadmium and zinc concentrations in the soil. The foregoing evidence indicates that mining waste is the major source of lead in outdoor soils in the Tar Creek area.

It is possible that lead in paint could contribute to the lead concentrations in soil and dust. However, if lead in paint were a significant contributor to the concentrations of lead in

soil and dust, one would expect the lead levels in soil to be disproportionately elevated compared to the cadmium and zinc concentration levels in soils, but lead concentrations in areas subject to paint contamination are proportionate to the concentrations of cadmium and zinc. That is, where lead is highly concentrated in soil, zinc and cadmium are also typically highly concentrated in soil. Since zinc and cadmium concentrations cannot be attributable to paint contamination, but can be attributed to mining waste, it can be concluded that the high concentrations of lead, proportionate to the cadmium and zinc concentrations, are due primarily to mining waste and not to paint. Outdoor paint chips were collected from 52 of 100 study group homes and 4 of 15 reference area homes; indoor paint chips were obtained from 10 study group homes and 1 reference area home. All of the paint chips were analyzed for lead. The small number of samples from reference area homes makes a detailed comparison of the prevalence of lead paint at homes in the two areas difficult; however, the available data do not indicate a marked difference between the two areas. Using a level of 5,000 mg/kg (i.e., 0.5% which is the standard for lead in paint used by the U.S. Department of Housing and Urban Development (HUD) and some state regulations) as an indicator of the presence of lead paint, the percentages of homes found with lead paint in the study group and in the reference area were roughly the same. Outdoor lead paint was found at 24 of the 52 study group homes sampled and at 3 of the 4 reference area homes sampled, indicating the presence of lead paint at 24% (24 of 100) of the study group homes and 20% (3 of 15) of the reference area homes. The mean lead concentration reported in outdoor paint samples from the study group was lower than in the reference area. Fewer indoor paint samples were collected and the lead concentrations were generally lower than the lead concentrations in outdoor paint; the indoor paint lead concentrations exceeded 5,000 mg/kg in just one of the 10 study group homes sampled. Only one indoor paint sample was collected from a reference area home. Its lead concentration (2,600 mg/kg), which was below the criterion for lead paint, was similar to the mean concentration found in paint from the study group homes. Overall the data suggest that the prevalence of lead paint and, therefore, the potential exposures of children to lead from this source are probably no greater in the study group than in the reference area homes. Also, specifically for outdoor soil, since the available data provide no evidence that the prevalence of lead paint differs significantly between the study group and reference area homes, the possible presence of lead paint in the soil is not likely to account for a significant part of the (order of magnitude) difference in soil lead concentrations measured between the study group and the reference area homes.

House dust and yard soil were estimated by the IEUBK model to account for more than 80% of the environmental lead exposure to young children in the study group homes. Fifty of the 100 study group homes had average dust lead concentrations greater than 200 mg/kg. The dust lead level of 200 mg/kg is an upper-end estimate for background dust concentrations and is the IEUBK model default level for dust. Only five of these 50 homes had higher lead concentrations in dust than in soil, which would suggest another significant source of lead. That is, the fact that most homes had higher concentrations of lead in soil than in dust would suggest that inside paint was not the cause of unusually high levels of lead in dust in the home.

To summarize, the information bearing on the possible sources of lead exposure in the Tar Creek area is as follows:

- Elevated levels of cadmium, lead, and zinc is a indicator of tht presence of mining waste in the Tar Creek area;
- The median and average concentrations of cadmium, lead, and zinc were each approximately an order of magnitude higher in soils from study group residences than in soils from reference area residences, indicating that mining waste is the major source of elevated lead concentrations, which are proportionate to cadmium and zinc, in study group soils;

- Lead paint was found in approximately the same proportion of study group and reference area homes, indicating that the presence of lead paint is not likely to account for a significant part of the difference in soil lead concentrations between the homes in the two areas, and;
- Fifty of the 100 study group homes had average lead concentrations in house dust greater than 200 mg/kg, which could be considered elevated. Only five also had dust concentrations higher than the corresponding soil concentrations, suggesting the probable presence of a significant source of lead other than the outdoor soil in only 5 of the fifty homes.

Overall, the evidence indicates that mining waste is the major source of elevated lead levels in environmental media in the Tar Creek area, and therefore it is likely to be the major contributor to lead exposure in the area. Lead paint may be present at some residences and could contribute to the lead concentrations in soil and house dust at those residences, but it can not account for the major differences in lead concentrations between the study area and reference areas. Lead paint may contribute to lead exposures at some homes and could be a major source of lead exposure at those homes; however, lead paint does not appear to account for a major portion of the lead in soil or house dust in the Tar Creek study area.

Apparently, the main evidence the Companies use to support their hypothesis that lead paint, rather than mining waste, is the primary source of lead exposure in the area is the similarity between the blood lead levels measured in the OSDH survey (which necessarily reflects all sources of lead exposure, including any exposure to lead paint) and the blood lead levels predicted by the IEUBK model, which excluded exposure to lead paint. The Companies apparently assume that the measured blood lead levels include a substantial exposure to lead paint because numerous studies have shown that exposure to lead paint can have a major effect on blood lead levels. Since the blood lead levels measured in the OSDH survey, which must reflect any exposure of these children to lead paint that may have occurred, are similar to the blood lead levels predicted by the IEUBK model, which excluded paint exposure, the Companies apparently conclude that the IEUBK model must have overestimated lead exposure from environmental sources. As noted above, the sets of residences underlying the blood lead levels measured in the OSDH survey and those used in obtaining the IEUBK model predictions may not be comparable; however, if they are, it is probable that the predicted and observed blood lead levels are similar because lead paint is not a major contributor to lead exposures in the Tar Creek area. That is, only five of the 50 homes in the study group which had average lead concentrations in house dust greater than 200 mg/kg also had dust concentrations higher than the corresponding soil concentrations, suggesting the probable presence of a significant source of lead other than the outdoor soil. Moreover, even if lead paint is identified as a significant source of contamination at a residence, it does not necessarily mean that lead paint is actually the major source of exposure at that residence.

The Companies also note that interior and exterior lead-based paint was identified as a source of lead contamination in the ATSDR lead exposure investigation in the Fall 1994. The ATSDR lead exposure investigation was a followup investigation to the finding that 35 percent of the Indian children that had been tested by the IHS had elevated blood lead levels. [As a side note, some of the children with elevated blood lead levels sampled by the IHS lived outside the mining area. However, it is not unusual that elevated blood lead levels existed in towns in Ottawa County distant from the mining area, since such towns may have other industrial sources of lead. Also, mine waste materials have been transported from the mining area to other areas for use as driveway material, playground material, and for other uses for which gravel is typically used.] However, ATSDR only identified significant sources of lead in two of the nine houses sampled. For these two houses, the lead was attributed to lead-based paint. For the other houses, significant sources of lead were not identified. That does not mean that

significant sources of lead did not exist. The ATSDR exposure investigation did not conclude that the elevated blood lead levels were not from mining waste. At several of the houses, investigators reported that mine tailings material was used for the driveways. ATSDR's soil samples were a composite of normal soil material and also mine tailings, if present. ATSDR did not use separate composites of each of the areas of a yard and types of material to the extent that EPA did in its investigations. The concentration of lead in mine tailings is typically much higher than normal soil materials, based on sampling results from Region 6 and Region 7. It is likely that the type of sample compositing that ATSDR conducted diluted the typically higher concentrations for mine tailings. Even with the type of compositing that ATSDR conducted, samples of soil from four of the houses had lead concentration greater than EPA's 400 mg/kg soil lead screening level (see EPA Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, July 14, 1994).

EPA's Responses to Dames & Moore's Specific Comments:

Lead in Soils, Minus 60 Mesh

The Companies criticized the approach used by EPA for estimating the exposure concentration of lead in soil at each residence by simply averaging the lead concentrations found in the front yard, back yard, play area, dripline (the point where runoff from the roof hits the yard), and driveway samples. EPA believes this averaging approach is valid. While the assumption that a child's exposure would be divided equally among these sources is unprovable, as the Companies say, any alternate assumption is equally unprovable. EPA considered the use of a weighted average of concentrations measured in five areas in each yard. Under the weighted average approach, the averages would be weighted to reflect the amount of time a young child might spend in each area; however, this approach was rejected because (1) without site-specific data, any weighting scheme would be subjective and subject to dispute, and (2) any reasonable weighted average is likely to be numerically similar (+ or - 10 to 20%) to the simple average, therefore, the use of a weighted average is not likely to have a substantial effect on the outcome of the risk assessment. Averaging the soil concentrations is the simplest and most reasonable approach for estimating long-term exposure in the absence of site-specific information to the contrary. The uncertainty associated with this assumption is recognized and discussed in Section 3.5.6 of the BHHRA report.

The Companies commented that garden soil metal concentrations should be included in the outdoor soil average. However, the BHHRA clearly explains that garden soil data were not included in the outdoor soil average because small children normally would not be expected to spend much time in a garden. That is, allowing children to play in a garden on a regular basis is likely to be incompatible with successful gardening because of the physical damage to plants that is likely to occur. Therefore, it was assumed that parents who wish to raise a garden will take steps to prevent or minimize this behavior. This is consistent with the way other contaminant exposures were assessed in the BHHRA. Under the BHHRA, only adult residents were assumed to engage in gardening activities involving contact with garden soils.

The Companies criticized EPA's determination of lead concentrations based on the minus-60-mesh fraction only. However, the soil samples were prepared in accordance with EPA Region 6's standard procedures. For the Contract Laboratory Program (CLP) analyses, that included sieving the samples through a 60-mesh screen. The minus-60-mesh fraction includes particles approximately 250 microns in size or smaller and is the fraction most likely to adhere to the skin and be ingested through hand-to-mouth contact. The EPA lead work group recommends that lead concentrations measured in this fraction of soil be used in the IEUBK model.

The Companies contend that the results of the CLP analyses of only the minus-60-mesh portions of the soil samples overstate (bias upward) the actual lead concentrations in the soil

by two or three times. The Companies contend that the minus-60-mesh portion constitutes only a small percentage of the sample by weight and that metals are concentrated in this finer material. However, the Companies present no site-specific evidence to support this premise. Most of the samples collected from the study group homes were not chat, but soil or soil mixed with chat. The Companies refer to grain size tests from other Superfund sites indicating that the percentage of minus-60-mesh material in chat may be only 12 to 15%. However, the percentage of minus-60-mesh material in soil samples from the study area was generally much higher. Sieve analyses indicate at least two thirds of most samples and over 80% of many samples would pass through a 60-mesh sieve (estimates were derived from the 40- and 100-mesh sieves since no 60-mesh results were reported in the sieve analyses). The Companies use XRF measurements of lead in chat driveways in Cherokee County, Kansas, and Jasper County, Missouri, from another study to estimate the bias of the CLP results for chat driveway samples from Picher. However, such an estimate of bias is questionable. In addition to differences in sampling and analysis methods, there may be real differences in the lead content of the chat between the samples from Picher and samples from Cherokee County and Jasper County. [Incidentally, page 5-9 of the BHHRA report does not state that the mean lead concentrations for chat are similar throughout the District, as the Companies suggest, but only that "the minerals extracted and the mining and milling process used were largely the same."] Furthermore, it is not reasonable to extend this estimate of bias to soil samples.

As mentioned in the previous paragraph, the Companies contend that using only the minus-60-mesh portions of the soil samples biases the actual lead concentrations in the soil upward by two or three times. However, a comparison of the results of the CLP and XRF analyses of cadmium and lead in study group soil samples, in Appendix E of the BHHRA report, shows that no such bias exists. Appendix E states that the Wilcoxon test for matched pairs "showed that the CLP and XRF results for lead were significantly different at the 0.05 level, but that cadmium results were not statistically different." The fact that there was no statistical difference between the cadmium data from the CLP analysis of the minus-60-mesh fractions of the soil samples and the XRF analysis of the minus-10-mesh fraction shows that cadmium is not substantially more concentrated in the finer of these two fractions. In addition, although the lead results by CLP and XRF analyses were significantly different in a statistical sense, the difference was small. The mean difference between the XRF and CLP results for the same sample (XRF - CLP) was -1.5 mg/kg, or less than 1%; the median difference was +21.9 mg/kg, about 4%, which indicates that the CLP results were more often lower, not higher, than the XRF results. The regression equation describing the overall relationship between the CLP and XRF lead results also indicates that they were quite similar. Based on the equation, XRF lead concentrations of 100, 500, and 2,000 mg/kg are equivalent to CLP lead concentrations of 109, 500, and 1,864 mg/kg. The regression equation also indicates that, at higher lead concentrations, the CLP results were slightly lower, not higher, than the XRF results.

Lead in Dust, Inhalation Pathway

The Companies suggest that the site-specific value for the lead concentration in air should be used in the IEUBK model rather than the model default value. However, the use of the IEUBK model default value for the lead concentration in air, rather than a lower estimate based on the local air measurements (which averaged between one-fifth and one-third of the default value), had virtually no effect on the IEUBK model results because the inhalation route accounted for less than it of the estimated total lead uptake.

Lead in Paint as a Source

The Companies commented that the BHHRA ignores lead-based paint as a source and made no effort to discriminate between mining waste lead and paint lead. EPA realizes that both mining waste lead and outdoor paint lead are possible sources of lead in soil at the Tar Creek Site.

However, the BHHRA indicates that paint lead is not the major source. While paint lead was found at some of the residences, it was equally prevalent in the study group and the reference area homes. Since there is little difference between the prevalence of lead paint between the study group and the reference area and since lead from automobile emissions is not expected to be significantly different between the study group and the reference area, then another source of lead, other than paint lead or automobile exhaust lead, is needed to explain why the lead in the soil at the study group homes was approximately 10 times greater than the lead in the soil at the reference area homes. This difference between the lead in the soil between the study group and the reference area is explained by the widespread presence of mining waste in the study area. As mentioned earlier, elevated levels of cadmium, lead, and zinc serve as a signature for the presence of mining waste in environmental media from the area. The site investigation showed that the concentrations of cadmium, lead, and zinc in soil from the study group homes were approximately 10 times greater than the concentrations of cadmium, lead, and zinc in soil from the reference area homes. The presence of elevated levels of other mining-related contaminants (notably cadmium and zinc) in addition to lead in soils at the majority of study group homes, and the absence of elevated levels of such contaminants in soils in the reference area homes, indicates that mining waste is the major source of lead in outdoor soils. Note that the BHHRA mentions the use of chat as fill or surfacing material, in addition to fugitive dust (past and current emissions) from chat piles and flotation ponds, as a source of site-related contamination.

As for lead in indoor dust, the degree of correlation between soil and dust lead concentrations and the presence of higher dust lead concentrations in some homes clearly shows that there may be other sources of lead in house dust, including paint. The risk characterization acknowledges, in Section 5.1.2.1, that outdoor soil is not the principal source of the highest observed indoor dust lead concentrations and mentions paint as a possible source. It should be noted, however, that in a substantial majority of study group homes with average soil lead concentration exceeding 1,000 mg/kg (26 of 30), the dust lead levels were elevated above 200 mg/kg. The dust lead Level of 200 mg/kg is an upper-end estimate for background dust concentrations and is the IEUBK model default level for dust. This indicates that lead contamination in outdoor soil is probably a significant contributor to lead in indoor dust at the study group homes.

The Companies suggest that the BHHRA implies that the transport of lead via fugitive dust from neighboring chat piles is the primary contributor to outdoor lead contamination. Nowhere in the BHHRA report was it implied that fugitive dust was the primary contributor to outdoor lead contamination.

IEUBK Model 0.99 and Lead-Based Paint

The Companies suggests that, when the IEUBK model was used, the multiple source option for dust should have been used for some homes where the indoor dust lead concentrations were greater than the outdoor soil lead concentrations. The Companies suggest the use of the multiple source option to separate the contribution of outdoor soil from the contributions of other sources, including paint, to total lead in dust. However, it is unclear exactly how and why this should be done. The multiple source option for dust is intended to be used when household dust lead data has not been collected. It allows the IEUBK model user to estimate household dust lead concentrations based on contributions from soil, air, and (if selected) various alternate sources, including several nonresidential sources and lead-based paint. Certainly, it is possible to "back out" estimates of the relative contributions of soil and paint to lead in house dust, if the concentrations of lead in all of these media are known. However, as noted by the Companies, the results are highly sensitive to the values assumed for the coefficients that describe the relationship between the concentration of lead in household dust and concentrations in the other media. What coefficient value would be assumed for soil, which is indicated to be

the greatest contributor of site-related lead? Regression analysis of the soil and dust data from the study group homes showed a positive correlation between soil and dust lead concentrations. However, the default soil-to-dust coefficient used by the IEUBK model (0.7) appears to be too high; the "site-specific" value based on the data for the study group homes was 0.26. Additionally, there are other important determinants of lead concentrations in house dust that are not accounted for by the multiple source option (e.g., housekeeping practices). Given the uncertainties, no purpose would be served by this exercise other than to show that paint may be a major source of lead in those households where dust lead levels were greater than soil lead levels, something that is already stated in the BHHRA report.

The Companies criticize the BHHRA for not including the available paint data in the quantitative evaluation of lead. According to the IEUBK model guidance manual, the correct use of the IEUBK model is to estimate geometric mean blood lead levels and distributions of blood lead levels in young children who have long-term chronic exposures to lead." The IEUBK model guidance manual goes on to explain that ingestion of paint chips on even a single occasion can cause serious lead intoxication, and states that "(t)he IEUBK model is not intended to address this situation. While the model allows for the evaluation of paint chip ingestion (in addition to lead-based paint present in household dust), the IEUBK model guidance manual cautions against such an evaluation, citing the great uncertainties in estimating chronic exposure by this route, and makes no recommendations for exposure parameter values. Because the huge uncertainty and the likely overwhelming effect that inclusion of paint data would have had on the IEUBK model results, a decision was made to set the paint data aside and to discuss the implications in the uncertainty section. The objective of the BHHRA was to evaluate potential health risks from environmental site-related contamination, not from lead-based paint. The possibility of additional exposures to lead from ingestion of paint does not reduce the potential risks posed by environmental site-related lead contamination.

The reasons for omitting the paint chip data and the potential impact of paint chip ingestion on blood lead levels were discussed in the BHHRA report. The suggestion that the paint chip data was deleted to force-fit the model prediction to the observed blood lead levels (presumably the OSDH blood lead results from Picher) has no basis in fact. The OSDH blood lead results had not been released and were unavailable to EPA when most of the BHHRA was prepared from September through November 1995. The Picher data (Table 5-3, copied from a table in the OSDH memo) was added to the BHHRA when it became available. [The source listed at the bottom of the Table 5-3 is incorrect, but will be corrected in the revised BHHRA report.] In presenting the Picher data, the BHHRA report states that 21% of children age 6 and under had blood lead levels greater than or equal to 10 Ig/dL, and that the percentage is similar to the percentages that were predicted by the IEUBK model. However, there is no implication that the observed blood lead concentrations confirm the model predictions, nor is there any attempt to explain the blood lead levels in terms of the model predictions.

The OSDH memo provides no information on known or likely sources of lead exposure for the individuals who exhibited elevated blood lead levels, and lead-based paint is certainly one possible source. However, the relatively greater number of young children found to have blood lead levels of 10 Ig/dL or more in Picher (10 out of 48 tested, or 21%) versus other parts of Ottawa County (4 out of 105 tested, or 4%) suggests that there is a connection with mining-related contamination.

The Companies stated that the results of the lead speciation tests should be provided in the BHHRA. However, the results of the lead speciation analysis were inconclusive and could not be used to determine the sources of lead in study area soils. As noted above, the coexistence of elevated concentrations of cadmium, zinc, and other mining-related contaminants with lead in study group soils indicates that mining waste is the main source.

IEUBK Model Validation

The Companies' comments regarding the IEUBK model validation are full of misleading statements. Section 5.4.1.2 in the BHHRA is a general discussion of the validity of the IEUBK model and is largely based on information presented in the IEUBK model guidance manual. The main point of that discussion is that while the model and its default values have been refined using matched environmental and blood lead data from a number of other sites, validation of the model by comparison with empirical data is an ongoing process. Nevertheless, the results so far have been satisfactory, according to the manual.

The available blood lead results mentioned in the Companies' comment regarding IEUBK model validation are obviously those released by OSDH in its memo dated December 18, 1995. The OSDH blood lead data cannot be used in any way to validate the IEUBK model or to justify changes in the model default values because the OSDH survey was not designed for that purpose and, consequently, lacks critical information needed if it were to be used for that purpose. Because the OSDH sampling was not conducted according to a statistically based sampling plan, the OSDH blood lead data cannot be considered representative of the general population of children in Picher and Ottawa counties. Sampling was most obviously biased outside of Picher, where participants were limited to children whose parents or guardians were aware of the blood lead screening program and were willing and able to transport them to one of the testing site's at local community centers. Because of this bias, the mean blood lead level and geometric standard deviation (GSD) from the OSDH data are not reliable. In addition, because no matched environmental samples were collected along with the blood lead samples, the environmental lead exposures of the children in the OSDH blood lead survey are unknown. Note again that the final statement in Section 5.1.4 of the BHHRA report is merely an observation about the Picher blood lead data, not a validation statement about the IEUBK model.

The Companies state that no attempt appeared to be made, in the BHHRA, to calculate an Ottawa County specific geometric GSD. However, although the IEUBK model guidance manual provides a procedure for calculating the GSD (in "Appendix A: How to Calculate the Geometric Standard Deviation from Blood Lead Data, If You Must"), it discourages the user from changing the default GSD in the model to a site-specific value, even when data from a well-conducted study are available. The IEUBK model guidance manual states, "(u)nless there are great differences in child behavior and lead biokinetics among different sites, the GSD values should be similar at all sites, and site-specific values should not be needed." Furthermore, a site-specific GSD cannot be calculated in accordance with the methods in Appendix A, because a site-specific GSD requires, in addition to the blood lead data, information that is not provided in the OSDH survey, including soil lead levels and dust lead levels. [Incidentally, if the Appendix A procedures are ignored and all of the data is treated as if it were from a single homogeneous group, which it is not, the GSD of the OSDH blood lead data for Picher children 6 years of age or less is 2.1, which is greater than the model default of 1.6. So even this rough approximation produces a higher GSD value.]

The Companies suggested that the IEUBK model be checked by utilizing matched blood lead data and environmental lead data. Although, matched blood lead data and environmental lead data, if available, could be used to check the IEUBK model predictions, such a comparison probably would not lead to any conclusive statement about the model's validity. The model should not be expected to reproduce observed blood lead concentrations exactly. As long as the prediction interval includes the observed blood lead level corresponding to the same exposure inputs, the model's performance is considered satisfactory. Even when the predicted and observed levels do not overlap, there may be a plausible explanation that does not necessarily invalidate the model.

Fugitive Dust Contamination of Yards

The Companies criticized the approach used in Section 6 of the BHHRA to calculate increases in lead concentrations in yard soils from air deposition. Section 6 was included at the end of the BHHRA to address EPA's concern that possible recontamination of remediated areas by redeposition of fugitive dust from chat piles or other sources might frustrate efforts to remediate residential properties. Even using extremely conservative assumptions that are likely to overestimate actual redeposition rates, Section 6 concludes that recontamination of the soil via deposition of airborne particles is a slow process and would not be expected to lead to significant recontamination.

The BHHRA never suggested that dust from chat piles has been the primary contributor to lead in yard soils, only that it was one of several sources of mining-related contamination, including chat used as fill.

Afton as a Reference Site

The Companies questioned whether Afton constituted an appropriate reference or background area for EPA's investigation. However, Afton was selected as the reference site for EPA's Tar Creek investigation precisely because it is one of the few communities in Ottawa County located outside the mining district and away from any other obvious sources of metals contamination, but it is similar to the study group in other respects such as such as type and age of housing stock and demographics. Based on site visits and visual observations, no socio-demographic variables that are important to the BHHRA are known to be significantly different between the study group and the reference area. There are no areas within the mining district that can be assumed to be uncontaminated by mining waste because mining activities were so widespread. The ore formation that was mined at the Site is over one hundred feet below the surface of the ground and natural surface minerals cannot account for the much higher levels of cadmium, lead, zinc, and other metals that were found in soils in Picher. It is clear that these surface minerals were deposited during mining activities.

Afton was selected as a reference area for a study of environmental contamination, not blood lead levels. While differences in socio-demographic variables such as education levels, income levels, and ethnicity may be very important factors to consider in blood lead studies, because they may be related to behavioral patterns that could affect children's overall exposures, the relevance of these variables to environmental contaminant levels is questionable. The suggestion that possible socio-demographic differences between the study group and reference area homes invalidate all comparisons of environmental data from the two areas or predictions based on that environmental data is not supported by any evidence.

Lead Concentrations, Indoor versus Outdoor

The Companies stated that the correlation between indoor dust lead concentrations and outdoor soil lead concentrations is very poor and implies that the outdoor concentrations may be biased. However, the Companies appear to have misunderstood the statistical summary information provided. The multiple R value for the regression, commonly called the correlation coefficient, was 0.82; the r^2 value was 0.67. This actually indicates that the regression was highly significant and remarkably good, considering the variability inherent in environmental data. In this simple linear relationship, the concentrations of lead in soil account for 67% of the variability in the lead concentrations in house dust. The slope of the regression line was 0.26, indicating that the dust concentrations predicted by the regression would be 26% of the corresponding soil concentration.

This statistical relationship in no way implies any bias in the soil lead concentrations, as the Companies suggest. The comparison of CLP results (on the minus-60-mesh portion) and XRF results (on the minus-10-mesh portion) for lead and cadmium clearly indicated that metals

concentrations found in soil were not artificially elevated to any significant degree by sieving the samples. The outdoor soil results used in the dust/soil correlation analysis were averages of individual samples results at each residence, not the grand mean of five data sets, as stated by the Companies. Since fine material from all of the outdoor areas sampled are potential sources of dust that could be tracked or blown into the home and contribute to indoor dust, it is entirely appropriate to combine these results.

Dames and Moore's Conclusions

EPA has already responded above in detail to the four points of criticism raised in the conclusion of the Dames & Moore comments on the BHHRA; however, a summary response to the four points is as follows:

- 1) The Companies criticized the BHHRA based on the fact that the blood lead data was not used for validating or calibrating the IEUBK model. However, as discussed above, the empirical blood lead data cannot be used for validating or calibrating the IEUBK model, because the OSDH survey was not designed for that purpose and, consequently, lacks critical information needed if it were to be used for that purpose;
- 2) The Companies criticized that the lead paint chip data was excluded from the quantitative assessment. As discussed above, the BHHRA clearly explained the reasons for excluding the paint chip data from the IEUBK model runs and discussed the possibility that paint chip ingestion could be a major route of exposure for some children;
- 3) The Companies questioned the validity of using Afton as the reference area because of possible differences in socio-economic variables between the reference area homes and the study group homes. However, as discussed above, Afton was selected as the reference site precisely because it is one of the few communities in Ottawa County located outside the mining district and away from any other obvious sources of metals contamination. Afton is similar to the study group in other respects such as such as type and age of housing stock and demographics. Based on site visits and visual observations, no socio-demographic variables that are important to the BHHRA are known to be significantly different between Afton and the study group. Even if such differences existed, they would not invalidate the comparisons of environmental data, which show that concentrations of cadmium, lead, zinc, and other mining-related contaminants are substantially elevated in the study group; and
- 4) The Companies stated that BHHRA used soil lead concentrations that were highly biased. As discussed above, this is not true. Comparison of CLP and XRF results for study group soil samples showed that the CLP results were not artificially elevated to any significant degree.

It appears that the main thrust-of the Companies' comments was to attempt to change the focus of the BHHRA from an evaluation of the risks potentially posed by environmental contamination (including lead and other site-related contaminants) at the Tar Creek Site to a recapitulation of the effects that lead paint can have on blood lead levels. EPA acknowledges that ingestion of lead paint chips can dramatically increase blood lead levels and that inclusion of paint chip data in the IEUBK model can substantially raise the blood lead distributions predicted by the model. However, lead paint and the risk it can pose was not and is not the focus of the site investigation carried out or the BHHRA. The BHHRA shows that even without considering the effect of paint chips, the lead-contaminated soil on the Site can be expected to result in a risk to children of unacceptably high blood lead levels.

A review of the data collected in the site investigation indicates that:

- A number of contaminants (including lead) are present at substantially elevated concentrations in environmental media in the Tar Creek study area compared to the reference area;
- The combination of contaminants present, principally cadmium, lead, and zinc, which are well known to be constituents of mining waste in the Tar Creek area, indicates that mining waste is the major source of the environmental contamination;
- Exterior "lead-based paint", as defined by HUD (greater than 0.5%, or 5,000 mg/kg, lead), is present at 20 to 25% of the residences in both the study group and reference areas, indicating that lead paint is unlikely to contribute significantly to the great difference (an order of magnitude difference) in lead concentrations in soil between the study group and reference areas;
- Of the 50 study group homes with lead concentrations in house dust that might be considered elevated (greater than 200 mg/kg), only five (10%) had dust concentrations higher than the corresponding soil concentrations, indicating that in most cases elevated house dust concentrations can be accounted for by the corresponding soil concentrations, and;
- While lead paint was found at some of the residences, it was equally prevalent in the study group and reference area homes, and there is no evidence that it is a major source of the lead in soil, or of the lead in dust in most homes.

Based on the lead concentrations actually measured in soil, house dust, and tap water, the IEUBK model predicts that about 20% of young children living in study group homes could have blood lead levels greater than 10 Ig/dL. Thus, the BHHRA concludes that exposure to lead in environmental media alone could result in blood lead levels above EPA's target level. Since lead paint was found at some of the residences, some of the children might also be exposed to lead paint. That exposure would be in addition to potential exposure to lead in environmental media, and if it were included in the IEUBK model would result in an even greater percentage of children with predicted blood lead levels greater than 10 Ig/dL.

EPA'S RESPONSE TO DOI'S COMMENTS

[Note: Much of the DOI letter of January 26, 1996, deals with non-technical issues, outside of the BHHRA, that have been addressed in other correspondence. Almost all of the issues raised by DOI have been addressed in the above responses to the Companies, and many of the responses below are excerpted/repeated from those responses. This section of the Technical Reply Document responds only to comments about the BHHRA on pages 2 and 3 of the DOI letter.]

DOI states that EPA's draft risk assessment fails to demonstrate that mining waste is the source of those elevated blood lead levels that exist at the Site. However, that was not its objective. The objective of the BHHRA was to evaluate the potential risks associated with environmental site-related contamination, not to explain observed blood lead levels. What the BHHRA did indicate, using EPA's IEUBK model, was that exposure to the elevated concentrations of lead in soil and dust that are present in many study group homes could lead to unacceptably high blood lead levels in children. To the extent that mining wastes contribute to the elevated concentrations of lead in soil and dust, they would also contribute to total lead uptake and blood lead levels. The BHHRA did not suggest that there are no other sources of lead in soil and dust or that there were no other routes of lead exposure. In fact, the document mentions that lead-based paint may be a source of lead in household dust (Section 5.1.2.1) and that

ingestion of paint chips could be a major route of lead exposure in some homes (Section 5.4.1.1). These issues, related to lead-based paint which appear to be DOI's primary basis for asserting that the BHHRA is flawed, are discussed in detail in the responses to the Companies' comments.

DOI stated that the BHHRA disregards paint as an explicit source of lead exposure and concludes that nearly all of the exposure is due to soil and household dust exposure. EPA disagrees. The BHHRA did not conclude that nearly all of the exposure is due to soil and household dust exposure, as stated by DOI at the bottom of page 2. Rather, the document states that the elevated blood lead levels predicted in the BHHRA study group are due primarily to elevated levels of lead found in soil and dust because soil and dust accounted for most of the total lead uptake estimated by the IEUBK model. The BHHRA report clearly explained that ingestion of paint chips, which could be a major source of lead for some children, was excluded from the quantitative evaluation. While it is true that flaking paint is a possible source of lead in soil and dust, the presence of highly elevated concentrations of cadmium, zinc, and other mining-related contaminants in addition to lead in the soils at the majority of study group homes, and the absence of such contamination in soils in the reference area, indicate that mining waste is the major source of the lead in outdoor soils. With regard to indoor dust, only five out of 50 study group homes with lead concentrations in indoor dust that could be considered elevated had indoor dust lead levels higher than the levels in the corresponding outdoor soils. This indicates that for most residences the lead levels in indoor dust can be accounted for by the levels in outdoor soil. Other sources of lead, including lead paint, could exist and could be contributing to the lead levels in indoor dust, which was acknowledged in the BHHRA. However, in most cases, it is not necessary to include such sources to account for the lead levels found in the indoor dust.

DOI concluded, by comparing blood lead levels predicted by the IEUBK model with observed blood levels from OSDH's survey for the Picher area, that EPA's BHHRA was overly conservative and overestimated exposure from soil and dust associated with mining waste. Regarding the blood lead results from the survey conducted by the OSDH, the BHHRA stated only that 21% of children ages 6 and under in Picher had blood lead levels greater than or equal to 10 Ig/dL, and that the percentage is similar to those that were predicted by the IEUBK model. DOI correctly points out that if paint ingestion was included in the IEUBK model, the predictions would be higher. DOI apparently assumes that the measured blood lead levels must include a substantial component of exposure to lead paint because other studies have shown that exposure to lead paint can have a major effect on blood lead levels. Apparently, since the blood lead levels measured in the OSDH survey, which must reflect any exposure of these children to lead paint that may have occurred, are similar to the blood lead levels predicted by the IEUBK model, while excluding paint exposure, DOI concludes that the IEUBK model must be overestimating lead exposure from environmental sources. DOI apparently has failed to consider the possibility that, while lead paint exposure can be a major contributor to blood lead levels, it may not be a major factor at the Site. The sets of residences underlying the blood lead levels measured in the OSDH survey and those used in obtaining the IEUBK model predictions may not be comparable because of differences in the way the sample sets were obtained. However, if they are comparable, it is possible that the predicted and observed blood lead levels are similar because lead paint is not a major contributor to lead exposures in the Tar Creek area.

DOI stated that the use of the 30 percent bioavailability default assumption in the IEUBK model runs was overly conservative and ignores recent research. Findings from research conducted by EPA Region 8 indicates that lead in yard soil and milling waste samples taken from the Tri-state mining area have a bioavailability of 30% or greater--the same or higher than the IEUBK model default. In any case, the BHHRA (Section 3.5.6) acknowledged that IEUBK model would tend to overestimate the uptake of lead and the resulting blood lead levels if the actual bioavailability were lower than the model default value. However, the OSDH blood lead survey

was not conducted according to a statistically based sampling plan, and the data are not statistically representative. Furthermore, the environmental lead levels in the homes of the children in the blood lead survey are unknown and may be different from the EPA's study group homes. No conclusions can be drawn from comparison of the OSDH blood lead data and IEUBK model predictions in the BHHRA, except to say that the observed blood lead levels are consistent with, the model's predictions.

DOI criticized the BHHRA for failing to analyze the sources of lead causing the elevations in children's blood lead levels. However, the OSDH blood lead survey provided no information on environmental lead levels or environmental lead exposures that could be used to analyze the sources of reported elevations in children's blood lead levels. Such an analysis would have required further investigation and was outside the scope of the BHHRA. Note again that the BHHRA's objective was to estimate potential risks posed by environmental site-related contamination (not just lead) based on the results of the EPA's environmental investigation, not to explain the results of blood lead surveys conducted by other agencies. The OSDH blood lead results were included in the BHHRA only as additional information that should be considered when making risk management decisions. The OSDH survey showed that blood lead levels of young children in Picher are elevated above levels that are considered acceptable under Centers for Disease Control (CDC) or EPA lead management policies. The BHHRA did not demonstrate that the source of these reported elevated blood lead levels was exposure to mining wastes. However, the BHHRA did show that exposures to elevated concentrations of lead in soil and dust at many Picher homes, which have been attributed primarily to mining wastes, could contribute significantly to lead intake and might result in elevated blood lead levels. Once again, all the BHHRA says is that the OSDH findings were consistent with BHHRA predictions.

APPENDIX B

STATE OF OKLAHOMA COMMENT LETTER

Dear Mr. Knudson:

The Oklahoma Department of Environmental Quality (DEQ) would like to express our concurrence with the U.S. Environmental Protection Agency's (EPA) Proposed Plan for Operable Unit 2 at the Tri-State Mining site in Ottawa County, Oklahoma. As part of this concurrence, the DEQ agrees with EPA's site-specific residential soil clean-up level of 500 parts per million (ppm) lead for the Tri-State Mining site.

As you know, other large lead-contaminated sites, primarily former smelters, are undergoing remediation in Oklahoma. The policy of the DEQ is to establish site-specific soil clean up goals at these sites, based primarily on the bioavailability of the prevalent forms of lead which are present. These site-specific clean up remediation goals will provide protection against the unacceptable risks of lead exposure to sensitive populations.

The predominant forms of lead at the Tri-State site are lead carbonates and lead oxides. The lead oxides and lead carbonates are natural weathering products of lead sulfides (i.e. galena) which accounts for their presence at the Tri-State site. These forms of lead are more soluble and bioavailable than lead sulfides which usually dominate at smelter sites.

At the Tri-State Mining site, EPA estimated lead risks to children by using the Integrated Exposure Uptake Biokinetic (IEUBK) model. IEUBK is designed to pharmacokinetically model exposure from lead in water, soil, dust, diet, paint and other sources to predict blood lead levels in the most sensitive population, which is children 6 months to 7 years old. Using a bioavailability of 30 percent, appropriate for the chemical forms of lead present at the site, the IEUBK model predicted that 21 percent of children between the ages of 6 months and 7 years living in Picher, Oklahoma (the community most impacted by mining waste) would have blood lead levels above the Center for Disease Control's (CDC) level of concern of 10 ug/dL. This prediction exceeded the CDC acceptable risk of no more than 5 percent of children between 6 months and 7 years of age having blood lead levels of 10 ug/dL or greater.

In addition, an independent blood lead survey conducted by the Oklahoma State Department of Health (OSDH) in October 1995 in Picher, Oklahoma found that 20.8 percent of young children in the target age range had blood lead levels elevated to 10 ug/dL or greater. This actual measurement of lead in blood was very similar to the predicted levels for the same community. The actual blood lead levels of children living in the Tri-State mining area are higher than any other location in Oklahoma, including those communities with smelter sites.

In August and September of 1996, further independent blood lead surveys were conducted in Picher and surrounding communities by the University of Oklahoma Health Sciences Center on behalf of certain mining companies which once operated in the area. These studies also indicated a high percentage (38 percent) of children in Picher with blood lead levels above 10 ug/dL. The nearby communities of Cardin and Quapaw also had elevated blood lead levels among a significant percentage of children, 62 percent and 13 percent respectively.

APPENDIX C

ITEC COMMENT LETTERS

April 8, 1997

Kent Curtis, Site Assessment Manager
Cherokee Nation
Office of Environmental Services
P.O. Box 948
Tahlequah, Oklahoma 74465
918-458-5498, FAX 918-458-5499

Donn Walters, Community Involvement Coordinator
U.S. EPA, Region 6 (6SF-P)
1445 Ross Avenue
Dallas, Texas 75202-2733
214-665-6483, FAX 214-665-6660

Dear Mr. Walters:

On behalf of the Inter-Tribal Environmental Council (ITEC), which is a consortium of 31 tribes in the state of Oklahoma and for which the Cherokee Nation's Office of Environmental Service (OES) is the lead agency, I am submitting the following comments about the EPA's Proposed Plan of Action for lead-contaminated soil at Residential Areas of the Tar Creek Superfund Site in Ottawa County, Oklahoma. This proposed plan of action impacts the population and lands of the Quapaw, Ottawa, Peoria, Miami, and Wyandotte tribes, which are ITEC member tribes, and I have asked representatives of these tribal governments to submit written comments to you concerning the proposed plan of action.

The ITEC member tribes are in favor of the EPA's preferred remedial alternative 2 (soil excavation with a 500 ppm action level). However, it may not be possible for the EPA to obtain access to all of the tribal members' properties that it wishes to remediate. Therefore, at least some of the community protective measures (CPMs) outlined in remedial alternative 3 will probably have to be included in the remedial alternative that is selected for implementation.

One of the main reasons that tribal members may refuse to grant the EPA access to their properties is that they are concerned that they will be held liable for cleanup costs on their property. If the EPA can assure all tribal property owners in writing that they will not be held liable for cleanup costs, then access to nearly all properties will probably be granted. If the EPA cannot give property owners such an assurance, then many owners may continue to refuse access to their properties. As remediation proceeds, many reluctant property owners may eventually grant access to their properties after they see the results of remediation on their neighbors' properties and note that their neighbors' are not being held liable for cleanup costs. Therefore, the EPA, the Bureau of Indian Affairs (BIA), and tribal governments should make efforts to educate reluctant property owners about the benefits of remediation on their neighbors' properties by hosting open houses and field trips to properties where remedial work is in progress or has been completed. Testimonials from owners of remediated properties should also be included in these presentations. Favorable opinions of the removal actions already taking place in Picher, Oklahoma were voiced by residents and town council members of Picher at the public comment meeting held by the EPA in Picher on March 27, 1997. This is a success story that the EPA, BIA, and tribal governments should publicize in order to promote the cooperation

of reluctant property owners.

The EPA should conduct soil and sediment sampling in the Tar Creek floodplain in Miami, Oklahoma to determine if flooding has contaminated soils on residential and other properties with lead above the 500 ppm action level or with other metals above concentrations of concern. If such contamination proves to be a problem, then the EPA should evaluate the use of constructed wetlands to control flooding and contaminant loading along the lower reaches of Tar Creek. This action should be included as part of the Record of Decision for the the Residential Portion of the Tar Creek Superfund Site Operable Unit 2.

The Quapaw Tribe is interested in the possible economic development of two non-residential properties that are located on tribal and individual trust lands in Cardin, Oklahoma. These properties are (1) the former field office of the Eagle-Picher Mining Company, which is located on Quapaw Tribal trust land in the S/2, SW/4, SE/4, Section 19, T29N, R23E, and (2) the former Childress Chemical Company site (Cerclis no. OKD078641412), which is located on individual trust, land in the NW/4, NE/4, Section 30, T29N, R23E. Structural debris and lead-contaminated soil are present on both of these properties. In addition, copper-contaminated soil is present on the Childress site. The Childress site has been referred to Gary Moore, who is the EPA's On-Scene Coordinator for the Tar Creek Superfund site, for possible removal action. ITEC urges the EPA to proceed with removal or remediation of these two properties as soon as possible, either as part of the Record of Decision for the Residential Portion of Operable Unit 2 or as part of the fumare Record of Decision for the Non-Residential Portion of Operable Unit 2. Timely remediation of these two properties will promote their economic development and thus benefit the Quapaw Tribe.

Finally, ITEC wishes to know if any studies are being conducted, or will be conducted, to document the nature of any lead-related health problems among residents of the Tar Creek Superfund site. Results of such studies, past and present, should be made known to the public.

cc: Noel Bennett, Remedial Project Manager, U.S. EPA, Region 6
Robbie Hirt, U.S. EPA, Region 6
Monte Elder, ODEQ
John Gault, Quapaw Tribe
John Froman, Peoria Tribe
Margie Ross, Ottawa Tribe
Barbara Collier, Wyandotte Tribe
Tamra Bro, Miami Tribe
Dennis Sisco, Bureau of Indian Affairs, Miami, Oklahoma
File

May 16, 1997

Kent Curtis, Site Assessment Manager
Cherokee Nation
Office of Environment Services
P.O. Box 948
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918-458-5498, FAX 918-458-5499

Donn Walters, Community Involvement Coordinator
U.S. EPA, Region 6 (6SF-P)
1445 Ross Avenue
Dallas, Texas 75202-2733
214-665-6483, FAX 214-665-6660

Dear Mr. Walters:

On behalf of the Inter-Tribal Environmental Council (ITEC), I am submitting the following comments as a supplement to my comments of April 8, 1997 concerning the EPA's Proposed Plan of Action for lead-contaminated soil at Residential Areas of the Tar Creek Superfund Site in Ottawa County, Oklahoma. This proposed plan of action impacts the population and lands of the Quapaw, Ottawa, Peoria, Miami, and Wyandotte tribes, which are ITEC member tribes.

I have discussed the problem of obtaining access to tribal members' properties for the purpose of remediation with Scott Thompson of the Oklahoma Department of Environmental Quality (ODEQ). I agree with Scott that the EPA will continue to have trouble obtaining access to these properties unless it implements one or both of the following options as part of the remedial action: (1) assure property owners in writing that they will not be held liable for the costs of cleaning up their property; (2) offer property owners settlement agreements that would protect them from efforts by the EPA and potentially responsible parties to recover cleanup costs.

cc: Noel Bennett, Remedial Project Manager, U.S. EPA, Region 6
Robbie Hirt, U.S. EPA, Region 6
Monte Elder, ODEQ
Scott Thompson, ODEQ
John Gault, Quapaw Tribe
John Froman, Peoria Tribe
Margie Ross, Ottawa Tribe
Barbara Collier, Wyandotte Tribe
Tamra Bro, Miami Tribe
Dennis Sisco, Bureau of Indian Affairs, Miami, Oklahoma
File

APPENDIX D

QUAPAW TRIBE COMMENT LETTER

Dear Mr. Walters:

This letter is to state the Quapaw Tribe of Oklahoma's opinion on the proposed action to remediate the Tar Creek Superfund Site. It is closely related to the one sent in by Kent Curtis of the Inter-Tribal Environmental Council.

The Tribe concurs that Remedial Action #2 is the most appropriate. The action level of 500 ppm is acceptable to the tribal leadership. The major problem is access to Indian Country. The Quapoaw tribe is most concerned that the EPA will not put into a contract that it will never try to recoup costs of remediation from the land owners or heirs. Noel Bennet has stated that this is policy but not written. This will not mollify those that are skeptical of government actions. The EPA must put a clause in its remediation contracts that the costs will never be borne by the allottees or their heirs. Without this guarantee then the Tribe will be unable to advise its members to allow the remediation.

The Tribe is concerned about the flood plain of Tar Creek as well. It is of our opinion that those properties which are subject to flooding by Tar Creek be tested and allowed to fall under the Tar Creek Superfund Remediation.

The CHAMP program which published its findings last night at a dinner in Picher had lots of pertinent data. The Tribe feels that this data should become a part of the public record regarding Tar Creek. Much of the data is confidential, especially that which pertains to specific people and homes. However, the conclusions and overall findings which identify no particular individuals should be added to the Tar Creek literature. If not added then at least mentioned so that later research will be so informed.

Let me add that as the contact person for the Quapaw Tribe that I am eager to resolve any of the problems associated with the federal agencies and the status of Indian Country. We do not want to seem belligerent but we must look after not only the health of the tribal members but also their land holdings.

APPENDIX E

WYANDOTTE TRIBE COMMENT LETTER

Environmental Protection Agency
Region 6
Community Relations (6SF-P)
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Re: Proposed Plan, Tar Creek
Super Fund Site

Dear Sirs:

Following review of your Tar Creek Proposed Plan of Action, and attending two of your community meetings, I would agree Alternative 2 - Soil Excavation with 500 ppm Action Level is most effective in order to maintain a cost effective remedy. I feel this will create a much safer environment especially for those living in the remains of the heavily mined areas.

Reiterating several verbal comments made during the community meetings I would again stress the need for the Environmental Protection Agency to put forth the legal effort to agree to the request of the Quapaw Tribe in placing a statement in the agreements for permission to excavate, for those Native American land owners, there will be no monetary requirements forced upon them, at a later date.

As was stated by the Inter-Tribal Environmental Council member from the Cherokee Nation, Mr. Kent Curtis, the lack of trust by the Native American land owners, does not stem from situations dealing with the Environmental Protection Agency, however, broken promises and problems stemming from broken treaties, and other numerous problems have been created throughout the years and the trust is not going to be there unless good faith statements included in the agreements are considered.

Personally, as a Quapaw-Tribal Member, I would like to see any and all of those individual land owners improve their land, however, I do not blame them if they do not agree without the EPA, and request written assurances. Those of us who have been in Indian Business for several years, of course, realize the Bureau of Indian Affairs is the entity that would be held responsible for the improper handling of the closures of the mines and the mess that has been left behind due to this fact. We realized the individual land owners are not liable for what has transpired, as they were at the mercy of the Bureau officials and their representatives to see that business was professionally and properly handled.

It is my great concern, if this is not pursued and is not included in the agreements, many of the Native American land owners will not agree to have their land excavated. Essentially, then will the Bureau of Indian Affairs be forced to cancel or not renew leases on lands and town lots for those individuals that may have lived there for decades? It would be their responsibility for those persons to live in a safe environment and unless excavated this would not be the case. Without this agreement, I only see the federal government in a terrible situation, with no solution in site.

Sincerely yours,

APPENDIX F
ADMINISTRATIVE RECORD INDEX

Prepared for
United States Environmental Protection Agency

Region 6

ADMINISTRATIVE RECORD INDEX

FOR

TAR CREEK SUPERFUND SITE
(Operable Unit 2 for Residential Areas
Record of Decision)

EPA ID No. OKD980629844

ESS VI
Work Assignment No. ESS06013

Noel T. Bennett
Remedial Project Manager
U.S. EPA Region 6

Prepared by

DPRA Incorporated
717 N. Harwood Street
Suite 1300
Dallas, Texas 75201

P.6113.06BE
August 27, 1997

INTRODUCTION

The "administrative record" is the collection of documents which form the basis for the U.S. Environmental Protection Agency's (EPA) selection of a response action at a Superfund site. Superfund is the name given to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) which can be found in Title 42 of the U.S. Code (U.S.C.) at Sections 9601 through 9675. As EPA decides what to do at the site of a release of hazardous substances, EPA compiles documents concerning the site and EPA's decision into an "administrative record file." This means that documents may be added to the administrative record file from time to time. Once the EPA Regional Administrator or the Regional Administrator's delegatee signs the Record of Decision memorializing the selection of the remedial action, the documents which form the basis for the selection of the remedial action are known as the "administrative record."

A remedial action is a type of CERCLA response action, and EPA is taking a remedial action at the Tar Creek Superfund Site (the "Site") which includes most of Ottawa County, Oklahoma. Under CERCLA section 113(k) (which can be found in Title 42 of the U.S. Code at section 9613), EPA must establish an administrative record for every CERCLA response action, and EPA must make a copy of the administrative record available at or near the Site of the response action.

The purpose of this document is to provide the public with an index to the administrative record for EPA's remedial action decision at the residential areas on the site. The administrative record will be available for public review during normal business hours at the EPA Region 6 offices which are located at the address given below, and it will also be available at a repository (e.g., a library) located near the site.

The administrative record is treated as a non-circulating reference document. Individuals may photocopy any documents contained in the administrative record, according to the photocopying procedures at the EPA Region 6 offices, and at the repository located near the Site.

The administrative record will be maintained at the local repository until at least the end of the construction of the remedial action. A public comment period was announced in the Miami News-Record, a major local newspaper of general circulation. The comment period lasted from March 17, 1997, to May 23, 1997.

The formal public comment period regarding this remedy selection is over, however, EPA welcomes written comments at any time. Please send all comments to:

Mr. Noel T. Bennett (6SF-AP)
Remedial Project Manager
U.S. Environmental Protection Agency Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

This index and the record were generally compiled in accordance with the EPA's Final Guidance on Administrative Records for Selecting CERCLA Response Actions, Office of Solid Waste and Emergency Response (OSWER) Directive No. 9833.3A-1 (December 3, 1990). According to OSWER Directive No. 9833.3A-1, Page 37, each Region should maintain a compendium of guidance documents which are frequently used in selecting response actions, and the record located at or near the Site should contain an index to the compendium of response selection guidance documents. However, the EPA Headquarters-generated compendium of guidance documents has not been updated since March 22, 1991 [see CERCLA Administrative Records: First Update of the Compendium of Documents Used for Selecting CERCLA Response Actions (March 22, 1991)]. Moreover, the Region 6

Superfund Division Director has decided that developing and maintaining a compendium index in Region 6 would require extensive resources which are better utilized elsewhere in the Division. Accordingly, the Division Director has decided not to maintain an indexed compendium of response-selection guidance documents. Instead, consistent with 40 CFR Sections 300.805(a)(2), 300.810(a)(2), and OSWER Directive No. 9833.3A-1, Page 37, the Region has listed, in the Administrative Record Index, all guidance documents which may form a basis for the selection of this response action. Unless the guidance documents indexed were generated specifically for the Site, the guidance documents may not be physically present in the administrative record. However, any guidance document listed in the index, but not physically present in the record will be sent to the repository if a request is made to Mr. Bennett at the address indicated above. Copies of guidance documents can also be obtained by calling the RCRA/Superfund/Title 3 Hotline at 1-800-424-9346.

Documents listed as bibliographic sources for other documents in the record might not be listed separately in the Site index. Where a document is listed in the Site index but not located among the documents which EPA has made available to the repository, EPA will, upon request, include the document in the repository (unless classified as a confidential document).

The Administrative Record Index helps readers locate and retrieve documents in the record. It also provides an overview of the response action history. The index includes the following information for each document:

- Administrative Record Page No. - The sequential numbers stamped on each page of the administrative record. The six digit numbers are located in the upper right corner of each page.
- Document Date - The date the document was published and/or released. "Undated" means no date was recorded.
- No. of Pages - Total number of printed pages in the document, including attachments.
- Author - Name and title of the originator.
- Company/Agency - Originator's affiliation.
- Recipient - Name, title, and affiliation of the recipient.
- Document Type - General identification, e.g., correspondence, Remedial Investigation Report, Record of Decision, etc.
- Document Title - Descriptive title or synopsis.

Please note that all documents listed in the various administrative record indices which are listed herein (e.g., the Phase 1 Removal Index) are part of the administrative record for this Record of Decision.

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: TAR CREEK SUPERFUND SITE
SITE NUMBER: OKD980629844

DOCUMENT NUMBER: 000001 - 000563
DOCUMENT DATE: 11/07/95
NUMBER OF PAGES: 563
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public and U.S. EPA Region 6 Site Files
DOCUMENT TYPE: Administrative Record Index and Administrative Record
DOCUMENT TITLE: Tar Creek - Phase 1 Removal

DOCUMENT NUMBER: 000564 - 000564
DOCUMENT DATE: 04/08/96
NUMBER OF PAGES: 001
AUTHOR: Noel T. Bennett, Remedial Project Manager (RPM)
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Re: 04/08/96 phone conversation with Monty Elder, Oklahoma Department of Environmental Quality (ODEQ), about proposal to fill sinkholes at Commerce, Oklahoma with old tires

DOCUMENT NUMBER: 000565 - 000565
DOCUMENT DATE: 05/15/96
NUMBER OF PAGES: 001
AUTHOR: Ghassan Khoury, Toxicologist, Superfund Branch
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Review of draft soil cleanup utilizing demographic data for Jasper County

DOCUMENT NUMBER: 000566 - 001066
DOCUMENT DATE: 06/06/96
NUMBER OF PAGES: 501
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public and U.S. EPA Region 6 Site Files
DOCUMENT TYPE: Addendum Index and Addendum Documents - Volume 1
DOCUMENT TITLE: Addendum to Removal Administrative Record (AR) - Phase 1

DOCUMENT NUMBER: 001067 - 001451
DOCUMENT DATE: 06/06/96
NUMBER OF PAGES: 385
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public and U.S. EPA Region 6 Site Files
DOCUMENT TYPE: Addendum Index and Addendum Documents - Volume 2
DOCUMENT TITLE: Addendum to Removal AR - Phase 1

DOCUMENT NUMBER: 001452 - 001452
DOCUMENT DATE: 06/21/96
NUMBER OF PAGES: 001
AUTHOR: Russell K. Holeman, Chief, Military/Environmental Branch
COMPANY/AGENCY: Corps of Engineers, Tulsa District
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/o Enclosure
DOCUMENT TITLE: Request for review and comment on Residential Remedial Investigation (RRI) Report

DOCUMENT NUMBER: 001453 - 001453
DOCUMENT DATE: 07/03/96
NUMBER OF PAGES: 001
AUTHOR: Russell K. Holeman, Chief, Military/Environmental Branch
COMPANY/AGENCY: Corps of Engineers, Tulsa District
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/o Enclosure
DOCUMENT TITLE: Request for review and comment on Draft Feasibility Study (FS) Report

DOCUMENT NUMBER: 001454 - 001456
DOCUMENT DATE: 07/10/96
NUMBER OF PAGES: 003
AUTHOR: Kent Curtis, Site Assessment Manager, Office of Environmental Services
COMPANY/AGENCY: Cherokee Nation, Tahlequah, Oklahoma
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Letter w/o Enclosure
DOCUMENT TITLE: Comments on Draft RRI Report

DOCUMENT NUMBER: 001457 - 001757
DOCUMENT DATE: 08/30/96
NUMBER OF PAGES: 301
AUTHOR: Ecology & Environment, Inc.
COMPANY/AGENCY: Contractor for U.S. EPA Region 6
RECIPIENT: Henry Thompson Jr., Project Officer, Program Management Branch, U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: "Data Evaluation Summary Report, Site Assessment/Risk Assessment"

DOCUMENT NUMBER: 001758 - 002070
DOCUMENT DATE: 08/30/96
NUMBER OF PAGES: 313
AUTHOR: Ecology & Environment, Inc.
COMPANY/AGENCY: Contractor for U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Risk Assessment
DOCUMENT TITLE: "Baseline Human Health Risk Assessment of Residential Exposures"

DOCUMENT NUMBER: 002071 - 002080
DOCUMENT DATE: 09/05/96
NUMBER OF PAGES: 010
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public
DOCUMENT TYPE: AR Index
DOCUMENT TITLE: Removal Action, Addendum 2 (Documents indexed are incorporated by reference into the Removal Action AR File. Documents may be reviewed at Region 6 or at the Miami Public Library, Miami, Oklahoma.)

DOCUMENT NUMBER: 002081 - 002081
DOCUMENT DATE: 09/19/96
NUMBER OF PAGES: 001
AUTHOR: Russell K. Holeman, Chief, Military/Environmental Branch
COMPANY/AGENCY: Corps of Engineers, Tulsa District
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/o Enclosure
DOCUMENT TITLE: Request for review and comment on Final Draft RI Report

DOCUMENT NUMBER: 002082 - 002092
DOCUMENT DATE: 09/30/96
NUMBER OF PAGES: 011
AUTHOR: Unspecified
COMPANY/AGENCY: Ecology and Environment, Inc.
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: "Preliminary Remediation Goals Residential Exposures"

DOCUMENT NUMBER: 002093 - 002093
DOCUMENT DATE: 10/02/96
NUMBER OF PAGES: 001
AUTHOR: Russell K. Holeman, Chief, Military/Environmental Branch
COMPANY/AGENCY: Corps of Engineers, Tulsa District
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Letter w/o Enclosure
DOCUMENT TITLE: Request for review and comment on Final Draft FS Report

DOCUMENT NUMBER: 002094 - 002094
DOCUMENT DATE: 10/16/96
NUMBER OF PAGES: 001
AUTHOR: Robert Wilson
COMPANY/AGENCY: Corps of Engineers, Tulsa District
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Review of RRI and RFS

DOCUMENT NUMBER: 002095 - 002097
DOCUMENT DATE: 10/17/96
NUMBER OF PAGES: 003
AUTHOR: Kent Curtis, Site Assessment Manager, Office of Environmental Services
COMPANY/AGENCY: Cherokee Nation, Tahlequah, Oklahoma
RECIPIENT: Robert Wilson, U.S. Army Corps. of Engineers, Tulsa District
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Comments on Final Draft "RFS Report"

DOCUMENT NUMBER: 002098 - 002098
DOCUMENT DATE: 10/17/96
NUMBER OF PAGES: 001
AUTHOR: Russell K. Holeman, Chief, Military/Environmental Branch
COMPANY/AGENCY: Corps. of Engineers, Tulsa District
RECIPIENT: John Gault, Quapaw Tribe of Oklahoma
DOCUMENT TYPE: Letter w/o Enclosure
DOCUMENT TITLE: Final Draft RI and FS Reports

DOCUMENT NUMBER: 002099 - 002100
DOCUMENT DATE: 10/18/96
NUMBER OF PAGES: 002
AUTHOR: Kent Curtis, Site Assessment Manager, Office of Environmental Services
COMPANY/AGENCY: Cherokee Nation, Tahlequah, Oklahoma
RECIPIENT: John Gault, Quapaw Tribe of Oklahoma
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Request for review and comment on RRI Report and RFS Report

DOCUMENT NUMBER: 002101 - 002102
DOCUMENT DATE: 10/23/96
NUMBER OF PAGES: 002
AUTHOR: John Gault
COMPANY/AGENCY: Quapaw Tribe of Oklahoma
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Comments on draft proposed plan

DOCUMENT NUMBER: 002103 - 002103
DOCUMENT DATE: 11/26/96
NUMBER OF PAGES: 001
AUTHOR: Noel T. Bennett, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Scott A. Thompson, Environmental Program Director, Waste Management Division, ODEQ
DOCUMENT TYPE: Letter w/o Enclosure
DOCUMENT TITLE: Request for review and comment on draft proposed plan for remedial action for residential areas

DOCUMENT NUMBER: 002104 - 002104
DOCUMENT DATE: 11/26/96
NUMBER OF PAGES: 001
AUTHOR: Noel T. Bennett, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Kent Curtis, Site Assessment Manager, Office of Environmental Services, Cherokee Nation
DOCUMENT TYPE: Letter w/o Enclosure
DOCUMENT TITLE: Request for review and comment on draft proposed plan for remedial action for residential areas

DOCUMENT NUMBER: 002105 - 002105
DOCUMENT DATE: 12/05/96
NUMBER OF PAGES: 001
AUTHOR: Kent Curtis, Site Assessment Manager, Office of Environmental Services
COMPANY/AGENCY: Cherokee Nation, Tahlequah, Oklahoma
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Comments on draft proposed plan

DOCUMENT NUMBER: 002106 - 002109
DOCUMENT DATE: 12/13/96
NUMBER OF PAGES: 004
AUTHOR: Deborah McNaughton, Senior Hydrologist, Waste Management Division
COMPANY/AGENCY: ODEQ
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Comments on draft proposed plan

DOCUMENT NUMBER: 002110 - 002110
DOCUMENT DATE: 12/17/96
NUMBER OF PAGES: 001
AUTHOR: Gary Moore, On-Scene Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Costs of remedial site activities

DOCUMENT NUMBER: 002111 - 002115
DOCUMENT DATE: 12/18/96
NUMBER OF PAGES: 005
AUTHOR: Noel T. Bennett, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Monty Elder, ODEQ
DOCUMENT TYPE: Facsimile Transmittal Cover Letter w/Enclosure
DOCUMENT TITLE: Re: Cost per residence for potentially responsible parties' cleanup at the National Zinc site

DOCUMENT NUMBER: 002116 - 002116
DOCUMENT DATE: 01/22/97
NUMBER OF PAGES: 001
AUTHOR: Noel T. Bennett, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: James Graves, Ottawa County Commissioner, District 1, Miami, Oklahoma
DOCUMENT TYPE: Cover Letter w/o Enclosure
DOCUMENT TITLE: Request to review and comment on draft proposed plan for the remedial action (long-term cleanup) for the residential areas

DOCUMENT NUMBER: 002117 - 002121
DOCUMENT DATE: 01/29/97
NUMBER OF PAGES: 005
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA, U.S. Department of the Interior (DOI), and Bureau of Indian Affairs (BIA)
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Memorandum of Agreement among EPA, DOI, and BIA for future actions to obtain access to allotted Quapaw Indian lands to conduct response actions

DOCUMENT NUMBER: 002122 - 002336
DOCUMENT DATE: 02/03/97
NUMBER OF PAGES: 215
AUTHOR: Russell Holeman, Chief, Military/Environmental Branch
COMPANY/AGENCY: U.S. Army Corps of Engineers - Tulsa District
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Cover Letter w/Report
DOCUMENT TITLE: RRI Report, Volume 1 (Prepared by Brown & Root Environmental)

DOCUMENT NUMBER: 002337 - 002787
DOCUMENT DATE: 02/03/97
NUMBER OF PAGES: 451
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. Army Corps of Engineers, Tulsa District
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: RRI Report, Volume 2 (Prepared by Brown & Root Environmental)

DOCUMENT NUMBER: 002788 - 002809
DOCUMENT DATE: 02/06/97
NUMBER OF PAGES: 022
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public and U.S. EPA Region 6 Site Files
DOCUMENT TYPE: AR Index
DOCUMENT TITLE: Removal Action, Addendum 3 (Documents indexed are incorporated by reference in the Removal Action AR File. Documents may be reviewed at Region 6 or at the Miami Public Library, Miami, Oklahoma.)

DOCUMENT NUMBER: 002810 - 002830
DOCUMENT DATE: 02/07/97
NUMBER OF PAGES: 021
AUTHOR: Unspecified
COMPANY/AGENCY: ODEQ
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Plan
DOCUMENT TITLE: Community Relations Plan

DOCUMENT NUMBER: 002831 003073
DOCUMENT DATE: 02/11/97
NUMBER OF PAGES: 243
AUTHOR: Russell K. Holeman, Chief, Military/Environmental Branch
COMPANY/AGENCY: U.S. Corps of Engineers, Tulsa District
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: RFS Report (Prepared by Brown & Root Environmental)

DOCUMENT NUMBER: 003239 - 003239
DOCUMENT DATE: 02/21/97
NUMBER OF PAGES: 001
AUTHOR: Monty Elder, Risk Communication Supervisor
COMPANY/AGENCY: ODEQ
RECIPIENT: Gary Moore, On-Scene Coordinator, Response and Prevention Branch, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Public meeting on 02/27/97, 6:30 p.m., Picher High School, Picher, Oklahoma

DOCUMENT NUMBER: 003075 - 003082
DOCUMENT DATE: 02/25/97
NUMBER OF PAGES: 008
AUTHOR: James Costello, Senior Attorney
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Leslie Nellermeoe, Attorney for ASARCO, Heller, Ehrman-White & McAuliffe
DOCUMENT TYPE: Letter w/Enclosure
DOCUMENT TITLE: Copy of 02/21/97, memorandum of 02/20/97 meeting, with Jane N. Saginaw, Regional Administrator, EPA Region 6

DOCUMENT NUMBER: 003083 - 003083
DOCUMENT DATE: 02/26/97
NUMBER OF PAGES: 001
AUTHOR: Gary Moore, On-Scene Coordinator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Lead speciation

DOCUMENT NUMBER: 003084 - 003087
DOCUMENT DATE: 02/28/97
NUMBER OF PAGES: 004
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public
DOCUMENT TYPE: Fact Sheet
DOCUMENT TITLE: "EPA Completes RI and FS for Residential Areas"

DOCUMENT NUMBER: 003088 - 003140
DOCUMENT DATE: 03/03/97
NUMBER OF PAGES: 053
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. Army Corps of Engineers, Tulsa District
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Plan
DOCUMENT TITLE: Quality Assurance Project Plan

DOCUMENT NUMBER: 003141 - 003143
DOCUMENT DATE: 03/04/97
NUMBER OF PAGES: 003
AUTHOR: Bruce K. Means, Chair, National Remedy Board
COMPANY/AGENCY: U.S. EPA Headquarters
RECIPIENT: Myron O. Knudson, Director, Superfund Division, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: National Remedy Review Board recommendations

DOCUMENT NUMBER: 003144 - 003182
DOCUMENT DATE: 03/04/97
NUMBER OF PAGES: 039
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public
DOCUMENT TYPE: Proposed Plan
DOCUMENT TITLE: Residential Areas

DOCUMENT NUMBER: 003183 - 003236
DOCUMENT DATE: 03/06/97
NUMBER OF PAGES: 054
AUTHOR: Noel T. Bennett, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Leslie C. Nellermeoe, Attorney for ASARCO, Heller Ehrman White & McAuliffe, et al.
DOCUMENT TYPE: Memorandum w/Enclosures
DOCUMENT TITLE: Response to comments about removal action selected in EPA's Action Memorandum dated 03/21/96

DOCUMENT NUMBER: 003237 - 003238
DOCUMENT DATE: 03/06/97
NUMBER OF PAGES: 002
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public and U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Administrative Record Index
DOCUMENT TITLE: Removal Action, Addendum 4 (Documents indexed are incorporated by reference into the Removal Action AR File. Documents may be reviewed at Region 6 or at the Miami Public Library, Miami, Oklahoma.)

DOCUMENT NUMBER: 003240 - 003248
DOCUMENT DATE: 03/17/97
NUMBER OF PAGES: 009
AUTHOR: Community Involvement Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Tar Creek Mailing List and U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Fact Sheet
DOCUMENT TITLE: Proposed Plan of Action

DOCUMENT NUMBER: 003249 - 003287
DOCUMENT DATE: 03/17/97
NUMBER OF PAGES: 039
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Public
DOCUMENT TYPE: Proposed Plan
DOCUMENT TITLE: Residential Areas, Tar Creek Superfund Site, Ottawa County, Oklahoma

DOCUMENT NUMBER: 003288 - 003292
DOCUMENT DATE: 03/17/97
NUMBER OF PAGES: 005
AUTHOR: Leslie C. Nellermeoe, Attorney for ASARCO Inc.
COMPANY/AGENCY: Heller Ehrman White & McAuliffe
RECIPIENT: Jane Saginaw, Regional Administrator, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: February 20, 1997 Meeting

DOCUMENT NUMBER: 003293 - 003295
DOCUMENT DATE: 03/17/97
NUMBER OF PAGES: 003
AUTHOR: Gary Moore, On-Scene Coordinator, Response and Prevention Branch
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Mayors and City Councils of Picher, Cardin, Quapaw, Commerce, and North Miami, Oklahoma
DOCUMENT TYPE: Memorandum w/Enclosure
DOCUMENT TITLE: EPA purchase of limestone for listed cities

DOCUMENT NUMBER: 003296 - 003298
DOCUMENT DATE: 03/19/97
NUMBER OF PAGES: 003
AUTHOR: James D. McDurmett, Acting Deputy Commissioner of Indian Affairs
COMPANY/AGENCY: U. S. Dept. of the Interior
RECIPIENT: Area Director, Muskogee Area Office and Superintendent, Miami Agency Office
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Town lot rental program

DOCUMENT NUMBER: 003299 - 003299
DOCUMENT DATE: 03/21/97
NUMBER OF PAGES: 001
AUTHOR: Gary D. Uphoff, Environmental Management Services Company
COMPANY/AGENCY: EMSC
RECIPIENT: James E. Costello, Assistant Regional Counsel U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Request for extension of public comment period

DOCUMENT NUMBER: 003300 - 003362
DOCUMENT DATE: 03/27/97
NUMBER OF PAGES: 063
AUTHOR: Rick L. Congdon, Certified Shorthand Reporter
COMPANY/AGENCY: Unspecified
RECIPIENT: Public
DOCUMENT TYPE: Meeting Transcript
DOCUMENT TITLE: Public meeting, Picher High School, Picher, Oklahoma, 7:00 p.m.

DOCUMENT NUMBER: 003363 - 003365
DOCUMENT DATE: 04/01/97
NUMBER OF PAGES: 003
AUTHOR: James E. Costello, Senior Attorney
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Leslie C. Nelleremoe, Attorney for ASARCO Inc., et al., Heller Ehrman White & McAuliffe
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Response to March 17, 1997 letter

DOCUMENT NUMBER: 003366 - 003367
DOCUMENT DATE: 04/01/97
NUMBER OF PAGES: 002
AUTHOR: H.A. Caves, Director, Waste Management Division
COMPANY/AGENCY: ODEQ
RECIPIENT: Myron Knudson, Director, Superfund Division, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: ODEQ concurs with proposed plan for Operable Unit 2

DOCUMENT NUMBER: 003368 - 003368
DOCUMENT DATE: 04/01/97
NUMBER OF PAGES: 001
AUTHOR: Ken Cadaret
COMPANY/AGENCY: OSDH
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Summary
DOCUMENT TITLE: Blood Lead Testing Summary, Miami, Oklahoma

DOCUMENT NUMBER: 003369 - 003371
DOCUMENT DATE: 04/04/97
NUMBER OF PAGES: 003
AUTHOR: Barbara Kyser-Collier, Environmental Director
COMPANY/AGENCY: Wyandotte Tribe of Oklahoma
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Public comment letter w/Enclosure
DOCUMENT TITLE: Comments on proposed plan

DOCUMENT NUMBER: 003372 - 003373
DOCUMENT DATE: 04/07/97
NUMBER OF PAGES: 002
AUTHOR: Susan Waldron, Community Health Action Management Program
(CHAMP) Project Coordinator
COMPANY/AGENCY: University of Oklahoma Health Sciences Center
RECIPIENT: Noel Bennett, U.S. EPA Region 6
DOCUMENT TYPE: Public Comment Letter
DOCUMENT TITLE: Comments on proposed plan of action

DOCUMENT NUMBER: 003374 - 003378
DOCUMENT DATE: 04/08/97
NUMBER OF PAGES: 005
AUTHOR: Karl L. Hatley, Executive Director
COMPANY/AGENCY: Oklahoma Toxics Campaign Fund, Inc.
RECIPIENT: Community Relations, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Comments on proposed plan of action

DOCUMENT NUMBER: 003379 - 003382
DOCUMENT DATE: 04/09/97
NUMBER OF PAGES: 004
AUTHOR: Kent Curtis, Site Assessment Manager
COMPANY/AGENCY: Cherokee Nation, Tahlequah, Oklahoma
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Inter-Tribal Environmental Council's comments about proposed
plan of action for lead-contaminated soil at residential areas

DOCUMENT NAME: 003383 - 003384
DOCUMENT DATE: 04/10/97
NUMBER OF PAGES: 002
AUTHOR: Myron O. Knudson, P.E. Director Superfund Division
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Bruce K. Means, Chair, National Remedy Review Board
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Response to National Remedy Review Board recommendations

DOCUMENT NUMBER: 003385 - 003386
DOCUMENT DATE: 04/11/97
NUMBER OF PAGES: 002
AUTHOR: Myron O. Knudson, Director, Superfund Division
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Gary D. Uphoff, Principal, Environmental Management Services Company
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Response to March 21, 1997 letter requesting an extension to the public comment period regarding the proposed plan

DOCUMENT NUMBER: 003387 - 003387
DOCUMENT DATE: 04/14/97
NUMBER OF PAGES: 001
AUTHOR: Cherokee Volunteer Society
COMPANY/AGENCY: Miami High School, Miami, Oklahoma
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Public comment letter
DOCUMENT TITLE: Comments on proposed plan

DOCUMENT NUMBER: 003388 - 003391
DOCUMENT DATE: 04/15/97
NUMBER OF PAGES: 004
AUTHOR: Lorraine Halinka Malcoe, Principal Investigator
COMPANY/AGENCY: CHAMP
RECIPIENT: Gary Uphoff, Environmental Management Services Company
DOCUMENT TYPE: Report
DOCUMENT TITLE: Quarterly Report, CHAMP Program, Ottawa County, Oklahoma, Towns of Picher, Cardin and Quapaw (January 1997 - March 1997)

DOCUMENT NUMBER: 003392 - 003403
DOCUMENT DATE: 04/15/97
NUMBER OF PAGES: 012
AUTHOR: Kent Curtis, Site Assessment Manager, Office of Environmental Services
COMPANY/AGENCY: Cherokee Nation, Tahlequah, Oklahoma
RECIPIENT: U.S. EPA Region 6 Superfund Site
DOCUMENT TYPE: Public Meeting List of Attendees and Presentation Materials
DOCUMENT TITLE: CHAMP Public Meeting at Picher Elementary School in Picher, Oklahoma, 6:30 p.m.

DOCUMENT NUMBER: 003404 - 003404
DOCUMENT DATE: 04/16/97
NUMBER OF PAGES: 001
AUTHOR: John Gault, Director
COMPANY/AGENCY: Quapaw Tribe of Oklahoma
RECIPIENT: Donn Walters, Community Involvement Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Comments on proposed action

DOCUMENT NUMBER: 003405 - 003405
DOCUMENT DATE: 04/17/97
NUMBER OF PAGES: 001
AUTHOR: Dennis L. Wickliffe, Acting Area Director, Muskogee Area Office
COMPANY/AGENCY: Unspecified
RECIPIENT: Superintendent, Miami Agency
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Administrative Order Update

DOCUMENT NUMBER: 003406 - 003411
DOCUMENT DATE: 04/21/97
NUMBER OF PAGES: 006
AUTHOR: Geotech
COMPANY/AGENCY: Unspecified
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: Evaluation of County Roads Used as Haul Routes

DOCUMENT NUMBER: 003412 - 003416
DOCUMENT DATE: 04/22/97
NUMBER OF PAGES: 005
AUTHOR: Tar Creek Field Office
COMPANY/AGENCY: Picher, Oklahoma
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Facsimile Transmittal w/Enclosures
DOCUMENT TITLE: Soil samples at disposal area

DOCUMENT NUMBER: 003417 - 003418
DOCUMENT DATE: 04/24/97
NUMBER OF PAGES: 002
AUTHOR: Myron O. Knudson, Director, Superfund Division
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: James Graves, Ottawa County Commissioner, Miami, Oklahoma
DOCUMENT TYPE: Letter w/Enclosure
DOCUMENT TITLE: EPA, through contract with Corps of Engineers, willing to repair road damage (or reimburse Ottawa County for reasonable cost of the repair of such damage) which EPA determines to be caused by EPA response actions.

DOCUMENT NUMBER: 003419 - 003419
DOCUMENT DATE: 04/25/97
NUMBER OF PAGES: 001
AUTHOR: Ken Cadaret
COMPANY/AGENCY: OSDH
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Blood Lead Screening Results
DOCUMENT TITLE: Children 6-72 months old, Tri-State Mining District, Oklahoma
Portion, Ottawa County. July 1, 1995 - November 30, 1996

DOCUMENT NUMBER: 003420 - 003420
DOCUMENT DATE: 04/29/97
NUMBER OF PAGES: 001
AUTHOR: Robert Wilson, Corps of Engineers
COMPANY/AGENCY: U.S. Department of the Army
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Flood plain study-related issues

DOCUMENT NUMBER: 003421 - 003421
DOCUMENT DATE: 04/30/97
NUMBER OF PAGES: 001
AUTHOR: Robert Wilson, Corps of Engineers
COMPANY/AGENCY: U.S. Department of the Army
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Structures located in flood plain designated as businesses

DOCUMENT NUMBER: 003422 - 003423
DOCUMENT DATE: 04/30/97
NUMBER OF PAGES: 002
AUTHOR: Robert Wilson, Corps of Engineer
COMPANY/AGENCY: U.S. Department of the Army
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum w/Enclosure
DOCUMENT TITLE: Twenty five (25) year floodplain

DOCUMENT NUMBER: 003424 - 003424
DOCUMENT DATE: 05/01/97
NUMBER OF PAGES: 001
AUTHOR: Robert Wilson, Corps of Engineers
COMPANY/AGENCY: U.S. Department of the Army
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Buy-out status

DOCUMENT NUMBER: 003425 - 003425
DOCUMENT DATE: 05/01/97
NUMBER OF PAGES: 001
AUTHOR: Ecology and Environment, Inc.
COMPANY/AGENCY: Consultants for U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Map
DOCUMENT TITLE: Tar Creek Soil and Sediment Sample Locations

DOCUMENT NUMBER: 003426 - 003427
DOCUMENT DATE: 05/04/97
NUMBER OF PAGES: 002
AUTHOR: Joan Miles, Health Officer, Director
COMPANY/AGENCY: Lewis and Clark City-County Health Department, Helena, Montana
RECIPIENT: Donn Walters, Community Involvement Coordinator, U.S. EPA
Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Proposed plan of action

DOCUMENT NUMBER: 003428 - 003429
DOCUMENT DATE: 05/06/97
NUMBER OF PAGES: 002
AUTHOR: Leslie C. Nellermeoe, Attorney for ASARCO Inc., et al.
COMPANY/AGENCY: Heller Ehrman White & McAuliffe
RECIPIENT: Myron O. Knudson, Director, Superfund Division, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Request for extension of public comment period for proposed plan

DOCUMENT NUMBER: 003430 - 003498
DOCUMENT DATE: 05/09/97
NUMBER OF PAGES: 069
AUTHOR: Lisa G. Esayian, Attorney for NL Industries, Inc.
COMPANY/AGENCY: Kirkland & Ellis
RECIPIENT: Donn Walters, Community Involvement Coordinator, U.S. EPA
Region 6
DOCUMENT TYPE: Letter w/Enclosures
DOCUMENT TITLE: Comments on proposed plan

DOCUMENT NUMBER: 003499 - 003500
DOCUMENT DATE: 05/12/97
NUMBER OF PAGES: 002
AUTHOR: Leslie C. Nellermeoe, Attorney for ASARCO Inc., et al.
COMPANY/AGENCY: Heller Ehrman White & McAuliffe
RECIPIENT: Myron Knudson, Director, Superfund Division, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Request for extension of deadline for comments on proposed plan

DOCUMENT NUMBER: 003501 - 003503
DOCUMENT DATE: 05/13/97
NUMBER OF PAGES: 003
AUTHOR: Bob Wilson, Corps of Engineers
COMPANY/AGENCY: U.S. Army
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: Estimating Costs to Remediate Areas Paved with Chat, Miami, Oklahoma

DOCUMENT NUMBER: 003504 - 003504
DOCUMENT DATE: 05/14/97
NUMBER OF PAGES: 001
AUTHOR: Scott A. Thompson, Environmental Program Director
COMPANY/AGENCY: ODEQ
RECIPIENT: Kent Curtis, Inter-Tribal Environmental Council, Tahlequah, Oklahoma
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Landowners reluctant to grant access to the U.S. EPA

DOCUMENT NUMBER: 003505 - 003624
DOCUMENT DATE: 05/15/97
NUMBER OF PAGES: 120
AUTHOR: Edward B. Cohen, Deputy Solicitor, Office of the Solicitor
COMPANY/AGENCY: U.S. Department of the Interior
RECIPIENT: Donn Walters, Community Involvement Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Letter w/Enclosures
DOCUMENT TITLE: Comments on RI/FS Reports, Risk Assessment, and Proposed Plan for Remedial Action

DOCUMENT NUMBER: 003625 - 003626
DOCUMENT DATE: 05/15/97
NUMBER OF PAGES: 002
AUTHOR: Myron O. Knudson, Director, Superfund Division
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Leslie C. Nellermeoe, Attorney for ASARCO, Inc. at al., Heller Ehrman White & McAuliffe
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Re: May 6, 1997 and May 12, 1997 letters requesting extension to public comment period regarding proposed plan

DOCUMENT NUMBER: 003627 - 003628
DOCUMENT DATE: 05/16/97
NUMBER OF PAGES: 002
AUTHOR: Kent Curtis, site Assessment Manager, Office of Environmental Services
COMPANY/AGENCY: Cherokee Nation, Tahlequah Oklahoma
RECIPIENT: Donn Walters, Community Involvement Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Supplemental comments to April 8, 1997 letter about proposed remediation actions

DOCUMENT NUMBER: 003629 - 003631
DOCUMENT DATE: 05/19/97
NUMBER OF PAGES: 003
AUTHOR: Unspecified
COMPANY/AGENCY: Unspecified
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Sampling results
DOCUMENT TITLE: Sampling results for soil repository

DOCUMENT NUMBER: 003632 - 003785
DOCUMENT DATE: 05/22/97
NUMBER OF PAGES: 154
AUTHOR: Gary D. Uphoff
COMPANY/AGENCY: Environmental Management Services Company
RECIPIENT: Donn Walters, Community Involvement Coordinator, U.S. EPA Region 6
DOCUMENT TYPE: Letter w/Report
DOCUMENT TITLE: Comments on proposed plan of action for residential component of Operable Unit 2

DOCUMENT NUMBER: 003786 - 003787
DOCUMENT DATE: 05/27/97
NUMBER OF PAGES: 002
AUTHOR: John Gault, Economic Development Director Quapaw Tribe of Oklahoma
COMPANY/AGENCY: Unspecified
RECIPIENT: Myron Knudson, Director, Superfund Division, U.S. EPA Region 6
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Proposed remedial action

DOCUMENT NUMBER: 003788 - 003789
DOCUMENT DATE: 06/12/97
NUMBER OF PAGES: 002
AUTHOR: Myron O. Knudson, Director, Superfund Division
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: John Gault, Economic Development Director, Quapaw Tribe of Oklahoma, Quapaw, Oklahoma
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Proposed remedial action

DOCUMENT NUMBER: 003790 - 003790
DOCUMENT DATE: 06/12/97
NUMBER OF PAGES: 001
AUTHOR: Cornelius Flynn
COMPANY/AGENCY: Geotech
RECIPIENT: Carol Wies, USACE QAR
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Removal action injury summary report

DOCUMENT NUMBER: 003791 - 003791
DOCUMENT DATE: 06/16/97
NUMBER OF PAGES: 001
AUTHOR: Gary Moore, On-Scene Coordinator, Response and Prevention Branch
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Phil Clark
DOCUMENT TYPE: Letter
DOCUMENT TITLE: Innovative technology in cleanup of hazardous waste sites

DOCUMENT NUMBER: 003792 - 003792
DOCUMENT DATE: 06/19/97
NUMBER OF PAGES: 001
AUTHOR: Noel Bennett, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Todd Adornato, U.S. Fish and Wildlife Service
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Proposed remedial actions

DOCUMENT NUMBER: 003793 - 003793
DOCUMENT DATE: 06/19/97
NUMBER OF PAGES: 001
AUTHOR: Noel Bennett, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Re: Natural Resource Damage Assessment Activities by U.S. Fish & Wildlife Services

DOCUMENT NUMBER: 003794 - 003794
DOCUMENT DATE: 06/20/97
NUMBER OF PAGES: 001
AUTHOR: Noel Bennett, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Scott Thompson, ODEQ
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Proposed remedial actions

DOCUMENT NUMBER: 003795 - 003805
DOCUMENT DATE: 07/0 /97
NUMBER OF PAGES: 011
AUTHOR: Billy E. Banks, Chief, Civil Works Branch, Tulsa District,
Corps of Engineers
COMPANY/AGENCY: Department of the Army
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Letter w/Report
DOCUMENT TITLE: Chat Survey Report on the City of Miami, Oklahoma

DOCUMENT NUMBER: 003806 - 003807
DOCUMENT DATE: 07/28/97
NUMBER OF PAGES: 002
AUTHOR: Jerry Clifford, Acting Regional Administrator USEPA Region 6
COMPANY/AGENCY: US EPA Region 6
RECIPIENT: Ed Chrono, Executive Director Grand Gateway Economic Letter
DOCUMENT TITLE: Application for United States Housing and Urban Development (HUD) Grant

DOCUMENT NUMBER:
DOCUMENT DATE: 07/31/97
NUMBER OF PAGES: 019
AUTHOR: Tulsa District, Corps of Engineers
COMPANY/AGENCY: U.S. Army
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Investigation
DOCUMENT TITLE: Netta East Mine Overburden Investigation at the Picher Reunion Park Site

DOCUMENT NUMBER: 003808 - 003809
DOCUMENT DATE: 08/01/97
NUMBER OF PAGES: 002
AUTHOR: Gary Moore, On-Scene Coordinator, Response and Prevention Branch
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Charles Gazda, Chief, Response and Prevention Branch, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Ottawa Reclamation Authority

DOCUMENT NUMBER: 003810 - 003810
DOCUMENT DATE: 08/06/97
NUMBER OF PAGES: 001
AUTHOR: Quapaw Tribe of Oklahoma
COMPANY/AGENCY: Unspecified
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Tribal Resolution #061297
DOCUMENT TITLE: Quapaw Tribe not liable for contamination at the site

DOCUMENT NUMBER: 003811 - 003811
DOCUMENT DATE: 08/08/97
NUMBER OF PAGES: 001
AUTHOR: Robert Wilson, Corps of Engineers
COMPANY/AGENCY: U.S. Army
RECIPIENT: Noel Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Tar Creek - Ottawa County Chat Survey

DOCUMENT NUMBER: 003812 - 003828
DOCUMENT DATE: 08/15/97
NUMBER OF PAGES: 017
AUTHOR: Robert Wilson, Tulsa District Office, Corps of Engineers
COMPANY/AGENCY: U.S. Army
RECIPIENT: Noel T. Bennett, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Survey
DOCUMENT TITLE: CHAT Survey, Miami, Oklahoma