Review and Summary of OU2, Residential and HAA Areas Tar Creek Superfund Site Ottawa County, Oklahoma

A Report
Prepared for the LEAD Agency
And Other Interested Parties

Prepared by the
Technical Advisor under a TAG Grant

By

Resource Management International
Gary Lawley, PhD

April 2002

Revised Spring 2004

Review of OU2, Residential and High Activity Areas, for the Tar Creek Superfund Site

1. Introduction and Overview

Tar Creek has been on the National Priority List (NPL) as a Superfund Site since 1983, due to its heavy metals contamination and other problems. It is a very high-ranking site (58.3) on the numerical Hazard Ranking System (HRS) applied to NPL Sites. Such sites are typically a priority by the EPA for "long-term remedial evaluation and response action". Response actions typically are performed at large, complex sites in phases called Operable Units (OUs). OU 1 was completed in 1987. EPA's required five year reviews of the effectiveness of the remedial work were published in 1994 and 2000.

The investigation that lead to the creation of Operable Unit 2 (OU2) was initiated in 1994, based on the assumption that high blood lead levels in children living in the Site area were due to exposure to mine wastes (chat). Chat was (and is) utilized at the Tar Creek Site in a variety of ways that makes it easily available for ingestion by children. The results of this investigation determined that additional remediation was needed at the Tar Creek Site and nearby areas to protect human health. The Indian Health Service had previously provided EPA with the results of their 1993 study indicating that approximately 35% of Native American children in the Tar Creek area had blood lead levels exceeding 10 ug/dL. This level is considered elevated and damaging to children's health by the Center for Disease Control (CDC).

In Picher and Cardin, towns considered the "epicenter" of the Superfund Site, the blood lead levels of children under age 6 were approximately 32% and 68%, respectively, above the 10 ug/dL action level. The Oklahoma average is 2% of children in this age group having levels above the recommended limit.

Blood lead levels considered dangerous to children have been lowered dramatically since the early 1980's, when the level considered elevated was 30 ug/dL. The CDC has since concluded that lead in children is much more dangerous than originally believed and have lowered the level considered elevated to 10 ug/dL. There is some evidence this action level may be lowered even more by the CDC in the future. Young children are most susceptible to lead poisoning, but adolescents and adults are also known to be affected.

From August 1994 until July 1995, the EPA, through its Site Removal Program (the Superfund program that generally includes emergency response activities), conducted a two-phase sampling project. Phase 1 sampling took place in High Access Areas (HAA) such as playgrounds, Day Care Centers and Schools. Phase 2 sampling took place in residential yards and driveways on and near the Site. Results were issued in two reports: the Baseline Human Health Risk Assessment in August 1996, and the Residential Remedial Investigation Report in January 1997.

These reports concluded that ingestion of lead-contaminated soil was the major exposure pathway with significant risk to children in the area, and that lead contamination in the soil at HAAs and residential areas on and near the Site posed an imminent and substantial danger to young children's health. This led to the preparation of a Record of Decision (ROD) by the EPA that was published in August 1997. A summary of this ROD are presented in this document.

A list and explanation of the acronyms used in this report is found in Attachment 1. A list of the literature reviewed in preparing this and other Tar Creek reports is available as Attachment 2. The Tar Creek Report Glossary should also be used in conjunction with this document to clarify the terms used.

The EPA settled for the surface and groundwater contamination (OU1) at the site with the principally responsible parties (PRPs) for the costs of the Tar Creek clean up prior to initiation of OU2. At that time, no additional work was anticipated at the Tar Creek Site. In 1995, EPA began developing the work plan for OU2 and included the Department of Interior (DOI) on its PRP list. EPA gave all the PRP's the opportunity to participate by cost sharing for OU2 during 1995 and 1996. In 1996, the EPA participated in a bankruptcy settlement with another major PRP, Eagle-Picher Mining Company, waiving any further responsibility for their obligations regarding the Tar Creek Site. The remaining PRPs now include ASARCO, Inc., Blue Tee Corporation, Childress Royalty Company, Inc., Gold Fields Mining Company, NL Industries, The Doe Run Resources Corporation, and the Department of Interior.

The PRPs, including the DOI, requested that EPA continue to negotiate with them and not implement the OU2 removal actions that were recommended. They did not agree with many of the test results, the interpretations reached or the remedial actions recommended.

The PRPs then offered to perform a Community Health Action Monitoring Program (CHAMP) to study blood lead levels of children in the area. The EPA accepted this offer and the PRPs hired the University of Oklahoma Health Sciences Center to perform this work.

At least seven public meetings were held by the EPA in communities near the Tar Creek Site from 1994 through 1997. Most of these meetings were to review and receive comments on the alternatives that had previously been selected and ranked by the EPA in the ROD for OU2.

2. Sampling

During the initial investigation, sampling (as well as remediation) was divided into two phases: Phase 1 included sampling of 28 HAAs; Phase 2 included sampling of 2070 residential properties. Five air samples were also taken.

Sampling was divided into the following groups:

- Study Area homes = 1955 homes in the Tar Creek Area;
- Study Group homes = 100 homes in Picher

- Reference Area homes = 15 homes in Afton

- Garden products in the Study Group and Reference area

- Air monitoring, using five stations in Picher and one background sample 3 miles west of Picher

The sampling resulted in the following conclusions:

- Lead levels in the Study Group soils were found to be approximately 10 times greater than concentrations in the Reference Area soils;
- 17 of the 28 HAAs sampled were determined to require removal action under Phase 1 Sampling.
- 1336 of the 2055 residential properties sampled under Phase II had concentrations of lead above 500 ppm.
- Lead levels of up to 0.137 ug/kg were detected in garden produce in the study area. However, differences in the lead content of garden produce between the Study Group and the Reference Area were not considered significant.
- Results of ambient air sampling for lead showed no results above the standard of 1.5 ug/m3.

Cadmium and zinc are known to be associated with lead in the Tar Creek mining wastes. Cadmium was found to be high enough in the target areas to warrant separate action or clean-up levels. However, the remedial action was intended to remove the cadmium and zinc, along with the lead.

A blood lead level survey by the University of Oklahoma under the CHAMP program showed that 38% of the children in Picher and 62% of the children in Cardin exceeded 10 ug/dL, the accepted standard. Children in the other towns of Quapaw, Commerce, North Miami, and Miami were many times the national average of 2 % BLL.

The PRPs hired a consultant, Dames and Moore, to sample some of the same areas sampled by EPAs contractor, Ecology and Environment. These two firms' sample results were significantly different regarding concentrations of lead in the soil and the presumed source of the lead. Both parties had reasonable explanations for their results.

3. Selected Alternative in the Record of Decision

The following are major components of the recommended alternative for remediation of residential and HAA properties. These components were intended to be modified by the contractor as they were implemented. The selected alternative called for:

- Excavation of lead-contaminated surface soil in HAAs and residential areas

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

- Disposal of excavated soil in abandoned on-site floatation ponds

- Covering or replacing chat in high traffic areas near remediated residences

- Restriction of access to mining wastes located near residences by physical barriers and signs

Some elements of the selected alternative were intended to be enforced by local or state authorities. These included:

- Chat should only be used for certain purposes and should be cleaned by washing before handling and use

- Actions that would recontaminate the areas should be controlled

- Actions that would contaminate areas that are presently clean should be prevented

- Exposures should be prevented at new residential areas

- Construction activities that would produce contamination should be controlled

- Legal notices should be placed on deeds to show whether the property had been cleaned up

- Lead sources and blood lead levels should continue to be sampled

The EPA intended that the BIA implement the above items on Indian Lands.

A Removal Action Memorandum (Emergency Action) was issued in March of 1996 based on sample results from the residential yards and HAAs. The first Action Memorandum was issued in 1995 was for the HAAs. The second was issued in 1996 for the residential areas with lead levels above 1500 ppm.

The selected response actions were intended to apply to the entire floodplain of Tar Creek and applicable HAAs in Ottawa County. But these areas were not considered a part of the Tar Creek Site.

The ROD stated that the EPA believed the removal action they proposed represented the maximum extent a permanent solution could be utilized in a cost-effective manner at this site.

The designated clean-up levels were intended to ensure that no more than 5% of the children exposed to lead in the soil at the 500-ppm level would have blood-lead levels greater than 10 ug/dL after the remediation was completed.

The excavation criteria were as follows:

Phase 1, HAAs

- Action criteria= 500 ppm lead or 100 ppm cadmium
- Clean-up level= 500 ppm lead or 100 ppm cadmium for the top 12": 1000 ppm for lead and 200 ppm for cadmium for the 12" to 18" level (this varied by site). No removal below 18".

Phase 2, Residential Areas

- Action criteria=Homes with children 6 years old or younger with blood lead levels higher than 10 ug/dL, and;
- Yards with surface concentrations of more than 1,500 ppm lead
- Clean-up level = remove soil containing 500 ppm or more lead down to 18"; place marker at this level if contamination went deeper than 18", and;
- Backfill with clean topsoil, level to grade and revegetate; this was later changed to only 6" of topsoil above a clay layer.

If the EPA contractor found additional residential areas with over 500 ppm lead, they had the authority to initiate removal action.

Air monitoring for workers was conducted near the areas disturbed during removal actions.

Under RCRA rules, solid wastes from mining and processing of ore or minerals are "exempt" from being designated as hazardous wastes, regardless of their contamination concentration. However, these same materials are considered hazardous wastes under CERCLA.

Excavated soils were disposed of at an old millpond near Picher, which was formerly a floatation pond. These contaminated materials were to be spread out and sampled. These piles containing more than 500-ppm lead were to be covered by clean soil and revegetated. The EPA considered this action to "improve" the already contaminated disposal areas.

4. Recommended Follow-up Actions

The long-term success of these removal actions was understood to depend on prevention of recontamination of the surface layers by disturbance and deposition of wind-blown dust or waterborne runoff.

It was understood that nearby chat piles might be the source of recontamination of residential area yards. Prevention methods proposed by and the responsibility of EPA included:

- Re-vegetate bare areas
- Cap some rapidly eroding areas with soil
- Cap some eroding areas with coarse materials or pave them
- Apply dust suppression or dust control to some areas
- Consolidate source materials
- Contain source materials, if required
- Abate other sources of lead contamination

Vacant lots and uninhabited house lots were included in the remediation program, but at a low priority. These actions were non-specific and were left up to the EPA and its contractors to implement.

5. Response to Comments on items in the ROD

The details of the recommended alternative were published in the ROD. The following are EPA's response to comments on those items in the ROD by citizens, stakeholders, other agencies and PRPs. The EPA responses and the questions that triggered those responses are only summarized. Those specific questions and answers can be found in the ROD.

There was considerable controversy during the comment period regarding the differences in soil sampling results of the two different contractors and what they meant. The PRP's did not agree with the concentrations of lead found by EPA' s contractor and did not agree these levels warranted removal of the soil.

Air quality at the Tar Creek Site was considered by EPA to be "good" in the area tested, which was near Picher, in the heart of the Tar Creek mining area. The exact type of air monitoring performed and the specific results of the air monitoring were not included in the ROD.

The potential for recontamination of residential areas and schoolyards due to blowing dust was considered minimal for most properties. EPA conceded dust might need to be controlled at some properties. Runoff was also a potentially significant factor for recontaminating some properties. The EPA agreed runoff might have to be controlled by rerouting drainage patterns. Provision for rerouting runoff was included in the selected alternative.

One EPA response indicated economically feasible treatment of contaminated water in the mines had not been found. EPA said water from Grand Lake and the Neosho River was not considered contaminated and could be used as a drinking water source; the fish in these water bodies were also considered safe for human consumption. This 1997 response was based on results from a 1983 report.

The EPA recommended no additional studies of downstream impacts. They based this response on a 1995 OSU/OWRB report which stated that heavy metals were bound up in the sediments of the lake and rivers, did not significantly impact fish or water quality and therefore did not affect human health. Spring River was considered a much greater source of metals loading to Grand Lake than the Neosho River.

The EPA stated that "shoveling chat into trucks at a loading facility" was not an uncontrolled release of hazardous materials, and therefore CERCLA rules did not apply to chat use. The response also noted that no other federal laws regarding chat use applied to this situation and if chat was washed and used in asphalt or concrete, it should not pose a threat to humans or the environment and could be sold as a useful product.

The EPA stated that relocation of local residents would be 10 times more expensive than other proposed remediation, but admitted it had used relocation many times in the past as the most cost-effective alternative.

The EPA stated it would have an office in the Tar Creek area for years. EPA said soils in the Tar Creek floodplain typically did not exceed the 500-ppm criteria for lead, but additional testing would be conducted in the floodplain to evaluate the risk of recontamination by flooding during the non-residential phase of OU2.

Consumption of locally grown produce was not believed to pose a risk to humans. Contamination of wildlife, plants, agricultural products and fish in the Tar Creek area would be evaluated in the non-residential portion of OU2, which would be divided into several phases during future work. Removal of chat piles and constructed wetlands would also be considered as remediation options in future studies.

The EPA stated that a five-year review of the residential part of OU2 would not be performed. However, a second Five-year Review of OU1 would be performed.

Remedial activities were not anticipated to cause harm to borrow areas or the local infrastructure. Measures intended to protect residents and the local community included air monitoring, dust control by watering and by covering trucks carrying contaminated soil.

It was agreed that a marker consisting of orange plastic fencing was to be placed at the 18" level in areas with high lead levels at and below this depth. Lead in the soil of the local residential areas was composed of very small size fractions (dust) and was chemically comprised of lead oxide and lead carbonate. The bioavailability of the lead in the soil was estimated to be approximately 30%. EPA concluded the primary source of lead available for ingestion by children was from mining activities that occurred in the Tar Creek Superfund Site.

EPA agreed that lead based paint was used in homes in this area until approximately 1978. Therefore, any structure built before that date may have lead paint that should be closely monitored and maintained in good condition. Lead paint is typically defined as paint having 5000 mg/kg (5%) or more lead. This level of lead in paint was found in about 25% of the homes sampled in this study.

Lead based paint can contain up to 20,000 mg/kg lead, which is much more than is present in the residential yard soils. Ingestion of lead based paint chips has been shown to increase the lead level in children very rapidly.

The EPA agreed that household dust in the Tar Creek area may contain significant concentrations of lead and should be cleaned with a HEPA vacuum. 200 mg/kg or more lead in dust was considered high. It was anticipated that HEPA vacuums would be supplied by local health agencies. HEPA vacuums were to be made available to local homeowners to periodically clean dust from their homes.

6. Results of OU2 Remedial Actions

A total of 237 properties were excavated under the Phase 1 removal action conducted during 1996 and 1997. Another 1300 properties were remediated under Phase II, which occurred from 1998 through 2000. The total properties remediated was 1600 under both Phases as of February 2002. The EPA estimated that another 500 to 800 properties should be remediated in this area.

Inadequate local infrastructure and poor drainage of surface water during heavy rains was not anticipated during the planning stage. Drainage ditches had to be added during the project. Later, the EPA provided the towns of Cardin, Picher and Commerce about four million dollars to fix their roads, culverts and other aspects of infrastructure after the project was mostly completed.

A new Governor's Task Force Report published in 2000 estimated a reduction of approximately 50% in the number of children whose blood lead levels exceeded the CDC-recommended level from 21% in 1993 to 11% in 2000. In a similar removal action, post-remediation blood lead levels in children in the Joplin, Missouri, area dropped from about 14% exceeding the recommended standard in 1991 to about 2% exceeding the standard in 2000.

The Tulsa District Corps of Engineers was the oversight manager for part of the residential work. They and their major contractor ceased participating in the yard remediation during the summer of 2001. The contractor is under federal investigation for various problems.

Approximately 450 properties did not give permission for the remediation of their property. The average cost to remediate each property was about the same as the original estimate, in spite of heavy rainfall and schedule slippage. Some estimates of the AVERAGE COST for remediation of a single property changed in 2003 to as high as $70,000.

The Army Corps contractor changed the composition of the backfill placed on the yards during the project from all topsoil to a clay-topsoil mix. There is controversy as to whether this was appropriate. Some property owners claim that the clay holds too much water and causes mold to grow beneath their homes and in their basements. The EPA stated there were fewer complaints after clay was added. There were 277 complaints during and just after the yard work. Seven of those complaints resulted in damage claims being filed. Total number of complaints during each phase and how they were resolved should be updated.

7. Costs

The cost of the selected alternative was originally estimated to be $25,700,000; later, this figure became $29,400,000. Well over this amount was eventually be spent during OU2. In a similar excavation project near Joplin, Missouri, approximately 2500 yards were remediated at an average cost of about $12,000 per yard. The average cost for remediation of each yard in the Tar Creek area was more than $20,000, and later estimated toward $70,000.

8. Summary

The results of the work accomplished so far during OU2 are summarized as follows.

The lead contamination in the surface soils of a large number of HAAs and residential yards has been greatly reduced. The excavated soils remain in the Tar Creek Superfund Site.

The blood lead levels of children in the area appear to have decreased significantly. It is not clear whether the decrease is due to the soil removal or the massive educational effort by the local communities.

The alternative that was implemented may be temporary in many ways.

A considerable amount of money has been spent and nearly eight years have passed since OU2 began.

The EPA promised to address some of the other problems of Tar Creek in the next non-residential portion of OU2, which is called OU4.

Attachment 1

The following Acronyms were used in this document.

OU- Operable Unit
IHS- Indian Health Service
EPA- Environmental Protection Agency
Ug- Micrograms (part per billion)
Mg-Milligram (part per million)
Kg-Kilogram
PPM- Part per million
dL- Deciliter
CDC- Center for Disease Control
HAA- High Access Area
ROD- Record of Decision
NPL- National Priority List
PRP- Potentially Responsible Party
DOI- Department of Interior
RCRA- Resource Conservation and Recovery Act
CERCLA- Comprehensive Environmental Response, Compensation, & Liability Act (Superfund)
CHAMP-Community Health and Monitoring Program
BIA- Bureau of Indian Affairs
OSU- Oklahoma State University
OWRB- Oklahoma Water Resources Board
HEPA- High efficiency particulate air
ATSDR- Agency for Toxic Substances and Disease Registry