



OKLAHOMA PLAN FOR TAR CREEK



OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY

...for a clean, attractive, prosperous Oklahoma

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Tar Creek Superfund Site Background

The Tar Creek Superfund Site is located in far northeastern Oklahoma near the Oklahoma/Kansas border in Ottawa County. The Site generally consists of a forty-square-mile area; however, it is part of the larger Tri-State Mining District that includes areas of Kansas and Missouri. The Site includes portions of five communities: Picher, Cardin, Quapaw, North Miami, and Commerce and affects a total population of roughly 30,000 residents. A substantial amount of the land in the mining area is owned by the Quapaw Tribe and its members held in trust by the U.S. Department of Interior.

Beginning in the early 1900s and continuing to some degree as late as the 1970s, the Site was extensively mined for lead and zinc ore. Most mines had their own mill, and Oklahoma mills in many cases served as central mills for mines operating in Kansas and Missouri. Milling the lead and zinc ore resulted in a concentrate of the original mined material. The milling process, however, also resulted in mine tailings that were originally considered an unmarketable waste product. Typically, the mine tailings were disposed of by collecting in piles or in flotation tailings ponds. Some piles are as high as 200 feet and contain elevated levels of lead and other heavy metals. The chat has been sold and marketed as a construction product, similar to limestone gravel, for many years. Chat piles are either owned privately or held in trust by the U.S. Department of Interior for members of the Quapaw Tribe.

The U.S. Geological Survey and the U.S. Army Corps of Engineers have estimated that the Site generally contains 75 million tons of chat piles and an additional amount of tailings in flotation ponds that has yet to be quantified. The Environmental Protection Agency and Oklahoma state agencies have determined that the mining and milling of lead and zinc ore left miles of underground tunnels, open mine shafts, and drill holes.

The Environmental Protection Agency (EPA) listed the Tar Creek Superfund Site on the National Priorities List in 1983 making it subject to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, 42 U.S.C. §9601 et seq.). CERCLA listing, also known as Superfund listing, establishes procedures under that law for clean up of a listed site and reimbursement for such clean up by collecting from responsible parties. In 1984, the EPA began work on its first Operable Unit (OU1) in the Site. Each OU is a portion of a remedial response, and the clean up of a Superfund site can be divided into a number of OUs. OUs may be organized by geographical portions of a site or specific site problems to be remediated. Since its listing in 1983, EPA has designated four different OUs within the Site. The first OU was designated to address surface water contamination in Tar Creek from discharge of mine water and the threat of contamination of the Roubidoux Aquifer beneath the Site from open abandoned wells. The EPA conducted work from 1984 to 1986 to build dikes, plug eighty-three abandoned wells, and divert surface water around abandoned mines and

collapsed mine shafts. The result of the work of OU1 was mixed. Surface water quality was not significantly improved. The diking and diversion remedial action was at best only partially effective, and there was insufficient data to evaluate the effectiveness of the well plugging operations. Concentrations of most constituents in the mine water discharges decreased; however, that may have occurred naturally, and the volume of the mine water discharged to Tar Creek was not significantly impacted by the remedial action. Some well plugging continues and the Oklahoma Department of Environmental Quality (ODEQ) continues water monitoring. EPA and ODEQ expenditures totaled just under \$10 million for the OU1 work.

The second designated OU occurred in 1995. It began as a result of information obtained from the Indian Health Service (IHS) concerning the concentration levels of lead in the blood of Indian children living in the area. IHS indicated that approximately 35 percent of the Indian children tested showed concentrations of lead in their blood that exceeded the level considered elevated by the Centers for Disease Control and Prevention. Subsequent county-wide testing showed that more than 30 percent of children had elevated blood lead levels. EPA found that tailings were located throughout residential properties in the Site. EPA cited that chat was commonly moved to use for fill and to cover driveways, alleyways, roadbeds, yards and home playgrounds. EPA also found that the foundations of area homes and business where local children regularly played were built on chat. In response, the EPA began sampling area soils and subsequently began the yard remediation activities that occurred from 1995 and are scheduled to conclude in 2003. EPA reports that more than 2,000 residential properties, day cares, schools, parks, and business properties in the five-city mining area have been remediated through this work. The EPA reports it has spent more than \$100 million to complete this work. Testing has shown a reduction in the percentage of children with elevated blood lead levels. This reduction has been attributed to a combination of the remediation and extensive public education campaigns on the dangers of lead and how to reduce exposures.

The third designated OU began in 1989 and ended in 1999. Pursuant to the request of the Quapaw Tribe, EPA investigated the abandoned Eagle Picher Industries mining laboratory located in Cardin. EPA disposed of 120 deteriorating containers of lead recovering chemicals at the laboratory. EPA estimated the cost of the OU3 work at \$55,000.

The fourth OU has only recently been designated. The EPA and U.S. Department of Justice are negotiating a proposed legal consent order and statement of work concerning the remedial investigation and feasibility study (RI/FS) with Department of Interior, Blue Tee Mining Company, and Gold Fields Mining Company. These entities are three of the potentially responsible parties (PRP) involved in the Tar Creek Superfund Site.

Although the RI/FS uses terms like "study," this is not simply another evaluation or study of the Site with no resulting action. An RI/FS is the first necessary action to identify the nature and extent of contamination and evaluate options for clean up. The RI/FS becomes the basis that establishes site remedies.

Oklahoma Plan for Tar Creek

Plan Summary

This plan was developed through the nonpartisan cooperation of political, academic, and tribal leaders. This plan is different from any other effort at the Tar Creek Superfund Site as this is the first time that leaders from the highest levels of federal, state, and tribal governments have been assembled to form a team to cooperatively address the issues at the Tar Creek Superfund Site. The efforts detailed in this document are the first steps of a scientifically sound comprehensive plan that will bring swift results on objectives where there are no legal obstacles to moving forward. We will start with issues that can be solved in a straight forward manner. These efforts will focus on the remediation of the perimeter area (e.g., Commerce, North Miami, Miami, and Quapaw), as well as work to protect human health in the Picher/Cardin area. We are also currently working to remove legal obstacles in the Picher/Cardin area, and will continually move the process forward as agreements are reached to achieve the final comprehensive solution for the Tar Creek Superfund Site.

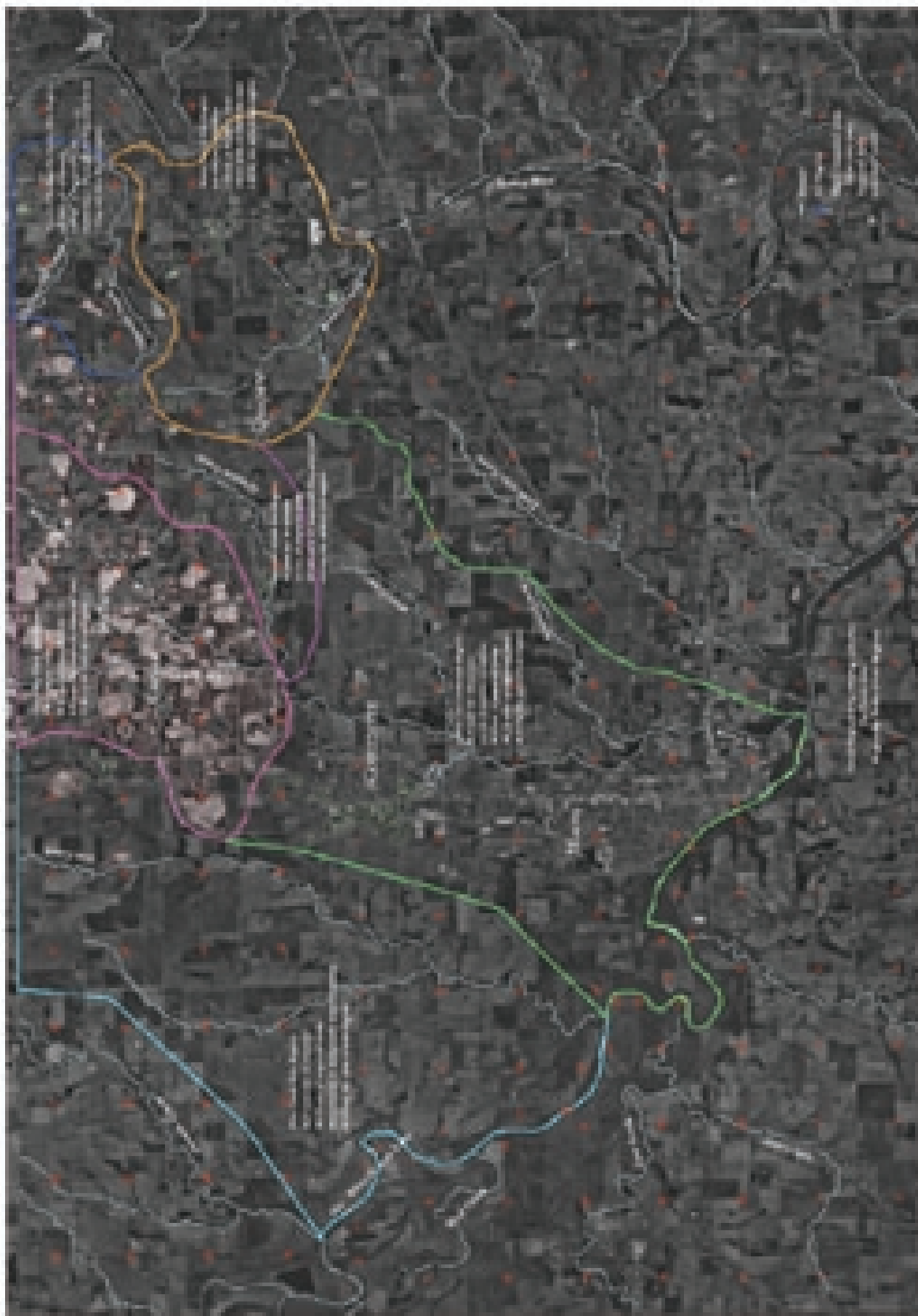
This plan effectively establishes more than a discrete set of cleanup projects; it also establishes a longer-term cleanup process. The technical team of the University of Oklahoma and the Oklahoma Department of Environmental Quality, in cooperation with the Quapaw Tribe and local leaders will implement practical solutions to environmental problems at the Tar Creek Superfund Site. The Site is divided into six subareas, five on the perimeter and one in the Picher/Cardin area. The initial efforts focus on the perimeter areas because there are no legal obstacles to moving forward in these areas, and these areas can be permanently restored over the next three to five years. Mitigation work will be implemented in the Picher/Cardin area to reduce exposure to lead dust and mine hazards.

This plan focuses on four objectives:

- **improving surface water quality**
- **reducing exposure to lead dust**
- **attenuating mine hazards**
- **land reclamation**

Improving Surface Water Quality – After the mines were abandoned they filled with water. Groundwater moves slowly through the mines reacting with heavy metals. Where the resulting mine drainage emerges on the surface, elevated levels of metals, especially iron, zinc, lead and cadmium, threaten both water quality and ecosystems. This plan is designed to remediate mine drainage with the construction of passive treatment systems. Harnessing the natural capacity of these highly productive ecosystems to sequester and filter heavy metals, systems will be designed, constructed and monitored to enhance water quality.

Reducing Exposure to Lead Dust – Lead dust is among the sources of exposure to lead for children and residents in the Tar Creek Superfund Site. This plan will focus on reducing sources of lead dust exposure by increasing the chat utilization in asphalt mixes, paving of remaining chat graded roads, and recontouring and revegetating chat piles and dry



millponds in close proximity to residences.

Attenuating Mine Hazards – The Tar Creek Superfund Site contains underground mines, vertical mineshafts, and drill holes. These mine workings pose a physical hazard as well as an environmental hazard. This plan will locate and map the mine hazards. Attenuation work will utilize chat to fill and seal mine hazards.

Land Reclamation – Chat accumulations throughout the Tar Creek site have scarred the land and inhibited productive use. This plan reclaims unproductive land through removal of chat for use as fill to close mine shafts and subsidence areas. These reclaimed areas and chat bases will be restored to productive use through grading, recontouring, and revegetation.

Parallel Steps –

While action is being taken to achieve the preceding objectives, the team is calling for parallel steps by the federal government regarding human health concerns. These parallel steps include the following:

- Requesting the EPA to use its emergency authority under CERCLA to make a determination if any residents inside the Tar Creek Superfund Site boundaries are at imminent risk and, if so, to take any and all appropriate measures to mitigate that risk. Additionally, as remediation plans are being developed for the Picher/Cardin area, this plan calls upon EPA to determine if any remedial activity would create exposure risk to residents and, if so, to take any and all appropriate measures to mitigate that risk.
- Requesting the Agency for Toxic Substances and Disease Registry (ATSDR) within the Center for Disease Control and Prevention to gather all available health data for the Tar Creek Superfund Site and evaluate any health threats to the children and residents.
- Requesting the ATSDR to consolidate all health information in order to develop a comprehensive health data base.
- Requesting the ATSDR to work with tribes to address tribal health concerns.

Pursuant to the Tar Creek Memorandum of Understanding among federal and state agencies reached under the leadership of Senator Jim Inhofe, the U.S. Army Corps of Engineers initiated work in August 2003 on the Tar Creek and Spring River Watershed Management Plan, which will evaluate short and long-term solutions that could be implemented to reduce flooding and improve ecosystems. The team will continue to work with the Corps of Engineers as this plan is being developed.

Members of the team will also partner with the Quapaw Tribe on efforts to consolidate ownership of chat on Quapaw member's land and reach an agreement with the Bureau of Indian Affairs to allow Quapaw members to sell their chat. Additional efforts to provide certainty to consumers of chat and incentives to increase its commercial use will also be undertaken by members of the team.



PLAN DETAILS

Passive Treatment of Metal Contaminated Mine Waters

- Mine drainage in the Tar Creek Superfund Site contains high concentrations of metals and sulfate that detrimentally impact water quality in receiving streams.
- The University of Oklahoma will lead in developing passive treatment systems to **remediate the water.**
- The University of Oklahoma has selected a site southeast of Commerce to implement **the first passive treatment system.**
- Passive treatment systems can be **implemented at other sites** within the Tar Creek Superfund Site.
- The result of implementing passive treatment will be **remediation of polluted mine drainage and improvement of water quality** in receiving streams.
- This will be the **first installation of a mine water treatment facility of any kind** at the Tar Creek Superfund Site.
- Construction of the system will take one year from commencement of work. Monitoring and analysis of the system will be conducted for the next two to four years

We will implement passive treatment systems to treat mine drainage contamination at the Tar Creek Superfund Site. The primary objective is to improve the quality of a polluted mine drainage discharge. The initial work will provide valuable insight for further passive treatment system implementation.

Problem Statement: Tar Creek mine drainage is characterized by elevated concentrations of metals (especially iron, zinc, lead and cadmium), mineral acidity and sulfate. Passive treatment technologies, i.e., those that rely on natural biogeochemical and microbiological processes to ameliorate mine drainage problems, provide a viable and cost-effective treatment alternative. Passive systems require less operational and maintenance labor and have lower initial costs but require larger land areas than traditional active chemical treatment systems. Based on the results of laboratory studies and field demonstration projects completed by the University of Oklahoma, a passive treatment system specifically designed for Tar Creek mine drainage will be implemented.

Implementation Location: We will implement the initial passive treatment system at a well-studied discharge in southeast Commerce, Oklahoma. The Commerce discharge has exited an abandoned borehole and entered a former horse pasture since 1979. Copious iron precipitation occurs as the mine water meanders to the receiving stream, an unnamed tributary to Tar Creek. The pasture has been transformed into a cattail marsh over the past 24 years. A second location in the Beaver Creek watershed is planned to mitigate mine water drainage.

Implementation Tasks:

Task 1 - Location and Characterization of Mine Drainage. The spatial location of the implementation site will be determined using a Global Positioning System and will be incorporated into the site-wide Geographic Information System. Existing water quality data (pH, dissolved oxygen, temperature, conductivity, turbidity, total alkalinity, iron, zinc, lead, cadmium, sulfate, calcium, magnesium, sodium, chloride and manganese) and discharge (flow rate) information will be compiled and analyzed for calculation of contaminant loadings.

Task 2 - Develop Conceptual Designs. Based on the available data and initial evaluation of on-site characteristics, a passive treatment system conceptual design will be developed for the selected discharge. The following figure demonstrates a preliminary conceptual design based on available existing information.

Task 3 - Landowner Permission and Stakeholder Consent. In conjunction with federal and state agencies, tribal authorities, local governments, interested stakeholders, and private landowners, permission for implementation and access will be acquired. The conceptual design will be presented and discussed with all interested parties.

Task 4 - Design and Size Passive Treatment System. Based on the results of an on-site survey, site-specific remedial designs will be developed. Due to existing drainage ways at the proposed site, storm water will need to be managed and redirected. Bid specifications, cost estimates and project schedules will be developed.

Task 5 - Construction of Passive Treatment System. Based on contractor availability and local stakeholder input, the passive treatment system will be constructed. Because the mine drainage discharges from abandoned workings, the existing borehole needs to be re-cased and flow will be redirected, at the appropriate elevation, to the implementation site.

Task 6 - Performance Monitoring. After construction, the passive treatment system will be evaluated from several perspectives. Input/output water quality/quantity monitoring will be conducted on a regular basis. In addition, in situ and ex situ biogeochemical analyses will be conducted in surface and pore waters and substrates, as well as microbiological and ecological analyses.

Expected Outcomes: This work will result in the remediation of a polluted mine drainage discharge to acceptable quality for the maintenance of the receiving water body aquatic

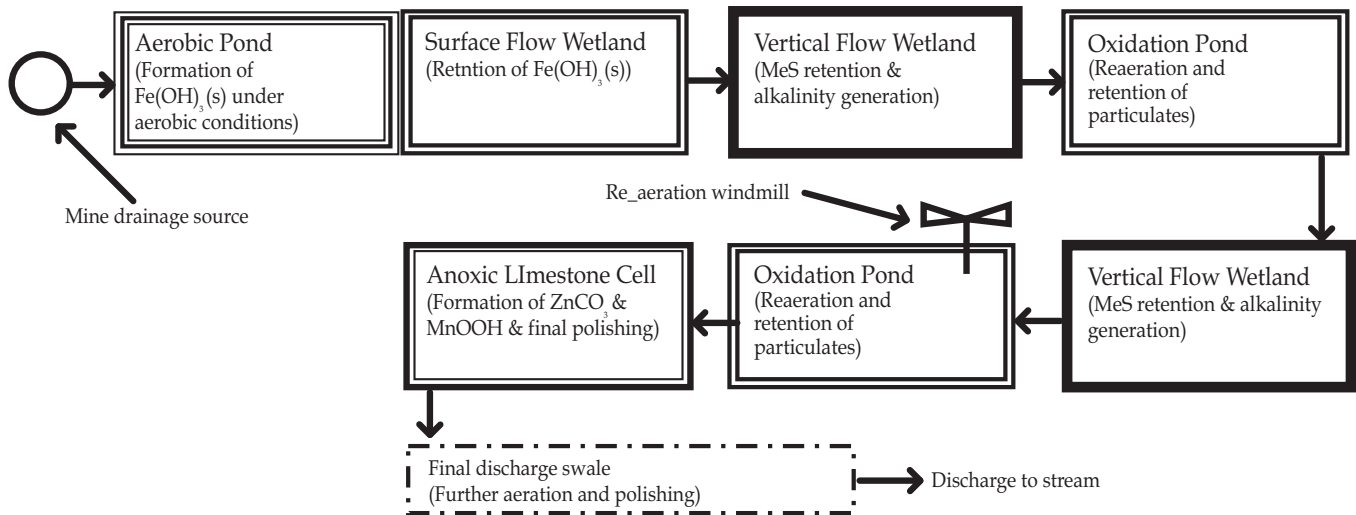


community. Furthermore, this work will provide the first installation of a mine water treatment facility of any kind at the Tar Creek Superfund Site. We anticipate short-term technology transfer activities will enhance the utility of these technologies and speed their application to other locations. Because of the high profile of the Tar Creek site, successful passive treatment here will help determine the future of this technology and its application elsewhere.

Coordination: The Passive Treatment Systems work will require close coordination with the Stream Restoration work.

Cost Estimate: Appropriations are expected over a three-year period. Construction of the passive treatment system will begin in the first year from commencement of work. Performance monitoring will continue for the duration of the work.

	Year 1	Year 2	Year 3	Total
Commerce-North Miami	\$840,000	\$370,000	\$390,000	\$1,600,000
Other Perimeter	\$2,000,000	\$790,000	\$830,000	\$3,620,000
Yearly Total	\$2,840,000	\$1,160,000	\$1,220,000	\$5,220,000



Stream Restoration

- Past mining activities in the Tar Creek Superfund Site have resulted in degradation of streams.
- The Oklahoma Department of Environmental Quality **will remove chat and mine waste that clog streams** and other water channels.
- **Stream remediation** adjacent to large chat piles will be coordinated with chat pile management plans.
- The first result of this work will be **restoration of stream segments** in the North Miami and Commerce areas followed later by restoration at other surface water sites.
- Remediation activities will be completed within three to five years.

We will remove chat from stream channels. This will improve drainage and water quality. This work will be coordinated as needed with implementation of passive treatment systems for mine drainage discharges and land remediation and restoration activities.

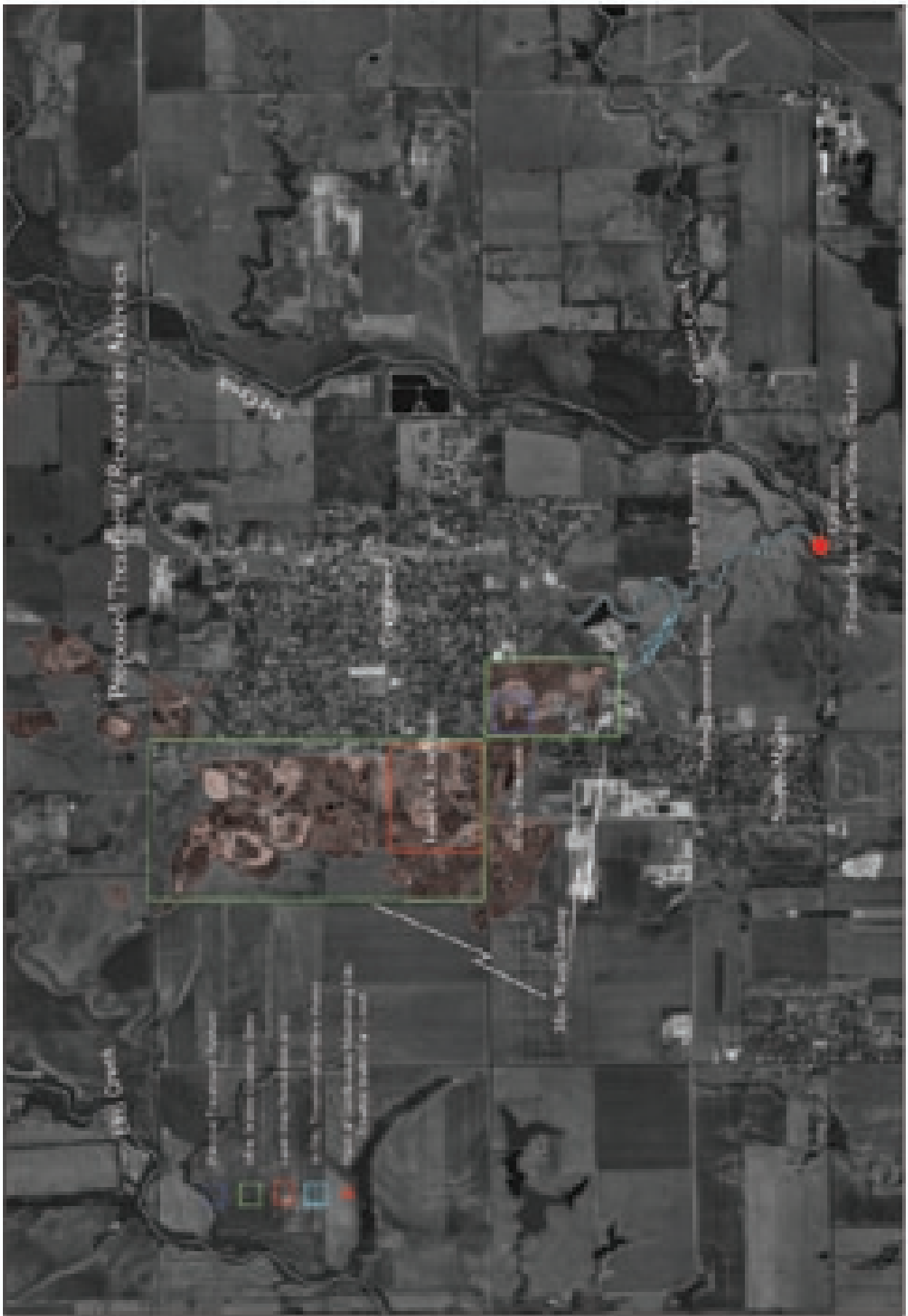
Problem Statement. Historical mining activities in the Tar Creek Superfund Site have resulted in large accumulations of chat and other mine wastes on the land surface. Over time, portions of the chat have been washed into stream channels. Chat in stream channels contributes to degradation of the water quality. In addition, clogging of the stream channels exacerbates flooding during rainfall events.

Implementation Location: Chat will initially be removed from three miles of stream segments in the North Miami/Commerce area and from streams in the Beaver Creek watershed. Stream clearing will be expanded to other perimeter areas of the site.

Implementation Project Tasks:

Task 1 – Site Mapping and Access. Impacted stream segments will be identified by field reconnaissance. The locations of chat accumulations in stream segments will be incorporated into the Geographic Information System (GIS) mapping database. Permission to access land adjacent to stream channels will be obtained from property owners.

Task 2 – Data Acquisition and Field Measurements. Relevant published data (e.g., U.S. Geological Survey stream flow data) on the impacted streams will be collected. Limited



field data (e.g., stream elevations, stream flows, etc.) will be collected as needed.

Task 3 - Stream Restoration Plan. The restoration plan will include details on final elevations, contours, disposition of dredged chat, and revegetation of the riparian banks to ensure stable stream morphology (meanders, gradient, etc.) and evaluate seasonal flooding. The dredged material may be used as fill in land restoration, for plugging mine shafts, stockpiled for reuse, or placed with other chat to be vegetated.

Task 4 - Implementation. ODEQ will gather the data and prepare the restoration plan. Construction will be managed by ODEQ and accomplished by local governments or contractors.

Task 5 - Monitoring. Stream segments will be periodically monitored to assess the effectiveness of the restoration efforts. Each segment will be visually surveyed to identify new accumulations of chat or areas of accelerated erosion. Water quality samples will be collected as part of the Environmental Monitoring project.

Expected Outcomes: Removal of chat from stream channels will improve drainage and water quality and enhance the success of other proposed water quality improvement projects.

Coordination: Clearing chat from streambeds will be coordinated with the passive treatment systems, mine hazard attenuation, and land restoration projects. The U.S. Army Corps of Engineers will evaluate region-wide flooding and drainage. The EPA is negotiating with Potentially Responsible Parties (PRPs) on the investigation and cleanup of mining waste. The ODEQ will coordinate its proposed work with these agencies, as well as the Quapaw Tribe to ensure work is efficiently performed.

Cost Estimate: Appropriations are expected over a three-year period. Construction will proceed over a five-year period.

	Year 1	Year 2	Year 3	Total
Commerce Sub-area	\$23,000	\$23,000	\$74,000	\$120,000
Perimeter Area	\$333,000	\$333,000	\$334,000	\$1,000,000
Mitigation Area	\$6,000	\$6,000	\$6,000	\$18,000
Totals:	\$362,000	\$362,000	\$414,000	\$1,138,000



Maximum Chat Utilization in Asphalt Paving - Pavement Test Road

- Large quantities of chat have been used over the years to grade unpaved area roads and driveways.
- Fine particles from the chat contain elevated levels of lead that contribute to high blood lead levels in the area children.
- Paving chat roads and encapsulating chat in asphalt **reduces exposure and risk.**
- Based on previous laboratory studies, the University of Oklahoma will **pave a test section maximizing chat content in asphalt.**
- The University of Oklahoma will closely **monitor air and water quality** at the implementation site.
- The result of this work will be a determination of the **optimum chat-in-asphalt mix** that can be widely applied as road paving continues in the area.
- This work will provide **the first comprehensive analysis** of the engineering and environmental aspects of chat-asphalt roads.
- The test section will be paved in the first year from commencement of work. Monitoring activities will be ongoing.

We will implement a chat-asphalt paving test road to address safe and cost-effective utilization of mining wastes from the Tar Creek Superfund Site. The primary objective is to pave a test section of road to demonstrate the engineering viability and environmentally responsible use of pile-run (raw) chat in asphalt pavement. This work will provide valuable insight for further large-scale chat-asphalt road paving projects.

Problem Statement: More than 75 million tons of processed mining waste materials (chat) are stockpiled on the surface of the Tar Creek Superfund Site. Chat piles encompass local residences and communities, posing health risks. Chat in its bulk form contains elevated levels of metals, raising serious human health and ecological concerns. The smaller size fractions contain most of the lead, zinc, and cadmium. Laboratory testing shows that encapsulation of chat in hot mix asphalt (HMA) presents a safe and cost-effective means to use this material and decrease environmental risk. However, chat is usually size-separated and washed prior to use in asphalt, with only the larger size

fractions used as aggregate. A relatively small percentage of chat is currently used in most asphalt applications. Based on the results of laboratory mix design studies completed at the University of Oklahoma, a test section of road will be built using maximum pile-run (raw) chat. The road will be monitored for engineering and environmental parameters.

Implementation Location: We will implement the initial chat-asphalt pavement test section in the Commerce-North Miami area. By analyzing the effectiveness and safety of maximum pile-run chat use in asphalt roads, problems and issues related to site-wide paving projects will be identified and addressed in a prudent and timely manner.

Implementation Tasks:

Task 1 - Determination of Asphalt Mix Design. Formulation of the mix design will focus on using the maximum amount of pile run chat in HMA. Conventional mix design-related tests (specific gravity, absorption, sand equivalent, durability, insoluble residue, volumetric properties, optimum asphalt content, aging, weathering, etc.) will be conducted. The results of laboratory mix design studies will be compared to paving needs in Ottawa County to determine the appropriate asphalt mix design for pavement test section installation.

Task 2 - Identification of Implementation Location. The location and timing of the pavement test section (400 feet) installation will be coordinated with appropriate city, county, state and tribal entities to maximize usefulness. Spatial locations will be determined using a Global Positioning System for incorporation into the Geographic Information System mapping database.

Task 3 - Characterization of Existing Chat Road. The existing chat road will be sampled prior to installation of the pavement test section. Vertical holes will be drilled at several locations and samples collected for laboratory testing (layer thickness, in-situ moisture, optimum moisture, maximum density, strength, resilient modulus, etc.). The results of these tests will be used to determine the “layer coefficient”, an important parameter that will dictate the design thickness of the surface course.

Task 4 - Collection of Traffic and Weather Data. Determination of equivalent single axle loads (ESALs) requires traffic data (number and composition) that are generally not available for county roads. Weather data for the selected site will be obtained from the Oklahoma Mesonet.

Task 5 - Design Plan. A design plan, including elevations, drainage structures, and cut and fill volumes will be completed. The design engineer will also develop bid specifications, cost estimates and project schedules, in cooperation with the associated agencies/offices.

Task 6 - Construction of HMA Surface Course. Based on contractor availability and input from the associated agencies, the pavement test section will be constructed. The County will be contracted to manage the work, using either its own labor and equipment



or subcontractors. Construction will be monitored by the project team. Asphalt cores will be taken during construction for laboratory testing to compare laboratory design with the compacted asphalt in the field.

Task 7 - Monitoring of Field Performance and Milling. The performance of the rehabilitated pavement will be monitored for a year for rutting, stripping, flushing, and cracking. Also, the pavement will be cored periodically and the properties of the cores evaluated. After a year of service, a segment (100 ft) of the pavement will be milled. Engineering and environmental analyses will be conducted during the milling operation to further evaluate the chat-asphalt pavement over its entire lifetime.

Task 8 - Environmental Monitoring. After construction is completed, the pavement test section will be subjected to standard traffic loads. To evaluate any associated environmental risks, regular environmental monitoring will be conducted. If appropriate, storm water sampling and analyses will be conducted to evaluate leaching of metals from the asphalt pavement. Samples will be analyzed for metal (lead, zinc and cadmium) concentrations. Air quality monitoring will include particulate matter, lead and silica.

Expected Outcomes: Although chat-asphalt paving has been previously conducted in the Tar Creek area, this project will provide the first comprehensive analyses of engineering and environmental aspects of chat-asphalt roads. We anticipate short-term technology transfer activities will enhance the utility of these technologies and speed their application to other locations.

Coordination: The University of Oklahoma is currently researching the use of chat in asphalt. The results of this study will be used to develop mix designs for the test section and for paving other roads. This work will be coordinated with the local city personnel, the county commissioners, the Oklahoma Department of Transportation, the U.S. Department of Transportation and with other groups engaged in asphalt and environmental studies.

Cost Estimates: Appropriations are expected over a three-year period. The test section will be paved in the first year from commencement of work.

	Year 1	Year 2	Year 3	Total
Commerce - North Miami	\$100,000	\$100,000	\$100,000	\$300,000

Chat Utilization



- Fine particles from graded chat roads contain elevated levels of lead that contribute to high blood lead levels in the area children.
- The Oklahoma Department of Environmental Quality will contract to **pave roads using chat asphalt.**
- The Oklahoma Department of Environmental Quality will ensure that these activities **do not pose environmental risk to residents.**
- The result of this work will be the **paving of all unpaved roads** in the Tar Creek Superfund Site.
- Initial paving will be completed in Picher and Cardin within the first year of work. Additional paving in other areas will be completed in the subsequent three to four years.

We will use chat in asphalt and as fill material in mine shafts and subsidences. The primary objective of these projects is to hasten the removal of chat piles through maximum practical and safe utilization of chat. Gravel roads will be paved using chat in the asphalt mix. Chat will also be used in land restoration activities to fill abandoned mine shafts and subsidences.

Problem Statement: There are approximately 75 million tons of chat piled throughout the Tar Creek Superfund Site. The region is served by approximately 70 miles of unpaved roads. Lead dust generated by the uncontrolled chat piles and chat-covered roads represents a health risk for local residents. By utilizing chat-based asphalt to pave these roads, the volume of chat will be reduced, lead dust generation will be suppressed and health risks will be mitigated. Chat will also be used in mine hazard attenuation and land restoration activities.

Implementation Locations: Initially, we will pave approximately 4 miles of haul roads in the Picher/Cardin area and approximately 15 miles of chat and gravel roads in the North Miami/Commerce area. Subsequent projects will be located in the other perimeter areas. We will also use chat as fill in land restoration and mine hazard attenuation activities in the perimeter.

Implementation Tasks:

Task 1 - GIS Mapping. Chat and gravel roads within the Tar Creek Superfund Site will be identified. The locations of these roads will be incorporated into a site-wide Geographic Information Systems mapping database. Traffic loads and road use will be analyzed to identify the roads to be paved. The Oklahoma Department of Environmental Quality will also work with the County Commissioner to assign priorities and set schedules.

Task 2 - Asphalt Mix Design. Asphalt specifications will be written to accommodate traffic loads

and road uses. Recommendations from the University of Oklahoma’s chat-in-asphalt study will be used for mix design. The County and the Oklahoma Department of Transportation will review and approve the specifications.

Task 3 – Road Design. A design plan, including elevations, drainage structures, and cut and fill volumes will be completed. Land surveys will be completed to document road locations, elevations and drainage patterns. The design engineer will use these data to develop specifications and cost estimates for paving each road.

Task 4 – Road Paving. The County will be contracted to manage the work, using either its own labor and equipment or subcontractors.

Task 5 – Environmental Monitoring. During installation of the pavement, environmental analyses of chat, asphalt, water and air quality will be conducted. For solid samples, these analyses will include metal (lead, zinc and cadmium) concentration determinations via the total digestion procedure. Air quality monitoring will include particulate matter, lead and silica.

Task 6 – Public Information. The County will provide timely information on road closures and alternate routes during road paving.

Expected Outcomes: This project will reduce exposure to lead by paving most of the unpaved chat roads in the Tar Creek Superfund Site. Work will begin in the initial area and in Picher/Cardin and will expand to the other areas of the perimeter.

Coordination: The University of Oklahoma is currently researching the use of chat in asphalt. This study will evaluate the environmental safety of using chat and its associated metals, as well as the engineering properties of the resulting asphalt. Chat is currently being used commercially in asphalt.

EPA is working with the Potentially Responsible Parties (PRPs) on the investigation and clean up of mining wastes. While this process is ongoing, the chat utilization project will remove a portion of chat and decrease exposure by paving roads.

Cost Estimate: Appropriations are expected over a three-year period. Initial paving will be completed in the Picher/Cardin area within the first year of work. Additional paving in other areas will be done in the subsequent three to four years.

	Year 1	Year 2	Year 3	Total
Commerce Subarea	\$390,000	\$570,000	\$750,000	\$1,710,000
Other Perimeter Subareas	\$2,100,000	\$3,100,000	\$2,600,000	\$7,800,000
Picher/Cardin subarea	\$510,000	\$510,000	\$520,000	\$1,540,000
TOTAL	\$3,000,000	\$4,180,000	\$3,870,000	\$11,050,000



Land Remediation and Restoration

- Mine waste throughout the Tar Creek Superfund Site has scarred the land.
- The Oklahoma Department of Environmental Quality, in conjunction with local, state, tribal, and federal conservation agencies will **revegetate scarred areas**.
- The Oklahoma Department of Environmental Quality has **selected an area west of Commerce to begin work**. The area contains chat bases, subsidences, and mine shafts.
- The work will include removing chat and using it as fill to **close mine shafts and subsidences, grading the remaining chat on the surface to be covered with organic matter, and revegetating in the Site area**.
- The result of this work will be **revegetation of mine impacted lands** within the Site area.
- The time frame for implementation and monitoring at the initial site in Commerce is two years; the expanded work throughout the perimeter area will be completed in three to five years.

We will restore mine-scarred land in the perimeter area and vegetate chat piles and mill ponds that are close to residences. Land restoration work will reduce human exposure to lead dust and will return land in the perimeter areas to productive use.

Problem Statement: Chat piles, chat bases, and millponds expose people to lead and eliminate productive use of the land they occupy. Chat bases are the materials left after removal of the larger chat piles. Millponds are the finer materials rich in lead left from milling processes. Land restoration will remove or revegetate these features in the perimeter areas. In the Picher/Cardin area, targeted chat piles and mill ponds located close to residences will be covered to reduce exposure.

Implementation Location: The first land restoration projects will be located west of Commerce, Oklahoma. This area covers about 381 acres. Work will then proceed to the other parcels in the perimeter area. Vegetation will be established on exposed targeted chat pile faces and mill ponds in the Picher/Cardin area.

Implementation Tasks:

Task 1 - GIS Mapping. Recent aerial photos, topographic maps and land ownership maps will be digitized and imported into a Geographic Information System (GIS) format, resulting in a GIS base map. The map will depict waste accumulations and areas with native soil for borrow material.

Task 2 – Site Sampling. Boring, auguring and trenching will be used to quantify the volume of mine waste accumulations on the surface and at depth. Hazards, such as mine shafts, boreholes, and subsidences will be located. Sampling and analysis of soils will yield data needed for planning appropriate soil amendments.

Task 3 – Land Restoration Plan. A conceptual plan will be developed for each parcel of land to be remediated. Restoration techniques may include removing chat for offsite reuse, using chat and rock as fill for mine shafts and subsidence features, grading the surface, and importing clean soil. Organic matter will be added where necessary. Native prairie or pasture grasses will be established. These techniques have been implemented on a site east of Picher and a site west of Commerce. It may also be cost effective to accomplish some of these tasks through a regime of feeding livestock, allowing the animals to generate and deposit the organic matter.

Lead dust from the chat piles in the Picher/Cardin area will be reduced through the use of contouring and temporary covers. Vegetation, chemical fixatives, and other artificial covers will be evaluated.

Task 4 – Implementation. The Oklahoma Department of Environmental Quality and other Oklahoma soils experts will gather the data and formulate the land remediation plans. Construction will be contracted to local governments or private contractors. ODEQ will oversee the work and monitor the results.

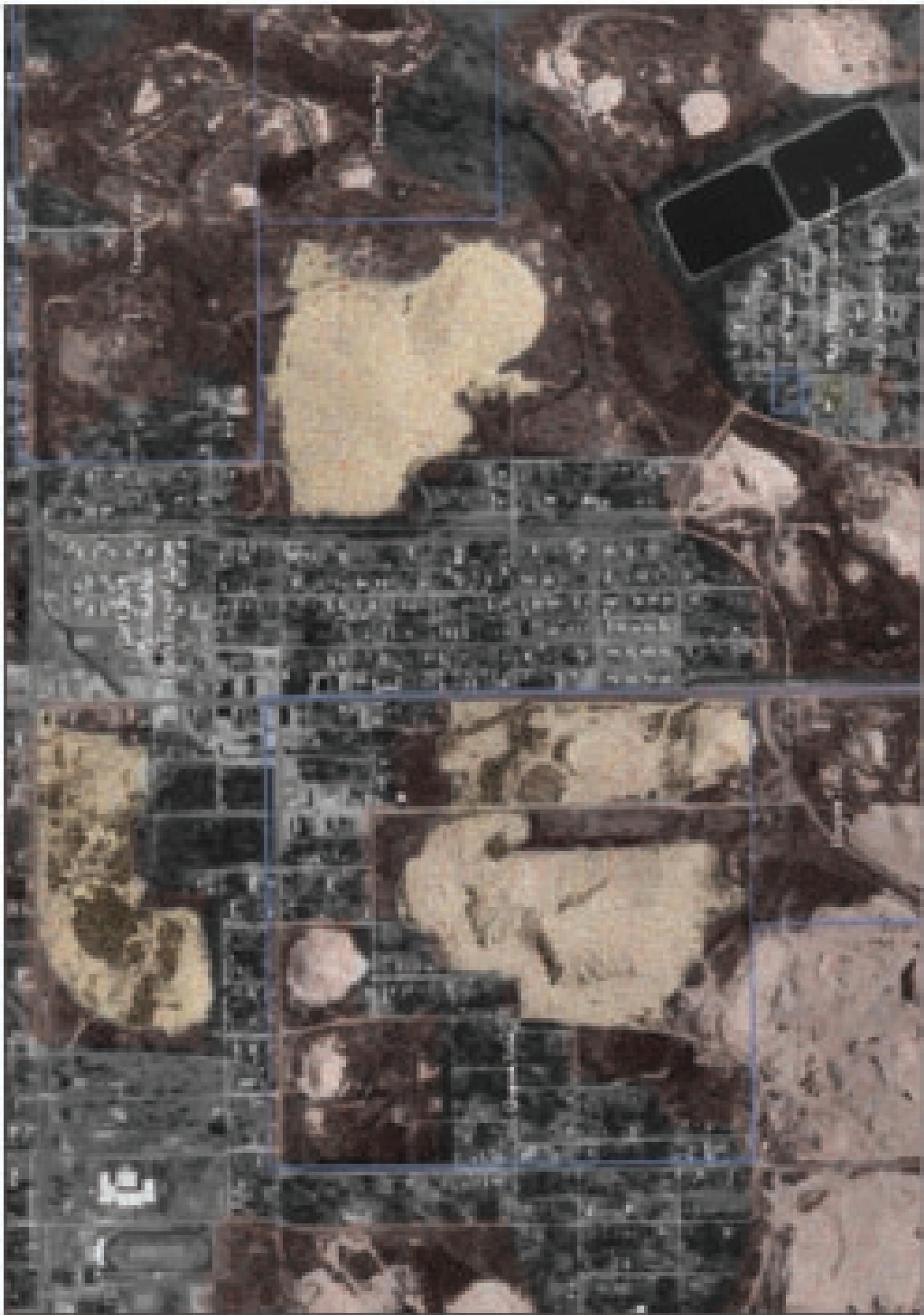
Expected Outcomes: Perimeter areas that are now unvegetated will be returned to native prairie or productive pasture. Chat piles will be removed and mine shafts and subsidence features will be closed. In Picher/Cardin, some areas of mining waste will be vegetated to reduce exposure.

Coordination: Land restoration projects will require close coordination with the Mine Hazard Attenuation and the Chat Use projects. Mine shafts and subsidences may be sealed and filled with chat and larger rock. Substantial chat piles may yield material for reuse offsite.

EPA is negotiating with the Potentially Responsible Parties (PRPs) to conduct an investigation and clean up of the mining waste. The Land Remediation and Restoration project will remediate mining wastes in the perimeter areas while the EPA investigation is underway.

Cost Estimates: Appropriations are expected over a three-year period. Construction will be completed over a three to five-year period.

	Year 1	Year 2	Year 3	Total
Commerce Subarea	\$1,05,000	\$1,500,000	\$2,500,000	\$5,050,000
Other Perimeter Subareas	\$2,600,000	\$2,600,000	\$3,100,000	\$8,300,000
Picher/Cardin subarea	\$520,000	\$540,000	\$540,000	\$1,600,000
TOTAL	\$4,170,000	\$4,640,000	\$6,140,000	\$14,950,000





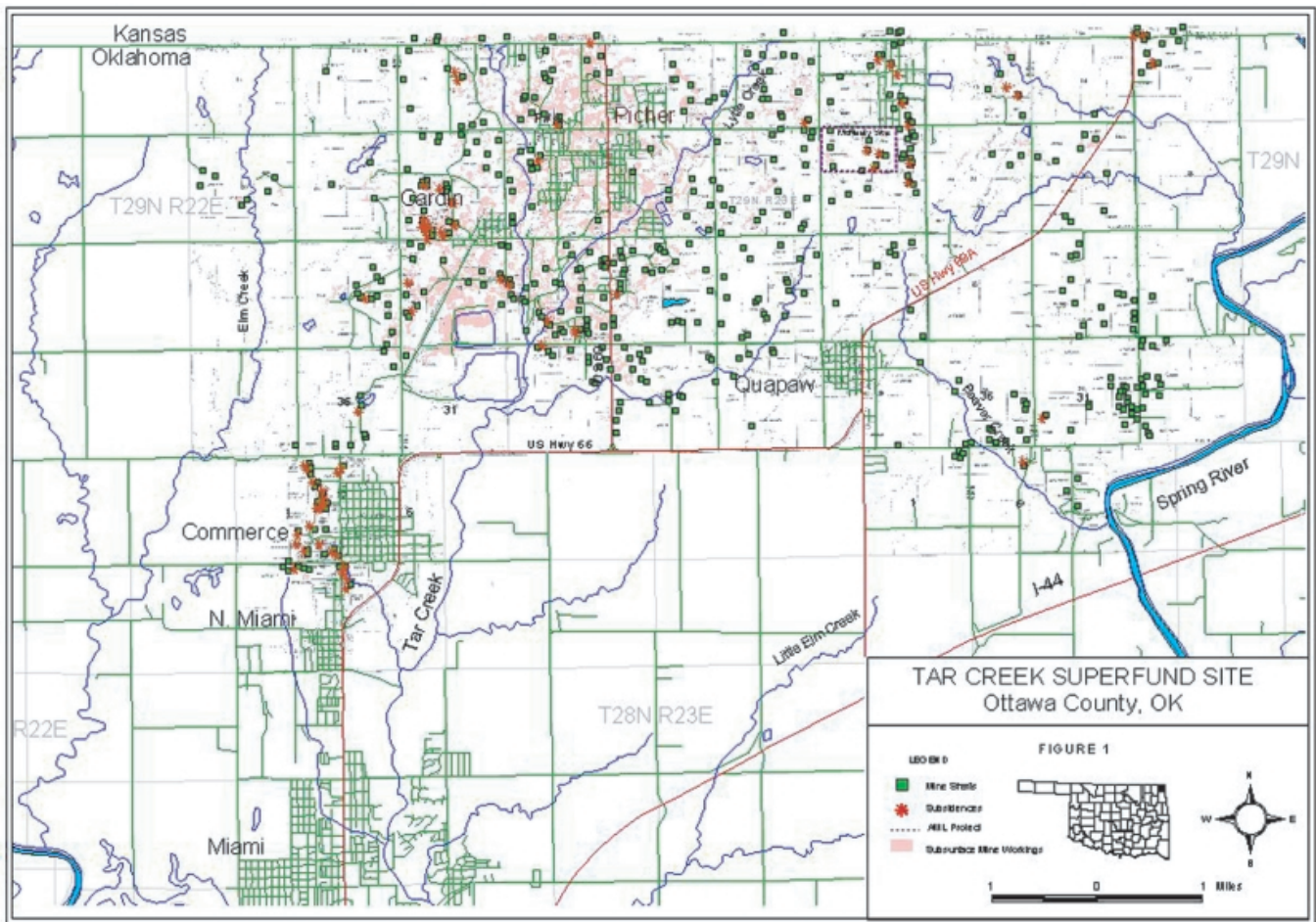
Mine Hazard Attenuation

- Mining activities in the Tar Creek Superfund Site have resulted in miles of underground mine voids, mine shafts, and drill holes.
- Some of the undermined areas have collapsed or subsided and created large craters throughout the Tar Creek Superfund Site.
- Open mine shafts and subsidences present safety hazards.
- Oklahoma Department of Environmental Quality has selected for implementation land west and south of Commerce, which includes more than thirty open mine shafts and ten subsidence areas.
- The Oklahoma Department of Environmental Quality will use chat and other fill materials to **close mine shafts and subsidences**. ODEQ has performed a pilot reclamation with the Oklahoma Conservation Commission near Hockerville.
- **Mapping of subsurface cavities** will aid local authorities in management of surface development / land use in areas of high risk. The Oklahoma Department of Environmental Quality will work with local and tribal governments to create workable land use plans.
- The result of this work will be management of physical and environmental hazards posed by open mine shafts and subsidences in the Site area. Coupled with the land restoration activities, much of the **impacted land in the area will be permanently restored**.
- The time frame for completing the mine hazard attenuation activities is three to five years.

We will reduce the hazards from open mine shafts, boreholes, sinkholes, and potential subsidence areas. Closure of mine hazards and filling of sinkholes will be among the first steps in the land restoration process. We will also produce more detailed maps of undermined areas that will aid local officials in land use planning. The maps will also aid others in the evaluation of subsidence potential.

Problem Statement:

Historical mining left miles of underground mine voids, vertical mine shafts, and drill holes. These penetrations are immediate safety hazards. Since they are all in various stages of collapse, there is also a danger of future subsidence. This project will close most mine shafts that are open to the surface, fill some subsidences, and create more detailed maps of the undermined areas.



Implementation Location: Work will begin west and south of Commerce, Oklahoma, where thirty mine shafts, ten subsidence features and pockets of undermining exist. The undermined areas in Commerce and Picher/Cardin will be mapped to include more information about the subsurface. This map will be useful to others in the evaluation of subsidence potential. Work will then proceed to other perimeter areas.

Implementation Tasks:

Task 1 - Data Collection and Mapping: Information on the number and location of open mine shafts and sinkholes, depth and volume of these features, location of undermined areas; cap-rock depth, thickness and type; and land ownership and usage will be compiled and mapped. The GIS base map will form the basis for planning, cost estimating, and budgeting.

Task 2 - Data Acquisition and Field Measurements: Field inspections will verify the location and condition of mine shafts and sinkholes. Geophysical surveys may be used to locate shallow underground mine voids. The ceiling heights of the mines, depth of mining, cap rock type and thickness will be determined for each land area using information from boring logs and half section mine maps. The volume of nearby mine waste will be compared to the subsurface void space of the mine shafts and sinkholes to assess its sufficiency for fill.

Task 3 - Construct Detailed Subsurface Map: All the data will be compiled to produce a subsurface map that can be used to evaluate subsidence potential.

Task 4 - Implementation: The Oklahoma Department of Environmental Quality will gather the data and prepare plans. Construction will be managed by ODEQ and accomplished by local governments or contractors. Construction is expected to begin late in the first year and be completed in the Commerce area before the end of the third year. Construction in the remaining perimeter areas will be completed by the fifth year.

Task 5 - Monitoring and Reporting: Each of the closed structures will be visually inspected on an annual basis to identify any unexpected changes (e.g., subsidence of fill material). Necessary repairs will be implemented immediately. The integrity of the closed structures will be summarized in an annual report.

Expected Outcomes: By the end of five years this project will plug the mine shafts and fill the subsidences that are the most dangerous in the perimeter area. By the end of three years the detailed subsurface map of Commerce and Picher/Cardin areas will be completed. By the end of the fifth year, the subsurface map of the remainder of the areas will be completed.

Coordination: The Oklahoma Department of Environmental Quality will consult with the Oklahoma Conservation Commission (OCC) on mine shaft plugging activities. Experts with federal and state mining agencies will be consulted for technical assistance. Active participation of the Department of Interior is critical to completion of the subsurface maps and subsequent evaluation of subsidence potential across the area. ODEQ will work with local governments and the U.S. Department of Interior which have the only legal tools to control land use in the undermined areas.

Cost Estimate: Appropriations are expected over a three-year period as presented below. Construction will proceed over a five-year period.

	Year 1	Year 2	Year 3	Total
Commerce Subarea	\$150,000	\$150,000	\$150,000	\$450,000
Other Perimeter Subareas	\$3,520,000	\$3,570,000	\$2,250,000	\$9,340,000
Mitigation Area (mapping only)	\$20,000	\$20,000	\$20,000	\$60,000
Totals:	\$3,690,000	\$3,740,000	\$2,420,000	\$9,850,000



Remediation and Restoration Monitoring

- The University of Oklahoma will **implement an environmental monitoring program** to evaluate the success of the remediation work throughout the Tar Creek Superfund Site.
- The work will include **monitoring surface water, groundwater and air quality**.
- Environmental monitoring is essential to ensure **proper and comprehensive evaluation** of remediation and restoration projects.
- The University of Oklahoma will coordinate with the U.S. Geological Survey to **expand the mine water modeling activities** underway at the Tar Creek Superfund Site.
- The monitoring will provide demonstration of the **results of the remediation and restoration efforts** and will help guide others in safely implementing work in the area.
- The monitoring activities will be implemented within the first year of work, and will continue for the duration of the remediation work.

We will implement a comprehensive environmental exposure monitoring program to evaluate remediation success at the Tar Creek Superfund Site. Monitoring will allow us to assess the effectiveness of the various remediation technologies and thus provide valuable insight for further larger-scale remediation implementation.

Problem Statement: The Tar Creek Superfund Site is characterized by contaminated surface and ground waters, soils, mining wastes (both chat and flotation tailings) and air. Any efforts implemented to alleviate human health and ecological exposure hazards from these media require collection and analysis of adequate types and amounts of both pre- and post-implementation environmental data.

Remediation Monitoring Location: We will implement the initial remediation monitoring efforts in the Commerce-North Miami area. Land and water remediation work is likely to begin in the short-term in these areas. As larger comprehensive remediation and restoration work is implemented, the remediation monitoring plan will be modified accordingly.

Implementation Tasks:

Task 1 - Surface and Ground Water Quality Information. All sources of existing information will be reviewed and existing data gaps identified. Additional data collection needs specific to project implementation, e.g., passive treatment systems, will be identified.

Task 2 - Mine Pool Characterization and Mapping. In conjunction with ongoing mine hazard attenuation projects, core logs, mine maps and other data will be used to identify sources and sinks of ground water contamination, undermined areas, and open shafts and boreholes.

Task 3 - Identification and Location of Water Pollution Sources. Through both remote sensing techniques and ground-truthing, sources of upwelling mine water discharges and chat pile and flotation pond runoff will be identified and located on a Geographic Information Systems base map.

Task 4 - Surface Water Quality Monitoring. A regular water quality and quantity monitoring effort will be conducted for upwelling mine water discharges, chat pile and flotation pond runoff and stream waters. Regularly scheduled base flow sampling episodes will be coupled with storm event sampling episodes to evaluate seasonality and effectiveness of the work. Flow measuring devices (weirs, flumes, etc.) will be installed at appropriate locations. Water quality parameters to be assessed include pH, dissolved oxygen, temperature, conductivity, turbidity and total alkalinity, iron, zinc, lead, cadmium, sulfate, calcium, magnesium, sodium, chloride and manganese.

Task 5 - Air Quality Information. All sources of existing air quality information will be reviewed including available data generated by the ambient air quality monitoring already being conducted in the Picher/Cardin area by the Quapaw Tribe. Any existing data gaps will be identified. Existing meteorological information, including existing monitoring station data, will be gathered. Additional data collection needs specific to project implementation, e.g., chat-asphalt road paving, will be identified.

Task 6 - Airborne Contaminant Receptors. Receptors (population centers) and potential pollution sources (chat piles, flotation ponds, chat processing facilities, chat roads, remediation work) will be identified and spatially coordinated on a Geographic Information System.

Task 7 - Air Quality Monitoring. A regular air quality monitoring effort will be conducted in receptor and source areas, as well as at implementation sites. This work will augment the ambient air quality monitoring already being conducted in the Picher/Cardin area by the Quapaw Tribe. Regularly scheduled sampling episodes will be coupled with more intensive efforts during specific operations, e.g., chat removal and road paving. Meteorological parameters (air temperature, relative humidity, barometric pressure, wind speed and direction, precipitation, solar radiation, soil temperature, etc.) will be collected. Air quality parameters to be assessed include particulate matter, lead, and silica.

Expected Outcomes. This project will result in the collection of essential and vital data appropriate to comprehensive remediation of contaminated environmental media at the Tar Creek Superfund Site. We anticipate short-term technology transfer activities will enhance the utility of these technologies and speed their application to other locations.

Coordination. Because environmental monitoring efforts have to precede implementation of any of the remediation technologies, close coordination with all of the remediation and restoration projects will be imperative.

Cost Estimates. Appropriations are expected over a three-year period. Implementation will begin within the first year of work. Monitoring efforts will continue for the duration of the remediation work.

	Year 1	Year 2	Year 3	Total
Commerce - North Miami	\$430,000	\$430,000	\$440,000	\$1,300,000
Other Perimeter	\$470,000	\$420,000	\$440,000	\$1,330,000
Yearly Total	\$900,000	\$850,000	\$880,000	\$2,630,000



FUNDING

For the plan to be successful, it must have the necessary resources. Senator Inhofe has long advocated for local control in government encouraging leadership by states, tribes, and municipalities with the input of the local citizens.

Senator Inhofe supports the leadership of state agencies, the University of Oklahoma, the Quapaw Tribe, and local leaders in the remediation of the Tar Creek Superfund Site. The University of Oklahoma and the Oklahoma Department of Environmental Quality technical team have estimated the cost of their work detailed in this plan to be \$45 million. Senator Inhofe has committed to obtain the necessary funding from the federal government to support this work.

Each year, the Congress must pass and the President sign into law, the appropriations to fund the federal government. Typically, the Congress passes thirteen appropriations bills to fund the federal government. Certain appropriations are specifically set aside for grants and funding to states, tribal, and local governments.

Unfortunately, there is no one federal agency that will be funding the source to accomplish the Plan. The various federal agencies through which funding will flow often have reporting requirements to ensure that taxpayer dollars are going to good and appropriate use. The University of Oklahoma and Oklahoma Department of Environmental Quality will be able to comply with these reporting requirements.



TEAM MEMBERS

Senator Jim Inhofe

Senator Inhofe has long recognized the importance of environmental stewardship for quality of life and economic development in Oklahoma and throughout the country. In January 2003 with the beginning of the 108th Congress, Senator Jim Inhofe became chairman of the U.S. Senate Committee on Environment and Public Works. For environmental purposes, the Committee's jurisdiction extends over the EPA, the Army Corps of Engineers, the U.S. Department of the Interior, and the White House Council on Environmental Quality.

Chairman Inhofe is in the perfect position to confront the problems that have plagued the Tar Creek Site since it was originally listed 20 years ago. With Chairman Inhofe's direct jurisdiction over all the major federal agencies involved in the Site, Inhofe can use the full power of his chairmanship for immediate and high level attention to the Tar Creek Superfund site and ensure that delays, lack of cooperation, and competing interests of the past are no longer barriers to real progress. Since becoming chairman, Senator Jim Inhofe has:

- Coordinated the first Memorandum of Understanding among all federal agencies involved in the Site to work together toward real progress and actual clean up.
- Coordinated the beginning of mediation between the U.S. Department of the Interior and the Quapaw Tribe to work toward resolving legal and trust issues without endless and costly litigation.
- Toured or received commitments to tour the Tar Creek Superfund Site with the highest ranking federal officials ever to tour the Site. These officials include: EPA Administrator Mike Leavitt, Deputy Secretary of Interior Steve Griles, Assistant Secretary of the Army J.P. Woodley, director for the Army Corps of Engineers, and EPA Regional Administrator Richard Greene.

Although some actions may not be highly visible, for the first time there is actual progress being made on several fronts that had previously been stalled for years.



**Governor Brad Henry
Oklahoma Department of Environmental Quality**

The Oklahoma Department of Environmental Quality (ODEQ) protects Oklahoma's Land Air and Water. This state agency was created in 1993 by combining the responsibilities of several state agencies. The ODEQ responds to thousands of environmental complaints through a network of field offices statewide. Our Customer Services Division includes the State Environmental Laboratory as well as specialists in assisting businesses or citizens with State and Federal environmental regulations.

Since Superfund processes began, ODEQ staff have worked along side the EPA to clean up large abandoned, or inoperative sites. ODEQ environmental scientists and engineers have many years of experience in characterizing and cleaning up complex sites either through Superfund or through voluntary programs. ODEQ has supervised cleanup of numerous smelter sites with heavy metal contamination.

ODEQ staff have expertise in geology, toxicology and geochemistry. Partnerships with other state and federal agencies and tribal groups help ODEQ leverage efforts to achieve cleanup fairly and efficiently. The philosophy of cleanup for the long term serves Oklahoma's citizens throughout the state.

Under the directions of Governor Brad Henry, and through the Secretary of the Environment, ODEQ will accomplish these tasks and coordinate with federal and tribal efforts toward a comprehensive solution at Tar Creek.



**Chairman John Berrey
for the Quapaw Tribe**

John L. Berrey is a Quapaw/Osage Indian and serves as the current Chairman of the Quapaw Tribe. His Quapaw name is Hum-bah-gah-kah (Big Elk) and his Osage name is Neeh-wah (Healing Water).

Chairman Berrey serves as a Board member for the Inter Tribal Monitoring Association and the Claremore Indian Hospital Board of Directors. He has also been designated as a Tribal representative leader on the U.S. Department of the Interior's "To Be" Trust Process Reengineering team

Chairman Berrey has been a frequent face in hearings related to Native American Trust issues presenting to the Senate Indian Affairs Committee and the House Resources Committee in the 107th and 108th Congress. Working for the past two years, John has been involved in the current Trust Reform initiatives facing Indian Country.

The Quapaw Nation is a rapidly growing political and economic force. The location of the Tar Creek Superfund Site is a controversial centerpiece to much of the future and past of the Quapaw's presence in Oklahoma.

Once the indigenous peoples of much of the State of Arkansas, the Quapaws have a rich and troubled history. The tribe once controlled the historic commerce along the Arkansas and Mississippi Rivers in Eastern Arkansas. Known throughout pre-western contact as the ceramic masters of the North American continent, Quapaw pottery was a highly valued article throughout Indian Country. After a series of treaties and removals the Quapaws were relocated to their current location in northeastern Ottawa County, Oklahoma in October of 1834.

Beginning in the early 1900s, the Quapaw Reservation was the home of the largest lead and zinc-mining operation in the history of the United States. Billions of dollars of ore were extracted in mining activity lasting into the late 1960s and early 1970s, the result of which has become the Tar Creek Superfund Site.

The Quapaw Tribe has an established Environmental Office, which is staffed with experienced environmental professionals. This office was created in 1997 to protect the human health, environment, and cultural heritage of the Quapaw people through applying scientific methods in understanding impacts to our natural world. Tribal staff possess the experience and expertise necessary to actively participate in the remediation of the Tar Creek Superfund Site. Additionally, the Tribal staff is uniquely able to ensure that remediation is consistent with the Tribe's cultural resource preservation.



University of Oklahoma

The University of Oklahoma is a technical partner on the Tar Creek Plan. OU has built a strong program in environmental engineering and science, drawing on faculty talent in the Colleges of Engineering, Geosciences, and Arts and Sciences. The College of Engineering consists of eight academic units, including the School of Civil Engineering and Environmental Science (CEES), which offers programs in the areas of environmental, geotechnical, transportation, and structural engineering as well as environmental science. The CEES students and faculty perform research and develop technologies highly relevant to the environmental needs of the Tar Creek Superfund Site. The educational experience is accomplished through innovative classroom instruction aided

by computer and multimedia-based instruction; laboratory, field, and teamwork experiences; and student mentoring. CEES faculty have led the College in external research expenditures for the last five years, averaging nearly \$2 million annually.

The University of Oklahoma technical team is headed by Dr. Robert W. Nairn, a leading authority on Tar Creek. He directs the Ecosystem Biogeochemistry and Ecology Laboratory (EBEL) in CEES. His research areas include mine drainage passive treatment systems, wetland biogeochemistry and ecosystem restoration, analysis of wetland structure and function, and water quality and biological monitoring. From 1989-1992, he was employed as a Research Biologist with the U.S. Bureau of Mines Pittsburgh Research Center. He serves on the National Executive Committee of the American Society of Mining and Reclamation, the Executive Board of the Society of Wetland Scientists South Central Chapter, and the Oklahoma Wetlands and Non-Point Source Pollution Working Groups. Dr. Nairn and his students have been actively involved in research and education at the Tar Creek Superfund Site since 1997, focusing their efforts on water quality assessment and development of passive treatment systems, as well as environmentally responsible chat reuse and comprehensive remediation and restoration design. Robert C. Knox, Ph.D., P.E. is the John A. Myers Professor and Director of the school of CEES at the University of Oklahoma. Dr. Knox's research areas are subsurface contaminant transport and fate processes and development of environmental remediation technologies. Dr. Knox was an instructor for the student capstone course (2000) that developed a holistic remediation plan for the Catholic 40 site in the Beaver Creek watershed. He is currently teaching the undergraduate Professional Practice course which is developing work plans for designing a new bridge and paved road for the Douthat Bridge site. Dr. Keith Strevett is an Associate Professor of Bioenvironmental Engineering and Science in the School of CEES and an Adjunct Associate Professor in the Department of Microbiology at the University of Oklahoma. Dr. Strevett's general research interests include biophysical chemistry, environmental microbiology, and microbial geochemistry. Dr. Musharraf Zaman is David Ross Boyd Professor and Director of the Oklahoma Transportation Center. His research areas are pavement materials and systems including asphalt, geotechnical engineering, and geomechanics. Other OU faculty and students, as well as colleagues from other universities, will participate in the implementation projects as required.

FREQUENTLY ASKED QUESTIONS

Question: What will \$45 million accomplish that \$100 million couldn't?

Answer: These are the first efforts of a scientifically sound comprehensive plan that will bring swift results to areas of the Tar Creek Superfund Site, where there are no legal or technical obstacles to moving forward. This is different from any other effort at Tar Creek as this is the first time that the highest levels of federal, state, and tribal governments have been assembled to form a team that cooperatively addresses the Tar Creek Superfund Site.

Question: What will be the health benefits of this plan?

Answer: These initial efforts will reduce exposure of children and other residents to lead from mining waste in the Picher/Cardin area and will virtually eliminate exposure in the perimeter area. The risk posed by mining hazards such as open mine shafts will be substantially reduced.

Question: When this plan is fully implemented and completed, will all of Tar Creek be remediated? If not, what will be completed and what will remain?

Answer: These are the first efforts of a scientifically sound comprehensive plan that will bring swift results to targeted areas of the Tar Creek Superfund site, where there are no legal obstacles to moving forward. These efforts will focus on the remediation of the perimeter area (e.g., Commerce, North Miami, Miami, and Quapaw). Additional work in the Picher/Cardin area will focus on protection of human health. We are currently working to remove legal obstacles in the Picher/Cardin area, and will continually move the process forward as agreements are reached to achieve the final comprehensive solution to Tar Creek.

Question: Will all of the surface contamination of the perimeter area be cleaned up?

Answer: Yes, with the cooperation of property owners, the plan will clean up the perimeter. Land will be remediated to allow productive use. Water will be treated to improve stream water quality.

Question: What will have been done for Picher/Cardin, and what will remain?

Answer: The plan will reduce risk by paving all remaining chat roads in Picher-Cardin, vegetating dry millponds and chat piles in close proximity to residences, and closing

targeted mineshafts. We are currently working to remove legal obstacles in the Picher/Cardin area, and will continually move the process forward as agreements are reached to achieve the final comprehensive solution to Tar Creek.

Question: What potential obstacles exist to moving forward?

Answer: This plan addresses areas of Tar Creek where obstacles do not exist. Legal obstacles (including liability and ownership) exist that must be resolved before any action can take place in the Picher/Cardin area. Lack of cooperation among federal, state, tribal and local entities has been a past obstacle that will be improved.

Question: Aren't these just more studies and test projects?

Answer: No, this plan will implement remediation technologies coupled with appropriate environmental monitoring.

Question: Does the plan involve large-scale movement and consolidation of chat to a central location?

Answer: No, the plan involves targeted chat utilization and chat base and tailings remediation. Federal entities will work with the Quapaw Tribe on consolidation of ownership.

Question: Will this plan benefit water quality?

Answer: Yes, surface water in the perimeter area will be improved by constructing passive treatment systems and performing stream channel restoration. We will evaluate mine-related groundwater contamination in cooperation with the U.S. Geological Survey.

Question: What are you going to do about sink holes and catacombs of shafts that cause instability and danger?

Answer: Mapping of subsurface cavities will aid local authorities in management of surface development / land use in areas of high risk. Sinkholes will be filled, and mine shafts will be closed. In general, the intent is to address all sink holes and mineshafts in the perimeter area with this plan.

Question: Does the plan involve input from local stakeholders?

Answer: Yes, local cooperation is a key to success, and local stakeholders are and will continue to be involved.

Question: What will be the role of EPA, Department of the Interior, and the Army Corps of Engineers?

Answer: The EPA, DOI, and the Corps will be three of the funding agencies and will provide technical advice. We will also be working with these agencies on plans that are being developed and will be implemented as legal obstacles are removed.

Question: Do we have to wait for the U.S. Army Corps of Engineers to complete their work before this plan can be initiated?

Answer: No, we will move forward independently of the Corps of Engineers. The Corps currently is conducting preliminary work to design a watershed plan for the entire area. The Corps work is important but does not preclude implementation of measures that will allow exposure potential to be reduced while issues of drainage, flooding and watershed planning are examined. No Corps plan can be fully implemented until legal issues have been resolved.

Question: How will subcontractors be selected?

Answer: Any contracting, other than to other governmental entities, will be done through the competitive bid process. As state agencies, OU and DEQ must conduct any such contracting through the Oklahoma Department of Central Services.

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