CASE STUDY

Annapolis Lead Mine Site
Iron County, Missouri

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Prepared by
The Interstate Technology & Regulatory Council
Mining Waste Team

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1. SITE INFORMATION

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1.2 Name, Location, and Description

The Annapolis Lead Mine (ALM) is a former lead-mining site located in the St. Francois mountain area. The site, accessible from Iron County Road 138, is located 1 mile east of Annapolis and 0.3 miles north of Highway 49.

Galena (lead-bearing ore) mining began at the site from about 1919 to 1941 by various mining companies. Production figures indicated that approximately 1,173,000 tons of mining wastes was generated during this time period. None of the responsible parties are viable companies today. Mining activities that took place at the site included excavation of ore bodies, crushing and concentrating of ore, and storage of the concentrated metals prior to shipment off site for smelting. The crushing and concentrating wastes (tailings) were disposed of on the property in a ravine that is a tributary of Sutton Branch Creek. A large tailings pile and various remaining concrete structures occupy about 10 acres at the estimated 50-acre site. Surface rocks are Cambrian and Ordovician aged dolomites. The formation mined is about 400 feet from ground surface in the Bonne Terre Formation.

2. REMEDIAL ACTION AND TECHNOLOGIES

The 10-acre tailings pile is composed of grey- to tan-colored material that resembles fine-grained sand. Tailings are classified as medium to fine sand–sized particles that are a waste product of the froth floatation-level extraction process. Chat is defined as crushed ore material that is 3/8 inch or less in diameter. Chat is a waste product from the density separation process. Tailings and chat are highly erodible. At one time, the pile had steep sides and an outwash area that fanned westward towards Sutton Branch Creek. EPA stabilized and capped the pile to prevent further erosion.

In September 2003, EPA proposed a Time-Critical Removal Action for the ALM. The goal of the Removal Action was to identify, consolidate, and stabilize the lead-contaminated waste mine tailings on site. The Time-Critical Removal Action Plan was finalized, with work beginning at the site in February 2004.

When the Removal Action began at the site, settling basins were constructed to manage storm water runoff. Then earth-moving equipment was used to form the tailings and contaminated soil into a mound in the middle of the ravine where the pile was originally. All areas on the ALM site that had an average lead concentration greater than 1,000 ppm were delineated and excavated. Excavations proceeded to the lesser of a depth of 12 inches or until a lead level below 400 ppm was reached. All excavated areas were backfilled with clean material (<240 ppm lead) and excavated soil was consolidated into the on-site tailings pile. The tailings pile was graded and compacted with an engineered protective cover installed over the tailings. The protective cover consists of uncontaminated clay and topsoil, allowing for the establishment of vegetative cover.

An EPA Fund Lead Record of Decision was completed for OU-1 in September 2005. The remedy for OU-1 was phosphate amendment of floodplain soils with in-stream stabilization techniques and limited sediment removal. This also included erosion controls around the existing vegetated cap.

EPA completed the Remedial Action for OU-1 in September 2008. The Remedial Action consisted of the following activities:

- Excavation of sediment from Sutton Branch Creek occurred in pockets, or depositional areas, where the benefit of excavation/removal outweighed the habitat destruction that resulted. Areas of sediment removal were determined and estimated during the Remedial Design phase.
- Excavated sediment was placed in the existing repository area and capped with a simple soil cover. The cover is approximately 3 feet thick. The capped tailings deposits were revegetated by planting with an appropriate site-specific seed mix selected through a site revegetation plan.
- Stabilization of the Sutton Branch Creek banks with large rock, other materials, and structures to prevent washouts and stream channel meandering. The quantity of rock used and the location of structures and their design were determined during the Remedial Design. The material was placed in increments in Sutton Branch Creek. The placement of the structures required the excavation of bank material in some areas. Excavated material was placed with the excavated sediment in the on-site repository.
- Construction of rock blankets, berms, settlement basin, and channels around the former mining area.

3. PERFORMANCE

The completion of the response actions has eliminated the continuing source of contaminated sediment at the site. Exposures have been reduced to the residual contaminated sediment in and along Sutton Branch Creek. Monitoring of aquatic macroinvertebrates, surface water, and sediment is being conducted to evaluate the effectiveness of the remedy.

4. COSTS

Cost of activities at this site is reported as a total: estimated capital and operation and maintenance (O&M) costs of less than $320,000.

5. REGULATORY CHALLENGES

This site is being addressed through federal and state actions, requiring coordination between the two agencies. Missouri Department of Natural Resources (MDNR) is the lead state agency.

6. STAKEHOLDER CHALLENGES

Environmental sampling results and blood lead testing indicated that in the past, on-site residents were exposed to cadmium and lead at levels of health concern.

There had been some community concern that the water, soil, and sediment of Big Creek in Sam A. Baker State Park have been affected by the contaminated runoff from the ALM site. Residents of the area and visitors to the park were concerned that arsenic, cadmium, lead, thallium, and zinc could be leaching out of the tailings pile at the ALM site and contaminating the water, sediment, and soil of Big Creek. MDNR addressed these comments at a public meeting in Annapolis by discussing the sampling that was completed at Sam A. Baker State Park in May 2004.

The ALM on-site area is considered to be a No Apparent Public Health Hazard for present and future exposures.

7. OTHER CHALLENGES AND LESSONS LEARNED

The design of a cap needs to be such that slopes are as low as possible. In addition, consideration must be made for the volume of runoff and the potential sediment load it carries. Improvements at the ALM site included placing rock around the entire perimeter of the tailings pile to slow the erosion of sediment. Initially only the lower portion of the drainage channel included rock.

8. REFERENCES

Agency for Toxic Substances and Disease Registry. 2006. *Public Health Assessment for Annapolis Lead Mine, Annapolis, Iron County, Missouri, Facility ID: MO0000958611*. www.atsdr.cdc.gov/HAC/pha/AnnapolisLeadMIne/AnnapolisLeadMinePHA090706.pdf.

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