

## **CASE STUDY**

# **McNeely Green Reclamation Tar Creek Superfund Site Ottawa County, Oklahoma**

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**Prepared by  
The Interstate Technology & Regulatory Council  
Mining Waste Team**

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**MCNEELY GREEN RECLAMATION, TAR CREEK SUPERFUND SITE  
OTTAWA COUNTY, OKLAHOMA**

**1. SITE INFORMATION**

**1.1 Contacts**

David Cates  
Oklahoma Department of Environmental Quality  
707 N. Robinson  
P.O. Box 1677  
Oklahoma City, OK 73101-1677  
Telephone: 405-702-5124  
E-mail: [david.cates@deq.state.ok.us](mailto:david.cates@deq.state.ok.us)

**1.2 Name, Location, and Description**

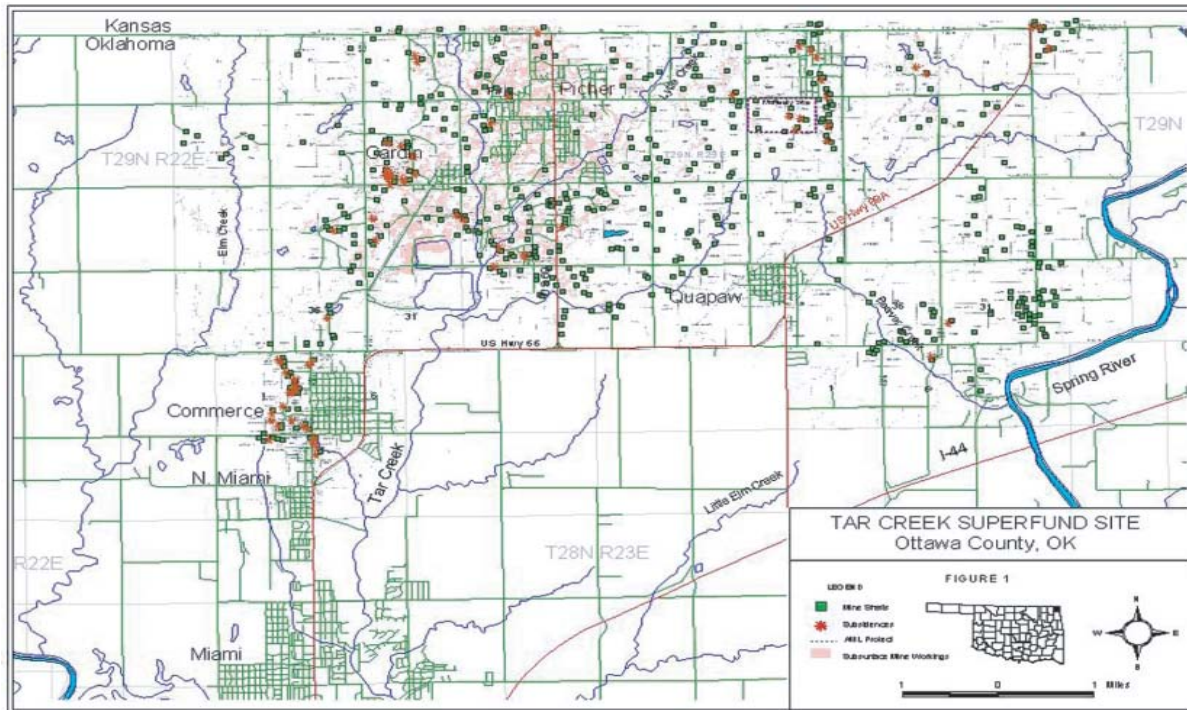
McNeely Green Reclamation Tar Creek Superfund Site, longitude 36.9833222, latitude 94.7836611

The McNeeley Green site is located in the NW/4 of Section 23-T29N-R23E in Ottawa County, Oklahoma (Figure 1-1) and contains 54 acres of mine waste, locally called “chat,” lying in a flat rural agricultural setting. The site is part of the Tar Creek Superfund Site of northeast Oklahoma, which resulted from wastes associated with abandoned lead and zinc mines of the Tri-State Mining District that operated from the early 1900s through 1970. Mining here consisted of underground room and pillar mines about 200 feet below land surface. Processing of the lead and zinc sulfide ores occurred at mills located about every 40 acres (due to leasing requirements of the Native American–owned lands) and resulted in many large piles of chat covering the approximately 40 square mile superfund site. At the mills, the ore was processed by crushing and simple gravity separation methods initially, and later floatation was employed. The resulting waste rock, chat, is composed of mainly chert with minor amounts of limestone and dolomite with particle sizes ranging from 9.51 mm to less than 0.075 mm, with most of the mass in the coarser sizes. Much of the original chat volume is gone due to its use as aggregate in asphalt and concrete, gravel for roads, rock metal for railroads, and general fill material. About 35 million cubic yards of chat remains to be dealt with at the site. The recent record of decision calls for continued chat sales for aggregate in asphalt as the remedy.

**2. REMEDIAL ACTION AND TECHNOLOGIES**

The McNeely Green pilot project is located several miles east of Picher in the NW/4 of Section 23-T29N-R23E in Ottawa County, Oklahoma and consisted of reclamation of approximately 52 acres of land covered with an average of 1.5 feet of chat, two open mineshafts, and two large subsidence areas. The work began in August 2003 and consisted of removal of chat pile bases down to the native soil horizon and translocation of approximately 82,000 cubic yards of this chat material to fill two large subsidences (collapses), one that contained water. The average levels of lead, zinc, and cadmium in the chat were 2,353 ppm, 24,875 ppm, and 143 ppm,

respectively. Soil below the chat had average concentrations of lead, zinc, and cadmium of 15.1 ppm, 227.8 ppm, and <1 ppm, respectively. A sample of bluestem grass showed 3.7 mg/kg, 76 mg/kg, and <1.0 mg/kg for lead, zinc, and cadmium concentrations (OKCC 2003).



**Figure 1-1. Location map.**

The reclamation plan also involved filling and sealing the two open shafts, exploring and resealing seven other shafts, burying on-site rubbish, building three ponds, capping the chat-filled subsidence areas with clay soil, and vegetating 52 acres with fescue/ryegrass/clover. The land was plowed, contoured, and amended (with nutrients) prior to establishing a vegetative cover over the reclaimed land.

After reclamation, a monitor well was installed in the chat-filled subsidence by DEQ using the statewide drilling contract. Comparisons of the water quality of surface water and groundwater in the subsidence, mine shaft, and nearby Roubidoux well were made before and after filling the subsidence with chat.

The demonstration project required a landowner agreement with remediation to agricultural standards. The remediation of the Tar Creek Superfund site will be to residential standards, and institutional controls may be required for some areas where mine waste is buried in a landfill or capped in place or areas that pose subsidence potential.

### 3. PERFORMANCE

The goal of the demonstration project was to restore land to productive use, i.e., clean up to agricultural standards. It also reduced surface exposures to lead, zinc, and cadmium. Current

remediation goals in soils of 500 mg/kg for lead, 1,100 mg/kg for zinc, and 10 mg/kg for cadmium have been established for the Superfund site with MCLs used for groundwater criteria. Comparisons of the pre- and post-remediation water quality were made to demonstrate the impacts to groundwater.

The similarity of the water levels in the mineshaft and the subsidence indicate a good connection between surface water and the underground mine workings approximately 160 feet below. After filling the subsidence with chat, the water levels in the monitor well rose partially due to displacement and remained elevated, with a small decline over time. This situation indicates the water within the chat-filled subsidence is not well connected to the underlying mine workings due to the low permeability of the chat fill material. The water level has not fluctuated over time in response to wet and dry climatic cycles, indicating the clay cap has sealed the top and little recharge is occurring. The low dissolved oxygen values measured in the monitor well samples also support this conclusion. The chat fill within the subsidence is basically enclosed in a low-permeability tomb with a clay cap above and shale of the Cherokee around the sides and bottom. Recharge to the subsidence is small due to the placement of a 3-foot-thick clay cap over the chat fill. This also minimizes the potential generation of acidic conditions.

#### **4. COSTS**

- Capital: \$6,734/acre or \$4.38/cubic yard
- Operation and maintenance: \$0.22/cu yd (\$13,500 for monitor wells and water analyses, \$4,500 for soil analyses)

#### **5. REGULATORY CHALLENGES**

The demonstration project was conducted by the Oklahoma Conservation Commission to show that mine waste land could be restored to public use. It led to the development of the Oklahoma Plan for Tar Creek, a comprehensive and cooperative remediation plan between the state, the Quapaw Tribe, and the University of Oklahoma, with appropriations of \$45 million in federal funding secured by Senator James Inhofe, the chairman of the U.S. Senate Committee on Environment and Public Works.

The demonstration project was designed to show that immediate environmental improvements can be achieved at much reduced costs when work is done cooperatively at the state and local level. No single federal agency involved in remediation has jurisdiction to holistically address all the issues at abandoned mine sites.

#### **6. STAKEHOLDER CHALLENGES**

The McNeely Green demonstration project reclaimed land to agricultural standards. While this made the land usable for farming, the property value remained impacted since the land is still part of the Superfund site and areas of potential subsidence still exist, thus limiting the land to nonresidential use. The application of public funds to remedies that did not address human health and safety issues was criticized.

## **7. OTHER CHALLENGES AND LESSONS LEARNED**

Excavation using a scraper (rather than an excavator) provided better and faster remediation of soils. The excavator may leave furrows of chat from the teeth on the bucket and requires a separate loading step while the scraper can excavate, haul, and dump. The costs are lower and the work can be completed faster than equivalent federal projects due to the elimination of layers of bureaucracy and fewer contractors using state and local operations.

## **8. REFERENCES**

OKCC (Oklahoma Conservation Commission). 2003. "Tar Creek Progress Report, 2/10/03."

*Summary Report and Water Quality Analyses for the McNeely-Green Monitoring Well, McNeely-Green Demonstration Project, Tar Creek Superfund Site, Ottawa County, Oklahoma.* February 2005.