

## **CASE STUDY**

# **I-99 Remediation Site Centre County, Pennsylvania**

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

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# I-99 REMEDIATION SITE, CENTRE COUNTY, PENNSYLVANIA

## 1. SITE INFORMATION

### 1.1 Contacts

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### 1.2 Name, Location, and Description

The I-99 Remediation Site is located in State College, Pennsylvania. The site is not a former mining site, but a highway construction project that unearthed a natural deposit of acid-forming pyritic rock which was excavated, redistributed in waste piles, and used as fill for construction along approximately 15 miles of the highway around the “Skytop” area. Approximately 1.2 million cubic yards of pyritic material was removed from the road cut.

Construction along Interstate Highway 99 during 2003 exposed sulfidic rock within a fresh road cut on Bald Eagle Mountain at Skytop, near State College, in Centre County, central Pennsylvania. The cut exposed pyrite veins associated with an unmined, sandstone-hosted, sulfide deposit. The sulfide deposit also contained minor amounts of galena and sphalerite. Excavated rock was crushed and used locally as road base and fill before the nature of the rock was understood. Within months, acidic (pH <3), metal-laden seeps and surface runoff from the crushed rock piles and road cut raised concerns about surface- and groundwater contamination and prompted a halt in road construction. The Pennsylvania Departments of Transportation and Environmental Protection expanded their site investigations and monitoring in response to the acid-drainage problem to determine the extent of the environmental effects at Skytop and to develop long-term remediation strategies.

Pyrite is an iron-rich mineral capable of producing extremely low pH levels and highly acidic water. At this location the pyrite occurs in veins, especially within sandstone units, and is present in the low percentage range (1%–4%). When mixed with water and oxygen, pyrite is a source of concentrated sulfuric acid and can leach heavy metals from the subsurface. The site is near the headwaters of a high-quality stream and crosses both groundwater and surface-water divides. In addition, residential water supply wells have been impacted.

The primary contaminants of concern include aluminum, iron, manganese, and sulfate along with low pH. The secondary contaminants of concern include arsenic, lead, mercury, and zinc. Affected media include surface water, sediment, and groundwater.



**Figure 1-1. Aerial view of the Skytop cut on January 6, 2005 looking north.** Existing Route 322 in foreground. Future I-99 roadbed runs along the base of the cut. Black plastic covers one of several areas of pyritic fill as a stopgap measure to minimize water infiltration. (Photograph courtesy Keith Brady)

## 2. REMEDIAL ACTION AND TECHNOLOGIES

After several treatment studies, remediation began in late 2006. Cleanup of the site is being conducted under the Clean Streams Law with cleanup goals based on mitigation of human health and ecological risks. Several technologies are being used at the I-99 Remediation Site, including excavation and disposal, capping/covers and grading, and chemical precipitation.

Approximately 1 million cubic yards of material was excavated, sent to a purpose-built lined and covered engineered rock placement area (ERPA) and mixed with lime. Construction and operation of the ERPA lasted for approximately two years. Monitoring of groundwater and surface water continues along with routine inspections and maintenance operations at the facility.

Approximately 1.4 million square feet of steep rock cut slopes, exposed rock under the highway, and crushed rock needed for hillside stability that therefore could not be moved were covered with an impermeable membrane systems to limit infiltration. The systems included both a multicomponent impermeable geosynthetic cover and a collection system for leachate. This work was performed in phases in conjunction with the completion of the highway and the removal of rock to the ERPA over approximately 2.5 years.

Sodium hydroxide (NaOH) is added to the discharge stream in a treatment pond for pH adjustment and metals precipitation prior to discharge as a temporary measure until a permanent

treatment system is built. This interim measure began in 2005. Construction of a permanent water treatment facility has begun.

I-99 fully opened to traffic in December 2008 with the ERPA and impermeable covers completed; collection and treatment of the discharges along with groundwater and surface-water monitoring continue. Work on restoring the impacted stream channels is in the design phase.

### **3. PERFORMANCE**

Effectiveness of the caps and covers is evaluated with regular inspections and surface-water and groundwater sampling. Water samples are collected and compared to water quality standards, upgradient sampling points, and preconstruction sampling data, as appropriate. Comparison of these results, along with looking at data trends, allows for some measurement of success.

The ultimate goal of the cleanup is to eliminate acidic discharges to the high-quality stream, Buffalo Run, and to eliminate the impacts of the groundwater plume on residential drinking water.

Additionally, routine inspections of remediated areas of the site are required to ensure that the caps and covers remain in place and are not compromised in any way.

### **4. COSTS**

The direct costs at the site can be broken into multiple parts: investigation costs; treatability study costs; costs associated with the construction and operation of the ERPA; costs for covering the material that could not be moved; costs for treating the discharges; costs associated with providing water to the impacted residences; and ongoing operation, maintenance, and monitoring costs. To date the total cost is over \$50 million.

### **5. REGULATORY CHALLENGES**

The majority of the material was placed in the Buffalo Run drainage. Buffalo Run is a high-quality stream, and the Clean Streams Law prevented discharge of contaminated water to it. Due to the expenses and technical difficulty in achieving the standards for discharge to a high-quality stream, the impacted water was piped for discharge to an adjacent watershed, which was not high quality and where a smaller amount of the pyritic material had been disposed during road construction.

Leaving waste in place on site presents issues with long-term stewardship (LTS). LTS can include the use of restrictive and/or environmental covenants and implementation of a monitoring and maintenance plan.

## **6. STAKEHOLDER CHALLENGES**

Public health and property value impacts were issues for the homeowners with water supplies that were affected. The site spans three townships, so there also was concern about what activities were occurring in each township. Recreational impacts from potential impacts on fishing in the stream were also of concern.

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

In situ treatment was tested but was not selected due to problems achieving complete penetration of the material through the waste rock. Variability in permeability of the fill material induced channeling affects. Developing a good sequence of activities that allows different parts of the project to mesh and minimizing delays is critical in completing a project of this scale.

It has been difficult to design and correctly size the final discharge treatment system as the quality and quantity of the discharge is expected to change as the cover system limits infiltration of precipitation into the remaining pyritic rock.

## **8. REFERENCES**

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