Pecos, New Mexico USA Lead-Zinc Mill Tailings Site: Case Study of a Durable Solution to an Inactive Mine Waste Pollution Problem

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at

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- **Environmental Remediation and Mine Waste Management challenges face every country**
- **Watersheds are littered with a legacy of disturbed landscapes, acidic drainage and open dumps at inactive and abandoned mines and mills in the countryside and industrial complexes in major cities and ports**
- **Meeting this challenge requires strategies that fix unhealthy places, sustain existing facilities and allow new projects in an era of rising technical expectations, open legal procedures with extensive rights of public participation in decision-making, and global markets.**

April 1, 2004
European Parliament takes action to begin
“huge tightening of draft EU rules on cleaning up waste at existing and abandoned mining facilities,” citing environmental damage from tailings spills in Spain and Romania

30 years of experience provide examples of effective solutions to mine waste problems

- Current public policy recognizes the *importance of environmental remediation and mine waste management to economic sustainability, nature protection, tourism development, water resource management and public health policy and in a local social and cultural setting*.
- Successful environmental remediation efforts are those that best *navigate complex legal policy matrix and best apply technologies that reflect that complexity*.
- Effective mine waste management systems are those that *address the range of administrative, technical, ecological and social aspects of a site from preliminary planning through completion*.

A Case Study with application for environmental remediation in Romania - the Pecos lead-zinc tailings sites, New Mexico.

- Ore discovered in 1881, in production 1927- 1939 by American Metals Company. Multi-mineral ore averaged 10.6% zinc, 3.3% lead, 0.5% copper, 2.8 oz./ton silver and 0.1 oz./ton gold, processed at a 600 ton per day selective flotation mill until "water problems, labor disputes and bad ground at depth contributed to the mine's shutdown in 1939"
- 2,200,000 tons of tailings disposed behind dams across creek downstream of the mill site, concentrations reported for key metals and other contaminants include: 2800 to 10,000 ppm - lead; 150 to 5500 ppm - copper; 130 to 13,000 - ppm zinc; 15 to 20 ppm- silver; and 2.7 ppm - cyanide
- **Near Hispanic community of 1,000, schools <500 m away, major fish kill in Spring, Significant public outcry for remedy**

Extensive Contamination

- **Surface water:**
  - lead (ranging from <0.01 to 4.1 ppm),
  - cadmium (<0.001 to 0.022 ppm),
  - iron (<0.1 to 67 ppm) and manganese (<0.05 to 1.4 ppm)
  - vs. Standards: Pb - 0.05 ppm, Cd - 0.01 ppm, Fe - 1.0 ppm, Mn - 0.005 (US)/0.2 (NM) ppm
- **Soil:**
  - lead (background 5 -30 ppm, tailings 2800 - 10000 ppm, downstream of tailings - 1400 ppm)
  - zinc (background 30 - 60 ppm, tailings 190 - 13000 ppm, downstream - 350 ppm)
  - copper (background 9 - 20 ppm, tailings 150 - 5500 ppm, downstream - 290 ppm)
  - iron (background 13000 - 17000, tailings 44000 - 51000 ppm, downstream - 31000 ppm)

Innovations at Pecos Tailings Site include:

- **Consolidate tailings and contaminated soil** with lead concentrations above the health based risk level (500 ppm) behind two dams
- **Convey run-off water over tailings** in lined 6-hr 100-yr storm channel;
- **Reinforce side drainages to the main channel** to minimize erosion and design for a 10-yr 24-hr storm and safety factor of 1.5;
- **Cap tailings ponds to control erosion and ponding and revegetate**;
- **Stabilize dams to meet embankment engineering standards**;
- **Replace wetlands and regrade and revegetate all borrow areas**;

Innovations at Pecos Tailings Site also include:

- **Install ground water monitoring wells and piezometers in tailings;**
- **Evaluate contamination of downstream water courses and fields;**
- **Developing, installing and maintaining measures to protect newly reclaimed areas and prevent vandalism;**
- **Use calibrated ground water and contaminant transport models,**
- **Contingency plans to protect or replace community/private wells;**
- **Develop long-term plan to monitor remediation including assessment of moisture and metals movement in tailings, revegetation success, channel and liner stability, tailings cap stability, and wetlands replacement success.**

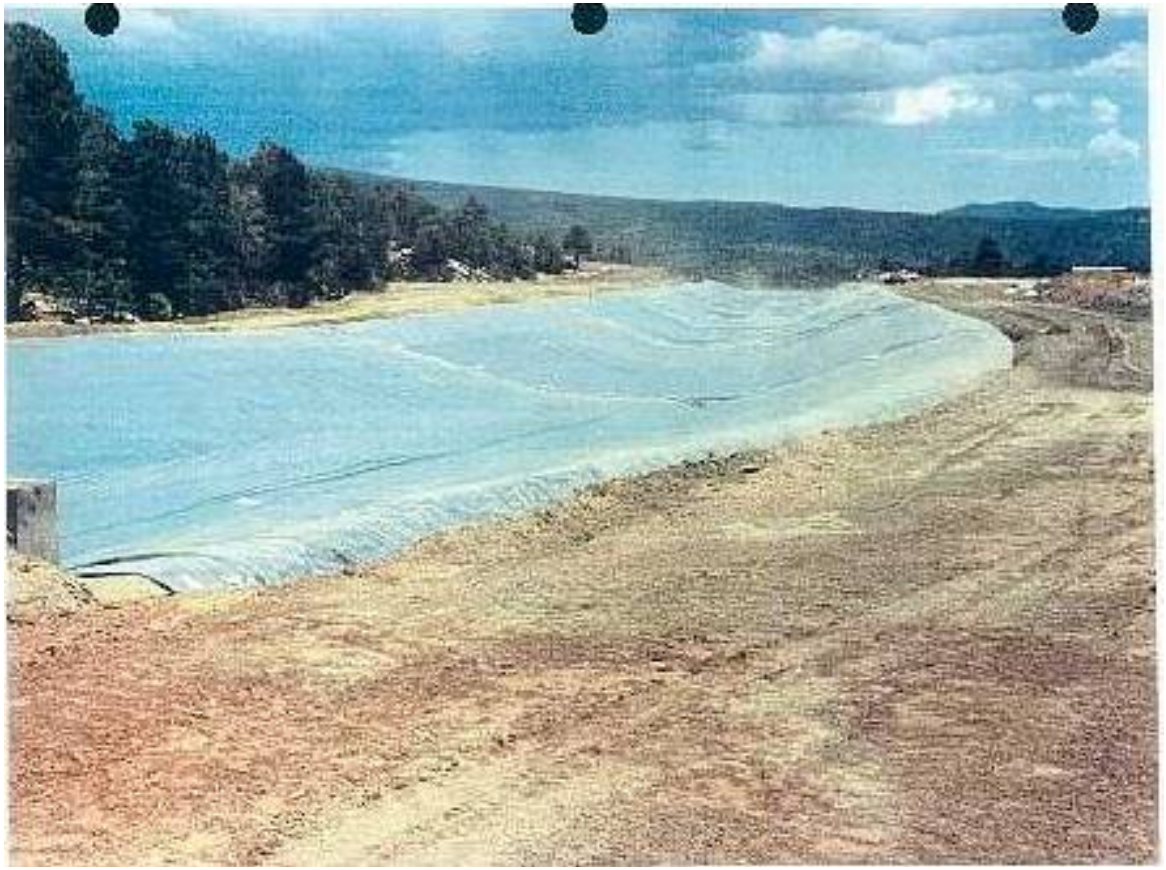
Acid drainage at Pecos tailings site before remediation

Active stream cutting causing erosion into tailings before remediation

Severity of erosion into tailings before remediation

Construction of permanent diversion channel on tailings and temporary diversion channel

Installation of synthetic liner on prepared subsurface prior to covering with rip-rap



Placement of 0.5 m rip-rap over synthetic liner to protect permanent diversion channel

Completed diversion channel and surrounding tailings covered by 0.5 meter clean soil before revegetation

Complete upstream inlet to permanent diversion channel

Contaminated soil removal and stream protection outside tailings disposal area