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science in ACTION

BUILDING A SCIENTIFIC FOUNDATION FOR SOUND ENVIRONMENTAL DECISIONS

LAND RESEARCH PROGRAM

MINE WASTE TECHNOLOGY PROVIDES CLEANUP SOLUTIONS

Issue:

Mining of metallic ores, phosphate, uranium, and oil shale in the United States produces between one and two billion tons of mine waste annually. As a result, more than 600,000 mines, most of which are abandoned, have polluted 180,000 acres of reservoirs and lakes, and 12,000 miles of streams. Since many of the mines involve sulfide minerals, mineral mine drainage is a common problem from abandoned mine sites as well. The combinations of acidity, heavy metals, and contaminated sediment have severe detrimental environmental impacts on delicate ecosystems. Without remediation and reclamation of these mines, they will continue to discharge toxic metals in water and sediment.

Scientific Objective:

The Land Research Program in the U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD) develops and demonstrates innovative, cost-effective cleanup technologies for mine land. Engineering solutions, through laboratory research and field testing, address the environmental legacy of mining and smelting of metallic ores.

Scientists and engineers work closely with other EPA offices involved with Superfund remediation and abandoned mine lands and collaborate with colleagues in state government, universities, and private entities to develop new approaches to developing remediation technologies for mining wastes.

At ORD's Engineering Technical Support Center (ETSC), engineers and scientists provide assistance to EPA regional offices, states, and communities on the design, function, and application of technologies. A major challenge is treating millions of gallons of acid mine run-off in remote locations without ready sources of electricity doing it in a cost-effective and sustainable manner. For information about the center, visit: www.epa.gov/ORD/NRMRL/lrpcd/rr/etsc/.

For the past 16 years, ORD's Mine Waste Technology Program (MWTP) has been fulfilling its role of developing new innovative remediation technologies that address remediation of hard rock mining sites and associated waste more efficiently and effectively. More than 90 projects have been completed and others are in progress. For more information on mine waste technology projects, visit: www.epa.gov/minewastetechnology/.

Researchers also study the complex environmental, social, and environmental issues at sites designated as Mine-Scarred

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Lands (MSLs) under the Brownfields law.

Application and Impact:

ORD researchers have made significant contributions to solving the complex issues of mine remediation. Successful remedies included:

- Passive and semi-passive acid drainage/water treatment systems
- Innovative components for conventional water treatment
- Permeable reactive barriers (PRBs)
- Pit lake treatment
- Source control
- Trace metal removal
- Cyanide destruction
- Sustainability

Site characterization of mineral mine drainage and long-term management methods of drainage and emissions from abandoned mines and disposal sites are at the heart of ORD's research efforts.

Research Contributions:

Cyanide Heap Biological Detoxification, Phase II

This technology was implemented at Barrick Gold's Cortez Mine in northeastern Nevada. Biological heap detoxification is a process that uses bacteria to detoxify a spent heap leach pad by destroying cyanide, nitrates, and sulfates and removing metals.

Sustainability of Substrates in Sulfate-Reducing Bioreactor Systems

In cooperation with the Colorado School of Mines, ORD is testing different configurations of bioreactors and various substrate materials on the same mine-influenced feed water. While the results of these test reactors are site specific, the data will provide some insight into the overall design of biochemical reactors. The project is the culmination of several years of research and development.

Permeable Treatment Wall

ORD designed a system at the Nevada Stewart Mine to provide an economical technology that uses the mineral, apatite, as a treatment media to passively remove zinc and iron from the discharge water flowing from an abandoned mine. The treatment media was placed into a fully contained subsurface retention basin for odor control, aesthetics, protection from vandalism, and prevention of damage from animals. Overall, the system effectively reduced the metals loading from the mine's opening or adit discharge.

More information can be found at: www.epa.gov/nrmrl/pubs/600r06153/600r06153.pdf.

OTHER REFERENCES:

Mine Waste Technology Research Web site: www.epa.gov/hardrockmining.

Grants for Research on Mining Impacts Web site: http://es.epa.gov/ncer/publications/topical/mining.html.

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