MINE WASTE TECHNOLOGY PROGRAM: PAST, PRESENT, AND FUTURE[1]

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Abstract: For the past fourteen years, the Environmental Protection Agency's (EPA) Mine Waste Technology Program (MWTP) has been implemented by MSE Technology Application's Butte, Montana office with administrative assistance from the Department of Energy's Western Environmental Technology Office and technical direction from EPA's National Risk Management Research Laboratory (EPA-NRMRL). The MWTP is the only effort with long-term, steady funding focused on how to effectively deal with mine wastes associated with active and abandoned hardrock mines.

A report by Resources for the Future (Probst and Konisky, 2001) indicated that hardrock mining mega sites (sites with estimated cleanup costs greater than $50 million) cost about twice as much to clean up when compared to other types of sites on the National Priority List (NPL) under EPA's Superfund program. In an effort to cut cleanup costs, the Office of the Inspector General (OIG) recommended that EPA perform a review and analysis of:

- "Innovative, alternative, or promising new remediation technologies (engineered or non-engineered) that identify enhanced efficiency and effectiveness in addressing remediation of hardrock mining sites and associated waste." (EPA-OIG, 2004)

The MWTP has been fulfilling this mission over its history. A recent review of the technologies demonstrated under the MWTP to date has been performed to assist with addressing issues at abandoned mine sites, some of which are Superfund mega sites. Thomas P. Dunne, EPA's acting assistant administrator for solid waste and emergency response also acknowledged the priority of mine waste issues in a New York Times article in October 2005:

- "Mining problems weren't considered a very high priority" in past decades, but they are a concern now." (Perlez and Johnson, 2005)

The attention that EPA is giving this issue should justify additional budgetary support to address it. The cost of the cleanup of inactive and abandoned mines is estimated to be between $2 and $37 billion (EPA-OIG, 2004).

Additional Key Words: MWTP, mine waste, acid drainage, ARD, AMD, innovative, technologies, sustainability

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Approach

MSE and Montana Tech of the University of Montana (Montana Tech) implement the MWTP with assistance from the DOE and EPA-NRMRL. The MWTP Technical Integration Committee (TIC), which includes representatives from industry, state and federal regulatory communities reviews proposals and determines the direction of research within the MWTP. Projects are also peer reviewed by EPA-NRMRL at least twice a year. All final reports are peer reviewed.

The presence of large volumes of aqueous and solid mine waste in Butte, makes it an ideal test bed for MWTP projects. Other locations around Montana have provided the majority of additional sites for MWTP projects. While Butte and Montana's past mining history has generated ideal test beds for the majority of MWTP projects, the MWTP has had a national impact. The map shown in Fig. 1, which shows the MWTP project locations, illustrates this point.

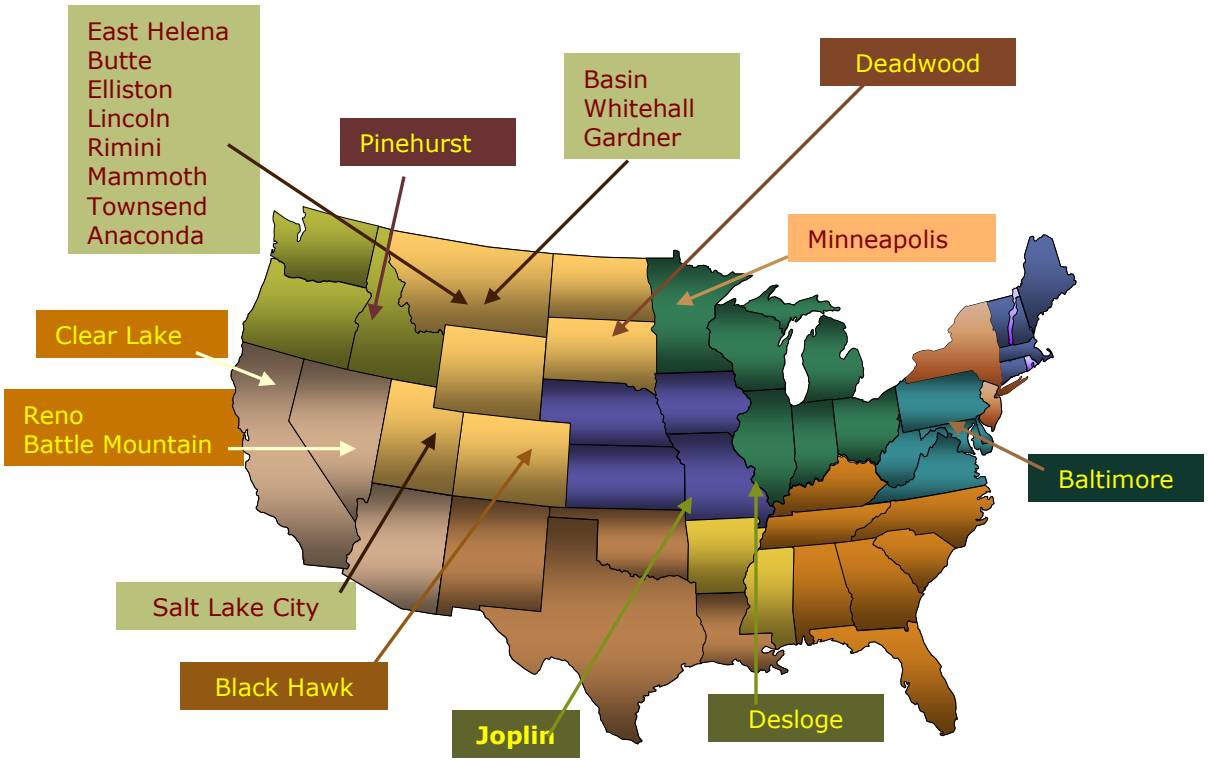

Figure 1. Map of MWTP Project Locations Performed by MSE.

Results

Over 70 MWTP projects have been completed or are currently being performed by MSE and Montana Tech of the University of Montana. Most MWTP projects are focused on source control, sustainability, acid drainage/water treatment (passive and active), trace metal removal, pit lakes, or addressing challenges associated with remote settings. Other funded areas of the program include: issue identification; quality management system; project specific quality assurance/quality control; bench-scale research; training and education; and technology transfer. Additional information on MWTP projects can be accessed from historical MWTP annual reports, MWTP CDs, and on the EPA MWTP website:

http://www.epa.gov/minewastetechnology/

Currently there are 11 active projects at MSE at various stages of completion. These projects are listed below under the appropriate issue area being addressed:

Sustainability of Reclamation Species

- Acid/Heavy Metal Tolerant Plants (Anaconda, Montana);

Sustainability of Treatment Technology

- Sustainability of Substrates in SRB Bioreactors (Colorado);

Sustainable Uses of Previously Mined Areas

- Resource Recovery from Flooded Underground Mine Workings (Butte, Montana);

Source control/Bioavailability reduction

- Contaminant Speciation in Riparian Soils (Rose Lake, Idaho);

Acid drainage/Water treatment

- In-Situ Source Control of Acid Generation Using Sulfate Reducing Bacteria (SRB) at the Lilly Orphan Boy Mine (Elliston, Montana);
- Integrated Passive Biological Treatment at the Sure Thing Mine (Elliston, Montana);

Passive treatments

- Passive Treatment Technology Evaluation for Reducing Metal Loading (Canyon Creek, Idaho);

Trace/Heavy metal removal

- Physical Solutions for Acid Mine Drainage at Remote Sites (Arsenic focus) (Rimini, Montana);

Pit lakes

- Integrated Process for Treatment of Berkeley Pit Water (Butte, Montana);
- Bioremediation of Pit Lakes (Gilt Edge Mine, South Dakota);

Heap detoxification/closure

- Cyanide Heap Biological Detoxification Phase II (Nevada).

Other papers presented in the Mine Waste Technology Program special session will present the successes of ongoing and completed work and provide technical details of the associated work.

Lessons Learned

The previous section provided an overview of ongoing MWTP project being performed at MSE. Lessons learned have also been identified and are briefly discussed below.

- Historically, the MWTP was structured around seven activities (issues identification, quality assurance, pilot-scale demonstrations, bench-scale research, technology transfer, training and education, and program support). An evolution of the MWTP has been in place and now the focus is on EPA and mining industry issues and how to most cost effectively address them rather than focusing on funded activities.
- Similarly, the technologies evaluated should have wide applicability at problem sites rather than solutions looking for problems.
- The MWTP needs to be more forward-looking and proactive to provide the mining industry with approaches for dealing with mine wastes.
- Collaboration with other US and international groups involved in similar efforts is needed to ensure the most efficient use of the available funding.
- TIC membership should be evaluated and become more focused on industrial/technical side.
- Industry partners, including Placer Dome—Cortez Mine (Nevada), Placer Dome—Golden Sunlight Mine (Montana), Kennecott Utah Copper Corporation (Utah), Doe Run Company (Missouri), BP America (Arco) (Montana), and Echo Bay Mining (Nevada) have contributed significantly to technology development by providing in-kind services. Even greater participation by industry can only improve and expand the program while ensuring ongoing work addresses the needs of industry.

Future success will depend on implementing necessary improvements and addressing high-level needs for government and industry and communicating this to the regulatory and scientific communities, industry, and the general public. An immediate need is to change the focus of the technology transfer activity from producing MWTP compact disks (CDs) and annual reports to also include support for site visits and meetings to communicate the availability of new technologies to address pressing mine waste issues and in some cases related types of wastes. One other key to MWTP success has been identifying regulatory individuals and industry participants that are willing to try innovative approaches. There is a certain personality type that best fits the mission of the MWTP when working with regulatory and industry personnel.

Future Opportunities

A report by the United States Environmental Protection Agency (EPA)—*Acid Mine Drainage: Innovative Treatment Technologies,* featured a case study of an MWTP project near Butte, Montana. This report concluded: "Given the seriousness and scale of mine drainage it is important to continue to work towards affordable and effective treatment options…there is need

for more work, some of the more pressing areas include communication, funding, and research about fundamental processes" (Costello, 2003).

The MWTP envisions an interstate, focused effort involving a cohesive group of state and federal agencies, industry, researchers, academia, and technology providers that most effectively uses available resources to address issues associated with mining wastes to mitigate the impacts of past, present, and future mining activity and ensure sustainable development of the mineral resources of the United States. The focus would be on the development of cost effective technologies in order to achieve cleanup of inactive and abandoned mines with substantial cost savings compared to traditional technologies. This will in turn lead to improved economics/sustainability for current and future mining opportunities in the United States and around the world. The new technologies developed could then be applied to address mine waste issues worldwide.

Other groups/technology developers involved in addressing this issue for both metal mining and coal mining would also be included in this focused effort. While many federal and state agencies, private companies, trade associations and non-government organizations, as well as academic institutions have variable focus on mining environmental problems, there is not an active, focused effort to address this significant, costly issue.

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