

FUTURE DIRECTIONS OF THE COAL MINING SECTOR OF THE ACID DRAINAGE TECHNOLOGY INITIATIVE AND THE NEEDS FOR ACID DRAINAGE RESEARCH¹

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Abstract. ADTI is a coalition of Federal and State agencies, industry, academia, and consulting firms working together to address a range of issues dealing with the technical problems of predicting and controlling acid drainage. The ADTI is organized into two major groups, a coal mining sector and a metal mining sector. The Coal Mining Sector (<http://wvwri.nrcce.wvu.edu/ADTI>) is organized into two primary working groups, one on prediction and the other on avoidance and remediation methods. Recently, the Coal Mining Sector met to review its accomplishments, the status of ongoing studies, and to develop a five-year plan for future studies and efforts. This paper discusses the planned activities of the Coal Mining Sector of ADTI and future research needs related to acid drainage.

Additional Key Words: acid mine drainage, acid rock drainage, coal mining sector.

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Introduction

The organizational efforts and activities of ADTI are discussed more fully discussed in Hornberger et al. (2000), Block et al. (2004) and Parsons et al. (2004). As outlined in those papers, the ADTI has resulted in a number of accomplishments and has fostered an ongoing spirit of cooperation and collaboration in addressing acid drainage related problems.

While some of the initial projections of funding and support for ADTI have not been realized, there has been a steady ongoing effort. In recent years, through the development of the Statement of Mutual Intent (Block et al., 2004), an effort has been made to expand the commitment to ADTI and to bring other partners into the effort. ADTI members have also been actively working to integrate ADTI's efforts with those of international organizations and efforts related to acid contaminated mine drainage.

The coal mining sector (CMS) component of ADTI has continued to pursue the original priorities identified when ADTI began as well as issues that have arisen since. An important vehicle for supporting ADTI CMS activities aimed at addressing these priorities is OSM's funding of a series of cooperative agreements with the National Mine Land Reclamation Center (NMLRC) at West Virginia University. This funding remains a key component of support to address ADTI priorities. OSM's funding has been between \$200,000 and \$250,000 per year. Cooperative agreement project proposals that address ADTI priorities are given preference for funding.

In order to better plan the future work of the ADTI CMS, a meeting was held in Morgantown, West Virginia, in November, 2003, to look at the initial plans for the ADTI, evaluate past accomplishments, discuss ongoing work, and identify current and future needs for applied studies and research related to acid drainage. The results of the discussions at that meeting are being crafted into a "Five-Year Roadmap" to guide ADTI related activities and to be used as a tool in recruiting additional participants and obtaining additional funding.

Areas of Focus

Initial Plans for ADTI

The initial efforts that led to the development of the ADTI also led to the identification of a number of issues that needed attention. Based on the files of a number of participants in those meetings, those initial focus areas are listed in Table 1.

Table 1. Initial Areas of Focus for ADTI

Prediction

Laboratory Testing	(Kinetic and static testing)
Field Sampling	(Density of sampling, methods, variability)
Hydrologic Analysis	(Field sampling and analytical methods)
Field Validation of Predictions	

Avoidance and Remediation

Special Handling	(Material handling and placement, alkaline amendments)
Barriers	(Flooding, dry barriers)
Water Treatment	(Active and passive)

Based on these areas of concentration, the ADTI Coal Mining Sector's first effort was to compile the state of knowledge on technologies to predict, and to avoid and remediate mine drainage issues. The results these efforts are summarized in two publications. The first, entitled, *A Handbook of Technologies for Avoidance and Remediation of Acid Mine Drainage* (Skousen, et al.) was published in 1998. This handbook compiled known technologies and provided general guidance on their application and expected effectiveness. In 2000, the CMS published the second of the handbooks, *Prediction of Water Quality at Surface Coal Mines* (Kleinmann, Ed.), a compilation of predictive methods for surface mines.

Recommendations from ADTI Handbooks

Identifying technical areas needing further work has always been a key activity of the ADTI CMS. Both handbooks identified priority areas that needed to be addressed in the future efforts. The priority areas identified in the handbooks have influenced the subsequent work. In the

Introduction of the Avoidance and Remediation handbook, Skousen et al. (1998) identified the need for field testing of then-current technologies and the development and testing of new technologies. The authors noted that variable success in treatment was probably caused by the variability found among mines and their associated environmental conditions. An imperfect understanding of the effect of this variability on the effectiveness applicability of treatment techniques resulted in imperfect criteria for selecting treatment technique. Long-term follow-up monitoring and analysis of water quality from these field installations will help refine understanding of and define the limits of applicability of AMD treatment technology.

In the Prediction handbook, recommendations on the use of kinetic testing methods and establishing a standard kinetic testing method to be use for refined analysis of materials falling in the “gray area” of ABA were made. Other “issues, opportunities and needs” identified in this handbook addressed the following issues: quantitative prediction of mine drainage quality, kinetic test methodology, field and post mortem studies to evaluate the effectiveness and limits of applicability of analytical and predictive methods, mine water quality prediction, new and revised investigative and analytical techniques, use of baseline and monitoring data to refine predictive techniques, use of mineralogical data and geochemical modeling techniques to refine mine drainage prediction (as applied in the hard rock mining industry), and the applicability of analytical tools, such as three-dimensional geologic modeling software to refine overburden volumetric analysis, and geostatistical analysis methods for detailed sampling and analysis.

Steering Committee Meeting

In November, 2002, OSM hosted a meeting of the CMS representatives to the ADTI Operations Committee to determine what had been accomplished related to the initial goals and areas of focus for ADTI, what remained to be done, and what additional priorities for work could be established. The following table lists the priorities developed at that meeting.

Table 2. ADTI CMS Priorities, November 2002

- Estimation of bonding liability for AMD
- Prediction of acid load prior to mining
- Long-term AMD generation
- Flooded underground mines
- Above drainage underground mines
- Surface mines
- Passive treatment systems
 - Long term performance
 - Reasons for success or failure
 - Improved methods
- Coal combustion byproduct minefills
 - Risk assessment methods
 - Documentation of benefits or impacts (field validation)
- In situ underground mine treatment
- Refuse capping and barriers
- Treatment for other contaminants (e.g., chlorine, sulfate, selenium)
- Technology transfer
 - Update of previous handbooks
 - Workshop on CMS priorities and review of work progress

At the conclusion of the meeting, it was decided that a workshop of the full CMS membership and should be convened to develop a “five-year roadmap” to focus future efforts and identify future resource needs. It was also determined that the participation in CMS activities needed to be as broad as possible, and that additional avenues for supporting work and additional resources needed to be explored.

Roadmap Development

In November of 2003, a meeting of the CMS was held in Morgantown, West Virginia, to discuss ongoing research, new issues that have arisen and the priorities for future work of the CMS. The meeting included a review of past and ongoing work, and provided an opportunity for participants to identify “unfinished business” related to their areas of expertise. The group began looking at the list of priorities in Table 2 above, and developed the issues shown in Table 3 as ones worthy of additional consideration. As a prelude to building a roadmap for future action, it was decided to develop white papers covering the issues in each of the identified areas, identifying particular work that needs to be completed, and, where possible, developing a specific proposal for work.

Table 3. Priority Issues for CMS

Treatment standards	(Manganese standard)
Prediction of acid load prior to mining	
Develop relationship between prediction methods and contaminant concentration	
Prediction of infiltration, recharge and discharge of water (hydrologic budget)	
Long term AMD generation	
Flooded underground mines	
Above drainage underground mines	
Surface mines	
Passive treatment systems	
Long term performance and metrics	
Reasons for success or failure	
Improved methods	
Coal combustion by-product minefills	
Risk assessment methods	
Documentation of benefits and impacts (field validation)	
In situ mine treatment: concurrent vs. post-mining methods	
Concurrent treatment of underground mine water prior to pumping	
Alkaline amendments, foundation drains, reactive barriers	
Refuse capping and barriers	

Treatment for “non-conventional” constituents associated with mine drainage
Technology Transfer

Update AMD handbooks

Workshops to update priorities and review progress

Treatment methods for large volume underground mine discharges

While some of the work is still ongoing, the CMS is actively engaged in the development of a roadmap. Following the completion of the white papers, the CMS will craft a plan for the work to be conducted during the next five years given the current level of resources. In addition, areas of work not able to be addressed will be ranked so that if additional resources become available, work can be focused on the agreed upon priorities. This will enable the work to progress logically and collaboratively towards solving the most important issues and problems.

Conclusions and Future Plans

In the past two years, the CMS of ADTI has been continuing to address areas of work previously identified as being of a high priority, while working to develop a five year roadmap for future work. The initial roadmap will serve as a starting point for cooperative work and as a means for recruiting additional participation and acquiring additional resources to address these issues. It is envisioned that the CMS will regularly update the roadmap to acknowledge accomplishments and to reflect new and emerging issues related to AMD and coal mining. This roadmap will also enable ADTI to more effectively work with other organizations concerned with acid drainage and to communicate to interested parties what has been accomplished and what remains to be done.

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