

COOPERATIVE EFFORTS IN SOLVING AND PROBLEMS: THE SURFACE NINE DRAINAGE TASK FORCE AND THE AND TECHNICAL ADVISORY COMMITTEE

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ABSTRACT

In 1978, the director of the West Virginia Department of Natural Resources (WVDNR) appointed the Surface Mine Drainage Task Force (Task Force) to address the problem of acid mine drainage (AMD) associated with surface mining in West Virginia. Task Force members included representatives from the coal mining industry, private consultants, researchers at West Virginia University, and regulatory personnel. After extensive meetings of the Task Force and due to the complexity of the AMD issue, the AMD Technical Advisory Committee (AMDTAC) was established in 1981 to generate innovative research on AMD. Nine projects were initiated at a total project cost of \$818,000. Three years later at the completion of the grant period, five additional projects were funded. The research results of the projects conducted by AMDTAC have provided new and innovative technologies to the AMD problem.

Keywords: acid mine drainage, reclamation, revegetation, pyrite oxidation, overburden analysis

INTRODUCTION

On September 15, 1978, West Virginia Department of Natural Resources (WVDNR) Director, David Callaghan, called a meeting at the WVDNR offices in Elkins, West Virginia to discuss acid mine drainage (AMD) from surface mining of coal. More particularly, he wanted to discuss AMD associated with surface mining in the Buckhannon, Middle Fork, and Tygart River drainage basins.

The state regulatory authority (SRA) was faced with intense pressure from environmental groups to cease issuing mining permits, both deep and surface, in some geographical areas of these drainage basins due to concerns with AMD on existing operations. A petition to declare large areas in central West Virginia unsuitable for mining was being considered. This action

would have affected over two billion tons of coal which are vital to the economy of the state and its people.

Director Callaghan, the SRA, the Office of Surface Mining (OSM), the Environmental Protection Agency (EPA), and the environmental community were demanding accountability from the industry if any further mining was to occur in these areas. Gathered at this meeting were responsible industry people who had operations, reserves, or other economic mining interests in this area.

The obvious question was should the SRA continue to issue mining permits in these areas if operators could demonstrate that reclamation, to include water quality, was feasible. The industry's principal concerns were mining coal for a profit, performing reclamation and getting bond releases without perpetual water treatment liability.

FORMATION OF A TASK FORCE

To study this regional AMD problem, Director Callaghan suggested that a Task Force be appointed. The Task Force would be comprised of responsible and knowledgeable industry people with an economic interest in AMD solutions. Regulatory people and consultants were also included. The Task Force membership today is made up of 11 industry representatives, two university research scientists, two consulting representatives, and two regulatory people. Although some of the people and the companies have changed, the distribution of voting members has remained unchanged.

The charge of the Surface Mine Drainage TaskForce is to find methods to mine coal in acid-producing areas without having perpetual water quality problems, chemical treatment and liability. The Task Force is predominately an independent, self-supporting coal industry group with no political, economic, or regulatory ties. It interacts and cooperates with all interests relative to surface mining and water quality and acts as a on-going catalyst to focus attention on the AMD problem. It is financially self-supporting and the members volunteer their time.

Initially, the Task Force met one evening each month at a member company's office. The goal was to determine the state-of-the-art in AMD technology, determine what was successful and feasible, and communicate this information to coal mine operating people. After very extensive literature review and deliberation, a handbook entitled "SUGGESTED GUIDELINES FOR MINING OF AREAS WITH POTENTIALLY ACID PRODUCING MATERIALS" was published in 1979 for use in premining planning and mining operations. The Task Force currently meets quarterly and invites speakers to present innovative AMD research and/or findings. To further assist the mining industry, the Task Force sponsors and conducts annual symposia featuring the leading researchers in North America presenting the latest technology available.

The Task Force encourages cooperation between West Virginia University and other research institutions, SRA's, and the coal industry to pool their resources to address this problem.

THE ESTABLISHMENT OF THE AMD TECHNICAL ADVISORY COMMITTEE

In September of 1978, a petition from environmental groups was served to the Director of WVDNR to designate 500 square miles in three counties unsuitable for mining due to AMD.

Because of the obvious socio-economic impacts and implications for coal mining in other areas of West Virginia, WVDNR was compelled to look for acceptable alternatives.

The alternative was to make a concerted technological research and demonstration effort to find solutions to prevent AMD from occurring in surface mining. The approach was to identify a number of recognized experts in the field of AMD research and select from that field of individuals specific disciplines relevant to AMD formation.

The objective was to make a bold departure from the customary approach of water treatment and to prevent acid formation at the reaction site. The individual experts were selected and the group was called the AMD Technical Advisory Committee (AMDTAC) (Table 1). Because of the uniqueness of the approach and the recognized talents of the committee members, this group soon became the foremost authority on AMD research.

Table 1. Names, affiliations, and primary area of expertise of the AMD Technical Advisory Committee.

<u>Name</u>	<u>Affiliation</u>	<u>Expertise</u>
Dr. John Sencindiver	West Virginia University	Acid minesoils, Acid-Base Account
Dr. Gwendelyn Geidel	University of South Carolina	Geology-hydrology
Dr. John Renton	West Virginia University	Geochemistry of coal overburdens
Dr. Robert Kleinmann	U.S. Bureau of Mines	Pyrite oxidation, wetlands, bacteria
Dr. Al Stiller	West Virginia University	Pyrite oxidation and reaction
Dr. Frank Caruccio	University of South Carolina	Geology-hydrology
Charles Miller	Grafton Coal Company	Coal operations and economics
Hans Nauman	Island Creek Coal Company	Coal operations and economics
Dave Callaghan	WV Dept. Natural Resources	Leadership and funding
James Pitsenbarger	WV Dept. Natural Resources	Leadership and funding
Roger Hall	WV Dept. Natural Resources	Leadership and funding

After much discussion within the group and with other interested parties, and with an evaluation of existing literature on AMD prevention being conducted, a group of projects was submitted for funding. A grant for funding nine projects was obtained by WVDNR from OSM for a total of \$818,050. The research project titles, investigators, and a brief explanation of the results of each project follow.

RESEARCH PROJECTS

I. Title:Demonstration of the Effectiveness of Current Mining Practices

PI:Sencindiver, Naumann, Kleinmann, Caruccio, and Geidel

Results: The mining and reclamation techniques used on the site included special handling of acid-producing material, compacting the toxic material, treating the toxic material with bactericides, and capping the toxic material with a clay liner. The application of these techniques reduced the acidity in the drainage but did not abate the problem. Clay seals were found to be effective barriers to water movement in two out of three cases. Soil and vegetation coverage were found to

also reduce acid production.

II. Title: Effectiveness of Crushed Sandstone as a Topsoil Material

PI: Sencindiver

Results: The crushed sandstone from the overburden on this site generally produced better growth of plants than the natural topsoil. Also the crushed sandstone produced little or no acidity. Appropriate analysis of overburden material was necessary to determine suitable topsoil substitutes.

III. Title: Induced Alkaline Recharge Zones to Mitigate Active Acid Seeps

PI: Caruccio and Geidel

Results: Trenches were constructed on the surfaces of surface mine backfills and filled with limestone and soda ash. Surface water was directed to these trenches, treated by the limestone, and the alkaline water moved into the backfill. After more than two years of analysis, the discharges were less acid. Tracers from the trenches were found in discharge water. Acid mine drainage still emanated from the site, however.

IV. Title: Soil Development and Root Growth and Distribution in the Topsoil above a Liner.

PI: Sencindiver

Results: A 50-acre site of acid-producing material was covered with a 20 mil PVC plastic liner to prevent water infiltration and movement through the material. Eighteen inches of soil were placed on the liner to protect the liner and provide a growth medium for plants. The integrity of the liner was preserved and the soil remained in place. Vegetation growth was good and soil development and root growth were normal.

V. Title: Bactericidal Control of AMD from Abandoned Mine Lands

PI: Kleinmann

Results: Bactericides kill Thiobacillus, an iron-oxidizing bacteria, which catalyze the pyrite oxidation reaction. The investigators were unable to document the effectiveness of the bactericide and also learned that the material rapidly leached from the site. The B.F. Goodrich Company purchased the patent and have developed this technology.

VI. Title: Evaluation of Surface Geophysical Methods for Locating AMD Source Areas

PI: Kleinmann

Results: An electronic sensing device was used to detect subsurface anomalies in rock formations and to locate pools or channels of water in backfills. After three attempts, it was discovered that the method could locate rock anomalies but there was little certainty as to whether it was water or some other highly conductive material. Resolution was also relatively poor, so exact locations could not be pinpointed.

VII. Title: Characterization of Overburden Materials and Rates of Acid and/or Base Production

PI: Renton

Results: With the use of Soxhlet leaching extractors, the investigator was able to determine the acid-producing potential of various lithic units. By fitting curves,

predictions were made about the rates and length of time acid would be produced.

VIII. Title: Control of AMD by Ferric Iron Complexing
PI: Stiller

Results: The use of rock phosphate to complex ferric iron and retard oxidation of pyrite was tested. The experiments clearly showed that the technique was effective.

IX. Title: Assessing the Alkaline and Acid loads of Coal Mine Overburden and Prediction of Mine Drainage Quality.
PI: Caruccio and Geidel

Results: The study evaluated the size fractions of acid-producing materials (surface area) and its effects on rates of acid production. There was a definite correlation between size fraction and acid production rates.

In 1985 as these nine Phase I projects were being completed, it was determined that some of the projects required further study and that some totally new ideas and approaches had come to light. The WV Department of Energy (now the SRA for coal mining in West Virginia) submitted another proposal to OSM for funding of Phase II projects. The grant amount was \$786,483. Table 2 lists the Phase II projects and the investigators.

Table 2. Phase II project titles and investigators.

<u>Title</u>	<u>Investigator</u>
1. Prong Site - Demonstration of the Effectiveness of Current Mining Practices and Identification of Deficiencies	Caruccio, Geidel
2. Mitigating Acid Seeps through Induced Alkaline Recharge Zones	Caruccio, Geidel
3. Effects of Topsoil and Vegetation on Mine Waste Drainage Quality	Sencindiver, Renton Stiller
4. The Use of Fine Grained Rock Phosphates as an AMD Ameliorant	Stiller, Renton
5. The Development of a Mathematical Model to Predict the Geochemical and Hydrologic Response of Surface Mining	Stiller, Renton

In 1986, the first, second, and third projects listed in Table 2 were terminated or completed. The fourth and fifth projects continued through 1988 when the National Mine Land Reclamation Center was established at West Virginia University. These projects have continued and have been developed further.

After years of intensive and innovative research work, AMDTAC succeeded in advancing the state-of-the-art in mine drainage abatement far beyond that of any effort mounted previously. A substantial body of new and unique information led to new understandings and the development of new technology. However, because of the complexities of the problem of pyrite oxidation and surface mining, much work remains to be done to have a complete grasp

of the problem.

The Task Force has continued to sponsor and conduct annual symposia and has asked researchers in AMD to report their results at the yearly meeting. The last meeting was held in April 1991. These reports can be obtained from the annual symposium proceedings. The authors have copies of the proceedings.

In addition, a report was published in 1987 which summarized much of the work accomplished by AMDTAC and also included other new technologies for the control of AMD. This report is entitled "A REVIEW OF PROCEDURES FOR SURFACE MINING AND RECLAMATION IN AREAS WITH ACID-PRODUCING MATERIALS". This report was published with the cooperation of the WVU Energy and Water Research Center and the WV Mining and Reclamation Association. Copies of this booklet can be obtained from the WVU Energy and Water Research Center, 617 Spruce St., Morgantown, WV 26506.

With the development of the National Mine Land Reclamation Center at West Virginia University, the AMDTAC group has ceased to function as a committee but, as mentioned, some of the researchers are currently conducting projects which developed from these early studies.

Numerous applications of the technologies advanced by AMDTAC research have been conducted by mining companies. A project has recently been initiated at West Virginia University to document the application and effectiveness of mining and reclamation technologies to control AMD. Economic evaluations are an important part of the assessment and some articles have been recently written. Future directions in AMD control are focusing on refining techniques and applying combinations of technologies to maximize AMD control.