The Role of the Acid Mine Drainage Technical Advisory Committee (AMDTAC) in Advancing West Virginia's Coal Industry

by

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Acid mine drainage is one of the major problems associated with some surface coal mines in the northern portion of the Bituminous coal field. In addition to the long term and expensive treatment processes necessary to neutralize the acid, prevention of the problem is becoming increasingly oriented toward prohibiting the mining of those coals historically associated with acid problems. As an example, the Eagle and Gilbert seams in Randolph County, as a general rule, do not produce significant amounts of acid. In contrast, some of the Kittanning seams in specific areas have been associated with acid mine drainage production. Yet at the same time, the Kittanning seams constitute a considerable portion of our energy base and the withdrawal of these coals would not only impact our energy resources, but, more importantly, affect the economy of the area. In many parts of the country, coal mining is the primary source of income for many people and closing off specific regions to mining will create adverse economic effects.

It is conceivable that many coals in the acid prone areas could be mined without producing perpetual acid mine drainage. Preliminary efforts along these lines were affected by the West Virginia Acid Mine Drainage Task Force. In their publication "Suggested Guidelines for Method of Operation in Surface Mining of Areas with Potentially Acid Producing Materials" several recommendations were put forth to assist coal mine operators in minimizing the acid production potential. Broad guidelines, in terms of water handling, overburden analysis and selective handling, and reclamation techniques and material blending were prescribed as part of the routine operation. In some cases the guidelines proved successful. Unfortunately in many other cases the techniques had limited success.

The question arises - why are the techniques successful under some conditions and not others? If one appreciates the variability of rock type in the overburden (where coal seams and rock strata pinch out and reappear in short distances), the uncertainty of how water infiltrates the mine surface travels through the backfill and emerges as a seep, the response of numerous rock types to varying weathering conditions, the various mining techniques and reclamation procedures used at different mine sites, and a host of natural complexities within the geology and hydrology of an area, one quickly realizes that too many variables exist within the system and that the answer is not clearly defined. Until each facet of the acid mine drainage problem is completely understood, and its role and relative importance are

clearly identified, we will never adequately know why the techniques succeed in some cases and not in others.

An extensive study of the fundamentals of the acid mine drainage problem was in order. To this end the Acid Mine Drainage Technical Advisory Committee (AMDTAC) was formed. The Committee's primary functions are (1) to identify and correct deficiencies in the current mining and reclamation practices to prevent the occurrence of acid mine drainage. In addition, (2) AMDTAC, with this data base is to develop on-site techniques to remedy existing acid mine drainage conditions.

The rationale behind organizing the Committee was based on the tracing of a drop of rain from the time it hit the mine surface, then infiltrated the soil profile, permeated the backfill, interacted with various rock and mineral components and eventually emerged as a seep. At each stage of the water migration, key elements were described and experts who were actively in doing research in these fields and were knowledgeable of these subjects were identified and asked to become part of the Committee.

Within the framework of a reclaimed mine and starting at the uppermost layer of soil, where the chemistry of the infiltrating rain water becomes quickly established and affects the geochemistry of the mine backfill system, the importance of vegetation cover, mine soil identification and mine soil development was readily recognized. Levels of alkalinity are determined at this horizon and radically affect the amount of acidity that may be produced. Dr. John Sencindiver, Division of Plant and Soil Science, West Virginia University was identified as the scientist who could contribute most to the understanding of this facet of the problem and was asked to Co-chair the Committee.

Once the water migrates through the mine soil, it permeates the pore spece of the backfill and begins to react with the rock and mineral matter of the overburden material. Initially the quality of the drainage will be affected and various degrees of alkalinity and acidity will form. Dr. Gwendelyn Geidel, Department of Geology, University of South Carolina, was selected to assist our understanding of how rock-water interactions take place in the backfill and affect drainage chemistry.

At this stage of mine drainage flow it is important to know not only the leachate quality (whether it will be acid or alkaline) but the amount (load) of acidity or alkalinity produced. In this way a balance between the two can be made to predict the mine drainage quality that could be expected and whether or not the amount of neutralizing material blended in the backfill is effective. Dr. Jack Renton, Department of Geology, West Virginia University, has been doing considerable research in this field and will add to the Committee's understanding of the rates of rock-water interactions and the geochemistry of acid mine drainage.

Under certain conditions, as the mine drainage migrates through the backfill, the amount of acidity generated will be low, in which case moderate amounts of alkalinity produced by admixed limestone will be sufficient to neutralize the acid. We also know that iron catalyzing bacteria accelerate acid production. Inhibiting the bacteria will reduce the acid loads and make limestone-generated alkalinity a reasonable and economical acid neutralizer. Dr. Bob Kleinmann, Acid Mine Drainage Research Section, U.S. Bureau of Mines, Pittsburgh, PA, has been doing outstanding research in the control of iron bacteria using detergents and will form an integral part of the development of the onsite control of acid mine drainage.

Along these same lines, if iron can be complexed in the early stages of acid production, acidity will not be formed. Dr. Al Stiller, Department of Chemical Engineering, West Virginia University, has been researching various iron complexing agents and the methods of application. Within this realm lies the key toward acid mine drainage prevention and at the present time, the Committee's primary effort in acid mine drainage prevention.

Finally, the identification of the actual flow paths within the backfilled mine is critical toward our understanding of the effectiveness of the techniques. Are the clay seals ineffective, does water only contact the acid material and not the alkaline zones, does most of the water bleed from the highwall of a backfilled mine and travel along the pavement, never contacting the overburden material, where within the backfill does acid drainage form? These are some of the fundamental questions regarding the hydrology and geochemistry of the reclaimed mine and which will be addressed by Dr. Frank Caruccio, Department of Geology, University of South Carolina and who is also Co-chairman of the Committee.

Thus we feel that the total mine drainage system, from the beginning where water falls on the mine surface, through the inner workings of the geochemistry of the backfill, until the water emerges as a mine drainage flow, is covered in all respects by the six scientific experts appointed to the Committee.

Although the solution to the problem looks good in the laboratory beaker, the manner in which it must be implemented in order for it to work must be economically and practically feasible. Further, all science must be blended with the ground truth of field experience so that the solutions to the problems will, in fact, be realistic. Two engineers were chosen to provide the Committee with this dimension, Mr. Charles Miller, Grafton Coal Company, Weston, WV and Mr. Hans Naumann, Island Creek Coal Company, Craigsville, WV.

Finally, in rounding out the Committee membership to afford DNR representation, first hand knowledge of the problem areas and research needs, are Director David C. Callaghan, Mr. Pete Pitsenbarger and Mr. Roger Hall of the West Virginia Department of Natural Resources (For a summary of Committee membership, see the attached table).

ACID MINE DRAINAGE TECHNICAL ADVISORY COMMITTEE

Member	Organization	Background
David C. Callaghan	West Virginia Department of Natural Resources, Charleston, W.V.	Director
Frank T. Caruccio, Ph.D.	CARGEID and Department of Geology, University of South Carolina, Columbia, S.C.	Geochemistry of acid mine drainage, environmental hydrogeology
Gwendelyn Geidel, Ph.D.	CARGEID and Department of Geology, University of South Carolina, Columbia, S.C.	Applied Geochemistry, rock-water interactions, overburden analysis
Roger Hall, M.S.	West Virginia Department of Natural Resources, Charleston, S.V.	Reclamation, mine permitting, environmental protection
Bob Kleinmann, Ph.D.	Supervisor, Acid Mine Drainage Research Section, U.S. Bureau of Mines, Pittsburgh, P.A.	Geochemistry of acid mine drainage, microbiology of iron bacteria
Charles Miller, M.S., P.E.	Grafton Coal Company, Weston, W.V.	Industry representative; Chairman, W.V. Surface Mine Drainage Task Force
Hans Naumann, P.E.	Island Creek Coal Company, Craigsville, W.V.	Industry representative, engineering services manager
Pete Pitsenbarger	West Virginia Department of Natural Resources, Charleston, W.V.	Chief, Division of Reclamation
Jack Renton, Ph.D.	Geology Department, West Virginia University, Morgantown, W.V.; W.V. Geol. Survey	Mineral matter in coal, geochemistry of acid mine drainage
John Sencindiver, Ph.D.	Division of Plant and Soil Science, West Virginia University, Morgantown, W.V.	Overburden analysis, mine soils reclamation
Alfred Stiller, Ph.D.	Department of Chemical Engineering, West Virginia University, Morgantown, W.V.	Iron sulfide geochemistry, oxidation kinetics, reactor processes

Each member of the Committee is an expert in a particular facet of the acid mine drainage problem. Through this concerted research effort, the Committee members have the opportunity to interact and begin to examine the acid mine drainage problem from a new perspective.

Within the scientific and industrial communities this approach is recognized as one of the major and significant efforts toward solving the acid mine drainage problem that has been

organized within the last twenty years. The successful completion of the Committee's objectives will not only lead toward the alleviation of current acid problems but will permit the mining of coals with a minimum environmental impact and maximum economic return.