FIELD EXPERIENCES IN ACID MINE DRAINAGE PREVENTION

by

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Paper presented at the West Virginia Surface Mine Drainage Task Force Symposium, April 3-4, 1991, Morgantown, West Virginia

Abstract

A project was initiated at the National Mine Land Reclamation Center of West Virginia University in 1989 to survey coal operators, consultants, and regulatory personnel about their experiences in AMD prevention. Overburden analytical techniques are being used by the industry to determine the quality of the overburden before mining. The Acid-Base Account is the predominant, method employed by nearly all people we interviewed. Leaching tests are used sparingly. Special handling of overburden has been done by operators with good success. There is agreement in principle concerning the effects of special handling and placement on AMD from reclaimed sites. Our respondents disagreed on the level of implementation and confidence in the actual placement of acid-producing materials in designated areas of the backfill.

Introduction

Land reclamation is a dynamic, rapidly-evolving field and research ill this area has been ongoing since the first laws were passed to protect the environment. Numerous research projects and demonstration plots have been conducted during the past three decades. Many results have been published in journals, proceedings and reports. However, some very important results and experiences with innovative mining and reclamation technologies have been obtained by private consultants, regulatory personnel, and coal operators. These results and experiences have rarely been published and are generally unavailable for scientific comment. Further, only a few people know about the application and its results.

Methods

Knowing that this kind of situation exists in our region, I submitted a proposal to the National Mine Land Reclamation Center in 1989 to determine from coal operators, consultants, and regulatory people the kinds of experiences they have had over the years concerning land reclamation. As the project has developed, I have brought other people on to help with different aspects of the work. Ben Faulkner was contracted to help with the on-site visits and interviews and to help with writing and reporting the results. Most recently, we have involved a couple of economists from WVU to begin developing a framework for cost estimation of applying different mining and land reclamation technologies.

During the summer of 1990, Ben and I selected 158 reclamationists in the region (90% were from West Virginia) and sent them a brief questionnaire concerning how much they felt they knew about different reclamation technologies. The response was great. We asked them how much they knew (on a 0 to 5 rating scale) about 20 different technologies. Some of the results are found in Table 1.

Table 1. A summary of the responses from a questionnaire sent to 158 prominent reclamationists in West Virginia and surrounding states. The respondents were asked to express their level of involvement and expertise with technologies associated with 20 reclamation topics. The scale was 0 to 5 (5 = I have alot of experience, 3 = I have some experience, 0 = I have no experience).

Question Area	% of individuals responding					
	5	4	3	2	1	0
Acid Mine Drainage	41	34	16	5	3	1
AMD Water Treatment	30	34	20	11	4	1
Planning to Prevent AMD	25	29	28	11	4	3
Toxic Material Handling	21	25	21	15	11	7
Phosphates in AMD Prevent	2	1	18	21	25	33
Acid-Base Accounting	18	20	22	20	9	11
Simulated Leaching Tests	10	12	20	12	21	25
Permit Preparation	34	30	12	12	4	8

The results showed that a lot of people were involved and experienced in acid mine drainage prevention and treatment. Many are using Acid-Base Accounting in toxic material handling, while leaching tests are not being used as much. Most of the respondents did not feel like they knew much about phosphates.

After the results of the questionnaires were evaluated, Ben and I selected approximately 20 individuals each that we felt would be willing to meet with us face-to-face and discuss some of their experiences. Therefore, we developed a list of interview questions under 12 different topics and technologies. The questions for each subject area involved describing their experience with the technology, the application of the technology on their sites, how long they have been using the technology, the costs associated with applying the technology, how it worked, and benefits or problems.

Table 2 lists the subject areas.

Table 2. Subject areas which were discussed in interviews.

1.	Chemicals for AMD Treatment
2.	Ammonia
3.	Anti-Microbial Ameliorants
4.	Overburden Sampling, Analysis and Interpretation
5.	Special Handling
6.	Hydrology
7.	Application of Limestone During Mining
8.	Waste Materials
9.	AMD Sludge Disposal
10.	Wetlands and Biological Amelioration
11.	Revegetation
12.	Miscellaneous Effects of Mining

I will speak briefly about some of the responses associated with AMD prevention like overburden analysis and interpretation, and special handling procedures. Ben will follow by discussing AMD treatment technologies, and Jerry Fletcher will give a presentation on the costs associated with AMD treatment, how costs might be calculated and how they can be used to select the most cost effective treatment technology.

Results and Discussion

After reviewing the questionnaires, I was surprised to learn that the interviewees, collectively, were responsible for or had experience with over 500 sites that had been mined. This pool of knowledge and experience is noteworthy.

The number of overburden samples or cores needed to assess the geology of a mine site received a wide array of responses. Some said that in their experience only 1 or 2 cores were necessary to confirm other results they had obtained from nearby sites. A few felt that many more cores would help in ascertaining the geologic conditions of the area and that a regional geologic data base was the only way that sufficient information could be gained to plan mining and reclamation. The majority of people tended to agree that 3 to 6 cores depending on size of the area, geologic consistency, and experience in the area were needed to make accurate mining and reclamation plans.

Acid-Base Accounting is a widely-used method to characterize overburdens before mining. Essentially 100% of the interviewees confirmed that this method is still commonly used by almost all coal operators and consultants, and is the method of choice by regulatory agencies. Some said that this method gives all the information that is needed to plan the mining operation. A few individuals felt that more work was needed to clarify certain aspects of the Acid-Base Account. For example, the method does not work well in some areas when siderite (iron carbonate) is present and also does not work well with sandstone layers associated with some coal seams. The majority felt that this method was a good tool in analyzing overburdens and provides a good place to start interpretations. About 75% said this was the only overburden analytical method they used. The other 25% explained that they rarely used other methods of overburden analysis.

Leaching tests are primarily used to confirm or provide additional information about overburden layers beyond that which is obtained from the Acid-Base Account. Of the people I

interviewed, only about 25% used some type of leaching test to get additional information on reaction rates of acid-producing materials. The leaching methods used by these individuals were column leaching and soxhlets. As a matter of fact, a couple of people who had used leaching tests to better understand questionable Acid-Base Account samples replied that leaching tests often gave more obscure and mysterious results than the Acid-Base Account originally gave. So, in general, leaching tests are not a common method of overburden analysis in this region, and several people cited that variation among methods was a major problem. Sulfur fractionation was mentioned by two operators as another laboratory method that has at times given them some important information.

In 1979, special handling of acid-producing materials was the major subject in the West Virginia Surface Mine Drainage's Bulletin entitled "Suggested Guidelines for Method of Operation in Surface Mining of Areas with Potentially Acid-Producing Materials". One of my major interests in this project was to understand the perceptions of operators, consultants, and inspectors concerning the use of special handling in mining and reclamation. A second interest was to document the extent of application on mine sites. A general perception without exception was that special handling of overburden does indeed affect the levels of AMD produced on a site. There was also general agreement that "high and dry" placement was preferable to placing acid-producing material anywhere else in the backfill. Pavement cleaning and liming was also perceived to be extremely important in AMD prevention. Rapid burial of acid-producing materials in the backfill was also mentioned as a critical step in special handling.

There were large disagreements as to how these practices were being implemented on sites. Most agreed that segregation of acid-producing materials had actually reduced the amounts of AMD produced based on comparisons with adjacent, non-segregated overburden sites. The majority felt that clay liners either on top of acid-producing material or on the pavement probably reduced water movement but these liners were only partially effective in keeping water from those areas. A few people said they had good success with compacted clay as a water barrier while others were sure that compacting thin veneers of clay to reduce permeability was impossible on a field scale. Sixty percent of the respondents said they had about 50% confidence that a clay cap would work effectively.

One of the most interesting questions we asked was "If special handling was approved as part of the mining and reclamation plan in the permit, how confident are you that it is actually being done in the field"? Forty percent of the respondents said that they were positively sure that it was not being done. Thirty percent said that about one-half of the material ended up where it was supposed to, and the other thirty percent said that about three-fourths of the material was placed according to the plan.

All individuals who were doing or had done special handling were asked how much they thought it cost them. A couple of operators (conscientious operators) stated that they didn't know because it was simply part of the plan and they didn't have a comparison to test it against. The operators who had estimated the costs said that it cost them from $0.50 to $1.50 per ton of coal mined.

Only one person had much experience with phosphate so the use of phosphate has still not received much attention in the field. Several of the operators mentioned that they used large amounts of limestone before, during, and after mining. They spread it before blasting, mixed

it and applied it with overburden while it was being moved, spread it so their equipment would drive through it, limed the pavement heavily, and spread it thickly on the surface after backfilling.

In conclusion, 1 learned a great deal concerning the perceptions and experiences of people in mining and reclamation, and the level of application of many technologies in the field. As more experiences on AMD prevention were related to me, I became more and more convinced that AMD can be controlled to a dramatic degree with the technologies that are available now. The biggest problem is instructing and training the individuals on bulldozers and other equipment to recognize the rocks and strata and placing them where they were designed to be placed. Water control is absolutely critical. The surface mine supervisor must be convinced of the importance of the overburden placement plan and must not compromise the placement of materials for any reason. Operators have told me "I can take you right now to reclaimed sites where I know that the majority of overburden was handled right and there is no AMD. On adjacent reclaimed sites where the overburden was not handled carefully, AMD is being produced and chemical treatment is being applied".