

A Handbook of Technologies for Avoidance and Remediation of Acid Mine Drainage



Prepared by

**J. Skousen, A. Rose, G. Geidel, J. Foreman, R. Evans, W. Hellier,
and Members of the
Avoidance and Remediation Working Group
of the
ACID DRAINAGE TECHNOLOGY INITIATIVE (ADTI)**



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at West Virginia University.*

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of best science applications to the problem of acid mine drainage.

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The concept for the Acid Drainage Technology Initiative (ADTI) was developed in the Spring of 1995 by Hammond Eve of USDI, Office of Surface Mining, David Finkenbinder of the National Mining Association, and Paul Ziemkiewicz of the National Mine Land Reclamation Center at West Virginia University. Shortly after the elementary idea was developed, it was enhanced and moved forward through the efforts of Greg Conrad of the Interstate Mining Compact Commission; Roger Hornberger of Pennsylvania Department of Environmental Protection; Rocky Parsons and Charles Miller of West Virginia Division of Environmental Protection; Dan Sweeney of the U.S. Environmental Protection Agency; Kim Burke of Anker Energy; Vance P. Wiram of Cyprus/Amax Coal, Inc.; Bruce Leavitt of Consolidation Coal, Inc.; and Robert Kleinmann of the U.S. Department of Energy.

The outreach for the volunteer technical experts resulted in 51 who would work in two working groups. This handbook is the product of working group two. Section leaders are Gwendelyn Geidel for Alkaline Addition Technologies; John Foreman for Engineered Structural Techniques; Tom Jageman (until January, 1997) and Robert Evans for Active Treatment; and George Watzlaf (until January, 1997) and Arthur Rose for Passive Systems. An initial compilation of technologies was completed by Inhi Hong, Mining Engineer, Office of Surface Mining. Charles Miller, Ben Faulkner, and Marcia Nelson handled most of the management aspects of the first working group meeting. The handbook then developed into a product of the entire working group, comprised as follows:

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Overall management is by the Operations Committee, comprised of Gene Kreuger, who represents Federal government; Roger Hornberger, who represents the Interstate Mining Compact Commission; Kim Burke, representing the National Mining Association; Robert Kleinmann, who serves as Chair of Working Group I: Prediction; Charles Miller, Chair of Working Group II: Avoidance and Remediation; and Paul Ziemkiewicz, Director of the National Mine Land Reclamation Center and Secretariat of the Operations Committee.

INTRODUCTION

An array of techniques have been developed during the last several decades to abate or control pollution by acid mine drainage (AMD) from coal and metal mines. Although most of these techniques are successful in eliminating or decreasing the deleterious effects of AMD in some situations, they are unsuccessful in others. Due to the inherent variability between mines and environmental conditions, no one abatement or treatment technique is effective on all sites, and selection of the best method on each site is difficult given the array of methods available. The techniques also vary in the type and size of problem they are capable of handling. Their individual costs, effectiveness, and maintenance are also important considerations. Therefore, accurate information is needed to understand the limitations of the various methods and their response to various site variables. Continued research is imperative for field testing of existing technologies, as well as continued development of new technologies. At present, there is no authoritative guide or manual to assist in evaluating the best technique for a given situation.

In order to continue to mine coal and other minerals without harming the environment, the best science and techniques must be identified and implemented in order to minimize the production of AMD. To accomplish this goal, the Acid Mine Drainage Technology Initiative (ADTI) was organized to promote communication among scientists and engineers dealing with AMD, and to develop a consensus on the identification and optimum usage of each method. The intent is to provide information on selection of appropriate techniques for specific problems that will ultimately lead to a higher level of success in avoidance of AMD and remediation of existing sources, at a savings in cost and staff time, and with greater assurance that a planned technique will accomplish its objective. This effort will result in enhancement of mine drainage quality, improvement in stream cleanup and its cost effectiveness, and development of a mechanism for technology transfer.

ADTI is a coalition of State and Federal agencies, industry and private organizations, academia, and consulting firms. It is a technology-based initiative, not regulatory or political. ADTI is divided into two groups: prediction and avoidance/remediation. About 30 individuals constitute Group 2 (as listed in the acknowledgments), which focused on avoidance and remediation techniques.

The group decided at its initial meeting on April 8-9, 1996 to produce a technology handbook that would describe the many techniques and a set of case studies from which conclusions could be drawn on the applicability and limitations of each technique. The handbook will address all types of mine drainage control and treatment methods, including generalized design and performance criteria, as well as historical case studies. Ultimately, the handbook should enable the user to select the best, technologically proven, most economical method suited to a particular situation. The handbook should provide design details associated with failure to avoid repeating inadequate and inappropriate methods. It should also aid in determining research needs and cost effectiveness for various options.

This Phase I document summarizes the technologies and provides some relevant case studies collected by the various members. Further development of technologies, their description, and increased numbers of case studies will be included in a future document. The work to date has been largely volunteer in nature; support for time and travel has been met by individuals or their organizations without a specific budget for the ADTI work. Although considerable progress has been made, as indicated by this Phase I document, the lack of funding has limited progress, and the results must be considered preliminary.

The initial focus has been on AMD from coal mining, mainly in the eastern U.S., because of the easier logistics in assembling a large group of experts in meetings, and because of the additional complications created by metal mine pollution. Although much of the discussion in this manual also applies to metal mine drainage, future work will contain more emphasis on drainage from metal mines.

The handbook will be updated periodically to add new information from case studies and research, and as improved insights are gained on the optimum applicability of the various techniques.