

*Model State Program for*  
**CONTROL AND PREVENTION  
OF WATER POLLUTION  
FROM UNDERGROUND MINES**

**OHIO RIVER VALLEY WATER SANITATION COMMISSION**

*an interstate agency representing*

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\* As of April 1, 1978

MODEL STATE PROGRAM  
FOR CONTROL AND PREVENTION OF WATER POLLUTION  
FROM UNDERGROUND MINES

April, 1978

Ohio River Valley Water Sanitation Commission  
414 Walnut Street Cincinnati, Ohio

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## FOREWORD

Because seventy percent of our national bituminous coal resources are located in the Ohio Valley, the Ohio River Valley Water Sanitation Commission (ORSANCO) has long been concerned about the impact of mining activities on Ohio River water quality. In 1960, the Commission first adopted procedures for use by the states to control water pollution resulting from acid mine drainage. These procedures have twice been revised and expanded.

Recently, as the need to develop energy resources has become more acute, increasing attention has focused on expanded utilization of coal for energy. Increases in coal production naturally augment potential sources of mine drainage. Anticipating expanded mining activities in the valley, the Commission established an ad hoc work group in 1976 to address mine drainage control. The group was charged with the task of reviewing the existing state mine drainage control programs and developing reliable procedures for the abatement of pollution from both active and inactive mining sites.

Chosen to man the committee were representatives from pollution control agencies of the eight states allied in ORSANCO, and from the Appalachian Regional Commission, the U. S. Corps of Engineers, and the U. S. Environmental Protection Agency. The work group has developed the following model program for management of underground mines to prevent water pollution. Future work of the committee will address other potential sources of mine drainage—surface mines, coal preparation facilities, and disposal areas for mining refuse.

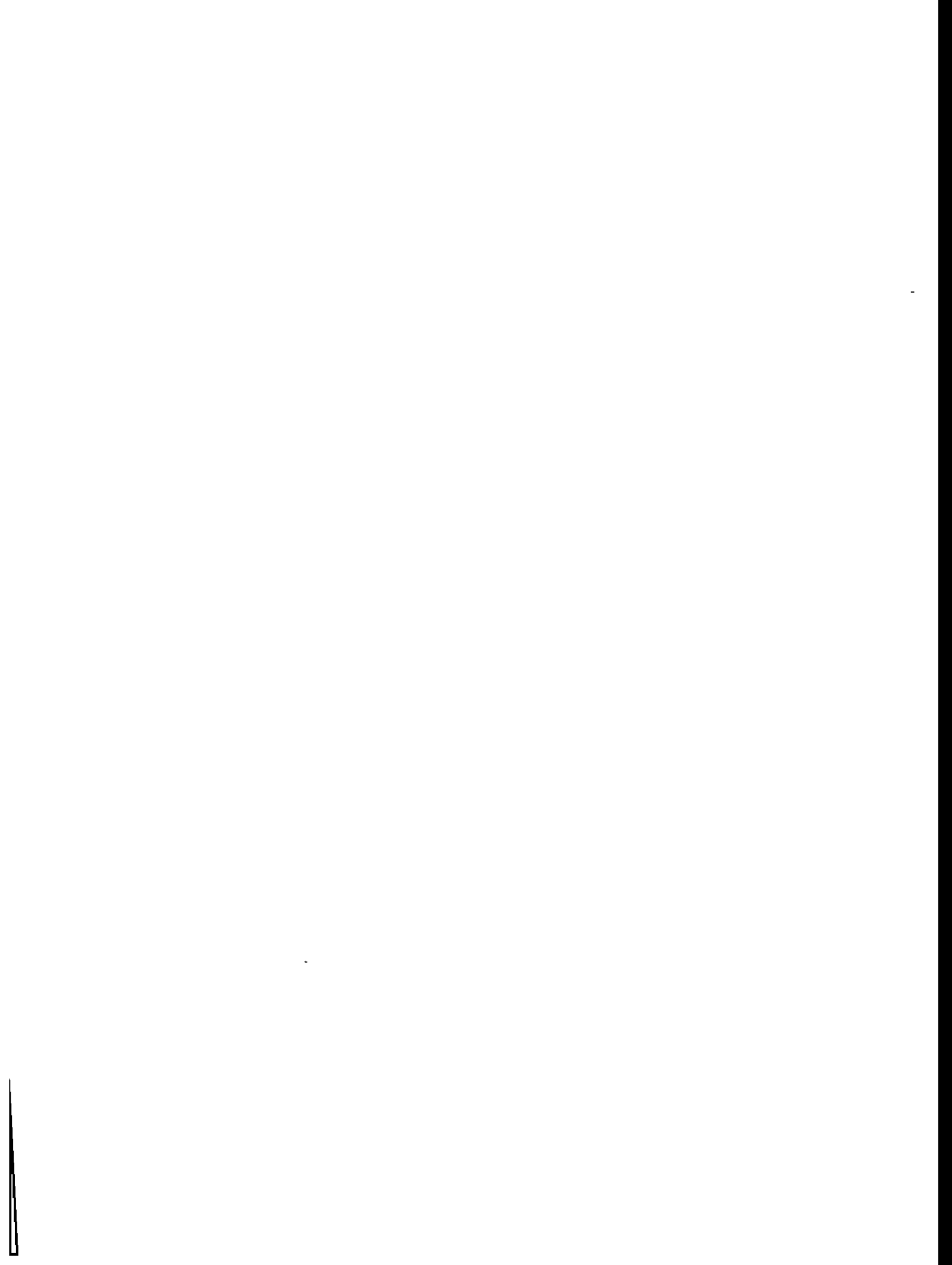
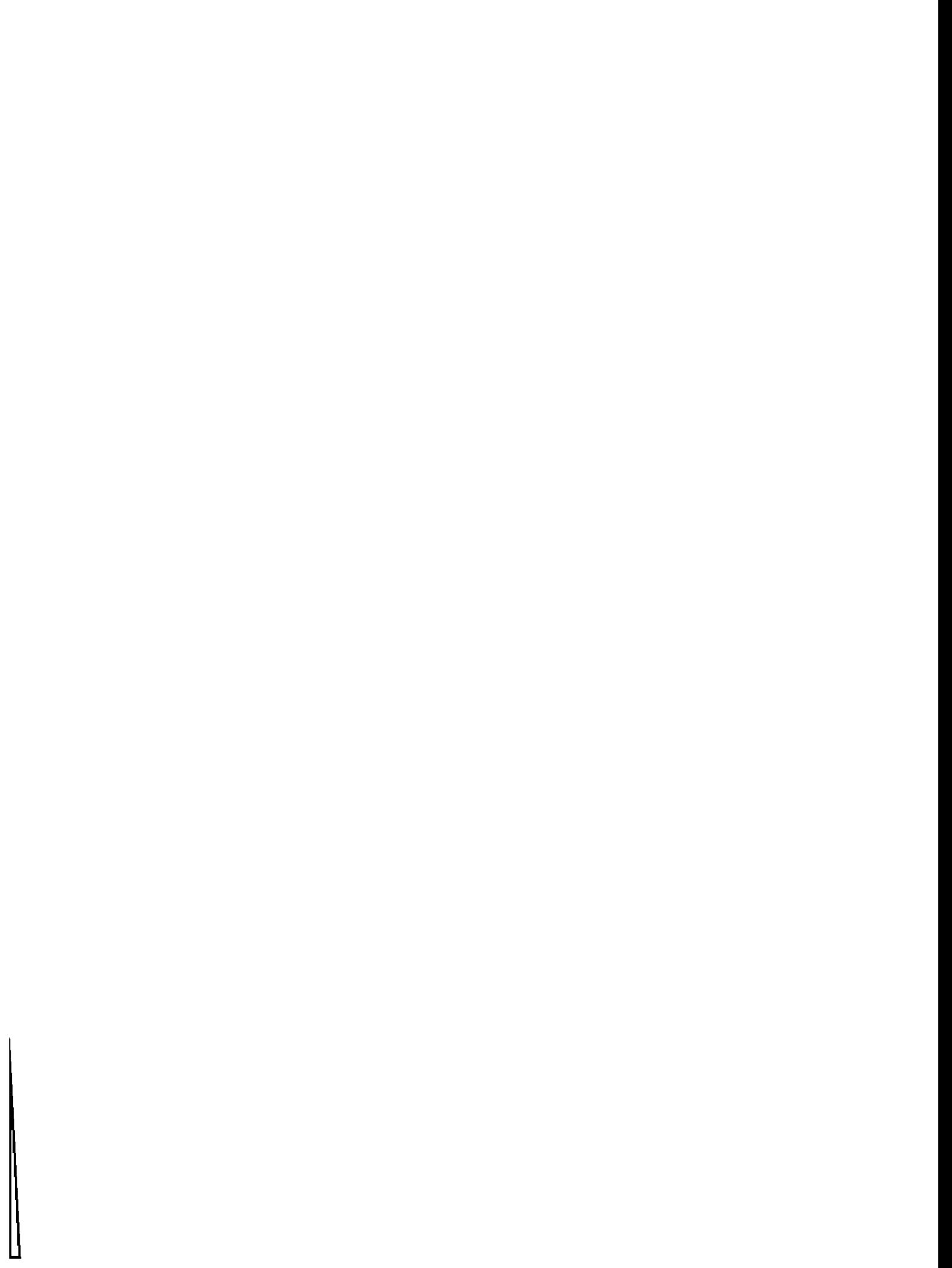


TABLE OF CONTENTS

|   | Page |
|---|------|
| FOREWORD . . . . .  | iii  |
| SUMMARY . . . . .   | vii  |
| INTRODUCTION . . . . .  | 1    |
| Objectives . . . . .  | 1    |
| I. PRE-MINING PLANNING . . . . .  | 3    |
| A. Hydrology/Geology . . . . .  | 3    |
| B. Mining Method . . . . .  | 4    |
| C. Evaluation of Surface Water Quality Impact and Treatment Needs . . . . . | 4    |
| D. Runoff Control . . . . .   | 5    |
| E. Evaluation of Groundwater Impact . . . . .                               | 5    |
| F. Closure Procedures . . . . .   | 6    |
| G. Reclamation of Surface . . . . .   | 6    |
| H. Conformance to Basin/Areawide Plans . . . . .                            | 7    |
| I. Legal/Financial Responsibilities . . . . .                               | 7    |
| J. Inter and Intrastate Environmental Agency Coordination . . . . .         | 8    |
| II. MINE OPERATION . . . . .  | 9    |
| A. Compliance Monitoring . . . . .  | 9    |
| B. Underground Mine Inspection . . . . .                                    | 9    |
| C. Maintenance and Operation of Pollution Control Facilities . . . . .      | 10   |
| D. "As Mined" Plans . . . . .   | 10   |
| E. Active Mining Enforcement Program . . . . .                              | 11   |
| III. POST-MINING CONTROL . . . . .  | 13   |
| A. Mine Closure . . . . .   | 13   |
| B. Reclamation of Surface Structures and Facilities . . . . .               | 13   |
| C. Inspection and Monitoring . . . . .                                      | 14   |
| D. Term and Scope of Responsibility . . . . .                               | 14   |
| E. Post-Mining Enforcement Capability . . . . .                             | 15   |





## SUMMARY

The following model program describes elements necessary to prevent and control water pollution originating from underground mines. Three distinct elements compose a total program for controlling drainage from underground mines: preplanning to insure proper functioning of new mines, effective operation of active mines, and satisfactory reclamation and maintenance of abandoned mining sites. While outlining methods to accomplish these three goals, the model also delineates the extent of legal authority needed to conduct an effective control program, as well as professional expertise required to implement the program.

Public participation is essential in the implementation of a model control program. Public notice of proposed mines should be given, with ample opportunity for public comment; and a response system for complaints against operative mines should be established.

The recently enacted Federal Surface Mining Control and Reclamation Act has been considered in the development of the model program, especially as it relates to surface effects of underground mines. The program was developed by the Commission's Ad Hoc Work Group on Mine Drainage, established in 1976.



## INTRODUCTION

Underground mining in the Ohio River Basin began in the early 1800's and is quite widespread today. In the early days, control of pollution was practically non-existent; and as a result, many miles of streams in the Ohio Basin are polluted by drainage from abandoned mines. In the recent past, however, programs for controlling pollution from underground mines have been initiated in most of the ORSANCO member states. The adequacy of the state programs in terms of program coverage, legal authority, and human resources is variable. This report describes those elements necessary for an "ideal" regulatory program to prevent and control drainage from underground mines, the legal authority needed to carry out such a program, and the type of professionals required to staff it.

### Objectives

The basic objective of a regulatory program for underground mines is to prevent to the extent possible the adverse impact of mining activities on both surface and groundwater quality and quantity. Prevention, as used in this objective, means minimizing the formation of pollutants, minimizing the disturbance of the hydrologic system, and treating any contaminated water in order to meet water quality goals and standards.

In order to achieve these objectives, state programs must have sufficient information to evaluate a mining proposal, adequate legal authority, sufficient personnel resources, and cooperation among agencies and industries concerned. There are three major program elements where the information, the legal authority, the institutions, and personnel resources must merge. These elements are pre-mining planning, mine operations, and post-mining control.

These program elements can be implemented or incorporated into a state regulatory program through the traditional program activities of permit issuance and inspection. The pre-mining planning element provides a basis for acting on permits; the mine operation element implies inspection; and post-mining control includes both permit issuance, inspection, and maintenance.

Also implicit in the control program is active public participation. Public participation should be tailored to meet the needs of individual states and the requirements of applicable federal regulations. At a minimum, however, public participation should include:

- (a) Public notification of applications for proposed mines,
- (b) Public hearings or public meetings to solicit comment on proposed mining operations, and
- (c) A response procedure for complaints or inquiries concerning the conduct of the mining operation.



# I

## PRE-MINING PLANNING

In developing a new underground mine, adverse impacts can be ameliorated if adequate pre-mining planning is done. Preplanning considers the impact of the proposed mining operation on surface and groundwater quality and quantity, and it identifies the effluent limitations for a mine discharge and the treatment needed. Most importantly, however, a pre-mining plan identifies the procedures and methods to be used to close a mine once mining has been completed.

Administratively, the pre-mining plan serves as the mechanism for approving or disapproving a proposed mining operation. Sufficient technical details should be available in the pre-mining plan. It will either provide a sound basis for approving a mining operation or supply sufficient data to deny a mining proposal.

The program for evaluating a pre-mining plan includes a number of considerations:

### A. Hydrology/Geology

The impact of the proposed mining operation on the hydrology and geology of the mining site must be evaluated to predict the operation's effect on surface and groundwater quality and quantity. Appropriate prevention and control measures may then be designed to ameliorate adverse impacts.

#### (1) Information Needed

Geological data, including rock structure, faults, joints, fractures, porosity, and permeability, are important factors in the evaluation of a proposed mining plan. The following information must either be submitted by the mine operator or obtained by the agency:

- . Surface water locations and flow
- . Geological structure--faults and fractures and their effect on the groundwater flow system--name and thickness of coal seam(s)
- . Stratigraphic sequence in the mine area
- . Acid and mineralization potential of strata above and below the coal seam
- . Regional and local groundwater flow systems
- . Permeability and porosity of the strata above and below the coal seam
- . Surface and groundwater quality/quantity
- . Location, surface elevation and depth of water; oil, gas, disposal, and recharge wells

(2) Authority Needed

State laws and regulations must provide the authority to require the applicant to produce the needed information.

(3) Personnel Needs

Expertise in hydrology and geology is needed within the state program so that hydrology/geology information can be properly evaluated.

B. Mining Method

The method of mining must be evaluated to determine its compatibility with the hydrologic and geologic features of the mining site. The mining method must not aggravate faulting and fracturing to an extent detrimental to the re-establishment of the groundwater table after mining. The plan of mining should not include entries to the mine located in unsealable areas.

(1) Information Needed

- . Mining method, i.e., longwall, room and pillar
- . Mine development plan, i.e., schedule, direction
- . Location of entries, i.e., airways, manways
- . Location and direction of main headings and sub-headings
- . Location, size, and capacity of sumps and pumps
- . Location of discharges to the surface
- . An assessment of mine dewatering effects on the groundwater flow system
- . Location and extent of adjacent mines

(2) Authority Needed

The regulatory agency must have the authority to require the above information from the mine operator and to approve or disapprove the proposed mining method.

(3) Personnel Needs

Expertise in geology and mining engineering is needed to perform a proper evaluation of the mining plan and its impact on the surface and groundwater quantity and quality.

C. Evaluation of the Surface Water Quality Impact and Treatment Needs

The potential impact of any discharges on surface water quality should be evaluated and the degree of treatment necessary to meet established water quality standards should be provided.

(1) Information Needed

In order to evaluate the impact on water quality, it will be necessary to estimate the quantity and quality of a discharge from a proposed mine, the applicable water quality standards, and design criteria plans and specifications for any proposed treatment facilities.

(2) Authority Needed

Authority is needed for the state agency to establish water quality standards, set effluent limitations based on water uses, permit the discharge of mine drainage to state waterways, and require the mine operator to submit appropriate information to the agency. The agency also needs the authority to deny or disapprove plans if the system or equipment is judged to be inadequate.

(3) Personnel Needs

Expertise in chemistry, wastewater treatment, and the biological sciences is needed to make an evaluation of water quality impact and treatment needs.

D. Runoff Control

Pollution caused by storm-water runoff from surface facilities and operations must be prevented. Surface facilities include haul roads, storage areas, loading facilities, ventilating shafts, portals, refuse storage areas, and rail yards.

(1) Information Needed

Description of management practices or structural measures to control storm-water runoff, erosion, and sedimentation.

(2) Authority Needed

The state agency must have authority to require a plan for controlling runoff and the implementation of runoff control practices.

(3) Personnel Needs

Personnel expertise would be required in storm-water management, as well as erosion and sedimentation (civil engineer, soils specialist).

E. Evaluation of Groundwater Impact

Mining activities may have a significant impact on both the quality and quantity of groundwater. Groundwater resources must be protected from degradation because they directly influence surface water and are not easily renovated once polluted.

(1) Information Needed

In order to evaluate the impact of mining upon groundwater, the present and future uses of the groundwater and points of water withdrawal need to be identified. Natural groundwater quality and quantity, aquifer characteristics, waste disposal wells, and the groundwater flow system in the vicinity of the proposed mines need to be identified. The information gained in the investigation of hydrology/geology would be used also to assess the impact upon groundwater.

(2) Authority Needed

The state agency must have the authority to set groundwater quality standards, require the mining company to furnish the necessary information or provide means to acquire it in some other manner, and approve or disapprove the act of mining where it will adversely affect groundwater.

### (3) Personnel Needed

In order to evaluate the impact of the proposed mining facility on groundwater, persons with expertise in geochemistry, groundwater hydrology, and coal-mining geology are needed.

## F. Closure Procedures

The methods and techniques for abandoning and closing a mine must be evaluated so that post-mining pollution is prevented. Insufficient planning of mine closure procedures may lead to post-abandonment pollutive discharges.

### (1) Information Needed

In addition to the geologic and hydrogeologic data described under Hydrology/Geology, other information needed includes:

- . Location and size of barriers
- . The estimated hydraulic pressure on mine barriers and seals
- . The design of the mine seal or other closure method

### (2) Authority Needed

The regulatory agency must have the authority to require mine closure plans with the permit application and to inspect the mine closure and other reclamation operations. The agency must have the authority to approve or disapprove mine closure plans before the mine operation begins.

### (3) Personnel Needed

The evaluation of mine closure plans would require the expertise of geologists, hydrologists, and engineers with experience in mine-sealing procedures.

## G. Reclamation of Surface

In order to operate an underground mine, entry ways must be made from the surface to the coal seam. Often in preparing these entry ways, substantial excavation is done. Reclamation of the surface in all areas relating to an underground mine is needed to prevent erosion and sedimentation, to minimize acid mine drainage, to limit environmental degradation, and to return the land for future desirable use.

### (1) Information Needed

In order to be certain that the reclamation is done properly, a reclamation plan should be submitted indicating:

- . the limits of area to be disturbed
- . the grading and final slope to be maintained
- . the type of cover to be placed on the exposed area

### (2) Authority Needed

The agency must have the authority to require the needed information from the mine operator, to order the land reclaimed and stabilized, and to approve or disapprove reclamation plans.



(3) Personnel Needed

The state agency fulfilling this function will need experts in agronomy, soil mechanics, and civil engineering.

H. Conformance with Basin/Areawide Plans

Under the 1972 Amendments to the Federal Water Pollution Control Act and some state laws, basin and areawide water quality management plans have been or are being developed. Mining activities within these basins or areas must be undertaken so as not to conflict with these plans.

(1) Information Needed

The agency undertaking the regulation of mines must coordinate its activities with the planning efforts. Information on the planning activities, areawide plans, and basin plans must be available to the mining company and the regulatory agency.

(2) Authority Needed

The state agency must have the authority to require applicants to conform to approved state and areawide water quality management plans.

(3) Personnel Needed

No specific expertise needed.

I. Legal/Financial Responsibilities

Upon abandonment and closure of a mine, the mine operator must insure that pollution does not occur. It hardly makes sense to control pollution during the operation of a mine, if pollution is allowed to occur after the mine is closed. Even with a strong pre-mining plan, it is likely that a few mines will have post-mining problems because of the frailties in technology and regulatory programs. In order to have some degree of assurance that any pollution after mining is abated, the mine operator must have the financial and legal responsibility to correct post-mining pollution.

(1) Information Needed

In order to evaluate financial responsibility, the state agency must obtain information concerning the responsible official of the mining company, its corporate structure, and the measure of its financial responsibility.

(2) Authority Needed

In order to insure that a mine operator has legal and financial responsibility, the state legislation must include a provision that makes a mine operator responsible for any water pollution resulting from his mine, even after it is abandoned. The mine operator must be required to abate any post-mining pollution. Bonding against post-mining pollution or a tax on coal mined might also be included in the state legislation to insure that reclamation funds are available.

(3) Personnel Needed

Expertise in the law and finances is needed.

J. Inter and Intrastate Environmental Agency Coordination

The activities of regulatory agencies involved in air, water, solid waste, and other environmental programs must be coordinated.

(1) Information Needed

The mine operator must show the water pollution control agency that he has consulted with other environmental agencies and has obtained or submitted applications for permits or authorizations required under the programs of these other agencies. In addition, the water pollution control agency should consult with the sister agencies so that all program requirements are coordinated.

(2) Authority Needed

The regulatory agency must have the ability and authority to coordinate its various environmental protection programs.

(3) Personnel Needed

No special personnel are needed for this effort.

## II

### MINE OPERATION

The period of mine operation begins with site preparation and ends with mine closure. During this period, there is a potential for surface and sub-surface changes which could have an adverse impact on the surface water and groundwater of the area. Therefore, regulatory control during this period is important.

#### A. Compliance Monitoring

The inspection and analysis of discharges emanating from underground mine operations and surface facilities are necessary to determine compliance with permits and regulations. Compliance monitoring is a combination of the agency's monitoring and inspection, self-monitoring and reporting by the mine operator, and review of self-monitoring reports by the agency. It includes a quality control program to insure that the methods of analysis used by the operator are adequate.

##### (1) Information Needed

Information needed for compliance monitoring is the quality and quantity of point source discharges to the surface streams and the impact of the mine on the quality and quantity of the groundwater. The parameters needed to evaluate the water quality impact would include but are not limited to flow, pH, total suspended solids, total dissolved solids, acidity/alkalinity, sulfates, and trace metals associated with mine drainage. Frequency of sampling would be determined by field condition.

##### (2) Authority Needed

There must be adequate legislation which requires self-monitoring by the operator and allows the regulatory authority to monitor compliance with permits, laws and regulations, to enter private property for the purpose of inspection, and to inspect records. These authorities are possessed by states administering NPDES (National Pollutant Discharge Elimination System) permits.

##### (3) Personnel Needed

Personnel needed for this evaluation include engineers, field technicians, chemists, and hydrogeologists.

#### B. Underground Mine Inspection

Inspection of underground mine operations is necessary to insure compliance with pre-mining plans, to evaluate water-handling procedures, and to determine the location and size of the barriers.

(1) Information Needed

Information required for this inspection includes:

- . A current mining map showing foreseeable future mine development and the location of future barriers
- . A registered surveyor's certification of existing barrier thickness
- . The location of collection sumps, pumps, and discharge lines

(2) Authority Needed

The agency must have the authority to require the submission of the above information, to make underground inspections, and to require corrective actions.

(3) Personnel Needed

Personnel required for inspection include mining geologists and mining engineers.

C. Maintenance and Operation of Pollution Control Facilities

Proper maintenance and operation of equipment is required to reduce the chances of failure, thereby minimizing water quality problems and violation of permit requirements.

(1) Information Needed

Information needed for this evaluation includes description of the maintenance program, maintenance logs, an operation and maintenance manual, and operating reports.

(2) Authority Needed

Authority must exist to require proper maintenance and operation of equipment; notification of equipment failure, by-pass, or abnormal discharges; and correction of any violation of discharge permit requirements.

(3) Personnel Needed

The personnel required for this evaluation would be field inspectors knowledgeable in maintenance and operation of pollution control equipment.

D. "As Mined" Plans

To record mining activities and to compare with the pre-mining plan, a certified map showing the extent of mining operations should be required periodically.

(1) Information Needed

"As mined" plans should be submitted periodically (at least annually) and should show areas that have been mined, size and location of barriers, coal contours, and mine openings.

(2) Authority Needed

The agency must have authority to require the submission of the above plans.

(3) Personnel Needed

Expertise in mine geology and mine engineering is needed for evaluation of "as mined" plans.

E. Active Mining Enforcement Program

The regulatory agency must have the capability of initiating administrative, civil, or criminal action to obtain compliance and assess penalties for non-compliance with rules, regulations, and other permit requirements.

(1) Information Needed

Violations of permits, regulations, or laws must be documented with sufficient evidence to undertake needed actions.

(2) Authority Needed

The state agency must have sufficient authority to initiate administrative actions such as:

- . Violation notices
- . Orders (written)
- . Permit revocation/suspension
- . Future permit denials
- . Economic sanctions
- . Cease and desist operations
- . Verbal orders/instructions

To initiate criminal actions such as:

- . First level judicial actions by field inspectors for relatively minor violations (usually before a district magistrate)
- . Second level judicial actions (usually before a criminal court)

And to initiate civil actions for damages and penalties.

(3) Personnel Needed

Expertise needed includes a technical staff able to show that violations have occurred and a legal staff to prosecute violations.



### III

#### POST-MINING CONTROL

In the past, many mines were abandoned when they could no longer yield a profit. Abandonment of a mine was often the beginning of a continuing pollution control problem. Post-mining control is concerned with altering this abandonment-pollution pattern.

##### A. Mine Closure

The process of closing a mine so that pollution will not occur in the future is important because a high potential for future problems exists if the mine is not closed properly.

###### (1) Information Needed

Information required for this evaluation would include the following:

- . Final as-mined plan
- . Updated fracture and subsidence data
- . Statement from permittee that the closure plan developed in the pre-mining plan is still applicable or, if no longer applicable, a revised plan
- . A certification from the permittee that the approved closure plan was followed

###### (2) Authority Needed

The state agency must have the authority to require the needed information from the permittee, to evaluate the mine closure plan, and to require modifications where necessary. Authority is also needed to inspect the mine during and after the mine closure and to require corrections if necessary.

###### (3) Personnel Needed

Expertise in geology, civil and mining engineering is needed for this evaluation.

##### B. Reclamation of Surface Structures and Facilities

The removal of all undesirable structures and reclamation of surface areas disturbed by all phases of mining activities are needed to prevent pollution from the area, to remove safety hazards, and to make the site aesthetically pleasing and available for alternate land uses.

###### (1) Information Needed

Required information includes a copy of the reclamation plan submitted in pre-mining planning and an evaluation as to its current adequacy in relation to 208 or other plans.

(2) Authority Needed

The state agency must have the authority to require a reclamation plan which is consistent with the areawide 208 plans and to conduct final inspection.

(3) Personnel Needed

Personnel required would include experts in reclamation procedures and persons knowledgeable in 208 and other plans.

C. Inspection and Monitoring

The agency must determine the effectiveness of reclamation and mine closure programs through inspection and monitoring of closed mines.

Initially, the monitoring should be done at the mine but later on, if no problems are indicated, stream monitoring may be sufficient.

(1) Information Needed

Information needed for inspection and monitoring includes record of mining operation, location of seals, pre- and post-mining water quality data, and general geologic information to determine potential sources of seepage.

(2) Authority Needed

The state agency should have a general authority to conduct a water quality monitoring and inspection program.

(3) Personnel Needed

Personnel needed would include field inspectors having general scientific background, geologists, and engineers.

D. Term and Scope of Responsibility

The mine operator should be responsible for abatement of any pollution which occurs after mine closure and surface reclamation. Generally, the term of the permittee's responsibility is perpetual unless other financial arrangements have been made through some institution to provide adequate protection.

It is important to insure that the pollution from closed mines can be corrected in a timely and satisfactory manner and to protect the public from a future financial burden from mining.

(1) Information Needed

The financial arrangements that have been made for pollution abatement should be supplied by the permittee.

(2) Authority Needed

There must be state legislation to provide the agency adequate authority to make the mine operator responsible for any pollution from the closed mine and to review and approve the alternate financial arrangements so that any post-mining problems are corrected. Authority is also needed to place perpetual responsibility on existing active mines.



(3) Personnel Needed

Expertise in finance, law/environmental law, and insurance is needed for this program.

(4) Institutions

Responsibility for perpetual care of mines could create some legal problems if a mine operator were to go out of business. Protection against such uncertainty of post-mining pollution control could be provided through institutional arrangements with the state agency or mining industry groups. These institutions could assume responsibility for perpetual care, in lieu of the mine operator. The institutions need the right to assess the participating operators for this care, an arrangement similar to the perpetual care provided at cemeteries.

E. Post-Mining Enforcement Capability

When post-mining pollution problems are identified, the regulatory agency must have the capability to initiate administrative or enforcement actions against the mine operator or his legal agent.

(1) Information Needed

Evidence should show post-mining pollution or an adverse impact on the pre-mining hydrologic system.

(2) Authority Needed

General authority is needed to require remedial action by operator or responsible agent.

(3) Personnel Needed

Technical staff would be required to show that violations have occurred, and legal staff would be needed to prosecute violations.



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