

THE NATIONAL MINE LAND RECLAMATION CENTER

Overview and Approach

by

P.F. Ziemkiewicz

Director
National Mine Land Reclamation Center
Prepared for the

West Virginia Surface Mine Drainage Task Force Symposium
25-26 April 1989
Morgantown, West Virginia

SUMMARY

The National Mine Land Reclamation Center was initiated in July 1988 to conduct coordinated research and technology transfer programs to improve the technologies available for the cost-effective and environmentally acceptable reclamation of land disturbed by both underground and surface mining operations. Programs of the Center address reclamation problems for abandoned and active mine sites. The initial focus of research will be on coal mine lands. Future programs will address reclamation problems associated with mining for other minerals.

The need for reclamation and improved technology transfer programs has been identified and documented in recent years in reports issued by regional and national committees. Benefits to be obtained from such programs include more successful short term and long term solutions for mitigating and eliminating the adverse effects that mining has on land, water resources, and structures, and, a more rapid transfer of reclamation technology to coal mine operators and regulatory agencies. Reduced land reclamation costs will promote an increased use of coal to strengthen our energy independence.

The National Mine Land Reclamation Center is organized around three Regional Centers located within the major coal-producing regions of the country. This approach provides industry and government regulatory agencies with a flexible and regionally responsive research tool. Direct involvement of industry and government regulatory agencies in the program will assist in guiding the research toward development of improved, practical reclamation technologies.

These activities are coordinated by the National Center located in Morgantown, West Virginia, and implemented by the three Regional Centers: Eastern, Midwestern, and Western. Research and technology Transfer programs will be developed in cooperation with Advisory Committees comprised of representatives from state and federal agencies, industry, and academic

institutions in each region.

The following paper outlines the objectives of the National Mine Land Reclamation Center, its philosophy, its organization and its approach to the problem of developing practical reclamation technologies.

TABLE OF CONTENTS

Summary	I
1.0 Introduction	1
1.1 The Objective	1
1.2 The Strategy	1
1.3 Industry/Government Involvement	
2.0 Progress Report	3
2.1 Organization	3
2.2 Procedures	4
2.3 Technology Transfer	4
2.3.1 Industry/Government/NMLRC Coordination	4
2.3.2 Written and Visual Mechanisms	6
2.4 Coordination with Bureau of Mines	6
2.5 Research Progress	6
3.0 Proposed Program for FY 1989	11
3.1 Program Description	11
3.2 New Initiatives	11

1.0 INTRODUCTION **Table of Contents**

Effective 1 July 1988, the National Mine Land Reclamation Center was established for the purpose of stimulating new initiatives toward the resolution of the outstanding technical challenges that still face the U.S. mining industry. These include such items as acid mine drainage, restoration of prime farmland, soil and groundwater salinization.

1.1 THE OBJECTIVE **Table of Contents**

The objective of the National Mine Land Reclamation Center is to develop better, more cost effective and environmentally acceptable technologies for the reclamation of lands affected by mining operations.

1.2 THE STRATEGY **Table of Contents**

Reclamation research is applied research. Its purpose is to develop practical technologies. This requires a close linkage between the developers of technology and the users of that

technology. The scope of most reclamation problems requires large-scale, long-term, interdisciplinary approaches. In short, this means a higher level of organization than has been customary in university research programs in the past.

The strategic role of the National Mine Land Reclamation Center is to provide that organization, both nationally and regionally. The following discussion Summarizes the functions of the National Center, its Regional Centers and the means by which it is organizing the National Reclamation Research Program.

A summary of the major functions of the Center are:

1. Conduct reclamation research;
2. Disseminate the results of the Center's research programs to user groups;
3. Coordinate research Activities and technology development with the academic community, industry, state and federal agencies and trade organizations;
4. Serve as a clearinghouse for regional and national information on mined land reclamation technology;
5. Provide, on request, appropriate technical and consulting expertise to industry and state/federal agencies regarding the status of current and new reclamation technologies. This includes the enactment, modification and feasibility of implementation of reclamation rules and regulations.

1.3 INDUSTRY/GOVERNMENT INVOLVEMENT

Table of Contents

The program cannot develop practical reclamation technologies without the active participation of industry and government. The reasons are simple:

1. Governments set the reclamation process in motion through their regulatory role. Any reclamation technology must be approved by these agencies.
2. Any reclamation research is considered exploratory until resulting technology has been applied and evaluated in a large-scale field trial.
3. Mining companies rarely adopt new technologies unless they have been proven for a significant period of time under their operating conditions.
4. Only the mining industry can evaluate the economic and technical feasibility of a new technology in the context of its operations.

In short, many reclamation technologies which look good in the laboratory or in small field trials fail when applied on the large scale. Many times the failure is the result of incompatibility with equipment, mining systems, problems applying the material or even operator reluctance. Most of the time these problems are not evident until large-scale application is tried.

Engineers as a profession, are familiar with the concept of scale up. Scale-up minimizes the up-front risk inherent in the adoption of any new technology. Scale-up trials Occur in that region between the laboratory and adoption. Such trials take a new technology through prototypes to full-scale operating units.

Each step is monitored and adjustments are made throughout the development process. The scale-up process most often occurs with the close involvement of the operating department of the user company. If it does not the result is likely to be a square peg for a round hole. Successful companies rarely make this mistake. The Japanese are very good at avoiding it.

We primarily see coal companies becoming involved at the scale-up stage. We see companies evaluating our own or other small-scale, exploratory projects and selecting those which have potential for their operations. Such initiatives would translate into field scale-up projects in which the company would contribute primarily by supplying the equipment, manpower, site and supplies to create the test site. The National Mine Land Reclamation Center would contribute to the cost of the research, management and analytical components.

We also see the companies suggesting areas to which exploratory research could be usefully directed. Industry is then given the opportunity to monitor the progress of the projects and to evaluate the opportunities.

Reclamation is a rapidly changing, technology-intensive field. It is not unique in that it has suffered from a gap between the technology developers and the technology users. We are attempting, through these organizational mechanisms, to ensure that the technologies developed through the National Mine Land Reclamation Center are: 1) needed, 2) usable and 3) used.

2.0 PROGRESS REPORT

2.1 ORGANIZATION

Table of Contents

The National Mine Land Reclamation Center consists of five universities organized within three regional centers. These participating universities are responsible for conducting the program's research activities. In addition, there is a series of independent advisory bodies which culminate in a National Advisory Council.

Each regional center has, as an advisory body: a regional advisory committee. These committees offer advice regarding strategic directions, priorities and access to potential industry and governmental collaborators in research projects. Membership of the Eastern Regional Advisory Committee is listed in Appendix

The U.S. Bureau of Mines has oversight responsibility for the program's federal funding. The relationship among regional centers, their advisory committees, the national center and the Bureau of Mines is illustrated in figure 1.

This organizational format was developed and agreed upon by the participating universities, the NMLRC and the Bureau of Mines in September 1988. It recognizes the need for regional focus and close collaboration with local industry and governmental bodies. It also provides for a coordinating mechanism through the NMLRC and a single window for its interaction with the Bureau of Mines and the National Advisory Council.

In August 1988 Dr. Paul Ziemkiewicz, was selected to serve as the first Director of the

National Mine Land Reclamation Center.

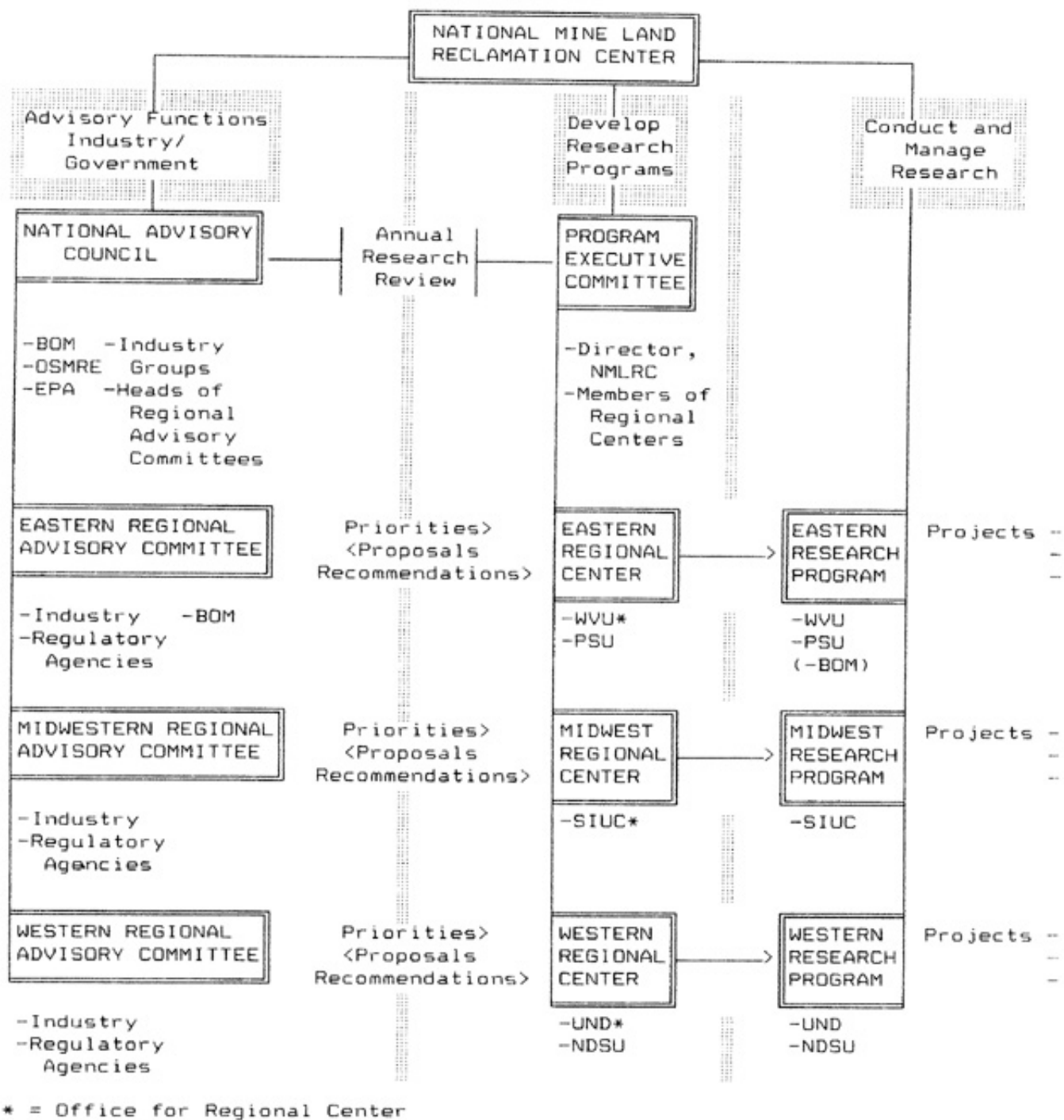


Figure 1. Organizational structure of the National Mine Land Reclamation Center indicating advisory, administrative and research roles.

- 4 -

2.2 PROCEDURES ^{Table of Contents}

Procedures have been established for reporting as well as proposal development and approval. The schedule for proposal development and annual program approval follows.

15 Nov.	NMLRC solicit project renewal and new proposals.
3 Jan.	Proposals submitted to Regional Centers.
1 Feb.	Review of proposals completed by Regional Centers.
15 Feb.	Regional programs assembled by NMLRC
1 Apr .	Submit the National Program to the Bureau of Mines.
1 Jul.	Commence research projects.

The program is managed through a cooperative agreement between the West Virginia Board of Regents on behalf of West Virginia University and the U.S. Department of Interior Bureau of Mines. Subcontracts between the West Virginia Board of Regents and the member universities control regional programs and payments.

2.3 TECHNOLOGY TRANSFER **Table of Contents**

Technology transfer refers to that group of activities which expedite the application of new technologies. Within the industrial context, the first step in technology transfer is identification of the user community. The technical requirements of the users then must be identified and the user community be convinced that the technology has economic and technical value within the context of ongoing operations.

In mine reclamation there are two primary elements to technology transfer: 1. Coordination with the user community and 2. Presentation of new technologies.

2.3.1 INDUSTRY/GOVERNMENT/NMLRC COORDINATION **Table of Contents**

The driving force in mine reclamation technology development is industry's desire for greater operating efficiency in response to regulatory requirements. In order to be effective, the NMLRC must be in the mainstream of mining industry technical challenges and advances. In addition, it is necessary that technologies developed through the NMLRC be acceptable to the government regulatory agencies. This approach will include response to new regulations and solutions to the resulting requirements. More importantly, NMLRC is expected to reduce technical uncertainty in the regulatory sphere and thereby lead to a more efficient process.

To maximize its application, reclamation research should be managed so as to serve the needs of an identified user group. The user group will ultimately evaluate the technology and decide whether it has value and whether it will be applied. In reclamation the "market" for these technologies is defined by the mining industry and the government regulatory agencies.

Coordination with the user community is achieved at several levels:

1. Through the Regional Advisory Committees and the National Advisory

- Council;
2. Through company participation in research projects;
 3. Through personal contacts;
 4. Through public presentations, written material etc.

Each of these means addresses a separate audience and is equally valuable. The nature of mine reclamation requires, however, that every effort be made to personally include representatives of the industry and the regulatory agencies at the earliest possible point in the technology development process.

2.3.2 WRITTEN AND VISUAL MECHANISMS

Table
of
Contents

In addition to the organization of industry/government coordinating mechanisms, the program includes traditional means of technology transfer including preparation of project and program reports, brochures and visual presentations. This aspect of the program will gain greater significance as the research projects begin to generate results.

2.4 COORDINATION WITH THE BUREAU OF MINES

Table
of
Contents

The U.S. Bureau of Mines is a major participant in reclamation research. The Bureau's Pittsburgh Research Center, in particular, is a leader in the area of acid mine drainage. Discussions are underway with the Center to ensure that research efforts are complementary and that a free flow of information exists between the Pittsburgh Research Center and NMLRC. In addition, a listing of NMLRC projects has been sent to the Pittsburgh Center. To ensure that a good working level contact is maintained, Dr. Robert Kleinmann, of the Pittsburgh Research Center serves on the Eastern Regional Advisory Committee.

2.5 RESEARCH PROGRESS

Table
of
Contents

Twenty-seven reclamation research projects are underway. Federal contributions total \$927,000 while university and industry contributions bring the total research budget to \$1,710,000. Tables 1 to 5 indicate the projects currently underway, their cost and source of funds. None of the projects will be completed until Sept. 1989 so there are few results to report.

Table 1. NATIONAL MINE LAND RECLAMATION CENTER PROGRAM
 Summary of Fiscal Year 1988 Program
 West Virginia University Research Programs

EASTERN REGION		WEST VIRGINIA UNIVERSITY			
PROJECT #	PRINCIPAL INVESTIGATOR	PROJECT TITLE	FUNDING		
			Federal	Univ.	Other
WV01	Bowers	Phosphatic Clay Slurry -Column Studies	0	20,372	0
WV02	Stiller	Rock Phosphate to Control AMD Production	63,541	38,585	27,000
WV03	Sencindiver	Cattail Wetlands -Fe, Mn Removal	8,652	65,071	0
WV04	Siriwardane	Prediction of AML Subsidence	29,900	65,497	0
WV05	Head	Grouts for Subsidence	33,439	15,464	0
WV06	Keefer	Revegetation of AML With Industrial Wastes	41,018	62,590	33,016
WV07	Jencks	Mycorrhizal Inoculation of Aspen	0	35,921	0
WV08	Skousen	Prediction of Natural Revegetation on AML	27,600	11,039	0
WV09	Lin	Highwall Stability in AML	18,924	41,150	0
TOTAL			223,074	355,689	60,016

Table 2. NATIONAL MINE LAND RECLAMATION CENTER PROGRAM
 Summary of Fiscal Year 1988 Program
 Pennsylvania State University Research Projects

EASTERN REGION		PENN STATE UNIVERSITY			
PROJECT #	PRINCIPAL INVESTIGATOR	PROJECT TITLE	FUNDING		
			Federal	Univ.	Other
PSU01	Sopper	Revegetation of Coal Refuse Banks	47,000	4,973	0
PSU02	Parizek	Pyrite Oxidation Chemistry	37,600	3,563	0
PSU03	Unz	Metal Chemistry of Wetlands	37,600	3,896	0
PSU04	Elsworth	Groundwater Flow Model	32,900	3,074	0
PSU05	Albert	Ranking of AML	37,600	3,896	0
PSU06	Phelps	Dump Stability	32,900	3,359	0
TOTAL			225,600	22,761	0

Table 3. NATIONAL MINE LAND RECLAMATION CENTER PROGRAM
 Summary of Fiscal Year 1988 Program
 Southern Illinois University at Carbondale Projects

MIDWESTERN REGION		SOUTHERN ILLINOIS UNIVERSITY-CARBONDALE			
PROJECT #	PRINCIPAL INVESTIGATOR	PROJECT TITLE	FUNDING		
			Federal	Univ.	Other
SIUC01	Caudle	Tillage Depth and Hydraulic Conductivity	23,903	20,151	0
SIUC02	Ashby	Mitigation of Soil Compaction	23,992	12,634	3 000
SIUC03	Chong	Soil and Crop Management	59,999	43,190	10,000
SIUC04	Puri	Geotechnical Properties of Slurry Wastes	15,600	26,803	0
SIUC05	Esling	Hydrology of Refuse Disposal Areas	32,400	20,060	0
SIUC06	Nawrot	Pyrite Reduction in Slurry Wastes	28,688	18,314	6,100
SIUC07	Ray	Soil-Water Exchange Model	20,438	25,401	0
SIUC08	Missavage	Subsidence Prediction in Room and Pillar Mining	20,400	34,837	0
SIUC09	Desai	Implementation of SMCRA	26,040	13,317	0
TOTAL			246,460	214,707	19,100

Table 4. NATIONAL MINE LAND RECLAMATION CENTER PROGRAM
Summary of Fiscal Year 1988 Program
North Dakota Research Projects

WESTERN REGION		UNIVERSITY OF NORTH DAKOTA NORTH DAKOTA STATE UNIVERSITY			
PROJECT #	PRINCIPAL INVESTIGATOR	PROJECT TITLE	FUNDING		
			Federal	Univ.	Other
ND01	Doll	Root Zone Hydrology	82,000	53,429	0
ND02	Groenewold	Spoil Hydrogeochemistry	104,803	60,674	0
ND03	Beaver	Subsidence Control in Abandoned Underground Mines	50,000	2,791	0
TOTAL			236 803	116,894	0

3.0 PROPOSED PROGRAM FOR FY 1989

3.1 PROGRAM DESCRIPTION

Table of Contents

1989 is the second of a multi-year research program. Most of the projects initiated in 1988 will continue this year. Five of the short-term projects are scheduled for completion in 1989. Most of these are scheduled to end on 30 Sept. 1989 while one will end on 31 Dec. 1989. The completed projects included the following topics: Mycorrhizal inoculation of aspen on mine spoil, phosphatic clay slurries for AMD control, implementation of SMCRA, soil compaction, geomechanics of coal slurry and pyrite removal from coal slurry.

New projects are proposed in the areas of acid mine drainage (2 projects), subsidence, waste material handling and soil reconstruction. Figures 2a,b and c indicate the status of completed, new and ongoing projects. Completed in this case refers to those scheduled at the end of the 1988/89 fiscal year and new projects are those proposed for the new year beginning on 1 July 1989. The projects are arranged within the figures so as to show their relationship to each other and to NMLRC objectives and priorities.

3.2 NEW INITIATIVES

Table of Contents

The National Mine Land Reclamation Center will maintain a base of small, exploratory research projects. However, the driving force behind future program growth will be large-scale industry and government sponsored projects. NMLRC will make every effort to keep industry and government agencies current with promising technologies and will assemble research proposals in response to their interest. As a management model it is responsive and flexible. With the proper support and diligence we should be able to make rapid and

significant advances in reclamation technology in the coming years.

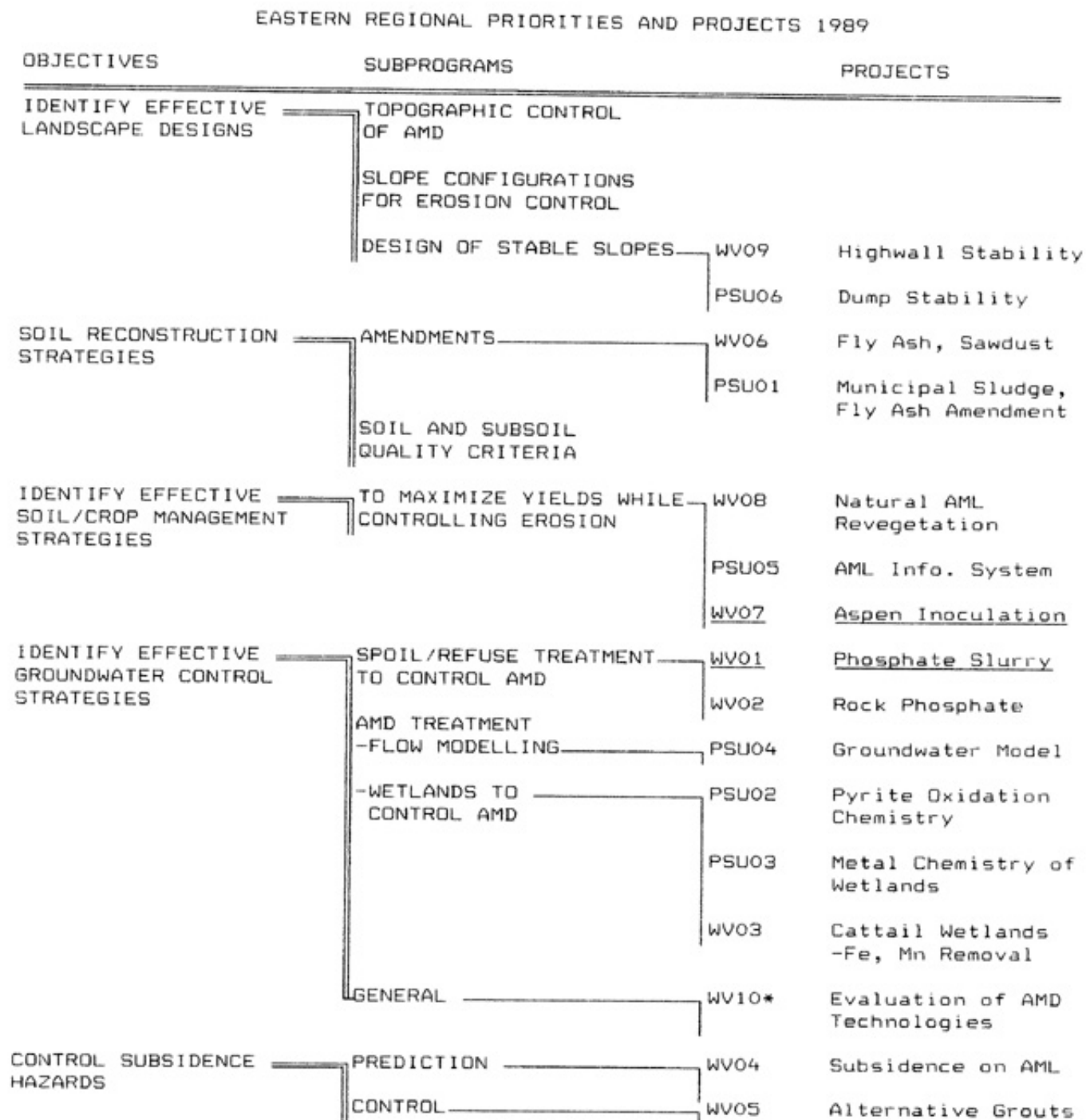


Figure 2a. Organization of West Virginia University and Penn State University research projects within priority areas. _____=COMPLETED, *=NEW

MIDWESTERN REGIONAL PRIORITIES AND PROJECTS 1989

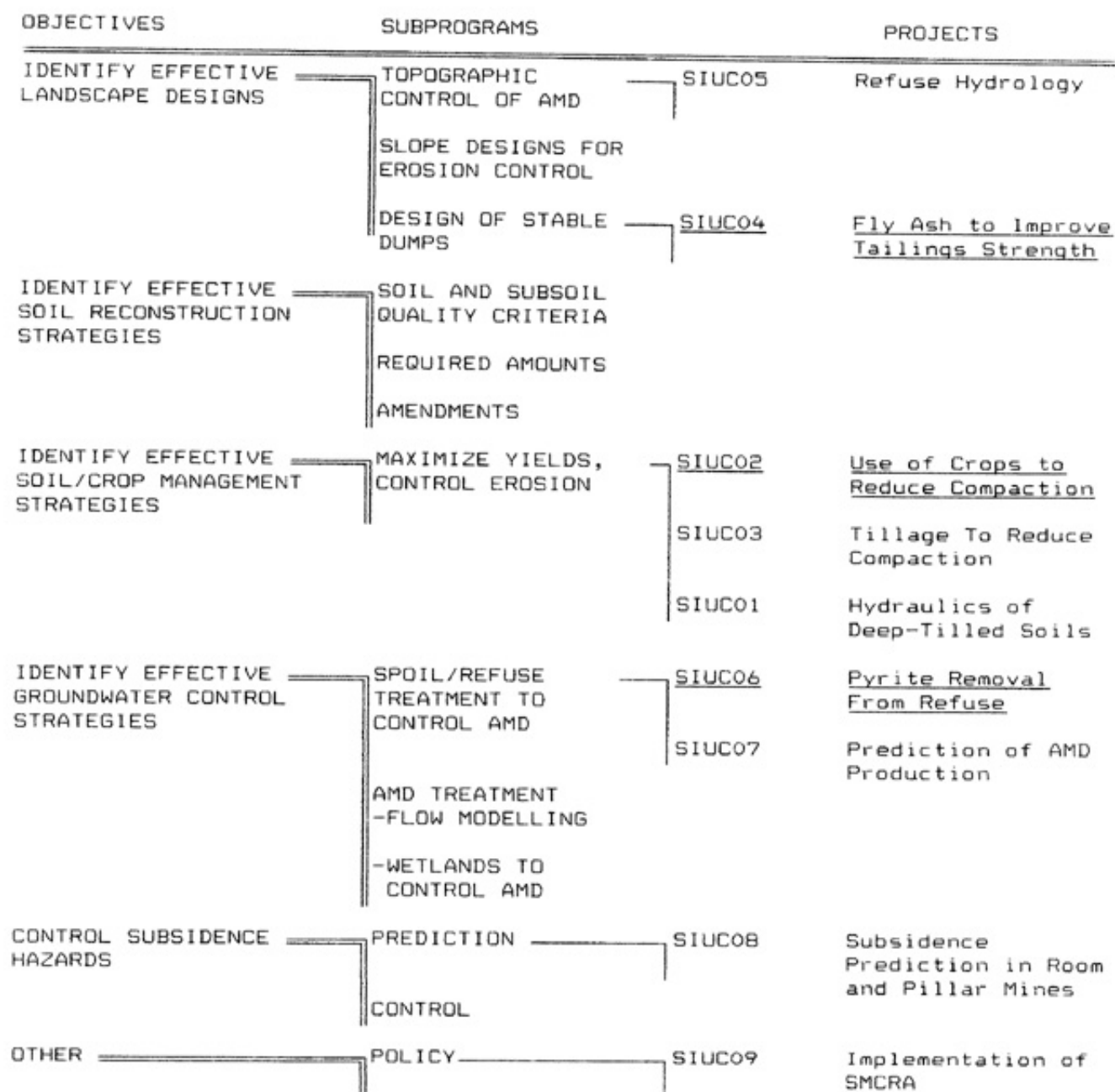


Figure 2b. Organization of Southern Illinois University at Carbondale research projects within priority areas. _____=COMPLETED, *=NEW

WESTERN REGIONAL PRIORITIES AND PROJECTS 1989

OBJECTIVES	SUBPROGRAMS	PROJECTS
IDENTIFY EFFECTIVE LANDSCAPE DESIGNS	TOPOGRAPHIC CONTROL OF SALINIZATION	ND01 Surface and Root Zone Hydrology
	TOPOGRAPHIC CONTROL OF PONDING	
	OPTIMAL SLOPE CONFIGURATIONS FOR EROSION CONTROL	ND01 Surface and Root Zone Hydrology
IDENTIFY EFFECTIVE SOIL RECONSTRUCTION STRATEGIES	SOIL AND SUBSOIL QUALITY CRITERIA	
	REQUIRED AMOUNTS	
	COMPACTION	
IDENTIFY EFFECTIVE SOIL/CROP MANAGEMENT STRATEGIES	TO MAXIMIZE YIELDS WHILE CONTROLLING EROSION AND SALINIZATION	ND01 Surface and Root Zone Hydrology
IDENTIFY EFFECTIVE GROUNDWATER CONTROL STRATEGIES	IDENTIFY THE EFFECTS OF MINING	ND02 Groundwater Movement and Chemistry
	IDENTIFY MECHANISMS FOR CONTROLLING ADVERSE EFFECTS	ND02 Groundwater Movement and Chemistry
CONTROL SUBSIDENCE HAZARDS	CONTROL	ND03 Fly Ash and Other Grouts
	PREDICTION	

Figure 2c. Organization of University of North Dakota and North Dakota State University research projects within priority areas.
 _____=COMPLETED, *=NEW

APPENDIX I **Table of Contents**

Eastern Regional Advisory Committee - NMLRC

Mr. Ben Greene (CHAIRMAN)
 President
 WV Mining and Reclamation Assoc.
 1624 Kanawha Building, East
 Charleston, WV 25311
 (304) 346-5318

Mr. Buddy Beach
 Vice President
 Environmental Affairs

Consolidation Coal Company
Pittsburgh, PA 15241
(412) 831 4530

Mr. Richard Bielicki
Director, Bureau of
Abandoned Mine Reclamation
Fulton Bank Building
Harrisburg, PA 17120
(ALTERNATE for Dr. Grace)

Dr. James R. Grace
Deputy Secretary for Resource Mgt.
Department of Environmental Resources
Fulton Bank Building
Harrisburg, PA 17120
(717) 787 5028

Mr. Roger Hall
WV Department of Energy
1615 Washington Street, East
Charleston, WV 25311
(304) 348-3500

Dr. Robert Kleinmann
Bureau of Mines
Pittsburgh Research Center
P.O. Box 18070
Pittsburgh, PA 15236
(412) 892-6555

Mr. Lawrence Streets
President
Allegheny Mining Corporation
P.O. Box 232
Mt. Storm, WV 26739
(304) 693-7621

Mr. Alfred Whitehouse
Deputy Assistant Director
Program and Technical Support
OSMRE - Eastern Field Operations
Ten Parkway Center
Pittsburgh, PA 15220
(412) 937 2814