

**West Virginia Water Research Institute**

**West Virginia University**

**Program Evaluation Report  
Fiscal Years 1998 - 2002**

*Submitted by*

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*Submitted to*

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## Executive Summary

The West Virginia Water Research Institute (WVWRI) addresses the key water resource issues facing policy makers, agency staff and the public. Our research program is guided by the West Virginia Advisory Committee for Water Research. It includes representatives from the following:

- West Virginia Department of Natural Resources
- West Virginia Bureau for Public Health
- West Virginia Division of Environmental Protection
- U.S. Federal Bureau of Investigation
- U.S. Geological Survey
- U.S. Environmental Protection Agency
- U.S. Department of Energy - National Energy Technology Laboratory
- U.S. Department of Agriculture - Natural Resources Conservation Service
- U.S. Army Corps of Engineers - Huntington, WV District
- Canaan Valley Institute

The Advisory Committee develops the Institute's research priority list, reviews its progress and selects startup projects at its annual meeting. With this direction, the Institute recruits new researchers to study emerging water research issues. Because the Advisory Committee understands future regulatory and economic driving factors, these issues tend to grow in importance and have often led to follow-on funding from their agencies.

### Funding:

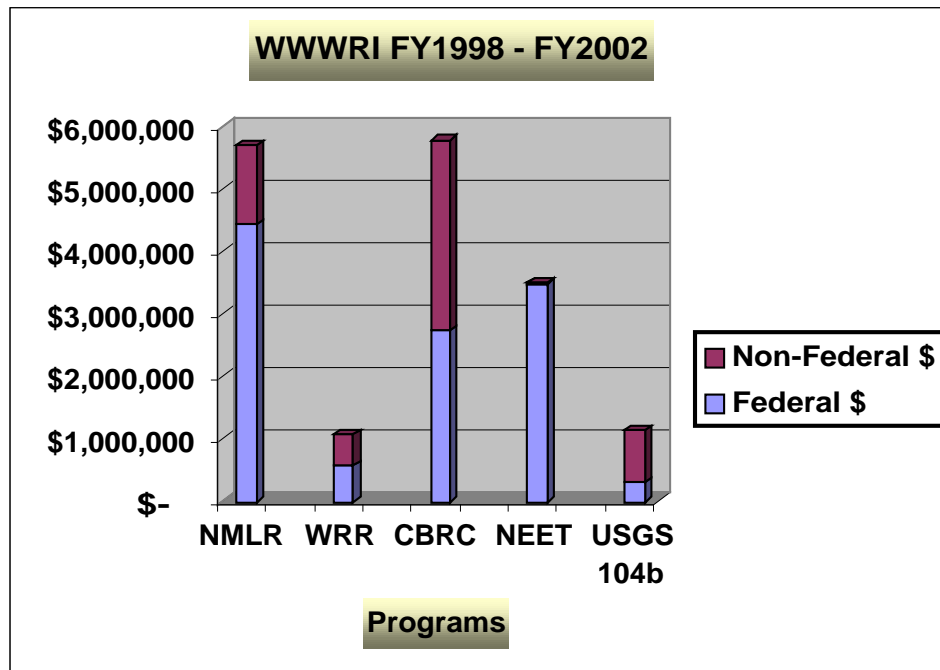
The Institute receives a grant of roughly \$92,000 annually through the U.S. Geological Survey CWA section 104b program. We use this funding to develop research capabilities in priority areas and to provide service to State agencies, its industry and citizen groups. As a result of successful leveraging, we supported a program with an average yearly value of \$3.4M between 1998 - 2002.

Our strategy relies on using the USGS section 104b funding to develop competitive capabilities that, in turn, translate into successful proposals funded by a broad spectrum of Federal and State agencies. Over the past three years our leveraging against section 104b dollars has been about 40:1.

Our strategy also relies on maintaining a broad cadre of researchers within WVU and other institutions within the state. We also work with faculty from institutions across the Country to form competitive research partnerships. As West Virginia University is the State's flagship research institution, its researchers have played the dominant role. Over the past 15 years over 50 WVU faculty members have been supported by WVWRI projects while 25 faculty from other State institutions have participated in the program. The following list indicates faculty who have received research funding through the Institute.

Key findings:

1. Determination of environmental effects of flooding in the Pittsburgh Basin coal mines.
2. Development of a boron doped diamond electrode for rapid mercury speciation.
3. Development of cost effective acid mine drainage treatment methods.
4. Development of GIS based watershed modeling software.
5. Commercialization of acid mine drainage design software package: AMDzine



Funding:

Our funding strategy relies on successful competition for Federal dollars while teaming with State agency and

Industry partners. They later provide test sites, in-kind support and invaluable background data. The following chart indicates the distribution of funding during the evaluation period. It indicates that, we have leveraged our annual \$90,000 in USGS funding by a factor of 190 resulting in \$17,170,437 total funding over the evaluation period. Of that amount \$11,525,646 were federal dollars.

### Development of our Research Capability:

The bulk of our research is undertaken by academic faculty. Since West Virginia University is the flagship research institution in the State, its faculty have received the bulk of Institute funding. Over 50 WVU researchers have been supported by the WVWRI representing 20 departments. In addition, the Institute has a staff of eight, with three research contractors. Roughly half of the Institute staff is directly engaged in research projects.

### Future Direction:

Development of the Institute's Hydrology Research Center will allow us to contribute to West Virginia's water supply and use initiatives while the new Geo Engineering Center is already capturing significant funding through the Department of Defense, Army Corps of Engineers for military base closure. Both of these areas are likely to expand rapidly while our other programs such as the Mine Land Center and the Combustion Byproducts Consortium are likely to remain stable or grow modestly.

### **Preface**

The West Virginia Water Research Institute receives an annual Federal matching grant as authorized by section 104 of the Water Resources Research Act of 1984 (Public Law 98-242) as amended by Public Law 101-397, Public Law 104-147, and Public Law 106-374. Section 104 of the Act requires that the Secretary of the Interior "conduct a careful and detailed evaluation of each institute at least once every 5 years to determine that the quality and relevance of its water resources research and its effectiveness as an institution for planning, conducting, and arranging for research warrants its continued support under this section." The U.S. Geological Survey (USGS), Department of the Interior, administers the provisions of the Act. This evaluation report describes, in the format prescribed by the USGS, the research, training, and information transfer activities supported by this section 104 grants and required matching funds in fiscal years 1998 through 2002.



**WEST VIRGINIA WATER Research INSTITUTE  
EVALUATION REPORT  
FY 1998 - FY 2002**

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# **WEST VIRGINIA WATER RESEARCH INSTITUTE EVALUATION REPORT 1998 - 2002**

## **Introduction**

### **The Water Resource Issues and Problems of West Virginia**

West Virginia's water resources are among the richest in the nation. Our rainfall and mountainous terrain give West Virginia more stream miles than any other state. With a small population and low water utilization rates, however, this resource has often been taken for granted.

The following list reflects the issues that affect the State's water resources:

- Impact of resource extraction (logging, mining, etc.)
- Aquatic ecosystem integrity
- Water policy (quality, quantity & Ownership)
- Sewage and non-point source contaminants
- Floods/Droughts
- Effects of urban sprawl
- Measuring water supply and use
- Water security
- Groundwater recharge
- Uses for mine water discharge

This list was developed by participants of the first West Virginia Water conference held in October, 2002 (organized by the West Virginia Water Research Institute). WVWRI's mission is to help the State protect its water resources while realizing its economic opportunities.

### **The West Virginia Water Research Institute: An Overview**

Established in 1967 under Federal legislation carried out by the U.S. Geological Survey, the West Virginia Water Research Institute (WVWRI) performs research related to water issues in the state. However, WVWRI's work reaches beyond the borders of West Virginia to help the nation. In fact, the WVWRI is recognized as an international leader in the development of watershed remediation tools and technologies.

With diversified funding and support, the WVWRI develops strong, multi-disciplinary research teams by collaborating with various West Virginia University (WVU) colleges and divisions, other higher education institutions, and private firms and

consultants. This team approach brings the best expertise available to address the State's water issues. It also allows the WVVRI to perform research in a number of areas at any given time.

The WVVRI is dedicated to the development and delivery of environmental technologies needed by West Virginia's agencies, industry, and the public to remedy historic pollution and minimize new sources of water pollution while maintaining economic competitiveness. The WVVRI provides services in the areas of project development, outreach, project management, and technical support. By maintaining close communication with our customers (state and federal agencies and industry) we develop research teams to compete for large-scale environmental research programs. We disseminate our research findings through reports, personal contacts, site visits, publications, web sites, and press releases. We support focused workshops and conferences on water remediation issues. We maintain a competitive position with our customers by delivering successful cost-effective results. We focus on clear project objectives and quality assurance keeping on schedule and within budget. We provide on-location technical support to remediation practitioners including watershed associations, regulatory agencies, and industry. We work with researchers at WVU and at universities nationwide to develop research teams. We develop and release RFP's to support environmental research projects. We also work with watershed groups.

### Background

West Virginia has had a Water Resources Research Institute since the 1967. While it has a statewide mandate, it has always been a small program, receiving about \$130,000 per year initially and declining gradually to \$82,000 per year. Between 1996 and 1999, USGS eliminated the state funding programs in favor of regional competitions based on regional priorities. While the West Virginia Water Research Institute was successful in winning several awards, the change effectively eliminated our ability to serve the State's water research priorities.

Starting in 2000, the research program came back to the states and in 2001 the amount of research dollars was increased. With water related issues increasing in importance to the State, this proved an opportune time to reinvigorate the West Virginia Water Research Institute (WVVRI). This report covers the three year period when the USGS state support terminated and the next two years when the WVVRI was reinstated.

### Objectives

Our objective is to build the West Virginia Water Research Institute as the premier water research center in West Virginia and, within selected fields, an international leader.

## Structure

The West Virginia Water Research Institute is a division of the National Research Center for Coal & Energy at West Virginia University. Between 1998 - 2002, the WVWRI was comprised of five major programs: The Water Research Program; The National Mine Land Reclamation Center; the Combustion Byproducts Recycling Consortium; the National Environmental Education and Training Center; and the Hydrology Research Center. The WVWRI consists of five full time staff; three full time staff shared with the College of Arts & Sciences; five student workers; and three part time staff.

## Strategy

The Director and management of the West Virginia Water Research Institute aggressively search for funding opportunities from Federal and State agencies and the private sector. These funds are used to support specific research projects, are used to match USGS 104b cost share requirements, and cover administrative costs.

## Accomplishments

Policy initiatives were developed with the assistance of the West Virginia Water Research Institute. These include the Appalachian Clean Streams Initiative (ACSI) and the West Virginia Coal Ash Policy.

### *Appalachian Clean Streams Initiative (ACSI)*

For decades, the problem of stream pollution from acid drainage has been recognized as a major problem in the eastern United States. Over the years, many programs have had great success, but despite the severity of the problem there had not been a coordinated effort with the primary focus of eliminating acid drainage until the Appalachian Clean Streams Initiative was introduced in the fall of 1994.

In early 1994, representatives of USDI/OSM and the West Virginia Water Research Institute's National Mine Land Reclamation Center met to develop methods for focusing resources and technology on remediating watersheds damaged by acid mine drainage. The result was the Appalachian Clean Streams Initiative as adopted by Director Robert Uram in November of that year. The strategy involved development of grass roots watershed organizations, partnerships with state programs and the industry. The program has received increasing funding from Congress (\$11m in the current year), has resulted in implementation of innovative technology, the cleanup of acid mine drainage in numerous streams and has helped nurture the watershed movement in the participating states. The WVWRI remains an integral part of ACSI providing technical support to states and watershed organizations through an annual contract provided by USDI/OSMRE.

The Appalachian Clean Streams Initiative began as a broad-based program to eliminate acid drainage from abandoned coal mines. Today the program is more focused, with a clear goal of cleaning up acid drainage problems using a combination of private and government resources.

The mission of the Appalachian Clean Streams Initiative is to facilitate and coordinate citizen groups, university researchers, the coal industry, corporations, the environmental community, and local, state, and federal government agencies that are involved in cleaning up streams polluted by acid drainage. The initiative responds to all major interests in this endeavor. Although eliminating acid drainage is now a federal government priority, the problem is so widespread and costly to solve that it can be eliminated only through combined public and private efforts.

The Appalachian Clean Stream Initiative is an opportunity for a partnership to solve one of the major environmental problems facing the regional ecosystems of the coalfields. The major benefits of coordinating acid drainage cleanup are:

- ! Environmental clean-up: Acid drainage has a devastating impact on people's lives and the vitality of the local economy. The benefits of cleaning up the rivers and streams can be observed and measured, and coordinated success produces significant long-term benefits.
- ! Multi-agency coordination: An outcome-oriented approach focuses a host of new talent and resources from traditional research organizations on projects that promise enhanced quality of life and health for the public. State, local, and community expertise and knowledge synergize as government and private groups work together to address a common problem.
- ! Reinventing government: This is an excellent opportunity to test the reinventing government principle of doing more with less. Interagency coordination will result in better use of public money and government personnel in a way that responds to the needs of the people affected by acid drainage.
- ! Benefits for local economies: Clean-up of acid drainage will promote tourism and recreational activities, including hiking, camping, fishing, and boating.
- ! Ecosystem approach: This plan for eliminating acid drainage is based on cleaning up watersheds, an approach that helps ensure funds are wisely spent. In addition, cleaning up the watersheds provides an opportunity for native plants and animals to once gain inhabit the watersheds.
- ! Citizen and corporate involvement: A critical aspect of the Appalachian Clean Streams Initiative is meeting the needs of the coalfield residents and involving the people who live in the coal fields and gaining the support of corporations including those in the coal industry. By combining their resources, they can help

ensure that clean-up efforts bring about tangible benefits to people and the environment.

### *West Virginia Coal Ash Policy*

In 1997 the West Virginia Division of Environmental Protection's (DEP's) Office of Mining and Reclamation (OMR) recognized the need for guidance to the mining, utility and manufacturing industries on the beneficial use of coal combustion byproducts (CCB's). The OSM further recognized that CCB's have both beneficial uses and the potential to provide positive impacts when properly managed. The West Virginia Coal Ash Policy, developed with the assistance of the WVWRI, provides the necessary guidance and required criteria for the beneficial use of coal combustion byproducts regulated under State statute so long as such placement is in conformance with an approved plan or permit issued pursuant to such provisions of the code.

The West Virginia Coal Ash Policy recognizes specific beneficial uses for CCB's and includes guidance as to amounts deemed beneficial under specific geological settings. The Director of the WVWRI worked closely with the OMR in developing this guidance and developed the formula (imbedded in the policy) by which such amounts are calculated.

The WVWRI funding also provided initial support for the following programs which are currently in use within West Virginia and other state programs:

1. Methods to value changes in acid related water quality parameters for recreational fishermen in the Monongahela Forest and recreational boaters and white water rafters on the Chat River. These methods are presently in use by the West Virginia Department of Natural Resources.
2. The development of the Natural Resource Analysis Center (NRAC) in the College of Forestry, Agriculture and Consumer Science. NRAC is now a recognized center for applications of GIS, remote sensing, and related technologies to environmental and natural resource management in West Virginia and Appalachia. NRAC now works with a variety of state and federal agencies, non-profit organizations, and local citizen groups to understand environmental and natural resource management questions.
3. Continued development of the Watershed Characterization and Modeling System (WCMS) now used by various offices in the West Virginia Division of Environmental Protection and the Maryland Bureau of Mines to support permitting and management activities.

Other successful project accomplishments during the 1998 - 2002 time frame include the Monongahela Basin Mine Pool Project and the Combustion Byproducts Recycling Consortium.

### *Monongahela Basin Mine Pool Project*

Since 1999, WVWRI's Hydrology Research Center has been studying the long-term environmental consequences of coal mining in the Monongahela Basin—an area that stretches from Clarksburg, West Virginia, to Pittsburgh, Pennsylvania. With \$2 million of funding from the U.S. Environmental Protection Agency through the U.S. Department of Energy - National Energy Technology Laboratory and assistance from researchers at the University of Pittsburgh and Carnegie Mellon University, this project's mission has been to map the approximately 1,200 abandoned and active underground coal mines in the area, monitor the flooding status of these mines, and predict locations of possible future discharges.

More than 27 billion gallons of water seeps from these mines each year, 60 percent of this water without any treatment. Because this untreated mine seepage contains heavy concentrations of aluminum, manganese, and iron, it has a major impact on the Monongahela River and the surrounding environment. Now that these mines have been located and mapped, HRC researchers can better project when the mines may flood and work with state agencies in advance to prevent, control, or treat these harmful discharges. Efforts are now underway to convert this ample supply of mine water from an environmental liability to an environmental asset. The HRC is currently working with state and federal agencies to explore options for the possible reuse of this abundant water source.

### *The Combustion Byproducts Recycling Consortium*

In 1998 with support from the U.S. Department of Energy's National Energy Technology Laboratory, the WVWRI formed the CBRC to find beneficial uses for coal combustion byproducts that are normally sent to a landfill for disposal. Innovative projects, funded by the CBRC and being performed by universities and businesses, are demonstrating that these byproducts can be safely used as construction materials. Successful projects have already used the byproducts as a structural fill to expand an airport runway and to backfill an abandoned mine pit. Other promising full-scale demonstration projects are using fly ash to replace foundry sand as a mold-making material in the automotive industry and to make bricks for the housing industry. Researchers are also discovering useful environmental applications for the byproducts.

### **Section 104b Objectives**

The West Virginia Advisory Committee for Water Research advises the West Virginia Water Research Institute regarding water issues of concern for the state. The Advisory Committee considers input such as that of Water Conference participants, researchers, as well as input from State and Federal agencies and the private sector. The following list of priorities was established by the Advisory Committee for use in the RFP released in 2002:

Aquatic ecosystem integrity (anti-degradation; water quality criteria;

nutrient/pathogen impacts; headwater stream valuation/mitigation)

Water metrics (methods for measuring physical, chemical, biological components; in situ monitoring; PPCP's; pathogens in drinking water)

Uses for mine water discharge (drinking water potential for underground mine pools; irrigation; industrial heating/cooling)

Industrial processes and urban sprawl (water budgets; contaminants; flooding; groundwater recharge; storm water applications)

Evaluation of water resources (uses)

These areas of concern are revisited each year by the West Virginia Water Advisory Committee and serve as the basis of setting research priorities for the request for proposals issued by the WVVRI each fall for submission to the U.S. Geological Survey 104b base grant program.

The WVVRI strives to use the USGS 104b base grant program as an opportunity to encourage new initiatives by new researchers within the State to help launch larger more widespread projects funded by other Federal and State agencies. Examples of some success stories to this effect are included in this report.....

The WVVRI has aggressively and successfully located many other sources of funding besides the USGS 104b grant program to fund various research projects to address many of the areas of concern listed above. Information on these various projects is included in this report.

The following is an estimate of the percentage of the total of WVVRI's 104B (base) grant and required match that was, on average, allocated to each of the following areas between FY98-FY02.

<b>Allocation of Federal Grant and Matching Funds Among Program Activities (Percent): 1998 - 2002</b>	
<b>Research</b>	79
<b>Information Transfer</b>	3
<b>Education</b>	0
<b>Administration</b>	18
<b>Other (please specify)</b>	0
<b>Total</b>	100

## **Institutional Support and Effectiveness**

### **Discretionary base funding**

Between 1998 and 2002, the WVWRI has received \$315,475\* from the U.S. Geological Survey through base grant 104b. Most of these funds are dispersed to water research projects throughout the state. In addition, between 1998 and 2002, the WVWRI has received on average \$120,000 per year from the State of West Virginia. These funds are used primarily for cost-share on research proposals submitted to various federal and state agencies. Between 1998 and 2002, the WVWRI provided \$823,829\*\* in matching funds to the program. The State of West Virginia's Division of Environmental Protection has also provided funds to the WVWRI for water-related research projects in the state.

The WVWRI has also received other Federal and external support to assist in funding water-related research projects.

### Federal support

Between FY 98 and FY 02, the WVWRI has received support from the following federal agencies:

- < U.S. Geological Survey
- < U.S. Environmental Protection Agency
- < U.S. Department of Energy - National Energy Technology Laboratory
- < U.S. Department of Interior - Office of Surface Mining
- < U.S. Department of Defense - Strategic Environmental Research & Development Program

### External support

The following have contributed cash and/or in-kind services to projects managed by the WVWRI:

- < Arch Coal
- < Consol Energy, Pittsburgh, PA
- < CGRS, Inc., Fort Collins, CO
- < University of North Dakota, Grand Forks, ND
- < GAI Consultants, Inc., Monroeville, PA
- < West Virginia Division of Environmental Protection, Nitro, WV
- < The Ohio State University, Columbus, OH
- < ADA Technologies, Inc., Littleton, CO
- < Oklahoma Conservation Commission, Oklahoma City, OK
- < Sunflower Electric Power Corp., Garden City, KS
- < Southern Illinois University, Carbondale, IL

- < Energy Industries of Ohio, Cleveland, OH
- < Tennessee Technical University, Cookeville, TN
- < University of Georgia, Athens, GA
- < The Ohio State University, Wooster, OH
- < University of Wisconsin, Madison, WI
- < AeRock, Inc., Littleton, CO
- < Waynesburg College, Waynesburg, PA
- < Lehigh University, Bethlehem, PA
- < Pennsylvania State University, University Park, PA
- < Tennessee Valley Authority, Muscle Shoals, AL
- < University of Missouri, Kansas City, MO
- < Ish, Inc., Sunnyvale, CA
- < University of Wisconsin, Milwaukee, WI
- < Maryland Department of Natural Resources, Annapolis, MD
- < Louisiana State University, Baton Rouge, LA
- < University of Florida, Fort Pierce, FL
- < Wayne State University, Detroit, MI

<b>Appropriated or Other Discretionary Funds Available to the Institute: 1998-2002</b>					
<b>Source of Discretionary Funds</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
<b>State</b>	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000

**Total West Virginia Water Research Institute Funding FY98 - FY02**

The following lists all grants (other than section 104 grants), contracts, and cooperative agreements for which the Director, Paul Ziemkiewicz, and staff of the WWRRI played a major role in assembling the proposals or otherwise obtaining the grant or contract.

<b>Water Resources Grants, Contracts, and Cooperative Agreements in Which the Institute Had a Major Role during the Period of Evaluation: 1998 - 2002</b>

<b>Project Title</b>	<b>Source of Funds</b>	<b>Year Initiated</b>	<b>Federal \$</b>	<b>Non-Federal \$</b>	<b>Total Project Value \$</b>
<b>National Mine Land Reclamation Center Projects</b>					
WV125b1: ACSI Technical Support	USDI/OSM	1998	\$19,946	\$0	\$19,946
WV128: Alkaline leakage field demonstration	OSMRE	1998	\$108,500	\$74,032	\$182,532
WV132: Monongahela Basin underground mine discharge study	EPA	1998	\$89,997	\$20,185	\$110,182
WV147a: Solidification Study	ANR Coal Co	1998	\$0	\$28,573	\$28,573
WV157: Fourth annual AMD conference and workshop	OSM	1998	\$37,775	\$0	\$37,775
WV130b: WVU/WVDEP Cooperative Agreement Analytical Services	WVDEP	1998	\$0	\$19,999	\$19,999
WV171: Removal of iron from AMD by OLCs	NRCCE WVU	1999	\$21,330	\$0	\$21,330
WV125e: OSMRE Technical Support - Program Development	OSMRE	1999	\$100,000	\$24,605	\$124,605
WV134 Phase 1: Combustion Byproducts Recycling Consortium	DOE-NE TL	1999	\$66,127	\$20,970	\$87,097
WV142: ADTI Technical Program	OSM	1999	\$200,000	\$0	\$200,000
WV146: Evaluation of reclamation technologies	WVDEP	1999	\$0	\$69,494	\$69,494
WV160: Alton closeout strategy	WVDEP	1999	\$0	\$161,203	\$161,203

WV165: Friends of Cheat Inc. Technical Support	Friends of Cheat	1999	\$0	\$9,000	\$9,000
WV166: Plant succession on reclaimed land in southern WV	Arch Coal	1999	\$0	\$30,011	\$30,011
WV173 Phase 1: Monongahela Basin mine pool flooding	EPA/DOE	1999	\$678,000	\$85,746	\$763,746
WV175: Joint conference on reclamation	OSMRE	1999	\$27,869	\$0	\$27,869
WV125f: Matthew Run in situ treatment	OSMRE	2000	\$115,000	\$2,938	\$117,938
WV134 Phase II Combustion Byproducts Recycling Consortium	DOE-NE TL	2000	\$1,497,979	\$2,310,568	\$3,808,547
WV176: AMD Workshop, USACE	USACE	2000	\$4,762	\$0	\$4,762
WV178: USOSMRE ADTI Support	OSMRE	2000	\$200,000	\$0	\$200,000
WV125g: ACSI Technical Support	OSMRE	2001	\$42,500	\$0	\$42,500
WV134 Phase III Combustion Byproducts Recycling Consortium	DOE-NE TL	2001	\$1,094,929	\$688,159	\$1,783,088
WV172: Greens Run AMD remediation	WVDEP	2001	\$0	\$263,335	\$263,335
WV173 Phase II Abandoned mine pool flooding of the Pittsburgh, Ohio, and Irwin Basins	EPA/DOE-NETL/Parsons	2001	\$546,327	\$118,273	\$664,600
WV173 Phase III: EPA Region III Mine pool flooding	EPA/DOE-NETL/Parsons	2002	\$729,707	\$0	\$729,707

WV190: AMD Design Manual	USACE/USGS	2002	\$76,179	\$0	\$76,179
WV195: Cost effective ecosystem restoration of the Monday Creek, Ohio watershed mining/reforestation	USACE/DOE-NE TL	2002	\$132,000	\$0	\$132,000
<b>Water Research Projects (not section 104 projects)</b>					
WRI18: Evaluation of biocidal polymers	USGS	1998	\$56,103	\$122,661	\$178,764
WRI23: Agricultural wastes: data management	WV Dept of Agric.	1998	\$0	\$33,644	\$33,644
WRI 23 PH2: Potomac Headwaters Sampling Project	WV Dept of Agric.	2000	\$50,307	\$0	\$50,307
WRI24: TMDL enhanced decision making	WV EPA	2000	\$101,015	\$0	\$101,015
WRI33: Assessments of mountain top mining EIS review	WVU Engineering Dept. (Syd Peng's state funds)	2000	\$0	\$15,000	\$15,000
WRI36: Enhancing Water Research in WV: Organization and Capacity Building	U.S. EPA/EPSCoR	2001	\$274,928	\$308,418	\$583,346
WRI37: Romania Jiu Valley	WVU International Studies	2000-2001	\$89,479	\$32,647	\$122,126
<b>National Environmental Education &amp; Training Center Projects</b>					
NE01: OCC Training of HazMat workforce	NEETC	1998	\$38,215	\$0	\$38,215
NE02: WVU NEETC Center of Excellence FY99	NEETC	1999	\$45,175	\$0	\$45,175
NE03: TexPert99	NEETC	1999	\$324,062	\$0	\$324,062

NE09: Deployment support leading to implementation	NEETC	2000	\$298,639	\$9,222	\$307,861
NE10: TexPert 2000	NEETC	2000	\$178,393	\$0	\$178,393
NE11: WVU NEETC Center of Excellence FY2000	NEETC	2000	\$44,042	\$0	\$44,042
NE11AM: TexPert 2000 Amendment	NEETC	2000	\$48,781	\$0	\$48,781
NE12: SERDP Ship Scrapping	NEETC	2000	\$85,605	\$0	\$85,605
NE12:SERDP Ship Scrapping Phase II	NEETC	2001	\$1,616,746	\$0	\$1,616,746
NE13:Cascade Grl Proof of Concept	NEETC	2001	\$237,000	\$0	\$237,000
NE14: Center of Excellence Work Plan 2002-03	NEETC	2002	\$565,337		\$565,337
<b>Other</b>					
ETD05: Disposal of Fluidized Bed Combustion Ash in an Underground Mine to Control AMD & Subsidence	DOE/METC	1998-2000	\$776,000	\$293,932	\$1,069,932
ETD05: Amendment	DOE/METC	1998-2000	\$51,395	\$0	\$51,395

## RESEARCH PROGRAM

The following are descriptions of each research project supported with USGS 104b grants and matching funds.

### USGS 104b Research Projects

#### PROJECT DESCRIPTIONS

<b>Title</b>	WRI Administration
<b>Project Number</b>	WRI "Year" (WRI98; WRI99; WRI00; WRI01; WRI02)

<b>Start Date</b>	35854
<b>End Date</b>	37314
<b>Research Category</b>	N/A: Administration
<b>Focus Categories</b>	N/A

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Paul Ziemkiewicz (1998 - 2002)	Director	West Virginia Water Research Institute, West Virginia University
Tamara Vandivort (2000 - 2002)	Program Coordinator	West Virginia Water Research Institute, West Virginia University
Courtney Black (1998 - 1999)	Program Coordinator	West Virginia Water Research Institute, West Virginia University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/98 - 2/99	20000	44066		
3/99 - 2/00	20001	40004		
3/00 - 2/01	0	0		
3/01 - 2/02	14900	43333		
3/02 - 2/03	6907	13930		

This project received follow-on funding after completion as a section 104-funded project:  
Yes  No

The WVWRI has been successful in leveraging support from many state and federal agencies. Refer to page 55 for a complete listing of funded projects and identified funding agency for the 1998-2002 time frame.

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	1	
<b>Masters</b>	1	
<b>Ph.D.</b>	0	
<b>Post Doctoral</b>	0	

<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
	For a complete list of articles pertaining to the WVWRI and its programs and projects, see page 87.

### **Awards and Achievements**

Newspaper article: Charleston Gazette, Friday, May 10, 2002, WVU to Study Stream Standards.

The West Virginia Water Research Institute has taken the lead on numerous technical support, outreach, and promotional activities between 1998 - 2002. These activities are funded in part with USGS 104b funds and are listed in a section entitled "Technical Support, Training and Outreach" on page 68 of this report.

<b>Title</b>	Slag recycle/AMD treatment
<b>Project Number</b>	WRI26
<b>Start Date</b>	36219
<b>End Date</b>	36583
<b>Research Category</b>	Water Quality
<b>Focus Categories</b>	Acid deposition

### **Principal Investigators**

<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Eung H. Cho	Professor	Chemical Engineering, West Virginia University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/99 - 2/28/00	38174	85888		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes \_\_\_ No X

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	0	0
<b>Masters</b>	2	2
<b>Ph.D.</b>	0	0
<b>Post Doctoral</b>	0	0

<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
M.S. Thesis, Chemical Engineering	Prashant Seshadri, 2000, Treatment of acid mine drainage with Weirton Steel slags.
M.S. Thesis, Chemical Engineering	Scott Renninger, 2000, Utilization of Steel Slag for Treatment of Acid Mine Drainage and Examination of Potential for Recycling Class C Steel Slag” - Problem Report

### **Awards and Achievements**

None.

<b>Title</b>	Arsenate Sorption to Actively Treated AMD Sludge
<b>Project Number</b>	WRI27
<b>Start Date</b>	36219
<b>End Date</b>	36583
<b>Research Category</b>	Water Quality
<b>Focus Categories</b>	Water Quality, Treatment, Geochemical Processes

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Louis McDonald	Assistant Professor	Plant & Soil Science, West Virginia University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/99 - 2/28/00	10000	27084		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes \_\_\_ No X

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	0	0
<b>Masters</b>	1	1
<b>Ph.D.</b>	0	0
<b>Post Doctoral</b>	0	0

<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
Peer-Reviewed Journal	Lenter, C.M., L. M. McDonald, J. Skousen and P.F. Ziemkiewicz, 2002. Sulfate effects on the physical and chemical properties of actively treated acid mine drainage floc. <i>Minewater and the Environment</i> . 21:114-120.
Proceedings Abstract	McDonald, L.M., J. Skousen, J. Selfridge, and P.F. Ziemkiewicz. 2002. Effects of chemical and sulfate on floc characteristics for treating acid mine drainage. Proceedings of the 23 <sup>rd</sup> West Virginia Surface Mine Drainage Task Force Symposium, p. 77. April 16-17. Morgantown, WV.
M.S. Thesis	2002. Catherine M. Bohan (Lenter). Chemical and Physical Properties of Acid Mine Drainage Floc.

There were four tasks for this project. During the time frame of 1998-2002, only the results from task 1 were submitted for publication. It is anticipated that one or more papers will be submitted in 2004.

### **Awards and Achievements**

None

<b>Title</b>	Nutrient Impacts on Macroinvertebrates and Periphyton Community Structure
<b>Project Number</b>	WRI30
<b>Start Date</b>	36585
<b>End Date</b>	36949
<b>Research Category</b>	Biological Sciences
<b>Focus Categories</b>	Nutrients, Nonpoint pollution, Water quality

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Peter Benjamin Vila	Assistant Professor, Environmental Studies	Shepherd College
Neil Gillies	Science Director	Cacapon Institute

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/00 - 2/28/01	32834	109294		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes \_\_\_ No X

*Note: A proposal is currently under review at the USDA to do a large scale periphyton project. Some summary results from this project are included in that proposal.*

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	2	0
<b>Masters</b>	0	0

<b>Ph.D.</b>	0	0
<b>Post Doctoral</b>	0	0

<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
	None

### **Awards and Achievements**

Poster presented at the Mid-Atlantic Water Pollution Biology meeting held at Cacapon State Park, March 29-30, 2001.

<b>Title</b>	AMD Models for TMDL development
<b>Project Number</b>	WRI31
<b>Start Date</b>	36585
<b>End Date</b>	36949
<b>Research Category</b>	Water Quality
<b>Focus Categories</b>	Water Quality, Models, Law, Institutions, Policy

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Jerald Fletcher	Director, National Resource Analysis Center Professor, Resource and Environmental Economics	West Virginia University
James Stiles	Environmental Engineer	West Virginia Water Research Institute, West Virginia University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/00 - 2/28/01	25001	78607		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes  No

The TAMDL model has been used in subsequent research projects including the US Army Corps of Engineers' supported Monday Creek Restoration Project Design in partnership with Ohio DNR and the WVVRI. Software developed by the Natural Resources Analysis Center has been used in numerous West Virginia DEP-supported planning projects.

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	2	0
<b>Masters</b>	1	0
<b>Ph.D.</b>	3	3
<b>Post Doctoral</b>	0	0

<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
Conference Proceedings	Stiles, J. M. 2001. "Developing Mining TMDL's with TAMDL" American Water Resources Association Summer Speciality Conference, Decision Support Systems for Water Resources Management, Snowbird, Utah, June 2001.
	Stiles, J. M. (2002) "TMDL Model Development for Acidic Mine Drainage." Water Resources Update, University Council on Water Resources, Carbondale, IL
Dissertation	Al, Md. Kamar. 2002. Stream Water Quality Management: A Stochastic Mixed-integer Programming Model. Ph.D. Dissertation, Natural Resource Economics, West Virginia University, Morgantown, WV.
Dissertation	Rodsomboon, Sujittra. 2002. Incorporating Risk into Watershed Management: A Chance Constrained Programming Approach. Ph.D. Dissertation, Natural Resource Economics, West Virginia University, Morgantown, WV
Abstract	Rodsomboon, Sujittra and Jerald J. Fletcher. 1999. A Quantitative Framework for Analyzing Total Maximum Daily Load Policies for Acid Mine Drainage Affected Watersheds, (Abstract) Agricultural and Resource Economics Review 28(2):232.

## Awards and Achievements

A paper, Developing Mining TMDL's with TAMDL, which describes both the theory of the computer program TAMDL and the program's application to the Paint Creek Watershed was presented at the American Water Resources Association, Summer Speciality Conference, Decision Support Systems for Water Resources Management at Snowbird, Utah, June 27-30, 2001.

While this research project did not include a formal information transfer program, Dr. Stiles taught a series of short courses in using the computer program TAMDL at West Virginia University in the summer and autumn of 2001. Attendees included employees of WVDEP and EPA Region III.

The economic implications of weather related stochastic processes on TMDL development was studied. The results indicate that the costs of assurance increase rapidly as the imposed level of certainty approaches 100%. Two students received Ph.D.s in Natural Resource Economics with partial support from this project. While the results have not altered current policy, they have led to discussions for appropriate TMDL implementation.

### Papers Presented:

Fletcher, Jerald J., Tim T. Phipps, and Md. Kamar Ali. 2000. "The TMDL Process: Environmental Federalism for Water Quality Management," presented at the W-133 Regional Project Annual Meeting, Kauai, Hawaii, February 28.

Ali, Md. Kamar, Jerald J. Fletcher, and Tim T. Phipps. 2002. "Stream Water Quality Management: A Stochastic Mixed-integer Programming Model," presented at the Annual Meeting of the American Agricultural Economics Association, Long Beach, July 28-31.

Ali, Md. Kamar, Jerald J. Fletcher and Tim T. Phipps. 2002. "Cost Effective Water Quality Management: A Watershed Perspective," presented at the World Congress of Environmental and Resource Economists, Monterey, CA, June 23-27.

Rodsomboon, Sujittra and Jerald J. Fletcher. "A Quantitative Framework for Analyzing Total Maximum Daily Load Policies for Acid Mine Drainage Affected Watersheds," Northeast Agricultural and Resource Economics Association meetings, Morgantown, WV, June 1999.

<b>Title</b>	Water quality measurement in polishing ponds of AMD treatment plants for selection of commercial aquaculture sites and waste management studies
<b>Project Number</b>	WRI39
<b>Start Date</b>	36950
<b>End Date</b>	37314
<b>Research Category</b>	Water Quality
<b>Focus Categories</b>	Wastewater, Treatment, Recreation

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Kenneth Semmens	Extension Specialist	Agriculture & Natural Resources Development, West Virginia University
Daniel Miller	Senior Project Coordinator	Animal Sciences, West Virginia University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/01 - 2/28/02	14900	78241		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes \_\_\_ No X

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	0	0

<b>Masters</b>	0	0
<b>Ph.D.</b>	0	0
<b>Post Doctoral</b>	0	0
<b>Publications</b>		
<b>Publication Type</b>	<b>Publication Citation</b>	
	None.	

### **Awards and Achievements**

Newspaper article: The Dominion Post; Sunday, April 7, 2002: "This fish story holds out hope for a new industry."

Newspaper article: Times West Virginia; Sunday, April 27, 2002: "Guyses Run 'stream animals' indicators that water healthy."

In 2004, the successful site (the old Tygart mine treatment plant) will host a kids fishing event and a SRS fishing day. Marion County is trying to find a way to turn the site into a county fishing park. Research continues to be conducted at the site.

<b>Title</b>	Aquaculture waste control & optimizing nutrient utilization
<b>Project Number</b>	WRI40
<b>Start Date</b>	36950
<b>End Date</b>	37679
<b>Research Category</b>	Biological Sciences
<b>Focus Categories</b>	Nutrients, Water Quality

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Jonathan C. Eya	Assistant Professor	West Virginia State College

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/01 - 2/28/02	38627	90094		
3/1/02 - 2/28/03	0	0		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes \_\_\_ No X

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	2	0
<b>Masters</b>	0	0
<b>Ph.D.</b>	0	0
<b>Post Doctoral</b>	0	0



<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
	None

**Awards and Achievements**

None

<b>Title</b>	Assessing extent and longevity of degradation following coal mining in West Virginia
<b>Project Number</b>	WRI46
<b>Start Date</b>	37315
<b>End Date</b>	37679
<b>Research Category</b>	Water Quality
<b>Focus Categories</b>	Water Quality, Surface Water, Acid Deposition

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Paul Ziemkiewicz	Director	West Virginia Water Research Institute, West Virginia University
Jennifer Simmons	Program Coordinator	West Virginia Water Research Institute, West Virginia University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/02 - 2/28/03	23542	46648		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes \_\_\_ No X

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	2	0
<b>Masters</b>	0	0

<b>Ph.D.</b>	0	0
<b>Post Doctoral</b>	0	0

<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
	None

### **Awards and Achievements**

Newspaper article: Charleston Gazette, Friday, May 10, 2002, WVU to Study Stream Standards.

<b>Title</b>	Establishing biological and water quality criteria for water resource management in mining impacted watersheds
<b>Project Number</b>	WRI47
<b>Start Date</b>	37315
<b>End Date</b>	37679
<b>Research Category</b>	Water Quality
<b>Focus Categories</b>	Water Quality, Acid Deposition, Surface Water

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Todd Petty	Assistant Professor	Forestry, West Virginia University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/02 - 2/28/03	\$36,746	\$110,531	Allegheny Energy	\$149,000
			EPRI	\$79,000

This project received follow-on funding after completion as a section 104-funded project:  
 Yes  No

The principal investigator, Todd Petty, received additional supplemental funding from Allegheny Energy and the Electrical Power Research Institute (EPRI) to conduct research that will allow the quantification of the overall degree of ecological impairment that can be attributed to different stressors in the Cheat River watershed. This information complements the research funded through the WVWRI and will make it possible to use the model being developed under the current WVWRI project to guide a pollutant trading program in the Cheat River watershed.

*Note: In addition, Todd Petty, Paul Ziemkiewicz, and Jim Stiles received a \$599,000 STAR grant in 2004 from the USEPA to continue their work relating mining activities,*

*water quality, and biological condition in streams at a watershed scale.*

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	2	0
<b>Masters</b>	1	0
<b>Ph.D.</b>	1	0
<b>Post Doctoral</b>	0	0

<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
	None

### **Awards and Achievements**

Newspaper article: Charleston Gazette, Friday, May 10, 2002, WVU to Study Stream Standards.

The results of this research are being used to guide the development of a water quality trading framework for the Cheat River basin. It also is being used to set water quality targets for stream restoration projects.

Five separate seminars were given on the topic of water quality trading and how biological communities can be used to quantify trades at the scale of an entire watershed. Three of these seminars were presented to participants in the Cheat Water Quality Trading Stakeholder Group. One seminar was given to an EPRI sponsored workshop on water quality trading, and a final seminar was presented to the USEPA Region III program in TMDL implementation and water quality trading.

<b>Title</b>	Impact of longwall mining on headwater streams in northern West Virginia
<b>Project Number</b>	WRI48
<b>Start Date</b>	37315
<b>End Date</b>	37679
<b>Research Category</b>	Biological Studies
<b>Focus Categories</b>	Water Quality, Surface Water, Acid Deposition

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Ben Stout	Associate Professor, Biology; Director, Environmental Studies	Wheeling Jesuit University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/02 - 2/28/03	17568	31753		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes \_\_\_ No X

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	4	0
<b>Masters</b>	0	0
<b>Ph.D.</b>	0	0
<b>Post Doctoral</b>	0	0



<b>Publications</b>	
<b>Publication Type</b>	<b>Publication Citation</b>
Conference Proceedings	Impacts of longwall mining on the diversity, longevity and functionality of benthic macroinvertebrate communities in central Appalachian headwater streams. Presented at the 51 <sup>st</sup> Annual meeting of the North American Benthological Society, Athens, GA.
Conference Proceedings	Longitudinal profiling of headwater streams; pg. 76-94 in Functions of Headwater Stream Systems. Technical Information Workshop, North American enthological Society, Athens, GA.

### **Awards and Achievements**

Newspaper article: Charleston Gazette, Friday, May 10, 2002, WVU to Study Stream Standards.

### **Summary of Research Projects**

The following is a count of the number of research projects and the percentage of total research funds expended in each of six categories between 1998 and 2002.

<b>Number of Research Projects and Percentage of Research Funds, by Research Category: 1998-2002</b>		
<b>Research Category</b>	<b>Number</b>	<b>Percent of Funds</b>
<b>Biological Sciences</b>	4	52
<b>Climate and Hydrologic Processes</b>	0	0
<b>Engineering</b>	0	0
<b>Ground Water Flow and Transport</b>	0	0
<b>Social Sciences</b>	0	0
<b>Water Quality</b>	5	48
<b>Total</b>	9	100

### **Follow-on Funding for Seed-Money Projects**

Two 104b-funded projects received follow-on funding:

WRI47: Establishing Biological and Water Quality Criteria for Water Resource Management in Mining Impacted Watersheds; Todd Petty, Principal Investigator.

WRI31: AMD Models for TMDL Development; Jerald Fletcher, Principal Investigator.

### **Summary of Research Publications**

The following is a count of the number of publications by category.

<b>Number of Research Publications, by Category of Publication: 1998 -2002</b>	
<b>Publication Category</b>	<b>Number</b>
<b>Articles in Refereed Journals</b>	2
<b>Book Chapters</b>	0
<b>Theses and Dissertations</b>	5

<b>Water Resources Institute Reports</b>	0
<b>Articles in Conference Proceedings</b>	4
<b>Other Publications</b>	7

### **Most Significant Research Findings**

Key findings:

1. Determination of environmental effects of flooding in the Pittsburgh Basin coal mines.
2. Development of a boron doped diamond electrode for rapid mercury speciation.
3. Development of cost effective acid mine drainage treatment methods.
4. Development of GIS based watershed modeling software.
5. Commercialization of acid mine drainage design software package: AMDzine

### **Summary of Awards**

Dr. Jeffrey Skousen, Professor of Plant and Soil Science won the the American Society for Mine Reclamation's Reclamation Researcher of the Year in 2001. Much of the cited research was supported by the WVVRI.

### **INFORMATION TRANSFER PROGRAM**

WVVRI's information transfer program between 1998 - 2002 consisted of the following:

- WVVRI web site
- conferences and workshops
- press releases

Information on the web site is listed on page 40 of this report. A listing of conferences and workshops can be found on page 38 of this report. Press releases resulted in newspaper articles, a listing of which is on page 87 of this report.

**Information Transfer Projects**

<b>Title</b>	WVWRI Information Transfer
<b>Project Number</b>	WRI32
<b>Start Date</b>	36585
<b>End Date</b>	36949
<b>Research Category</b>	N/A
<b>Focus Categories</b>	

<b>Principal Investigators</b>		
<b>Name</b>	<b>Rank During Project Period</b>	<b>Affiliation</b>
Paul F. Ziemkiewicz	Director	West Virginia Water Research Institute, West Virginia University

<b>Funding</b>				
<b>Funding Period</b>	<b>Federal 104 Funds</b>	<b>Required 104 Matching Funds</b>	<b>Other Funding Source</b>	<b>Other Funds</b>
3/1/00 - 2/28/01	10131	20447		

This project received follow-on funding after completion as a section 104-funded project:  
 Yes  No

<b>Student Support</b>		
<b>Degree Level</b>	<b>Number of Students</b>	<b>Number of Dissertations/Theses</b>
<b>Undergraduate</b>	0	0
<b>Masters</b>	1	0
<b>Ph.D.</b>	0	0

<b>Post Doctoral</b>	0	0
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Publications	
Publication Type	Publication Citation
	None

### **Awards and Achievements**

A web site detailing information on the West Virginia Water Research Institute programs, projects, and research results was developed under this initiative.....

### **Audio-visual Productions**

DVDs and video tapes were produced in part using 104b and matching funds. The focus is on the mission of the WVWRI and highlighting specific projects. An introduction and four project highlights (including one 104b-funded project) appear on the WVWRI web site at <http://wvwri.nrcce.wvu.edu>.

Multiple slide shows and power point presentations were produced during 1998 - 2002 for various meetings and presentations and are too numerous to list.

### **Newsletter**

The WVWRI does not produce a WVWRI newsletter but rather provides information via a web site at <http://wvwri.nrcce.wvu.edu>. This site contains information on the 104b-funded projects, a link to USGS, and NIWR. In addition, the site contains information on all WVWRI programs and projects.

The WVWRI does produce a newsletter for one of its programs, the Combustion Byproducts Recycling Consortium. This newsletter is produced quarterly and paid for by a cooperative agreement with the U.S. Department of Energy - National Energy Technology Laboratory. This newsletter was distributed in both hard copy and placed on the WVWRI web site until 2002 when DOE-NETL made the decision to do away with the hard copies and only place it on the web site. Electronic notices are sent out to a distribution list of over 600 each quarter when the newest edition is placed on the web site.

A brochure on the WVWRI was also produced in 2002.



## **Conferences**

The WVVRI played a major role in organizing the following conferences and workshops.

### **2000**

November 14-16, 2000

Abandoned Mine Land Remediation Workshop

US Army Corps of Engineers

St. Louis, MO

Topics included hard rock and coal mine drainage treatment technologies, design, performance, and cost estimates.

December 4-6, 2000

Society of Mine Reclamation Annual Meeting for State of Indiana regulators, AML staff, and remediation designers

Jasper, Indiana

Topics of discussion included acid mine drainage control and treatment technologies

### **2001**

July 25-26, 2001

Methods for Measuring and Evaluating the Effects of Mining on Streams: Implications for Underground Coal Development Assessment

West Virginia Water Research Institute

Morgantown, West Virginia

Technical workshop with invited participants representing experts from industry, state and federal agencies. There were two background presentations on ground control and mine hydrology followed by three panel sessions.

16-18 October 2001

Abandoned Mine Land Remediation Workshop

US Army Corps of Engineers

Fairmont Hot Springs, MT

Topics included hard rock and coal mine drainage treatment technologies, design, performance, and cost estimates.

### **2002**

23-25 July 2002

Abandoned Mine Land Remediation Workshop

US Army Corps of Engineers

Gallup, NM

Topics included hard rock and coal mine drainage treatment technologies, design, performance, and cost estimates.



**Cosponsor or Supporter:**

**1998**

April

West Virginia Surface Mine Drainage Task Force Symposium

ADTI Workshop

Morgantown, West Virginia

The premier meeting for acid mine drainage reclamation techniques in the world. The Task Force was formed by the Governor of West Virginia in 1977 to address issues related to surface coal mining in Appalachia. The West Virginia Water Research Institute normally contributes 2-3 technical papers to the proceedings and WVVRI staff assist in the facilitation and coordination of the symposium.

**1999**

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The premier meeting for acid mine drainage reclamation techniques in the world. The Task Force was formed by the Governor of West Virginia in 1977 to address issues related to surface coal mining in Appalachia. The West Virginia Water Research Institute normally contributes 2-3 technical papers to the proceedings and WVVRI staff assist in the facilitation and coordination of the symposium.

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## **2002**

April

West Virginia Surface Mine Drainage Task Force Symposium

ADTI Workshop

Morgantown, West Virginia

The premier meeting for acid mine drainage reclamation techniques in the world. The Task Force was formed by the Governor of West Virginia in 1977 to address issues related to surface coal mining in Appalachia. The West Virginia Water Research Institute normally contributes 2-3 technical papers to the proceedings and WVVRI staff assist in the facilitation and coordination of the symposium.

### **Internet Services**

#### **WVVRI Web Site**

<http://wvri.nrcce.wvu.edu>

The purpose of the WVVRI web site is to provide information on the WVVRI and its programs and projects. It allows users to obtain information on what we do, how to contact us, upcoming events, funding opportunities, etc.

The WVVRI web site was redeveloped in 2002 to include information on WVVRI as follows:

- projects
- publications
- events and conference listings
- sponsors/participants
- background
- research priorities
- contacts
- news updates and announcements
- calculators and tools
- links to useful sites

Information on the following WVVRI programs included within the web site are:

- National Mine Land Reclamation Center
- Acid Drainage Technology Initiative
- Acid CSI
- Combustion Byproducts Recycling Consortium
- National Environmental Education & Training Center
- Industrial Institute for Decommissioning
- State Water Institutes

- Monongahela Basin Mine Pool Project
- EPA Experimental Program to Stimulate Competitive Research

Information is current and updated on an on-going basis. The WVWRI uses partial 104b funds to support 1 undergraduate student writer and a staff webmaster.

**Awards**

***None.***

**Most Significant Achievements**

- Conferences and workshops, Listed above.
- Development of the WVWRI Website.
- Development of educational DVDs and Tapes.
- Service on State boards and committees
- Presentations at numerous public functions

**EDUCATION**

We do not have a student internship arrangement with USGS. However, USGS funds are used to support graduate and undergraduate students at West Virginia University and at other State institutions. Funds from other federal agencies are used to support students at WVU and other universities nationwide.

The following is a count of the number of students supported by section 104 grants and required matching funds between 1998-2002.

<b>Number of Students Supported, by Degree and Grant Type: 1998 - 2002</b>		
<b>Degree</b>	<b>Base Grants</b>	<b>Regional and National Competitive Grants</b>
<b>Undergraduate</b>	15	Historically, we have only kept these statistics on the 104b projects. Beginning FY03, these statistics will be kept on all WVWRI projects regardless of funding source.
<b>Masters</b>	6	
<b>Ph.D.</b>	4	
<b>Post Doc</b>	0	

The following is a count of the total number of dissertations and theses that resulted from this student support (104b funded only).

<b>Number of Theses and Dissertations Resulting from 104b Student Support: 1998 - 2002</b>	
<b>Master's Theses</b>	3
<b>Ph.D. Dissertations</b>	2

**Student Grants-in Aid and Summer Fellowships**

None.

## **ADMINISTRATION, COORDINATION, AND COOPERATION**

### **Regional and National Competitive Grant Program**

The following lists the proposals submitted by the WVWRI to regional and national competitive grant programs between 1998 - 2002. Also indicated are which of those proposals were funded.

**Proposals Submitted by the WVVRI Between 1998 - 2002**  
(Does not include proposals submitted to the USGS 104b program.)

Fiscal Year Submitted	Identifier	Title	\$ Requested	Cost-Share Match \$	Total Project Value \$	Agency to Whom Proposal was submitted	Funded (Yes or No)
1998	WRI18	Evaluation of biocidal polymers	\$56,103	\$122,661	\$178,764	USGS	Yes
1998	WRI21	Canaan Valley Institute - Technical support	\$20,000	\$0	\$20,000	Canaan Valley Institute	No
1998	WRI23	Agricultural wastes: sampling/analysis	\$33,644	\$0	\$33,644	WV Dept. Of Agriculture	Yes
1998	WV125B1	ACSI Technical Support	\$19,946	\$0	\$19,946	OSMRE	Yes
1998	WV125e	OSMRE Technical Support - Program Development	\$100,000	\$24,605	\$124,605	Office of Surface Mining	Yes
1998	WV128	Alkaline Leakage Field Demonstration	\$108,499	\$74,032	\$182,531	U.S. Environmental Protection Agency	Yes
1998	199 WV132	Mon Basin Underground Mine Discharge Study	\$79,997	\$8,012	\$88,009	U.S. Environmental Protection Agency	Yes
1998	199 WV138	Third Annual AMD Conference and Workshop	\$32,509	\$0	\$32,509	WV Division of Environmental Protection/U.S. Environmental Protection Agency	Yes
1998	WV147	Alkalinity Generation Determinations for Steel Slags	\$0	\$50,000	\$50,000	WVVRI State funds	Yes
1998	WV147a	Solidification Study	\$28,573	\$0	\$28,573	ANR Coal Company	Yes

1998	WV150	AMD sludge solidification	\$30,000	\$0	\$30,000	Coastal Corp.	No
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1998	WV151	Underground mine insitu remediation-Cheat and Tygart	\$650,000	\$600,000	\$1,250,000	U.S. Army Corps of Engineers/Greer/Viking/ANR	No
1998	WV152	Carbon Sequestration	\$121,681	\$55,973	\$177,654	DOI/US Geological Survey	No
1998	WV154	In-situ remediation of metal/organic groundwater	\$600,000	\$0	\$600,000	SERDP/DOD	No
1998	WV155	Upper Youghiogheny-Casselman-Lauriel Hill Watersheds	\$160,000	\$0	\$160,000	PA-DCNR	No
1998	WV157	4 <sup>th</sup> Annual AMD Conference	\$37,775	\$0	\$37,775	Office of Surface Mining	Yes
1998	WV160	Alton closeout strategy	\$142,000	\$19,203	\$161,203	WV Division of Environmental Protection	Yes
1998	WV161	Omega Mine south lobe closeout	\$150,000	\$0	\$150,000	WV Division of Environmental Protection	No
1998	WV165	Friends of Cheat, Inc. Technical Support	\$9,000	\$0	\$9,000	Friends of Cheat, Inc.	Yes
1998	WV166	Plant succession on reclaimed land in southern WV	\$30,011	\$0	\$30,011	Arch Coal Inc.	Yes
1998	WV171	Removal of iron from AMD by OLCs	\$21,330	\$0	\$21,330	National Research Center for Coal & Energy - WVU	Yes
1998	NE01	OCC Training of HazMat workforce	\$38,215	\$0	\$38,215	USDOD SERDP	Yes
1998	WV146	Evaluation of Reclamation Technologies	\$41,500	\$27,994	\$69,494	WV Division of Environmental Protection	Yes

1998	WV130a	Technical services for WVDEP	\$20,000	\$0	\$20,000	WV Division of Environmental Protection	No
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1998	WV130b	Technical services for WVDEP	\$19,999	\$0	\$19,999	WV Division of Environmental Protection	Yes
1999	WV125f	Matthew Run In-Situ Treatment	\$115,000	\$2,938	\$117,938	Office of Surface Mining	Yes
1999	WRI25	Rehabilitation of P, AS loaded fields	\$150,000	\$0	\$150,000		No
1999	WV173 Phase I	Monongahela basin mine pool flooding	\$678,000	\$85,746	\$763,746	U.S. Environmental Protection Agency through U.S. Department of Energy	Yes
1999	WV177	Grout Formulation	\$3,402	\$0	\$3,402	Heintzmann Corp.	No
1999	WV176	AMD workshop, USACE	\$4,762	\$0	\$4,762	U.S. Army Corps of Engineers/U.S. Department of Energy	Yes
1999	WV175	Joint Conference on Reclamation	\$27,869	\$0	\$27,869	Office of Surface Mining	Yes
1999	NE02	WVU Center of Excellence	\$45,175	\$0	\$45,175	USDOD SERDP	Yes
1999	NE03	TexPert 99	\$324,062	\$0	\$324,062	USDOD SERDP	Yes
1999	WV174	Low cost grout for underground mine injection	\$54,816	\$22,522	\$77,338	Emission Control Byproducts Consortium	No
1999	WV134	Emission Control Byproducts: Treatment and Use	\$66,127	\$20,970	\$87,097	U.S. Department of Energy	Yes
1999	WV142	ADTI Technical Program	\$200,000	\$0	\$200,000	Office of Surface Mining	Yes
2000	WRI23 Phase 2	Potomac Headwaters Sampling Project	\$50,307	\$0	\$50,307	WV Dept. Of Agriculture	Yes

2000	WRI33	Assessments of mountain top mining EIS review	\$0	\$15,000	\$15,000	WVU engineering Dept (Syd Peng's)	Yes
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2000	WRI34	Effects of Passive Treatment Systems on Overall Watershed Health	\$50,000	\$0	\$50,000	US Environmental Protection Agency	No
2000	WV178	ADTI Support	\$200,000	\$0	\$200,000	Office of Surface Mining	Yes
2000	WV187	Lick/Pringle Run	\$1,900,000	\$0	\$1,900,000	Preston County Comm./U.S. Army Corps of Engineers	Yes
2000	WV188	Reforestation CO2 sequestration	\$121,681	\$55,973	\$177,654	U.S. Geological Survey	No
2000	NE09	Deployment Support Leading to Implementation	\$298,639	\$9,222	\$307,861	US Department of Energy	Yes
2000	NE10	TexPert 2000	\$178,393	\$0	\$178,393	USDOD SERDP	Yes
2000	NE11	NEETC	\$44,042	\$0	\$44,042	USDOD SERDP	Yes
2000	NE11AM	NE11 Textpert 2000 Amendment	\$48,781	\$0	\$48,781	USDOD SERDP	Yes
2000	NE12	SERDP Ship Scrapping	\$85,605		\$85,605	USDOD SERDP	Yes
2000	NE12 Ph2	SERDP Ship Scrapping	\$1,616,745	\$0	\$1,616,745	USDOD SERDP	Yes
2000	WV181	HSRC/Mid Atlantic/Great Lakes Center for Industrial Byproducts Benefication and Reuse	\$1,963,812	\$327,200	\$2,291,012	US EPA	No
2000	WV184	Clean Water and watershed restoration	\$486,505	\$0	\$486,505		No
2000	WV125g	ACSI Technical Support 2000	\$42,500	\$0	\$42,500	Office of Surface Mining	Yes
2000	WV134 Phase II	Emission Control Byproducts: Treatment and Use	\$678,000	\$1,214,921	\$1,892,921	U.S. Department of Energy	Yes

2000	WV173 Phase II	Abandoned Mine Pool flooding of the Pittsburgh, Ohio and Irwin Basins	\$546,327	\$118,273	\$664,600	U.S. Environmental Protection Agency through U.S. Department of Energy through Parsons, Inc.	Yes
2000	WRI24	TMDL enhanced decision making	\$101,015	\$0	\$101,015	WV Division of Environmental Protection	Yes
2001	WRI36	State Implementation Plan and Mercury project	\$274,928	\$308,418	\$583,346	WV EPA EPSCOR	Yes
2001	WRI37	Romania Jiu Valley	\$89,479	\$50,515	\$139,994	World Learning via International Studies, WVU	Yes
2001	WV172	Greens Run AMD remediation	\$117,165	\$146,170	\$263,335	West Virginia Division of Environmental Protection	Yes
2001	WV173 Phase III	EPA Region III Mine Pool Flooding	\$7,239,707	\$0	\$729,707	U.S. Environmental Protection Agency through U.S. Department of Energy through Parsons, Inc.	Yes
	WV190	AMD Design Manual	\$76,179	\$0	\$76,179	U.S. Army Corp of Engineers through U.S. Geological Survey	Yes
2001	NE13	Cascade General Proof of Concept	\$237,000	\$0	\$237,000	NEETC, Inc.	Yes
2001	WRI38	Berea Data	\$108,015	\$103,285	\$211,300	USGS 104g	No

2001	WV179	Simultaneous Sorption of metals and organic chemicals	\$216,071	\$0	\$216,071	U.S. Department of Energy	No
2001	WRI42	Nutrient loading rates from non point sources	\$74,848	\$0	\$74,848	U.S. Dept. Of Agriculture	No

2001	WV134 Phase II-2	Emission Control Byproducts: Treatment and Use	\$819,978	\$972,214	\$1,792,192	U.S. Department of Energy	Yes
2001	WRI43	Institute for Appalachian Water Resources	\$1,500,000	\$0	\$1,500,000	WV Challenge Grant	No
2002	NE14	Center of Excellence Work Plan 2002-2003	\$565,337	\$0	\$565,337	NEETC, Inc.	Yes
2002	WRI44	TAMDL Development	\$0	\$31,786	\$31,786	WVU Research Corp.	No
2002	WRI45	Sequestration of Metals Using Rock Phosphate	\$146,705	\$146,709	\$293,414	USGS	No
2002	WV134 Phase III	Combustion Byproducts Recycling Consortium	\$1,094,929	\$688,159	\$1,783,088	U.S. Department of Energy	Yes
2002	WV134 Ph III-2	Combustion Byproducts Recycling Consortium	\$71,493	\$0	\$71,493	U.S. Department of Energy	Yes
2002	WV195	Cost effective ecosystem restoration of the Monday Creek, Ohio Watershed	\$132,000	\$0	\$132,000	U.S. Army Corps of Engineers through U.S. Department of Energy	Yes
2002	WV198	AML	\$1,000,000	\$0	\$1,000,000	U.S. Army Corps of Engineers	No
2002	WV199	Restoration of the AMD impacted Cheat River Watershed	\$20,000	\$1,929,000	\$1,949,000	National Fish & Wqildlife Foundation	No
2002	WV201	Rockhouse Rk. ACSP	\$25,000	\$0	\$25,000	NRCS	No
2002	WV203	Mon River Remediation	\$1,000,000	\$334,000	\$1,334,000	U.S. Army Corps of Engineers	
2002	WV204	AMD Treatment using red mud, CKD and slag	\$46,682		\$46,682	Alcoa	No

2002	WV134 Ph IV	Combustion Byproducts Recycling Consortium	\$1,760,844		\$1,760,844	USDOE	Yes
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1998-2000	ETD05	Disposal of Fluidized Bed Combustion Ash in an Underground Mine to Control AMD & Subsidence	\$827,395	\$293,932	\$1,121,327	DOE/METC	
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## Cooperation

The following describes the expenditure of section 104 and matching funds at WVU and at other universities or organizations.

<b>Expenditure of Section 104 and Matching Funds, by University or Other Organization, State, and Year: 1998 - 2002</b>						
<b>University or Organization</b>	<b>State</b>	<b>Section 104 Federal Grant and Matching Fund Expenditures</b>				
		<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
West Virginia University	WV	\$64,066	\$221,151	\$134,186	\$133,297	210593
Wheeling Jesuit University	WV	0	0	0	0	49321
Shepherd College	WV	0	0	142128	0	0
West Virginia State College	WV	0	0	0	0	43671

## Institute Directors over Evaluation Period

Paul F. Ziemkiewicz, Ph.D. served as Director of the West Virginia Water Research Institute between 1998 - 2002. Dr. Ziemkiewicz's responsibilities focus on developing water-related research opportunities, assembling and managing research teams and responding to the needs of sponsoring agencies. In addition to his research roles, Dr. Ziemkiewicz serves on both state and federal policy advisory committees focusing on mine reclamation and water pollution. Presently, he provides technical support to USEPA toward developing new regulatory guidance for the use of coal combustion wastes in coal mines. Dr. Ziemkiewicz is a member of the Board of Directors of the National Environmental and Education Training Center, and a member of the West Virginia Acid Mine Drainage Task Force, the Eastern Mine Drainage Federal Consortium, and the National Research Council Study Team: Water Quality in the Pittsburgh Region.

Dr. Ziemkiewicz received the E.M. Watkin Award in 1985 for Outstanding Contribution to the Betterment of Land Reclamation in Canada, presented by the Canadian Reclamation Association. He holds a Bachelor's in Biology and a Master's in Range Ecology from Utah State University, and Doctorate in Forest Ecology from the University of British Columbia.

## Advisory Committees

Our interactions with USGS are frequent. We have representatives of USGS on our West Virginia Advisory Committee for Water Research and we work with USGS representatives on other projects such as the Monongahela Basin Mine Pool project funded by the U.S. Department of Energy - National Energy Technology Laboratory.

### West Virginia Advisory Committee for Water Research

The West Virginia Advisory Committee for Water Research serves as the primary advisory committee for the West Virginia Water Research Institute. This committee is not set by the state. Its members are solicited by the Director of the West Virginia Water Research Institute. This committee meets at least twice each year. This committee reviews proposals submitted to the WVWRI for consideration for further submission to the U.S. Geological Survey for base grant 104b. In addition, the committee identifies statewide water research priorities, reviews the annual request for proposals, evaluates progress of all WVWRI projects, advises the director regarding program direction and management, and finally, identifies opportunities for collaborative research efforts. This advisory committee consists of representatives of the following organizations:

- ! U.S. Geological Survey
- ! U.S. Environmental Protection Agency
- ! U.S. Department of Energy - National Energy Technology Laboratory
- ! U.S. Department of Agriculture - Natural Resources Conservation Service
- ! U.S. Army Corps of Engineers - Huntington, WV District
- ! West Virginia University
- ! West Virginia Department of Natural Resources
- ! Canaan Valley Institute
- ! West Virginia Bureau for Public Health
- ! West Virginia Division of Environmental Protection
- ! U.S. Federal Bureau of Investigation

### Combustion Byproducts Recycling Consortium

The CBRC is a U.S. Department of Energy - National Energy Technology Laboratory funded program managed by the WVWRI. It began in 1998 and its mission is to promote and support the commercially viable and environmentally sound recycling of coal combustion byproducts for productive uses through scientific research, development, and field testing. The CBRC program has a National Steering Committee to identify both national and regional research priorities. They review requests for proposals and review the performance of the Combustion Byproducts Recycling Consortium annually. In addition, they review proposals submitted in

response to the RFP's and make recommendations to DOE-NETL as to which should be funded. The NSC advises the CBRC Director on strategic direction for the program and reviews project final reports. This committee meets twice yearly.

The National Steering Committee consists of representatives from the following organizations:

- ! Ohio Coal Development Office
- ! Interstate Mining Compact Commission
- ! University of New Hampshire
- ! TXU Energy
- ! American Coal Ash Association
- ! U.S. Army Corps of Engineers
- ! Tennessee Valley Authority
- ! University of Kentucky
- ! Utility Solid Waste Activities Group
- ! Office of Surface Mining
- ! Illinois Office of Coal Development and Marketing
- ! U.S. Environmental Protection Agency

In addition to the NSC, representatives of the following serve in an administrative and technical oversight capacity.

- ! U.S. Department of Energy - National Energy Technology Laboratory
- ! Southern Illinois University - Carbondale
- ! University of North Dakota
- ! West Virginia University

#### Monongahela Basin Mine Pool Flooding

A steering committee attends quarterly technical progress meetings in which the researchers present findings during the previous quarter and plans for the upcoming quarter. The committee advises the researchers and gives overall direction to the project. The steering committee is comprised of representatives from the following organizations:

- ! U.S. Department of Energy - National Energy Technology Laboratory
- ! West Virginia Division of Environmental Protection
- ! Pennsylvania Department of Environmental Protection
- ! U.S. Environmental Protection Agency
- ! Office of Surface Mining

This committee has been active since the beginning of the mine pool studies which began in 1998 and remains active well into 2004.

## **Research Proposal Review and Selection Process**

### **Water Resources Research - USGS 104b Program**

Each fall, the WVWRI issues a request for proposals. This RFP is released to contacts at all educational institutions in the state of West Virginia. Researchers across the state submit their proposals to the WVWRI. The WVWRI forwards proposals to the members of the West Virginia Advisory Committee for Water Research for review. The advisory committee makes recommendations as to which proposals should be forwarded to USGS for funding consideration. The WVWRI forwards those proposals to the USGS for funding consideration.

Members of the advisory committee possess a variety of expertise including technical expertise in water chemistry, acid mine drainage, sampling and analytical methodology. The members of this advisory committee represent a cross section of state agencies poised to know which projects merit the relevance to state and regional water resource issues.

The WVWRI manages the funded 104b projects ensuring deliverables are submitted on time, monies are expended appropriately, and external cost share is tracked. In addition, the WVWRI places project information on the WVWRI web site.....

### **Combustion Byproducts Recycling Consortium (CBRC) Program**

During fiscal years 1998 -2002, three RFP's were released. The WVWRI develops the RFP which is reviewed by the national steering committee and the U.S. Department of Energy - National Energy Technology Laboratory. When both the steering committee and DOE-NETL are satisfied with the language of the RFP, the WVWRI releases it to the public via post card notices through the mail and electronic notices to our mailing lists. This is a national solicitation open to the U.S. states and its territories. The WVWRI collects the proposals, sends them to the steering committee and peer reviewers for review. The proposal evaluations are collected by the WVWRI and tallied into a results matrix. This matrix is supplied to the national steering committee and to DOE-NETL. The steering committee makes recommendations to DOE-NETL as to which proposals to fund. DOE-NETL makes the final decision as to which proposals to fund. When those selections are made, funding from DOE-NETL is channeled to the WVWRI which then channels funds to the selected researchers. The WVWRI manages the CBRC research projects to ensure deliverables are turned in on time, that monies are expended appropriately, that external cost share is tracked, and that final reports, newsletters, and information on the program are placed on the CBRC page of the WVWRI web site.

## **Peer Review of Institute Publications**

For acid mine drainage related materials, the Acid Drainage Technical Initiative

subcommittee reviews. For water-related materials, the West Virginia Water Advisory Committee reviews. In addition, depending on the topic of the publication, appropriate academic faculty members are solicited to review.

**Number of Principal Investigators Supported by Rank and Year**

<b>Principal Investigators on Research Projects Supported by Section 104 Grants and Matching Funds, by Academic Rank and Year: 1998 - 2002</b>					
<b>Academic Rank</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
<b>Assistant Professor and below</b>	0	1	3	3	2
<b>Associate Professor</b>	0	0	0	0	1
<b>Professor</b>	1	1	1	0	1
<b>Total</b>	1	2	4	3	4

**ADDITIONAL INFORMATION FOR THE EVALUATION PANEL**

The evaluation period covers the period during which the State 104b program was eliminated then re-instituted by Congress. The report reflects our effort to take the opportunity to reorganize our environmental research programs under the WV Water Research Institute to maximize leveraging opportunities and synergy among stakeholders.

**The West Virginia Water Research Institute**

The mission of the West Virginia Water Research Institute is to preserve and restore the natural environment through research and partnerships with industry, government agencies, academia, and citizens groups. To achieve this mission, the WVVRI actively seeks external funding from federal, state, and private sources. With diversified funding and support, the WVVRI develops strong, multi-disciplinary research teams by collaborating with various West Virginia University colleges and divisions, other higher education institutions, and private firms and consultants. This team approach brings the best expertise available to address the State’s water issues. It also allows the WVVRI to perform research in a number of areas at any given time.

Between 1998 - 2002, the WVVRI was comprised of the following four programs in addition to the USGS 104b water resources research program:

- National Mine Land Reclamation Center

- Combustion Byproducts Recycling Consortium
- National Environmental Education & Training Center
- Hydrology Research Center

These programs are described below. ....

**National Mine Land Reclamation Center (NMLRC)**

Coal mine reclamation rehabilitates land and water affected by current and historic mining operations. The National Mine Land Reclamation Center works to improve methods for protecting streams from mine pollution and develop ways to establish productive forests on mined land. Working with State and Federal agencies, citizen watershed organizations and the coal industry, the NMLRC has pioneered large-scale watershed reclamation strategies that mesh regulatory programs with voluntary remediation. The NMLRC works to further the understanding of the hydrologic and ecological impacts of the coal mining industry by exploring technologies that mitigate these impacts. Research being performed by the NMLRC is addressing both impact measurements as well as mitigating technologies that are critical to the viability of the coal mining industry while safeguarding groundwater quality in the Appalachian states. The following is a list of all NMLRC projects over fiscal years 1998-2002.

**Table 2. National Mine Land Reclamation Center Projects FY98 - FY02.**

Fiscal Year	Project No.	Title	Principal Investigator	Institution/Affiliation	Funding Source	Federal \$	Non-federal \$	Total Project Value \$
1998	WV125b1	ACSI Technical Support	Ziemkiewicz	WVU	USDI/OSM	\$19,946	0	\$19,946
1998	WV128	Alkaline leakage field demonstration	Donovan	WVU	U.S. EPA	\$108,500	\$74,032	\$182,532
1998	WV132	Mon basin underground mine discharge study	Ziemkiewicz	WVU	U.S. EPA	\$89,997	\$20,185	\$110,182
1998	WV147a	Solidification Study	Ziemkiewicz	WVU	NRCCE-WU/IMS	\$0	\$28,573	\$28,573
1998	WV157	Fourth annual AMD conference and workshop	Ziemkiewicz	WVU	U.S. OSM	\$37,775	0	\$37,775
1998	WV171	Removal of iron from AMD by OLCs	Ziemkiewicz	WVU	NRCCE-WVU	\$21,330	\$0	\$21,330
1998	WV130b	Technical Services for WVDEP	Ziemkiewicz	WVU	WV Div. Of EP	\$0	\$19,999	\$19,999
1998	ETD05	Disposal of Fluidized Bed Combustion Ash in an Underground Mine to Control AMD & Subsidence	Ziemkiewicz	WVU	DOE/METC	\$776,000	\$293,932	\$1,069,932
1999	WV125e	OSMRE Technical Support - Program Development	Ziemkiewicz	WVU	OSMRE	\$100,000	\$24,605	\$124,605
1999	WV134 Phase 1	Emission Control Byproducts Consortium	Ziemkiewicz	WVU	USDOE/FETC	\$66,127	\$20,970	\$87,097
1999	WV142	ADTI Technical Program	Ziemkiewicz	WVU	USDI/OSM	\$200,000	0	\$200,000

1999	WV146	Evaluation of reclamation technologies	Skousen	WVU	WVDEP	0	\$69,494	\$69,494
1999	WV160	Alton closeout strategy	Ziemkiewicz	WVU	WVDEP	0	\$161,203	\$161,203
1999	WV165	Friends of Cheat, Inc. - Technical Support	Black	WVU	FOCI	0	\$9,000	\$9,000
1999	WV166	Plant succession on reclaimed land in southern WV	Ziemkiewicz/Skousen	WVU	Arch Coal	0	\$30,011	\$30,011
1999	WV173 Phase 1	Monongahela basin mine pool flooding	Ziemkiewicz	WVU	U.S.EPA/USDOE	\$678,000	\$85,746	\$763,746
1999	WV175	Joint conference on reclamation	Ziemkiewicz	WVU	OSMRE	\$27,869	0	\$27,869
2000	WV125f	Matthew Run in situ treatment	Ziemkiewicz	WVU	OSMRE	\$115,000	\$2,938	\$117,938
2000	WV134 Phase II	Emissions control Byproducts Consortium	Ziemkiewicz	WVU	USDOE	\$1,497,979	\$2,310,568	\$3,808,547
2000	WV176	AMD Workshop, USACE	Ziemkiewicz	WVU	US Army Corps of Engineers	\$4,762	\$0	\$4,762
2000	WV178	USOSMRE - ADTI Support	Ziemkiewicz	WVU	OSMRE	\$200,000	\$0	\$200,000
2000	ETD05 AM	Disposal of Fluidized Bed Combustion Ash in an Underground Mine to Control AMD & Subsidence	Ziemkiewicz	WVU	DOE/METC	\$51,395	\$0	\$51,395
2001	WV125g	ACSI Technical Support	Ziemkiewicz	WVU	OSMRE	\$42,500	\$0	\$42,500
2001	WV134 Phase III	Combustion Byproducts Recycling Consortium	Ziemkiewicz	WVU	USDOE/NETL	\$1,094,929	\$688,159	\$1,783,088
2001	WV172	Greens Run AMD remediation	Ziemkiewicz	WVU	WVDEP	\$0	\$263,335	\$263,335

2001	WV173 Phase II	Abandoned Mine Pool flooding of the Pittsburgh, Ohio, and Irwin basins	Ziemkiewicz	WVU	DOE/ Parsons	\$546,327	\$118,273	\$664,600
2002	WV173 Phase III	EPA Region III Mine Pool Flooding	Ziemkiewicz	WVU	DOE/ Parsons	\$729,707	\$0	\$729,707
2002	WV190	AMD Design Manual	Ziemkiewicz	WVU	US Army Corps of Engineers	\$76,179	\$0	\$76,179
2002	WV195	Cost Effective Ecosystem Restoration of the Monday Creek, Ohio Watershed Mining/reforestation	Ziemkiewicz	WVU	US Army Corps of Engineers	\$132,000	\$0	\$132,000

## **Combustion Byproducts Recycling Consortium (CBRC)**

The Combustion Byproducts Recycling Consortium, funded by the U.S. Department of Energy - National Energy Technology Laboratory, provides seed money to researchers to develop innovative applications for coal combustion byproducts while ensuring their economic and environmental viability. The mission of the Consortium is to promote and support the commercially viable and environmentally sound recycling of coal combustion byproducts for productive uses through scientific research, development, and field testing. Since it was established in 1998, the CBRC has funded 36 projects with a total value exceeding \$7 million (more than \$3.5 million in federal funds and nearly \$4 million in matching funds). The following is a list of those 36 projects.

**Table 3. Combustion Byproducts Recycling Consortium (CBRC) U.S. Department of Energy - National Energy Technology Laboratory-funded Projects FY98 FY 02.**

Fiscal Year	Project No.	Title	Principal Investigator	Organization	Federal \$	Non-federal \$	Total Project Value \$
1999	WV134 Phase I	National Center Seed Money	Ziemkiewicz	West Virginia University	\$66,127	\$20,970	\$87,097
2000	WV134 Phase II	National Center and Eastern Regional Center Administration	Ziemkiewicz	West Virginia University			
2000	SIUC Sub	Midwestern Regional Center Administration	Chugh	Southern Illinois University	\$41,625	\$32,759	\$74,384
2000	UND Sub	Western Regional Center Administration	Hassett	University of North Dakota	\$78,667	\$5,080	\$83,747
2000	99-EC-E04	Economical treatment of high carbon fly ash to produce a low foam index product with carbon content retained	LaCount	Waynesburg College	\$68,673	\$97,156	\$165,829
2000	99-EC-E06	Effects of ammonia absorption on fly ash due to installation of SCR technology	Brendel	GAI Consultants, Inc.	\$84,969	\$69,486	\$154,455
2000	99-EC-E08	Flue gas desulfurization byproducts provide sulfur and trace element nutrition for alfalfa and soybean	Dick	Ohio State University	\$48,650	\$48,650	\$97,300
2000	99-EC-E11	Utilization of fly ash/urban yard waste compost as soil amendments to improve soil fertility	Stofella	University of Florida	\$75,466	\$41,102	\$116,568
2000	99-EC-E13	Odor and HAP control in waste treatment processes using coal combustion ash (CCA)	Das	University of Georgia	\$59,553	\$19,851	\$79,404

2000	99-EC-E15	Water quality at an abandoned mine site reclaimed with pressurized fluidized bed combustion byproducts	Haefner	U.S. Geological Survey	\$92,000	\$30,560	\$122,560
2000	99-EC-E16	Ammonia removal from fly ash in a bubbling fluidized bed	Levy	Lehigh University	\$83,188	\$56,263	\$139,451
2000	99-EC-E17	Hydrogeologic evaluation of strata above the north lobe of the Omega mine	Broschart	WV Division of Environmental Protection	\$25,072	\$27,656	\$52,728
2000	99-EC-E24	Use of clean coal technology products in the construction of low permeability liners	Wolfe	Ohio State University	\$25,258	\$924,544	\$949,802
2000	99-EC-M01	Development of structural materials from sulfate-rich wet scrubber sludge	Malhotra	Southern Illinois University	\$116,180	\$405,331	\$521,511
2000	99-EC-M04	Boron transport from CCP utilization and disposal sites	Paul	Southern Illinois University	\$66,795	\$51,446	\$118,241
2000	99-EC-M05	Soil stabilization and drying by use of fly ash	Edil	University of Wisconsin	\$101,310	\$34,624	\$135,934
2000	99-EC-M06	Development and demonstration of high carbon CCP's and FGD byproducts in permeable roadway base construction	Naik	University of Wisconsin	\$66,190	\$40,000	\$106,190
2000	99-EC-M07	Development of CCP based transmission poles	Chugh	Southern Illinois University	\$113,880	\$299,394	\$413,274
2000	99-EC-W01	Varra coal ash burial project	Adams	CGRS, Inc.	\$18,762	\$23,754	\$42,516
2000	99-EC-W02	Fiber fly ash based wall panel development	Hunt	AeRock, Inc.	\$42,052	\$22,864	\$64,916
2000	99-EC-W04	The use of CCPs for in situ treatment of AMD	Canty	Oklahoma Conservation Commission	\$85,890	\$38,560	\$124,450

2000	99-EC-W05	Promote increased use of CCPs to state regulators and government agencies	Murarka	Ish, Inc.	\$45,000	\$20,000	\$65,000
2001	WV 134 Phase III	National Center and Eastern Regional Center Administration					
2001	SIUC Sub	Midwestern Regional Center Administration	Chugh	Southern Illinois University	\$34,474	\$18,408	\$52,882
2001	UND Sub	Western Regional Center Administration	Hassett	University of North Dakota	\$38,450	\$0	\$38,450
2001	00-CBRC-E15	Siege of Acre	Petrick	Maryland Department of Natural Resources	\$50,000	\$111,552	\$161,552
2001	00-CBRC-E24	Laboratory and field demonstration of the control of ettringite swelling	Scheetz	Pennsylvania State University	\$40,667	\$17,546	\$58,213
2001	00-CBRC-E37	Effects of large scale CCB applications on groundwater: Case studies	McDonald	West Virginia University	\$66,946	\$39,005	\$105,951
2001	00-CBRC-E41	Environmental effects of large-volume FGD fill	Glogowski	GAI Consultants, Inc.	\$45,500	\$115,800	\$161,300
2001	00-CBRC-E42	The use of fly ash as an aggregate for foundry sand mold and core production	Sobczak	Energy Industries of Ohio	\$42,100	\$41,800	\$83,900
2001	00-CBRC-M04	Crushed aggregates from class C fly ash	Misra	University of Missouri	\$37,751	\$49,409	\$87,160
2001	00-CBRC-M05	Long term excavatability of flowable fill containing CCBs	Crouch	Tennessee Technological University	\$38,933	\$15,965	\$54,898

2001	00-CBRC-M09	Environmental performance evaluation of filling and reclaiming a surface coal mine with CCBs	Murarka	Ish, Inc.	\$53,043	\$60,000	\$113,043
2001	00-CBRC-M11	Development of CCB fill materials for use as mechanically stabilized marine structures	Rusch	Louisiana State University	\$81,694	\$45,411	\$127,105
2001	00-CBRC-M14	High performance masonry units from 100% fly ash: synergistic approach	Wu	Wayne State University	\$66,921	\$29,180	\$96,101
2001	00-CBRC-W02	Varra coal ash burial project	Adams	Varra Companies, Inc.	\$45,761	\$15,804	\$61,565
2001	00-CBRC-W04	Pilot testing of fly ash derived sorbents for mercury control in coal fired flue gas	utz	ADA Technologies, Inc.	\$87,819	\$31,015	\$118,834
2001	00-CBRC-W10	Evaluation o flyash admixtures for final cover and composite liner applications	Carlson	Sunflower Electric Power Corporation	\$49,575	\$61,575	\$111,150

## Water Resources Research

In addition to 104b-funded water resources research projects, the WVWRI has additional water-related projects. The following is a list of these projects.

**Table 4. Water Research Projects (not section 104 projects)**

Fiscal Year	Project No.	Title	Principal Investigator	Organization	Federal	Non-Federal \$	Total Project Value \$
1998	WRI18	Evaluation of biocidal polymers	R. Turton	WVU	\$56,103	\$122,661	\$178,764
1998	WRI23	Agricultural wastes: data management	Brant		\$0	\$33,644	\$33,644
2000	WRI23 Ph2	Potomac Headwaters Sampling Project	Brant		\$50,307	\$0	\$50,307
2000	WRI24	TMDL enhanced decision making	Ziemkiewicz		\$101,015	\$0	\$101,015
2000	WRI33	Assessments of mountain top mining EIS review	Ziemkiewicz		\$0	\$15,000	\$15,000
2001	WRI36	Enhancing water research in WV: Organization and Capacity Building	Ziemkiewicz		\$274,928	\$308,418	\$583,346
2000-01	WRI37	Romania Jiu Valley	D. Weiner		\$89,479	\$32,647	\$122,126

## **Hydrology Research Institute (HRC)**

Established in 2002, the HRC is dedicated to improving the understanding and management of West Virginia's water resources. The Center's researchers are actively studying applied water problems in the state, conducting research that addresses acid mine drainage, flooding and discharge from abandoned mines, groundwater supply and protection, and other watershed management issues. The HRC assembles multi-disciplinary research teams from West Virginia University and other higher education institutions to investigate current hydrologic science issues that are of interest to industry, government, and the general public. Two proposals were developed in FY 02 but not funded during the FY02 fiscal year.

## **National Environmental Education & Training Center (NEETC)**

NEETC is a non-profit group that provides environmental training and develops new technologies to protect workers. The following is a listing of NEETC projects funded over fiscal years 98-02.

**Table 5. National Environmental Education & Training Center (NEETC) Funded Projects FY98 - FY02.**

Fiscal Year	Project No.	Title	Principal Investigator	State Institution	Federal \$	Non-federal \$	Total Project Value \$
1998	NE01	OCC Training of HazMat Workforce	Black		\$38,215		\$38,215
1999	NE02	WVU NEETC Center of Excellence FY99			\$45,175		\$45,175
1999	NE03	TexPert 99	Gopalakrishnan		\$324,062		\$324,062
2000	NE09	Deployment Support Leading to implementation	Reed		\$298,639	\$9,222	\$307,861
2000	NE10	TexPert 2000	Black		\$178,393		\$178,393
2000	NE11	WVU NEETC Center of Excellence FY00	Black		\$44,042		\$44,042
2000	NE11 AM	Amendment	Black		\$48,781		\$48,781
2000	NE12	SERDP Ship Scrapping	Black		\$85,605		\$85,605
2001	NE12 Ph2	SERDP Ship Scrapping Phase 2	Black		\$1,616,746		\$1,616,746
2001	NE13	Cascade General Proof of Concept	Hoffman		\$237,000		\$237,000
2002	NE14	Center of Excellence Work Plan 2002/03	Hoffman		\$565,337		\$565,337

The following is a summary of the program value of the West Virginia Water Research Institute between 1998 - 2002.

**West Virginia Water Research Institute Program Value By Year: 1998-2002**

	<b>National Mine Land Reclamation Center</b>	<b>Water Resources Research</b>	<b>Combustion Byproducts Recycling Consortium</b>	<b>National Environmental Education &amp; Training Center</b>	<b>USGS 104b</b>
<b>1998 Federal \$</b>	\$1,053,548	\$56,103	\$0	\$38,215	\$20,000
<b>1998 Non-Federal \$</b>	\$436,721	\$156,305	\$0	\$0	\$44,066
<b>1998 Total Program Value</b>	\$1,490,269	\$212,408	\$0	\$38,215	\$64,066
<b>1999 Federal \$</b>	\$1,005,869	\$0	\$66,127	\$369,237	\$68,175
<b>1999 Non-Federal \$</b>	\$380,059	\$0	\$20,970	\$0	\$152,976
<b>1999 Total Program Value</b>	\$1,385,928	\$0	\$87,097	\$369,237	\$221,151
<b>2000 Federal \$</b>	\$561,957	\$151,322	\$1,564,106	\$655,460	\$67,966
<b>2000 Non-Federal \$</b>	\$34,989	\$15,000	\$2,331,538	\$9,222	\$210,177
<b>2000 Total Program Value</b>	\$596,946	\$166,322	\$3,895,644	\$664,682	\$278,143
<b>2001 Federal \$</b>	\$872,122	\$364,407	\$779,634	\$1,853,746	\$74,571
<b>2001 Non-Federal \$</b>	\$406,735	\$341,065	\$344,079	\$0	\$211,668
<b>2001 Total Program Value</b>	\$1,278,857	\$705,472	\$1,123,713	\$1,853,746	\$286,239
<b>2002 Federal \$</b>	\$937,886	\$0	\$315,295	\$565,337	\$84,763
<b>2002 Non-Federal \$</b>	\$0	\$0	\$344,079	\$0	\$204,942
<b>2002 Total Program Value</b>	\$937,886	\$0	\$659,374	\$565,337	\$289,705

**West Virginia Water Research Institute Summary of Program Value: 1998-2002**

<b>Program</b>	<b>Federal \$</b>	<b>Non-Federal \$</b>	<b>Total Program Value</b>
<b>National Mine Land Reclamation Center</b>	\$4,431,382	\$1,258,504	\$5,689,886
<b>Water Resources Research</b>	\$571,832	\$512,370	\$1,084,202
<b>Combustion Byproducts Recycling Consortium</b>	\$2,725,162	\$3,040,666	\$5,765,828
<b>National Environmental Education &amp; Training Center</b>	\$3,481,995	\$9,222	\$3,491,217
<b>USGS 104b</b>	\$315,475	\$823,829	\$1,139,304
<b>Total</b>	<b>\$11,525,846</b>	<b>\$5,644,591</b>	<b>\$17,170,437</b>

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## **Information Transfer Activities**

### Technical Support, Training, and Outreach

#### *Director's Activities*

#### **FY 1998 (July 1, 1997 - June 30, 1998)**

- July 18, 1997: Attended poultry waste technical committee meeting, Moorefield, WV.
- July 22-24, 1997: Made 4 site visits for ACSI.
- August 7-8, 1997: Visited Pyrolusite demonstration sites, Clarion, PA and Kempton, MD
- August 22, 1997: Attended annual AML meeting, Athens, OH
- August 26, 1997: Gave USACE Dredging presentation, Pittsburgh, PA
- August 28, 1997: Visited Aquafix limestone demonstration, Cuzzart, WV
- Sept. 5, 1997: Met with WVDEP, USDOJ, EPA, Charleston, WV
- Sept. 11, 1997: Met with WVDEP, USDOJ, EPA, Charleston, WV
- Sept. 12, 1997: Attended AMD Conference, Pittsburgh, PA
- Sept. 15-16, 1997: Attended IMCC annual meeting, Lake Placid, NY
- Sept. 27-28, 1997: Attended NMA Mining Convention, Orlando, FL
- Oct. 20-22, 1997: Attended International Coal Ash Symposium, Lexington, KY
- Oct. 23-24, 1997: ACSI Technical Support Team Visit, Evansville, IN
- Nov. 18, 1997: Attended USEPA/USACE meeting re. Mine pools, Pittsburgh, PA
- Nov. 19, 1997: Attended EPA, WVDEP meetings, Berkeley Springs, Moorfield, WV
- Jan. 13-16, 1998: Attended WVMRA annual meeting, Charleston, WV
- Jan. 20-23, 1998: Attended Federal coal symposium/EMDFC, Washington, DC
- Feb. 5, 1998: Met with Kimberley Industries, Charleston, WV

Feb. 9-10, 1998: Meetings with congressional staff/NMA, IMCC, Washington, DC

Feb. 23-24, 1998: Met with Congressman Murtha's staff re. ADTI, Washington, DC

Mar. 16-17, 1998: Attended NIWR annual meeting, Washington, DC

Mar. 26, 1998: Slag bed construction, Patriot Mining, Osage WV

Mar. 30, 1998: Slag bed construction, Patriot Mining, Osage, WV

Mar. 30-31, 1998: NEETC Board of Directors Meeting, Alexandria, VA

April 1, 1998: Check slag bed, Patriot Mining, Osage, WV

April 9, 1998: Check construction at site #62, Hudson, WV

April 14, 1998: Met with Westvaco re. AMD treatment, Luke, MD

April 17, 1998: Potomac Headwaters Steering Committee, Moorefield, WV

April 20, 1998: Met with PA Congressional Staff, Connellsville, PA

April 21-22, 1998: ACSI Technical Support Team site visit, SE Ohio

April 23, 1998: Met with Congressman McDade, Washington, DC

April 24, 1998: Met with coal industry representatives regarding TMDL, Charleston, WV

May 1, 1998: Toured mines with Anker management, Coal Age reporter, Jere, WV

May 4, 1998: Inspected AMD site with CVI/citizen, Fayetteville, WV

May 5-7, 1998: USACE harbor dredging project, Loraine, New Philadelphia, OH

May 18-23, 1998: Made presentations at HSRC conference, Salt Lake City, UT

May 27-29, 1998: Attended TRB Symposium on Contaminated Sediments, Washington, DC

June 3, 1998: Technical support for WVDEP, Omega Mine

June 8-9, 1998: WVDEP Interagency Evaluation, Logan, Boone Counties

June 10, 1998: Pneumatic demonstration, Irish Ridge, WV

June 11, 1998: Pneumatic demonstration, Irish Ridge, WV  
June 23, 1998: OSM Coal Symposium, OMRA Meeting, Huntington, WV,  
Columbus, OH

**FY 1999 (July 1, 1998 - June 30, 1999)**

July 7, 1998: Met with Ron Hamric, Osage, WV  
July 14, 1998: Met with Kiena Smith re. WVU strategic alliance, Canaan Valley  
Institute, Canaan Valley, WV  
July 27, 1998: ACSI Technical Support Team site visit, Paxonis, PA  
July 30, 1998: Chinese Delegation, Preston County, WV  
Aug. 2, 1998: ACSI Technical Support site visit, Birmingham, AL  
Aug. 5, 1998: Visited Hiser/Manilla Watershed with OSM, Poca, WV  
Aug. 10, 1998: Project WV123, Lenore, WV  
Aug. 12-14, 1998: Attended ADTI meeting-Metal Mine Sector, Denver, CO  
Aug. 18-19, 1998: ACSI Technical Support site visit, Birmingham, AL  
Aug. 31-Sept. 1: ACSI Technical Support site visit, London, KY  
Sept. 9-12, 1998: AMD conference, Knoxville, TN  
Sept. 15-16, 1998: Resource Recovery Conference, Johnstown, PA (2 trips)  
Sept. 17, 1998: Met with WVDEP re. Valley Mining, Flatwoods, WV  
Sept. 21-23, 1998: Attended EPA EMPACT conference, Alexandria, VA  
Oct. 6, 1998: Gave presentation at Ohio Mineland Partnership, Lancaster, OH  
Oct. 13, 1998: Attended AMDTF meeting, Nutter Fort, WV  
Oct. 16, 1998: Visited Consol site; gave presentation at IUP for ADTI, W. Newton,  
Indiana, PA  
Oct. 28, 1998: Met with WVDEP/Coastal Corp., Nitro, WV  
Nov. 12, 1998: EMDFC at BLM, Springfield, VA

Nov. 18-19, 1998: Hizer/Manilla Ck. ACSI visit, Nitro, WV

Dec. 8, 1998: Met with OSMRE re. WV125f, Washington, DC

Dec. 9, 1998: Met with WVDEP/Coastal Corp., Albright, WV

Dec. 16, 1998: Project WV128 and WV160, Alton, WV

Dec. 18, 1998: Met with WVDEP/Coastal Corp., Albright, WV

Jan. 6, 1999: Met with WVDEP/Coastal Corp., Albright, WV

Jan. 13-15, 1999: Attended WVMRA annual meeting, Charleston, WV

Jan. 21-22, 1999: Met with KY AML Chief re. Rock Ck. Project, Frankfort, KY

Feb. 8, 1999: Met with WVDEP and Coastal Corp. Re. Remediation of AMD from the T&T mine.

Feb. 10, 1999: Presentation to northern WV Sierra Club regarding our work on mine pool flooding in the Pittsburgh Coal Basin.

Feb. 16, 1999: Met with federal agencies in Charleston to develop remediation plan for AMD in the Hizer/Manilla Watershed.

Feb. 22, 1999: Met with WVDEP and Coastal Corporation regarding remediation of AMD from the T&T mine.

Mar. 1-2, 1999: ACSI Technical Support site visit, Jackson County, OH

Mar. 4-5, 1999: ADTI WG3 meeting, Denver, CO

Mar. 8, 1999: Met with Lee Alman, Carol Wallace, Washington, DC

Mar. 10, 1999: Attended meeting for WV170, Johnstown, PA

Mar. 16, 1999: Gave presentation to Dunkard Creek Watershed Association regarding our work on mine pool flooding in the Pittsburgh Coal Basin, Blacksville, WV

Mar. 22-23, 1999: Attended OSM Technical Forum, Ft. Mitchell, KY

Mar. 24, 1999: ACSI Technical Support site visit, Evansville, IN

Mar. 25, 1999: Attended EMDFC meeting, Germantown, MD

Mar. 29, 1999: Attended Cheat River TMDL meeting, Kingwood, WV

Mar. 30, 1999: Attended WV170 planning meeting, Johnstown, PA

April 6, 1999: Presentation to Friends of the Cheat regarding progress on the Sovern Run and Big Bear Lake projects

Apr. 6-7, 1999: Attended ADTI Operations Committee meeting, Washington, DC

Apr. 10-14, 1999: Visited mine/CCB disposal sites with USEPA, EEI, Fulda, Cologne, Germany

April 14, 1999: Presentation to the WV Acid Mine Drainage Task Force on innovative watershed remediation techniques.

Apr. 27, 1999: Take USDOE staff to ETD05 field site, Preston County, WV

Apr. 30, 1999: ACSI Technical Support site visit, Georges Creek Basin, MD

May 10-11, 1999: Visit water treatment sites with WVDEP, Northern WV

May 12-13, 1999: ACSI Technical Support site visit, Grundy, VA

May 18, 1999: Met with WVDEP and Coastal Corporation regarding remediation of acid mine drainage from the T&T Mine, Preston County, WV

May 26, 1999: ACSI site visit to US Steel site, Pleasant Hills, PA

June 18, 1999: Met with WVDEP and Coastal Corporation regarding remediation of acid mine drainage from the T&T mine

June 19, 1999: Presentation to the Pennsylvania Watershed conference regarding innovative AMD treatment methods, State College, PA

June 22, 1999: ADTI Operations Committee Meeting with USACE, Washington, DC

June 29, 1999: Assist organization and tours for the WV Interagency Reclamation Tour

**FY 2000 (July 1, 1999 - June 30, 2001)**

July 8, 1999: WVADMTF meeting, Nutter Fort, WV

July 12, 1999: Presentation in State Capital press conference regarding findings of WVWRI poultry waste project

July 15, 1999: Meet with USACE re. ADTI, Washington, DC

July 22, 1999: EMDFC meeting at USGS, Reston, VA

July 26, 1999: Sample Aloe Coal Site, Imperial, PA

July 28, 1999: Field inspection of WVDEP Alton to develop remediation plans

July 30, 1999: Presentation in Moorefield, WV press conference re. findings of WVVRI poultry waste project

July 30, 1999: Potomac River Ceremony, Washington, DC

Aug. 16-18, 1999: ASSMR annual meeting, Phoenix, AZ

Aug. 26, 1999: Met with WVDEP and Coastal Corp. Regarding remediation of acid mine drainage from the T&T mine

Aug. 30-31, 1999: Visit TN ACSI sites with OSM/State staff, Knoxville, TN

Sept. 7, 1999: Met with WVDEP and Coastal Corp. Regarding remediation of AMD from T&T mine.

Sept. 8, 1999: Met with WVDEP in Oak Hill, WV to begin planning for remediation of the Royal Scott mine

Sept. 8, 1999: Technical support for WVDEP, Royal Scott project, Clarksburg, WV  
 Sept. 14, 1999: Royal Scott Mine Site visit with WVDEP

Sept. 14-17, 1999: ACSI watershed conference, Roanoke, VA

Sept. 24, 1999: Visit T&T site with Coastal Corp., Preston County, WV

Oct. 20, 1999: ADTI CMS steering committee meeting, Pittsburgh, PA

Oct. 21, 1999: Met with Cheat River Stakeholders to discuss TMDL implications

Oct. 25,27, 1999: Maryland Coal Symposium, Frostburg, MD

Oct. 26, 1999: Field sampling for WV125f project, Midland, MD

Nov. 4, 1999: Aquaculture project development, Bayard, WV

Nov. 12, 1999: Met with PADEP re. WV173, Pittsburgh, PA

Nov. 19, 1999: Met with WVDEP in Oak Hill, WV to begin planning for remediation

of the Royal Scott mine.

Dec. 5-7, 1999: Met with Transport Canada re. AMD treatment, Halifax, NS

Dec. 7-8, 1999: ADTI meeting with Corps of Engineers, Washington, DC

Dec. 9-10, 1999: ACSI design meeting Racoon/Monday Creeks, Athens, OH

Dec. 14, 1999: AMDTF meeting, Clarksburg, WV

Dec. 16, 1999: Conduct tour for Trout Unlimited Chapter of AMD remediation project at Big Bear Lake

Dec. 21, 1999: Assist WV Mining and Reclamation Association in developing policy regarding mountaintop mining and valley fill issues at AMDTF meeting, Clarksburg, WV

Jan. 6, 2000: Met with US Steel/Michigan Tech re. Slag project, Monroeville, PA

Jan. 11-14, 2000: Chair mountaintop mining/valley fill conference for USEPA MTR meeting/WVMRA annual meeting, Charleston, WV

Jan. 26, 2000: Met with USEPA region III staff to discuss improved process for TMDLs in Appalachia

Jan. 31 - Feb. 11: USAID/USDOE Coal Ash Meetings, New Delhi, India

Feb. 15, 2000: Meeting of AISI Science Board, Detroit, MI

Feb. 16, 2000: Met with USEAP staff and WV stakeholders regarding TMDL issues in West Virginia

Feb. 17-18, 2000: ACSI field visit to Little Racoon Ck. Sites, Athens, OH

March 7, 2000: Assist WV Public Television in developing program: West Virginia After Coal

March 9, 2000: Assist MDE with plans for North Branch cleanup, Kempton, MD

March 15, 2000: OSM/Chinese mining delegation tour, Monongalia, Preston Counties

March 22, 2000: Assist WV Mining and Reclamation Association in developing policy regarding mountaintop mining and valley fill issues.

March 27, 2000: Public meeting with the Hiser/Manilla Watershed Association

March 28, 2000: Presentation to the Allegheny Watershed Association regarding our project on flooding of underground mines in the Pittsburgh Coal Basin, Indiana, PA

March 30, 2000: ACSI field visit to Nixon Run portal, Saltwell, WV

April 14, 2000: Tour NMLRC sites with USDI staffer, Preston County, WV

April 17-18, 2000: ACSI field visit to S. Fk. Potoka R. Indiana, Evansville, IN

April 24, 2000: Hiser Manilla Project, Putnam Co., WV

April 27, 2000: Project WV 125f, Georges Creek Basin, MD

May 8, 2000: Site visit for N. Fk., Greens Run Project, Preston Co., WV

May 11, 2000: Present proposal WV182 to MDE, Frostburg, MD

May 12, 2000: WV 173 Presentation to OSM, USGS, Pittsburgh, PA

May 15, 2000: Sampling on Taywood site with WVDEP, Mingo County, WV

May 16, 2000: Visit with Congressman Mollohan's staff, Washington, DC

May 19-21, 2000: Met with Florida Power and Light, Jupiter, FL

May 21-26, 2000: ICARD meeting, Denver, CO

June 12, 2000: Met with USDOE re. WV180, Washington, DC

June 13, 2000: ACSI field visit to Captina Ck. Project, Powhattan, OH

June 23, 2000: ACSI field visit to Dunkard project area, Bobtown, PA

June 26, 2000: Presentation on TMDLs, Kingwood, WV

**FY 2001 (July 1, 2000 - June 30, 2001)**

July 5, 2000: Tioga River AMD evaluation, Morris Run, PA

July 19, 2000: Sampling on Taywood site, Mingo Co., WV

August 15, 2000: Cheat River TMDL meeting, Rowlesburg, WV

Aug. 21-22, 2000: AL ACSI Hurricane Creek project, Birmingham, AL

Aug. 28, 2000: Conduct tour for PA Senator Wozniak, Monngalia, Marion Cos., WV

Aug. 29, 2000: WVMRA/WVCA technical committee meeting, Charleston, WV

Aug. 31, 2000: EMCFC meeting, Leetown, WV

Sept. 9-15, 2000: Attend USEPA/USDOE Symposium, Prague, Czech Republic

Oct. 2-3, 2000: Gave presentation to Ohio Mineland Partnerhip, Coshocton, OH

Oct. 15-16, 2000: Attended NRC Committee on Earth's Resources, Washington, DC

Nov. 1-3, 2000: Attended CBRC Annual Meeting, Denver, CO

Nov. 13-17, 2000: Attended USACE AML workshop, St. Louis, MO

Nov. 20, 2000: Met with PADEP re. Monongahela Basin mine pool flooding project, Harrisburg, PA

Nov. 27, 2000: Met with Kiena Smith at CVI re. WRI35, Thomas, WV

Dec. 4-6, 2000: Gave ACSI short course, visited sites in IN, OH, ISMR, Jasper, IN, New Lexington, OH

Dec. 12, 2000: AMDTF meeting, Nutter Fort, WV

Dec. 14, 2000: Attended WRI annual meeting, Flatwoods, WV

Jan.5, 2001: ACSI field visit to Jobs, Big 4 projects, New Straitsville, OH

Feb. 15-16, 2001: Attended WV Coal Association Symposium, Charleston, WV

Feb. 22, 2001: USEPA Longwall mining meeting, Pittsburgh, PA

Feb. 27, 2001: Paint Creek TMDL, Kanawa County, WV

Mar. 12-13, 2001: Met with congressional staff, EPA Region III, Washington, DC, Philadelphia, PA

Mar. 19-20, 2001: Visited AT Massey, Arch Coal, Paint Creek Association, Boone County, WV

Mar. 26-27, 2001: Visited ACSI Rock Creek project, London, KY

Apr. 23, 2001: Met with County Commission re. WV187, Kingwood, WV

May 1-4, 2001: Visited CCB minefills with USEPA, Edmonton, AB

May 29-31, 2001: Visited ACSI Barney, Cane Creek, Hurricane Creek, Birmingham, AL

June 11-12, 2001: Visited with WVDEP, Arch Coal, Samples Mine, Charleston, WV

June 27, 2001: MRAM meeting with USEPA, Arlington, VA

June 29, 2001: NEETC Board of Directors Meeting, Rocky Gap, MD

**FY 2002 (July 1, 2001 - June 30, 2002)**

July 17-18, 2001: ADTI Operations Committee Meeting, Washington, DC

July 19, 2001: Site visit with USDOE/WVDEP for WV191, Preston County, WV

July 28 - Aug. 2: ICOBTE Conference, Guelph, ON, Canada

Aug. 8, 2001: Monongahela Mine Pool project research committee meeting, Washington, PA

Aug. 21-22, 2001: Gave short course at annual NAAML P meeting, Athens, OH

Aug. 31, 2001: Site visit for WV172, Preston County, WV

Sept. 5, 2001: ACSI field visit to Elk Lick Creek MD03, Kitzmiller, MD

Oct. 4, 2001: Review Yellow Creek remediation with ODN R, USACE, New Philadelphia, OH

Oct. 9, 2001: Meeting of ACWR, Flatwoods, WV

Oct. 11, 2001: EMDF meeting at NPS, Harper's Ferry, WV

Oct. 15-19, 2001: Attended USACE AML workshop, Fairmont Hot Springs, MT

Oct. 24, 2001: Met with NTPC at DOE-NETL, Pittsburgh, PA

Oct. 24-25, 2001 Attended CBRC Annual Meeting, Lexington, KY

Nov. 14, 2001: Showed WV172 Green's Run site to WVDEP/USEPA, Preston Co., WV

Nov. 15, 2001: Provided expert testimony for WVDEP vs. T&T, Elkins, WV

Dec. 12, 2001: Met with County Commission re. WV187, Kingwood, WV

Dec. 17, 2001: Met with County Commission re. WV187, Kingwood, WV

Jan. 9-11, 2002: WV08, MU/EPA EPSCoR, WVDEP/OWR-WRI, Delbarton, Huntington, Charleston, WV

Jan. 28-29, 2002: WV187, WV08, EPSCoR Conference, Nitro, Delbarton, Charleston, WV

Feb. 6-7, 2002: Visited mines; met with ODNR, and CBRC meeting, SE Ohio to Columbus, OH

Feb. 12, 2002: AMDTF meeting, Clarksburg, WV

Feb. 15, 2002: Met with DOE-NETL re. CBRC, Pittsburgh, PA

Feb. 17-19, 2002: USEPA/Mountain top mining tour, southern WV

Feb. 27-28, 2002: ACSP project VA02 site visit, Wise, VA

March 1, 2002: Met with USEPA/USACE re. Mon River, Wheeling, WV

Mar. 3-5, 2002: Attended NIWR meeting; made congressional visits, Washington, DC

Mar. 6, 2002: Met with USACE/PADEP re. Mon River, Greensburg, PA

Mar. 11, 2002: NEETC meeting, Indiana, PA

Mar. 13-14, 2002: Project WV180 meeting with USDOE, Washington, DC

Mar. 15, 2002: Check construction at ACSP WV05, Saltwell, WV

Mar. 20, 2002: Met with USACE/WVDEP re. Mon River, Nitro, WV

Mar. 22, 2002: Briefed PADEP re. WV 173: Monongahela Basin Mine Pool Project, Greensburg, PA

Apr. 24, 2002: Made site selection for WCAs, Kingwood, WV

Apr. 25-28, 2002: Represented ADTI at INAP meetings, Vancouver, BC

May 1, 2002: Made site evaluation, ACSP/MD DNR, Crellin, WV

May 2, 2002: EMDFC meeting at USEPA, Wheeling, WV

May 7-8, 2002: USFS National CERCLE meeting, Athens, Ohio

May 17, 2002: WRI Advisory Committee Meeting, Flatwoods, WV

May 20-22, 2002: Made presentation of WV173 Monongahela Basin mine pool project to EPA/States meeting, Williamsburg, VA

May 24, 2002: Arch Coal presentation, Eksdale, WV

June 6, 2002: Met with MU EPSCoR staff, Huntington, WV

June 7, 2002: Made site evaluation for WV191, Preston, CO, WV

June 10-13, 2002: WV195: Monday Creek feasibility study, Athens, OH

June 17, 2002: WV172: Green's Run kickoff meeting, Kingwood, WV

## Information transfer activities

### Publications resulting from WVVRI projects during fiscal years 98-02

#### *Technical*

The following is a listing of technical publications, articles, conference papers, and proceedings written as a result of project funded through the West Virginia Water Research Institute between FY98 - FY02.

#### *Technical*

The following is a listing of technical publications, articles, conference papers, and proceedings written as a result of project funded through the West Virginia Water Research Institute between FY98 - FY02.

Adams, Joby, et al. "Varra Coal Ash Burial Project." Final Report for CBRC Project No. 00CBRCW02. CGRS, Inc.

Avery, W.H. and J.J. Donovan. 1999. Recharge Estimation By Stage-Discharge Interpolation Of Springflows From Cross-Correlated Well Measurements. *Ground Water* 36(3).

Baltrus, J.P. and R.B. LaCount. 2001. Measurement Of Adsorption Of Air-Entraining Admixture On Fly Ash In Concrete And Cement. *Concrete and Cement Research* 31(5): P. 819-824.

Baltrus, J.P., R.B. LaCount, and D.G. Kern. 2001. Relationships Between Foam Index, AEA Adsorption And Unburned Carbon Content Of Coal-Combustion Fly Ash. *ACS Division Fuel Chemistry Preprints* 46(1): P. 304-305.

Baltrus, J.P., R.B. LaCount, and D.G. Kern. 2001. The Role Of Unburned Carbon In AEA Adsorption As Measured By Foam Index And UV-Vis Methods. Proceedings: USDOE/NETL Conference on Unburned Carbon on Utility Fly Ash, May 15, P. 25-26, Pittsburgh, Pennsylvania.

Berland, Tera D., et al. "Development Of A Database Of CCB Publications". Final Report for CBRC Project No. 01CBRCW1. University of North Dakota.

Black, D.C., P.F. Ziemkiewicz, and J.G. Skousen. 1999. Construction Of A Limestone Leach Bed And Preliminary Water Quality Results In Beaver Creek. In: Proceedings, Twentieth West Virginia Surface Mine Drainage Task Force Symposium, April 13-14, Morgantown, West Virginia.

Black, D.C. and P.F. Ziemkiewicz. 1998. Consortium for Research and Development in Coal Combustion By-Product Utilization. In: *Advanced Coal-Based*

Power and Environmental Systems 98 Conference, U.S. Department of Energy, Federal Energy Technology Center, July 21-23, Paper 2B.1.

Black, D.C. and P.F. Ziemkiewicz. 1998. Full Scale Injection of Coal Combustion By-Products into an Underground Mine to Control Acid Mine Drainage and Subsidence. In: Advanced Coal-Based Power and Environmental Systems 98 Conference, U.S. Department of Energy, Federal Energy Technology Center, July 21-23, Paper 2B.2.

Brant, David, et al. ACSI Refuse Piles. Final Report for ACSI Project No. WV125c. U.S. Department of Interior/Office of Surface Mining.

Brendel, Gary, et al. Effects of Ammonia Absorption on Fly Ash Due to Installation of SCR Technology. Final Report for CBRC Project No. 99ECE06. GAI Consultants, Inc.

Broschart, David, et al. Proposal for Hydrogeologic Evaluation of Strata Above the North Lobe of the Omega Mine. Final Report for CBRC Project No. 99ECE17. WVDEP.

Butalia, T.S., W. E. Wolfe, and H. Walker. 2001. Long-Term Monitoring of an FGD-Lined Pond Facility. In: 2001 International Ash Utilization Symposium, October 22-24, Lexington, Kentucky.

Butalia, T.S. 2000. Use of Stabilized FGD Material for Liners and Encapsulations. In: Educational Program for Managers of Coal Combustion Products, American Coal Ash Association, June 4-9, Morgantown, West Virginia.

Butalia, T.S. and W. E. Wolfe. 2000. Performance Assessment of a Flue Gas Desulfurization Material at a Lined Pond Facility. In: Proceedings of The Use and Disposal of Coal Combustion By-Products at Coal Mines: A Technical Interactive Forum, April 11-12, Published by United States Department of Interior, Office of Surface Mining, Morgantown, West Virginia.

Butalia, T.S. and W.E. Wolfe. 1999. Evaluation Of Permeability Characteristics Of FGD Materials. FUEL Journal, Vol. 78, P. 149-152.

Butalia, T.S. 1998. Use of CCPs as Liners and Feedlots. In: Educational Program or Managers of Coal Combustion Products, American Coal Ash Association, June 8-11, Morgantown, West Virginia.

Butalia, T.S., S. Mafi, and W.E. Wolfe. 1998. Design And Construction Of Full-Scale Demonstration Lagoon Using Coal Combustion By-Products. The Journal of Solid Waste Technology and Management, Vol. 25 (3&4): P. 189-192.

Butalia, T.S., S. Mafi, W. E. Wolfe. 1997. Design of Full Scale Lagoon Using Clean Coal Technology By-Products. In: Thirteenth International Conference on Solid Waste Technology and Management, November 16-19, Philadelphia, Pennsylvania.

Butalia, T.S. and W.E. Wolfe. 1997. Re-Use of Clean Coal Technology By-Products in the Construction of Impervious Liners. In: International Ash Utilization Symposium, October 22-22, Lexington, Kentucky.

Butz, James R., et al. Pilot Testing of Fly Ash-Derived Sorbents for Mercury Control in Coal-Fired Flue Gas. Final Report for CBRC Project No. 00CBRCW04. ADA Technologies, Inc.

Carlson, James R., et al. Evaluation of Fly Ash Admixtures for Final Cover and Composite Liner Applications. Final Report for CBRC Project No. 00CBRCW10. Sunflower Electric Power Corp.

Cockley, Kent. 2001. Rostraver Airport Safety Expansion Project. In: 14<sup>th</sup> International Symposium on Management & Use of Coal Combustion Products, San Antonio, Texas, January, 2001.

Coleman, J., K. Hench, K. Garbutt, A. Sexstone, G. Bissonnette, and J. Skousen. 2001. Treatment of Domestic Wastewater by Three Plant Species in Constructed Wetlands. *Water, Air, Soil Pollution* 128: P. 283-295.

Crouch, L.K., et al. Long Term Excavatability of Flowable Fill Containing Coal Combustion Byproducts. Final Report for CBRC Project No. 00CBRCM05. Tennessee Technical University.

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Das, K.C., et al. "Odor and HAP Control in Waste Treatment Processes Using Coal Combustion Ash." Final Report for CBRC Project No. 99ECE13. University of Georgia.

Dick, Warren A., et al. Flue Gas Desulfurization Byproducts Provide Sulfur and Trace Mineral Nutrition for Alfalfa and Soybean. Final Report for CBRC Project No. 99ECE08. Ohio State University.

Dick, W.A., Y. Hao, R.C. Stehouwer, J.M. Bigam, W.E. Wolfe, D. Adriano, J.H. Beeghly, and R.J. Haefner. 2000. Beneficial Uses of Flue Gas Desulfurization By-Products: Examples and Case Studies of Land Application. In: Land Application of Agricultural, Industrial, and Municipal By-Products, Soil Science Society of America Book Series No. 6, Chapter 18, P. 505-536, Madison, Wisconsin.

Dick, W., J. Bigam, L. Forster, F. Hitzhusen, E. McCoy, R. Stehouwer, S. Traina, W. Wolfe, R. Haefner, G. Rowe, and J. Beeghly. 1998. Land Application Uses for Dry Flue Gas Desulfurization By-Products, Phase 3. Electric Power Research Institute, Report TR-112916 (variously paginated), Palo Alto, California.

Donovan, J.J., J. Frazier, M. Daly, E. Werner, P.F. Ziemkiewicz, and D.C. Black.

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Donovan, J.J. and K.W. Frysinger. 1997. Delineation of Preferred-Flow Paths by Response to Transient Lagoon Leakage. Ground Water 35: P. 990-996.

Donovan, J.J., K.W. Frysjer, and T.P. Maher. 1997. Geochemical Response of Acid Groundwater to Neutralization by Alkaline Recharge. *Aquatic Geochemistry* 2: P. 227-253.

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LaCount, R.B., J.P. Baltrus, T.L. Banfield, J.R. Diehl, E.A. Frommell, K.A. Giles, G.A. Iradi, D.G. Kern, T.A. Leyda, D.V. Martello, and J.P. Tamilia. 2001. Treatment of High Carbon Fly Ash to Produce a Low Foam Index Product with Carbon Content Retained. In: Proceedings: 14<sup>th</sup> International Symposium on Management and Use of Coal Combustion Products (CCP's), January 22-5, San Antonio, Texas, Volume I, EPRI, Palo Alto, California, 2001.1001158, P. 15-1 to 15-13.

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McDonald, L., J. Skousen, J. Selfridge, and P. Ziemkiewicz. 2002. Effects of Chemical and Sulfate on Floc Characteristics for Treating Acid Mine Drainage. In: Proceedings, West Virginia Surface Mine Drainage Task Force, April 16-17, 2002, Morgantown, West Virginia. P. 77.

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Donovan, J.J., J. Frazier, M. Daly, E. Werner, P.F. Ziemkiewicz, and D.C. Black. 2000. Experimental Injection of Alkaline Lime Slurry for In Situ Remediation of an Acidic Surface Mine Aquifer. ICARD 2000, May 21-24, 2000, Denver, Colorado.

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Ziemkiewicz, P.F. and D.C. Black. 2000. Disposal and Use of Coal Combustion Products in Mined Environments. ICARD 2000, May 21-24, 2000, Denver, Colorado.

### *Other Publications*

Ziemkiewicz, P.F and J.G. Skousen. 1998. The Use of Steel Slag for Acid Mine Drainage Treatment. Green Lands, Winter 1998. P. 46-56.

### *Newspaper Articles*

The following is a list of newspaper articles that mention the West Virginia Water Research Institute, its programs, projects, researchers, and/or Director Paul Ziemkiewicz.

Coal Age magazine, August 1998, "Anker Energy Battles AMD in West Virginia." P. 90-93.

The Dominion Post, November 7, 2000, "A problem that couldn't be solved. Miner's son fought AMD for 12 years."

Greene County Observer-Reporter, April 19, 2001, "Researchers studying underground mine flooding."

Exponent Telegram, March 24, 2002, "Officials look to clean West Vork, prevent future damage."

The Daily Athenaeum, May 4, 1998, "Friends of Cheat work to restore river's health."

Pittsburgh Post Gazette, Friday, May 17, 2002, "National Experts to Study Region's Sewer Problems"

The Dominion Post., May 21, 2002, "National Water Study Taps WVU Director"

The Daily Athenaeum, May 22, 2002, "WVU Research Director Appointed to Evaluate Pittsburgh's Water Supply."

Charleston Gazette, May 28, 2002, "Arch Coal establishes fellowship at WVU."

The Daily Athenaeum, June 12, 2002, "WVU Studies Effects of Acid Mine Runoff on Groundwater"

U.S. Water News, June, 2002, "West Virginia University Scientists to Study How Clean a Stream Should Be"

Spirit, May 30, 2002, "Director of WRI to Study Pittsburgh Water Quality"

The Dominion Post, June 19, 2002, "Groups Hope AMD Treatment Will Work"

Spirit, June 27, 2002, "NMLRC Breaks Ground for New Treatment System"

Spirit, June 27, 2002, "Researchers Study Effects of Using Coal Combustion Byproducts on Groundwater"

Pittsburgh Post Gazette, September 1, 2002, "Defunct mines are flooding—and the fouled water isn't staying buried."

Pittsburgh Post Gazette, February 10, 2003, "Costly Legacy: A Crisis Looms as more flooded mines begin discharging acid water into the Mon."

## WVU/WRI Funding Provided to WVU Faculty:

<u>Faculty Member</u>	<u>Department</u>
Ahluwalia, Rashpal	Industrial and Management Systems Engineering
Ameri, Sam	Petroleum Engineering
Aminian, Kashy	Petroleum Engineering
Banta, Larry	Mechanical and Aerospace Engineering
Becker, Paul	Extension
Bissonnette, Gary	Plant & Soil Science
Cho, Eung Ha	Chemical Engineering
Clark, Nigel	Mechanical and Aerospace Engineering
Cumming, Jonathan	Biology
Donovan, Joe	Geology and Geography
Fletcher, Gerald	Natural Resource Analysis Center
Fuller, Jack	Marketing Management
Golpalkrishnan, B.	Industrial and Management Systems Engineering
Gray, Donald	Civil & Environmental Engineering
Harris, Trevor	Geology and Geography
Hessl, Amy	Geology and Geography
Keith Garbutt	Biology
Khair, Wahab	Mining Engineering
Kuhlman, John	Mechanical and Aerospace Engineering
Manivannan, Ayyakkannu	Physics
Martinelli, David	Civil & Environmental Engineering
McConnell, Joyce	Law
McDonald, Louis	Plant & Soil Science
McGraw, Jim	Biology
Miller, Dan	Animal Science
Miller, Patricia	Extension
Mohaghegh, Shahab	Petroleum Engineering
Myers, Warren	Industrial and Management Systems Engineering
Nutter, Roy	Computer Science and Electrical Engineering
Peng, Felicia	Mining Engineering
Peng, Syd	Mining Engineering
Peterjohn, William	Biology
Petty, Todd	Forestry
Phipps, Tim	Resource Management
Rauch, Henry	Geology and Geography
Renton, Jack	Geology and Geography
Rosenberger, Randy	Resource Management
Seehra, Mohindar	Physics
Semmens, Ken	Agriculture & Natural Resource Development
Sencindiver, John	Plant & Soil Science
Sexstone, Alan	Plant & Soil Science
Siriwardane, H.	Civil & Environmental Engineering

Skousen, Jeff	Plant & Soil Science
Smart, Ron	Chemistry
Smart, Ronald	Chemistry
Stiller, Alfred	Chemical Engineering
Van Scoy, Frances	Computer Science and Electrical Engineering
Vesper, Dorothy	Geology and Geography
Viadero, Roger	Civil & Environmental Engineering
Winn, Gary	Industrial and Management Systems Engineering
Yuill, Charles	Resource Management