

PROCEEDINGS

Thirteenth Annual Meeting

American Society for Surface Mining and Reclamation

SUCCESSSES AND FAILURES: APPLYING RESEARCH RESULTS TO INSURE RECLAMATION SUCCESS

May 18 - 23, 1996 - Knoxville, Tennessee



Published by ASSMR and the Powell River Project of Virginia Tech

PROCEEDINGS

Thirteenth Annual Meeting

American Society for Surface Mining and Reclamation

SUCSESSES AND FAILURES: APPLYING RESEARCH RESULTS TO INSURE RECLAMATION SUCCESS

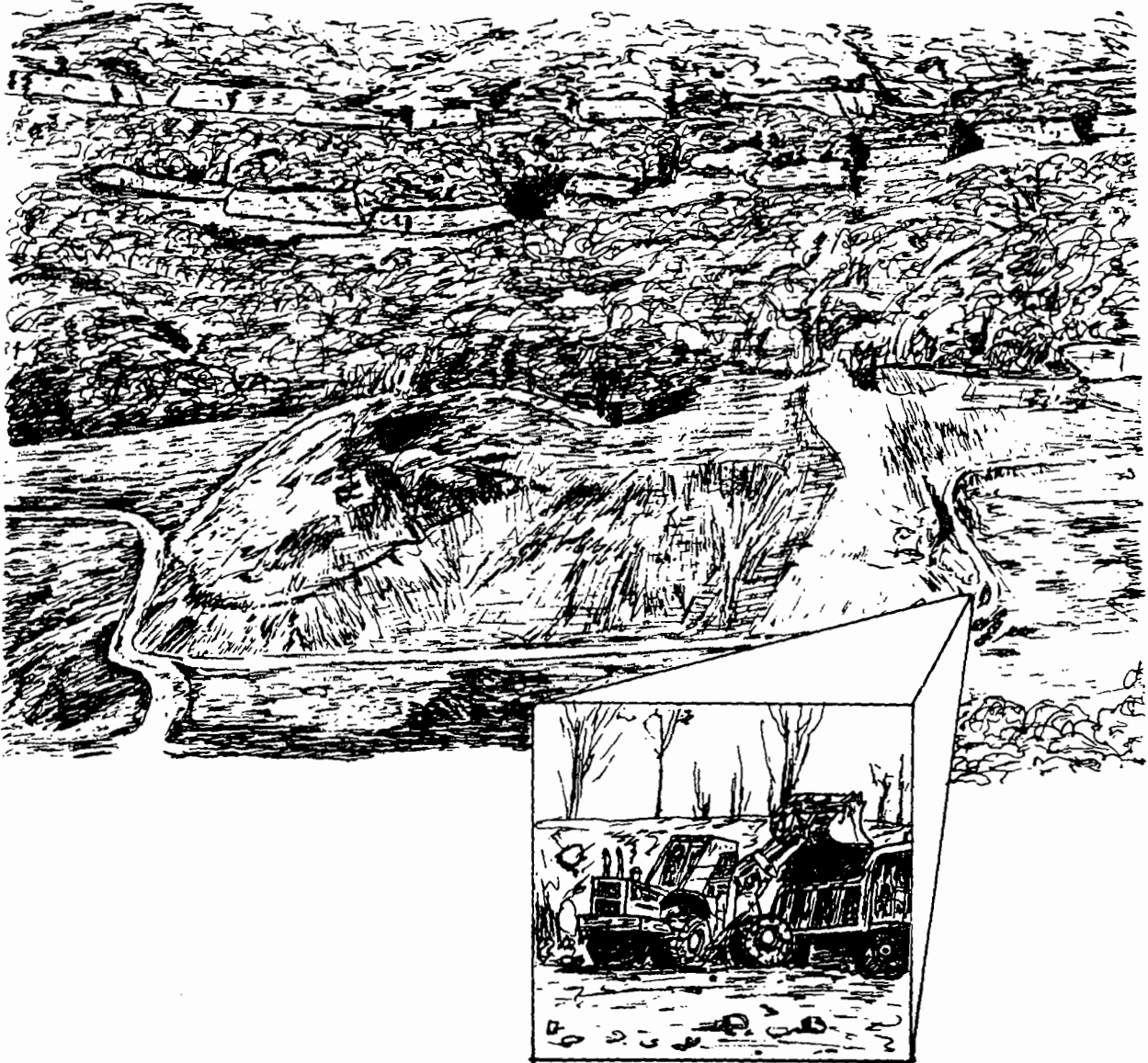
May 18 - 23, 1996 - Knoxville, Tennessee

Co-Editors:

W. Lee Daniels, James A. Burger, and Carl E. Zipper
*Departments of Crop and Soil Environmental Sciences and Forestry
Virginia Tech, Blacksburg, Virginia, USA, 24061*

Coordinators:

Sue Brown and Julia Burger
*Department of Crop and Soil Environmental Sciences
Virginia Tech*



Coal surface mining in Southwest Virginia. Original drawing by J. Michael Schmidt.

This volume contains presentation papers and abstracts from the 1996 Annual Meeting of the American Society for Surface Mining and Reclamation (ASSMR) held May 18 - 23, 1996, in Knoxville. Paper presentation here does not preclude authors from pursuing publication in other outlets. These Proceedings should be cited as:

Daniels, W.L., Burger, J.A. and C.E. Zipper (Eds.). 1996. Proceedings, 1996 Annual Meeting of the American Society for Surface Mining and Reclamation, Knoxville, TN, May 18 - 23, 1996. Virginia Tech Research Division, Powell River Project, Blacksburg, VA, USA.

Sponsors of the 13th Annual National Meeting of ASSMR

We appreciate the generous support of the following sponsors:

The Tennessee Valley Authority

**Virginia Polytechnic Institute and State University
Powell River Project
Dept. Of Crop and Soil Environmental Sciences**

USDI - Office of Surface Mining

1996 Annual Meeting Program Committee

Local Arrangements

Cindy Britt
Knoxville, TN
423/693-8763

Program Chair

W. Lee Daniels
Virginia Tech
540/231-7175

Workshops/Field Trips

Joe Galetovic
USDI-OSMRE, Denver
303/672-5554

Technical Session and Proceedings

Jim Burger
Virginia Tech
540/231-7680

Carl Zipper
Virginia Tech
540/231-5741

Registration and Coordination

Sue Brown
CSES Dept., Virginia Tech
Blacksburg, VA 24061-0404
540/231-5741; fax: -7630

ASSMR Executive Secretary

William T. Plass
ASSMR
21 Grandview Dr.
Princeton, WV 24740
304/425-8332



TABLE OF CONTENTS

PAPER PRESENTATIONS:

Page No.

SESSION 1: CONTAINMENT AND MITIGATION OF TOXIC MINE WASTE

1

Oxygen Transport and Pyrite Oxidation in Unsaturated Coal-Mine Spoil.

Weixing Guo, Charles A. Cravotta III 3

Pumped Co-Disposal of Black Coal Washery Wastes in Australia.

David J. Williams 15

Site Characterization and Containment/Remediation of Acid Mine Drainage at an Abandoned Mine Waste Dump.

Fred Djahanguiri, James Snodgrass, John Koerth 23

SESSION 2: MINE HYDROLOGY

40

Shallow Ground Water Flow in Unmined Regions of the Northern Appalachian Plateau:

Part 1. Physical Characteristics.

Jay W. Hawkins, Keith B.C. Brady, Scott Barnes, Arthur W. Rose 42

Shallow Groundwater Flow in Unmined Regions of the Northern Appalachian Plateau:

Part 2. Geochemical Characteristics.

Keith B.C. Brady, Arthur W. Rose, Jay W. Hawkins, Michael Dimatteo 52

Mine Seepage Problems in Drift Mine Operations.

Clyde DeRossett, David E. Johnson, David B. Bradshaw 63

Effects of Spoil Groundwater on Water-Quality in a Receiving Lake.

Douglas C. Turney, Kenneth B. Edwards, Walter E. Grube, Jr. 72

Ground- and Surface-Water Interactions Involving an Abandoned Underground Coal Mine in Pike County, Indiana.

Denver Harper, Greg A. Olyphant, Donald R. Sjogren 87

Modeling the Effects of Longwall Mining on the Ground Water System.

R.J. Matetic, J. Liu, D. Elsworth 96

Groundwater Conditions Around a Coal-Combustion Residue Site in Southern Illinois.

Steven Esling, Merryn Fielding, Bradley Paul 115

SESSION 3: MINE SUBSIDENCE AND DAMAGE MITIGATION

132

Use of Analog Ground Medium of Taylor-Schneebeili Type for Modelling of Multiparametric Deformations Arising in Mining-Influenced Areas.

Kazimierz Klosek 134

<i>Releveling and Behavior of Strap Retrofitted Damaged Test Foundations Exposed to Mine Subsidence.</i> Gennaro G. Marino	146
<i>Consideration of Subsidence in Land Use Planning Policies and Procedures in England.</i> David Brook	163
<i>Repair of the Czar Shaft Sinkhole.</i> J. David Deatherage, Jack Starkey, Nils Gustavson	175
<i>Monitoring of a House During Mining Subsidence.</i> G. Lin, E.C. Drumm, R.M. Bennett, L. Powell	184
<i>Using GIS and Numerical Modeling to Assess Subsidence Over Abandoned Mines.</i> Kevin M. O'Connor, John A. Siekmeier, Jan Stache	204
<i>Mine Design: The Long Term Effects of High Extraction Mining.</i> Paul W. Jeran	217
<i>Error Correction for Vertical Surveys Conducted Over a Subsiding Longwall Mining Panel.</i> D. Allen Hughes	234
<i>A History of Metal Shaft/Portal Closures in Utah.</i> Louis A. Amodt	242
<u>SESSION 4: MINE-SLOPE STABILITY</u>	254
<i>Application and Analysis of Anchored Geosynthetic Systems for Stabilization of Abandoned Mine Land Slopes.</i> Stanley J. Vitton, M. Frank Whitman, Wendell Harris, Robert Y. Liang	256
<i>Maximum Safe Slope Angles for Proposed Shiplock Slopes of Three Gorges Dam Site Based on Kinematic Analyses Performed on Major Discontinuities.</i> Jeong-gi Um, Pinnaduwa H.S.W. Kulatilake, Jianping Chen, Jianren Teng	267
<i>Application of Soil Nails to the Stability of Mine Waste Slopes.</i> Clyde R. Tant, Eric C. Drumm, Matthew Mauldon, Richard M. Berry	282
<u>SESSION 5: ACID MINE DRAINAGE REMEDIATION</u>	294
<i>Hydrologic Investigation and Remediation of a Post-Remining Acidic Seep.</i> William W. Aljoe, Nile A. Linberg	296
<i>Water Quality Improvements Resulting from FBC Ash Grouting of Buried Piles of Pyritic Materials on a Surface Coal Mine.</i> Joseph Schueck, Mike Dimatteo, Barry Scheetz, Mike Silsbee	308
<i>Remediation of Acid Mine Drainage within Strip Mine Spoil by Sulfate Reduction Using Waste Organic Matter.</i> Arthur W. Rose, Jeralee Stalker, Louise H. Michaud	321

<i>Improving Groundwater Quality in the Backfill with Alkaline Additions.</i> V. Patrick Wiram, Hans E. Naumann	336
<i>The Use of Sediment Sampling to Evaluate the Success of Hydrologic Reclamation.</i> Robert G. Liddle	355
<u>SESSION 6: ACID MINE DRAINAGE PASSIVE TREATMENT - DRAINS</u>	365
<i>Acid Mine Drainage Treatment with Open Limestone Channels.</i> Paul F. Ziemkiewicz, David L. Brant, Jeffrey G. Skousen	367
<i>An Apatite Drain: New Method for Iron and Aluminum Removal from Highly Contaminated Acid Mine Drainage.</i> Jung-Chan Choi, Terry R. West	375
<i>Assessment of the Applicability of an Anoxic Limestone Drain for a Surface Mine in East Central Tennessee.</i> Terry W. Schmidt, Robert S. Hedin, P.R. Lorello	384
<u>SESSION 7: SOILS AND OVERBURDEN</u>	391
<i>Constructing Vegetation Productivity Equations by Employing Undisturbed Soils Data: An Oliver County, North Dakota Case Study.</i> Jon Bryan Burley, Kenneth J. Polakowski, Gary Fowler	393
<i>Productivity of Prime and Nonprime Topsoil Reclaimed in Equivalent Topographic Positions.</i> Gary A. Halvorson, M.V. Nathan	402
<i>A Methodology for Evaluating the Costs of Selective Handling of Overburden Materials.</i> T. Phipps, J. Skousen, J. Fletcher	407
<i>Selenite-Selenate Speciation in Mine Soils and Salt Solutions: A Comparison of Atomic Absorption Spectroscopy and Ion Chromatography.</i> Shankar Sharmasarkar, George F. Vance, Florence Cassel-Sharmasarkar	424
<i>Compaction Effects on Mineland Soil Quality.</i> Padam P. Sharma, Fredric S. Carter	430
<i>Availability of P and K in Restored Prime Farmland.</i> O. Semalulu, R.I. Barnhisel	442
<u>SESSION 8: REVEGETATION ECOLOGY</u>	451
<i>The Potential for Using Wildflower Species to Increase Natural Habitat in Contour Surface Mine Reclamations.</i> John R. Heckman, Karen D. Holl, Mara Sabre, Robert B. Atkinson, John Cairns, Jr.	453

<i>Predicting Grass Stand Adequacy from Early Stand Parameters.</i> R.E. Ries	462
<i>Vegetation Diversity within Native and Reclaimed Coal Mine Sites: Environmental Factors and Seasonal Variability.</i> Brenda K. Schladweiler, George F. Vance	472
<i>Natural and Planted Flora of the Log Mountain Surface-Mined Demonstration Area, Bell County, Kentucky.</i> Ralph L. Thompson, Gary L. Wade, R. Allen Straw	484
<i>The Relative Merits of Dolomitic and Calcitic Limestone in Detoxifying and Revegetating Acidic, Nickel- and Copper-Contaminated Soils in the Sudbury Mining and Smelting Region of Canada.</i> Derek McHale, Keith Winterhalder	504
<i>Ontogeny of Accidental Wetlands and Hydric Soil Development in Surface Mined Landscapes.</i> Robert B. Atkinson, W. Lee Daniels, John Cairns, Jr.	516
 <u>SESSION 9: CONSTRUCTED WETLANDS</u>	529
<i>Acidic Mine Drainage Abatement in an Anaerobic Sub-Surface Flow Wetland Environment - Case History of the Treatment System at Corsica, PA.</i> Jonathan M. Dietz, Dennis M. Stidinger	531
<i>Chemical Characterization of Iron Oxide Precipitates from Wetlands Constructed to Treat Polluted Mine Drainage.</i> Caryl L. Fish, Robert S. Hedin, Jonna Partezana	541
<i>The Bark Camp Run Demonstration Constructed Wetlands: Findings and Recommendations for Future Design Criteria.</i> William W. Hellier	550
<i>Manganese and Trace Metal Removal in Successive Anaerobic and Aerobic Wetlands.</i> F.J. Sikora, L.L. Behrends, G.A. Brodie, M.J. Bulls	560
<i>The Use of Overland Flow Wetland Treatment Systems to Remove Nickel from Neutral Mine Drainage.</i> Paul Eger, Jon Wagner, Glenn Melchert	580
<i>Treatment of Metal Contaminated Groundwater in Passive Systems: A Demonstration Study.</i> R. F. Mueller, D.E. Sinkbeil, J. Pantano, W. Drury, F. Diebold, W. Chatham, J. Jonas, D. Pawluk, J. Figueira	590
 <u>SESSION 10: MINED LAND REFORESTATION</u>	599
<i>The Use of Leguminous Trees in Reclamation of Tropical Mined Soils.</i> Luiz E. Dias, Avilio A. Franco, Eduardo F.C. Campello, Sérgio M. de Faria	601
<i>Organic Amendment Effects on Nitrogen and Carbon Mineralization in an Appalachian Minesoil.</i> R.D. Faulconer, J.A. Burger, S.H. Schoenholtz, R.E. Kreh	613

<i>Tree Shelter and Interplanted N-Fixing Shrub Effects on Crop Tree Growth on a Calcareous Minesoil.</i>	
David A. Kost, Merlyn M. Larson, John P. Vimmerstedt	621
<i>Evaluation of Natural Succession on Reclaimed Coal Mine Land in Western Kentucky.</i>	
Dan L. Williamson, R. Brent Gray	629
<i>Influence of Grading Intensity on Herbaceous Ground Cover, Erosion, and Tree Establishment in the Southern Appalachians.</i>	
John L. Torbert, James A. Burger	637
<u>SESSION 11: GEOCHEMISTRY OF ACID MINE DRAINAGE</u>	647
<i>Neutralization and Release of Metals Properties of Fly Ash.</i>	
Hrissi K. Karapanagioti, Asmare Atalay	649
<i>Adsorption of Acid Mine Drainage Metals on Fly Ash.</i>	
Hrissi K. Karapanagioti, Asmare Atalay	659
<i>Equilibrium Modeling of Trace Metal Transport from Duluth Complex Rockpile.</i>	
Paula D. Kelsey, Ronald W. Klusman, Kim Lapakko	671
<i>Solubility of Fe (III) and Al in AMD by Modelling and Experiment.</i>	
Kevin G. Mitchell, Thomas R. Wildeman	681
<i>Pyrite Microencapsulation: Potential for Abatement of Acid Mine Drainage.</i>	
A.K. Seta, V.P. (Bill) Evangelou	690
<i>Limestone Additions to Affect Changes in Loading to Remediate Acid Mine Drainage.</i>	
Frank T. Caruccio, Gwendelyn Geidel	695
<u>SESSION 12: BYPRODUCTS AS SOIL AMENDMENTS</u>	701
<i>Soil Development in a Coal Waste, Slag and Sludge Artificial Topsoil Mix.</i>	
Justine A. Cox, Rob J. Whelan, Stuart C. Thompson	703
<i>Acidic Minespoil Reclamation with AFBC By-Product and Yard-Waste Compost.</i>	
R.C. Stehouwer, W.A. Dick, R. Lal	713
<i>Municipal Sewage Sludge and Phosphorus as Amendments for Minesoils on the Cumberland Plateau.</i>	
C.L. Walker, J.T. Ammons, R.W. Dimmick, J.H. Reynolds	728
<i>A Reclamation Approach for Mined Prime Farmland by Adding Organic Wastes and Lime to the Subsoil.</i>	
Quiang Zhai, Richard I. Barnhisel	740

SESSION 13: LANDSCAPE REHABILITATION 749

Applying Geomorphologic Principles to Restore Streams Impacted by Surface Mining.
Michael S. Ellison 751

Reinterpreting SMCRA: "Permitting" Phased Postmining Land Use.
Zina R. Merkin, Thomas J. Nieman 766

The Prospect of Gully Gravure on Reclaimed Hillslopes.
Terrence J. Toy, W.R. Osterkamp 781

POSTER PAPERS AND ABSTRACTS: 787

SOIL AND OVERBURDEN TECHNICAL DIVISION

Methodology for Building Soil Based Vegetation Productivity Equations: A Statistical Approach.
Jon Bryan Burley 789

An Investigation of Brown Iron Ore Spoils in Tennessee.
S.E. Gaither, J.T. Ammons, J.L. Branson, D.E. McMillen, M.E. Essington, V.H. Reich, S. Gaither .. 799

Crop and Soil Responses to Sewage Sludge Applied to Reclaimed Prime Farmland.
Q. Zhai, R.I. Barnhisel 813

Acid Mine Drainage and Minesite Salinity in Australia.
David J. Williams 821

Organic Matter and Nutrient Accumulation in Reclaimed Kaolin Mine Soils of Georgia.
R.B. Haddock, L.A. Morris, R.L. Hendrick, E.A. Ogden 821

Plant Materials and Amendments for Controlling Wind and Water Erosion on a Fly Ash Disposal Area: TVA Colbert Fossil Plant, Alabama.
Jimmy J. Maddox, David Behel, John M. Soileau, Jimmie Kelsoe 822

Reclamation of Acidic, Denuded Copper Basin Land: Revegetation Performance of Phosphate Rock vs. Other Nutrient Sources.
J.M. Soileau, F.J. Sikora, J.J. Maddox, J.J. Kelsoe 823

Improved Methods for Acid Base Accounting Utilizing Geospatial Modeling.
Michael DiMatteo, Mark Gaylord 824

FORESTRY AND WILDLIFE TECHNICAL DIVISION

Age and Site-Related Patterns of Carbon Allocation to Wood, Foliage, and Roots on Reclaimed Kaolin Mines in Georgia.
A. Legerski, R. Hendrick, E. Ogden 825

Mycorrhizal Fungi + Trees--Practical Beneficial Tools for Mineland Reclamation.
C.E. Cordell, D.H. Marx, B. Jenkins 825

GEOTECHNICAL ENGINEERING TECHNICAL DIVISION

Comparative Assessment of Groundwater Chemistry Evolution at Three Abandoned Mines and Its Practical Implications.

Jaroslav Šolc 826

Injection of Alkaline Ashes into Underground Coal Mines for Acid Mine Drainage Abatement.

William W. Aljoe 827

Closure of the Brewer Gold Mine by Pit Backfilling.

Anne Lewis-Russ, John F. Lupo, Jon Bronson, Joe M. Flynn, B.G. "Bud" Long 827

Leachate Generation, Qualitative Trends and Groundwater Contamination Potential in Dry Deposits of Fly Ash.

Jaroslav Šolc 828

Backfill Hydrologic Characteristics in a Tennessee Area Surface Coal Mine.

Charles G. Blackburn 829

Erosion Control on Tailings Dams Using Soil Bioengineering.

Moreen Miller 830

WETLANDS TECHNICAL DIVISION

WQEP - A Computer Spreadsheet Program to Evaluate Water Quality Data.

Robert G. Liddle 831

Limestone Drains to Increase pH and Remove Dissolved Metals from an Acidic Coal-Mine Discharge in Pennsylvania.

Charles A. Cravotta III, Mary Kay Trahan 836

Controlling and Monitoring Flow in Treatment Wetlands Using Weirs.

Thomas M. Walski, Stephen J. Draus 841

Sulfur Acidic Lakes in Germany: What has to be Done?

Helmut Klapper, Walter Geller, Martin Schultze 855

Manganese Removal in Saturated Gravel Beds: Obtaining Design Criteria.

F.J. Sikora, G.A. Brodie, L.L. Behrends 857

Acidic Stream Mitigation by Limestone Sand Addition.

David L. Brant, Anthony J. Marich, Jr., Keith L. Largent 858

Performance of a Wetland/Anoxic Limestone Drain Treatment System at the Douglas Abandoned Mine Land Project

P.L. Sterner, J.B. Cliff, J.G. Skousen, A.J. Sexstone 859

Advanced Design and Construction Techniques for Staged Passive Wetland Treatment Systems for Coal Ash Leachate.

Terry A. Rightnour 860

<i>Passive Treatment of Acid Mine Drainage in Systems Containing Compost and Limestone: Laboratory and Field Results.</i> G.R. Watzlaf and D.M. Pappas	861
<i>Evaluation of Selected Grasses for the Revegetation of a Coal Slurry Lagoon in Western Kentucky by Direct Seeding.</i> T.P. Carter, R.I. Barnhisel, B. Gray, J.R. Nawrot	861
<i>Constructed Wetland Treatment System for Upper Blackfoot Mining Complex.</i> F.S. Sanders	862
ECOLOGY TECHNICAL DIVISION	
<i>Reclamation of Degraded Areas in Eastern Amazonia: The Potential of <u>Sclerolobium Paniculatum</u> Vogel.</i> Silvio Brienza Jr, Luiz Eduardo Dias, Cassio Alves Pereira	863
<i>Field Inoculation Rates of Mycorrhizal Fungi in Revegetation of Abandoned Coal Mine Lands.</i> Robert K. Noyd, F.L. Pflieger	871
<i>Lateral Thinking on Minesite Rehabilitation in Australia.</i> David J. Williams	872
<i>Reclamation of the Wasatch Gathering System Pipeline in southwestern Wyoming and northeastern Utah.</i> D. Strickland, G. Dern, G. Johnson, and W. Erickson	872
<i>Case Studies of Ecosystem-Based Approaches to Remediation.</i> K. Trimble	873
<i>Abandoned Mined Land Impacts on Water and Sediment Quality, and Invertebrate Assemblages in Two Virginia Watersheds.</i> J.L. Yeager, J.R. Bidwell, D.S. Cherry, C.E. Zipper	874
<i>Revegetation Standards for Floodplain Forest Ecosystems in western Washington, USA.</i> B. Zamora	875

SESSION 1: CONTAINMENT AND MITIGATION OF TOXIC MINE WASTE

Page No.

Oxygen Transport and Pyrite Oxidation in Unsaturated Coal-Mine Spoil.
Weixing Guo, Charles A. Cravotta III 3

Pumped Co-Disposal of Black Coal Washery Wastes in Australia.
David J. Williams 15

*Site Characterization and Containment/Remediation of Acid Mine Drainage at
an Abandoned Mine Waste Dump.*
Fred Djahanguiri, James Snodgrass, John Koerth 23

