International Mine Water Association Symposium 2010

Mine Water and Innovative Thinking

Sydney, Nova Scotia, Canada
5-9 September 2010

Editors:

Christian Wolkersdorfer    Antje Freund

ISBN: 978-1-61839-345-6
1 MINE WATER ISSUES & INNOVATIVE MINING METHODS

Akoachere, Richard Ayuk II; Van Tonder, Gerrit
Thermal dilution test: a new method for the determination of fracture positions, flow zones and ground water velocities in aquifers, using temperature as a tracer in single wells 27

Bender, Michael; Long, Dejiang; Fitch, Murray
Oil Sands Mining Water Use and Management 31

de Castro, Leonardo Mitre Alvim; Cordeiro, José Roberto Centeno; de Souza, Ana Katiuscia Pastana; Oliveira, Gilcimar Pires Cabral
A Water Resources Management System as a tool to guarantee the water supply of an iron ore mining project in Brazil 35

Das, Bidus Kanti; Bhattacharya, Jayanta
Carbon drought and its effects on the biochemical events in a chemo-bioreactor treating Acid Mine Drainage 39

Jenk, Ulf; Michalek, Bedrich; Paul, Michael; Meyer, Jürgen; Zabojník, Pavol; Lusk, Karel
Hydrochemical Development in Flooded Uranium Mines – A comparison between the Mines at Olsi (Czech Republic) and Pöhla (Germany) 43

Lind, Helena
Groundwater flow model of the Estonian oil shale mining area towards to innovative system 47

Müller, Mike; Jolas, Peter; Mansel, Holger; Struzina, Michael; Drebenstedt, Carsten
Dewatering of Multi-aquifer Unconsolidated Rock Opencast Mines – Alternative Solutions with Horizontal Wells 51

Price, William Andrew
Acid base accounting criteria used in prediction of drainage chemistry 55

Smith, Lucas Andries; Kotze, Johanita
Challenges of Open Pit Dewatering for an Intrusive Ore Body 59

Verburg, Rens; Chatwin, Terrence

Younger, Paul Lawrence
Water Management Issues in the Underground Gasification of Coal and the Subsequent Use of the Voids for Long-Term Carbon Dioxide Storage 67
| 2 Mine Water Engineering |

de Castro, Leonardo Mitre Alvim; Cordeiro, José Roberto Centeno; de Souza, Ana Katiuscia Pas- 
tana; Oliveira, Gilcimar Pires Cabral; Lemos, Sérgio  
A Water Resources Management System using the hydrologic potential of the tailings  
dam on iron ore mining  
Fernández-Rubio, Rafael; Lorca Fernández, David  
Artificial recharge of groundwater in mining  
Junghans, Udo; Arndt, Olaf; Kaden, Stefan; Schätzl, Peter; Thilo, Frank; Gädeke, Anne  
Results and experiences using grid-based optimization in groundwater management  
Roy, Arup; Bhattacharya, Jayanta  
Synthesis of Ca(OH)₂ nanoparticles for rapid treatment of mine waste water  
Rüde, Thomas R.; Banning, Andre; Klauder, Wiebke; Roger, Sebastian; Vinzelberg, Gero  
Improving the effectiveness of wells for lignite mine dewatering  
Weyer, Jürgen  
CO₂ in underground openings and mine rescue exercise  

| 3 Mine Water Treatment – Active Systems |

Adams, D. Jack; Peoples, Michael  
New Electrobiochemical Reactor and Water Gas Mixing Technology for Removal of  
Metals, Nitrate, and BOD  
Asapo, Emmanuel Sesofia; Coles, Cynthia Anne  
Batch and Kinetic Studies of Ni and Co on Highly Humified Newfoundland Peat  
Beckingham, Neil  
A Phosphate Plant Process Water Treatment System  
Cravotta III, Charles A; Parkhurst, David L; Means, Brent P; McKenzie, Robert M; Arthur, William  
Using the Computer Program AMDTreat with a PHREEQC Titration Module to Compute  
Caustic Quantity, Effluent Quality, and Sludge Volume  
de Beer, Marinda; Maree, Jannie  
Acid Mine Water Reclamation using the ABC Process  
Gast, Martin; Schöpke, Ralph; Walko, Manja; Benthaus, Friedrich Carl  
In Situ Aquifer Treatment by Microbial Sulfate Reduction  
Geroni, Jennifer Nia  
The potential for semi-passive mine water treatment by CO₂ stripping at Ynysarwed, S.  
Wales  
Hamai, Takaya; Okumura, Masao  
A result of batch test to select effective co-precipitator of zinc containing mine drainage  
treatment
Janneck, Eberhard; Arnold, Ingolf; Koch, Thomas; Meyer, Jürgen; Burghardt, Diana; Ehinger, Susan
Microbial synthesis of schwertmannite from lignite mine water and its utilization for removal of arsenic from mine waters and for production of iron pigments 131

Karakatsanis, Kathy; Cogho, Vik

Mackie, Allison L; Farmer, Heather; Walsh, Margaret E
Mine Water Treatment with Cement Kiln Dust (CKD) 139

McCloskey, Kieren; Almoric, Etienne; Bessboussè, Haad; Mezailles, Nicolas; Van Zutphen, Steven
Magpie Polymers – selective heavy metal capture 143

Mey, Wendy Sue
Mine Water Reclamation and Reuse Schemes – What’s In It for Us? 147

Misheer, Natasha; Madzivire, G.; Gitari, W. M.; Ojumu, T. V.; Balfour, G.; Petrik, L. F.
Removal of sulphates from South African mine water using coal fly ash 151

Nason, Peter Alexander; Alakangas, Lena Inger; Öhlander, Björn
The Effectiveness of Using Sewage Sludge as a Sealing Layer on Sulphide-rich Mine Tailings: A Pilot-scale Experiment, Northern Sweden 155

Navratil, James D.; Akin, Andrew C.
Use of Recycled Concrete and Magnetite for Mine Water Treatment and Metal Recovery 159

Noack, Greg; Clelland, Lawrence; Ross, Trevor; Donato, Randy
Controlling Surface Water at One of Canada’s Largest Base Metals Operations: From Legacy Challenges to Environmental Award Winner 163

Oliphant, David S.; Christophersen, David
Three-Phase Mining Effluent Treatment Plant To Meet Stringent Standards 167

Preuss, Volker; Schöpke, Ralph; Koch, Thomas
Reduction of Sulphate Load by Nanofiltration – Process Development in Bench Scale 171

Pust, Christopher; Schüppel, Benn; Merkel, Broder; Schiepek, Mandy; Lilja, Göran; Rabe, Wolfgang; Scholz, Günter
Advanced Mobile Inlake Technology (AMIT) – An efficient Process for Neutralisation of Acid Open Pit Lakes 175

Reddy, Sarashree Traci; Lewis, Alison Emslie
Waste minimisation through recovery of salt and water from a hypersaline brine 179

Romano Neto, Roberto; Salvador Crocetta, Michael; Ronconi de Souza, Maria Gisele; Rocha, Edilane; Zanuz, Mácio; Baldoni Gomes, Cleber José
Combined Treatment of Acid Mine Drainage and Sewage in the State of Santa Catarina – Brazil 183

Silva, Renato; Rubio, Jorge
The Neutralization-Flocculation-Lamellar Settling (NF-LS) process in the treatment of Acid Mine Drainage (AMD) from Coal Mines in South Brazil – Comparative processes and new basis for sulphate ions removal 187
4 Mine Water Treatment – Passive Systems

Antunes, Marcel; Fernandes, Ricardo; Pinheiro, Avelino; Valente, Teresa Maria; Nascimento, Sérgio
Potential of reuse and environmental behaviour of ochre-precipitates from passive mine treatment 205

Behrooz, Mehrnoosh; Borden, Robert C.
Controlling Sulfidic Tailings Oxidation with Surface Application of Crude Glycerol – Column Experiments 209

Clark, John Peter

Clark, John Peter
Treatment of Mine Site Runoff Containing Suspended Solids Using Sedimentation Ponds – Optimizing Flocculant Addition to Ensure Discharge Compliance 217

Conly, Andrew George; Shankie, Simon; Lee, Peter
Treatment of sulphate toxic waters using permeable reactive barriers: batch and flow-through reactor experiments 221

Friese, Kurt; Koschorreck, Matthias; Wendt-Potthoff, Katrin; Schultze, Martin; Geller, Walter
Application of whey to prevent re-oxidation in a passive anoxic in-lake reactor – success and failure 225

Gent, Thomas; Bussière, Bruno; Zagury, Gérard J.; Benzaazoua, Mostafa
Passive treatment of high-iron acid mine drainage using sulphate reducing bacteria: comparison between eight biofilter mixtures 229

Gitari, Wilson Mugera; Petrik, Leslie Petrik; Key, David Key; Okujeni, Charles
Inorganic contaminants attenuation in acid mine drainage by fly ash and its derivatives: Column Experiments 233

Hedin, Bob
Sustained Treatment of AMD Containing Al and Fe³⁺ with Limestone Aggregate 237

Jarvis, Adam Paul; Gandy, Catherine Jane
A case study of long-term geochemical evolution of coal waste rock drainage and its remediation 241

Kruse, Natalie A. S.; Brewster, Kimberly; Riefler, R. Guy
A new look at designing steel slag leach beds 245
Matthies, Romy; Aplin, Andrew C.; Boyce, Adrian J.; Jarvis, Adam P.
Tracking Dominant Alkalinity Sources in a Passive Mine Water Treatment System with Stable Carbon Isotopes 249

Muhlbauer, Ritva; Raja, Sashnee; de Villiers, Div; Pulles, William; Clark, Sharon; Heath, Ralph
Implementation of a demonstration scale Integrated Managed Passive (IMPI) process 251

Nairn, Robert W.
A Large, Multi-Cell, Ecologically Engineered Passive Treatment System for Ferruginous Lead-Zinc Mine Waters 255

Rait, Rachel; Trumm, Dave; Pope, James; Craw, Dave; Newman, Nigel; MacKenzie, Hayden
Passive treatment of mine drainage arsenic through adsorption by acid mine drainage precipitates, West Coast, New Zealand. 259

Sartz, Lotta; Bäckström, Mattias; Allard, Bert
On the neutralisation of ARD and acid-generating waste rock by different alkalinity sources – carbonate an/or hydroxide 263

Sartz, Lotta; Bäckström, Mattias; Karlsson, Stefan; Allard, Bert
Strategy for instant neutralisation and metal immobilisation in ARD 267

Skogsjö, Erika; Allard, Bert; Bäckström, Mattias
Barrier system for treatment of heavy metal drainage at Ranstad, Sweden 275

Sobolewski, Andre
Benefits of using liquid carbon sources for passive treatment systems 279

Tsukamoto, Timothy K.; Weems, Vance
Semi-Passive Bioreactors for Treatment of Acid Mine Drainage 283

Warrender, Ruth; Pearce, Nick; Perkins, Bill; Brown, Andy; Sapsford, Devin; Bowell, Rob; Dey, Matt
Field Trials of Low-Cost Permeable Reactive Media for the Passive Treatment of Circum-Neutral Metal Mine Drainage in mid-Wales, UK 291

Wolkersdorfer, Christian
Tracer Test in A Settling Pond – The Passive Mine Water Treatment Plant of the 1 B Mine Pool, Nova Scotia, Canada 295

5 Mine Water Uses – Geothermal, Geochemistry, Biochemistry

Hidalgo, Carmen; Rey, Javier; Martínez, Julián; Benavente, José
Evolution of mine water uses in the abandoned sulphide mines of the province of Jaén, Spain 301
King, Mark; Perez, Waldo; Kieley, John; Reidel, Frits; Peralta, Eduardo  
A Novel Form of “Mine Water”: A Lithium Brine Deposit Under Dry Salt Lakes (Salars) in the Puna Region of Argentina  

Marques, Antonio; Garcia-Ordiales, Efren; Loredo, Jorge  
Potential for Mine Water Reuse in an Abandoned Coal Mine in Northern Spain  

Usher, Brent H; Strachotta, Chris; Strand, Roald; Jackson, James  
Linking fundamental geochemistry and empirical observations for water quality predictions using Goldsim  

Vaute, Laurent; Le Pape, Pierre; Collon-Drouailllet, Pauline; Fabriol, Robert  
Modelling the long-term evolution of groundwater’s quality in a flooded iron-ore mine using a reactive transport pipe network model  

6 ANALYSIS OF MINE WATER AND ITS CHEMISTRY  

Alakangas, Lena; Nason, Peter  
Declining element concentrations in groundwater after remediation in sulphide-rich tailings at Kristineberg, northern Sweden  

Bauer, Johannes K.  
Closure of an open pit and landfill for excavated earth  

Braungardt, Charlotte Barbara; Buterfield, Martin; Wajrak, Magdalena  
On-site mine water analysis: application note for the PDV6000plus  

Cukrowska, Ewa Maria; Lusilao-Makiese, Julien; Tessier, Emmanuel; Amouroux, David; Weiersbye, Isabel  
Mercury speciation in gold-mining environments – determination and development of predictive models for transformation, transport, immobilisation and retardation  

Frau, Franco; Cidu, Rosa  
Diel changes in water chemistry in the Baccu Locci stream (Sardinia, Italy) affected by past mining  

Godwin, Amy Lynn; Lee, Peter Ferguson; Conly, Andrew George; Goold, Andrea R.  
Predicting toxicity of future combined pit lakes at the former Steeprock Iron Mine near Atikokan, Ontario  

Grawunder, Anja; Lonschinski, Martin; Boisselet, Tsilla; Merten, Dirk; Büchel, Georg  
Hydrogeochemistry of rare earth elements in an AMD-influenced environment  

Harck, Terry Richard  
Mobilisation of salts from mine waste. A pinch or a pound?  

Ji, Sang Woo; Yim, Gil Jae; Cheong, Young Wook; Lee, Hyeon Seok; Min, Jeong Sik; Choi, Yong Suk; Bhattacharya, Jayanta  
The Impact of water chemistry in the vicinity of Imgi mine on the pollution potential in the Soo-young river, Korea
Karlsson, Stefan; Allard, Bert; Bäckström, Mattias
Weathering mechanisms and composition of effluents from a sulphide mine waste deposit after covering – Twenty years of field data

Kolesárová, Jana; Rodová, Alena; Nesetril, Kamil; Zeman, Josef
Arsenic occurrence and geochemical evolution of the abandoned ore mine Kaňk in the Czech Republic

Lauzon, Nicolas
Mine Water Characterization for Probabilistic Modelling and Uncertainty Analysis

Lemière, Bruno
Neutralisation distance of acid drainage and migration range of pollutants

Müller, Mike; Eulitz, Katja
Characterizing Water Quality of Pit Lake through Modeling

Nordström, D. Kirk; McCleskey, R. Blaine; Ball, James W.
Challenges in the analysis and interpretation of acidic waters

Palumbo-Roe, Barbara; Banks, Vanessa; Chenery, Simon; Weiss, Dominik
Tracing sources and fate of zinc in a mining-impacted river catchment: insights from flow measurements, synoptic sampling and zinc isotopes

Paul, Michael; Meyer, Jürgen; Jenk, Ulf; Jahn, Sylvia; Klemm, Werner
Investigation of arsenic emissions from flooded ore mines of the Westerzgebirge region, Saxony, Germany

Plante, Benoît; Benzaazoua, Mostafa; Pepin, Geneviève; Bussière, Bruno
Evaluation of the Ni-contaminated neutral drainage generation potential in the Tio mine waste rocks

Schneider, Ivo André Homrich; Freitas, Ana Paula Pires; Schwarzbold, Albano
Algae in the Acid Mine Drainage on Santa Catarina Coalfield, Brazil

Sjöberg, Viktor; Karlsson, Stefan; Sartz, Lotta
Release of vanadium from LD-slag by exposure to ARD

Sjöblom, Åsa; Håkansson, Karsten; Allard, Bert
Particulate matter as scavenger and carrier of trace metals in simulated mine water

Younger, Paul Lawrence
Where There is no pH Meter: Estimating the Acidity of Mine Waters by Visual Inspection

7 COAL MINING – UNDERGROUND MINING, SURFACE MINING

Amboni, Mirlene Meis; Zanuz, Marcio; Campos, Jonathan Jurandir; Gomes, Cleber Jose Baldoni
Qualitative and Quantitative Representation of the Coal Mining Impact in the Rivers of Santa Catarina State, Brazil

Gautama, Rudy Sayoga; Kusuma, Ginting Jalu; Lestari, Iin; Anggana, Rachmanta P.
Weathering Behaviour of Overburden-Coal Ash Blending in Relation to Overburden Management for Acid Mine Drainage Prevention in Coal Surface Mine
Gossel, Wolfgang; Stollberg, Reiner; Wycisk, Peter  
Modelling of environmental impacts of 140 years of open pit lignite mining and chemical industry on groundwater contaminants in the Bitterfeld area (Germany) 421

Halir, Josef; Zizka, Lukas  
The issues of the self-fill aquifer in the North Nohemian Brown Coal Basin 425

Kruse, Natalie A. S.; Kerber, Robert; Brewster, Kimberly; McCosker, Loraine  
A road to progress? The impacts of cutting a new highway through the heavily mined hills of Southeast Ohio 429

MacLeod, Glenn  
Innovative Uses of LIDAR Technology to assist in the Remediation of former Coal Mine Sites 433

Marchand, Geneviève; Waterhouse, John; Crisostomo, Joseph  
Mudstone Depressurisation behaviour in an open pit coal mine, Indonesia 437

Singh, R.N.; Stace, R.; Pathan, A.G.; Doulati Ardejani, F.; Atkins, A.S.  
Hydrogeological Assessment of the Thar Lignite Prospect 441

Wang, Changshen; Bai, Haibo; Liu, Shucai  
Mine Water Issues in China 445

Zizka, Lukas; Halir, Josef  
Groundwater flowing in the forefield of the ČSA mine (North Bohemian Brown Coal Basin in the Czech Republic) 449

8 MINE CLOSURE — COAL, METAL

Breckenridge, Larry  
Evapotranspiration Caps for Mine Waste Closure – Case Studies in Extreme Environments 455

Cidu, Rosa; Frau, Franco  
Natural attenuation of contaminants in mine drainage at abandoned mines 459

Clark, Sharon; Muhlbauer, Ritva  
Mine Closure Water Management: Choosing the Right Alternative within a Changing Environment 463

Dickin, Rob; Mills, Ryan; Bright, Doug; Runnells, Joanna  
Assessment of Atlin-Ruffner Abandoned Mine, BC, Canada 467

Dye, Peter John; Weiersbye, Isabel  
The Mine Woodlands Project in the Witwatersrand Basin, South Africa: research strategy and progress 471

Johnson, Raymond H.; Yoshino, Miori E.; Hall, Susan M.; Shea, Valois R.  
Predictive Modeling Strategies for Operations and Closure at Uranium In-Situ Recovery Mines 475

Kalin, Margarete; Paulo, Carlos; Sleep, Brent  
Proactive Prevention of Acid Generation: Reduction/Inhibition of Sulphide Oxidation 479
Le Gal, Nils; Lagneau, Vincent; Charmoille, Arnaud
Mechanisms of gas migration in flooding post-mining context 483

Lim, Eddy; Beckett, Kirsty; Jaen, Wilhelm; Kumar, Atish
Probabilistic Analysis of Mine Void Salinity and Lake Level Associated with Climate Change 487

Mara, Septimius; Vlad, Serban Nicolaе
Integrated quality environmental monitoring and warning-alarming system for emergencies due to technical accidents at waste deposits in mining industry 491

Metschies, Thomas; Becker, Martin; König, Christoph; Jenk, Ulf
Modelling of the hydraulic behaviour of deep mines in regional aquifer systems 495

Metschies, Thomas; Gantar, Ivan; Dolenc, Peter; Paul, Michael
Remediation of an Uranium Mining Waste Rock Pile in Slovenia 499

Nelson, Mark Richard; Hazen, Gary L.; Fundingsland, Stephen D
Mine Water Remediation at Large Scale Metal Mines: Balancing Near-Term Expenditures for Source Control with Long-Term Expenditures for Collection and Treatment 503

Santofimia, Esther; Lopez-Pamo, Enrique
Influence of runoff and ground water inflow in the stratification developed in the Concepción pit lake (Iberian Pyrite Belt, Spain) 507

Vermeulen, Petrus Daniel
The assessment of mine rebound and decanting in deeper coal mines 511

Villain, Lucile; Alakangas, Lena; Öhlander, Björn
Geochemical Evaluation of Mine Water Quality in an Open-pit Site Remediated by Backfilling and Sealing 515

Willscher, Sabine; Hertwig, Thomas; Felix, Manfred; Sohr, Antje
Environmental Impact of Differently Remediated Hard Coal Overburden and Tailings Dumps a Few Decades after Remediation 519

Ziemkiewicz, Paul; Peckham, Donald; Kehoe, Alan
Evaluating the effects of moving to a low maintenance ARD control strategy at the Victoria Junction coal tailings site 523

Zinck, Janice; Fiset, Jean-François; Griffith, Wesley
Stability of Treatment Sludge in Various Disposal Environments: A Multi-Year Leaching Study 527

9 Legal and Social Aspects of Mine Water

Fleischhammel, Petra; Menendez Lolo, José Antonio
Post-mining lakes – various types and their integration in river basin landscapes according to the European Water Framework Directive 533

Liefferink, Mariette; van Eeden, Elize S.
Proactive environmental activism to promote the remediation of mined land and acid mine drainage: a success story from the South African goldfields 537
Loredo, Jorge; Marques, Antonio; Beggs, Chris; Venegas, Marcela; Amezaga, Jaime; Rötting, Tobias; Younger, Paul
Guidelines for catchment management and mining impacts in arid and semi-arid regions of South America (CAMINAR Project)  

Twardowska, Irena; Ingar, Walder; Margareta, Wahlstrom; Tommi, Kaartinen; Johannes, Drielsma
European Waste Characterisation Standards for the prevention of acid rock drainage  

10 Mine Tailings

Bäckström, Mattias
Environmental impact from an alum shale deposit, Kvarntorp, Sweden – present and future scenarios  

Bäckström, Mattias; Sartz, Lotta
Stabilisation of acid generating waste rock with fly ash – immobilization of arsenic under alkaline conditions  

Bäckström, Mattias; Sartz, Lotta; Karlsson, Stefan; Allard, Bert
Prevention of ARD through stabilization of waste rock with alkaline by-products – results from a meso-scale experiment  

Behrooz, Mehrnoosh
Particle Size Controls Oxidation Rate of Tailings Surface and AMD Production – Hydrologic Characterization of Ore Knob Tailing Pile  

Bouzahzah, Hassan; Benzaazoua, Mostafa; Bussière, Bruno
A modified protocol of the ASTM normalized humidity cell test as laboratory weathering method of mill tailings.  

Colling, Angéli Viviani; Menezes, Jean Carlo Salomé dos Santos; Silveira, Pricila Silva; Schneider, Ivo André Homrich
Biohydrometallurgical Process to Produce the Coagulant Ferric Sulfate from the Pyrite Present in Coal Tailings  

DeSisto, Stephanie L.; Parsons, Michael B.; Jamieson, Heather E.
Using Hydrogeochemical Data to Improve Remediation of Historical Gold Mine Tailings in Nova Scotia  

Destrigneville, Christine; Castet, Sylvie; Munoz, Marguerite; Courjault Radé, Pierre; Ghorbel, Manel; Souissi, Radhia; Souissi, Foued; Ben Mamhou, Abdallah; Abdeljaouad, Sâadi
Are abandoned mine tailings of Northern Tunisia a source of metal contamination in surface water?  

Gumbo, Jabulani Ray
Evaluating the suitability of Paspalum as a candidate for Rehabilitation of Mine Tailings dams: A Case study of New Union Gold Mine  

Mirgorodsky, Daniel; Ollivier, Delphine; Merten, Dirk; Büchel, Georg; Willscher, Sabine; Jablonski, Lukasz; Wittig, Julian; Werner, Peter
Phytoremediation experiments on a slightly contaminated test field of a former uranium mining site
Ogola, Jason Samuel
Heavy Metals Impacts on the Environment: A Case Study of Gold Mine Tailings Dams in Giyani Greenstone Belt, Limpopo Province, South Africa 591

Sidenko, Nikolay V.; Mathers, Karen H.; McKernan, J. Michael
Delineation of metal sources in runoff from East Tailings Management Area (ETMA), Lynn Lake, Manitoba, Canada as a means to optimize remediation efforts. 595

Stefaniak, Sebastian; Twardowska, Irena
Impact of engineering constructions made of Carboniferous waste rock on groundwater deterioration 599

Vigâncio, Eunice Maria; Silva, Rodrigo Almeida
Hydrometallurgical/UV Process to Produce Ferrous Sulfate from the Pyrite Present in Coal Tailings 603

Yim, Gil Jae; Cheong, Young Wook; Min, Dae Sik; Ji, Sang Woo
Effects of capillary zone on water movement in soil column with tailings 607

Ziemkiewicz, Paul; O’Neal, Melissa
Selenium leaching kinetics and in-situ control 611

11 The ‘CAPE BRETON DEVELOPMENT CORPORATION’ LEGACY

Campbell, Belinda; Gauthier, Andre
Development of Remedial Objectives for the former Cape Breton Development Corporation Mine Closure Program 617

Forgeron, Steve Vincent
Protocols for the Remediation of Lands Impacted by Former Coal Mining Operations, Sydney Coalfield, Nova Scotia, Canada 621

Forrester, Dave; King, Mark; Hilchey, Jeff
Remediation of the Gowrie Wash Plant 625

Forrester, Dave; Noble, Bruce
Overcoming the Pitfalls of abandoned mine workings in the Sydney Coalfield 629

Shea, Joe
Innovative Management Techniques to deal with Mine Water Issues in the Sydney Coal Field, Nova Scotia, Canada 633

12 DISCUSSING THE CONCEPT OF A ‘ZERO WASTE MINE’

Amaral Filho, Juarez Ramos do; Schneider, Ivo André Homrich; Tubino, Rejane M. C.; de Brum, Ireneu A.S.; Mitzahek, Gerson; Sampaio, Carlos H.; Schneider, Carlos H.
Characterization of a Coal Tailing Deposit for Zero Waste Mine in the Brazilian Coal Field of Santa Catarina 639
Marisco, Lenisa Veiga; Orellana, Daniel; Candiota Tubino, Rejane Maria
Possibility of removing metals from acid mine drainage using industry waste processing agates as adsorbent 643

13 Fracture Flow to Mines

Bellin, James; Bonson, Christopher; Jack, Alice
The importance of geotechnical characterisation and structural interpretation in predicting fracture flow to mines 649

Da Gama, Evandro Moraes
Experimental Verification Of Equations For Determining The Flow Of Water In Rock Discontinuities 653

Johnson, Christopher Scott; Cooper, Lorne
Estimating Mine Inflow Rates Real Time Using Analytical Methods 657

Seidel, Torsten; König, Christoph
Density-dependent calculation of matrix fracture flow 661

Seok, Eunjeong; Gale, John
Scaling-up Fracture Pore Space Permeability – Approach to Mine Water Inflow Prediction 665

Lagniappe

Author Index 671
Keyword Index 676