International Mine Water Association Symposium (IMWA 2022)

Reconnect

Christchurch, New Zealand 6 – 10 November 2022

Editors:

James Pope Christian Wolkersdorfer Rachel Rait Dave Trumm

Hana Christenson

Karoline Wolkersdorfer

ISBN: 978-1-7138-7233-7

Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Printed with permission by Curran Associates, Inc. (2023)

For permission requests, please contact International Mine Water Association - IMWA at the address below.

International Mine Water Association - IMWA c/o Itasca Denver, Inc. 143 Union Blvd. Suite 525 Lakewood, CO 80228 USA

Phone: +1 303 969-8033 Fax: +1 303 969-8357

Secretariat@IMWA.info

Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA Phone: 845-758-0400

Fax: 845-758-2633

Email: curran@proceedings.com Web: www.proceedings.com

Table of Contents

| Abraham, Daniel Arulraj; Jin, Fei; Okeme, llemona; Sapsford, Devin | |
|---|----|
| Detection And Measurement Of Dissolved Metals In Mine Water Using Cation-Binding Resins And Field Portable XRF | 1 |
| Bamforth, Selina Mary; Satterley, Christopher | |
| Evaluating Manganese in Mine Water in UK Coal Authority Mine Water Schemes | 7 |
| Barroso, Ana; Valente, Teresa Maria; Horta Ribeiro Antunes, Isabel Margarida; Marinho Reis, Amélia Paula; Canovas, Carlos Ruiz | |
| Evaporation-dissolution Cycles In Highly Acidic Mine-influenced Waters And Their Control Over The Secondary Paragenesis Of Sulfate Salt Efflorescences | 15 |
| Blanchard, Ryan; Kofoed, Val; Green, Mitchell | |
| Integrity Assessment of a Tailings Storage Facility Characterized with the Willowstick Method | 21 |
| Bothe-Fiekert, Mareike; Binder, Angela; Langefeld, Oliver | |
| Historic Mining Infrastructure as An Opportunity for Regional Water- & Energy Supply (Harz Mountains, Germany) | 27 |
| Cairns, Stuart; Todd, Aaron Martin Lawrence; Robertson, lain; Byrne, Patrick | |
| Metals Removal from Acid Mine Water by Wood-Ash Amended Biochar | 33 |
| Choopani, Atefe; Ronchi, Benedicta; Declercq, Pierre-Yves; Devleeschouwer, Xavier | |
| Ground Deformations Related to an Old Drainage Adit in The Abandoned Coal Concession Around Saint-Vaast (Wallonia, Belgium) Analyzed Using PS-InSAR and Piezometric Wells Time Series | 39 |
| Christenson, Hana Kirsten; Skews, Rachel; Trumm, Dave; Pope, James; Newman, Nigel; Lee, Gavin; Ross, Duncan; Boyt, Charlotte | |
| Enhanced Passive Treatment of Sulfate and Nitrate Enriched Mine Water: Laboratory Optimisation Experiments | 47 |
| Coetzee, Henk; Cole, Patrick; Ramugondo, Sealelo | |
| Estimation of Mine Water Ingress Volumes for the Witwatersrand Goldfields | 53 |
| Craw, David; Rufaut, Cathy; Pillai, Dhana; Kerr, Gemma | |
| Rehabilitation of Extreme Chemical Substrates on Mine Sites Without Soil in a Semiarid Climate, New Zealand | 59 |

| Dale, Caroline Jane; Jogand, Henri | |
|--|-------|
| A Holistic Approach to Water and Salt Management in Mining : Biological Treatment Solution to Allow Direct Discharge of Excess Water Instead of Brine Production Through Reverse Osmosis treatment | 65 |
| Devleeschouwer, Xavier; Choopani, Atefe; Declercq, Pierre-Yves | |
| Ground Deformations Observed for Three Decades (199–2022) above Old and Deep Coal Mines Reused for Deep Gas Storage Sites (Wallonia, Belgium) Using PS-InSAR Time-series | 71 |
| Ferrier, Ainsley Camille; Clauson, Shane | |
| Integrating Water Planning into Operational Mine Planning | 81 |
| Flores, Hernan; Rudolph, Tobias; Möllerherm, Stefan | |
| Hyperspectral Sensing To Boost Mine Waste Characterization And Water Monitoring | 83 |
| Fosso-Kankeu, Elvis; Masindi, Vhahangwele; Maree, Johannes; Mamba, Bhekie; Nkambule, Thabo | |
| Effective Attenuation of AMD Pollution Potential Using By-product from Municipal Wastewater Treatment | 91 |
| Gautama, Rudy Sayoga; Putri, Rara Aulia; Kusuma, Ginting Jalu; Badhurahman, Abie; Dwiki, Sendy | |
| Study of Mining Void Utilization Model as a Flood Control in Tropical Region | 99 |
| Gcasamba, Sisanda Prudence; Ramasenya, K.; Lekgothoane, M.; Nyale, S.M.; Vadapalli, V.R.K.; Madzivire, G.; Coetzee, Henk; Sinthumule, Eth Morokane, Molefe | el; |
| In situ Mine Water Treatment of Flooded Underground Mines Using Waste Concrete: A Feasibility Study | 105 |
| Gemson, Wijnand; Harck, Terry; Burgess, Ryan | |
| Nitrate Dynamics at Mine Sites – Broader Context, Source and Management Considerations | 111 |
| Genth, Till; Rose, Lisa Jasmin; Jasnowski-Peters, Henning; Melchers, Christian | |
| Bulk- and Clay-mineral Quantification in the Upper Cretaceous Emscher Formation – Evaluating a Potential Hydraulic Barrier During Mine Water Rebound in the Ruhr District | 115 |
| Gómez-Arias, Alba; Yesares, Lola; Castillo, Julio; Vermeulen, Danie; Puro Walter | :ell, |
| Phalaborwa Complex: from Rock Drainage Characterization to Waste Revalorization | 121 |
| Green, Ros; Chapman, John | |
| Critical Decisions for AMD Management | 127 |

| Haanpää, Kirsi-Marja; Picken, Päivi; Lauri, Hannu; Wichmann, Anneli; Isaksson, Linus Lejon | |
|---|----------|
| Nordic Experiences in Climate Change Analysis in Modelling Mining Area Environmental Impacts | a 133 |
| Hansen, Robert Neill | |
| Analysis of Shallow Groundwater Monitoring data of a Platinum Mine, Bushveld Complex, South Africa – Implications for Post-Closure | 139 |
| Hayton, Stephanie; Trumm, Dave; Horton, Travis; Pope, James; Ross, Duncan; Williams, Megan | |
| Passive Treatment For Elevated Iron And Arsenic In Circum-Neutral Min Affected Water | e 147 |
| Hoekstra, David Pieter; Saavedra, Victor Munoz; Milad, Carolina | |
| Development of a Streamflow Model Incorporating Stochastic Daily Climate, Climate Change, and El Niño La Niña Effects | 153 |
| Huisamen, Altus; Glendinning, John Edward | |
| Post-Mining Hydrogeology of Underground Collieries – Effects of Hanging Wall Subsidence | 161 |
| Jasnowski-Peters, Henning; Melchers, Christian | |
| Natural Tracers For Mine Water Fingerprinting II – a multi tracer approach to unravel underground fluid movements during Mine Water Rebound in the Ruhr District Area | 167 |
| Kennedy, Julia | |
| Circular Economy Potential of Widescale Implementation of Sodium Carbonate Dosing for Circumneutral Zinc-rich Mine Water in Wales | 175 |
| Kerr, Gemma; Craw, David; Pope, James | |
| Dissolution Rates of Arsenic Minerals in Natural and Mining Environments, New Zealand | 181 |
| Kleinmann, Bob; Sobolewski, André; Skousen, Jeff | |
| The Evolving Nature of Active, Passive, and Semi-Passive Mine Water Treatment Technologies | 187 |
| Kurukulasuriya, Devmi; Howcroft, William; Meredith, Karina; Timms, Wendy | |
| The Conundrum of Incongruent Multiple Age Tracer Results in Mine Water | 195 |
| Kusuma, Ginting Jalu; Gautama, Rudy Sayoga; Dwiki, Sendy; Badhurahman, Abie; Abfertiawan, Muhammad Sonny | |
| Performance of Fly Ash and Bottom Ash as Coal Combustion Product to Prevent Acid Mine Drainage Generation: Preliminary Result on A Pilot Scale | 201 |

| Kuznetsova, Alsu; Afzal, Iram; Suri, Navreet; Kuznetsov, Petr; Siddique, Tariq | |
|--|-----|
| Inhibition of Methanogenesis through Redox Processes in Oil Sands Tailings | 209 |
| Lemos, Mariana; Valente, Teresa Maria; Marinho Reis, Paula; Fonseca, Rita; Delbem, Itamar; Filho, José Gregório; Guabiroba, Fernanda; Pantaleão, João; Magalhães, Marcus | 203 |
| Geoenvironmental Characterization of Gold Mine Tailings from Minas Gerais and Goiás, Brazil | 217 |
| Ligavha-Mbelengwa, Lufuno; Madzivire, Godfrey; Nolakana, Pamela; Coetzee, Henk; Gomo, Modreck | |
| Potential Use Of Emerging Organic Contaminants As Pollution Source Tracers | 223 |
| Lukas, Eelco; Vermeulen, Danie; Gomez Arias, Alba | |
| Recharge Flooding | 229 |
| Lusunzi, Rudzani; Wandeers, Frans | |
| Speciation of Metals in Sediments of the Sabie River System by Sequential Extraction | 237 |
| Madzivire, Godfrey; Ligavha-Mbelengwa, Lufuno; Nolakana, Pamela; Coetzee, Henk | |
| Evaluation Of The Changes In Mine Water Quality In The Witwatersrand Basin: Basis For Proactive Long-term Solution | 243 |
| McCullough, Cherie; O'Grady, Ben | |
| Closure Of An Australian Pit Lake With AMD Using A Terminal Water Balance As An Evaporative Sink | 247 |
| McLachlan, Christine Jane; Walker, Barry | |
| Determination of acid producing potential using pXRF: A case study from Cypress Mine, Stockton Plateau | 253 |
| Molaba, Leshego Esther; Wolkersdorfer, Christian | |
| Investigating the Effects of Temperature on Density Stratification in a flooded Analogue Model Mine | 259 |
| Moreno, Raul; Olias, Manuel; Ruiz Cánovas, Carlos; Macias, Francisco | |
| Update Of Hydrological Study And Prediction Of Flood Levels Of Acidic Pit Lakes (Tharsis) mines, Spain | 267 |
| Mosai, Alseno; Richards, Heidi; Tutu, Hlanganani | |
| Modelling The Transport Of Pollutants From Mine Dump And Landfill Sites To Groundwater And Surface Water | 273 |

| Mothetha, Matome; Msagati, Titus; Masindi, Vhahangwele; Kebede | , Kefeni |
|--|-------------|
| Application of Pulverized Kaolin Clay for Remediation of Acid Mine Drainage | 281 |
| Mphahlele, Malehlogonolo Ramogohlo Rosemary; Kotzé, Izak Alder Mosai, Alseno Kagiso; Tutu, Hlanganani | t; |
| Recovery Of Pt And Pd From Aqueous Solutions By N,N-di(trimethoxysilylpropyl)-N'-benzoylthiourea Modified Silica Gel | 291 |
| Muedi, Khathutshelo Lilith; Masindi, Vhahangwele; Maree, Jannie; Hendrik Gideon | Brink, |
| Rapid Removal of Cr(VI) from Aqueous Solution Using Polycationic/di-metallic Adsorbent Synthesized Using Fe ³⁺ /Al ³⁺ Recovered from Real Acid Mine Drainage | 299 |
| Mugova, Elke; Wolkersdorfer, Christian | |
| Insights into the First Flush Effect – The Flooded Underground Mine a Chemical Reactor | as a 305 |
| Mulliner, Tim; McLachlan, Christine | |
| Oxidation Modelling to Optimise Waste Rock Storage | 311 |
| Murray, Jodi; Walker, Barry | |
| Stockton Coal Mine. Management of AMD Sludge | 317 |
| Navarro, Leo; Hayton, Stephanie; Williams, Megan; Weber, Paul | |
| Globe Progress Lake – Closure performance monitoring and adaptive management | e 323 |
| Netshitungulwana, Khashane Robert Tshishonga; Gauert, Christop Vermeulen, Danie; Yibas, Bisrat; Shai, Mateo; Lusunzi, Rudzani | h; |
| Geochemical Characterisation of the Witbank Coalfield Geological Strand Assessment of Potential Metal Impact on the Receiving Environn | |
| Nigéus, Susanne Pia Teresia; Maurice, Christian; Lindblom, Jenny | |
| Water Retention Capacity As a Measure to Evaluate the Effectiveness a Green Liquor Dregs-amended Till to Cover Sulfidic Mine Waste | of 337 |
| Nkele, Kgolofelo Masegare; Mpenyana-Monyatsi, Lizzy; Masindi, Vhahangwele | |
| Effective Removal Of Manganese From Mine Effluent Contaminated River Water Using Ca-Mg-(OH) ₂ Nanocomposite | 345 |
| Nolakana, Pamela; Ligavha-Mbelengwa, Lufuno; Madzivire, Godfre Coetzee, Henk | y; |
| Evaluation Of The Water Quality Impacts Associated With Relaxation Environmental Critical Levels: A Case Study In The West Rand Basin, South Africa | Of 353 |

| Nordstrom, D. Kirk; Campbell, Kate M.; Alpers, Charles N. | |
|--|-----|
| Quantifying Mineral Precipitation Processes during Dilution, Mixing, and Neutralization of Acid Rock Drainage | 359 |
| Oldham, Carolyn; Singh, Ana Catarina; Kanse, Lisette; Bourgault, Chant | al |
| Developing The Business Case For Responsible Acid And Metalliferous Drainage (AMD) Management | 365 |
| Parhi, Pradeep Kumar; Rao, M. S.; Asnani, C. K. | |
| Groundwater Hydrology Studies around a Carbonate Hosted Flatly Dipping Uranium Deposit and Environmental Management | 373 |
| Paulsson, Oscar; Widerlund, Anders | |
| Geochemical Loading Rates from Open Pit Walls at the Åkerberg and Laver Mine Sites in Relation to Pit Lake Water Quality | 379 |
| Potgieter, Gerhard; Jacobs, Karin; Cason, Errol; DeFlaun, Mary; van Heerden, Estariëthe | |
| Optimizing Denitrification Efficiencies at Low-Temperature Conditions for the Enhancement of Site-Specific Bioremediations Solutions | 385 |
| Primo Doncel, Maria de la Paloma; Möllerherm, Stefan; Rudolph, Tobias Goerke-Mallet, Peter | 5; |
| PostMinQuake: Diagnosis Of Post-Mining Induced Seismicity In Former European Hard Coal Basins | 393 |
| Ramugondo, Selaelo Jacquelene; Molapo, Donald; Coetzee, Henk; Tegeg Kefyalew | n, |
| The effectiveness of upgrading the Van Ryn Canal as an option to reduce water ingress into the underground mine workings in the East Rand of the Witwatersrand Basin in Gauteng Province, South Africa | 397 |
| Robinson, James; Dodd, Jason; Andrews, Ian; Milton Thompson, Olivia | |
| Successful Construction of a Full Scale Passive Sulfate Treatment System | 403 |
| Romero Matos, Jonatan; Ruiz Cánovas, Carlos; Macías Suáres, Francisco León Cortegano, Rafalen; Millán Becerro, Ricardo |); |
| Wildfire Effects On A Watercourse Affected By Acid Mine Drainage (Odiel River, SW Spain) | 411 |
| Rose, Lisa Jasmin; Genth, Till; Jasnowski-Peters, Henning; Melchers, Christian | |
| First Petrophysical Data Compilation on the Effectiveness of an Extensive Hydraulic Barrier During Mine Water Rebound in the Ruhr District – the Upper Cretaceous Emscher Formation | 417 |
| Rufaut, Cathy; Craw, David; Weightman, Erin; Pillai, Dhana; Lee, Gavin | |
| The Macraes Gold Mine Irrigation Project, New Zealand | 421 |

| Ruiz Cánovas, Carlos | |
|--|-----|
| Towards a Sustainable Restorarion of a Watershed Strongly Polluted by Acid Mine Drainage (AMD): the Case of the Odiel River (SW Spain) | 427 |
| Ryanta, Albert; Saputra, Muhammad Nur Wangsa; Senduk, Marco; Anggoro, Dhoni; Husodo, Ibnu | |
| Successful Installation of Indonesia's First Dual ESP System for Dewatering Applications | 433 |
| Sartz, Lotta; Bäckström, Mattias | |
| Mesocosm Experiments Performed in 1975, 1993 and 2017 to Determine Changes in Release Rates of Zinc from Sediments Affected by an Old Mining Operation | 439 |
| Saxby, Tim; Buckley, Sarah | |
| Central Region Water Resilience Project - Sustaining production in a changing climate | 445 |
| Schmidt, Nadja; Eulenberger, Sven; Jenk, Ulf | |
| Final Flooding of the Königstein Uranium Mine – Supporting Activities and Implications for Monitoring | 453 |
| Shabalala, Ayanda Nomaswazi | |
| Comparative Study Of Leaching of Metals From Pervious Concrete Incorporating Coal Fly Ash And Ground-granulated Blast-furnace Slag | 459 |
| Simcock, Robyn | |
| Mediating Risk of Acid Generation – The Roles of Vegetation Direct Transfer | 467 |
| Sinclair, Eden; Weber, Paul | |
| Managing Legacy AMD to Achive Sucessful Mine Closure | 469 |
| Stanley, Peter Clive; Thorn, Peter; Williams, Tom; Siddorn, Louise; Cook Dave | ce, |
| A River System Approach to Mine Water Mitigation and Management | 483 |
| Szczepiński, Jacek | |
| Impact of Dewatering of the Planned Lignite Open Pit in Poland on the Water Environment on the Basis of Groundwater Flow Model | 491 |
| Todd, Aaron Martin Lawrence; Robertson, Iain; Walsh, Rory P.D.; Byrne Patrick; Edwards, Paul; Williams, Tom |), |
| Using Tracer Injection and Synoptic Sampling, and Salt Dilution Flow to Gauge Metal Fluxes in a Temperate Watershed in the UK | 497 |
| Totsche, Oliver; Kunze, Katja | |
| Rehabilitation of the Lusatian Water Balance, in Consideration of Climate Change and the End of Lignite Mining | 503 |

| Trumm, Dave; Moynihan, Eamon; Young, Jill; Pope, James | |
|--|------|
| Passive Treatment Of AMD Using a Full-Scale Upflow Mussel Shell Reactor, Echo Coal Mine, New Zealand | 511 |
| Tuck, Jeff; Hayton, Stephanie; Hartwell, Sioban | |
| Predictive Water Balance and Mass Load Modelling for Mine Water Through a Passive Treatment System | 517 |
| Tuheteru, Edy Jamal; Kusuma, Ginting Jalu; Gautama, Rudy Sayoga; Pranoto, Kris; Palinggi, Josef | |
| Comparison of Pit Wall Leaching Test in the Field and Laboratory | 519 |
| Vadapalli, Viswanath Ravi Kumar; Coetzee, Henk; Gcasamba, Sisanda; Ramasenya, Koena; Ntholi, Thakane; Nyale, Sammy; Sinthumule, Etl Morokane, Molefe | nel; |
| Integrated and Sustainable Mine Water Management Solution for Witwatersrand Gold Fields | 529 |
| Vaezihir, Abdorreza; Mahjoubi, Reza; Aghili, Somayeh; Mazaheri, Nader Haji Ahmadi, Morteza | ; |
| The Role of Natural Attenuation in Decrease of Metal Concentration in a River Polluted by AMD Released from Sungun Mine (NW of Iran) | 535 |
| Walter, Stefanie; Mugova, Elke; Wolkersdorfer, Christian | |
| Public Opinion on Mine Water in Three Former German Hard Coal Mining Regions | 541 |
| Walton-Day, Katherine; Gusek, James; Newman, Connor | |
| Opportunities to Improve Water Quality during Abandoned Mine-Tunnel Reclamation | 545 |
| Wang, Jiaqi; Zhang, Qiang; Wang, Yunbo; Gao, Difa | |
| Detection and Sealing Technology of River-goaf Water Supply Channel and Their Application | 553 |
| | |