Technology Innovation News Survey

Entries for February 16-28, 2023

Market/Commercialization Information

SOURCES SOUGHT ANNOUNCEMENT NO. W9128F23SE002 INDEFINITE DELIVERY/INDEFINITE QUANTITY (IDIQ) FOR ENVIRONMENTAL REMEDIATION SERVICES (ERS), NORTHWESTERN DIVISION AND CUSTOMERS, USACE

U.S. Army Corps of Engineers (USACE), Omaha District, Omaha, NE
Contract Opportunities on SAM.gov, Solicitation W9128F23SE002, 2023

This is a sources sought notice for marketing research purposes only. The Omaha District of USACE is seeking information from interested, qualified small businesses and large businesses that can provide services under NAICS code 562910, which has a small business size standard of 750 employees. All qualified, interested, capable firms are highly encouraged to respond to this Sources Sought announcement. The Environmental Remediation Service (ERS) activities required include preliminary assessments, site inspections, remedial investigations, feasibility studies, and site remediation including excavation/removal of contaminated soil, off-site disposal of contaminated soil, and installation of treatment systems. The ERS actions may address both regulated and non-regulated toxic substances and emerging contaminants. As part of any site remediation activities, remedial design and construction may also be included in this anticipated contract. This ERS contract also may support work for hazardous toxic and radioactive waste sites and Military Munitions Response Program sites. Services may include, but are not limited to, the assessment, inspection, investigation, study, control, characterization, containment, removal and/or treatment of environmental contamination from pollutants, toxic substances, perfluorinated compounds, radioactive materials, and hazardous materials. ERS projects include both civilian and military agencies of the Federal Government. This contract for ERS will include services related to requirements of RCRA, CERCLA, the EPA Emerging Contaminate Program; the National Oil and Hazardous Substances Pollution Contingency Plan, Military Munitions Response Program, the Clean Water Act, the Clean Air Act, National Environmental Policy Act, National Historic Preservation Act, Endangered Species Act and other related Federal Programs in addition to State/Local specific regulations/requirements dealing with hazardous waste management/disposal, radioactive waste/mixed waste management/disposal, and with Underground Storage Tanks, and other fuels related issues. Responses to this sources sought notice are due by 5:00 PM CDT on April 17, 2023. https://sam.gov/opp/ddf848eec8054e528eb90e001a29b9e1/view

FORMER HARSHAW CHEMICAL SITE REMEDIATION (FUSRAP)

U.S. Army Corps of Engineers, Buffalo District, Buffalo, NY
Contract Opportunities on SAM.gov, Solicitation W912P423R0019, 2023

This is a total small business set-aside under NAICS code 562910. The U.S. Army Corps of Engineers, Buffalo District, requires the remediation of the Harshaw FUSRAP Site in Cleveland, Ohio. Contaminants of concern are characterized as low-activity radioactive waste or low-activity comingled waste. Impacted soils will be excavated to achieve cleanup goals for recreational use. Expertise is required in the following areas: environmental remediation; health physics monitoring and worker safety; installation, operation and maintenance of air monitoring systems; environmental laboratory operations; water treatment system operation and maintenance; database programming and maintenance; waste classification, manifesting and shipping; and hazardous material surveys. The award will be a three-year Type C contract. Offers are due by 3:00 PM EDT on May 1, 2023. https://sam.gov/opp/210caf86ed4249ae838bf6b2e2d2a6f/view

OPTIMIZED REMEDIATION CONTRACT (ORC), KIRTLAND AIR FORCE BASE, NEW MEXICO (SOL)

U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, NM
Contract Opportunities on SAM.gov, Solicitation W912PP23R0017, 2023

This is a full and open competition under NAICS code 562910. The U.S. Army Corps of Engineers, Albuquerque District, requires a contractor to conduct environmental remediation activities at Kirtland Air Force Base in New Mexico. This work will be conducted under an Optimized Remediation Contract utilizing Performance Objectives. The Contractor shall undertake Environmental Remediation activities to achieve Performance Objectives at ten Installation Restoration Program sites and six Military Munitions Response Program sites. The range of activities includes maintenance of established remedies, optimization at applicable sites, and achievement of site-specific Performance Objectives, including but not limited to Decision Documents, Response Complete, and Site Closeout. Remediation activities at KAFB are being conducted pursuant to CERCLA, as amended by the SARA, and RCRA requirements. Regulatory oversight is provided by EPA Region 6 and the New Mexico Environment Department Hazardous Waste Bureau. The Contractor will be responsible for fully executing the Firm-Fixed-Price (FFP) approach under a Performance-Based Acquisition by conducting required investigation and environmental remediation services, which includes addressing soil and water contamination, scheduling, and regulatory issues arising under the contract, and satisfactorily achieving the contracts performance objectives. Offers are due by 2:00 PM MDT on May 9, 2023. https://sam.gov/opp/94d8687aa0224e5edb9a17755f7171174/view

Cleanup News

MINE LAND RECLAMATION, MINE LAND REUSE, AND VEGETATION COVER CHANGE: AN INTRIGUING CASE STUDY IN DARTFORD, THE UNITED KINGDOM

Yu, H., I. Zahidi, and D. Liang. I Environmental Research 225:115613(2023)

Several companies collaborated under the guidance of the local authorities to reclaim abandoned mine land in Dartford, England, and develop it into housing, known as the Ebbsfleet Garden City project. The project is highly innovative as it not only focuses on environmental management but also provides potential economic benefits and employment opportunities, builds a sustainable and interconnected community, fosters urban development, and brings people closer together. The project employs satellite imagery, statistical data, and Fractional Vegetation Cover calculations to analyze the Dartford revegetation progress and the Ebbsfleet Garden City development. Results indicate that Dartford has successfully reclaimed and revegetated the mine land, maintaining a high vegetation cover level, while the Ebbsfleet Garden City project has advanced*This article is* ***Open Access a***https://www.sciencedirect.com/science/article/abs/pii/S0013935123004052?via%3Dihub

SWASTIKA MINE AND DUTCHMAN CANYON MAINTENANCE AND STREAM RESTORATION PROJECT

Maestas, Y. I The 43rd Annual Conference of the National Association of Abandoned Mine Land Programs, 16-20 October, Grand Junction, CO, abstract only, 2022

The Swastika Mine and Dutchman Canyon Maintenance and Stream Restoration Project in Raton, NM, near an abandoned coal mine and community where two streams converge, was damaged by flooding from an extreme rain event in 2013. A stream at the base of the previously reclaimed landforms was eroding rapidly and cutting into banks, and the gullies in the uplands were getting steeper and more incised after minor storm events. The goals of the geomorphic reclamation design were to restore functional drainage to the landscape and create stable landforms from the coal waste material that could be successfully revegetated and would blend into the surrounding topography. Maintenance activity and post-maintenance reclamation were documented with video, time-lapse cameras, wildlife cameras, and UAS flights. *See project nomination for more information:* https://www.emnrd.nm.gov/mmd/wp-content/uploads/sites/5/DutchmanSwastikaOSMREnomination-2021.pdf

RESTORATION SUCCESS IN FORMER AMAZONIAN MINES IS DRIVEN BY SOIL AMENDMENT AND FOREST PROXIMITY

Konig, L.A., J.A. Medina-Vega, Regina M. Longo, Pieter A. Zuidema and Catarina C. Jakovac.
Philosophical Transactions Of the Royal Society B, 378(1867): 20210086(2022)

The influence of ecological factors (restoration age, soil properties, and surrounding forest area) and management factors (diversity and density of planted species and mine zone) were investigated on the recovery rate of forest structure and tree diversity in 40 post-mining restoration areas in Southern Amazonia, Brazil. The investigation used a 9-year annual monitoring dataset consisting of over 25,000 trees. Recovery of forest structure was closely associated with interactions between soil quality and the planted tree communities; tree diversity recovery was positively associated with the extent of surrounding forests. Forest structure and diversity recover more slowly in mine tailings than in pit surroundings. The study confirms the complexity of mine land restoration but reveals that planting design and soil improvement can increase restoration success. For resource-efficient mine restoration, it is recommended to focus efforts on tailings, which are hardest to restore, and reduce efforts in pit surroundings and areas close to the surrounding forest because of their potential for restoration by natural regeneration. https://royalsocietypublishing.org/doi/epdf/10.1098/rstb.2021.0086

A DESIGN & BUILD ACTIVE TREATMENT PLANT FOR THE GLOBE MINE HIGH STRENGTH MINE DRAINAGE

Dietz, J. I West Virginia Mine Drainage Task Force Symposium, 4-5 October, Morgantown, WV, 31 slides, 2022

The Globe Mine, located on the hillslope of the Ohio River near Newell, WV, is a closed refractory clay mine with two slope mine discharges (Mine 1 and Mine 2). Mine waters are low pH, high acidity (6,000 to 8,000 mg/L), and contain high concentrations of dissolved Fe (2,000 to 4,000 mg/L) and Al (to 300 mg/L). The mine water poses several treatment challenges, including neutralization demand, solids production, and coprecipitation of gypsum. A temporary treatment was installed to address the mine water chemistry; treatment changed over time in response to operational problems and the high treatment cost. A permanent treatment plant was constructed that included: 1) modifications and improvements to the two mine entry pump systems: 2) an aboveground storage tank where mine discharges are pumped and from which raw water is pumped to the treatment plant; 3) a permanent lime slurry storage tank; 4) a pH controlled lime slurry feed system; 5) a reactor system that dissolves the lime and oxidizes the ferrous iron in the mine water to produce a high-density sludge; 6) a flocculation system with polymer addition to forming a settleable solid; 7) a lamella clarifier to separate suspended solids from the water and collect settled sludge; 8) a sludge holding tank to store collected sludge; 9) a plate and frame filter press to dewater collected sludge for offsite transport and disposal; and 10) a control system containing remote cellular-based monitoring and alarms for the various treatment plant components. The presentation describes the treatment approach and treatment plant components.
https://wvmdtaskforce.files.wordpress.com/2022/10/2022-8-dietz-wvamd2022_jet_globe_220924.pdf

Demonstrations / Feasibility Studies

PASSIVE MULTI-UNIT FIELD-PILOT FOR ACID MINE DRAINAGE REMEDIATION: PERFORMANCE AND ENVIRONMENTAL ASSESSMENT OF POST-TREATMENT SOLID WASTE

Vasquez, Y., C.M. Neculita, G. Caicedo, J. Cubillos, J. Franco, M. Vasquez, A. Hernandez, and F. Roldan. I Chemosphere 291(Part 3):133051(2022)

The performance of a passive multi-unit field pilot that operated for 16 months to treat acid mine drainage (AMD) from a Colombia Andean Paramo coal mine was evaluated. The pilot combined a pre-treatment unit (550 L) filled with a dispersed alkaline substrate and six passive biochemical reactors (PBRs; 220 L) under open (PBRs-A) and closed (PBRs-B) configurations to the atmosphere. The AMD quality was 1200 ± 91 mg/L Fe, 38.0 ± 1.3 mg/L Mn, 8.5 ± 1.6 mg/L Zn, and 3200 ± 183.8 mg/L SO_4^{2-}, at pH 2.8. The input and output effluents were monitored to establish AMD remediation. The study also assessed physicochemical stability of the post-treatment solids, including metals (Fe^{2+}, Zn^{2+}, and Mn^{2+}) and sulfates for environmental contamination from reactive mixture post-treatment. The system achieved a total removal of 74% SO_4^{2-}, 63% Fe^{2+}, and 48% Mn^{2+} with the line of PBRs-A, and 91% SO_4^{2-}, 80% Fe^{2+}, and 66% Mn^{2+} with the line of PBRs-B, as well as 99% removal for Zn^{2+}, without significant differences ($p < 0.05$) between the two lines. Post-treatment solids could produce acidic leachates capable of releasing large quantities of Fe and Mn if disposed of in oxidizing conditions; contact with water or any other leaching solutions must be avoided.

MINE ROCK STOCKPILE RECLAMATION TRIAL, DETOUR LAKE MINE: DESIGN, CONSTRUCTION, AND LESSONS LEARNED

Cash, A.E., C.A. Mendoza, J. Straker, V. Raizman, K. Lyle, and G. McKenna.
British Columbia Mine Reclamation Symposium, 19-22 September, Kimberly, BC, 13 pp, 2022

A large-scale (10 ha) Test Cover Trial on waste rock stockpiles during the early stages of mining is being designed, established, monitored, and evaluated at Detour Lake Mine. Results will be used to develop guidance for beneficial strategies for landform design and progressive reclamation. The design included 13 cover trial treatments with varying characteristics to consider geotechnical aspects (i.e., constructability, stability, erodibility), ecological aspects (i.e., plant and root development, habitat development), and hydrological aspects (i.e., partitioning water between evapotranspiration, surface runoff, net percolation). The available cover materials were silt rich with variable amounts of peat. Design variables for the trial included ranges in waste rock slope angles, reclamation cover thickness, composition, surface grading, and revegetation treatments to accommodate the unique and challenging properties of these materials. Design modifications were required during construction to accommodate operational challenges and site conditions. Modifications were also necessary to decrease cover density, account for minimal to variable peat content, and compensate for reduced planting densities while maintaining the design intent. Insights into operational-scale construction methods and techniques gained throughout the construction process are being applied to ongoing progressive reclamation at the mine. Monitoring results are described in a companion paper. https://open.library.ubc.ca/media/stream/pdf/59367/1.0421800/9
Companion paper: https://open.library.ubc.ca/media/stream/pdf/59367/1.0421800/5

A NOVEL PHOTOCATALYTIC APPROACH TO PASSIVE MINE WATER TREATMENT

Martin, J., Z. Young, T. Leshuk, T. Chai, and F, Gu.
Proceedings of Mine Water Solution, 14-16 June, Vancouver, Canada, 2022

SolarPass is a novel buoyant photocatalytic treatment system for the passive advanced oxidation of dissolved contaminants that naturally forms a floating reactive barrier and intercepts and treats volatile emissions. The system can be deployed and recovered in situ for off-grid, high-strength oxidative treatment of recalcitrant mining contaminants without the use of chemical or electrical inputs. SolarPass can continuously operate without gas handling, operator intervention, or adsorbent regeneration/disposal. Previous bench-scale research has validated this floating solar-photocatalytic process for recalcitrant naphthenic acids treatment in mining process-affected water. Photocatalysis has also been successfully demonstrated to treat mining wastewater and tailings applications targeting ammonia, cyanide, and selenium. The efficacy of the SolarPass system was further validated at bench scale (1 L) to treat organoselenium and at pilot scale (500 L) to treat and mitigate reduced sulfur emissions from a mining tailings pond containing anaerobic sludge. *See* ***pages 265-269:*** https://www.miteconferences.com/files/ProceedingsofMineWaterSolutions2022.pdf

BIOLOGICAL TREATMENT OF URANIUM AT THE HISTORICAL SCHWARTZWALDER MINE, COLORADO, USA

Gault, A.G., J.M. Harrington, E. Busby, R,M. Kleinberger, R. Martz, and V.P.M. Friesen.
Proceedings of Mine Water Solution, 14-16 June, Vancouver, Canada, 2022

The Schwartzwalder mine was dewatered to prevent seepage into Ralston Creek, as the mine water contained U levels up to 26 mg/L. Biological in situ treatment of the flooded mine workings (mine pool) involved injecting soluble organic carbon into the mine pool, creating strong reducing conditions, resulting in 80-90% U removal in situ. Before discharge to Ralston Creek, the pre-treated mine pool water is pumped to an ex situ reverse osmosis and ion exchange system. Although discharged water meets local water quality guidelines (< 0.03 mg/L), continued active water treatment is not sustainable for site closure. Pilot-scale trials for semi-passive and passive biological U treatment via bioreactors and constructed wetland treatment systems (CWTS) evaluated alternative long-term water treatment options to achieve reclamation targets without perpetual active treatment. Bioreactors supplemented with synthetic iron sulfide and ethanol, or ethanol and elevated phosphate, demonstrated ~83% and 96% dissolved U removal, respectively. Microbial community profiling of the bioreactor substrate identified a significant fraction of the bacteria population comprised of genera with known U- and sulfate-reducing functionality. Bulrush and water sedge plant species were tested in CWTS pilots for their ability to foster conditions to sequester U from mine discharge water. Bulrush and water sedge systems treated U to 0.6 to 4.2 mg/L (93 to 29% removal) and 0.01 to 0.5 mg/L (>99% to 93% removal), respectively, depending on the hydraulic residence time (HRT) of the CWTS. Water sedge systems treated to lower U concentrations than bulrush, including at a relatively short 5-day HRT. https://www.miteconferences.com/blueprint/wp-content/uploads/2022/07/29-Jim-Harrington-Andrew-Gault-Biological-treatment-of-Uranium-at-the-Historical-Schwarzwalder-Mine-.pdf

Top of Page

Research **INTEGRATED ASSESSMENT OF CHEMICAL AND BIOLOGICAL RECOVERY AFTER DIVERSION AND TREATMENT OF ACID MINE DRAINAGE IN A ROCKY MOUNTAIN STREAM**

Kotalik, C.J., J.S. Meyer, P. Cadmus, J.F. Ranville, and W.H. Clements.
Environmental Toxicology and Chemistry 42(2):512-524(2023)

Construction of a water treatment plant on the North Fork of Clear Creek (NFCC) Superfund site captured, diverted, and treated the two major point-source inputs of acid mine drainage (AMD) and provided an opportunity to investigate immediate water quality improvements in water quality. A 9-year study included intensive within- and among-year monitoring of receiving-stream chemistry and benthic communities before and after construction of the treatment plant. Results showed a 64%-86% decrease in metal concentrations within months at the most contaminated sites. Benthic communities responded with increased abundance and diversity, but downstream stations remained impaired relative to reference conditions, with significantly lower taxonomic richness represented by a few dominant taxa (*Baetis* sp., *Hydropsyche* sp., *Simulium* sp., *Orthocladiinae*). Elevated metal concentrations from apparent residual sources and relatively high conductivity from contributing major ions not removed during treatment likely limited downstream recovery. The study demonstrates that direct AMD treatment can rapidly improve water quality and benefit aquatic life, but effectiveness is limited, in part, to the extent that inputs of metals are captured and treated. The effects of elevated major ion concentrations from the treated effluent not removed during the lime treatment process should also be considered. Continued chemical and biological monitoring will be needed to quantify the recovery trajectory and to inform future remediation strategies.

ENHANCED REMEDIATION OF CD-CONTAMINATED SOIL USING ELECTROKINETIC ASSISTED BY PERMEABLE REACTIVE BARRIER WITH LANTHANUM-BASED BIOCHAR COMPOSITE FILLING MATERIALS

Li, S., Y. Wu, X. Li, Q. Liu, H. Li, W. Tu, X. Luo, and Y. Luo.
Environmental Technology [Published online 4 March 2022 before print]

Biochar and a novel lanthanum-based biochar composite (LaC) were synthesized from the malignant invasive plant *Eupatorium adenophorum* and used as inexpensive and environmentally benign permeable reactive barrier (PRB) filling material. The PRB was combined with electrokinetic remediation (EK) to remediate simulated and actual Cd-contaminated soil. During remediation, pH and residual Cd concentration in the simulated contaminated soil gradually increased from the anode to the cathode used to apply an electric field

to the EK-PRB system. However, the soil conductivity changed in the opposite way; current density first increased and then decreased. For simulated contaminated soils with initial Cd concentrations of 34.9 and 100.6 mg/kg, the mean Cd removal rates achieved using LaC were 90.6% and 89.3%, respectively, significantly higher than those of biochar (P

CO-REMEDIATION OF ACID MINE DRAINAGE AND INDUSTRIAL EFFLUENT USING PASSIVE PERMEABLE REACTIVE BARRIER PRE-TREATMENT AND ACTIVE CO-BIOREMEDIATION

Thisani, S.K., D.V. Von Kallon, and P. Byrne. I Minerals 12:565(2022)

A study evaluated the performance of an active-passive process comprised of passive permeable reactive barrier acid mine drainage (AMD) pre-treatment and active anaerobic digestion AMD treatment using effluent as a carbon source. The bioreactor was operated for 24 days with peak chemical oxygen demand (COD) and sulfate loading rates of 6.6 kg COD/m^3/day and 0.89 kg SO_4^{2-}/m^3/day, respectively. The AMD pre-treatment removed 99% of Fe, 94% of K, and 42% of Al concentrations. Biological treatment removed 89.7% of COD and 99% of sulfate concentrations. Cu, SO_4^{2-}, and pH in treated wastewater were within South Africa's effluent discharge limits and potable water standards. Fe, Al, Mn, Ni, and Zn concentrations in the treated wastewater were marginally higher than the discharge and potable water limit, with all concentrations exceeding the limit by less than 0.65 mg/L. The remediation performance of the process was effective with limited operational inputs, which can enable low-cost co-remediation. *This article is* ***Open Access*** *at* https://www.mdpi.com/2075-163X/12/5/565/htm

ANALYSIS OF THE DEVELOPMENT AND EFFECTS OF A COMBINED TREATMENT SYSTEM FOR ACID MINE DRAINAGE VIA BIO-OXIDATION AND CARBONATE ROCK NEUTRALIZATION

An, L., R. Zhang, N. Wang, P. Wu, S. Wang, Z. Han, Y. Zhang, Y. Fu, and Y. Zhang.
Environmental Science: Water Research & Technology 2(9):642-653(2023)

A novel treatment system for AMD combining bio-oxidation and carbonate rocks before the neutralization phase was proposed. The system is based on biofilm formation on the surface of an elastic filler by iron-oxidizing bacteria. Fe^{2+} oxidation efficiency and total iron (TFe) removal efficiency reached 40.18-55.00% and 5.86-17.39% (during Fe^{2+} oxidation without carbonate rocks) as well as 39.09-52.64% and 25.09–47.33% (during Fe^{2+} oxidation with carbonate rocks), respectively. The corresponding control group values (single carbonate neutralization) were 24.22-34.73% and 12.31-30.14%, respectively. The X-ray diffractometry and scanning electron microscopy results showed that carbonate rock addition in the oxidation section regulated the acidic environment and provided favorable conditions for schwertmannite formation. The schwertmannite provided ideal attachment conditions for bacteria. High-throughput sequencing revealed that *Acidithiobacillus* and *Leptospirillum* dominated the biological oxidation stage, accounting for > 75% of bacteria. The study showed that *Acidithiobacillus* and *Leptospirillum* could co-exist in passive processing systems as the dominating flora. Results can be used as a basic data reference to develop a process and method for combined AMD treatment by biological oxidation and carbonate rock neutralization.

IMMOBILIZATION OF METAL(LOID)S FROM ACID MINE DRAINAGE BY BIOLOGICAL SOIL CRUSTS THROUGH BIOMINERALIZATION

Kuang, X., L. Peng, S. Chen, C. Peng, and H. Song.
Journal of Hazardous Materials 443(Part B):130314(2023)

A study found that biological soil crusts (BSCs) have a high metal(loid)s accumulation ability and can survive in a strongly acidic environment (pH = 3.28). The algae of genera *Fragilaria*, *Klebsormidium*, *Cymbella*, *Melosira*, *Microcystacea*, and *Planctonema* were the main components of BSCs. These organisms regulated fatty acids and produced acid-resistant enzymes in the BSCs. The bioconcentration factors for As, Cd, Pb, Zn, and Cu were as high as 16,000, 200, 50, 26, and 400, respectively. Concentrations of metal(loids)s in acid mine drainage decreased from 7.1 μg to 1.9 μg (As) and 350 μg/L to 110 μg/L (Cd). In total, 56% of As, 79% of Cd, 88% of Pb, 85% of Zn, and 92% of Cu were present in BSCs as residual or mineral-bound forms. XRD, SEM, and correlation results show that these metal(loid)s are immobilized by *Cymbella* (diatoms) during silica deposition in the acidic environment, in addition to potential adsorption and co-precipitation.

DEVELOPMENT OF A NOVEL SIZING APPROACH FOR PASSIVE MINE WATER TREATMENT SYSTEMS BASED ON FERRIC IRON SEDIMENTATION KINETICS

Opitz, J., M. Bauer, M. Alte, and S. Peiffer. I Water Research 233:119770(2023)

A study evaluated Fe removal performance of a pilot-scale passive system operating in three identical, parallel lines to treat mining-influenced, ferruginous seepage water. The study determined and parameterized a robust, application-orientated model approach to size settling ponds and surface-flow wetlands. By systematically varying flow rates (and thus residence time), it was demonstrated that the sedimentation-driven removal of particulate hydrous ferric oxides in settling ponds might be approximated by a simplified first-order approach at low to moderate Fe levels. The first-order coefficient was found in the order of 2.1(±0.7) × 10 $^{-2}$ $^{-1}$, which corresponds well with previous lab studies. The sedimentation kinetics may be combined with the preceding Fe(II) oxidation kinetics to estimate the required residence time for pre-treatment of ferruginous mine water in settling ponds. In contrast, Fe removal in surface-flow wetlands is more complex due to the phytologic component; therefore, the study parameterized the underlying concentration dependency for polishing of pre-treated mine water. The quantitative results provide a novel, conservative approach for customized sizing of settling ponds and wetlands in integrated passive mine water treatment systems

Top of Page

General News **"PHREEQ-N-AMDTREAT+REYS" WATER-QUALITY MODELING TOOLS TO EVALUATE ACID MINE DRAINAGE TREATMENT STRATEGIES FOR RECOVERY OF RARE-EARTH ELEMENTS**
Cravotta III, C.A. I West Virginia Mine Drainage Task Force Symposium, 4-5 October, Morgantown, WV, 28 slides, 2022

The PHREEQ-N-AMDTreat+REYs water-quality modeling tools can simulate aqueous chemical reactions and predict metal-rich solid formation during acid mine drainage (AMD) treatment. The new user-friendly, publicly available tools were expanded from the PHREEQ-N-AMDTreat tools to include the precipitation of rare earth elements plus yttrium (REYs) and REY adsorption onto hydrous Fe, Al, and Mn oxides. The toolset consists of a caustic titration model that indicates equilibrium surface and aqueous speciation of REYs as functions of pH and caustic agent and a kinetics+adsorption model that simulates progressive changes in pH, major ions, and REYs in water and solids during sequential steps through passive and/or active treatment. A goal of the modeling is to identify strategies that can produce a concentrated REYs extract from AMD or mine waste leachate. Each model has a user interface that facilitates the input of water-quality data and adjustment to geochemical or treatment system variables (i.e., retention time and aeration rate). On-screen graphs display results of changes in metals and associated solute concentrations as functions of pH or retention time. Preliminary modeling shows that Fe and Al can be removed at pH ***Slides:*** https://wvmdtaskforce.files.wordpress.com/2022/10/2022-10-cravotta_revised-phreen-n-amdtreatreys_wvmdtf22-2.pdf
Paper: https://wvmdtaskforce.files.wordpress.com/2022/10/2022-10a-cravotta-paper-amdtreat-rees-2022.pdf

MINE WATER TREATMENT – ACTIVE AND PASSIVE METHODS

Wolkersdorfer, C. Springer Berlin, Heidelberg. ISBN 978-3-662-65770-6, 328 pp, 2022

This book provides the basics of mine water treatment and includes information on correct sampling for planning purposes and active and passive purification systems. Respective chapters cover the most important techniques about the parameters to be measured (e.g., on-site parameters, flow rate) and which methods are available to actively (e.g. high-density sludge method, reverse osmosis, ion exchange) and passively treat mine water (e.g., constructed wetlands, vertical flow reactor, limestone channel). It also provides insight into the use of mine water.

CHALLENGES AND AVENUES FOR ACID MINE DRAINAGE TREATMENT, BENEFICIATION, AND VALORISATION IN CIRCULAR ECONOMY: A REVIEW

Masindi, V., S. Foteinis, P. Renforth, J. Ndiritu, J.P. Maree, M. Tekere, and E. Chatzisymeon.
Ecological Engineering 183:106740(2022)

This article reviews the body of knowledge on acid mine drainage (AMD) treatment, beneficiation (metals/minerals recovery), valorization (water reclamation), and life cycle assessment, with a focus placed on circular economy. It also provides future research direction to introduce reuse, recycle, and resource recovery paradigms in wastewater treatment and to inspire innovation in valorizing AMD. Overall, AMD beneficiation and valorization appear promising since the reclaimed water and the recovered minerals/metals may offset treatment costs and environmental impacts. However, the main challenges include high cost, complexity, co-contamination in the recovered minerals, and the generation of a highly heterogeneous and mineralized sludge.

RESOURCE UTILIZATION OF ACID MINE DRAINAGE (AMD): A REVIEW

Yuan, J., Z. Ding, Y. Bi, J. Li, S. Wen, and S. Bai. I Water 14(15):2385(2022)

This review provides updated information on sustainable treatments engaged in the literature on the resource utilization of AMD. The recovery and reuse of valuable resources (e.g., clean water, sulfuric acid, and metal ions) from AMD can offset the cost of AMD remediation. Iron oxide particles recovered from AMD can be applied as adsorbents to remove pollutants from wastewater and fabricate effective catalysts for heterogeneous Fenton reactions. Applying AMD in beneficiation fields, such as activating pyrite and chalcopyrite flotation, regulating pulp pH, and leaching copper-bearing waste rock, provides easy access to innovative AMD utilization. The review will help researchers understand the progress in research and identify the strengths and weaknesses of each treatment technology, which may help shape the direction of future research in this area. *This article is* ***Open Access*** *at* https://www.mdpi.com/2073-4441/14/15/2385

Top of Page

The Technology Innovation News Survey welcomes your comments and suggestions, as well as information about errors for correction. Please contact Michael Adam of the U.S. EPA Office of Superfund Remediation and Technology Innovation at adam.michael@epa.gov or (703) 603-9915 with any comments, suggestions, or corrections.

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