Technology Innovation News Survey

Entries for August 16-31, 2020

Market/Commercialization Information

RED DEVIL MINE BASELINE MONITORING

Bureau of Land Management (BLM), Alaska State Office, Anchorage, Alaska.
Contract Opportunities at Beta.SAM, Solicitation 140L6320R0005, 2020

This RFQ is a total small business set-aside under NAICS code 541620. The Government anticipates award of a single firm-fixed-price contract but may award multiple contracts if more advantageous to the government. BLM is conducting response actions at the Red Devil Mine, once the leading mercury producer (mine and retort) in southwest Alaska. Large volumes of tailings adjacent to Red Devil Creek are the primary contaminant source of arsenic, mercury and antimony in the site groundwater. The project is being conducted under CERCLA, and the RI/FS phase of the process is complete. The scope of work describes baseline monitoring activities to be performed in 2021 with an option to conduct monitoring in 2022. Offers are due by 5:00 PM ET on October 30, 2020. https://beta.sam.gov/opp/d9c72aaff894404bb9a573ae4abf959b/view

WETLANDS AQUATIC RESOURCES TECHNICAL SUPPORT

U.S. Environmental Protection Agency (EPA), Cincinnati, OH.
Contract Opportunities at Beta.SAM, Solicitation 68HERC20R0041, 2020

This RFP is a total small business set-aside under NAICS code 541620. EPA is seeking technical expertise for the review of proposed activities that require authorization under CWA section 404. Common activities under review include mineral and coal mines and facilities, transportation infrastructure development, and residential and commercial developments. Based on the circumstances of the proposed project and impacts, review of these projects may focus on identification of jurisdictional waters on site; direct impacts to aquatic resources; effects on the physical, chemical, and biological integrity of downstream waters; and/or secondary and cumulative environmental impacts. To support project-specific and general policy reviews, EPA is seeking technical assessments of site hydrology, construction, development, mine design and operation, wastewater treatment practices, compensatory mitigation practices, and watershed condition and projected change in condition. EPA is also seeking site assessment expertise for field investigation and reporting for aquatic resource mapping, structural and functional characteristics, and relationships to other waters and ecological resources. Go to FedConnect for details at https://www.fedconnect.net/FedConnect/?doc=68HERC20R0041&agency=EPA. Offers are due by 4:30 PM ET on October 14, 2020. https://beta.sam.gov/opp/3fb78ec5d7cd4deca2e1ecf1986cedd5/view

ENVIRONMENTAL CONSULTATION FOR THE LAKE ROOSEVELT NATIONAL RECREATION AREA

Department of the Interior, National Park Service, Port Angeles, WA.
Contract Opportunities at Beta.SAM, Solicitation 140P8320Q0003, 2020

This RFQ is a total small business set-aside under NAICS code 541620, size standard $16.5M. Work performed under this contract will support National Park Service (NPS) involvement in a CERCLA site in the Upper Columbia River that includes the Lake Roosevelt National Recreation Area. Contractor will support efforts to complete remedial investigation/ feasibility studies, natural resource damage assessment and restoration efforts, and other environmental compliance-related resource management projects. The contract may include tasks related to planning and logistical support of environmental sampling, data management, and laboratory analysis followed by data interpretation; tasks related to development of conceptual remediation and restoration designs based on site information and research in coordination with NPS staff; and other environmental compliance tasks that do not involve the CERCLA site. The Government intends to award a single IDIQ task-order type contract with a total capacity of $4M over a planned duration of a base year and four option years. Offers are due by 5:00 PM PT on October 21, 2020. https://beta.sam.gov/opp/d6ebc3a5723d41309ed35f7df53e9fdc/view

ENVIRONMENTAL SERVICES MULTIPLE-AWARD TASK-ORDER CONTRACT

U.S. Army Corps of Engineers (USACE), Detroit District, MI.
Contract Opportunities at Beta.SAM, Solicitation W911XK20R0009, 2020

This RFP is 100% set-aside for small businesses under NAICS code 541620, size standard $15M. The USACE Detroit District seeks contractors with the capability to provide environmental services for sampling, assessment, and analytical services under the Environmental Services multiple-award task-order contract. The Government intends to award three firm-fixed price IDIQ contracts for environmental services with an overall contract value of $7M. Each contract will include a five-year ordering period for individual task orders used for environmental sampling, assessment, and analysis within the boundaries of the USACE Detroit District. Task orders require contractors to provide sampling and analytical services for the characterization of soils, sediments, sludges, groundwaters, surface waters, tissues, oils, wastes, and other environmental sample types. Typical projects involve conducting sampling operations and analyzing samples collected at field sites to determine contaminant concentrations. Offers are due by 2:00 PM ET on October 23, 2020. https://beta.sam.gov/opp/36d386e4cfc54e43a65f5db7f420706d/view

CONSTRUCTION OF ENERGETIC WASTE INCINERATOR AND CONTAMINATED WASTE PROCESSOR (EWI/CWP)

U.S. Army Corps of Engineers (USACE), Norfolk District, VA.
Contract Opportunities at Beta.SAM, Solicitation W91236-20-R-4000, 2020

This acquisition is solicited as an unrestricted procurement under NAICS code 236210 for a firm-fixed-price contract for design-build construction of a new Energetic Waste Incinerator/ Contaminated Waste Processor (EWI/CWP) at the Radford Army Ammunition Plant (RFAAP) in Radford, VA. Magnitude of construction is estimated to fall between $100M and $250M. RFAAP, a Government-owned, contractor-operated energetic materials manufacturing facility, is the only domestic source of nitrocellulose (NC) propellants used in the manufacture of ammunition and missiles. NC propellant manufacturing processes generate multiple types of energetic waste for treatment on site. The EWI/CWP will be constructed to replace the current aged EWI facilities, relocate the waste treatment and decontamination activities into one centralized facility, and reduce/eliminate open burning conducted at RFAAP. Site layout has already been determined. No demolition is required for this project, and a timber harvest has already been completed. Offers are due by 2:00 PM ET on October 26, 2020. After receiving notice to proceed, Contractor shall begin performance within 10 calendar days and complete it within 710 calendar days. https://beta.sam.gov/opp/eaf70337646a4aef95ab45490789ed58/view

Cleanup News

PERFORMANCE OF A GEOSYNTHETIC-CLAY-LINER COVER SYSTEM AT A CU/ZN MINE TAILINGS IMPOUNDMENT

Pakostova, E., A.J. Schmall, S.P. Holland, H. White, C.J. Ptacek, and D.W. Blowes.
Applied and Environmental Microbiology 86(8):e02846-19(2020)

A geosynthetic clay liner (GCL) cover system was installed on a high-sulfur tailings impoundment at the abandoned Kam Kotia Mine in 2008 to isolate acid-generating tailings from water and oxygen and mitigate sulfide oxidation. The cover system includes a vegetated soil layer underlain by a sand layer, a clay moisture-retaining layer, GCL, cushion sand, and a crushed waste rock-capillary break layer installed above the tailings. The microbiology of the covered tailings was characterized by extracting and analyzing total genomic DNA to

assess the cover system's performance for mitigating sulfide biooxidation. Low relative abundances and viable counts of microorganisms that catalyze iron and sulfur transformations in the covered tailings, compared to previous studies on unreclaimed tailings, indicate that sulfide oxidation rates have decreased due to the presence of the GCL.

LONG-TERM PERFORMANCE AND COSTS FOR THE ANNA S MINE PASSIVE TREATMENT SYSTEMS

Hedin, R.S. | Mine Water and the Environment 39:345-355(2020)

Acid mine drainage from the Anna S Coal Mine has been treated successfully since 2004 in the Anna and Hunters Drift passive systems, which consist of vertical flow ponds and constructed wetlands. Monitoring data collected over 15 years shows that the systems have effectively treated 1,910 L/min of flow with pH 2.8-3.1 containing 121-330 mg/L acidity, 11-31 mg/L Al, 6-33 mg/L Fe, and 6 mg/L Mn. The systems produce effluents with pH 7.5, 134-140 mg/L alkalinity, <1 mg/L Al, 1 mg/L Fe, 2-3 mg/L Mn, and has never discharged water with <60 mg/L alkalinity. The systems generated a combined 5,600 tonnes of net alkalinity. Over 20 years, the passive systems generate alkalinity at a cost of $1,168/t of CaCO3, which is 50% less than unit costs for lime treatment plants currently operating in Pennsylvania. *For a description of the passive treatment systems, see*
https://www.yumpu.com/en/document/read/39687815/the-anna-s-mine-passive-treatment-complex-springer

INNOVATIONS IN LOW-ENERGY WATER TREATMENT USING GEOTEXTILE DEWATERING SYSTEMS FOR THE REMOVAL OF CHALLENGING ENVIRONMENTAL CONTAMINANTS

Bossy, K. | EnviroTech 2020, 11-12 June, Virtual Event, 2020

Geotextile woven polypropylene bags are being used to prevent environmental impacts at metal leaching/acid rock drainage sites and have been proven to be an effective and economical tool in treating impacted drainage. This presentation highlights case studies of the permanent and long-term use of chemical conditioning and geotextile dewatering bags as a combined system that can be used to adjust pH, precipitate metals, and capture and retain solids. The proposed treatment methodology was demonstrated to be effective through rigorous bench-scale testing before commencing with practical field applications.
https://www.esaa.org/wp-content/uploads/2020/06/ET2020-Bishop.pdfLonger abstract:
https://www.esaa.org/wp-content/uploads/2020/05/Innovations-in-Low-energy-Water-Treatment.pdf
More on the Omega Mine dewatering system:
https://geosyntheticsmagazine.com/2019/10/01/recovery-of-rare-earth-elements-from-acid-mine-drainage-using-geotextile-tubes/

RECLAMATION OF CANMORE CREEK: EXAMPLE OF A SUCCESSFUL WALK AWAY PIT LAKE CLOSURE

Stephenson, H.G. and D. Castendyk.
Mining Engineering 71(8):20-34(2019)

The mining of semi-anthracite coal in the Bow River valley began in 1886 and continued until the Canmore Mines Ltd. closed in 1979. This article discusses Canmore Creek Mine pit lakes' reclamation into sustainable, post-closure resources that are highly valued today by the local community and tourists. The project included stabilizing and revegetating the banks of Claymore Creek using a 50:50 ratio of peat and silt, hydroseeding, and layering mulch to create a microclimate over the seeded soil. In addition, three pit lakes were reclaimed by removing debris, backfilling with mine waste, and constructing dams to create a pond to encourage seed germination and plant growth. In addition, one pit was filled using spring-fed streams to create a lake. A later project on the pit included adding a dam to deepen the lake, hydroseeding, and creating two shallow beach areas.
https://www.golder.com/download/975/news-support-documents/79103/mining-engineering_august-2019-canmore-creek-article.pdf

TAILINGS BASIN RECLAMATION: ATLANTIC CITY IRON MINE, WYOMING

Gusek, J.J. and B.K. Schladweiler. | 36th Annual Meeting of the American Society of Mining & Reclamation, 3-7 June, Big Sky, MT, 65 slides, 2019

A 200-acre capped tailings impoundment at an abandoned taconite operation was a source of blowing dust that caused zero visibility on an adjacent state highway. A project was undertaken to reclaim the tailings and adjacent underclaimed waste rock dumps, railroad fills, and a tailing decant pipeline. The reclamation design included incorporating organic amendments and fertilizers into a 12 in. thick cap, planting trees in the protective wind/snow shadows of rock berms and rock snow fences, lowering the water level in a flooded mine pit that was feeding uncontrolled seeps, and constructing a tailings pond spillway that allows flood control while minimizing seasonal water level fluctuations in the pond. Reclamation was complete in 2001. Google Earth™ imagery from 1994, 2006, 2012, and 2014 and observations during a site tour in 2018 provided the basis of an informal assessment of the site's current status, including which reclamation techniques appeared to work or not, and an educated guess as to how the ecology of the site may continue to evolve.
https://www.asrs.us/Portals/0/Documents/Meetings/2019/PowerPoints/6C_400_Schladweiler.pptx

Demonstrations / Feasibility Studies

IN-SITU REMEDIATION OF ACID MINE DRAINAGE FROM ABANDONED COAL MINE BY FIELD PILOT-SCALE PASSIVE TREATMENT SYSTEM: PERFORMANCE AND RESPONSE OF MICROBIAL COMMUNITIES TO LOW PH AND ELEVATED FE

Chen, H., T. Xiao, Z.Ning, Q. Li, E. Xiao, Y. Liu, Q. Xiao, X. Lan, L. Ma, and F. Lu
Bioresource Technology 317:123985(2020)

The microbial community was analyzed in a field pilot-scale passive treatment system developed for in-situ bioremediation of acid mine drainage (AMD). Results indicated that the system removed 93.7% of total soluble Fe and 99% of soluble Fe(II). A low pH and an elevated Fe concentration within the system created a unique microbial community dominated by acidophilic iron-oxidizing bacteria and iron-reducing bacteria. Species of *Ferrovum*, *Delftia*, *Acinetobacter*, *Metallibacterium*, *Acidibacter*, and *Acidiphilium* were highly enriched, promoting iron removal. Results revealed important data for the biogeochemical coupling of microbial communities and environmental parameters beneficial to apply in-situ field bioreactors to remediate AMD.

DESIGN, CONSTRUCTION AND MONITORING OF PILOT SYSTEMS TO EVALUATE THE EFFECT OF FREEZE-THAW CYCLES ON POLLUTANT RETENTION IN WETLANDS

Heiderscheidt, E. U.A. Khan, K. Kujala, A.-K. Ronkanen, and H. Postila.
Science of The Total Environment 703:134713(2020)

Two replicate pilot peat-based wetlands were used to treat pre-treated gold mine process wastewater collected from a full-scale treatment wetland at a mining site in Northern Finland. The wastewater (pH ~7.8, electric conductivity ~3.6 mS/cm) contained a mix of metals/metalloids (Ar 12 µg/L, Sb 19 µg/L) and sulfate (~2 g/L). The study measured fluctuations in the removal efficiency of target compounds due to freezing and thawing conditions. Removal of sulfate and Ar decreased during frost periods, while removal of Sb increased. Comparisons of seasonal variations in pollutant concentrations in outflow samples from a full-scale wetland and the pilot wetlands suggested that the pilot wetlands simulated the real system well.

OPTIMIZATION OF NANOFILTRATION FOR TREATMENT OF ACID MINE DRAINAGE AND COPPER RECOVERY BY SOLVENT EXTRACTION

Pino, L., E. Beltran, A. Schwarz, M.C. Ruiz, and R. Borquez.
Hydrometallurgy 195:105361(2020)

A pilot-scale study was implemented to evaluate the operational conditions of acid mine drainage (AMD) nanofiltration (NF) to recover water and subsequently recover Cu from a concentrated retentate solution by a solvent extraction (SX) process. NF showed a high Cu concentration capacity (0.6 to 2.4 g/L) and good total rejection of species (~82%). While NF treatment recovered 80% of water, the polarization resistance could limit its performance. A 1.1 g/L Cu retentate solution was selected for use in the SX study to prevent membrane fouling in a possible in-series process (NF-SX). Two countercurrent extraction stages and one stripping stage recovered 97% of Cu. The use of antiscalants and CaSO4 precipitates formed during NF had a negligible effect on SX's copper extraction yield.

PILOT TEST OF THE PERMEABLE REACTIVE BARRIER FOR REMOVING URANIUM FROM THE FLOODED GUNNAR PIT
Kong, D., L. McGilp, A. Klyashtorin, I. Wilson, and L.D. Wilson.
Journal of Geoscience and Environment Protection, 8(7):155-176(2020)

Iron oxide coated sand (IOCS) media was applied in an experimental permeable reactive barrier to remove U species from water at the legacy Gunnar Uranium Mine and Mill Site. The flooded Gunnar mine pit contains about 3.2 million m3 of water contaminated with dissolved U (1.2 mg/L), Ra-226 (0.4 Bq/L), and minor concentrations of other contaminants. The pilot test provided technical data and information needed for designing a full-scale permeable barrier that employs the IOCS media. This approach can be applied for in-situ water treatment at Gunnar and other legacy uranium sites. https://www.scirp.org/pdf/gep_2020072813585759.pdf

STUDY ON THE APPLICATION OF FLOATING BEDS OF MACROPHITES (*VETIVERIA ZIZANIOIDES* AND *PHRAGMITES AUSTRALIS*) IN PILOT SCALE FOR THE REMOVAL OF HEAVY METALS FROM AGUA FORTE STREAM (ALENTEJO-PORTUGAL)
Borralho, T., D. Gago, and A. Almeida.
Journal of Ecological Engineering 21(3):153-163(2020)

The Roxo stream sub-basin's surrounding area has completely sterile sections due to the Agua Forte stream inflow, which has characteristics of acid mining drainage (AMD). A macrophyte floating bed technology (and *Phragmites australis*) was pilot tested to remove heavy metals from the Agua Forte stream over six months in 1 m^3 polyvinyl chloride tanks filled with ~0.8 m^3 of water (renewed monthly). The floating beds consisted of a high-density polyethylene floating system and an organic plant support mat filled with a plant density of 285 plants/m^2. The heavy metal removal rates obtained from the floating bed were Fe=40%; Zn=33%; Cu=23%; Mn=14% (*V. zizanioides*) and Fe=27%; Zn=19%; Mn=17%; Cu=14% (*P. australis*). The growth of macrophytes showed the ability to survive in the AMD-containing waters without severe damage in their external and anatomical morphology, although their growth suffered inhibition. The results suggest that the floating bed technology may be an environmentally sustainable alternative, allowing long-term heavy metal removal. *This article is **Open Access** at*
http://www.jeeng.net/Study-on-the-Application-of-Floating-Beds-of-Macrophites-Vetiveria-zizanioides-and,118285,0,2.html

Research

PHYTOSTABILIZATION OF STORE-AND-RELEASE COVER MADE WITH PHOSPHATE MINE WASTES IN ARID AND SEMIARID CLIMATE USING WILD LOCAL PLANTS
Hamza, Z., H. Rachid, E.A. Mariam, L. Kamal, E. Sara, A.B. Rachid, M. Laila, et al.
Remediation [Published online 1 September 2020 prior to print]

A store-and-release system constructed to limit acid mine drainage generation at the Kettara abandoned mine in Morocco consisted of a cover of phosphate waste rock on top of coarse-grained tailings. A study was conducted to assess the ability of local plants to phytostabilize the cover. Pot experiments were conducted using *Atriplex semibaccata* R. Br., *Peganum harmala* L., *Asparagus horridus* L., *Launaea arborescens* (Batt.) Murb. and *Vicia sativa* L. grown in PW and PW amended with different ratios of compost and commercial peat. Results affirmed *A. semibaccata* R. Br., *V. sativa* L. and *L. arborescens* (Batt.) Murb. as good candidates to phytostabilize the cover.

IDENTIFICATION OF TROPICAL NATIVE HIGH-ACCUMULATING PLANT SPECIES FOR PHYTOREMEDIATION
Adesipo, A.A., D. Freese, O.O. Awotoye, A.T. Salami, and D.J. Oyedele.
Journal American Society of Mining and Reclamation, Vol.9, No. 1(2020)

Native plants with a high level of heavy metals tolerance were identified growing on an abandoned gold mining site, an active gold mining site, and an undisturbed vegetation site in southwestern Nigeria. Soil properties and total Pb, Cd, Fe, and Cu concentration were analyzed at 0-20 and 20-40 cm sampling depths in soils. *Acanthus montanus*, *Chromolaena odorata*, *Crinum jagus*, *Melanthera scandens*, *Melochia corchorifolia*, *Palisota ambigua*, *Pteris togoensis*, *Musa sapientum*, and *Theobroma cacao* showed elevated metal content and high accumulating potential of Pb with high Fe. No plant met the threshold criteria for hyperaccumulators but showed high-accumulating potential for phytoremediation. *C. jagus* had the highest accumulation factors of 8.71 (Pb), 37.47 (Cd), 1.08 (Fe), and 29.38 (Cu) and can be employed both in tropical regions and other climatic adaptable regions for phytoremediation.
https://www.asrs.us/Portals/0/Documents/Journal/Volume-9-Issue-1/Adesipo-GR.pdf

ASSESSMENT OF LAND RECLAMATION BENEFITS IN MINING
Yu, X., C. Mu, and D. Zhang. | Sustainability 12(5):2015(2020)

Land reclamation for the Hanjiawan coal mine was assessed using the fuzzy comprehensive evaluation. After compiling a model of land reclamation influencing factors, an evaluation index of land reclamation benefit was constructed using monitoring data for the northern part of the mining area over the last decade. An expert scoring method and a traditional evaluation model were used to estimate the comprehensive benefits of land reclamation at the mine. Land reclamation improved the land type within the mining region and decreased the amount of damaged land, including subsided and occupied land, and improved land area. The model obtained an overall 63% increase in the land reclamation area. Ecological benefits were the most significant, with a growth rate of 56%. Over time, land reclamation will offer greater comprehensive benefits to the mining area. *This article is **Open Access** at*
https://www.mdpi.com/2071-1050/12/5/2015

EVALUATING THE LONG-TERM ECOLOGICAL RESPONSES TO RIPARIAN ECOSYSTEM RESTORATION AT THE FORT BENNING, GEORGIA MILITARY INSTALLATION
Griffiths, N.A., B.S. Helms, J.W. Feminella, S. Bickley, and D.J. Isenberg., SERDP Project RC-2704, 90 pp, 2020

Two experimental restoration projects (ephemeral drainage revitalization and instream coarse woody debris [CWD] additions) were implemented 14 years ago to reduce the environmental impacts of military training activities. An evaluation of the short-term effects of restoration found that instream restoration improved some aspects of ecosystem function and community structure. This study re-evaluated the effect of these restoration practices on stream ecosystem processes after implementation. The instream restorations had minimal long-term effects on stream ecosystem structure and function. While the study found minimal long-term benefits, results are likely not applicable to all stream ecosystems. Due to the stream bed's dynamic nature in these sandy, Coastal Plain streams, CWD additions may only have short-term benefits. Implementing this restoration technology in Coastal Plain streams may require continual addition of CWD dams. https://www.serdp-estcp.org/content/download/51686/508244/file/RC-2704%20Final%20Report.pdf

SYNERGISTIC EFFECT OF ORGANO-MINERAL AMENDMENTS AND PLANT GROWTH-PROMOTING RHIZOBACTERIA (PGPR) ON THE ESTABLISHMENT OF VEGETATION COVER AND AMELIORATION OF MINE TAILINGS
Benidire, L., A. Madline, S.I.A. Pereira, P.M.L. Castro, and A. Boularbah.
Chemosphere 262:127803(2021)

A study was conducted to investigate the role of organo-mineral amendments and plant growth-promoting rhizobacteria (PGPR) to improve Kettara Mine tailings properties and *Lolium perenne* L. (ryegrass) growth. Plants grown in mine tailings were mixed with agricultural soil (1:1), 10% compost, rock phosphate (6%) or lime (3%), and inoculated with *Advenella kashmirensis* BKM20 and *Mesorhizobium tamadayense* BKM04. The application of agricultural soil, compost, lime, and inoculation of both PGPR strains enhanced

the establishment of vegetation cover, thus promoting Kettara mine tailing stabilization. Further studies are needed to confirm its effectiveness under field conditions. *This article is* ***Open Access*** *at* https://www.sciencedirect.com/science/article/pii/S0045653520319986.

RECOVERING IRON AND SULFATE IN THE FORM OF MINERAL FROM ACID MINE DRAINAGE BY A BACTERIA-DRIVEN CYCLIC BIOMINERALIZATION SYSTEM

Wang, X., H. Jiang, G. Zheng, J. Liang, and L. Zhou.
Chemosphere 262:127567(2021)

A bacteria-driven biomineralization system was constructed based on *Acidithiobacillus ferrooxidans*-mediated Fe^{2+} oxidation and *Acidiphilium multivorum*-controlled Fe^{3+} reduction to remediate Fe and SO_4^{2-} in acid mine drainage. Fe^{2+} oxidation, Fe precipitation, and Fe^{3+} reduction was maintained at 98%, 32%, and 87%, respectively. In five cycles, ~89% Fe and 60% SO_4^{2-} were precipitated into jarosite mineral. Biomineralization for five cycles drastically reduced the amount of required lime and neutralized sludge by 75% and 77%, respectively.

THE USE OF TAILINGS TO MAKE GLASS AS AN ALTERNATIVE FOR SUSTAINABLE ENVIRONMENTAL REMEDIATION: THE CASE OF OSOR, CATALONIA, SPAIN

Alfonso, P. O. Tomasa, L.M. Domenech, M. Garcia-Valles, S. Martinez, and N. Roca.
Minerals 10(9):819(2020)

Waste materials were removed from Osor Fluorite Mine tailings and used as a raw material to manufacture glass. Waste materials included SiO_2, Al_2O_3, and CaO contents suitable for glass production, but required the addition of Na as $NaCO_3$ to create two glass formulations (80% residue and 20% Na_2CO_3 [G80-20] and 90% residue and 10% Na_2CO_3 [G90-10]). The G80-20 and G90-10 glasses, respectively, had an 875 and 901°C crystallization temperature, 1220 and 1215°C melting temperature, and 637 and 628°C transition temperature. Chemical stability test results indicated that the tailings' potentially toxic elements were incorporated into the glass structure. *This article is* ***Open Access*** *at* https://www.mdpi.com/2075-163X/10/9/819/htm.

REMOVAL OF ZINC FROM CIRCUM-NEUTRAL PH MINE-IMPACTED WATERS USING A NOVEL "HYBRID" LOW PH SULFIDOGENIC BIOREACTOR

Holanda, R. and D.B. Johnson | Frontiers in Environmental Science Vol. 8 Article 22(2020)

A laboratory-scale, continuous flow hybrid sulfidogenic bioreactor (HSB) provided elemental zero-valent sulfur (ZVS) and sulfate (electron acceptors) and glycerol (electron donor) to remediate synthetic and actual circum-neutral pH, zinc-contaminated water bodies from two abandoned metal mining sites. The bacterial consortium included several acid-tolerant bacteria species to catalyze the reduction of both ZVS and sulfate and a novel acidophilic ZVS-reducing *Firmicute*. In both cases, >99% zinc was removed in the sulfide phase using two configurations: in-line (mine water pumped directly into the bioreactor) and off-line (hydrogen sulfide was transferred from the HSB to a separate contactor vessel containing the mine waters). Both mine waters contained sufficient alkalinity to neutralize the generation of acidity resulting from ZnS formation. A potential scenario is described for full-scale treatment of one of the mine waters using an HSB. *This article is* ***Open Access*** *at* https://www.frontiersin.org/articles/10.3389/fenvs.2020.00022/full.

PERFORMANCES OF STABILIZATION/SOLIDIFICATION PROCESS OF ACID MINE DRAINAGE PASSIVE TREATMENT RESIDUES: ASSESSMENT OF THE ENVIRONMENTAL AND MECHANICAL BEHAVIORS

Jouini, M., M. Benzaazoua, C.M. Neculita, and T. Genty.
Journal of Environmental Management 269:110764(2020)

Stabilization/solidification (S/S) with General Use Portland Cement (GU) was conducted on residues collected from a tri-step acid mine drainage (AMD) passive treatment system operating for six years at the reclaimed Lorraine mine site. GU and ground-granulated blast-furnace slag (GGBFS) and fly ash type C (FAC) blended binders were used in proportions (w/w %) of 100GU, 20GU/80GGBFS, and 50GU/50FAC, respectively. At 56 days, GU (1.3 MPa) and GU/GGBFS (0.7 MPa) satisfied Quebec's strength requirements for landfill disposal (0.7 MPa), but not GU/FAC (0.6 MPa). All elements were immobilized successfully in GU and GU/GGBFS. Results indicate that S/S using GU, GGBFS, and FAC can be used for the immobilization of contaminants in AMD passive treatment residues. A comparison between replicates using Student's t-test indicated good reproducibility of S/S treatment.

General News

REQUEST FOR INFORMATION (RFI): REDUCING ENVIRONMENTAL METHANE EVERY DAY OF THE YEAR (REMEDY)

Advanced Research Projects Agency-Energy, Funding Opportunity DE-FOA-0002419, 2020

The purpose of this RFI is solely to solicit input for a potential future ARPA-E research program focused on technologies to prevent and/or abate methane emissions. The goal is to reverse the rate of accumulation of methane in the atmosphere, resulting in a decrease in atmospheric methane concentration. ARPA-E is seeking information at this time regarding transformative and implementable technologies that could (1) prevent or limit methane emissions from anthropogenic activities, such as abandoned coal mines; oil and gas wells; landfills; agricultural-related emissions from farming and ruminants; and methane source emissions from stacks, vents, and leaks; or (2) remove methane from the air. ARPA-E is interested in processes that reduce methane emissions by >90% on a life-cycle basis. See more at the ARPA-E eXCHANGE: https://arpa-e-foa.energy.gov/. Responses are due by October 15, 2020.
https://www.grants.gov/web/grants/view-opportunity.html?oppId=329162

MINE CLOSURE REVIEW: PLANNING FOR SUCCESSFUL REHABILITATION

Mining Journal Intelligence, SRK Consulting, and Turner & Townsend. Aspermont Media, London, UK, 12 pp, 2020

Mine closure has become a core part of a much wider industry conversation around social responsibility, environmental stewardship, and corporate governance. This white paper addresses the current industry practice for mine-closure planning and execution, trending regulatory changes that govern fiscal provisions and liabilities around mine closure, social transitioning and sustainability, what an integrated mine-closure plan and contemporary rehabilitation should look like, and the steps the industry needs to take to improve best practice and ensure the optimal outcome for all stakeholders.
https://dxi97tvbmhbca.cloudfront.net/upload/user/image/PlanningSuccessfulRehabilitation_20202020060216383526 2.pdf

ACID MINE DRAINAGE FROM COAL MINING IN THE UNITED STATES - AN OVERVIEW

Acharya, B.S., and G. Kharel. | Journal of Hydrology 588:125061(2020)

Treatment of acid mine drainage (AMD) discharged from active, abandoned, and reclaimed coal mine sites with relatively higher acidity is often complex, costly, and challenging. This review summarizes the formation and effects of acid mine drainage, reviews prediction and treatment methods, identifies critical research gaps, and explores the associated challenges and opportunities AMD poses for environmental scientists and researchers.

DISTINGUISHING RECLAMATION, REVEGETATION AND PHYTOREMEDIATION, AND THE IMPORTANCE OF GEOCHEMICAL PROCESSES IN THE RECLAMATION OF SULFIDIC MINE TAILINGS: A REVIEW

Xie, L., and D. van Zyl. | Chemosphere 252:126446(2020)

To help design an appropriate reclamation plan during the mine closure stage, this paper clarifies the relationships between and distinguishes the concepts of reclamation, revegetation, and phytoremediation. It concludes that the concept of reclamation includes revegetation, and revegetation includes phytoremediation. The review proposes amended phytostabilization as the most potential phytoremediation technique for reducing metal(loid) mobility in sulfidic tailings. Since much research has focused on microbial activities in the tailings-plants system, the paper further indicates the importance of inorganic geochemical processes to revegetate sulfidic mine tailings and emphasizes its potential as a future research topic.

PHYTORESTORATION OF ABANDONED MINING AND OIL DRILLING SITES 1ST EDITION
Bauddh, K., J. Korstad, and P. Sharma (eds.). Elsevier, ISBN: 9780128212004, 800 pp, 2020

Within 25 chapters, this book presents case studies and the latest research on the most effective methods to address the large amounts of waste materials released due to mining and oil drilling. Phytoremediation is described as a novel, eco-friendly, cost-effective method for extracting toxic compounds by plants to restore contaminated sites. *See the abstract and a list of chapters at* https://www.elsevier.com/books/phytorestoration-of-abandoned-mining-and-oil-drilling-sites/bauddh/978-0-12-821200-4

DESIGN, APPLICATION, AND MICROBIOME OF SULFATE-REDUCING BIOREACTORS FOR TREATMENT OF MINING-INFLUENCED WATER
Habe, H., Y. Sato, T. Aoyagi, T. Inaba, T. Hori, T. Hamai, K. Hayashi, M. Kobayashi, et al.
Applied Microbiology and Biotechnology 104:6893-6903(2020)

Test design procedures and precedents of full-scale bioreactor application for mining-influenced water treatment are summarized, and recent knowledge on the sulfate-reducing microbial communities of field-based bioreactors from fine-scale monitoring are presented in this review.

CAN BIOCHAR RECLAIM COAL MINE SPOIL?
Ghosh, D. and S.K. | Maiti. Journal of Environmental Management 272:111097(2020)

The aftermath of surface coal mining includes huge coal mine spoil dumps characterized by high rock fragments, extremely low water holding capacity, compacted and high bulk density, lack of organic carbon and plant nutrients, and low cation exchange capacity, acidic pH, and toxic metal contamination. This review focuses on factors affecting biochar properties, the mechanism involved in altering the physical, chemical, and biological properties of coal mine spoil by biochar, remediation of potentially toxic elements in soil, and restoration of degraded land using biochar. It highlights important aspects to consider while using biochar reclaim coal mine spoils and suggests suitable methodologies for bulk production, application, and economics of biochar in coal mine spoil reclamation.

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