Technology Innovation News Survey

Entries for August 16-31, 2023

Market/Commercialization Information

F -- SYNOPSIS FOR RADMAC III (COMBINE)
Naval Facilities Engineering Systems Command (NAVFAC) Southwest, San Diego, CA
Contract Opportunities on SAM.gov, Solicitation N62473-23-R-1029, 2023

This is a full and open competition under NAICS code 562910. NAVFAC Southwest requires a contractor to provide radiological investigations, surveys, and remediation, along with preparing work documents and reports in support of Navy Environmental programs. Such radiological work will generally support environmental investigations with a particular focus on possible radioactive contamination; implementing recommendations of Historical Radiological Assessments, remedial actions; removal actions; remedial design; expedited and emergency response actions; pilot and treatability studies; remedial actions, systems operation and maintenance; and other related activities associated with returning sites to safe and acceptable levels of contamination to achieve appropriate decontamination and decommissioning requirements. Radiological actions may include, but will not be limited to, preparation of work documents, performance of surveys, investigations, remediation, implementation of radiological controls, storage and handling of waste materials, performance of on-site radiological survey and sampling analysis, and include all associated reporting requirements. The objective of this procurement is to obtain services for performing environmental remediation services of radiological contaminants at environmentally contaminated sites. The sites may consist of those ranked on the Superfund National Priorities List (NPL) as well as non-NPL sites regulated under CERCLA, RCRA, Underground Storage Tanks (UST), and other sites, which might require environmental remediation services. The award will be a multiple-award Indefinite Delivery/Indefinite Quantity contract with a base period of two years and two three-year option periods. Task Orders will be issued on a firm-fixed-price basis. Offers are due by 2:00 PM PST on November 9, 2023.
https://sam.gov/opp/cda0e72e9628d6cab97509ed377c3c43/view

F -- IDIQ MULTIPLE AWARD TASK ORDER CONTRACT (MATOC) TO SUPPORT THE ENVIRONMENTAL REMEDIATION SERVICES (ERS) (PRESOL)
U.S. Army Corps of Engineers, Savannah District, Savannah, GA
Contract Opportunities on SAM.gov, Solicitation W912HN24R1000, 2023

When this solicitation is released on or about October 30, 2023, it will be competed as an 8(A) set-aside under NAICS code 562910. The U.S. Army Corps of Engineers plans to issue a Request for Proposal (RFP) for an Indefinite Delivery/ Indefinite Quantity (IDIQ) Multiple Award Task Order Contract (MATOC) for Environmental Remediation Services (ERS) to respond to numerous requests for environmental support for the U.S. Army Corps of Engineers South Atlantic Division as well as customers of the Savannah District. This IDIQ contract will support military installations, federal agencies, Formerly Used Defense Sites (FUDS), and civil work entities where the USACE is authorized to respond. However, contract capacity may be shared with other CONUS geographic USACE Districts where the principles of the ER 5-1-10 and ER 5-1-11 (Project Management Business Process) have been met. The Contractor shall be responsible for providing services related to requirements of RCRA, CERCLA, the Clean Air Act, and other related Federal Programs in addition to State/Local specific regulations/requirements dealing with hazardous waste management/disposal and with Underground Storage Tanks (USTs), and other fuels related issues. The ERS actions may address both regulated and non-regulated toxic substances. As part of any site remediation activities, incidental construction may also be included in the task orders. Remedial actions may address both regulated and non-regulated toxic substances and emerging contaminants for customers of the U.S. Army Corps of Engineers. Traditional construction activities only related to restoration, renovations, repairs, and modernization of existing facilities are included. The period of performance includes a three-year base period and one two-year option period. https://sam.gov/opp/feb8807ae1ed4f9a8a5ad88dd0e8e02d/view

Cleanup News

SLAG RECYCLING AT THE FORMER ASARCO SMELTER IN EAST HELENA
Rhodes, M. I Mine Design, Operation & Closure Conference, 8-11 May, Butte, MT, 21 minutes, 2023

Over a century of lead smelting left a 16-million-ton pile of blast furnace slag at the Former ASARCO Smelter in East Helena, Montana. The majority of the slag was processed (or "fumed") through a zinc fuming facility where marketable zinc was extracted before molten slag was poured onto the slag pile. After the zinc plant was shut down in 1982, ~2 million tons of "unfumed" slag was placed on the top (upper lift) of the slag pile. The upper lift of the unfumed slag is a significant source of contamination loading to groundwater due to precipitation percolating through the cracks and crevices in the slag pile, mobilizing metals to the groundwater and contributing to offsite migration of the arsenic and selenium plumes. The area represents an estimated 75% of the source of selenium loading from the slag pile to groundwater. The Montana Environmental Trust Group (METG) implemented three interim corrective measures to address contamination in soil, surface water, and groundwater at the site: (1) the South Plant Hydraulic Control (including Prickly Pear Creek Realignment) Project, (2) the evapotranspirative cover system, and (3) removal of the most highly contaminated soils that were an ongoing source of contaminant loading to groundwater. EPA approved the interim measures, along with an additional measure-grading and capping the slag pile with a vegetative cover-to reduce leaching of contaminants (primarily arsenic and selenium) to groundwater when it rains or snow melts. METG has been working with a local manufacturer that recovers modest quantities of fumed slag to use as aggregate for manufacturing cement. METG is also working with an international metals trading company to recycle the ~2 million tons of unfumed slag. The unfumed slag is crushed into 2" or smaller pieces, shipped to Canada, then loaded onto ships and transported to South Korea, where zinc and other metals are extracted from the slag and the remaining "fumed" slag is used to manufacture cement. Removing the unfumed slag has significantly reduced the grading and capping needed to implement EPA-approved final corrective action measures. Project benefits include reducing the slag pile, 100% recycling of the unfumed slag material, and removing the selenium source. In addition, $3 million from recycling of the slag material is returned to the trust to fund the St. Helena cleanup. https://www.youtube.com/watch?v=LFbv96KCedw.
*For more information, see*https://www.mtenvironmentaltrust.org/east-helena-smelter-site-project-update-fact-sheet-december-2022/

BUNKER HILL COMPLEX, NINEMILE BASIN REMEDIATION PROGRESS UPDATE
Wesche, T. I American Society of Reclamation Sciences Conference, 5-7 June, Boise, ID, 31 slides, 2023

Ninemile Basin, which lies within Operable Unit 3 of the Upper Basin of the Bunker Hill Mining and Metallurgical Complex Superfund site, is one of the largest loaders of heavy metals to the South Fork of the Coeur d'Alene River. The mine operated from 1884 until the late 1970s, producing over 20 million ounces of silver, 700 million lbs of lead, and 650 million lbs of zinc. The legacy waste rock piles within Ninemile Basin contain heavy metals, including lead and zinc, which are the primary contaminants of concern. Initial remedial actions began in 2014 and will continue through 2026. Remedial action is completed or is in the process of being completed at six former mine sites along the East Fork of Ninemile (EFNM) Creek and Ninemile Creek. These sites include the Interstate-Callahan (IC) Rock Dumps, Success Complex, Interstate Millsite, Tamarack Complex, Dayrock Complex, and Lower EFNM Creek. After remediation is completed, over 1.45 million bank yd^3 of mine waste will be excavated and hauled to the EFNM Waste Consolidation Area, 102 acres revegetated, and ~14,600 lineal feet of EFNM and Ninemile Creeks reconstructed. The presentation provides an update on the IC Rock Dumps and a remediation overview for each mine site, including construction elements (waste excavation, stream reconstruction, and revegetation), challenges encountered, lessons learned, and post-remediation water quality updates. https://www.asrs.us/wp-content/uploads/2023/08/Bunker-Hill-Complex-Ninemile-Basin-Remediation-Progress-Update.pdf

BEYOND RECLAMATION AND REMEDIATION, NEXT STEPS IN A RECOVERED WATERSHED
Mackey, A., N.K. Daniels, N. Sullivan, and M.O. Henneh.
American Society of Reclamation Sciences Conference, 5-7 June, Boise, ID, 38 slides, 2023

The 684-square mile Raccoon Creek Watershed drains six counties in southern Ohio including ~50,000 acres of abandoned underground and surface mines. The Ohio EPA (OEPA) designated the creek as Limited Resource Water in the 1990s. Reclamation and remediation projects conducted throughout the watershed have included land reclamation of abandoned strip pits and coal processing areas, treatment wetlands, a vertical flow reactor, numerous steel slag leach beds, and a lime doser. OEPA performed a comprehensive Total Maximum Daily Load (TMDL) study, as previous studies only assessed portions of the watershed. Based on this data, OEPA redesignated the stream reaches from the town of Vinton at river mile 40 to the backwaters of the Ohio River as Exceptional Warm Water Habitat and the remaining mainstem of the stream as Warm Water Habitat. The redesignation of the creek has opened new opportunities in the watershed. The transition from Exceptional Warm Water Habitat to Warm Water Habitat is at a low-head dam that restricts fish passage. Removal of the low-head dam is a priority but has been met with community and landowner resistance. A recent evaluation suggests that much of the creek and the main tributary, Little Raccoon Creek, would meet state criteria for a state Wild, Scenic, or Recreational River. The new growth in funding for abandoned mine lands opens possibilities for further recovery, economic development through outdoor recreation and education, and engagement with the community on the improvements and continued maintenance of the recovered stream.
https://www.asrs.us/wp-content/uploads/2023/08/Beyond-Reclamation-and-Remediation-Next-Steps-in-a-Recovered-Watershed.pdf
The TMDL report is available at https://epa.ohio.gov/static/Portals/35/tmdl/TSD/Raccoon%20Creek/2016_RaccoonCreek_TSD.pdf

Demonstrations / Feasibility Studies

CONSTRUCTION OF A PASSIVE SULFATE TREATMENT SYSTEM
Robinson, J., I. Andrews, and J. Dodd. Mine Closure 2022: 15th International Conference on Mine Closure, Australian Centre for Geomechanics, Perth, pp. 367-374, 2022

The third phase of a project to construct a passive sulfate reduction system with sulfur sequestering is reported in this paper. The tiered approach included bench- and pilot-scale systems to prove the feasibility of the system using a biochemical reactor (BCR) with different proportions of wood chips, straw, manure, limestone, and biochar to culture sulfate-reducing bacteria. The project also tested the use of a fixed-bed anaerobic bioreactor (FBAR), where alcohol was added to enhance the sulfate reducer activity. Three BCRs and two FBARs were set up for this stage of the assessment. The resulting treated leachate was passed through different media types to remove sulfur species generated by the bacteria, using an aerobic wetland to polish the effluent. The success of the bench-scale (Tier 1) project led to the construction of a pilot-scale system (Tier 2). The system operated continuously through 2021, with planning permission being awarded for the project and construction (Tier 3) in late 2022/early 2023. https://papers.acg.uwa.edu.au/d/2215_24_Robinson/24_Robinson.pdf

RARE EARTH ELEMENT RECOVERY IN HARD-ROCK ACID MINE DRAINAGE AND MINE WASTE: A CASE STUDY IN IDAHO SPRINGS, COLORADO
Goodman, A.J., A.J. Bednar, and J.F. Ranville.
Applied Geochemistry 150:105584(2023)

Rare earth element (REE) geochemistry in acid mine drainage (AMD) and waste rock was investigated in the Idaho Springs gold district in Colorado. Two AMD inputs to the Argo Tunnel Wastewater Treatment Plant (ATWTP) containing high dissolved REE concentrations (0.7 and 1.3 mg/L) and REEs were concentrated using a two-stage pH adjustment. The first stage precipitated iron and removed thorium by adsorption, while the second stage precipitated aluminum, which removed REEs by adsorption. Solids generated were 2,670 and 2,800 mg/kg for each REE-bearing AMD source. At 90% REE recovery, the ATWTP could produce ~1,000 kg of REEs yearly, with an economically favorable MREE enrichment. REE leaching in waste rock was also investigated, but results indicate that it is unlikely to be a significant source of REEs. More work is needed to characterize the critical metal content (including other metals besides REEs) and the economic feasibility of extracting mine waste and AMD in hard-rock mining environments.

OPPORTUNITIES FOR FOREST SLASH-BASED BIOCHAR IN ABANDONED MINE LAND RECLAMATION
Pierson, D. I American Society of Reclamation Sciences Conference, 5-7 June, Boise, ID, 19 slides, 2023

This presentation discusses the emerging capability for biochar production from forest slash in the western U.S. and two associated biochar-based remediation projects underway in the Boise National Forest that center on surface additions of slash-based biochar and native seed mix. Treatments aim to improve soil structure, pH, and water-holding capacity and establish native vegetation on otherwise barren, rocky soils left from historic mining activity. Pilot study results provide insight and guidance into viable avenues and methods for utilizing slash-based biochar applications to rejuvenate ecosystem services in disturbed and contaminated soil. https://www.asrs.us/wp-content/uploads/2023/08/Opportunities-for-Biochar-to-Remediate-Forest-Soils-at-Abandoned-Mine-Lands.pdf

DESIGN AND CONSTRUCTION OF A COMBINATION SOIL AND WATER COVER ON A TAILINGS STORAGE FACILITY IN TASMANIA
Cahill, C., R. Longey, and D. Tonks.
Mine Waste and Tailings Conference, 13-14 July, Brisbane, Australia, 11 pp, 2023

The Main Creek Tailings Dam (MCTD), located at the Savage River Mine in northwest Tasmania is transitioning from an upstream-constructed operational tailing storage facility (TSF) to closure. Tailings stored in the MCTD are potentially acid-forming (PAF), requiring careful management through operation and closure to minimize the risk of Acid and Metalliferous Drainage (AMD) forming in the TSF. The site is situated on Tasmania's west coast, with rainfall significantly exceeding evaporation. While a water cover would typically be most suitable, due to the upstream constructed embankments, a soil cover was required adjacent to embankments to meet long-term stability requirements. During operations, three trial covers were constructed to monitor the performance over several years. Data obtained was used to evaluate cover performance and calibrate numerical transient seepage models. Based on the trial cover performance, the preferred cover was a combination of clay and rock fill cover that maintained a high degree of saturation in the clay, minimizing oxygen ingress to the underlying tailings and reducing the likelihood of AMD formation. The preferred clay and rock combination cover was assessed and optimized during the detailed design phase by undertaking 2-dimensional transient unsaturated seepage modeling in SVFlux, considering a conservative climate scenario. The construction process, challenges, and QA/QC are described in the article.
https://ghd-p-001.sitecorecontenthub.cloud/api/public/content/67d59747151e4d77a422f1238d261b9e?v=0a7d361c&_gl=1*1kd8cya*_ga*Nzk2MzAwMzE3LjE2OTUzMDc3NDI.*_ga_5RYWTRLG6P*MTY5NTMwNzc0Mi4xLjEuMTY5NTMwOTIxMi40OS4

Research

ZINC ACCUMULATION IN ATRIPLEX LENTIFORMIS IS DRIVEN BY PLANT GENES AND THE SOIL MICROBIOME
Kushwaha, P., A. Tran, D. Quintero, M. Song, Q. Yu, R. Yu, M. Downes, R.M. Evans, A. Babst-Kostecka, J.I. Schroeder, and R.M. Maier.
Science of The Total Environment 899:165667(2023)

A project aimed to identify relationships between tailings properties, the soil microbiome, and plant stress response genes during growth of *Atriplex lentiformis* in compost-amended (10 %, 15 %, 20 % w/w) mine tailings. Analyses included RNA-Seq for plant root gene expression, 16S rRNA amplicon sequencing for bacterial/archaeal communities, metal concentrations in both tailings and plant organs, and phenotypic measures of plant stress. Zn accumulation in *A. lentiformis* leaves varied with compost levels and was highest in the intermediate treatment (15 %, TC15). Microbial analysis identified *Alicycloba cillus*, *Hydrotalea*, and *Pseudolabrys* taxa with the highest relative abundance in TC15, which were strongly associated with Zn accumulation. The study identified 190 root genes with significant gene expression changes. The root genes were associated with different pathways, including abscisic acid and auxin signaling, defense responses, ion channels, metal ion binding, oxidative stress, transcription regulation, and transmembrane transport. The increasing levels of compost did not drive root gene expression changes. For example, 15 genes were up-regulated in TC15, whereas 106 genes were down-regulated in TC15. The variables analyzed explained 86% of the variance in Zn accumulation in *A. lentiformis* leaves. Zn accumulation was driven by shoot concentrations, leaf stress symptoms, plant root genes, and microbial taxa. Results suggest there are strong plant-microbiome associations that drive Zn accumulation in *A. lentiformis* and different plant gene pathways are involved in alleviating varying levels of metal stress.

PASSIVE TREATMENT OF METALS-IMPACTED WATER USING SULFATE-MEDIATED METALS REDUCTION (SMMR)
Le, R. J. Smith, T. Carlson, M. Williams, D. Graves, S. Cronk, K. Cracchiola, and S. Dworatzek.
2023 Bioremediation Symposium Proceedings, 8-11 May, Austin, TX, 21 slides, 2023

The continuous removal of heavy metals, sulfate, fluoride, and total dissolved solids (TDS) from subsurface mine water at a copper mine was investigated in bench-scale up-flow anaerobic packed bed reactors over 8 weeks. The native sulfate-reducing community was stimulated using lactate as an electron donor and by maintaining anaerobic conditions (-0.5 V to 0.1 V), neutral pH, and a 24-hour hydraulic retention time. A sustainable source of hydroxyapatite was used as a sorption media in one of the three columns to enhance the sorption of heavy metals and fluoride. TDS, heavy metals, and sulfate removal were successfully achieved, along with the notable production of hydrogen sulfide in up-flow anaerobic packed bed reactors containing sulfate-reducing microbial communities. Fluoride removal was successfully achieved in the hydroxyapatite amended column. Findings from the bench-scale investigation are translatable to pilot- and full-scale implementations.
Slides: https://www.battelle.org/docs/default-source/bidden/2023-bio-symp-presentations/track-a/a2_1120_323_le_aurey.pptx.pdf?sfvrsn=8ef8bd7c_3
Longer abstract: https://www.battelle.org/docs/default-source/bidden/2023-bio-symp-abstracts/323_updabs.pdf?sfvrsn=a80985b2_3

PILOT-SCALE FEASIBILITY STUDY FOR THE STABILIZATION OF COAL TAILINGS VIA MICROBIALLY INDUCED CALCITE PRECIPITATION
Rodin, S., P. Champagne, and V. Mann.
Environmental Science and Pollution Research 30:8868-8882(2023)

A study evaluated the physical and geochemical stabilization of coal tailings using microbially induced calcite precipitation at pilot scale. Three application techniques simulated commonly used agricultural approaches and equipment that could be deployed for field-scale treatment: spraying treatment solutions with irrigation sprinklers, mixing tailings and treatment solutions with a rotoriller, and distributing treatment solutions via shallow trenches using an excavator ripper. Test cells containing 1.0×1.0×0.5 m of tailings were treated with ureolytic bacteria (*Sporosarcina pasteurii*) and cementation solutions composed of urea and calcium chloride for 28 days. Penetrometer tests were performed following incubation to evaluate the extent of cementation. The spray-on application method showed the greatest strength improvement, with an increase in surface strength of >50% for the 28-day testing period. The distribution of treatment solution using trenches was less effective, resulting in greater variability in particle size distribution of treated tailings, and is not recommended for field use. The use of rotoilling equipment provided a homogenous distribution of treatment solution; however, disruption to the tailings material was less effective for facilitating effective cementation. Bacterial plate counts of soil samples indicated that *S. pasteurii* cultures remained viable in a tailings environment for 28 days at 18°C and near-neutral pH. The treatment also stabilized the pH of tailings porewater sampled over the incubation period, suggesting the potential for the treatment to provide short-term geochemical stability under unsaturated conditions.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9898352/pdf/11356_2022_Article_22316.pdf

5-YEAR LEACHING EXPERIMENTS TO EVALUATE A MODIFIED BAUXITE RESIDUE: REMEDIATION OF SULFIDIC MINE TAILINGS
Merdy, P., A. Parker, C. Chen, and P. Hennebert.
Environmental Science and Pollution Research 30:96486-96498(2023)

A study explored different ways for recovering and reusing Bauxaline®, a commercial product produced by washing bauxite residue after alumina extraction and drying it in a press filter, including transformation into a vegetated soil, use in acid mine drainage depollution, and application in sulfide-mine tailings remediation. Bauxaline was transformed into modified bauxite residue (MBR) resulting in reduced alkalinity, salinity, and sodicity. Various treatments were applied to counterbalance the net acid generation potential of two sulfidic mine tailings with 1 mol H+/kg (1.5% sulfide) and 3.3 mol H+/kg (5.3% sulfide), respectively. These treatments included adding 10% MBR or 10% MBR plus limestone, or by limestone only, within 40-l lysimeters. Six lysimeters were monitored over 5 years to assess the long-term emissions from treated materials. Vegetation was tested under various conditions and its impact on emission was evaluated. Mine tailing emissions treated with MBR and limestone were very low. The mine tailings with limestone showed intermittent emission peaks, probably due to the coating of calcite grain by ferric oxide, hindering contact with percolating water. Vegetation successfully grew in the treated tailings. The study demonstrated that the alkalinity of limestone can temporarily immobilize elements in sulfidic mine tailings, with a reduction factor of emissions of 300 and 40 for the two mine tailings, respectively. The alkalinity provided by both limestone and MBR and the Al and Fe oxides of MBR are more effective and necessary for long-term immobilization, with a reduction factor of 300 and 900, respectively.

PHYTOSTABILIZATION MITIGATES ANTIBIOTIC RESISTANCE GENE ENRICHMENT IN A COPPER MINE TAILINGS POND
Yi, X., P. Wen, J.-L. Liang, P. Jia, T.-T. Yang, S.-W. Feng, B. Liao, W.-S. Shu, and J.-T. Li.
Journal of Hazardous Materials 443(Part B):130255(2023)

A phytostabilization project implemented in an acidic copper mine tailings pond employed metagenomics to explore antibiotic resistance gene (ARG) characteristics in soil samples. Phytostabilization decreased the total ARG abundance in 0-10 cm soil layer by 75%, accompanied by a significant decrease in ARG mobility and a significant increase in ARG diversity and microbial diversity. Phytostabilization was also found to drastically alter the ARG host composition and significantly reduce the total abundance of virulence factor genes of ARG hosts. Soil nutrient status, heavy metal toxicity and SO_4^{2-} concentration were important physicochemical factors that affected the total ARG abundance, while causal mediation analysis showed that their effects were largely mediated by the changes in ARG mobility and microbial diversity. The increase in ARG diversity associated with phytostabilization was mainly mediated by a small subgroup of ARG hosts, most of which could not be classified at the genus level and deserve further research.

CHARACTERIZATION OF ROOT-ASSOCIATED FUNGI AND REDUCED PLANT GROWTH IN SOILS FROM A NEW MEXICO URANIUM MINE
Portman, T.A., A. Granath, M.A. Mann, E. El Hayek, K. Herzer, J.M. Cerrato and J.A. Rudgers.
Mycologia 115(2): 165-177(2023)

Soils and cultured root-associated fungi were sampled from blue grama grass (*Bouteloua gracilis*) collected from historical uranium-mined lands and contrasted against communities from nearby, off-mine sites. Plant root-associated fungal communities from mine sites had lower taxonomic richness and diversity than root fungi from paired, off-mine sites. The potential functional consequences of unique mine-associated soil microbial communities were assessed using plant bioassays, which revealed that plants grown in mine soils in the greenhouse had significantly lower germination, survival, and less total biomass than plants grown in off-mine soils but did not alter allocation patterns to roots versus shoots. Candidate culturable root-associated Ascomycota taxa for bioremediation were identified and increased understanding of the biological impacts of heavy metals on microbial communities and plant growth.

General News

EVALUATING TECHNOLOGIES FOR MINING-INFLUENCED WATER (MIW) TREATMENT: INFORMATION AND DATA NEEDS
Bulter, B.A. and M. Mahoney. 2023 National Meeting of the American Society of Reclamation Sciences, 4-7 June, Boise, ID, poster, 2023

Case studies examining established and recently developed technologies to treat mining-influenced water (MIW) are reported in conference proceedings, reports, or journal articles ranging in size, duration, and purpose, from bench-scale proof-of-concept testing to field pilot-scale testing conducted from months to years-long, full-scale field deployments. Data and information from case studies are examined to evaluate whether a treatment is suitable for remediation, including what elements are treatable, treatment efficiency, the concentrations and flows able to be treated, the volume of waste material generated, waste disposal requirements, necessary site requirements (e.g., land space required, available energy source) and costs. In examining various technologies across case studies documenting performance for six months or more in field-scale systems treating MIW from hardrock mining sites, the level of detail reported for some technologies was found to be inadequate for determining their use and transferability to a site different from the locations where the case studies were conducted. Information and data deemed necessary to be reported from case studies are discussed, along with how the data and information can contribute to assessing technology transferability. https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=546944&lab=CESER

TREATMENT AND REMEDIATION OF METAL-CONTAMINATED WATER AND GROUNDWATER IN MINING AREAS BY BIOLOGICAL SULFIDOGENIC PROCESSES: A REVIEW
Li, Y., Q. Zhao, M. Liu, J. Guo, J. Xia, J. Wang, Y. Qiu, J. Zou, W. He, and F. Jiang.
Journal of Hazardous Materials 443(Part B):130377(2023)

This review focuses on developments in the sulfur-reducing bacteria (S0RB)-driven biological sulfidogenic process (BSP) for the treatment and remediation of metal-contaminated wastewater and groundwater. To identify the bottlenecks and to improve BSP performance, this paper reviews sulfidogenic bacteria presenting in metal-contaminated water and groundwater; highlights the critical factors for the metabolism of sulfidogenic bacteria during BSP; the ecological roles of sulfidogenic bacteria and the mechanisms of metal removal by sulfidogenic bacteria; and the application of sulfidogenic systems and their drawbacks. Research knowledge gaps, current process limitations, and future prospects are provided to improve the performance of BSP in the treatment and remediation of metal-contaminated wastewater and groundwater in mining areas.

HYBRIDIZED TECHNOLOGIES FOR THE TREATMENT OF MINING EFFLUENTS
Fosso-Kankeu, E. and B.B. Mamba (eds.) Scrivener Publishing LLC, Print ISBN: 9781119896425, Online ISBN: 9781119896920, 291 pp, 2023

In eight specialized chapters, this book reviews the principles, development, and performances of hybridized technologies developed over the years for treating mine effluent, including AMD. The book introduces readers to:

- The limitations of passive and active treatment processes as stand-alone technologies while appraising the functioning and performances of these technologies when combined to address their challenges;
- The numerous approaches considered over the years for the effective combination of these technologies, taking into account their successful implementation at large scale and long-term sustainability.

https://www.wiley.com/en-us/Hybridized+Technologies+for+the+Treatment+of+Mining+Effluents-p-9781119896906

LIMITING FACTORS TO RESTORE ABANDONED MINE LANDS WITH WOODY BIOCHAR
Franco, C.R., D.S. Page-Dumroese, D.N. Pierson, and J..M. Tirocke.
American Society of Reclamation Sciences Conference, 5-7 June, Boise, ID, 33 slides, 2023

This presentation addresses limiting factors in the use of biochar and provides valuable information to facilitate its application in the restoration of mining sites, either using biochar alone or in combination with other organic amendments. Despite its benefits, biochar for mine restoration has not been adopted and applied extensively in the U.S. Limiting factors are policy and regulations limiting production, the high cost of transportation from the mill to the site, the high cost of biochar per ton, and still developing biochar markets. https://www.asrs.us/wp-content/uploads/2023/08/Limiting-factors-to-restore-abandoned-mine-lands-with-woody-biochar.pdf

POLLUTANTS IN ACID MINE DRAINAGE
Valente, T. (ed). Special Issue of Minerals, 13(7):931(2023)

This Special Issue addresses various topics, such as the source and nature of pollutants, speciation, mobilization/precipitation, and toxicity of trace elements and features articles that cover the modeling of processes, innovative techniques for removal of hazardous elements, and advanced monitoring techniques to enlarge the base knowledge about pollutants in AMD. The latest advances in (bio)geochemistry and mineralogy of AMD and wastes from which AMD develops are also presented. The issue contains 19 articles that provide examples of methodological approaches and novel tools and solutions to monitor, treat, and remediate AMD. https://www.mdpi.com/2075-163X/13/7/931

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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