Technology Innovation News Survey

Entries for November 16-31, 2020

Market/Commercialization Information

SOURCES SOUGHT: HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE SERVICES
U.S. Army Corps of Engineers, Huntington District, Huntington, WV.
Contract Opportunities at Beta.SAM, Solicitation W91237-21-R-SS01, 2020

This notice is issued as a market survey is to gain knowledge of potential qualified small business sources for hazardous, toxic, and radiological waste services and general environmental consulting services for projects assigned to districts within the USACE Great Lakes and Ohio River Division geographical boundaries, including the Buffalo, Chicago, Detroit, Huntington, Louisville, Nashville and Pittsburgh districts. The NAICS code is 541620. Services include conducting Phase I and II environmental site assessments; asbestos investigations; lead-based paint investigations; information gathering and records review; preparation of drawings, sketches, charts and graphs; environmental field investigations; underground and aboveground storage tank investigations; sample collection (e.g., lead paint, asbestos, soil, groundwater, sediment, and air); evaluations and consultation; laboratory analysis; data definition/collection; digital photography; preparation of technical reports; and other environmental services as required. Capabilities statements (20 pages max) are due by 5:00 PM ET on January 15, 2021. https://beta.sam.gov/opp/530732f890c1443a975a16ce91af0cf2/view

WATERSMART COOPERATIVE WATERSHED MANAGEMENT PROGRAM PHASE I GRANTS
Dept. of the Interior, Bureau of Reclamation, Funding Opportunity BOR-DO-21-F003, 2020

Under the Cooperative Watershed Management Program, Reclamation provides funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. By providing this funding Reclamation promotes water reliability and cooperation between stakeholders to reduce conflict, facilitate solutions to complex water issues, and stretch limited water supplies. Up to 20 awards are anticipated under estimated total program funding of $2M. Closing date for applications is January 19, 2021. https://www.grants.gov/web/grants/view-opportunity.html?oppId=329878

QUALITY ASSURANCE (QA) SEEDING SOLICITATION
U.S. Army Corps of Engineers, W2V6 Engineering Support Center Huntsville, Huntsville, AL.
Contract Opportunities at Beta.SAM, Solicitation W912DY20R0028, 2020

This acquisition is for an unrestricted, full and open MATOC IDIQ contract under NAICS code 562910 (Environmental Remediation Services), size standard 750 employees, to allow continued mission support for services to address munitions response concerns assigned to USACE. This QA Seeding solicitation is for a firm-fixed-price contract with $49M in shared capacity. Contracts will have an ordering period of a 24-month base with three 12-month options. The objective of the QA Seeding MATOC is to procure services to provide third-party blind validation seeding and advanced geophysical classification, data collection, and processing. The applicable PCS for this acquisition is F108 (Hazardous Substance Removal, Cleanup, and Disposal Services and Operational Support). Offers are due by 9:00 AM CT on January 21, 2021. See the attachments at beta.sam for additional information.
https://beta.sam.gov/opp/48385cf6497d4370878bfe77755f1892/view

UNDERGROUND MINE EVACUATION TECHNOLOGIES AND HUMAN FACTORS RESEARCH
DHHS, Centers for Disease Control and Prevention, Funding Opportunity RFA-OH-21-006

The purpose of this funding opportunity is to provide grant opportunities to universities with graduate programs in mining and explosives engineering to support research related to mine emergencies, and to build on the work of NIOSH to address mandates in the Mine Improvement and New Emergency Response Act of 2006 (P.L. 109-236). Interested applicants are encouraged to consider aspects of their graduate program in mining and explosives engineering, including unique facilities that could support research related to mine emergencies. Proposals are due by 5:00 PM ET on February 1, 2021. Please note that this Forecasted Opportunity is dependent upon the availability of funding. https://www.grants.gov/web/grants/view-opportunity.html?oppId=328769

18TH ANNUAL P3 AWARDS: A NATIONAL STUDENT DESIGN COMPETITION FOCUSING ON PEOPLE, PROSPERITY AND THE PLANET
U.S. Environmental Protection Agency, P3 Funding Opportunities, 2020

EPA is seeking applications that propose innovative technology-based projects to research, develop, design, and demonstrate solutions to real world challenges and achieve the mutual goals of improved quality of life, economic prosperity and protection of the planet. These opportunities are open to open to teams of college/university students. Areas of interest include the following: ** **EPA-G2021-P3-Q1 - Air Quality** - https://www.grants.gov/web/grants/view-opportunity.html?oppId=329821. ** **EPA-G2021-P3-Q2 - Safe and Sustainable Water Resources** - https://www.grants.gov/web/grants/view-opportunity.html?oppId=329812. ** **EPA-G2021-P3-Q3 - Sustainable and Healthy Communities** - https://www.grants.gov/web/grants/view-opportunity.html?oppId=329814. ** **EPA-G2021-P3-Q4 - Chemical Safety** - https://www.grants.gov/web/grants/view-opportunity.html?oppId=329835. This Opportunity closes February 9, 2021. See more at https://www.epa.gov/P3/18th-annual-p3-awards-national-student-design-competition-focusing-people-prosperity-and-planet-0.

POLLUTION PREVENTION & MITIGATION BROAD AGENCY ANNOUNCEMENT
U.S. Agency for International Development (USAID), Funding Opportunity BAA-OAA-E3-POLLUTION-2020

This BAA seeks opportunities to co-create, co-design, co-invest, and collaborate in the research, development, piloting, and scaling of innovative interventions for effectively mitigating air, water, and soil pollution, including ocean plastic pollution, electronic and other forms of solid waste in low and middle-income countries. USAID invites organizations, companies, academic and research institutions, and investors to propose innovative approaches for preventing and mitigating pollution in countries to promote healthier populations, cleaner environments, and inclusive, sustainable economic growth. This BAA for pollution prevention and mitigation was developed to improve the Agency's ability to assist partner countries in solving complex pollution problems that threaten sustainable development. Specific opportunities to do so will be provided through Addenda issued under this BAA. The current closing date for applications is February 5, 2022. https://www.grants.gov/web/grants/view-opportunity.html?oppId=324244

Cleanup News

NONPOINT SOURCE SUCCESS STORY: TREATMENT OF MINE DRAINAGE IMPROVES HUBLER RUN
Office of Water, EPA 841-F-20-001J, 2 pp, 2020

Abandoned mine drainage (AMD) discharged from drift mines and some surface mining degrading the aquatic ecosystem in Hubler Run in Pennsylvania. A watershed implementation plan and total maximum daily load (TMDL) were developed to address pollution sources. More than six AMD seeps were identified and sampled, and four priority areas were listed in the watershed implementation plan. Four passive treatment systems composed of anoxic limestone drains and limestone leach beds were constructed to address the priority areas. Water quality and aquatic habitat have been improving, and the stream was removed from the impaired waters list in 2018. https://www.epa.gov/sites/production/files/2020-06/documents/pa_hubler_1869_508.pdf
See the 2007 Implementation Plan:
http://files.dep.state.pa.us/Water/BWEW/Watershed%20Management/lib/watershedmgmt/nonpoint_source/implementation/complete_hubler_run.pdf

BIOGEOCHEMICAL BEHAVIOR OF METALS ALONG TWO PERMEABLE REACTIVE BARRIERS IN A MINING-AFFECTED WETLAND
von Gunten, K., B. Bishop, L. Zhang, K. Muehlenbachs, M.S. Alam, K.O. Konhauser, et al.
JGR Biogeosciences 124(11):3536-3554(2019)

The biogeochemistry of two alkaline permeable reactive barriers (PRBs), which were installed to remediate a mining-affected wetland, was investigated to assess the importance of colloidal particles on metal removal processes in the systems. Both PRBs removed U, Cu, and Zn (>95%) from groundwater but were slightly less efficient for Ni and Co (

DESIGN, CONSTRUCTION AND PERFORMANCE OF A PASSIVE WATER MANAGEMENT SYSTEM AT THE ABANDONED ATLIN RUFFNER MINE
Mills, R., G. Walker, K. Jia, M. Javadi, J. Runnells, and L. Whitehead-Delong.
42nd Annual Mine Reclamation Symposium, 16-19 September, Kimberley, BC, 2019

This case study focuses on the design, construction, performance, and initial monitoring results for a passive water management system at an abandoned mine in British Colombia. Primary design challenges included a cold climate, steep slopes, slope stability, remoteness, and low revegetation potential. The innovative remedy included an automatic siphon combined with an integrated geomembrane cover and interceptor trench system to prevent clean water from contacting the tailings and becoming contaminated. Post-remediation monitoring indicated that the passive system is functional and has reduced metal loading to the shallow groundwater flow system. The system conveys 58,874 m^3 of water around the tailings annually. The contaminant plume downgradient of tailings pond has begun to shrink, and annual contaminant loads have been reduced by an estimated 11,562 kg of sulfate and 505 kg of zinc, in addition to other metals. A

long-term monitoring and maintenance plan using an automated data collection system was developed to ensure that risk controls remain effective and satisfy the provincial and federal regulations. https://open.library.ubc.ca/cIRcle/collections/59367/items/1.0391935

BIOCHEMICAL REACTOR SYSTEM AT THE BRULE MINE: A SEMI-PASSIVE APPROACH TO OPERATIONAL AND POST-CLOSURE SELENIUM AND NITRATE REDUCTION

Miller, T., M. Marshall, and G. Gilron.
42nd Annual Mine Reclamation Symposium, 16-19 September, Kimberley, BC, 2019

A biochemical reactor (BCR) was constructed for the post-closure phase of the Conuma Coal's Brule Mine life cycle to manage selenium, nitrate, and other parameters site-wide. The BCR will aid in the ongoing water quality improvement to comply with provincial permits and proposed national effluent limits. The basic design and initial construction took place in 2015, with a recent upgrade in 2017. Analysis of a year's worth of operating data showed a downward parameter concentration trend. The BCR has achieved removals of 50-90% for selenium and 65-99% for nitrates. Challenges encountered in implementing the system yielded lessons learned, including that sequencing and flow control are crucial to the proper functioning of the BCR system, sediment curtains help reduce sediment load to the aerator, and raised edges help reduce surface water runoff entering the BCR system. Future work relating to the dynamics of resident microbial communities is being planned. https://open.library.ubc.ca/cIRcle/collections/59367/items/1.0391938

GEOCHEMICAL CHALLENGES ASSOCIATED WITH WATER TREATMENT AT ABANDONED OR NEGLECTED MINES IN SOUTHEAST YUKON

Rainey, D.K. and P. Geo, 42nd Annual Mine Reclamation Symposium, 16-19 September, Kimberley, BC, 2019

The Ketza River, Wolverine, and Faro Mine Complex were compared to illustrate how the interim delay between the cessation of mining and implementing the remediation plan at abandoned and neglected mines is impacted by challenging pre-remediation water treatment requirements. The complexity, cost, and duration of water treatment activities differed between the sites, depending on the contaminants' chemical nature and the volume of water to be treated. Remote, subarctic, mountainous conditions where most water management activities must be conducted during a short summer season contributed to water treatment challenges. Water treatment at Faro is anticipated to continue in perpetuity, whereas remediation at Ketza River and Wolverine could eliminate the need for repeated and seasonal water treatment campaigns. A key lesson learned from these sites is that it is common for geochemical conditions to deteriorate so severely during this interim period that remediation plans become obsolete. This leads to unanticipated water treatment costs while remediation plans are updated. https://open.library.ubc.ca/cIRcle/collections/59367/items/1.0391915

Demonstrations / Feasibility Studies

SUCCESSFUL BIOREMEDIATION OF LONG CHAIN HYDROCARBONS IN THE ARCTIC

Lacey, R. and K. Trefry. | REMTECH 2020: The Remediation Technologies Symposium, 14-15 October, Virtual Meeting, abstract, 2020

The remote location of the Ekati Diamond Mine led to exploring bioremediation to remediate and manage contaminated materials. In June 2018, an initial bioremediation trial treated 1400 m3 of hydrocarbon-impacted (F1-F4 fractions) materials with BioLogix, a blend of naturally-occurring microbes selected for their ability to degrade a wide range of organic chemicals and formulated to remediate petroleum and toxic organics. By September 2019, the BioLogix treatment reduced all petroleum hydrocarbon fractions. Microbes effectively degraded all fractions to the point that the materials passed agricultural subsoil guidelines, and the need to haul contaminated material offsite was avoided.

PHYTOREMEDIATION OF PETROLEUM HYDROCARBON-CONTAMINATED SOILS WITH TWO PLANT SPECIES: *JATROPHA CURCAS* AND *VETIVERIA ZIZANIOIDES* AT GHANA MANGANESE COMPANY LTD

Nero, B.F.
International Journal of Phytoremediation [Published online 17 August 2020 prior to print]

A 16-week pilot study was conducted to test the effect of *Jatropha curcas* (JC) and *Vetiveria zizanioides* (VZ) on hydrocarbon concentrations in mine spoils. Use of compost amendment significantly reduced total petroleum hydrocarbon and total oil and grease concentrations compared to other treatments; however, the effect of species on concentrations was marginally significant. Growth measurements indicated that JC grew better in contaminated soils in the presence of compost than fertilizer. Only the number of tillers in the VZ was significantly influenced by the soil amendments. Results suggested that JC could be used to reduce soil hydrocarbon concentration levels, but soils must be amended with compost for effective remediation and rapid, vigorous, early growth of plants.

LONG-TERM PERFORMANCE OF A UASB REACTOR TREATING ACID MINE DRAINAGE: EFFECTS OF SULFATE LOADING RATE, HYDRAULIC RETENTION TIME, AND COD/SO_4^{2-} RATIO

Cunha, M.P., R.M. Ferraz, G.P. Sancinetti, and R.P. Rodriguez.
Biodegradation 30:47-58(2019)

A study was conducted to establish a highly efficient biological process using an upflow anaerobic sludge blanket (UASB) reactor with a short hydraulic retention time (HRT) and low organic matter input to treat acid mine drainage. The process was evaluated over 739 days in terms of the influence of HRT (14-24 h), metal addition, sulfate loading rate (0.5-2.6 g SO_4^{2-}/L/d), and the COD/SO_4^{2-}ratio (0.67-1.0) using ethanol as the only electron donor at a pH of 4.0. Neutral effluent pH was achieved throughout the time apart from operational modifications. The fully optimized conditions of the UASB reactor were set at an HRT of 16 h, SLR of 1.5 g SO_4^{2-}/L/d, and a COD/ SO_4^{2-} ratio of 1.0.

A MULTI-FACETED, ENVIRONMENTAL FORENSIC CHARACTERIZATION OF A PARADIGMATIC BROWNFIELD POLLUTED BY HAZARDOUS WASTE CONTAINING HG, AS, PAHS AND DIOXINS

Fernandez, B., L.M. Lara, J.M. Menendez-Aguado, J. Ayala, N. Garcia-Gonzalez, et al.
Science of The Total Environment 726:138546(2020)

A multi-purpose forensic approach was used to examine accumulations of mining-metallurgical waste (volumes >80,000 t) and construction and demolition (C&D) waste as a repository of pollutants (above 10% of As leached in standard tests) at the La Soterrana site in northern Spain. High Hg and As content in very fine grain-size fractions (up to 100,000 mg/kg of As in metallurgy waste below 10 µm) was significant, as was As (III) predominance in metallurgy waste. PAHs showed a pyrogenic fingerprint, as determined by molecular ratios. Toxic organometallics were detected, and metallurgy waste was identified as a source of dioxins and furanes. Observations suggest La Soterrana is one of the most polluted sites in Europe and requires urgent remediation. Key findings indicated that C&D waste should be considered hazardous, and metallurgical waste raises concerns, given the simultaneous presence of toxic inorganic and organic contaminants.

FARO WASTE ROCK PROJECT: CHARACTERIZING VARIABLY SATURATED FLOW BEHAVIOR THROUGH FULL-SCALE WASTE-ROCK DUMPS IN THE CONTINENTAL SUBARCTIC REGION OF NORTHERN CANADA USING FIELD MEASUREMENTS AND STABLE ISOTOPES OF WATER

Bao, Z., D.W. Blowes, C.J. Ptacek, J. Bain, S.P. Holland, D. Wilson, W. Wilson, et al.
Water Resources Research 56(3): e2019WR026374(2020)

A field project was undertaken at the Main and Intermediate Dumps at the Faro Mine Complex to better understand the hydrological behavior of water flow through unsaturated waste-rock dumps, quantify factors controlling flow s, and assess impacts on long-term drainage water quality. Flow through the fine matrix materials was the dominant flow mechanism, with possible preferential flow through macropores and ponding/runoff during intense infiltration events. Cross $\delta^{18}O$-$\delta^{2}H$ plots of pore water collected from near-surface waste-rock samples suggested that evaporation at the surface of the dumps occurred during precipitation-free periods in the summer. Depth profiles of$\delta^{18}O$-$\delta^{2}H$ of pore water extracted from core samples provided indications of internal evaporation within the waste-rock dumps and pore-water displacement, mainly in response to summer rainfall events. Mixing calculations using $\delta^{18}O$-$\delta^{2}H$ show that 76-95% of pore water present in the waste-rock matrix was derived from summer rainfall, leading to lower concentrations of dissolved constituents in the summer effluent, and vice versa in winter. Results will inform cover design and remedial options.
https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2019WR026374

Research

ACID MINE DRAINAGE TREATMENT WITH NOVEL HIGH-CAPACITY BIO-BASED ANION EXCHANGER

Gogoi, H., T. Leiviska, J. Ramo. And J. Tanskanen.
Chemosphere Volume 264 Part 1:128443 (2020)

Batch and column mode sorption studies were conducted using aminated peat (PG-Peat) to remove sulfate from acid mine drainage (AMD). In batch tests, PG-Peat removed sulfate (up to 125.7 mg/g) even at low temperatures (2-5°C), achieving equilibrium within a 30 min contact time. Column tests using real AMD showed higher sulfate uptake capacity (up to 154.2 mg SO_4^{2-}/g). The regenerative and practical applicability of PG-Peat was also tested in column set-ups using synthetic sulfate solutions. The sulfate uptake capacity obtained was higher in column mode when the solutions were treated at a pH of 2.0 compared to a pH of 5.8, which could be attributed to the presence of cationized amine groups on PG-Peat under acidic pH conditions. Almost complete sulfate desorption was achieved with NaCl in the column that treated the synthetic solution at pH 5.8. The lowest desorption rates were observed in the column that treated the synthetic solution at a pH of 2.

EVALUATION OF DISPERSED ALKALINE SUBSTRATE AND DIFFUSIVE EXCHANGE SYSTEM TECHNOLOGIES FOR THE PASSIVE TREATMENT OF COPPER MINING ACID DRAINAGE

Schwarz, A., I. Nancucheo, M.A. Gaete, D. Munoz, P. Sanhueza, M. Torregrosa, et al.
Water 12:854(2020)

The performances of three passive technologies to treat high-strength acid mine drainage (AMD) from copper mining were evaluated: alkaline diffusive exchange systems (ADES), sulfidogenic diffusive exchange systems (SDES), and dispersed alkaline substrate (DAS) technology. The DAS and ADES systems removed 98-100% of Cu, Al, and Zn, while the SDES reactors removed an average of 0.28 mol/m ^{3}/day of sulfate. The SDES technology effectively protected the sulfate-reducing communities from AMD's high toxicity and maintained bed permeability. The DAS reactor showed the highest reactivity, accumulating metallic precipitates in a lower reactor volume. These results indicate that the DAS requires the lowest hydraulic residence time. However, precipitate concentrations in the DAS resulted in a hardpan formation, which may require removal to avoid compromising the treatment process's continuity.
https://www.mdpi.com/2073-4441/12/3/854/pdf

ACCUMULATION OF HEAVY METALS IN METALLOPHYTES FROM THREE MINING SITES (SOUTHERN CENTRE MOROCCO) AND EVALUATION OF THEIR PHYTOREMEDIATION POTENTIAL

Midhat, L., N. Ouazzani, A. Hejjaj, A. Ouhammou, and L. Mandi.
Ecotoxicology and Environmental Safety 169:150-160(2020)

A field survey of three abandoned mining sites was performed to assess metals pollution in soils and the accumulation potential of native plant species. Soils were deficient in major macronutrients and contained toxic levels of Cu, Zn, Pb, and Cd. Botanical surveys showed an abundance of diverse plant communities (46 species and 19 families) with no obvious toxicity symptoms. Heavy metal concentrations varied in the same plant species and from one plant species to another. *Hirschfeldia incana* (L.) Lagr.-Foss, *Citrullus vulgaris* (L.) Schradi, *Portulaca oleracea* L., *Stipa capensis* Thunb., *Lactuca viminea* (L.) J.Presl and C.Presl, *Forsskaolea tenacissima* L., *Lycium intricatum* Boiss. and *Hammada scoparia* (Pomel) Iljin were the best-performing specimens due to their high ability to accumulate multiple metals in their shoots and roots without being affected by excessive metal contents.

PHYTOTOXICITY STUDY OF NATIVE PLANTS IN EX-MINING LAKE WATER TREATMENT

Draman, S.F.S., S.A. Khalid, N.M. Sidek, S.R.S. Abdullah, and N. Anuar.
IOP Conference Series: Materials Science and Engineering 808:012040(2020)

The ability of *L. articulata*, *E. ochrostacys*, and *E. dulcis* to survive when exposed to acid mine drainage water was investigated in free flow or free surface systems for 30 days with water from an ex-mining lake in Bukit Besi, Malaysia. The physical growth of the plants, including height and withered leaves, was monitored every seven days. *E. ochrostacys* had the highest accumulation ability with a maximum accumulation of 123,584 mg Fe/kg in lower plant parts and 55,151 mg Fe/kg in upper plant parts. *E. ochrostacys* was also able to tolerate and survive in the water, exhibiting up to an 80% survival rate during the study.
https://iopscience.iop.org/article/10.1088/1757-899X/808/1/012040/pdf

ABOVEGROUND AND BELOWGROUND COLONIZATION OF VEGETATION ON A 17-YEAR-OLD COVER WITH CAPILLARY BARRIER EFFECT BUILT ON A BOREAL MINE TAILINGS STORAGE FACILITY

Proteau, A., M. Guittonny, B. Bussiere, and A. Maquoud. | Minerals 10(8):704(2020)

Vegetation colonizing a 17-year-old cover with capillary barrier effect (CCBE) in the mixed forest of Quebec was analyzed and quantified. Colonization was investigated through cover and density surveys in 12 transects. Then, aboveground vegetation and root colonization intensity at three depths in the moisture-retaining layer (MRL) was characterized on 25 plots of five dominant vegetation types (*Salix*, *Populus*, *Alnus*, *Picea* sp., and herbaceous species). The mean root length density under plots dominated by Salix sp. was higher than in the other plots. Root colonization of the MRL was concentrated in the first 10 cm and occurred under all woody and herbaceous species. The data will be useful in predicting the long-term performance of the engineered reclamation cover.
This article is ***Open Access*** *at* https://www.mdpi.com/2075-163X/10/8/704.

BENEFICIAL REUSE OF MUNICIPAL BIOSOLIDS AS LOW-PERMEABILITY, LOW COST OXYGEN BARRIER IN CAPILLARY BARRIER COVERS FOR REACTIVE MINE TAILINGS

Hey, C.M. and P.H. Simms.
42nd Annual Mine Reclamation Symposium, 16-19 September, Kimberley, BC, 2019

A custom reclamation mix ([CRM] 1:1 volumetric mix of anaerobically digested biosolids and leaf and yard waste) blended biosolid was evaluated as a candidate barrier layer in a capillary barrier cover (CBC) through material characterization, biosolids CBC column testing, and numerical unsaturated flow modeling. The CRM exhibited strong potential as oxygen barrier covers, demonstrating low saturated hydraulic conductivities ($k = 4.21x10^{-7}$ cm/s at $e = 4.01$) and an air-entry value of ~400 kPa. Throughout column testing, biosolid layers within the CBCs remained highly saturated, acting as a barrier to oxygen diffusion and water flux. Numerical modeling showed reduced oxygen diffusion by up to three orders of magnitude when using biosolid CBCs relative to uncovered tailings. https://open.library.ubc.ca/cIRcle/collections/59367/items/1.0391911

LEAD AND CADMIUM SPATIAL PATTERN AND RISK ASSESSMENT AROUND COAL MINE IN HYRCANIAN FOREST, NORTH IRAN

Tavakoli, M., S. M. Hojjati, and Y. Kooch.
International Journal of Environmental and Ecological Engineering 13(4):205-208(2019).

The effect of coal mining activities on Pb and Cd concentrations and spatial distribution in soil was measured in the Hyrcanian forest, North Iran. Sixteen 20x20 m^2 plots were established in a 4 ha area around the mine entrance. An area next to the mine not affected by the mining activity was used as the controlled area. A sample was collected from each plot from a depth of 0-10 cm for Pb and Cd analysis. To assess the spatial properties of soil and Pb and Cd concentrations, 80 systematic-random samples were collected at 10 m intervals in an 80x80 m^2 area. Pb and Cd concentrations were higher in the mine area (Pb: 10.97±0.30, Cd: 184.47±6.26 mg/kg) in comparison to the control area (Pb: 9.42±0.17, Cd: 131.71±15.77 mg/kg). Variography and kriging method results showed that it is possible to prepare interpolation maps of Pb and Cd around the Hyrcanian forest mining areas. Risk assessment results indicated that the forest soil requires remediation and reclamation.
https://waset.org/publications/10010213/lead-and-cadmium-spatial-pattern-and-risk-assessment-around-coal-mine-in-hyrcanian-forest-north-iran

ANTHROPOGENIC REMEDIATION OF HEAVY METALS SELECTS AGAINST NATURAL MICROBIAL REMEDIATION

Hesse, E., D. Padfield, F. Bayer, E.M. van Veen, C.G. Bryan, and A. Buckling
Proceedings of the Royal Society B: Biological Sciences 286: 20190804(2019)

To determine how liming of acidic mine-degraded soils influences microbial community function and composition, 30 samples were collected from a historical mining area to determine whether liming has a consistent effect across soils varying widely in initial pH, metal content, and community composition. Soil microcosms were incubated for 12 weeks with and without hydrated lime. Soil characteristics, siderophore production, and changes in community composition were quantified before and after experimental manipulation. Results demonstrate that liming opposes selection on natural decontamination traits by favoring microbial taxa that produce few or no siderophores, leading to a net decrease in community siderophore production.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6599979/pdf/rspb20190804.pdf

General News

ABANDONED HARDROCK MINES INFORMATION ON NUMBER OF MINES, EXPENDITURES, AND FACTORS THAT LIMIT EFFORTS TO ADDRESS HAZARDS

Government Accountability Office (GAO), Washington, DC. Report No: GAO-20-238, 56 pp, 4 Mar 2020

This report describes (1) what is known about the number of abandoned hardrock mines in the United States; (2) agency spending to address abandoned hardrock mines from fiscal years 2008-2017 and estimated future costs; and (3) factors that limit federal and state agencies' and stakeholders' efforts to address abandoned mines. GAO obtained and summarized information from agency databases about the number of abandoned mines, features, and hazards as of 2019; summarized agency spending data from fiscal years 2008 through 2017, the most currently available; and interviewed federal and state agency officials and stakeholders, selected to provide diverse perspectives. https://www.gao.gov/assets/710/705146.pdf

BIOCHAR ASSISTED PHYTOREMEDIATION AND BIOMASS DISPOSAL IN HEAVY METAL CONTAMINATED MINE SOILS: A REVIEW

Ghosh D. and S.K. Maiti.
International Journal of Phytoremediation [Published online 11 November 2020 prior to print]

This review focuses exclusively on applying biochar-assisted phytoremediation in heavy metals-contaminated mine spoils. The review covers mechanisms of

metal immobilization by biochar, potential plants, and contaminated biomass disposal methods. Keys to a successful biochar-based heavy metals remediation of mine tailings and coal mine spoils include biochar feedstock availability and production conditions, application rate optimization and techniques, selecting suitable hyperaccumulators, and bulk biochar production cost optimization. From an economic viewpoint, the environment cost-benefit analysis should be considered before considering a technology's feasibility.

DEVELOPMENT AND APPLICATION OF THE THERMODYNAMIC DATABASE PRODATA DEDICATED TO THE MONITORING OF MINING ACTIVITIES FROM EXPLORATION TO REMEDIATION

Reillera, P.E. and M. Descostes.
Chemosphere 251:126301(2020)

The newly developed PRODATA thermodynamic database is dedicated to U mining activities. Relevant species and phases for U and Ra are chosen from existing data compilations, complemented with important missing data for mining activity applications and environmental monitoring. Important major anion and cation chemistry are included, as well as secondary pollutants such as Ar, Pb, or Ni. The article presents the application of the PRODATA extracted database file for PhreeqC to theoretical speciation calculations of U and Ra for actual water compositions, either linked to uranium mining activities or under environmental survey monitoring. Wider applications to other available water compositions from different geochemical concepts are also tested. The major Ra and U species obtained using PRODATA are compared with other available thermodynamic databases for the tested cases. The choice of the database file and the ionic strength correction can strongly impact the final speciation results.

REMOTE SENSING AND GIS TECHNOLOGIES IN LAND RECLAMATION AND LANDSCAPE PLANNING PROCESSES ON POST-MINING AREAS IN THE POLISH AND WORLD LITERATURE

Buczynska, A. | AIP Conference Proceedings 2209:040002(2020)

This review summarizes the quantity and quality of scientific materials published about the reclamation process, remote sensing, and geographic information system technologies. https://aip.scitation.org/doi/pdf/10.1063/5.0000009

MINE DRAINAGE: REMEDIATION TECHNOLOGY AND RESOURCE RECOVERY

Viadero, R.C., S. Zhang, X. Hu, and X. Wei.
Water Environment Research 92(10):1533-1540(2020)

In two main sections, this review first covers traditional and emerging passive and active treatment technologies to remediate mine drainage, then summarizes resource recovery efforts of mine drainage using various technologies, such as selective precipitation, membrane process, and biological systems.
https://onlinelibrary.wiley.com/doi/epdf/10.1002/wer.1401

POTENTIAL IMPLICATIONS OF ACID MINE DRAINAGE AND WASTEWATER COTREATMENT ON SOLIDS HANDLING: A REVIEW

Spellman Jr., C.D., T.L. Tasker, J.E. Goodwill, and W.H.J. Strosnider.
Journal of Environmental Engineering 146(11)(2020)

This mini review focuses on determining how cotreating municipal wastewater (MWW) with acid mine drainage (AMD) could impact the solids handling processes at wastewater treatment plants (WWTPs). Iron and aluminum are already present in MWW sludge and typically benefit most solids handling processes. While adding AMD would elevate iron and aluminum concentration, it would likely result in improved sludge dewatering, removal of odor-causing compounds during processing, and a decreased bioavailability of trace metals and water-soluble phosphorus in land applications. Co-treating MWW with moderate to low volumes (

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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