Technology Innovation News Survey

Entries for August 16-31, 2021

Market/Commercialization Information

REPAIRING THE DAMAGE: THE COSTS OF DELAYING RECLAMATION AT MODERN-ERA MINES
Savage, E. | Appalachian Voices, Boone, NC. 44 pp, 2021

The main purpose of this report is to estimate the cost to clean up mine sites for seven Eastern coal mining states - Alabama, Tennessee, Virginia, Kentucky, West Virginia, Ohio, and Pennsylvania - and to compare that with available funding sources for the cleanup, based on publicly available data. State mining agencies and the Office of Surface Mining Reclamation and Enforcement collect some data on mine reclamation, but no region-wide analysis has been done to estimate total outstanding reclamation. Using state and federal reclamation data and an average dollar-per-acre cost for mine reclamation for several mine types, roughly 426,000 acres of mined land have been partially reclaimed, and 207,000 acres are unreclaimed for a total 633,000 acres in need of some degree of reclamation. The total outstanding cost of this reclamation is estimated to range from $7.5B to $9.8B, whereas the total available bonds to accomplish this reclamation amount to ~$3.8B. The potential for creation of jobs via proper mine reclamation is also explored.
https://appvoices.org/resources/RepairingTheDamage_ReclamationAtModernMines.pdf

TECHNICAL SUPPORT FOR IMPLEMENTATION OF THE UNREGULATED CONTAMINANT MONITORING (SRCSGT)
U.S. Environmental Protection Agency, Cincinnati Acquisition Division, Cincinnati, OH
Contract Opportunities at SAM.gov, Solicitation 68HERC21R0232, 2021

This is a sources sought announcement for market research purposes only for small businesses under NAICS code 541620. EPA requires contractor support to provide technical, analytical, and administrative support services for the Unregulated Contaminant Monitoring Rule (UCMR). The purpose of this acquisition is to establish an ongoing contracting mechanism in the Office of Ground Water and Drinking Water (OGWDW) to support the Standards and Risk Management Division (SRMD) with both specific programmatic needs and evolving Agency policies and programs. The resulting contract may be used, with OGWDW's permission, by related organizations in the Office of Water (OW) and other parts of EPA when those organizations require technical support within the scope of the Performance Work Statement (PWS). The anticipated solicitation release date is late November 2021, and the close date shall be approximately 30 days thereafter. Capability statements are due by 5:00 PM EDT on October 16, 2021. https://sam.gov/opp/988b996d43d04b5f8f1eb5582f621a34/view

FENCE TO FENCE (F2F) ENVIRONMENTAL SERVICES AT JOINT BASE MCGUIRE-DIX-LAKEHURST, NJ; HANSCOM AIR FORCE BASE (AFB), MA; NEW BOSTON AFS, NH; AND ROME LABS, NY (SOL)
U.S. Army Corps of Engineers, Baltimore District, MD
Contract Opportunities at SAM.gov, Solicitation W912DR21R0042, 2021

This is a total small business set-aside under NAICS code 562910. The U.S Army Corps of Engineers, Baltimore District, requires environmental services to support the Air Force at Joint Base McGuire-Dix-Lakehurst, NJ; Hanscom AFB, MA; New Boston AFS, NH; and Rome Labs, NY. The contract will encompass the full range of methods, technologies, and supporting activities necessary to conduct environmental operations and services efforts to address F2F compliance needs. Each installation requires support in one or more of the following programs: Hazardous Waste (HW), Hazardous Material Management, Environmental Sampling and Analysis, Air Quality, Wastewater, and Stormwater, Drinking Water, Natural Resources Management, Cultural Resources Management, Solid Waste Management, Pollution Prevention, Petroleum Oil and Lubricants Management, Storage Tank Environmental Compliance and Toxic Substances Control Act (TSCA), as needed/regulated by state or region. The contract will be a standalone firm fixed-price contract. The period of performance for this contract will be one base year with four option years. Offers are due by 2:00 PM EDT on October 25, 2021.
https://sam.gov/opp/f272c0e6e99e42b8b571e3259ef00355/view

BASIC ENVIRONMENTAL SUPPORT SERVICES (BESS IV)
U.S. Army Contracting Command, Aberdeen Proving Ground, MD.
Contract Opportunities at SAM.gov, Solicitation W56ZTN21R0001, 2021

This procurement is issued as an 8(a) set-aside for a multiple-award IDIQ contract under NAICS code 541620 with task orders issued on a firm-fixed-price basis. Under an overall ceiling of $25M, the period of performance is one base year and four one-year options. Contractors shall provide a wide range of environmental services in support of the Installation Restoration and Military Munitions Response programs in addition to public works services to comply with federal and state environmental laws and regulations at properties within the control of Aberdeen Proving Ground and garrison-supported organizations. Proposals are due via the DoD SAFE service site by 2:00 PM ET on October 29, 2021.
https://beta.sam.gov/opp/85085d8d2efd4272bb671a0bcc834d56/view

BIA GAP ANALYSIS - BETHEL, AK (COMBINE)
U.S. Fish and Wildlife Service, Northeast Regional Office, Hadley, MA
Contract Opportunities at SAM.gov, Solicitation 140F0521R0011, 2021

This is a full and open competition under NAICS code 541620. The U.S. Fish and Wildlife Service requires a contractor to perform a historical geospatial data compilation of the known and suspected sources of environmental contamination using available reports and documentation at the 27-acre and 18-acre subparcels of the Bethel BIA site in Bethel, Alaska. Using the historical geospatial data compilation, the contractor will prepare a data gap analysis of sources, contaminants of potential concern (COPCs), and contaminant migration pathways will be prepared. The data gap analysis should be sufficiently thorough to allow for the development of a Phase II Assessment Remediation Investigation Work Plan. Documentation and analytical results of hazardous building materials do not need to be included in the data compilation. Instead, a stand-alone review and summary of hazardous building materials, including a current site inspection, testing, evaluation, and remediation cost estimate should be prepared as a separate submittal in conjunction with the data gap analysis to inform future removal and demolition activities. The award will be a firm-fixed-price contract. Offers are due by 6:00 PM EDT on November 1, 2021.https://sam.gov/opp/fb7d5a509fd7d9a29c2a9da1014997d7/view

Cleanup News

PIT LAKE TREATMENT AT THE RECLAIMED FORMER FARLEY MINE
Bonner, D., J. Forbort, J. Vogan, C. Leask, W. Nixdorf, O. Beruar, and R. Frost.
2020 Mine Design, Operation & Closure Conference, 18-20 August, virtual, 26 minutes, 2020

Reclamation activities completed between 2010 and 2014 at a former mine in Manitoba consisted of consolidating sulfide mineral-bearing tailings and installing: an impermeable cover system over the coarse tailings; a rock cover system over the fine tailings; stormwater diversion systems; an impermeable cover system over a waste rock stockpile; and an interim acid rock drainage (ARD) treatment system. Approximately 900 million gallons of ARD were treated using the interim ARD treatment system to create freeboard for future ARD management, as well as in situ treatment of ARD within the pit lake. The presentation details the reclamation approach, ARD management, and pit lake treatment campaigns. *See times 1:25-1:51:* https://www.youtube.com/watch?v=k3XVMlRUQgQ&list=UU1baRH1jNK0LYbYruTERQg&index=5

EFFECT OF AN EXTREME FLOOD EVENT ON SOLUTE TRANSPORT AND RESILIENCE OF A MINE WATER TREATMENT SYSTEM IN A MINERALISED CATCHMENT
Mayes, W.M., M.T. Perks, A.R.G. Large, J.E. Davis, C.J. Gandy, P.A.H. Orme, and A.P. Jarvis.
Science of The Total Environment 750:141693(2021)

A catchment containing the UK's first passive metal mine water treatment system experienced an extreme rainfall event in December 2015 that equated to a 1 in 200-year event. The catchment had been subject to intense monitoring of solute dynamics before and after commissioning, which provided an opportunity to assess the effects of a major storm event on: (1) catchment-scale solute transport; and (2) the resilience of the new and novel passive treatment system to extreme events. This article discusses trends observed in treatment efficiency, the resilience of the passive mine water treatment system to extreme events, and the importance of catchment-scale monitoring to ensure continued effectiveness of treatment initiatives after major perturbation.

BIOREMEDIATION FOR ACID MINE DRAINAGE AND HEAVY METALS CONTAMINATION
Uy, B. and L. Fairchok. Geo Engineer, April 21, 2021

One method of remediating acid mine drainage includes the usage of bioreactors powered by sulfate-reducing bacteria (SRB). Sulfate-reducing bacteria are grown with some organic material, like cow manure or peat. These bacteria, in anaerobic conditions, use the organic carbon (CH_2O) from these environments to reduce sulfate (SO_4^{2-}) to sulfide (H2S), which reacts with the dissolved metal ions created by the reactions with pyrite and water to precipitate them. This decreases available concentrations of sulfate and dissolved metal ions from the original acid mine effluent, neutralizes pH from reduction of sulfate and removal of free hydronium (H_3O^+) ions, and additionally produces the pH buffer bicarbonate (HCO_3^-), which increases the pH of the acid mine effluent (produces alkalinity). By exposing this effluent to these bacteria, cleaner water can be discharged from mines. Case studies of Lilly and Orphan Boy Mine and Sure Thing Mine are presented and compared to understand the efficiencies of bioreactors with sulfate-reducing bacteria and the evolution in their designs. The mines are both located within similar regions in mountainous Montana, with similar climate, geology, and contaminants, but have very different methods of using sulfate-reducing bacteria in bioreactors. Because the remediation of Lilly and Orphan Boy Mine occurred beforre Sure Thing, the design ideology and lessons learned can be compared from one mine to the other. https://www.geoengineer.org/education/web-class-projects/ce-176-environmental-geotechnics/assignments/bioremediation-for-acid-mine-drainage-heavy-metals-contamination#sure-thing-mine

WATER-QUALITY CHANGE FOLLOWING REMEDIATION USING STRUCTURAL BULKHEADS IN ABANDONED DRAINING MINES, UPPER ARKANSAS RIVER AND UPPER ANIMAS RIVER, COLORADO USA
Walton-Day, K., M.A. Mast, and R.L. Runkel.
Applied Geochemistry 127:104872(2021)

Water quality improved in tunnel discharge from two watersheds after bulkheads were installed in drainage mine tunnels to improve water quality. However, water quality was degraded at other sites in both watersheds following closure of the bulkheads. Bulkheads did not substantially improve downstream water quality other than in a decline in Mn concentrations in both watersheds. https://www.sciencedirect.com/science/article/pii/S0883292721000044

Demonstrations / Feasibility Studies

LABORATORY AND FIELD-BASED ASSESSMENT OF THE EFFECTS OF SEDIMENT CAPPING MATERIALS ON ZINC FLUX, BIOAVAILABILITY, AND TOXICITY
Cervi, E.C., K. Thiamkeelakul, M. Hudson, A. Rentschler, S. Nedrich, S.S. Brown, and G.A. Burton Jr. | Environmental Toxicology and Chemistry 39(1):240-249(2020)

Remediation and restoration at a former mining site has focused on disconnecting mine spoils from groundwater and managing the quantity and quality of runoff, though Zn concentrations in the stream outflow of a pit lake remain above water quality standards. Lab and field assessments were conducted to determine the efficacy of multiple capping materials to decrease Zn dissolution from sediments under natural and reasonable worst-case conditions (pH = 5.5). Capping materials included AquaBlok™, limestone, and limestone-bone char. Field exposures were conducted in limnocorrals that isolated overlying water columns above the sediment and capping treatments. Simultaneous in situ and ex situ toxicity tests were conducted using *Daphnia magna*, *Hyalella azteca*, and *Chironomus dilutes* that exposed organisms to surficial sediments, caps, and hypolimnetic overlying waters for 4 days. In situ caged organisms were deployed within a Toxicity Assessment Container System (TACS) to protect from temperature shock. Ex situ testing was conducted in core tube mesocosms containing sediments and caps at similar temperatures (15-19°C). Results demonstrated the usefulness of TACS deployment in stratified lake systems. There were no differences in responses between treatments involving sediment capping materials in both in situ and ex situ tests, likely due to dissolved Zn in surface water being below the hardness-adjusted threshold effects levels (164 µg/L). https://setac.onlinelibrary.wiley.com/doi/epdf/10.1002/etc.4612

PILOT-SCALE FIELD STUDY FOR VANADIUM REMOVAL FROM MINING-INFLUENCED WATERS USING AN IRON-BASED SORBENT
Zhang, R., I. Walder, and T. Leiviska. | Journal of Hazardous Materials 416:125961(2021)

A pilot-scale study investigated vanadium removal from mining waters at a closed mine site in Mustavaara, Finland, using granular ferric oxyhydroxide (CFH-12). Two filter systems (pilot A and pilot B) were placed in different streams; the pilot A influent contained a higher and variable vanadium concentration (6.46-99.1 mg/L), while the pilot B influent had lower vanadium concentrations (0.443-2.33 mg/L). The operation periods were 51 days for pilot A and 127 days for pilot B. Vanadium was efficiently captured in the filter system in both pilots, and the filter beds were not fully saturated with vanadium. Oxidized vanadium (5^+) existed in the used CFH-12, and the carbon content in the used material increased due to the adsorbed organic compounds. For comparison, lab-scale coagulation experiments were conducted using ferric sulfate for the influent of pilot A (the sampled batch contained 15.9 mg/L V). The optimum coagulant dosage was 350 mg/L (>93% vanadium removal) at the original pH (7.8-7.9) of the influent, whereas the required coagulant amount decreased when the influent pH was adjusted to 4.6-4.8. http://jultika.oulu.fi/files/nbnfi-fe2021051429845.pdf

NEUTRALIZATION AND UPTAKE OF POLLUTANT CATIONS FROM ACID MINE DRAINAGE (AMD) USING LIMESTONES AND ZEOLITES IN A PILOT-SCALE PASSIVE TREATMENT SYSTEM
Silva, D., C. Weber, and C. Oliveira. | Minerals Engineering 170:107000(2021)

A passive pilot-scale acid mine drainage treatment system was developed using open channels of calcitic (CL-I and CL-II) and dolomitic (DL-I and DL-II) limestone beds and mixtures with natural zeolites (NZ) and functionalized zeolites (FZ). Several parameters were examined, including pH, electrical conductivity, total acidity, total alkalinity, and concentrations of aluminum, iron, and manganese ions. DL-I, CL-II, and mixtures of CL-II/NZ and CL-II/FZ increased pH levels from 3.3 to 7.9, 8.2, 7.9, and 7.6, respectively; increased total alkalinity levels from 0 mg $CaCO_3$/L to 20, 107, 42 and 34 mg $CaCO_3$/L, respectively; and reduced total acidity levels by 95, 91, 90 and 90%, respectively. All beds promoted aluminum, iron, and manganese ion removal, but the CL-II/FZ mixture was the most efficient due to neutralization and a higher uptake of manganese ions (~99%). Results reveal ways to transform passive treatment systems using limestone beds and unconventional materials such as zeolites, combine neutralization and adsorption mechanisms in the same operation, ensure a simple maintenance and operational system and improve the economic and environmental sustainability of related processes.

CONVERSION TO NO-PURGE GROUNDWATER SAMPLING AT A FORMER MINE IN NEW MEXICO
Gilbert, J. | Mine Design, Operations, and Closure Conference, Anaconda, MT, August 22-26 August, 22 minutes, 2021

A network of ~100 monitoring wells is used to monitor remedial actions at a former molybdenum mine in northern New Mexico. A pilot study was completed to compare the current low-flow method that relies on bladder pumps to a no-purge method using HydraSleeves™ in wells in various hydrogeologic conditions with different well casing diameters and screen lengths. A statistical and graphical analysis of the sample data revealed no systematic bias or influence of sampling method on inorganic constituent concentrations, while data representativeness, usability, and quality were maintained. Results of the pilot study were used to formulate a basis to convert the current sampling method to the no-purge method, which was subsequently approved for long-term performance monitoring of remedial actions. The added benefits of the no-purge method are the elimination of purge water and disposal, reduction in time to collect samples, and reduction in overall sampling costs. *See times 1:07-1:29:* https://www.youtube.com/watch?v=uTR70FLxQBo

Research

EFFECT OF INORGANIC CARBONATE AND ORGANIC MATTER IN THERMAL TREATMENT OF MERCURY-CONTAMINATED SOIL
Cho, K., J. Kang, S. Kim, O. Purev, E. Myung, H. Kim, and N. Choi.
Environmental Science and Pollution Research (2021)

Hg-contaminated soil collected from two locations with different soil types at a mine and industrial site was thermally treated to investigate the effect of inorganic carbonate minerals and organic matter content on the thermal desorption process of Hg at different temperatures. The effect of soil composition on Hg desorption showed similar behavior at 100°C but differed at 300°C. Thermal desorption efficiency at 300°C was affected by the Hg desorption capacity and the thermal properties of the soil. Hg from both soil types was removed above 300°C. Hg was effectively removed from mine soil due to the partial decomposition of carbonate in the soil composition. Desorption of industrial soil was restrained by Hg organic matter complexes due to organic matter content. Hg removal efficiency was greater in the mine soil than in the industrial soil, despite a relatively higher Hg concentration. Sequential extraction results showed that residual Hg fractions in mine soil changed, while the industrial soil was affected by changes in Hg fractions at 300°C. Changes in soil pH during thermal desorption were also influenced by heating time and temperature. The volatilization of Hg in the soil was induced by organic carbon, while organic matter complexes controlled soil Hg release. https://link.springer.com/content/pdf/10.1007/s11356-021-14024-z.pdf

ACID MINE DRAINAGE AND SEWAGE IMPACTED GROUNDWATER TREATMENT BY MEMBRANE DISTILLATION: ORGANIC MICROPOLLUTANT AND METAL REMOVAL AND MEMBRANE FOULING
Asif, M.B., W.E. Price, Z. Fida, A. Tufail, T. Ren, and F.I. Hai.
Journal of Environmental Management 291:112708(2021)

This study forecasted a scenario using acid mine drainage (AMD)-contaminated groundwater from mining activities and/or sewage to investigate the performance of a direct contact membrane distillation (DCMD) system using different AMD compositions of sewage-impacted groundwater. Regardless of the composition, MD achieved 98-100% removal of metals and bulk organics, while the removal of the selected micropollutants ranged from 80 to 100%. Contaminants accumulated in the system over time affected the hydraulic performance of the membrane and reduced the permeate flux by 29-76%. Integrating persulfate (PS) -mediated oxidation process into the DCMD, degraded bulk organics (50-71%), and micropollutants (50-100%), reducing accumulation. Characterization of the fouling layer revealed the occurrence of membrane scaling primarily due to the deposition of precipitates. For an identical composition of the AMD- and sewage-impacted groundwater, flux decline was 10% less in PS-assisted DCMD than in the standalone DCMD, though it did not prevent the formation of iron oxide scales on the MD membrane during the operation of PS-assisted DCMD.

PHYTOSTABILIZATION OF ACIDIC MINE TAILINGS WITH BIOCHAR, BIOSOLIDS, LIME, AND LOCALLY-SOURCED MICROBIAL INOCULUM: DO AMENDMENT MIXTURES INFLUENCE PLANT GROWTH, TAILING CHEMISTRY, AND MICROBIAL COMPOSITION?
Trippe, K.M., V.A. Manning, C.L.Reardon, A.M. Klein, C. Weidman, T.F. Ducey, J.M. Novak, D.W. Watts, H. Rushmiller, K.A. Spokas, J.A. Ippolito, and M.G. Johnsong.
Applied Soil Ecology 165:103962(2021

Amendment mixtures composed of lime, biochar, biosolids (LBB), and locally sourced microbial inoculum (LSM) were evaluated to alleviate the constraints that hinder phytostabilization success in acid mine tailings. A greenhouse study that simulated in situ conditions to measure the influence of LBB-LSM amendment blends on plant growth, plant nutrients, metal concentrations, microbial function, and microbial community structure was conducted. Blue wildrye was grown in tailings collected from the Formosa mine site amended with various combinations of LBB-LSM. The above and belowground biomass of plants grown in mine tailings amended with LBB was 3-4 times larger than the biomass of plants grown in tailings amended with lime. Although the LSM addition did not influence immediate plant growth, it did affect nutrient content and altered the rhizosphere community composition.

HEAVY METALS MULTI-TOLERANT BRADYRHIZOBIUM ISOLATED FROM MERCURY MINING REGION IN ALGERIA
Salmi, A. and F. Boulila. | Journal of Environmental Management 289:112547(2021)

This study isolated and characterized the strains nodulating the *Calicotome spinosa* plant that naturally occurred in two Algerian mercury mines. Fifty-four bacterial strains were isolated, then grouped into sixteen distinct BOX-PCR patterns belonging to the *Bradyrhizobium* genus. The strains induced nodules on *Retama monosperma, R. reatam, Lupinus albus*, while no nodulation was observed in *Glycine max*. Their symbiotic capacity was confirmed by amplifying the *nod* C gene. Phylogenetic analysis grouped the *Bradyrhizobium* strains to either symbiovar, genistearum, or retamae. The isolates revealed diversity in terms of NaCl, pH tolerance, and phosphate solubilization. Production of siderophores was negative for these strains. The isolated *Bradyrhizobium* were tolerant to both Zn and Pb but were sensitive to Cu and Cd, while 43% of strains were tolerant to high Hg levels.

ROLE OF MULTIPLE SUBSTRATES (SPENT MUSHROOM COMPOST, OCHRE, STEEL SLAG, AND LIMESTONE) IN PASSIVE REMEDIATION OF METAL-CONTAINING ACID MINE DRAINAGE
Molahid, V.L.M., F.M. Kusin, and Z. Madzin.
Environmental Technology 40(10): 1323-1336(2019)

The efficiencies of single and mixed substrates using low and high-concentrations solutions to treat acid mine drainage were investigated using synthetic AMD. Substrates included spent mushroom compost (SMC), ochre, steel slag (SS), and limestone. Different ratios of treatment materials were incorporated in the substrate mix and tested under anoxic conditions. The study analyzed pH, redox potential, total dissolved solids, conductivity, Ca concentration, and heavy metals (Fe, Mn, Pb, Zn, and Al) in batch tests. The mixed substrates showed satisfactory performance in increasing pH with increasing Ca concentration and removing metals. Mixed substrates SM1 (10% SMC mixed with 20% ochre, 30% steel slag, and 40% limestone) and SM2 (20% SMC mixed with 30% ochre, 40% steel slag, and 10% limestone) increased the pH from as low as 3.5-8.09 and achieved a removal efficiency of more than 90% for heavy metals.

CHARACTERISTICS AND STABILITY OF INCIDENTAL IRON OXIDE NANOPARTICLES DURING REMEDIATION OF A MINING-IMPACTED STREAM
Rand, L.N. and J.F. Ranville.
Environmental Science & Technology 53(19)11214-11222(2019)

This work linked field measurements and lab experiments to explore surface chemistry effects on acid mine drainage-generated Fe oxide iron nanoparticle (INP) behavior before and 6 months after remediation of a hydrologically dynamic alpine stream. Fe and Cu INP concentrations were ~107 and 105 particles/mL before and after treatment, respectively. Overall, ~4 Cu-containing INPs were counted for every 100 Fe-containing INPs. Surface chemistry changes were also studied during the treatment period using hematite (a model Fe INP) suspended in filtered field waters. Changes in zeta potential and INP size, measured by dynamic light scattering, support that the contaminated stream chemistry (low pH, high ionic strength) promoted rapid aggregation while improved water quality favored stability. The water chemistry and INP stability were impacted by electrolyte dilution, the addition of dissolved organic matter, and physical scouring during snowmelt.

MICROBIAL CONSORTIA CAPABLE OF REDUCING SELENATE IN THE PRESENCE OF NITRATE ENRICHED FROM COALMINING-IMPACTED ENVIRONMENTS
Nkansah-Boadu, F., I. Hatam, and S.A. Baldwin.
Applied Microbiology and Biotechnology 105:1287-1300 (2021)

Microbial consortia capable of removing dissolved selenium (Se) in the presence of nitrate was enriched from native bacteria at sites influenced by coalmine seepages with elevated concentrations of Se, nitrate, and sulfate. Enrichments were collected from sediments in different vegetated or non-vegetated seepage collection ponds. Nitrate inhibited dissolved Se removal rates in four of these enrichments, though microorganisms enriched from a mine seepage influenced natural vegetated marsh removed dissolved Se and nitrate simultaneously. Enrichments from one seepage collection pond achieved enhanced dissolved Se removal in the presence of nitrate. Based on functional metagenomics, the dominant species with the metabolic capacity for selenate reduction were classified in Orders Enterobacterales and Clostridiales. *To view supplemental information for free, see* https://pubs.acs.org/doi/10.1021/acssuschemeng.0c07549

General News

SYSTEMS AND PROCESSES FOR RECOVERY OF HIGH-GRADE RARE EARTH CONCENTRATE FROM ACID MINE DRAINAGE
Ziemkiewicz, P., A. Noble, and C. Vass, West Virginia University, Morgantown, WV. United States Patent Office, Washington, DC. U.S. Patent No 10,954,582, 23 March, 2021

This patent application is for the invention of a continuous process to treat acid mine drainage while simultaneously recovering a high-grade rare earth preconcentrate suitable to extract commercially valuable rare earth oxides. The preconcentrate is from about 0.1% to 5% rare earth elements on a dry weight basis. The disclosure includes a method to process the preconcentrate to generate a pregnant leach solution that does not form gels or emulsions and is suitable to process via solvent extraction, a system and plant for carrying out the disclosed process, and a composition containing rare earth elements produced by the process disclosed herein.
https://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PALL&p=1&u=%2Fnetahtml%2FPTO%2Fsrchnum.htm&r=1&f=G&l=50&s1=10954582.PN.&OS=PN/10954582&RS=PN/10954582

TAILINGS AND MINE WASTE '20: PROCEEDINGS OF THE 24TH INTERNATIONAL CONFERENCE ON TAILINGS AND MINE WASTE, VIRTUAL, 15-18 NOVEMBER, 2020
UBC Studios, Vancouver BC, 812 pp, 2020

Proceedings of the Tailings and Mine Waste 2020 conference present over 72 state-of-the-art papers on mine and mill tailings and mine waste, as well as current and future issues facing the mining and environmental communities, such as dealing with technical capabilities and developments, regulations, and environmental concerns. Papers include topics related to site characterization and monitoring; reclamation and remediation; protective liners, covers, and barriers; design and operation; geotechnical and geochemical aspects; reprocessing, utilization, and treatment; new technologies; paste disposal technology; and case histories.https://tailingsandminewaste.com/2020/TMW2020_V3.pdf

ABANDONED MINE LANDS RECLAMATION BY PLANT REMEDIATION TECHNOLOGIES
Peco, J.D., P. Higueras, J.A. Campos, J.M. Esbri, M.M. Moreno, F. Battaglia-Brunet, and L.M. Sandalio. I Sustainability 13:6555(2021)

Plant-based techniques have become an environmentally friendly reclamation alternative over the last 20 years to treat potentially toxic elements (PTEs) on abandoned mine lands (AMLs). This article reviews phytoextraction, phytostabilization, and phytovolatilization techniques, focusing on selecting appropriate plants in each case. The accumulation capacity and tolerance mechanisms of PTEs are described to assess the suitability of plants for phytoremediation purposes. The article also includes a collection of interesting examples of AML phytoremediation. On-site studies have shown positive results in terms of soil quality improvement, reduced PTE bioavailability, and increased biodiversity. However, phytoremediation strategies need to better characterize potential plant candidates to improve PTE extraction and reduce the negative impact on AMLs. https://www.mdpi.com/2071-1050/13/12/6555/pdf

INNOVATIVE TECHNIQUES FOR LANDSCAPE RECOVERY AFTER CLAY MINING UNDER MEDITERRANEAN CONDITIONS DIANA TURRION
Turrion, D., L. Morcillo, J.A. Alloza, and A. Vilagrosa. I Sustainability 13:3439(2021)

The TECMINE case study was developed to evaluate the feasibility and suitability of applying innovative restoration practices to clay-mine reclamation under Mediterranean conditions. The restoration strategy was designed at the landscape level with two main approaches: natural geomorphology shape recovery and ecological restoration, including vegetation recovery and soil quality, based on proper reference ecosystems. After the geomorphological land remodeling, a combination of several innovative restoration techniques was implemented to reclaim plant communities and ecosystem functioning, including (i) accurate species selection according to microhabitat characteristics; (ii) high-quality plant production; (iii) surface remodeling to improve substrate stabilization; and (iv) implementing rainfall collection to enhance availability of resources, soil fertility improvement and the amelioration of abiotic conditions for seedlings. Finally, a monitoring program was developed to assess the implemented restoration techniques over time. https://www.mdpi.com/2071-1050/13/6/3439/pdf

CRITICAL METAL RECOVERY POTENTIAL OF APPALACHIAN ACID MINE DRAINAGE TREATMENT SOLIDS
Hedin, B.C., R.S. Hedin, R.C. Capo, and B.W. Stewart.
International Journal of Coal Geology 231:103610(2020)

While rare earth elements (REE) are critically important in clean energy technologies, mining and refining are energy-intensive and generate significant quantities of environmentally harmful waste. Acid mine drainage (AMD) treatment preconcentrates REE and critical metals such as manganese and cobalt into oxide/hydroxide waste products where they can potentially be recovered. Analysis of 281 treatment solids from coal AMD remediation systems across the northern Appalachian Basin indicate that the most promising solids (REE value >$400 USD/metric ton) are produced in systems that use limestone or sodium hydroxide to treat low pH <5) AMD with elevated dissolved aluminum and manganese content. Recovering REE from passive treatment systems could subsidize AMD treatment while reducing the environmental footprint of REE extraction.

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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