Technology Innovation News Survey

Entries for August 16-31, 2022

Market/Commercialization Information

ELY MINE ENVIRONMENTAL REMEDIATION, VERSHIRE, VT

Contract Opportunities at SAM.gov, Solicitation W912WJ23X0004, 2022
U.S. Army Corps of Engineers, New England District, Concord, MA

This is a sources sought notice for marketing purposes only. The U.S. Army Corps of Engineers, New England District, seeks to determine the interest, availability, and capability of 8(a), HUBZone, Service-Disabled Veteran-Owned, Woman-Owned, and Small Business concerns qualified to provide Environmental Remediation Services at the Ely Copper Mine Superfund Site under NAICS code 562910. Work will include the excavation and on-site capping of metals contaminated waste rock, tailing, sediment, and soils, as well as the permanent closure of specific shafts and adits as described in the Record of Decision for OU1, 2, and 3. The value of the construction project is expected to be in the $20M - $30M range. Remediation field work is expected to begin in 2024 and be completed within three to five years. All work will be performed in accordance with CERCLA, the OU1 Record of Decision signed in September 2011, the OU2/3 Record of Decision signed in June 2016, the OU1 Explanation of Significant Differences signed in September 2019, and EPA green and sustainability principles. This anticipated contract is expected to be an Indefinite Delivery/Indefinite Quantity (IDIQ) Remedial Action Contract (RAC). No solicitation is currently available. Capability packages are due by 1:00 PM EDT on October 21, 2022.
https://sam.gov/opp/eb89428f6d1a432c980d9c37ce36f11c/view

ENVIRONMENTAL REMEDIATION SERVICES AT THE DURHAM MANUFACTURING COMPANY SITE IN DURHAM, CONNECTICUT

Contract Opportunities at SAM.gov, Solicitation W912WJ22R0014, 2022
U.S. Army Corps of Engineers, New England District, Concord, MA

This is a total small business set-aside under NAICS code 562910. The U.S. Army Corps of Engineers, New England District, is issuing a best-value solicitation for environmental remediation for the temporary treatment of groundwater and excavation and disposal of soils contaminated with volatile organics at the Durham Meadows Superfund Site in Durham, Connecticut. Contract Line Items (CLINs) will clearly define separable cost-reimbursable line items. The project footprint impacts two properties - the Durham Manufacturing Company (DMC) located at 201 Main Street and the adjacent residential property at 215 Main Street. Subsurface soils and groundwater in some portions of the Project Site are impacted with TCE, PCE, and non-chlorinated VOC contaminants. For that reason, the work is subject to the requirements for hazardous waste operations specified in Federal Occupational Safety and Health regulation 29 CFR 1910.120. The DMC will remain in operation throughout the duration of the remedial work, so the contractor should expect considerable pedestrian and vehicle traffic around the Project Site. Planned excavation limits impact existing utilities including power and septic, and they extend to the bottom of the existing DMC foundation wall. The project includes establishing temporary utilities for the DMC, temporary shoring and foundation support, groundwater treatment, excavation and transport of approximately 11,000 yd^3 of contaminated soils to off-site permitted disposal facilities, permanent foundation restoration, utility restoration, and general site restoration. The remediation activities will be broken into phases to ensure that the manufacturing building can continue normal operations. Temporary site fencing and erosion controls are to be installed around a Phase 1A excavation in the parking area north of the building. Offers are due by 1:00 PM EDT on October 24, 2022. https://sam.gov/opp/ac3fd3f6885646fba84ad44bf277de49/view

JACOBSVILLE ENVIRONMENTAL REMEDIATION SERVICES (SOL)

Contract Opportunities at SAM.gov, Solicitation W912QR22R0056, 2022
U.S. Department of the Army, Louisville Engineer District, Louisville, KY

This is a full and open competition under NAICS code 562910. The U.S. Department of the Army seeks a contractor to perform environmental services to remediate lead- and arsenic-contaminated soil specified on remedial design drawings for residential properties within Operable Unit 2 (OU2) of the Jacobsville Neighborhood Soil Contamination Superfund Site. In general, remedial action includes excavation of residential lead- and arsenic-contaminated soil per EPA-provided remedial designs, backfill/restoration of disturbed areas, transportation and disposal of contaminated soil, and completion of remediation reports documenting cleanup. USACE anticipates that 400 remedial designs will require remediation during each of the first two field seasons. Up to 400 remedial designs may be remediated during each field season thereafter. A field season may last from March through mid-December but is dependent on weather, approval of all planning documents and suitable backfill, and the number of remedial designs to be remediated. It should be noted that the Contractor's schedule for gaining approval of all planning documents and backfill in advance of starting excavation for the first field season will need to be aggressive so fieldwork can commence in a time frame that will allow for remediation of 400 properties during the first field season. Most remedial design drawings encompass one property as identified by a single Vanderburgh County tax identification number. However, some remedial design drawings encompass more than one adjacent property, each having a separate Vanderburgh County tax identification number but the same property owner. These properties were combined into one remedial design drawing by EPA during the remedial design phase for ease of reporting and sampling because they have the same property owner. Other remedial design drawings encompass one property with two adjacent street numbers and a single Vanderburgh County tax identification number and property owner. Therefore, one remedial design drawing may encompass more than one residence. The award will be an Indefinite Delivery, Indefinite Quantity Contract with a base ordering period of three years from the date of award and two one-year option periods. The base ordering period will have an ordering capacity of $51 million. Each option period, if exercised, would increase the ordering capacity by $8 million. Offers are due by 2:00 PM EDT on October 24, 2022.
https://sam.gov/opp/bc98322e11cc40e89a0a2378bb37e5ab/view

Cleanup News

CLIMATE ADAPTATION PROFILE: IRON MOUNTAIN MINE

EPA website, 2022

EPA recently released a climate adaptation profile describing measures taken at the 4,400-acre Iron Mountain Mine near Redding, California. Response actions at this National Priorities List site have been conducted under five interim remedies to address waste rock and acid mine drainage (AMD) resulting from past mining activity. Current work focuses on operating an extensive, onsite AMD collection and treatment system. The site is vulnerable to intense storms, stormwater-related soil erosion or landslides, and wildfires such as the 2018 Carr Fire. Climate adaptation measures to protect the AMD collection and conveyance system have involved a redundant network of buried pipes in areas prone to landslides and replacing flammable aboveground pipes with stainless steel pipes. Measures to protect the site infrastructure included maintaining the capacity to store excess AMD in the event electricity is temporarily

unavailable for AMD treatment, adding protective materials such as gabions in stormwater let-down channels, and annually reassessing the need for additional fire-hardening measures.
https://www.epa.gov/superfund/climate-adaptation-profile-iron-mountain-mine.

REPLACEMENT OF A FAILED PASSIVE TREATMENT SYSTEM WITH THE REMOTELY MONITORED LIME SLURRY ACTIVE TREATMENT SYSTEM

Dietz, J.M. | 2022 PA Abandoned Mine Reclamation Conference, 22-23 June, State College, PA, 30 minutes, 2022

This presentation provides an overview of the various components of a lime slurry active passive treatment system installed to treat acid mine drainage (AMD) at the Orcutt-Smail discharge, a major source of AMD loading in the Little Mill Creek watershed, a tributary to Mill Creek. The AMD is a moderate flow (80-200 gpm) high acidity (500-700 mg/L as $CaCO_3$) discharge with elevated Fe (~200 mg/L), Mn (~70 mg/L), and Al (~10 mg/L) associated with a surface mine. A previous system constructed to provide permanent treatment of AMD failed within several years, indicated by decreasing flow through the successive alkalinity-producing system underdrains and increasing acidity and metal concentrations in the passive system effluent. The innovative lime slurry active treatment system consists of a lime slurry storage and feed system, a pre-aeration and oxidation reactor, and a control system. The control system includes electrical components to operate the various mechanical components and a unique cellular and internet-based remote monitoring and alarm system. The overall treatment system also utilized converted and existing passive treatment units to settle and handle metal solids.
https://www.youtube.com/watch?v=tGZG9gvs90w

KEMESS SELEN-IX™ PLANT FOR SELENIUM REMOVAL

Clean 50 Top Project, website, 2022

The Kemess Selen-IX™ Plant, located at a remote mine site in Northern British Columbia, utilizes ion exchange resins and electrochemical cells to remove selenium from impacted mine water. The key objective was to meet end-of-pipe selenium limits of < 2 ppb without relying on dilution while producing a stable and non-toxic solid residue that satisfies the criteria for onsite disposal. Once lab testing confirmed that combining ion exchange and electrochemistry could remove selenium, a mobile pilot plant was built to complete larger-scale testing on mine water containing varying selenium concentrations. The pilot project produced treated water with < 5 ppb of selenium. As the team progressively improved the process, more pilot projects resulted in new efficiencies that positively impacted capital and operating costs. A two-month industrial demonstration operated on multiple water compositions under conditions expected in full-scale plants achieved results that matched the performance expected from the pilot projects. Based on the demonstration, a phased implementation approach began, ending with the commissioning and startup of a full-scale plant. The selenium is removed without transforming it into a more toxic form of selenium, and no chemicals or contaminants not previously present are added to the treated water. The treatment process not only adjusts rapidly to fluctuations in feed water flow and composition, but its efficiency is also not impacted by cold water temperatures.
https://clean50.com/projects/raising-a-glass-to-bge-the-kemess-selen-ix-mining-wastewater-selenium-removal-plant/
More information on Selen-IX:
https://bc-mlard.ca/files/presentations/2021-15-LIANG-ETAL-non-biological-active-selenium.pdf

COLLABORATIVE APPROACH TO REMEDIATION AT THE HOWARD MINE MILL AND TAILINGS AREA

Croston, J., H. Bains, J. White, and G. Sinnett.
2021 British Columbia Mine Reclamation Symposium, 22-23 September, virtual, 2021

The former Howard Mine Mill and Tailings Area (Site), south of Ymir, British Columbia, included a mill and tailings deposit along the banks of the Salmo River. The mine wastes were acid-generating, contained metal concentrations greater than soil standards protective of human and ecological health, and were a source of contamination to the river. While the mine wastes were on Crown land, a small portion extended onto adjacent residential properties and contaminated a local drinking water well. The site was prioritized for remediation. Engagement with the community, Indigenous Peoples, and government agencies was an important part of the remedial planning process. It included meetings to seek input on the remedial plan and reclamation design. Through engagement, consensus on the plan was achieved, and the remedial work was approved. Remediation included excavation and consolidation of mine waste into an approved hazardous waste facility covered with a bituminous geomembrane liner and growth medium. All disturbed areas were reclaimed, and an erosion barrier/artificial floodplain with a fish habitat was constructed on the east bank of the Salmo River. A new drinking water well was installed for the adjacent landowner. The site is currently undergoing long-term monitoring to ensure the remedial works are performing as designed and to measure natural attenuation of residual contamination in groundwater. Performance verification results indicate the remediation successfully removed terrestrial risks to human and ecological receptors and reduced metal concentrations in groundwater, porewater, and surface water across most of the site. https://open.library.ubc.ca/media/download/pdf/59367/1.0402668/5

Demonstrations / Feasibility Studies

PASSIVE TREATMENT OF CIRCUMNEUTRAL MINE DRAINAGE FROM THE ST. LOUIS MINE TUNNEL, RICO CO: PART 3-HORIZONTAL WETLANDS TREATMENT TRAIN PILOT STUDY

Sobolewski, A.B., A.C. Riese, T.J. Moore, and A.R. Brown.
Mine Water and the Environment (2022)

A study tested the performance of a demonstration-scale horizontal wetlands passive treatment train comprised of a settling basin, surface flow wetland, horizontal-flow anerobic wetland, aeration channel, and rock drain at the Rico-Argentine site. Mine drainage from the St Louis Tunnel is circumneutral most of the year, with spring freshets increasing flow, decreasing pH, and increasing metal concentrations. Total Zn, Cd, and Mn effluent concentrations met project treatment goals (PTGs) 75, 96.9, and 100% of the time, respectively, and 93.9, 100, and 100% of the time for the dissolved metals. Most PTG exceedances occurred during the freshet events. Most Zn and Cd attenuation was attributed to sulfide precipitation in the anaerobic cell and capture/filtration of suspended ZnS particles in the anaerobic wetland and rock drain. Manganese was attenuated in the aerobic portion of the anaerobic cell as Mn oxides and carbonates. Oxidation of Mn occurred in the rock drain as biogenically formed Mn oxides adhered to the rock matrix. Carryover of dissolved sulfides from the anaerobic cell limited the rock drain's Mn removal efficiency. Low temperatures did not significantly affect biological activity within the system; the effects of seasonal water quality were more important. https://link.springer.com/content/pdf/10.1007/s10230-022-00856-9.pdf

RONDELL-CORREAL MINE DRAINAGE TREATMENT SYSTEM - TREATMENT FOR HIGH LEVEL ALUMINUM MINE DISCHARGES PILOT PROJECT

Douglas, F. and C. Ruddock | 2022 PA Abandoned Mine Reclamation Conference, 22-23 June, State College, PA, 39 minutes, 2022

The Rondell-Correal discharge, sourced from the former Rondell Strip Mine, is located at the headwaters of Newmyer Run, a tributary of Poplar Run within the Indian Creek watershed. It exhibits the most degraded water quality in the watershed, discharging anywhere between 4-60 gal/min of highly acidic (pH 2.8) water with high levels of Al (60 mg/L), Fe (40 mg/L), and Mn (40 mg/L). An advanced catalytic treatment process is being developed that will concentrate on removing high levels of aluminum from the discharge with limited area for traditional or passive treatment. This process removes >99% Al and > 99% Fe in a comparatively small footprint compared to sedimentation technologies. The process also demonstrates significant Mn removal. This presentation provides an overview of the pilot phase, including successes and challenges, and discusses what is needed for full-scale implementation.
https://www.youtube.com/watch?v=iCiWucGffNs

ARSENIC UPTAKE BY PTERIS VITTATA IN A SUBARCTIC ARSENIC-CONTAMINATED AGRICULTURAL FIELD IN JAPAN: AN 8-YEAR STUDY

Kohda, Y. H.-T., G. Endo, N. Kitajima, K. Sugawara, M.-F. Chien, C. Inoue, and K. Miyauchi.
Science of The Total Environment 831:154830(2022)

Pteris vittate was investigated in an As-contaminated field near an abandoned goldmine in a subarctic area of northeast Japan. This study aimed to decrease the risk of water-soluble As in soil while nurturing the soil and respecting the plant life cycle for sustainable phytoremediation over eight years. The field was tilled and planted with new fern seedlings every spring, and grown ferns were harvested every autumn. Fronds, rhizomes, and roots of the fern were analyzed separately for biomass and As after harvesting each year. Frond biomass was significantly affected by the yearly change in weather conditions. As concentration in fronds was maintained at a 100-150 mg/kg dry weight. The accumulated As in *P. vittata* was higher than that of As-hyperaccumulator fern *Pteris cretica*, the native fern in the field trial area. Harvested biomass of *P. vittata* per plant was also higher than that of *P. cretica*. More than 43.5 g As/154 m^2 (2.82 kg of As/hectare) was removed via phytoremediation during the experiment. Because of the short-term plant growth period and soil tilling process, total As in soil did not show significant depletion. However, the water-soluble As in the surface and deeper soil decreased to 10 µg/L (Japan Environmental Quality Standard for water-soluble As in soil).

ASSESSING PILOT-SCALE TREATMENT FACILITIES WITH STEEL SLAG-LIMESTONE REACTORS TO REMOVE MN FROM MINE DRAINAGE

Kim, D.-M., H.-S. Park, J.-H. Hong, and J.-H. Lee.
Mine Water and the Environment volume 41(2):402-414(2022)

A pilot study tested a steel slag-limestone reactor (slag reactor) and compared a successive alkalinity producing system (SAPS) to a SAPS incorporating slag from a basic oxygen steelmaking furnace at the Ilwol mine in South Korea. The SAPS decreased Mn from 23.3 to 7.4 mg/L on average because the alkalinity generated led to saturation with rhodochrosite. Adding a slag reactor decreased Mn levels to 0.002-1.8 mg/L from influent Mn as high as 17.1 mg/L with a residence time of 5-25 h. Mn-containing carbonates and oxides were precipitated, supported by the geochemical modeling, and observed with scanning electron microscopy with energy dispersive spectroscopy. The increased alkalinity in the SAPS before the slag reactor helped remove Mn at a pH range of 8.0-8.3. Mn removal and Mn-standardized Mn removal rates in the slag reactor were 0.76 mg/L/h and 0.105/h on average, respectively. To consistently meet the effluent standards for Mn and pH, the passive treatment of Mn using a Fe-pretreatment and alkalinity-generation system, a slag-limestone reactor, and a wetland rather than a SAPS including slag, an oxidation-settling pond, and a wetland is suggested.

Research

METAL LABILITY AND MASS TRANSFER RESPONSE TO DIRECT-PLANTING PHYTOSTABILIZATION OF PYRITIC MINE TAILINGS

Hammond, C.M., R.A. Root, R.M. Maier, and J. Chorover.
Minerals 12(6):757(2022)

Metal lability trends were investigated following a direct-planting phytostabilization trial at a Superfund mine tailings site in semi-arid central Arizona. Unamended tailings were characterized by high concentrations (mmol/kg) of Fe (2,100), S (3,100), As (41), Zn (39), and Pb (11), where As and Pb exceeded Arizona non-residential soil remediation levels. Phytostabilization treatments included a no-compost control, 100 g/kg compost with seed, and 200 g/kg compost with and without seed to the top 20 cm of the tailings profile. All plots received supplemental irrigation to double the mean annual precipitation. Tailings cores up to 90 cm were collected at planting and every summer for three years. The cores were sub-sectioned at 20 cm increments, then analyzed via total digestion and an operationally-defined sequential extraction for elemental analysis. Calculations of a mass transfer coefficient were normalized to Ti as an assigned immobile element. Pb was recalcitrant and relatively immobile in the tailings environment for the uncomposted control and composted treatments, with a maximum variation in the total concentration of 9-14 mmol/kg among all samples. Metal lability and translocation above the redox boundary (ca. 30 cm depth) were governed by acid generation, where surficial pH was measured as low as 2.7 ± 0.1 in and strongly correlated with the increased lability of Mn, Co, Ni, Cu, and Zn. There was no significant pH effect on V, Cr, or Pb availability. Translocation to depths was highest for Mn and Co though Zn, Ni, Cr, and Cu were also mobilized. Adding organic matter enhanced Cr mobilization from the near-surface to 40-60 cm depth (pH > 6) during the phytostabilization study compared to the control. Increased enrichment of some metals at 60-90 cm indicates that the long-term monitoring of elemental translocation is necessary to assess the efficacy of phytostabilization to contain subsurface metal contaminants and thereby protect the surrounding community from exposure. *This article is* ***Open Access*** *at* https://www.mdpi.com/2075-163X/12/6/757.

TRANSPORT AND SPECIATION OF URANIUM IN GROUNDWATER-SURFACE WATER SYSTEMS IMPACTED BY LEGACY MILLING OPERATIONS

Byrne, P., Christopher C.Fuller, D.L. Naftz, R.L. Runkel, N.J. Lehto, and W.L. Dam.
Science of The Total Environment 761:143314(2021)

A study utilized novel in-situ sampling methods to establish the location and magnitude of contaminated groundwater entry into a receiving surface water environment and investigate the speciation and potential bioavailability of uranium

in groundwater and surface water. Streambed temperature mapping identified the location of groundwater entry to the Little Wind River, downgradient from the former Riverton uranium mill site. Diffusive equilibrium in thin-film (DET) samplers further constrained the groundwater plume and established sediment pore water solute concentrations and patterns. This system presented evidence for attenuation of uranium-rich groundwater in shallow sediments where surface water and groundwater interaction occur. Surface water grab and DET sampling detected an increase in river uranium concentrations where the groundwater plume enters the Little Wind River; however, concentrations remained below environmental guideline levels. Uranium speciation was investigated using diffusive gradients in thin-film samplers and geochemical speciation modeling. These investigations indicate uranium may have limited bioavailability to organisms in the river and, possibly, in other similar sites in the western U.S. This could be due to ion competition effects or the presence of non- or partially labile uranium complexes. Development of methods to establish the location of contaminated (uranium) groundwater entry to surface water environments, and the potential effects on ecosystems, is crucial to develop site-specific and general conceptual models of uranium behavior and potential toxicity in affected ground and surface water environments.

EVALUATION OF CAPPING MATERIALS TO REDUCE ZINC FLUX FROM SEDIMENTS IN A FORMER MINING PIT LAKE

Cervi, E.C., M. Hudson, A. Rentschler, S. Clark, S.S. Brown, and G.A. Burton Jr.
Environmental Toxicology & Chemistry 41(1):193-200(2022)

A former vanadium mine, which drains via two streams into Lake Catherine, has undergone extensive reclamation to significantly reduce groundwater and surface water contact with mine spoils. One of the streams passes through a former mine pit forming East Wilson Pond. To mitigate potential risks, an investigation was conducted to evaluate the efficacy of capping materials to partition Zn-contaminated sediments from overlying water in East Wilson Pond. A 28-day lab study compared the effectiveness of capping materials (combinations of limestone, bentonite clay, and gravel) to mitigate Zn flux, including under reasonable worst-case conditions (pH 5.5) encountered in the hypolimnion. Dissolved Zn was monitored in overlying water and sediment porewaters within untreated controls and within the capping layer of treated systems. Using limestone and/or bentonite clay improved buffering capacity compared to the noncapped control, and pH declined gradually but modestly in the overlying water and porewater of all treated systems. Zn concentrations in the overlying water of the noncapped control increased from ~30 to 100 µg/L, while concentrations in the overlying water and porewater of systems containing capping materials remained low (10-30 µg/L). Results demonstrated the effectiveness of the capping materials for neutralizing pH and reducing Zn flux and were used to inform the selection of cap materials. https://setac.onlinelibrary.wiley.com/doi/epdf/10.1002/etc.5258

EFFECTIVE TREATMENT OF ACID MINE DRAINAGE USING A COMBINATION OF MGO-NANOPARTICLES AND A SERIES OF CONSTRUCTED WETLANDS PLANTED WITH VETIVERIA ZIZANIOIDES: A HYBRID AND STEPWISE APPROACH

Nguegang, B., V. Masindi, T.A.M. Makudali, and M. Tekere.
Journal of Environmental Management 310:114751(2022)

Acid mine drainage (AMD) was treated in a study using a hybrid approach that combined a nano-and-biotic system synergistically integrated in a stepwise and modular fashion. The treatment chains were composed of different stages, including neutralization using activated magnesite or MgO-nanoparticles (NPs) (Stage 1) and polishing using a series of wetlands (Stage 2) in a stepwise connection. In Stage 1, actual AMD was treated with MgO-NPs at a ratio of 1:100 (1 g/100 mL - w/v ratio), 500 rpm of mixing speed, and 1 hour of hydraulic retention time (HRT). In Stage 2, the final water was fed into three interconnected constructed wetlands with different flow modalities [(subsurface vertical flow (SSVF-CW), free water surface flow (FWS-CW), and subsurface horizontal flow (SSHF-CW)], for further purification and polishing. The product water and substrate were collected daily at the outlet and bottom of each wetland. After treatment, the pH of the product water increased from 2.6 to 10.4. Significant removal of inorganic contaminants was observed in the following removal sequence: Fe (99.8%) ≥ Al (99.5%) ≥ Mn (99.24%) ≥ Zn (98.36%) ≥ Cu (97.38%) ≥ Ni (97.7%) ≥ SO_4^{2-} (80.59%). Reduced electrical conductivity was also observed (86%). Step 1 partially removed the metals and sulfate while Step 2 effectively removed SO_4^{2-} and EC levels, thus denoting stellar combination and complementary performance for the hybrid system in an integrated fashion. Analytical instruments underpin and succinct the fate of chemical species in raw and product MgO-NPs, substrates, and the grass. The product water conformed to the prescribed standards for effluent discharge, proving that the synergy of neutralization and bioremediation could yield the desired results in mine water management.

INVESTIGATING THE POTENTIAL FOR MICROBIALLY INDUCED CARBONATE PRECIPITATION TO TREAT MINE WASTE

Proudfoot, D., L. Brooks, C. Gammons, E. Barth, D. Bless, R. Nagisetty, and E. Lauchnor.
Journal of Hazardous Materials 424(Part C):127490(2022)

The feasibility of promoting microbially induced carbonate precipitation (MICP) in mine waste piles was explored by using an environmental bacterial enrichment to reduce metals and acid leaching. A native bacterial enrichment was utilized to promote MICP on seven mine waste samples with variability in acid production and extent of toxic metal leaching. Calcium carbonate ($CaCO_3$) formed on grain surfaces within all waste samples in 15 applications of MICP solutions and bacteria on waste rock in bench-scale columns, though microscopy revealed uneven distribution of $CaCO_3$ coating. The effluent from acid-producing wastes increased in pH during MICP treatment. Humidity cell and synthetic precipitation leaching procedure (SPLP) tests revealed reductions in Cd, Pb, and Zn concentrations in all but one sample, mixed results for Cu, and increased As in all but one leachate sample after treatment. MICP technology may potentially coat mine waste and reduce the release of acid and some metals.

METALS REMOVAL IN A TWO-STAGE HDS PILOT STUDY ON CONCENTRATED MINE WATER

Schubert, J. and S. Ananthanarayan.
Proceedings of Mine Water Solution, 14-16 June, Vancouver, Canada, 2022

Closing an inactive mine site included managing and disposing of highly acidic water that accumulated onsite, with high concentrations of sulfate, total dissolved solids, metals, and metalloids. Several processes were evaluated to remove the bulk of the wastewater constituents, including sulfate, fluoride, Al, Cu, Fe, and a host of metals and metalloids at lower concentrations. As an initial evaluation, the high-density sludge (HDS) process was selected for a lab-scale pilot study. Lime and limestone were evaluated as neutralizing agents. Two runs were conducted. The pilot system operated at a nominally 100 mL/min flow under various operating conditions. The high strength of the wastewater and the resulting high solids formed in neutralization presented major challenges. This paper describes the wastewater characteristics, pilot system configuration, overall pilot system performance, and the degree of removal of some of the specific metals present. *See* ***pages 347-362:***

https://www.mlneconferences.com/files/ProceedingsofMineWaterSolutions2022.pdf

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General News

EVAPOTRANSPIRATION COVERS AT URANIUM MILL TAILINGS SITES

Caldwell, T.G., S. Tabatabai, J.M. Huntington, G.E. Davies, and M. Fuhrmann.
Vadose Zone Journal 21(5):e20222(2022)

This update reviews the current state of the science regarding evapotranspiration (ET) covers and considerations for long-term applications. Waste isolation is a key strategy to mitigate risk from municipal solid waste (MSW) and hazardous waste streams. Conventional covers at MSW facilities are designed for a 30-yr post-closure period where compacted soils and geosynthetics are used to minimize percolation into buried waste. ET covers have shown beneficial use for MSW management by encouraging infiltration, storage, and precipitation transpiration to minimize percolation. Uranium Mill Tailings Radiation Control Act sites were covered by a clay radon barrier, creating tortuous flow paths that allow radioactive decay and attenuation of short-lived, ^{222}Rn gas. An ET-radon cover may provide greater resilience for long-term waste isolation by exploiting natural processes instead of resisting them.
https://acsess.onlinelibrary.wiley.com/doi/epdf/10.1002/vzj2.20222

THE MODEL IS WRONG, GET OVER IT - UNCOMFORTABLE TRUTHS AND DECISION MAKING WITH MATHEMATICAL MODELS

Morrissey, J., M. Jeddere-Fisher, J. Lofts, M. Lacroix, and C. Sonntag.
Proceedings of Mine Water Solution, 14-16 June, Vancouver, Canada, 2022

The application of a decision framework for use with mathematical models of surface and groundwater systems through an iterative approach rather than a more traditional linear planning process is discussed in this paper. Following this framework can dramatically improve the transparency and clarity of any mathematical model with a specific focus on the more challenging applications, such as in surface water and groundwater systems. Applying the framework will help determine the reliability of a model, highlight what is known from what is not, assist in preparing to procure modeling services and, importantly, facilitate communication of the decision-making process to all stakeholders. *See pages* ***205-213:***
https://www.mineconferences.com/files/ProceedingsofMineWaterSolutions2022.pdf

REPURPOSING LEGACY SEDIMENT FOR ABANDONED MINE LANDS

Sweeney, J. and D. Coleman. | 2022 PA Abandoned Mine Reclamation Conference, 22-23 June, State College, PA, 39 minutes, 2022

Repurposing legacy sediments from stream restoration projects presents a unique challenge and opportunity to support and incentivize future projects and landowner willingness to participate in potential projects. Using second-generation and third-generation Light Detection and Ranging (LiDAR), this project will identify, prioritize, and evaluate areas of legacy sediment with the highest erosion potential with a focus on riparian corridors within the Piedmont physiographic province, previously identified as having legacy sediment. The work overlaps third-generation Light Detection and Ranging (LiDAR) with second-generation LiDAR to identify the areas of legacy sediment with the highest erosive potential. Ten sites will be chosen for a site-specific evaluation based on GIS data, landowner objectives, and the best-case treatment system. The evaluation will include soil sampling to assure there is no presence of hazardous materials and assess how and where the sediment can be relocated, including costs associated with relocation. The results of this analysis will recommend the most efficient and cost-effective method of treatment of the legacy sediment and identify site characteristics that will allow for a successful project. https://www.youtube.com/watch?v=FdVQ4sG2Pew

ADVANCES IN THE USE OF RECYCLED NON-FERROUS SLAG AS A RESOURCE FOR NON-FERROUS METAL MINE SITE REMEDIATION

Ban, J., K. Sun, J. Yao, G. Sunahara, K. Hudson-Edwards, G. Jordan, L. Alakangas, W. Ni, and C.-S. Poon. | Environmental Research 213:113533(2022)

This review discusses the current research on the effect of non-ferrous slags on the reaction mechanisms of ordinary Portland cement (OPC) and alkali-activated materials (AAMs). Solidification and stabilization of heavy metal(oid)s (HMs) from the non-ferrous slags in AAM and OPC is also reviewed. HM can be stabilized in these materials based on the complex salt effect and isomorphic effects. The major challenges faced in AAMs and OPC for HM stabilization include the long-term durability of the matrix. Existing knowledge gaps and future trends for the sustainable application of non-ferrous slags are also discussed.

THE MICROBIOLOGY OF METAL MINE WASTE: BIOREMEDIATION APPLICATIONS AND IMPLICATIONS FOR PLANETARY HEALTH

Newsome, L. and C. Falagan. | Geohealth. 5(10):e2020GH000380(2021)

This article reviews the microbiology of the metals and metalloids commonly associated with mine wastes: As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn. The article also discusses the molecular mechanisms by which bacteria, archaea, and fungi interact with contaminant metals and the consequences for metal fate in the environment, focusing on long-term field studies of metal-impacted mine wastes where possible. Metal contamination can decrease the efficiency of soil functioning and essential element cycling due to the need for microbes to expend energy to maintain and repair cells. However, microbial communities can tolerate and adapt to metal contamination, particularly when the contaminant metals are essential elements subject to homeostasis or have a close biochemical analog. Stimulating the development of microbially reducing conditions (i.e., constructed wetlands) is beneficial for remediating many metals associated with mine wastes and is effective at low, circumneutral, and high pH conditions in the lab and at pilot scale. Further demonstration of this technology at full field-scale and more research to optimize bioremediation and investigate combined remediation strategies are needed.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8490943/pdf/GH2-5-e2020GH000380.pdf

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