Technology Innovation News Survey

Entries for November 16-30, 2017

Market/Commercialization Information

MATOC TO PROVIDE THIRD PARTY BLIND VALIDATION SEEDING AND ADVANCED GEOPHYSICAL CLASSIFICATION DATA COLLECTION AND PROCESSING

U.S. Army Corps of Engineers, USACE District, Albuquerque, NM.
Federal Business Opportunities, FBO-5874, Solicitation W912PP17R0011, 2017

This proposed procurement will be open to small and large businesses under NAICS code 562910 to result in firm-fixed-price IDIQs to multiple firms. In general, task orders under these MATOC IDIQs will support the USACE South Pacific and Southwestern Division with advanced geophysical classification QA/QC activities on existing, previously awarded, separate Military Munitions Response Program remedial investigation, removal, and/or remedial action contracts, task orders, or delivery orders. The contractor shall provide all personnel, equipment, supplies, facilities, transportation, tools, materials, supervision, and other items and non-personal services necessary to perform third-party blind validation. Release of the solicitation is anticipated around January 9, 2018. https://www.fbo.gov/index?s=opportunity&mode=form&id=1cfb1e8303ac9c5410f66a5abcb00ad7&tab=core&_view=0

NAVFAC NW ENVIRONMENTAL REMEDIATION SERVICES

Naval Facilities Engineering Command, NAVFAC Northwest, Silverdale, WA.
FBO-5874, Solicitation N44255-18-R-5011, 2017

NAVFAC Northwest (NW) issued this sources sought to determine small business capability and interest to perform planned environmental remediation services at installations and facilities located within the NAVFAC NW area of responsibility (Washington, Oregon, Idaho, Montana, Alaska, Iowa, Minnesota, North Dakota, South Dakota, Nebraska, and Wyoming). Most of the work likely will be performed in Washington state and Alaska. The NAICS code is 562910 (Remediation Services). The contract is to obtain services for environmental compliance and remediation program support, technical consultation, and optimization, planned as a firm-fixed-price IDIQ contract with a base year and four option years, not to exceed ~$40M in total. The response form posted with the FedBizOpps announcement must be completed and received via email by 2:00 PM PT on January 22, 2018.
https://www.fbo.gov/spg/DON/NAVFAC/N44255/N44255-18-R-5011/listing.html

Cleanup News

PASSIVE MINE WATER TREATMENT WITH A FULL SCALE, CONTAINERIZED VERTICAL FLOW REACTOR AT THE ABANDONED METSÄMONTTU MINE SITE, FINLAND

Wolkersdorfer, C. and B. Qonya.
Mine Water & Circular Economy (Wolkersdorfer, C. et al., eds.). IMWA, Vol I:109-117(2017)

The first full-scale containerized vertical flow reactor (VFR) operating in Finland is sized such that it treats all the mine water discharging from the abandoned Metsämonttu mine site. The design criteria allow treatment of 1-35 L/min of circum-neutral mine water. The full-scale reactor was designed and constructed based on the results of 6 weeks of small-scale experimental VFR operation, with measurement of Fe removal rate, flow, and on-site parameters. The experimental reactor removed > 80% of the iron in the mine water, whereas the full-scale VFR removes 95% of the iron and about 80% of the arsenic. Electrical conductivities range between 250 and 1300 µS/cm, pH between 7.0 and 7.9, and the redox-potential between 140 and 360 mV. Influent total iron concentrations range between 6.3 and 10.7 mg/L and outflow concentrations between 0.2 and 10.0 mg/L. A tracer test with NaCl revealed a mean residence time of 10 ± 1 h within the reactor, which is substantially below the design criteria of 48 hours. An on-site oxidation test showed that oxidation of the mine water reached 90% after 1 h, starting from an initial oxygen saturation of 30%. Neither removal of sulfate nor a statistically significant decrease of mine water mineralization was observed. https://www.imwa.info/docs/imwa_2017/IMWA2017_Wolkersdorfer_109.pdf

TRANSFORMING ABANDONED MINE LANDS INTO A BOTANIC GARDEN

Watzlaf, G.R., R.S. Hedin, B.C. Hedin, K. Kaiser, and R.L.Beam.
2017 National Meeting of the American Society of Mining and Reclamation, Morgantown, WV, 9-13 April. ASMR, Champaign, IL. 49 slides, 2017

The Pittsburgh Botanic Garden is being developed on 186 ha of abandoned mine land. Reclamation and remediation of this property is ongoing in four major project areas: the Woodlands Lotus Pond passive treatment system, the Kentucky Hollow passive treatment system, the Abandoned Mine Land Economic Revitalization Pilot Program, and remining/reclamation. A drainable limestone bed (DLB) constructed in the Woodlands area has treated mine drainage effectively for 3.5 years. The treated water is of such good quality that it discharges into the fish-stocked Lotus Pond, a project focal point. A newly funded project will treat two low-pH, high-aluminum mine discharges in the Kentucky Hollow area using DLBs. Over 10 ha are being remined to enable more effective treatment. About 1.3 ha of the remining area has been reclaimed and planted with trees.
Longer abstract: http://www.asmr.us/Portals/0/Documents/Meetings/2017/04-15-Watzlaf.pdf
Slides: http://www.asmr.us/Portals/0/Documents/Meetings/2017/04-15-Watzlaf-Slides.pdf

SUSTAINABLE POST-MINING LAND USE: ARE CLOSED METAL MINES ABANDONED OR RE-USED SPACE?

Kivinen, S.
Sustainability 9(No. 1705):1-18(2017)

An examination of landscape characteristics and post-mining land use in 51 metal mining sites in Finland looked at mines that were closed during the period of 1924-2016. Over half of the mines had been active more than 10 years. Mines were typically located in sparsely populated forest landscapes. Cultural and recreational functions were found in one-third of the sites, especially in significant historical mining areas close to the population centers, and nearly one-third of the post-mining sites included new activities related to industry and infrastructure. The diversity of post-mining functions was generally limited at small and isolated sites. Re-opening of five closed mines was planned or under development, and exploration permits (or claims) were applied or admitted for half of the post-mining areas. Results show that every closed mine is unique and thus sustainable post-mining land use requires careful evaluation of site potentials and limitations (e.g., contamination and other hazards). http://www.mdpi.com/2071-1050/9/10/1705/pdf

COMBINING IN SITU TREATMENT AND ACTIVE WATER TREATMENT: CASE STUDY AT SCHWARTZWALDER URANIUM MINE

Harrington, J.
The 23rd British Columbia MEND Metal Leaching/Acid Rock Drainage Workshop, Vancouver. 25 slides, 2016

The Cotter Corporation Schwartzwalder Mine (Jefferson County, CO) is an underground uranium mine that was operated from 1953 to 2000 and is now in reclamation. Mine pool water and groundwater in alluvial fill are contaminated with uranium, sulfate, manganese, and other constituents. The operator treats mine pool water using an in situ biological process. The site also has a reverse osmosis (RO) system for treating pumped mine pool water and an ion exchange (IX) system for treating alluvial groundwater that is captured in underground sumps. In situ pretreatment prevents buildup of constituents of concern within the mine pool. The operator monitors groundwater quality in 11 alluvial wells, 8 bedrock wells, and the mine pool. The RO system is operational, and the mine pool is currently being pumped and treated. In October 2016, Colorado approved Technical Revision No. 24 to relocate the water treatment facility to a new industrial water treatment plant (IWTP). The operator is constructing the new IWTP and commissioning the new treatment trains. http://bc-mlard.ca/files/presentations/2016-24-HARRINGTON-combining-in-situ-active-water.pdf

OPERATION AND MAINTENANCE OF PASSIVE TREATMENT SYSTEMS

Hedin, R.
The 23rd British Columbia MEND Metal Leaching/Acid Rock Drainage Workshop, Vancouver. 32 slides, 2016

Passive treatment of contaminated mine drainage is less costly than active treatment, but its reliability is sometimes questioned. A simple approach is presented that has been used to design effective passive treatment systems in Pennsylvania. Three systems that demonstrate commonly utilized passive technologies are described along with long-term monitoring data: (1) the Marchand system of oxidation/settling ponds and a constructed aerobic wetland; (2) the Anna S system of vertical flow ponds and aerobic wetlands; and (3) the Scooba system of a drainable limestone bed and settling pond. The systems have provided highly reliable and effective treatment for 3 to 18 years. The data demonstrate that properly designed, constructed, and maintained passive treatment systems are a highly cost-effective solution for contaminated mine discharges.
Slides: http://bc-mlard.ca/files/presentations/2016-22-HEDIN-operation-maintenance-passive-treatment-systems.pdf
Paper: http://www.hedinenv.com/pdf/NAMLP_Effective_Passive_Treatment_Paper.pdf

Demonstrations / Feasibility Studies

YEAR-ROUND PERFORMANCE OF A PASSIVE SULFATE-REDUCING BIOREACTOR THAT USES RICE BRAN AS AN ORGANIC CARBON SOURCE TO TREAT ACID MINE DRAINAGE

Sato, Y., T. Hamai, T. Hori, H. Habe, M. Kobayashi, and T. Sakata.
Mine Water and the Environment [Publication online 2 Sep 2017 prior to print]

The project objective was to demonstrate the stable operation of a sulfate-reducing bioreactor for at least a year in terms of continuous acid mine drainage (AMD) sulfate reduction and metal removal. The 35-L bioreactor contains sulfate-reducing bacteria (SRB) and a packed inoculum layer of a mixture of rice husks, limestone, and field soil covered with rice bran. During operation, the AMD input flow rate was adjusted to 11.7 mL/min (hydraulic retention time 50 h). Throughout the year, physicochemical analyses of system input and output AMD samples revealed that both pH and oxidation-reduction potential values remained consistent with the process of sulfate reduction by SRB, although this reduction was stronger in summer than in winter. Metal concentrations at the outlet port of < 0.33 mg/L Zn, < 0.08 mg/L Cu, and < 0.005 mg/L Cd more than met Japan's national effluent standards. Illumina sequencing of 16S rRNA genes revealed the dominance of *Desulfatirhabdium butyrativorans*-related species within the bioreactor. *This paper is temporarily* ***Open Access*** *at* https://link.springer.com/article/10.1007/s10230-017-0489-6.

INTERNATIONAL TRIALS OF VERTICAL FLOW REACTORS FOR COAL MINE WATER TREATMENT

Blanco, I., D.J. Sapsford, D. Trumm, J. Pope, N. Kruse, Y.-W. Cheong, H. McLauchlan, et al.
Mine Water and the Environment [Publication online 26 Oct 2017 prior to print]

Vertical flow reactors (VFRs) were trialed at coal mine sites in New Zealand, South Korea, and the USA to evaluate iron removal efficiency and removal mechanisms. The field trials were conducted at low pH and circumneutral pH to evaluate VFR performance alone and alongside other passive treatments. Total Fe and Mn removal efficiencies at circumneutral pH (6-8) often exceeded 90%, with effluent concentrations < 1 mg/L. Microbial Fe(II) oxidation and precipitation as schwertmannite together with aggregation of colloidal and nano-particulate Fe(III) are suspected to be the main removal mechanisms. Iron solubility limited removal under very acidic conditions (pH < 3). The reproducibility of the results confirmed that VFRs can be used as stand-alone passive treatment systems for iron removal from mine waters while doing so within a footprint less than half of the area required by a conventional aerobic wetland. A VFR can also provide useful iron pretreatment for other passive treatment systems under circumneutral conditions, but would have to be combined with alkaline generating systems to achieve full iron removal from acidic mine waters. *This paper is* ***Open Access*** *at* https://link.springer.com/article/10.1007/s10230-017-0491-z.

Research

MINE DRAINAGE: RESEARCH AND DEVELOPMENT

Wei, X., S. Zhang, Y. Han, and F.A. Wolfe.
Water Environment Research 89(10):1384-1402(2017)

This review summarizes mine drainage research and development as found in literature published in 2016 and early 2017. The review contains three main sections. (1) Section one covers the characterization of mine drainage and its related environmental impacts, including three subsections focused on physiochemical characterization, microbiological characterization, and environmental impacts. (2) Section two is divided into subsections focused on either the prediction or prevention of acid mine drainage. (3) The final section focuses on treatment technologies for mine drainage, including physiochemical, biological, and passive treatments as well as beneficial uses of mine drainage and treatment wastes. *This paper is temporarily* ***Open Access*** *at* http://www.ingentaconnect.com/content/wef/wer/2017/00000089/00000010/art00020.

PASSIVE BIOLOGICAL TREATMENT OF MINE WATER TO REDUCE CONDUCTIVITY: POTENTIAL DESIGNS, CHALLENGES, AND RESEARCH NEEDS

Smyntek, P.M., R.C. Wagner, L.-A. Krometis, S.C. Sanchez, T. Wynn-Thompson, and W.H.J. Strosnider.
Journal of Environmental Quality 46:1-9(2017)

Passive biological treatment systems can be effective in removing acidity and metals from mine water, but review of current literature suggests that their ability to reduce conductivity appears somewhat limited. Some systems, particularly those that do not incorporate limestone into their construction materials, have been observed to reduce conductivity by 30-40%, which might prove useful as a pretreatment or finishing component of a larger treatment system, or in the treatment of legacy discharges. Design optimization will require identification of the ionic constituents responsible for primary conductivity constituents in various regions, long-term monitoring data of current systems that might not have been designed primarily to treat conductivity, and evaluation of the environmental factors governing underlying biogeochemical processes responsible for specific ion removals. Ideally, field-scale monitoring efforts will concurrently evaluate downstream impacts on aquatic ecology. https://aries.energy.vt.edu/content/dam/aries_energy_vt_edu/journal_paper_waste_and_water_management/Smyntek_PM_etal_Journal%20of%20Environmental%20Quality_2017.pdf

LOW-COST BIOLOGICAL TREATMENT OF METAL- AND SULPHATE-CONTAMINATED MINE WATERS

Neale, J.W., H.H. Muller, M. Gericke, and R. Meuhlbauer.
Mine Water & Circular Economy (Wolkersdorfer, C. et al., eds.). IMWA, Vol I:453-461(2017)

A passive biological sulfate reduction process was developed using a substrate mix comprising wood chips, wood shavings, hay, lucerne, and cow manure to address mine-affected water from a South African coal mine. The process achieved over 90% sulfate removal, raised the pH level above 7, and precipitated the metals. Operating parameters were optimized to increase process kinetics, and the results were used to design a pilot plant that will be operated at the mine to treat several hundred liters of water per day. https://www.imwa.info/docs/imwa_2017/IMWA2017_Neale_453.pdf

SEASONAL CHANGE OF MICROBIAL ACTIVITY IN MICROBIALLY AIDED BIOREMEDIATION

Schindler, F., L. Merbold, S. Karlsson, A.R. Sprocati, and E. Kothe.
Journal of Geochemical Exploration 174:4-9(2017)

Microbial community patterns and their potential substrate utilization were examined to test for sustainability in metal-contaminated soil. The acid mine drainage-influenced test field was characterized for total soil respiration and the functional diversity of the soil bacterial communities using BIOLOG EcoPlate assays. Inoculation with the mycorrhizal fungus *Rhizophagus irregularis* and two streptomycetes led to an altered metabolic diversity and soil vitality, with cell numbers increased by one to three orders of magnitude. The change in metabolic activity was stable even after one winter with severe frost periods. The inoculation thus resulted in enhanced microbial activities, which in turn resulted in enhanced formation of soil organic matter, which in turn can sustain higher microbial cell numbers. Inoculation with indigenous bacteria and a versatile mycorrhizal fungus holds great potential for land-use strategies on metal-contaminated sites in general.

A NOVEL BIOELECTROCHEMICAL SYSTEM FOR CHEMICAL-FREE PERMANENT TREATMENT OF ACID MINE DRAINAGE

Pozo, G., S. Pongy, J. Keller, P. Ledezma, and S. Freguia.
Water Research 126:411-420(2017)

A novel bioelectrochemical system (BES) can deliver permanent treatment of acid mine drainage without chemical dosing. The technology consists of a two-cell bioelectrochemical setup to enable the removal of sulfate from the ongoing reduction-oxidation sulfur cycle to < 550 mg/L (85 ± 2% removal in AMD from an abandoned silver mine), thereby also reducing salinity at an electrical energy requirement of 10 ± 0.3 kWh/kg of sulfate sulfur removed. In addition, BES operation drove the removal and recovery of the main cations at rates of 151 ± 0 g Al/m^3/d, 179 ± 1 g Fe/m^3/d, 172 ± 1 g Mg/m^3/d and 46 ± 0 g Zn/m^3/d into a concentrate stream containing 263 ± 2 mg Al, 279 ± 2 mg Fe, 152 ± 0 mg Mg and 90 ± 0 mg Zn per gram of solid precipitated after BES fed-rate control treatment. The solid metal sludge was twice less voluminous and 9 times more readily settleable than metal sludge precipitated using sodium hydroxide. The continuous BES treatment also demonstrated the concomitant precipitation of rare earth elements together with yttrium (REY), with up to 498 ± 70 µg Y, 166 ± 27 µg Nd, 155 ± 14 µg Gd per gram of solid, among other high-value metals. The high-REY precipitates might be used to offset treatment costs. *See more information in G. Pozo's Ph.D. thesis at* https://espace.library.uq.edu.au/view/UQ:683456/s42737838_final_thesis.pdf.

RECOVERY OF RARE EARTH ELEMENTS AND YTTRIUM FROM PASSIVE-REMEDIATION SYSTEMS OF ACID MINE DRAINAGE
Ayora, C., F. Macias, E. Torres, A. Lozano, S. Carrero, J.-M. Nieto, R. Perez-Lopez, A. Fernandez-Martinez, and H. Castillo-Michel.
Environmental Science & Technology 50(15):8255-8262(2016)

Although acid mine drainage (AMD) is commonly considered an environmental pollution issue, concentrations of rare earth elements and yttrium (REY) in AMD can be several orders of magnitude higher than in naturally occurring water bodies. The project objective was to study the behavior of REY in AMD passive remediation systems (i.e., AMD reaction with calcite-based permeable substrates followed by decantation ponds). Experiments with two columns simulating AMD treatment demonstrated that schwertmannite did not accumulate REY, which instead were retained in the basaluminite residue. The same observation was made in two field-scale treatments from the Iberian Pyrite Belt (southwest Spain), where findings suggest that the proposed AMD remediation process can represent a modest but suitable REY source. In this sense, the Iberian Pyrite Belt could function as a giant heap-leaching process of regional scale in which rain and oxygen act as natural driving forces with no energy investment. In addition to the environmental benefits of its treatment, AMD is expected to last for hundreds of years; hence, the total REY reserves are practically unlimited. *See an earlier version of this paper at* http://www.ehu.eus/sem/seminario_pdf/SeminSEM_12.Ayora.prov.pdf.

PROXIMAL SENSOR ANALYSIS OF MINE TAILINGS IN SOUTH AFRICA: AN EXPLORATORY STUDY
Koch, J., S. Chakraborty, B. Li, J.M. Kucera, P. Van Deventer, A. Daniell, C. Faul, T. Man, et al.
Journal of Geochemical Exploration 181:45-57(2017)

Researchers investigated 419 tailings samples across four mines in South Africa using both portable X-ray fluorescence (PXRF) spectrometry and visible near infrared diffuse reflectance spectroscopy (VisNIR DRS). Specifically, PXRF was used to provide elemental data for comparison to X-ray diffraction (XRD) and energy dispersive X-ray spectroscopy (EDAX) coupled with scanning electron microscopy (SEM) for confirmation of tailings mineralogy. Next, PXRF data were used to model first-derivative (1D) VisNIR reflectance spectra. Results revealed many satisfactory calibrations ($R2 > 0.70$) relative to PXRF analysis with VisNIR DRS predictive models, showing fair (RPD 1.4-2.0) to stable, accurate (RPD > 2.0) prediction of multiple elements. Use of better data partitioning methods and consideration of target variability is likely to improve model accuracy further.

ATTENUATION OF ACID ROCK DRAINAGE WITH A SEQUENTIAL INJECTION OF COMPOUNDS TO REVERSE BIOLOGICALLY MEDIATED PYRITE OXIDATION IN THE CHATTANOOGA SHALE IN TENNESSEE
Byl, T.D., R. Oniszczak, D. Fall, P.K. Byl, D.E. Young, and M.W. Bradley.
U.S. Geological Survey Karst Interest Group Proceedings, San Antonio, Texas, May 16-18, 2017: U.S. Geological Survey Scientific Investigations Report 2017-5023:37(2017)

A study was conducted to disrupt chemolithotrophic bacteria responsible for acid rock drainage (ARD) associated with the Chattanooga Shale in Tennessee's karstic central basin. Researchers used chemical treatments to foster an environment favorable for competing microorganisms to attenuate the biologically induced ARD. Chemical treatments were injected into flow-through microcosms consisting of 501 grams of pyrite-rich shale pieces inoculated with ARD bacteria. Treatments included a sodium hydroxide-bleach mix, a sodium lactate solution, a sodium lactate-soy infant formula mix—each treatment with or without phosphate buffer, or injected sequentially with sodium hydroxide. The optimal treatment was a sequential injection of 1.5 g sodium hydroxide, followed by 0.75 g lactate and 1.5 g soy formula dissolved in 20 mL water. The pH of the discharge water rose to 6.0 within 10 days, dissolved-iron concentrations dropped < 1 mg/L, the median alkalinity increased to 98 mg/L as $CaCO_3$, and the stimulated sulfur-reducing and slime-producing bacteria populations exhibited an increase in estimated population counts. The ARD-attenuating benefits of the optimal treatment remained evident after 33 weeks. The other treatments provided ARD-attenuating effects but were tempered by problems such as high phosphate concentrations, short longevity, or other shortcomings.

GEOCHEMICAL STUDY OF A MINING-METALLURGY SITE POLLUTED WITH AS AND HG AND THE TRANSFER OF THESE CONTAMINANTS TO *EQUISETUM* SP
Matanzas, N., M.J. Sierra, E. Afif, T.E. Diaz, J.R. Gallego, and R. Millan.
Journal of Geochemical Exploration 182(PtA):1-9(2017)

When scientists studied the paradigmatic site of La Soterrana (Asturias, NW Spain) after > 40 years of abandonment and weathering, a multivariate study of the geochemistry of the soil-waste system revealed average concentrations of thousands of ppm for Hg and tens of thousands for As. Other elements of concern were also well above soil threshold levels. Despite the potential toxicity of the waste mixed in the soil, the incipient soil overlying the spoil heap was colonized by pioneer plants tolerant of high metal(loid) content, predominantly randomly distributed clusters of *Equisetum* (horsetail). These plants preferred Al- and K-rich soils regardless of As and Hg levels. *Equisetum* showed low efficiency for As accumulation (excluder) but high efficiency for Hg accumulation (bioaccumulation factors above 1) in its tissues.

BIOSORPTION OF HEXAVALENT CHROMIUM FROM AQUEOUS SOLUTIONS USING HIGHLY CHARACTERISED PEATS
Rizzuti, A.M., C.R. Newkirk, K.A. Wilson, L.W. Cosme, and A.D. Cohen.
Mires and Peat 19(Article 4):1-10(2017)

Researchers investigated the biosorption of Cr(VI) from aqueous solutions by six highly characterized peats. Samples of the peats were tested both in unaltered condition and after being treated with hydrochloric acid to free any occupied exchange sites. Other variables tested were sample dose, contact time, mixing temperature, and the concentrations and pH of the Cr(VI) solution. Desorption studies were also performed, and tests were done to determine whether the peats could be re-used for Cr(VI) biosorption. Results indicate that all six peat types biosorb Cr(VI) from aqueous solution well (42-100% removal). The factors that had the greatest impact on peat Cr(VI) removal capacity were the concentrations and pH of the Cr(VI) solution. With increase of Cr(VI) solution concentration and pH, percent removed decreased dramatically: 33-56 % decrease for concentration increase; 36-45% decrease for pH increase with four of the six peat types. Desorption results indicate that it may be possible to recover up to 5% of the Cr(VI) removed. All of the peat types tested can be re-used repeatedly for additional Cr(VI) biosorption cycles.
http://mires-and-peat.net/media/map19/map_19_04.pdf

PHYTOEXTRACTION OF POTENTIALLY TOXIC ELEMENTS BY SIX TREE SPECIES GROWING ON HAZARDOUS MINING SLUDGE
Mleczek, M., P. Golinski, M. Krzeslowska, M. Gasecka, Z. Magdziak, P. Rutkowski, S. Budzynska, B. Waliszewska, T. Kozubik, Z. Karolewski, and P. Niedzielski.
Environmental Science and Pollution Research 24(28):22183-22195(2017)

The phytoextraction abilities of six tree species—*Acer platanoides* L., *Acer pseudoplatanus* L., *Betula pendula* Roth, *Quercus robur* L., *Tilia cordata* Miller, *Ulmus laevis* Pall.—were compared following cultivation on mining sludge contaminated with As, Cd, Cu, Pb, Tl, and Zn. All six tree species survived on the unpromising substrate. With the exception of *A. pseudoplatanus*, the analyzed tree species showed a bioconcentration factor (BCF) > 1 for Tl, with the highest value for *A. platanoides* (1.41), although the translocation factor (TF) for this metal was < 1 in all the analyzed tree species. *A. platanoides* showed the highest BCF and a low TF and thus could be a promising species for Tl phytostabilization. *This paper is* ***Open Access*** *at*https://link.springer.com/article/10.1007/s11356-017-9842-3.

ACID POND SEDIMENT AND MINE TAILINGS CONTAMINATED WITH METALS: PHYSICOCHEMICAL CHARACTERIZATION AND ELECTROKINETIC REMEDIATION
Karaca, O., C. Cameselle, and K.R. Reddy.
Environmental Earth Sciences 76(12):[408](2017)

Mine tailings and acid pond sediment from a former mining area in Canakkale (Turkey) were analyzed for physical (e.g., moisture content, particle size, specific gravity, and hydraulic conductivity) and chemical parameters (e.g., organic content, pH, ORP, and EC) as well as metal content and sequential extraction analysis in an attempt to evaluate their risk as a source of contaminants. Column tests demonstrated that Fe and Pb can be released to waterbodies in contact with the solid materials. Pb was released more easily than Fe due to its content in the more labile fractions in the sequential extraction analysis. When electrokinetic remediation was tested for metals removal from mine tailings and sediment, the technique removed 20% of Pb and Fe in 9 days of treatment at 1 VDC/cm. Metals removal efficiency was strongly affected by metal speciation. Electrokinetics removed metal fractions I-IV, especially in the closest section to the anode of the solid matrix, and the metals accumulated in the following sections. Results suggested that Fe and Pb could be removed from the mine tailings and sediment effectively if the advance of the acid front was favored and the treatment time increased, but considering the physicochemical characterization and electrokinetic treatment results, other green and more sustainable remedial strategies must be proposed for mitigation of environmental risks of former mining areas, such as metals immobilization and stabilization via phytocapping.

BENEFICIAL USE OF SPRINGER PIT LAKE AT MOUNT POLLEY MINE
Vandenberg, J. and S. Litke.
Mine Water and the Environment [Publication online 7 Dec 2017 prior to print]

The Springer Pit Lake and Mount Polley Mine provided an opportunity to store mine waste such as tailings and mill process water while the mine repaired its tailings storage facility after a breach in its perimeter embankment, which released tailings to the downstream environment in 2014. One year after the breach, a water treatment plant was installed so that the pit lake could be drawn down. Frequent monitoring of water quality in the pit, combined with a calibrated and verified water quality model, showed that water quality is improving. Based on observations that tailings, suspended solids, and associated constituents are being removed efficiently by the pit, the treatment plant was reconfigured to a passive mode that did not entail the use of reagents or mechanical energy—only in-line instrumentation. **Slides:** http://bc-mlard.ca/files/presentations/2016-16-VANDENBERG-ETAL-beneficial-use-of-springer-lake.pdf.

GASIFIED GRASS AND WOOD BIOCHARS FACILITATE PLANT ESTABLISHMENT IN ACID MINE SOILS
Phillips, C., K. Trippe, G. Whittaker, S. Griffith, M. Johnson, and G. Banowetz.
Journal of Environmental Quality 45:1013-1020(2016)

Biochars derived from the pyrolysis or gasification of biomass potentially can serve as a valuable soil amendment to revegetate mine sites. Biochars produced by gasification of either Kentucky bluegrass seed screenings (KB) or mixed conifer wood (CW) were investigated for mine soil amendment to support the growth of wheat plants in heavy metal-laden mine soils from the abandoned Formosa and Almeda mines, Oregon. Both KB and CW biochar amendments promoted plant establishment by increasing soil pH, increasing concentrations of macro- and micronutrients, and decreasing the solubility of heavy metals. Amending these soils with between 2% to 4% biochar (by weight) was needed to promote healthy wheat growth and reduce metals mobility.

PREDICTIVE REACTIVE TRANSPORT MODELING AT A PROPOSED URANIUM IN SITU RECOVERY SITE WITH A GENERAL DATA COLLECTION GUIDE
Johnson, R.H. and H. Tutu.
Mine Water and the Environment 35(3):369-380(2016)

At the Dewey Burdock site near Edgemont, South Dakota, a change in groundwater flow direction created a scenario in which the oxidized side of a U roll-front deposit is downgradient of the ore zone. This increases the potential for future U transport, given that conventional understanding of U geochemistry is that the reduced side provides more natural attenuation. A general data collection guide is provided for steps in evaluating downgradient transport at future U in situ recovery sites. These steps include core sampling in the downgradient and restored zones, along with batch sorption and column testing with restored and background groundwater in contact with the restored zone solid phase. Final reactive transport modeling will rely on high-quality calibration data from batch and column testing (plus any available field testing), but thorough site evaluation will also require appropriate long-term monitoring. *See additional information in the Dewey-Burdock Class III Draft Area Permit Fact Sheet at*https://www.epa.gov/sites/production/files/2017-03/documents/class_iii_draft_area_permit_fact_sheet_0.pdf.

PROSPECT FOR TREATING ANTIMONY-LADEN MINE WASTEWATER USING LOCAL MATERIALS
Ji, X., S. Liu, H. Juan, J. Jiang, A. He, E. Bocharnikova, and V. Matichenkov.
Mine Water and the Environment 36(3):379-385(2017)

Wastewater from the world's largest antimony mine (in Hunan, China) contains high levels of metal and metalloid contaminants (As, Cd, Hg, Pb, Se, and Sb). A study of the effectiveness of low-cost local industrial by-products [coal fly ash (CFA) and Ca-Si slag from the metals industry] and traditional agents [limestone, diatomaceous earth (DE), and zeolite] to treat the wastewater led to the ranking of their relative effectiveness: CFA > Ca-Si slag > DE > limestone > zeolite. CFA and Ca-Si slag removed 9.9 to 85.5% of As, Cd, Hg, Pb, Se, and Sb from wastewater. The CFA and Ca-Si slag could be employed as commercial filters or biogeochemical barriers to protect surface water and groundwater, and a similar approach might be used at other mines.

General News

STUDY OF TAILINGS MANAGEMENT TECHNOLOGIES
Mine Environment Neutral Drainage Program, MEND Report 2.50.1, 164 pp, 2017

In Canada, most mines manage their tailings conventionally as slurry deposited behind containment dams. The dams sometimes fail. Dry closure of tailings significantly reduces this type of physical risk but needs to be balanced against potential geochemical risks. This study looks at the technologies used to dewater tailings and how tailings are placed and managed, and then evaluates their relative efficacy in addressing physical and geochemical risks. Opportunities for further research and development are identified. The reader can gain an understanding of the strengths and limitations of tailings dewatering technologies and deposition practices and how these choices apply to specific sites and mining projects compared to conventional practices. In application, this guide takes into account site conditions, project constraints (e.g., production schedules), tailings physical properties (e.g., grain-size and plasticity), and geochemical properties (e.g., the potential for tailings to generate metal leaching or acid rock drainage). http://mend-nedem.org/wp-content/uploads/2.50.1Tailings_Management_Technologies1_.pdf.

THE INTERNATIONAL NETWORK FOR ACID PREVENTION (INAP)

When rock surfaces containing sulfide minerals are exposed to air and water, chemical reactions can occur, resulting in soluble oxidation by-products. When dissolved in water, these oxidation by-products can acidify the water. Acidification can be catalyzed by the presence of bacteria (primarily members of the *Acidithiobacillus* genus). The resulting effluent is known as acid drainage (also acid rock drainage (ARD) or acid mine drainage (AMD)). To assist mine planners, INAP in 2014 developed and continues to maintain a best practice guide for the prevention and mitigation of ARD: the *Global Acid Rock Drainage Guide* (the GARD Guide). INAP's objective is to reduce the liability associated with sulfide mine materials through networking and information-sharing, technology transfer, and gap-driven research. http://www.inap.com.au/acid-drainage/.

IN SITU LEACH URANIUM MINING: AN OVERVIEW OF OPERATIONS
International Atomic Energy Agency (IAEA), STI/PUB/1741, ISBN: 978-92-0-102716-0, 60 pp, 2016

In situ leach or leaching (ISL) or in situ recovery mining has become one of the standard uranium production methods. Its application to amenable uranium deposits in certain sedimentary formations has grown owing to its competitive production costs and low surface impacts. This publication provides an historical overview and shows how ISL experience around the world can be used to direct the development of technical activities, taking into account environmental considerations and emphasizing the economics of the process, including responsible mine closure. Suggestions on how to design, operate, and regulate current and future projects safely and efficiently are offered with a view to maximizing performance and minimizing negative environmental impact. A separate 153-page appendix contains case studies of uranium mines from around the world.
http://www-pub.iaea.org/books/IAEABooks/10974/In-Situ-Leach-Uranium-Mining-An-Overview-of-Operations

MINE SITE CLEANUP-RELATED EVENTS IN 2018

2018 SME Annual Conference & Expo and 91st Annual Meeting of the SME-Minnesota Section, February 25-28, Minneapolis, MN. Society for Mining, Metallurgy, & Exploration, Inc.: http://www.smeannualconference.com/

West Virginia Mine Drainage Task Force Meeting, March 27-28, 2018, Morgantown, WV: https://wvmdtaskforce.com/

The 35th Annual Meeting of the American Society of Mining & Reclamation: The Gateway to Land Reclamation, June 3-7, 2018, St. Louis, Missouri: http://www.asmr.us/Meetings/2018-Annual-Meeting

NAAMLP 2018: New Solutions for Historic Mining, September 9-13, 2018, Williamsburg, VA: The 40th Annual National Association of Abandoned Mine Lands Program Conference: https://dmme.virginia.gov/dmlr/amlconference/AMLindex.shtml
Abstract Proposal Deadline: June 1, 2018

11th ICARD: Eleventh International Conference on Acid Rock Drainage and the 2018 International Mine Water Association (IMWA) Conference, September 10-14, Pretoria, South Africa: http://www.icard2018.org/

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.

Mention of non-EPA documents, presentations, or papers does not constitute a U.S. EPA endorsement of their contents, only an acknowledgment that they exist and may be relevant to the Technology Innovation News Survey audience.