Technology Innovation News Survey

Entries for February 16-29, 2020

Market/Commercialization Information

RILEY PASS URANIUM MINES CERCLA PROJECT; BLUFF A RESPONSE ACTION

USDA, Forest Service Regional Office, R1, Missoula, MT.

This requirement is a total small business set-aside under NAICS code 237990. The Custer Gallatin National Forest is conducting a removal action as part of the Riley Pass Uranium Mines CERCLA response action in Harding County, South Dakota. The Riley Pass site comprises several abandoned uranium mines with elevated levels of heavy metals and radioactive isotopes. The work involves excavating and moving about 20,000 CY of contaminated mine waste to a designated consolidation area, regrading excavated areas, and placing 15,000 CY of soil cover over the consolidated waste and removal areas. Erosion control, dust control, soil amendments, and revegetation are part of the contract requirements. This work is being performed under the Forest Service's CERCLA authority, and all personnel must have current 40-hr HAZWOPER certification. Contractor shall begin performance within 10 calendar days and complete it within 150 calendar days after receiving notice to proceed. The estimated price magnitude is between $1M and $5M. Responses are due by 3:00 PM MT on April 20, 2020.
https://beta.sam.gov/opp/7dd391a53d8347a3a9ecf675eaaa363c/view

NOT-FOR PROFIT ACID MINE DRAINAGE WATERSHED COOPERATIVE AGREEMENT (WCAP) PROGRAMS

Department of the Interior, Office of Surface Mining, Funding Opportunity S20AS00006, 2020

The not-for-profit Acid Mine Drainage (AMD) Reclamation program seeks applications from eligible applicants to restore streams affected by AMD to a level that will support a diverse biological community and provide recreational opportunities for the community. Eligible applicants (other than institutions of higher education) are restricted to nonprofits having a 501(c)(3) status with the IRS. The closing date for applications is June 30, 2020. About 20 awards are anticipated out of an estimated $1M in program funding.
https://www.grants.gov/web/grants/view-opportunity.html?oppId=323813

EXPOSURE SCREENING TOOLS FOR ACCELERATED CHEMICAL PRIORITIZATION (EXPOCAST)

U.S. Environmental Protection Agency, Cincinnati Acquisition Div., OH.
Contract Opportunities on Beta.Sam.gov, Solicitation 68HERC19Q0120, 2020

EPA is interested in building models to quantitatively predict potential exposure for thousands of chemicals in commerce. To support these computational models, three kinds of exposure measurement data are required: (1) physical-chemical properties, (2) chemical emissions from products and building materials used indoors, and (3) chemical occurrence in products, environmental, and biological media. Methods and technologies to generate these data might include broad-spectrum chemical recognition/screening, metabolic profiling, and high-throughput screening. Results will be used in EPA's ExpoCast (Exposure Forecasting) project to evaluate, calibrate, and reduce uncertainty in exposure model predictions and to prioritize compounds for more in-depth testing and risk assessment. EPA requires contractor support to use appropriate rapid, high-throughput methods on sets of dozens to hundreds of industrial compounds from the growing ToxCast (Toxicity Forecasting) library of chemical standards, which is part of the Agency's Chemical Safety and Sustainability Strategic Research Action Plan. EPA will select compounds for evaluation in a minimum of 10 samples and a maximum of 500 samples per task order. Contractor shall furnish all resources to perform the contract PWS, to carry out the specific tasks identified in task orders, and to perform management functions, including meetings with EPA representatives to review issues, problems, and performance. Responses are due by 11:59 PM ET on April 14, 2020.
https://beta.sam.gov/opp/8e85b1b8106f49498df5f3f95551139c/view

EPA REGION 1 EMERGENCY AND RAPID RESPONSE SERVICES

U.S. Environmental Protection Agency, Region 1 Contracting Office, Boston, MA.
Contract Opportunities on Beta.Sam.gov, Solicitation 68HE0120R0001, 2020

This acquisition is issued as a total small business set-aside, NAICS code 562910, for EPA Region 1 Emergency and Rapid Response Services (ERRS V). The purpose of the ERRS contract is to provide fast, responsive environmental cleanup services for release of hazardous materials and petroleum products/oil. Environmental cleanup in response to natural and manmade disasters; terrorist activities; weapons of mass destruction; and chemical, biological, radiological, and nuclear incidents may also be required. Services are to be provided primarily within the EPA Region 1 geographic area, which includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, and 10 Tribal Nations. Period of performance: 11/04/2020 to 11/03/2025. Offers are due by 3:00 PM ET on April 15, 2020. Monitor FedConnect for updates at https://www.fedconnect.net/FedConnect/?doc=68HE0120R0001&agency=EPA.

EPA ENVIRONMENTAL SERVICES ASSISTANCE TEAM (ESAT)

U.S. EPA, Region 1 Contracting Office, Boston, MA.
Contract Opportunities on Beta.Sam.gov, Solicitation 68HE0119R0002, 2020

This acquisition is unrestricted under NAICS code 541380. Contractor shall provide technical, analytical, and QA support to U.S. EPA programs, such RCRA and Superfund, to the offices of Air, Water, and Enforcement & Compliance Assistance, and possibly to other EPA programs, federal and state agencies, and tribal organizations to facilitate identification, assessment, regulation, and remediation of environmental hazards that might pose a threat to human health or the environment. Contractor shall perform work in the following task areas: (1) analytical support; (2) data review; (3) analytical logistical support; (4) QA/QC support; (5) other task-related activities; and (6) external regional lab analysis. Proposals are due by 3:00 PM ET on April 30, 2020. Details of the ESAT acquisition are available only on FedConnect at https://www.fedconnect.net/FedConnect/?doc=68HE0119R0002&agency=EPA.

Cleanup News

PLANNING RADIOLOGICAL RISK MITIGATION FOR REMEDIATION OF ABANDONED URANIUM MINE SITES

Petelina, E., D. Sanscartier, and A. Klyashtorin. | RemTech 2019: Remediation Technologies Symposium, 16-18 October, Banff, 16 slides, 2019

A radiological risk mitigation approach was implemented in the remediation of 35 legacy uranium mine sites in northern Saskatchewan. Mining activities resulted in an irregular increase of gamma radiation dose rate up to 18 µS/hr above the regulatory requirements. Radiological objectives (ROs) included a dose rate averaged over a hectare (https://www.esaa.org/wp-content/uploads/2019/10/19-Sanscartier.pdf *More information on the 35 satellite uranium mine sites* https://www.src.sk.ca/project-cleans/satellite-mine-sites

50 YEARS OF AMD POLLUTION AND REMEDIATION AT THE ANNA S MINE, TIOGA COUNTY, PA

Hedin, R. | 36th Annual Meeting of the American Society of Mining & Reclamation, 3-7 June, Big Sky, MT, 34 slides, 2019

The Anna S Mine supported underground and surface coal mining activities in the Bloss coal seam since the 1890s. Mine drainage had a low pH with elevated concentrations of Al, Fe, and Mn. Daylighting significantly worsened the chemistry of the mine drainage and caused severe water quality problems in Babb Creek and Pine Creek. In 2003-2004, two passive treatment systems were installed with vertical flow ponds and constructed wetlands. Since their installation, the systems have continuously produced net alkaline effluents that contribute to the restoration of good water quality in the creeks. In 2010, both creeks were removed from

the degraded stream list and reclassified as high-quality coldwater fisheries. System operation and management include sampling, routine maintenance, and major maintenance projects in 2014 and 2016 when the organic substrates in the vertical flow ponds were replaced. The presentation highlighted degradation caused by daylighting operations, natural improvements in water chemistry in decades since mining completion, and the benefits and cost of the passive treatment.
https://www.asmr.us/Portals/0/Documents/Meetings/2019/PowerPoints/5A_200_Hedin.pptx
More information http://www.wbsrc.org/babb-creek.html

Demonstrations / Feasibility Studies

TRANSFORMATION OF ARSENIC DURING REALGAR TAILINGS STABILIZATION USING FERROUS SULFATE IN A PILOT-SCALE TREATMENT

Wang, X., H. Zhang, L. Wang, J. Chen, S. Xu, H. Hou, Y. Shi, J. Zhang, M. Ma, et al.
Science of the Total Environment 668:32-39(2019)

Stabilization technologies are not well developed for As in realgar tailings that are Fe-deficient and rich in Ca and S. Stabilization of tailings by adding ferrous sulfate was pilot tested to evaluate As transformation during stabilization.. Si, As, Ca, and S were the predominant elements in the raw realgar tailings with a low content of Fe, and realgar and pharmacolite were the main As-bearing minerals. After the ferrous sulfate treatment, the As leaching concentration of realgar tailings decreased from 135 mg/L to below the Chinese regulatory limit (2.5 mg/L). Based on the results of leaching tests, sequential extraction analysis, XRD, SEM-EDS, XPS, and thermodynamic modeling, the investigators concluded that ferrous sulfate addition enhanced the transformation of Ca-As and S-As species to more stable Fe-As species. The dissolution of pharmacolite was facilitated by H^+ and SO_4^{2-} derived from the hydrolysis and oxidation of ferrous sulfate. Oxidation of realgar could be promoted by reactive oxygen species (ROSs) from Fe(II) oxygenation.

PILOT-SCALE REMOVAL OF ARSENIC AND HEAVY METALS FROM MINING WASTEWATER USING ADSORPTION COMBINED WITH CONSTRUCTED WETLAND

Nguyen, H.T.H., B.Q. Nguyen, T.T. Duong, A.T.K. Bui, H.T.A. Nguyen, H.T. Cao, et al.
Minerals 9:379(2019)

A pilot study was conducted to assess the removal of As and heavy metals from mining wastewater by combining adsorption (using modified iron-ore drainage sludge) and horizontal-subsurface-flow constructed wetland with common reed (*Phragmites australis*). The pilot-scale experiment operated with a constant flow rate of 5 m^3/day for four months using real wastewater from a Pb-Zn mine in northern Vietnam. Atomic absorption spectroscopy was used for elemental analysis in the wastewater and plants. X-ray diffraction, surface charge measurements (by a particle charge detector), Fourier-transform infrared, and surface area Brunauer-Emmet-Teller measurements determined the characteristics of the adsorbent. Results showed that the average removals of As, Mn, Cd, Zn, and Pb by the combined system with limestone substrate during four months were 80.3%, 96.9%, 79.6%, 52.9%, and 38.7%, respectively. The use of another constructed wetland substrate, laterite, demonstrated better removal efficiency of As than limestone. The concentrations of As and heavy metals in the effluent were lower than the limits established for industrial wastewater, which indicated the feasibility of combining adsorption and constructed wetland for the treatment of mining wastewater. https://www.mdpi.com/2075-163X/9/6/379/pdf

TREATMENT OF SMALL SCALE GOLD MINING WASTEWATER USING PILOT-SCALE SEDIMENTATION AND COCOPEAT FILTER BED SYSTEM

Samaniego, J. and M.A.N. Tanchuling.
Global Journal of Environmental Science and Management 5(4):461-470(2019)

A field-scale filter bed system was constructed and run for 50 days to treat heavy metal-laden wastewater from a small-scale gold mining site in the Philippines. The system consists of a sedimentation tank and filter bed with Cocopeat, a byproduct of coconut husk, as the

adsorbent. Physicochemical parameters and heavy metal concentrations were monitored during the experiment, which was run at a flow rate of 40 L/hr for 3 hours daily wastewater application. A significant reduction was achieved on As (97.11%), Ba (39.75%), Cd (74.24%), Hg (97.02%), Pb (98.82%) in the sedimentation phase. Further reductions on As (1.39%), Ba (28.00%), Cd (4.95%), Hg (2.91%), Pb (0.97%) were achieved by adsorption in the Cocopeat filter bed. The physicochemical parameters and heavy metal concentrations of the effluent were within the respective regulatory limits. Effluent parameters with a strong correlation to total suspended solids, such as turbidity and color, were reduced significantly. All adsorbed heavy metals accumulated in the upper 25 cm of the Cocopeat column in the filter bed. Heavy metal concentrations in Cocopeat suggest that the adsorbent was not saturated, and further application of small-scale gold mining wastewater is recommended to determine its useful life.
https://www.gjesm.net/article_36261_54175f505dfa7e82f9f8cf43a30f282f.pdf

PILOT-SCALE TESTS OF PASSIVE TREATMENT SYSTEM FOR AMD IN JAPAN

Hayashi, K., T. Washio, K. Kojima, Y. Masaki, A. Kanayama, T. Hamai, M. Kobayashi, et al.
Proceedings of the International Mine Water Association (IMWA) Conference, 15-19 July, Perm, Russia, 2019

A passive treatment system was developed to remove metal ions contained in acid mine drainage (AMD) as sulfides by using sulfate-reducing bacteria (SRB). A 300-day field test conducted on anaerobic reactors filled with rice bran and rice husk successfully remediated AMD with hydraulic retention time (HRT) of 50 hours. A pilot-scale demonstration began in November 2016 at an abandoned mine site in Japan on AMD that contains iron and zinc ions. The passive treatment system consisted of two reactors. AMD was first introduced into an iron oxidation reactor filled with rice husk to promote iron oxidation and capture iron oxides. The reactor had a flow rate of ~5.2 L/min and an HRT of 2.5 hours. AMD was introduced as a shower to increase dissolved oxygen. Total iron in this reactor was decreased from 30-40 mg/L to < 10 mg/L. The anaerobic reactor contained three layers to reduce sulfate ions and metal ions as sulfides: a bottom limestone layer, middle rice husk/limestone/soil layer for SRB reaction, and a top rice bran layer. The anaerobic reactor had a flow rate of ~2.6 L/min and an HRT of 30 hours. The rice husk layer was later thickened to promote more effective zinc removal. After the layer was thickened, zinc concentration measured ~0 mg/L in nonfiltered effluent samples. *See **pages 195-198**:*
http://www.imwa.info/docs/imwa_2019/IMWA_2019_proceedings.pdf

Research

ENVIRONMENTALLY SUSTAINABLE ACID MINE DRAINAGE REMEDIATION: USE OF NATURAL ALKALINE MATERIAL

Garcia-Valero, A., S. Martinez-Martinez, A.Faz, J.Rivera, and J.A. Acosta.
Journal of Water Process Engineering 33: 101064(2020)

The effect of marls, sandstone, and calcareous crust was evaluated to assess their impact on metals precipitation and neutralization of acid mine drainage (AMD). Experiments were conducted at a 5/10 alkaline material(g)/mL AMD ratio using three particle sizes (2-10, 10-20, and 20-30 mm) of each material. The AMD was pretreated using 2.5 g $Ca(OH)_2$/L AMD to raise the pH to 4, which was necessary to prevent viscous substance formation when lower pH AMD contacted alkaline material. Marl, sandstone, and calcareous crust removed 100% of Fe, Cu, and Pb. Sandstone also removed ~60% of Zn and Cd. The optimal particle sizes were 20-30 mm for marl and10-20 mm for sandstone. The contact time required to neutralize AMD and metal(loid)s was lower for marl and sandstone than the calcareous crust. Results indicated that any of the three alkaline materials could be used in AMD treatment depending on availability in the study area.

KRAFT PULP MILL DREGS AND GRITS AS PERMEABLE REACTIVE BARRIER FOR REMOVAL OF COPPER AND SULFATE IN ACID MINE DRAINAGE

Farage, R.M.P., M.J. Quina, L. Gando-Ferreira, C.M. Silva, J.J.L.L. de Souza, et al.
Scientific Reports 10:4083(2020)

This study evaluated the performance of kraft pulp mill alkaline residues known as dregs and grits as material for a permeable reactive barrier and determined their capacity for retaining copper and sulfate. The work was carried out in lab adsorption kinetics assays, batch assays, and column tests. Tests for elemental characterization, point of zero charge, acid neutralization capacity, total porosity, bulk density, and moisture content of the dregs and grits were conducted. The results showed high retention of Cu due to a chemical precipitation mechanism, notably for dregs (99%) at 5 min in adsorption kinetics. The grits presented similar results after 180 min for the same assay. Sulfate retention was effective at pH below 5, with an efficiency of 79% and 89% for dregs and grits, respectively. Dregs presented the best results for acid drainage remediation, notably with a solid:liquid ratio of 1:10.

INVESTIGATION OF BY-PRODUCTS FROM ACETYLENE MANUFACTURING FOR ACID MINE DRAINAGE REMEDIATION

Lam, S.-M. and J.-C. Sin. | Mine Water and the Environment 38(4):757-766(2019)

Carbide lime, a byproduct of acetylene manufacturing, was characterized and compared to commercial calcium oxide (CaO) for acid mine drainage (AMD) treatment. Chemical and x-ray diffraction data revealed that the carbide lime was calcium-rich. Morphological analysis indicated it differed from commercial CaO in that it has a layered structure. Physical characterization, including nitrogen adsorption-desorption isotherm, and particle size distribution, demonstrated that the carbide lime had a greater surface area and finer particle size than the commercial CaO. Jar tests evaluated the effect of the carbide lime and CaO loading on actual AMD. The optimum quantity of carbide lime for treating the AMD was 0.4 g/L, which increased the pH and reduced the metal and sulfate concentrations to acceptable levels. The carbide lime showed superior acid-neutralizing and contaminant diminution at all studied loadings. Additionally, an Imhoff cone test confirmed that the sludge produced using carbide lime settled better than that produced using CaO powder.
https://link.springer.com/article/10.1007/s10230-019-00640-2

HYDRAULIC CONDUCTIVITY OF GEOSYNTHETIC CLAY LINERS PERMEATED WITH ACID MINE DRAINAGE

Wang, B., X. Dong, B. Chen, and T. Dou.
Mine Water and the Environment 38(3): 658-666(2019)

Two geosynthetic clay liners (GCLs) were lab-tested on acid mine drainage (AMD) from a coal gangue impoundment. One liner contained natural sodium bentonite (GCL-N), and the other contained sodium-activated bentonite (GCL-S). The chemical compatibility and the effects of effective stress and type of bentonite used in the liners were evaluated. Results showed that permeation with a synthesized AMD increased the hydraulic conductivity by 33 times (GCL-N) and 104 (GCL-S) times at an effective stress of 10 kPa. Under an effective stress of 50 kPa, the hydraulic conductivity of the GCL-N and GCL-S permeated with AMD was 1.1 and 6.6 times higher than the values based on permeation with distilled water. However, when the effective stress was increased to 200 kPa, the AMD had no negative effect on hydraulic performance. The difference in hydraulic conductivity was observed at effective stresses of 10 and 50 kPa, with the GCL-N consistently having less hydraulic conductivity than the GCL-S. The detrimental effects of AMD permeation and low-quality bentonite can be countered by applying high effective stress to the GCLs. Both GCLs types may be suitable as effective basal liners for coal gangue impoundments where relatively high stress can be applied.

LABORATORY REMEDIATION OF IRON-SULPHATE CONTAMINANT IN ACID MINE WATERS USING WASTE ROCKS

Oke, S., M. Purchase, and L. Mokitlane.
Proceedings of the 5th World Congress on New Technologies, 18-20 August, Lisbon, Portugal, 2019

Acid mine drainage (AMD) from an abandoned mine was treated with three waste rocks

(shale, bentonite, and a mixture of shale, bentonite, and calcrete to remove iron sulfate. Waste rocks were ground into different particle sizes and sorted by grain size. The sorted grains were arranged from coarsest at the top to finest at the bottom in transparent bottles with a controlled tip end. Results showed iron concentrations in the AMD decreased from 253 mg/L before treatment to 0.08 mg/L (bentonite), 0.02 mg/L (mixture), and 0.80 mg/L (shale) after treatment. Sulfate concentration decreased from 5067 mg/L to 3207 mg/L (bentonite), 3662 mg/L (mixture), and 2238 mg/L (shale) after treatment. Results indicated that waste rocks of shale or bentonite with a variety of grain size contents could remove iron-sulfate contamination and be used for liners in a constructed wetland to minimize AMD generation. https://avestia.com/NewTech2019_Proceedings/files/paper/ICEPR/ICEPR_162.pdf

PHYTOREMEDIATION OF MULTI-METAL CONTAMINATED MINE TAILINGS WITH SOLANUM NIGRUM L. AND BIOCHAR/ATTAPULGITE AMENDMENTS

Li, X., X. Zhang, X. Wang, and Z. Cui.
Ecotoxicology and Environmental Safety 180:517-525(2019)

An enhanced phytoremediation technique using *Solanum nigrum L.* and two soil amendments (10% biochar [MB_2] and 10% attapulgite [MA_2]) was greenhouse tested on multi-metal contaminated mine tailings. Plant length and fresh weight in the MA_2/MB_2-applied treatments were significantly higher than those in the non-amended treatment, indicating MA_2 and MB2 amendments could alleviate metal phytotoxicity. MA_2 and MB_2 application decreased metal uptake in plant leaves but increased metal uptake in plant roots, suggesting that MA_2 and MB_2 had significant enhancement on metal stabilization. Temporal variation of metal translocation in the soil-to-plant system showed that the function of MA_2 and MB_2 nearly reached a plateau in seven months. The removal rates of metals were higher after the application of MA_2 than MB_2, and by the following order: Cu (39.6%) > Zn (35.0%) > Cd (34.1%) > Hg (32.1%) > Pb (31.8%) > Mn (19.1%). The synergistic effect between *S. nigrum L.* and MA_2/MB_2 appeared to be particularly effective in terms of metal phytostabilization, and MA_2 was superior to MB_2.

A LABORATORY INVESTIGATION ON THE PERFORMANCE OF SOUTH AFRICAN ACID PRODUCING GOLD MINE TAILINGS AND ITS POSSIBLE USE IN MINE RECLAMATION

Gcasamba, S.P., K. Ramasenya, S. Ekolu, and V.R.K. Vadapalli.
Journal of Environmental Science and Health, Part A 54(13):1293-1301(2019)

Laboratory investigations were conducted on gold mine tailings (GMT) to assess their chemical, mineralogical, and geotechnical characteristics and their suitability as an alternative backfilling solution in mine reclamation. Chemical characterization revealed that GMTs are dominated by Si, Al, and Fe with notable amounts of Cr, Zr, Zn, Pb, Ce, As, Ba, Ni, V, Sr, Nd, Cu, U, and Co. Mineralogical characterization revealed a composition of silicate minerals with secondary minerals such as jarosite, goethite, and hematite. GMT composites showed improved strength characteristics with a particle size that could produce a paste fill with a low water-cement ratio. Curing and addition of cement showed positive effects on the compressive strength and shear strength of the tailings but had a negligible impact on compaction characteristics and permeability.

REMEDIATION OF ACID MINE DRAINAGE-AFFECTED STREAM WATERS BY MEANS OF ECO-FRIENDLY MAGNETIC HYDROGELS CROSSLINKED WITH FUNCTIONALIZED MAGNETITE NANOPARTICLES

Atrei, A., M. Fiorani, A. Bellingeri, G. Protano, and I. Corsi.
Environmental Nanotechnology, Monitoring & Management 12:100263(2019)

A study was conducted to explore the suitability of a carboxymethylcellulose hydrogel cross-linked with functionalized magnetite nanoparticles (CMC-Fe_3O_4) to remove heavy metals from solutions of Zn(II) in deionized (DI) water and AMD-affected stream waters. AMD-affected stream waters collected in a former mining site located in the Metalliferous Hills ore district were chosen as a suitable benchmark to validate the hydrogel applications. The hydrogel was able to adsorb Zn(II) from DI water solutions and reduce Zn and other heavy metals such as Cd, Co, Cu, Ni, and Pb in the AMD-affected stream waters. Growth inhibition

testing of the hydrogel and treated waters for their effects on the freshwater green alga *R. subcapitata* showed no effects on growth upon exposure, suggesting that the technique is eco-friendly. Moreover, the hydrogel was able to reduce the toxicity of heavy metals to the green alga, both in DI and AMD-affected stream water.

APPLICATION OF THE FLOTATION TAILINGS AS AN ALTERNATIVE MATERIAL FOR AN ACID MINE DRAINAGE REMEDIATION: A CASE STUDY OF THE EXTREMELY ACIDIC LAKE ROBULE (SERBIA)

Petronijevic, N., S. Stankovic, D. Radovanovic, M. Sokic, B. Markovic, S.R. Stopic, et al.
Metals 10(1):16(2020)

Flotation tailings rich in carbonate minerals were created from a tailings deposit at the Majdanpek copper mine and applied to neutralize water from Lake Robule. Tests showed that after neutralization of the lake water to pH 7, over 99% of Al, Fe, and Cu precipitated, as well as 92% of Zn and 98% of Pb. Water was further treated with NaOH to remove residual Mn and Ag. After treatment with NaOH, all concentrations of metals in the lake water samples were below Serbian discharge limits for municipal wastewater. Results suggest that mining waste could be used for active neutralization of the acid mine drainage. The use of the mining waste instead of lime could reduce the costs of the active treatment of the acid mine drainage. *This article is* ***Open Access*** *at* https://www.mdpi.com/2075-4701/10/1/16.

REMEDIATION OF MANGANESE-CONTAMINATED COAL-MINE WATER USING BIO-SORPTION AND BIO-OXIDATION BY THE MICROALGA PEDIASTRUM DUPLEX (AARLG060): A LABORATORY-SCALE FEASIBILITY STUDY

Thongpitak, J., J. Pekkoh, and C. Pumas.
Frontiers in Microbiology 10:2605(2019)

This study evaluated the potential of microalgal Mn remediation of water under three different water conditions: filtrated water obtained from a rehabilitated lignite coal mine in Thailand, non-filtrated water that was sterilized with an autoclave, and non-treated water from the mine. *Pediastrum duplex* AARLG060 microalga was cultured with a modified medium consisting of N, P, C, and Mg nutrients. The remediated Mn concentration present in the cultures was detected by atomic absorption spectroscopy. The precipitated Mn was collected as a result of biooxidation, and EDTA was used to wash Mn from the biomass. Characterization of biosorption was evaluated by employing the Langmuir and Freundlich models. Results demonstrated that >97% of the Mn was removed in every treatment. The adsorption characteristics revealed a close similarity to the Langmuir isotherm of monolayer adsorption. The scanning electron microscope-energy dispersive spectroscopy indicated precipitation of Mn oxide on the cell surface, while transmission electron microscopy revealed that the nanoparticles of Mn were scattered mainly in the chloroplast and throughout the vacuoles of the cells. *This article is* ***Open Access*** *at* https://www.frontiersin.org/articles/10.3389/fmicb.2019.02605/full

General News

LEGAL AND REGULATORY STATUS OF ABANDONED MINE METHANE IN SELECTED COUNTRIES: CONSIDERATIONS FOR DECISION MAKERS

Denysenko, A., M. Evans, N. Kholod, N. Butler, and V. Roshchanka.
EPA 430-R-19-003, 29 pp, 2019

Globally, the coal mining industry accounts for about 8% of total methane emissions. Coal mines capture methane mostly for safety reasons because methane can be dangerous for underground mining. After closure, however, underground coal mines continue to release methane into the atmosphere. This methane is known as abandoned mine methane (AMM). Depending on the quality of the coal mine gas and other factors, potential uses for recovery and utilization of AMM include electricity production; combined heat and power for industry and/or urban areas; and supply to commercial natural gas market via existing pipelines. Because of the value of these assets, methane recovery and utilization from abandoned mines

can boost local economic growth, create new jobs, reduce air and water pollution, and increase national energy supply. This report presents case studies from Australia, Germany, the United Kingdom, and the U.S., which have successfully developed an enabling environment for AMM recovery and utilization. Under EPA's Coalbed Methane Outreach Program, the Agency has supported studies of the economic potential and infrastructure requirements for recovery and utilization of AMM.
https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100W9PO.txt The Program also has supported feasibility studies in two other countries: *Pre-Feasibility Study for Methane Drainage and Utilization at the Tenghui Coal Mine, Shanxi Province, China* (EPA 430-R-19-005A, 83 pp, 2019) https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100WOHK.txt *Colombia Coal Mine Methane Market Study* (EPA 430-R-19-002, 50 pp, 2019) https://nepis.epa.gov/Exe/zypurl.cgi?Dockey=P100W9OA.txt

COMMUNITY ACTIONS THAT DRIVE BROWNFIELDS REDEVELOPMENT

U.S. EPA, Office of Brownfields and Land Revitalization, Washington, DC.
EPA 560-R-19-002, 16 pp, 2019

This brief report describes five steps for successful brownfield redevelopment, presents three redevelopment case studies from Pennsylvania, West Virginia, and Ohio, and discusses opportunities for obtaining brownfield grants and technical assistance.
https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100WWVK.txt

BROWNFIELDS: PROPERTIES WITH NEW PURPOSE — IMPROVING LOCAL ECONOMIES IN COMMUNITIES WITH BROWNFIELD SITES

U.S. EPA, Office of Brownfields and Land Revitalization, Washington, DC.
EPA 560-R-19-003, 16, 2019

EPA's Brownfields Program empowers states, tribes, communities, and other stakeholders to work together to prevent, assess, safely clean up, and sustainably reuse brownfields. Revitalizing brownfield sites creates benefits throughout the community. Since 1995, EPA's Brownfields Program has cleaned up 1,816 properties; attracted 144,800 jobs; and made 80,952 acres ready for anticipated reuse. Through fiscal year 2018, on average, $16.86 was leveraged for each EPA brownfield dollar, and 8.6 jobs were leveraged per $100,000 of EPA brownfields funds expended on assessment, cleanup, and revolving loan fund cooperative agreements. Results of five pilot studies show a 32-57% reduction in vehicle miles traveled when development occurred at a brownfield site rather than a previously undeveloped site. Fewer vehicle miles traveled mean a reduction in pollution emissions, including greenhouse gases. These same site comparisons show an estimated 47-62% reduction of stormwater runoff for brownfield site development. A 2017 study concluded that cleaning up brownfield properties led to residential property value increases of 5% to 15.2% within 1.29 miles of the sites. Analyzing data near 48 of those brownfield sites, another study found an estimated $29-$97 million in additional tax revenue for local governments in a single year after cleanup—2 to 7 times more than the $12.4M EPA contributed to the cleanup of those sites.
https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100XWBS.txt

ALTERNATIVE TREATMENT TECHNOLOGIES TO OPEN BURNING AND OPEN DETONATION OF ENERGETIC HAZARDOUS WASTES

U.S. EPA, Office of Resource Conservation and Recovery, Washington, DC.
EPA 530-R-19-007, 83 pp, 2019

The purpose of this report is to identify and describe alternative treatment technologies that can reduce the reliance on open burning and open detonation (OB/OD) to destroy military munitions and other energetic materials. Many of the developed technologies have been tested and demonstrated to prove their capabilities in terms of the types of energetic materials they can destroy safely. Thus, this report also identifies the extent to which individual technologies have been developed, implemented, and used. It does not attempt to provide a comprehensive analysis of the technologies' efficacy for various waste streams, nor does it attempt to compare their advantages and disadvantages.
https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100Y4FP.txt

REPURPOSING CLOSURE COST ESTIMATION TOOLS: A GOLD FIELDS CASE STUDY OF THE BENEFIT OF INTEGRATION

Getty, R; D. Caporn, D. Kyan, and J. Beltran.
Proceedings of the 13th International Conference on Mine Closure p.1577-1586(2019)

The Standardized Reclamation Cost Estimator (SRCE) was developed to provide a robust, defensible calculator for mine closure financial assurance by the State of Nevada and has been used internationally for financial assurance cost estimates, life-of-mine and provision for environmental rehabilitation, and internal closure cost estimates. Minimizing the liability of closure costs is increasingly important for mine planners as experience dealing with mature mine sites has led to a better understanding of the magnitude of actual closure costs, and as companies seek to reduce ongoing liabilities associated with unrehabilitated land. The revised SRCE (v2.0) was used to repurpose the closure cost model to facilitate real-time planning and management of mine closure at the St. Ives Gold Mine and analyze closure options. Using SRCE reduced long-term closure costs by adapting short-term mine plans to accommodate the extended view of the mine life. *This paper is **Open Access** at* https://papers.acg.uwa.edu.au/p/1915_123_Getty/ *The SRCE can be accessed at* https://nvbond.org/.

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