Entries for May 16-31, 2026

Market/Commercialization Information

REGION 2 ERRS RECOMPETE (COMBINE)
U.S. Environmental Protection Agency, Region 3 Contracting Office, Philadelphia, PA Contract Opportunities on SAM.gov 68HE0326R0009, 2026

This is a total small business set-aside under NAICS code 562910. EPA seeks a contractor to support its ERRS contract. The purpose of the ERRS contract is to provide fast, responsive environmental cleanup services to the release, or threatened release, of hazardous substances/waste/pollutants and contaminants/materials and petroleum products/oil for the EPA Region 2, which has a geographic area comprised of New Jersey, New York, Puerto Rico, the US Virgin Islands, and eight Indian Nations. 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 under this contract. A regional cross-over may be requested under this contract; under rare circumstances, international responses may be required. The award will be an IDIQ contract with a period of performance from January 27, 2027, through January 26, 2035. Offers are due by 10:00 AM EDT on August 20, 2026. https://sam.gov/workspace/contract/opp/26dd719fc2dc439ba8850eff4863f41f/view

DRAFT RFP - HANFORD 222-S LABORATORY
Department of Energy, Environmental Management Consolidated Business Center, Cincinnati, OH
Contract Opportunities on SAM.gov 89303326REM000152, 2026

The Department of Energy (DOE) is releasing the Draft Request for Proposal (RFP) for a competitive procurement for the management and services of the 222-S Laboratory Complex at the Hanford Site for the industry to review. This RFI seeks input from interested parties regarding their capabilities to meet the requirements for the planned competitive procurement for "Hanford 222-S Laboratory Contract." In particular, DOE is seeking feedback from interested parties to questions posed in the cover letter posted with the Draft RFP. DOE will determine if the full requirements can be performed by a small business, including 8(a), HUBZone, small disadvantaged, woman-owned, or service-disabled-veteran-owned small businesses under NAICS Code 562910. Small businesses capable of performing all or a part of the Major Elements of Scope are encouraged to submit a capability statement. DOE intends to conduct a pre-solicitation conference, site tour, and one-on-one information exchange sessions with interested parties in support of the upcoming procurement. DOE has scheduled these activities to be held July 14-16, 2026. DOE is not requesting proposals at this time, and interested parties shall not submit proposals in response to the draft RFP. DOE hereby invites all interested parties to thoroughly examine the Draft RFP and the accompanying procurement website (https://www.emcbc.doe.gov/SEB/Hanford222S) in their entirety and to submit questions or comments in writing by July 31, 2026.

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Cleanup News

BMP CONVERSION FOR AMD REFURBISHMENT
Denicola, T.A. 27th Annual PA AMR Conference, 14-16 October, State College, PA, 41 minutes, 2025

An acid mine drainage (AMD) treatment project was constructed in the mid-1990s to remediate hundreds of gals/min of mine water utilizing anoxic limestone drains and compost-limestone beds. The treatment footprint was ~3.5 acres. After over 20 years of operation, the system required refurbishment, and the landowner desired the land to be returned to a usable condition. An oxic treatment system with a smaller footprint was proposed to achieve the desired treatment effect. Calculations were performed to assess heterogeneous iron oxidization rates under fluctuating temperature, pH, and dissolved oxygen conditions and estimate the volume of precipitated sludge. The detailed calculations allowed an appropriately sized series of alkalinity-generating and oxidation-inducing treatment practices in series while managing precipitated solids along the treatment path and provided the client with an estimate of treatment performance under varying climatic and site conditions. The project is currently achieving similar contaminant reductions in a ~0.5-acre footprint. Https://www.youtube.com/watch?v=gzhuMTrz4lc

LONG-TERM EFFECTS OF VEGETATION COVER ON THE REHABILITATION OF LEAD/ZINC MINE TAILINGS
Olea, F.E.S., I.T. Burke, R. Courtney, W.M. Mayes, A.J. Weightman, G. Webster, F. Bydalek, and D.I. Stewart. | Science of The Total Environment 1013:181257(2026)

Pb/Zn sulfide ore is extracted from carbonate host rock by milling to grain sizes
Https://www.sciencedirect.com/science/article/pii/S0048969725028992/pdfft?md5=31618d0c6e5ffa7db7f7a3689d045cbd&pid=1-s2.0-S0048969725028992-main.pdf

LESSONS FROM FEASIBILITY AND CONCEPTUAL DESIGN STUDIES FOR A POTENTIAL GROUNDWATER UNDERDRAIN REMEDY NELSON TUNNEL/ COMMODORE WASTE ROCK SUPERFUND SITE COLORADO
Piestrzeniewicz, A. | DCHWS West 2025 Winter Symposium, 26-28 January, Denver, CO, 21 slides, 2026

The Nelson Tunnel/Commodore Waste Rock Superfund site consists of the abandoned Nelson Tunnel, associated historical mine workings, and mine tailings. Impacted mine water with elevated metals and low pH is impounded in three separate mine pools within the Nelson Tunnel and discharges at a consistent rate of ~350 gals/min through the collapsed tunnel portal and into adjacent West Willow Creek. The interim remedy consists of a new mine adit and flow control bulkhead to prevent release of ≤ 22 million gals of mine water. A key component will be controlling the flow of water into the tunnel before remediating the impacted mine water. Constant discharge of water from the portal and evidence from previously collected data suggest primary input of water into the tunnel may be upwelling groundwater along the Amethyst Fault and associated fractured rock. Lessons learned from a recently completed treatability and conceptual design study support a potential groundwater underdrain. The main objectives were to evaluate the location and rate of groundwater upwelling into the Nelson Tunnel to confirm it is the dominant source of water influx and inform the conceptual design, and assess groundwater quality to determine whether it meets applicable water quality standards for surface water discharge without requiring costly treatment. Two angled boreholes within the Commodore 5 Level Tunnel revealed potential new groundwater flow paths not in the conceptual site model, offering critical data for the final remedy selection and design. The presentation describes the various challenges and implementation factors associated with mobilizing and operating equipment in a narrow underground tunnel within a remote and steep mountain canyon. Https://mediacdn.guidebook.com/upload/213718/jw9kWlR5R9zI8SZWTIFW9kgOpNWEWRjwyJTi.pdf

MANGANESE REMOVAL IN A FULL-SCALE CONSTRUCTED WETLAND FOR PASSIVE MINE WATER TREATMENT: ENVIRONMENTAL FACTORS AND MICROBIAL COMMUNITIES
Lafont, C., S. Vaxelaire, A. Gelabert, C. Joulian, H. Thouin, F. Dure, M. Charron, J. Gorny, D. Vantelon, F. Battaglia-Brunet, and E.D. van Hullebusch.
Water Research 295:125539(2026)

Key biogeochemical factors influencing Mn removal were examined in a full-scale passive mine water treatment plant located in Ales, France. Monitoring physicochemical parameters, microbial communities, and Mn speciation in solid phases was conducted every two months for one year. Results highlight temporal variations in Mn removal efficiency, with two main mechanisms identified: (1) $MnCO_3$ precipitation, likely influenced by high carbonate concentrations in mine water; and (2) Mn oxide (δ-MnO_2) formation, mainly associated with reed rhizosphere, where it accumulates as mineral plaque. In mine water, Mn removal correlates with Fe particle concentrations, suggesting a catalytic effect, as well as with alkalinity and the abundance of microorganisms affiliated to *Alteromonadaceae*, suggesting a microbial influence. Mn removal appears to be primarily abiotic, driven by favorable pH and alkaline conditions that promote Mn carbonate precipitation, autocatalytic oxidation reactions occurring on rhizosphere surfaces, and the plant's design, including surface area and hydrological conditions.
Https://www.sciencedirect.com/science/article/pii/S0043135426002216/pdfft?md5=92133d2b164474406fdfffcdd27002efc&pid=1-s2.0-S0043135426002216-main.pdf

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Demonstrations / Feasibility Studies

FIVE-YEAR PERFORMANCE REVIEW OF A MINE ROCK STOCKPILE COVER TRIAL IN THE CANADIAN SHIELD
Harrington, J., A. Cash, C. Mendoza, J. Straker, M. Iverson, V. Raizman, and M. Leclair.
Haagner, A. and F. van Wyk. Proceedings of the 18th International Conference on Mine Closure, 14 pp, 2025

The planned end land use for mine rock stockpiles at the Detour Lake Mine in Canada is dense mature coniferous forest to reestablish pre-mine ecosystems. A 10-hectare cover trial was constructed to assess the relative performance of different cover and revegetation prescriptions to achieve planned end land use. The trial was divided into plots considering a range of slope angles, aspect, cover thickness, surface grading and revegetation prescriptions. The paper reviews the cover trial performance after five years of monitoring. Large-scale slope instabilities were not observed in the silt-rich reclamation cover. Most erosional and depositional features stabilized three to four years following construction. The primary factors influencing erosion are variability in surface water run-on from the upstream bench and surface grading on slopes, with lesser influence from slope angle and cover thickness. Erosion performance improved by limiting surface water run-on to slopes by using a microtopography surface grading of offset hummocks and hollows plus rapidly establishing vegetation. The density of conifers was within the range required to achieve the planned end land use, although it neared the lower end of that range, with some ongoing mortality. Green alders were growing well and reaching heights >2 m. Peat was the key driver of seedling survival and vigor, where survival was ~25% higher in areas with increased peat. A 0.7 m cover thickness promoted vegetation growth and managed erosion. Insights into operational-scale construction methods and the relative performance of cover characteristics are being applied to ongoing progressive reclamation activities. Https://papers.acg.uwa.edu.au/d/2515_98_Cash/98_Cash.pdf

ADAPTATION OF THE ENVIRONMENTAL CLAMSHELL DREDGE FOR BITUMEN MAT REMEDIATION IN BASE MINE LAKE DEMONSTRATION
Adedeji, O.E., N. Wang, R. Young, D. Major, A. Dunmola, A. Lanoue, and M. London.
Tailings and Mine Waste 2025 Conference, 2-5 November, Banff, AB, Canada, 12 pp, 2025

The Base Mine Lake Demonstration (BML) is the oil sands industry's first full-scale commercial demonstration of water-capped tailings technology in an end pit lake. The closure method involves placing fine tailings (FT) below grade in a mined-out pit, then covering them with a water cap deep enough to prevent wind-driven resuspension of mineral solids, which allows the tailings to densify. Over time, the water layer on top of the tailings forms a lake that supports plants and animals. Since commissioning the BML in 2012, research and monitoring have shown that FT settlement occurs as expected through self-weight consolidation, water quality improves over time, and ecological communities develop. Bitumen mats have been found at the FT-water interface in certain areas of BML, which could impact lake performance. A 55-day field pilot program was conducted at BML to remediate bitumen mats during the open season. The goal was to demonstrate that the environmental clamshell dredge could effectively remove the mats from a soft-sediment water body, such as the BML, and assess the accuracy of the dredge bucket's position through surface surveys before and after dredging, using bathymetric data. A target depth of 40 cm from the mudline was established, which is within the 45 cm limit of the clamshell bucket. The pilot was successful, with the post-dredging surface averaging ~39 cm, close to the intended 40 cm. https://drive.google.com/file/d/1wKAx1dPUX8Iy050cHmoeQIgXGD0nOUIz/view

TREATMENT OF ACID MINE DRAINAGE (AMD) FROM THE SANTA CATARINA BASIN (BRAZIL) TO RETRIEVE RARE EARTH
Viola, V.O., T.F. de Aquino, B. Bonetti, L. Canarin, A.D. Cardoso, G. Clark Bleyer, K. Shirmer,
M. Nascimento, P.S.M. Soares, C. Soares, N. Padoin, and H.G. Riella.
Journal of Water Process Engineering 82:109549(2026)

A study evaluated the technical feasibility of producing a rare earth element-preconcentrate from coal AMD collected in the Santa Catarina coal basin. Three production scales were assessed at bench (18 L), glass reactor (100 L), and pilot plant scale (15 m3) using a sequential precipitation process based on controlled oxidation and pH adjustment. This approach generated two solid precipitates: the first with pH between 4.5 and 5.0 (P1), iron-rich (up to 56% Fe2O3), and the second with pH between 8.5 and 9.0 (P2), enriched with REEs (up to 2.5% by mass). Production results showed a yield of ~0.07 kg P2/cm3 of AMD treated. Solid P2 was subjected to acid leaching, followed by hydrometallurgical extraction and selective precipitation. The method recovered a REE-rich product with >90% purity, obtaining ~1 g of mixed rare earth oxide equivalent for every 3.6 m3 of AMD processed. Effluent quality demonstrates removal efficiencies >95% for Fe and Al, with reductions in Mn and Zn. Reproducibility across scales demonstrates the potential for industrial implementation.
Https://www.sciencedirect.com/science/article/pii/S2214714426001078/pdfft?md5=928bb6945467bf0a7b466bc7a2116cb3&pid=1-s2.0-S2214714426001078-main.pdf

RESPONSES OF ARSENIC AND SOIL PROPERTIES TO REMEDIATION: EVIDENCE FROM A TWO-YEAR MONITORING STUDY IN AN ABANDONED GOLD MINING AREA
Tang, Z., L. Li, Y. Li, H. Chen, Y. Zhang, T. Hu, and Z. Hu.
Toxics 14(4):316(2026)

A two-year field monitoring program was conducted at a severely As-contaminated abandoned gold mine in Guangdong Province, China, to examine the temporal dynamics of soil properties and As behavior under different remediation strategies. Representative slopes included slope A (slope reshaping and revegetation), slope B (terraced engineering interception), and slope C (an area influenced by acidic water bodies). Both total and available As at slopes A and B exhibited a similar pattern of initial increase followed by decline and stabilization, indicating a clear temporal scale for remediation effects. Slope A exhibited greater spatial variability, whereas slope B showed relatively minor fluctuations, suggesting that terraced engineering measures contributed to enhanced As stability. In contrast, slope C had lower total As but a higher proportion of available As before remediation due to acidic conditions. Following remediation, total and available As at slope C decreased markedly and remained stable for about six months; however, a rebound trend was observed after ~1.5 years, indicating the time-limited effectiveness of passivation treatments. Total As at slope C decreased from 22,916 to 4,011 mg/kg, accompanied by a 65-85% reduction in available As. Meanwhile, soil pH, soil organic matter, and cation exchange capacity exhibited pronounced non-linear variations, with an overall tendency to recover toward pre-remediation conditions. *This article is* ***Open Access*** *at* https://www.mdpi.com/2305-6304/14/4/316

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Research

IMPLEMENTATION OF (AIDED)PHYTOEXTRACTION IN PB/ZN MINE TAILINGS USING HYPERACCUMULATORS IMPROVES SOIL HEALTH
Alvarez-Lopez, V., B. Rodriguez-Garrido, A. Prieto-Fernandez, C. Trasar-Cepeda, C. Monterroso, and P. Kidd. | Chemosphere 394:144780(2025)

A field trial of (aided)phytoextraction was implemented at an abandoned Pb/Zn-mining area in northwestern Spain. The Cd/Zn-hyperaccumulator *Noccaea caerulescens* was planted in monoculture or co-cropped with the leguminous *Lotus corniculatus* in replicate plots established in non-amended or compost-amended mine tailings. Compost amendment improved soil properties such as total C and N contents, C/N ratio and nutrient availability, but decreased soil metal availability. Compost addition improved plant nutrition and biomass production of the hyperaccumulator. After 1.5 years of plant growth, no significant changes in soil total metal concentrations were observed. However, the concentrations of NH_4Cl-extractable Zn decreased in plots cultivated with *N. caerulescens*. Intercropping with the legume induced significant increases in shoot metal concentrations in the hyperaccumulator. Plant cover and compost addition increased the activity of hydrolytic and dehydrogenase enzymes, while decreasing catalase activity, which showed abnormally high values in mine tailings. The successful establishment of plant cover was essential to maintaining the improvement of organic matter and other soil properties induced by the compost amendment over time.

APPLICATION OF UNSUPERVISED MACHINE LEARNING TO REFINE SPATIAL DISTRIBUTIONS OF TRACE METAL AND METALLOID SOIL CONTAMINATION AT THE HISTORIC CRONIN MINE
Novakowski, K., N. Logan, C. Thomas, and P. Garvey. | British Columbia Technical and Research Committee on Reclamation, 22-25 September, Penticton, British Columbia, 13 pp, 2025

The Cronin Mine, located ~30 km northeast of Smithers, B.C., was primarily used to mine silver, lead, and zinc. The Upper Mine comprises the former mine workings and waste rock deposits, while the Lower Mine comprises the former concentrator mill site and tailings deposits. The most recent investigation focused on the Upper Mine. Situated at elevation(s) ranging from 1,440 to 1,830 m above sea level, the area is characterized by steep mountainous terrain and exposed bedrock. A major challenge in investigating the Upper Mine was distinguishing between elevated metals and metalloids in soil due to historic mining activities versus naturally elevated background concentrations from localized mineralization and the physical weathering of the exposed bedrock. Preliminary site investigations to define the spatial distribution(s) of elevated metals and metalloids in soil resulted in identifying areas that extended beyond the footprint of former mine activities and were too large to physically remediate. Recently, unsupervised machine learning methods combined with multivariate analysis were identified as tools that could potentially be used to refine these spatial distributions. This paper describes how results of the unsupervised machine learning process provided a clear visualization of the spatial distribution of metals and metalloids concentrations in soil and a key tool to advance remedial planning.
Https://open.library.ubc.ca/soa/cIRcle/collections/59367/items/1.0450922?o=4

INNOVATIVE PILOT-SCALE PROCESS FOR SUSTAINABLE RARE EARTH OXIDE PRODUCTION FROM COAL BYPRODUCTS: A COMPREHENSIVE ENVIRONMENTAL IMPACT ASSESSMENT
Rabbani, M., J. Werner, A. Fahimi, and E. Vahidi. Journal of Rare Earths 43(2):397-404(2025)

A pilot-scale process feeding was developed with two different materials from a column leaching process and acid mine drainage streams to recover rare earth elements (REEs). A life cycle assessment study evaluated the environmental impacts of rare earth production from deleterious material in the form of highly contaminated leachate (HCL) and low-contaminated leachate (LCL). Results indicate that the main contributors to environmental categories that produce

RE-hydroxide stages are NaOH and electricity. Oxalic acid, Na_2CO_3, and hydrochloric acid significantly contribute to the production stage of individual rare earth oxides (REOs), including solvent extraction (SX) and precipitation steps. The HCL route has higher environmental impacts than LCL due to higher chemical/energy and H2SO4 usage; 468 and 292 kg of carbon dioxide were generated to produce 1 t of individual REOs from the HCl and LCL routes, respectively. Carbon dioxide emitted from the process, including the RE-hydroxide production, SX, and REOs production, was less than 10 t CO_2. A sensitivity analysis was performed to assess the changeability of the environmental footprints of the main inputs in the SX process, as the main stage has a higher contribution to the whole process.
Https://www.sciencedirect.com/science/article/pii/S1002072124001108X?casa_token=gYNcZaQ43ycAAAAA:M_k4GsRq7SCrVRibjYuVvyZHeqjM48jf86hKXEj_gcxykdQBoXcN24e9rxtoWuF2QEdWooYVpA

NUMERICAL MODEL-GUIDED OPTIMIZATION FOR REMEDIATION OF HIGH-FLUORINE ACID MINE DRAINAGE IN A LARGE-DEEP MINE PIT
LI, Y., Y. DU, H. Xu, A. Yan, S. Zhao, Z. Huang, and L. Wang.
Environmental Earth Sciences 85:4(2026)

Conventional remediation of high fluoride and high acid mine drainage in one of the deepest and largest abandoned mine pits in eastern China was challenging due to its immense volume and vertical stratification and was estimated to take several years through pilot testing and monitoring. An Integrated Treatment Station (ITS), consisting of a pump and dosing tank, was designed to promote vertical mixing, with deep water being drawn to the surface by the pump and supplemented by an appropriate amount of neutralizer being added in the dosing tank, and then sprayed nearby. A 3D k-ε hydrodynamic coupled water exchange model was established to predict the feasibility and optimality of the solution and was also used to track the efficiency of the real treatment operation. The first scheme, V1, involved a few high-capacity land-based ITS, while V2 employed many low-capacity floating ITS, and V3 used a moderate number of low-capacity floating ITS, deployed in varying areas depending on the bathymetry. Based on simulation results, after running V1, V2, and V3 schemes for 3 months, the water exchange efficiency of the total alkaline addition reached 71.37%, 76.18%, and 81.56%, respectively, meeting the efficiency requirements for AMD treatment. During the operation of the selected V3 scheme, the fluoride ion levels in the surface and bottom layers were monitored synchronously to assess the effectiveness of the treatment. The total fluoride ion concentration showed a remarkable logarithmic decrease, with surface, bottom, and total water body levels following a consistent downward trajectory, as predicted by the model. Using the model simulation reduced the trial and error, increased the remediation efficiency, and decreased the treatment time. Within ~ one year, the water had substantially achieved treatment objectives.

TOWARDS SUSTAINABLE RECOVERY OF RARE EARTH ELEMENTS FROM ACIDIC MINE WATERS: A CIRCULAR TREATMENT APPROACH INTEGRATING SELECTIVE PRECIPITATION AND ION EXCHANGE
Roa, A., J. Lopez, and J.L. Cortina.
Proceedings from the International Mine Water Association Conference, 7-11 July, Braga, Portugal and Oviedo, Spain, 7-11 July, 2025

A study introduces a sustainable, circular approach for treating acidic mine waters (AMWs), focusing on recovering valuable rare earth elements and other critical raw materials (CRMs). Using AMWs from the Aznalcollar Open Pit in southwestern Spain, metals like Fe, Al, and Zn were removed through precipitation and sulfide formation, achieving >99% efficiency. Ion exchange resins separated heavy and light REEs, which were recovered as >90% pure oxalates. This eco-friendly process minimizes sludge, mitigates pollution, and supports CRM demand, demonstrating global applicability. Https://www.imwa.info/docs/imwa_2025/IMWA2025_Roa_819.pdf

APPLICATION OF X-RAY-TOMOGRAPHY AND GEOCHEMICAL MODELING TO OPTIMIZE AMD TREATMENT DESIGN USING DAS AT A FORMER TIN MINE SITE IN FRANCE
Rhino, K., J. Jacob, A. Lassin, F. Dure, J. Engevin, J. Huron, V. Guerin.
Proceedings from the International Mine Water Association Conference, 7-11 July, Braga, Portugal and Oviedo, Spain, 7-11 July, 2025

First pilot-scale trials of dispersed alkaline substrate (DAS) reactors to treat acid mine drainage (AMD) at a closed Sn mine in Abbaretz, France revealed notable iron precipitation and clogging over time. To address this, a fixed-bed limestone reactor was used to estimate precipitate volume via X-ray tomography, linking iron precipitation to porosity reduction. A second DAS reactor was conducted, and a geochemical model, developed with PHREEQC, was used to simulate calcite dissolution, AMD neutralization, and iron hydroxide precipitation under varying residence times. DAS results aligned with experimental data, offered insights into DAS efficiency and lifespan, and helped identify the main mechanisms that control the fate of iron and metals at the different stages of the process. Findings inform the design of robust passive treatment systems for long-term AMD management. Https://www.imwa.info/docs/imwa_2025/IMWA2025_Rhino_813.pdf

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General News

CRITICAL-MINERALS RECOVERY FROM MINE TAILINGS: A TECHNICAL REVIEW AND STRATEGIC ASSESSMENT
Podgorney, R., T. McLing, A. Nickens, S. Bragg-Sitton, and J. Wagner. Idaho National Laboratory Report INL/RPT-25-89279, 66 pp, 2025

This report presents a comprehensive technical assessment of the billions of tons of mine tailings generated by more than a century of hardrock mining across the U.S. The tailings contain recoverable quantities of critical minerals that were either not economically valuable during mining operations or technically difficult to extract with past-generation processing technologies. Recent efforts documented >300 datasets from more than 100 sources characterizing these tailings. Preliminary analysis indicates that domestic mine tailings contain ~ 13,904 MMT of material across 189 sites, with significant concentrations of critical minerals as REEs. The diverse deposit types of these tailings provide multiple pathways to develop domestic critical-mineral supplies from secondary sources. Many legacy tailings sites represent ongoing pollution sources through acid mine drainage, heavy-metal leaching, and dust generation. Reprocessing these materials offers the opportunity to simultaneously extract valuable minerals and remediate environmental hazards. However, significant barriers impede large-scale development of critical-mineral recovery from mine tailings, including incomplete site characterization; the absence of a comprehensive, standardized national database of tailings sites with verified critical-mineral content that creates uncertainty for private-sector developers; long permitting timelines; and liability concerns under CERCLA. Economic barriers include the technical complexity of separating multiple critical minerals from complex matrices, volatile commodity prices that create investment risk, and the high upfront capital requirements of processing facilities capable of handling large material volumes necessary to achieve economies of scale. The phenomenon of "companionality" in which 61% of evaluated metals are produced primarily as byproducts rather than as primary commodities, further complicates supply dynamics. Https://inl.gov/content/uploads/2026/04/INL-RPT-25-89279.pdf

SUSTAINABLE REMEDIATION OF ACID MINE DRAINAGE USING COAL FLY ASH: A COMPREHENSIVE REVIEW AND BIBLIOMETRIC ANALYSIS
Mogashane, T.M., A.M. Motlatle, B.N. Mosoma, L. Mokoena, and J. Tshilongo.
Chemical Engineering Journal Advances 25:101047(2026)

This review analyzes current developments in using coal fly ash (CFA) for acid mine drainage (AMD) remediation, emphasizing its physicochemical characteristics, pollutant removal methods, and performance-enhancing changes. Key findings from experimental and pilot-scale studies show that CFA can effectively neutralize acidic pH, removing ≤ 99% of heavy metals and precipitate sulphates through adsorption and co-precipitation processes. Modified CFA materials, including those treated with acids, bases, or nanomaterials, further enhance removal efficiencies and broaden application potential. Challenges related to CFA variability, long-term stability of treated effluents, and potential secondary pollution are discussed. The integration of CFA into sustainable AMD management frameworks is also explored, along with emerging innovations such as CFA-based composites and combined treatment systems. A bibliometric analysis identified key trends in research production. https://www.sciencedirect.com/science/article/pii/S2666821126000165/pdfft?md5=53d6bf2435084de7118d2bbf5b0fff38&pid=1-s2.0-S2666821126000165-main.pdf

EXTREMOPHILE RED ALGAE FOR ACID MINE WASTE REMEDIATION: A DESIGN-FORWARD REVIEW FOCUSED ON GALDIERIA SULPHURARIA
Sivanantharajah, S., K. Sriram, M. Sivanesarajah, S. Nadesananthan and T. Selvaratnam.
Processes 14(3):417(2026)

Thermoacidophilic red algae of the order Cyanidiales, particularly *Galdieria sulphuraria* (*G. sulphuraria*), have attracted interest as a biological option to remediate acid mine drainage (AMD) because they tolerate extreme acidity and elevated temperatures, grow under low light in mixotrophic or heterotrophic modes, and display rapid metal binding at the cell surface. This review synthesizes 20 years of peer-reviewed work to clarify how *G. sulphuraria* can be deployed as a practical module within mine water treatment trains. It examines the mechanisms of biosorption and bioaccumulation and shows how they map onto two distinct configurations. Processed freeze-dried biomass functions as a regenerable sorbent for rare earth elements (REEs) and selected transition metals in packed beds with acid elution for recovery. Living cultures serve as polishing units for divalent metals and, when present, nutrients or dissolved organics under low light. Realistic operating windows centered on pH 2-5 and temperatures of approximately 25-45°C are defined. Matrix effects that govern success are identified, including competition from ferric iron and aluminum, turbidity and fouling risks, ionic strength from sulfate, and suppression of REE uptake by phosphate in living systems. Building on lab studies, industrial leachate tests, and ecosystem observations, the review proposes placing *G. sulphuraria* upstream of bulk neutralization and outlines reporting practices that enable cross-site comparison. The goal is an actionable framework that reduces reagent use and sludge generation while enabling metal capture and potential recovery of valuable metals from mine-influenced waters. *This article is* ***Open Access*** *at* https://www.mdpi.com/2227-9717/14/3/417

MULTIDIMENSIONAL SYNERGISTIC MANAGEMENT OF ACID MINE DRAINAGE: CONSTRUCTING CLOSED-LOOP TECHNOLOGICAL SYSTEMS BRIDGING CONTAMINATION CONTROL AND RESOURCE CIRCULATION
Ma, Z., L. Zhou, S. Wang, S. Zhu, Z. Zhao, R. Li, T. Wang, and H. Guo.
Journal of Water Process Engineering 78:108782(20265

A systematic review was conducted on recent research progress in the field of AMD treatment, with a focus on the transition from traditional treatment technologies to integrated resource recovery and comprehensive management models. Guided by the principles of a circular economy, the review constructed a tripartite technical system encompassing "pollution control-resource recovery-ecological restoration" and provided a detailed analysis of the synergistic mechanisms of key technologies such as physicochemical treatment, bioremediation, and the application of novel functional materials. The review thoroughly examined the principles and effectiveness of advanced technologies like selective adsorption, membrane separation, and bioelectrochemical systems in AMD treatment, while outlining optimization pathways for multi-technology coupling systems. It also analyzed current challenges in practical applications, including water quality complexity and operational stability, and explored future development directions such as intelligent monitoring and the development of new functional materials.
Https://www.sciencedirect.com/science/article/pii/S2214714425018550/pdfft?md5=d2c3e69672a273be77c9d2adc3c229bc&pid=1-s2.0-S2214714425018550-main.pdf

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 and Emergency Management at adam.michael@epa.gov or (703) 399-4268 with any comments, suggestions, or corrections.

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