

Four decades after cessation of 150 years of ore processing, researchers investigated an area downwind from a decommissioned iron smelter for signs of metals contamination and if any were found to evaluate the options for intervention. Samples taken from topsoils over an area of 15 km² near the pollution source showed total concentrations of 101 mg Cr, 8 mg Co, 41 mg Ni, 70 mg Cu, 143 mg Zn, 6 mg As, 1.3 mg Cd, 0.5 mg Sb, 92 mg Pb, and 1.3 mg Bi kg/soil, with standard errors exceeding 50%. Results indicate that it is unlikely soils in the vicinity of the former smelter are a source of disproportionate human metals intake. Considering a minimum area of 1 km² and a minimum depth of 10 cm, the total cost of soil remediation with subsurface remediation would be about one quarter of the local municipality's annual budget. Economically feasible options for reducing any risks would likely rely on optimization of risk assessment factors by adopting soil conservation practices. http://metallipinesanti.altervista.org/Pubblicazioni/Gallini_Aimone_Scielenge_2018.pdf

IPC2017 FIELD TOUR

14th International Phytotechnologies Conference, September 25-29, Montreal, Canada. 17 pp, 2017

This brochure contains descriptions of four sites visited during the 2017 phytotechnologies conference field tour of September 29. The tour included the following projects: Stop 1. Constructed wetlands planted with willow for treatment of municipal wastewater in small municipalities with a population of less than 5,000 inhabitants; Stop 2. Short-rotation willow coppice land application system for treatment of small municipality wastewater in northern regions; Stop 3. Constructed wetland for the treatment of underground contaminated water (C10-C50 HF, HAP, BTEX, isopropylbenzene) from a petrochemical site; and Stop 4. Phytoremediation of moderately contaminated soils in a peri-urban brownfield on Montreal Island using willows, poplars, and herbaceous species. http://ipc2017.org/files/field_tour_092917.pdf

USING FIRE TO REMEDIATE CONTAMINATED SOILS

Torero, J.L., J.I. Gerhard, L.L. Kinsman, and L. Yerman. Underground Coal Gasification and Combustion. Elsevier, NY, ISBN: 978-0-08-100313-8. 601-625(2017)

Combustion of an organic phase contained within a porous medium involves an exothermic reaction, during which heat is transmitted from the burning to the pore space and the solid matrix. Contaminant destruction in such applications is largely dominated by smoldering (as opposed to flaming) combustion. The results described in this paper indicate that smoldering remediation is viable across a considerable range of porous media types and subsurface conditions. See [additional information on the smoldering technology in a paper at https://pubs.acs.org/doi/10.1021/acs.est.5b03177](https://pubs.acs.org/doi/10.1021/acs.est.5b03177).

ORGANIC LIQUID MOBILITY INDUCED BY SMOLDERING REMEDIATION

Kinsman, L., J.L. Torero, and J.I. Gerhard. Journal of Hazardous Materials 325:101-112(2017)

Smoldering is a relatively new, energy-efficient thermal treatment for organic liquid waste. Lab column experiments plus analytical and numerical modeling together suggested that for organic liquids mixed with inert sand, downward organic liquid mobilization can occur and affect smoldering behavior under certain conditions. The observed effects included increased peak temperatures (by up to 35%) and increased treatment times (by up to 30%). Downward organic liquid migration occurred when (i) injected Darcy air flux was < 3 cm/s, (ii) treatment systems were tall (90 cm as opposed to 30 cm), and (iii) the organic liquid was temperature-sensitive (viscosity < 0.01 Pa s at 150°C). An applied air flux can negate the downward organic liquid gradient required for migration. Smoldering behavior was demonstrated to adjust to liquid migration and thereby still destroy all the organic waste in the system. See [additional information in L. Kinsman's thesis at https://doi.org/10.1016/j.jhazmat.2016.08.044](https://doi.org/10.1016/j.jhazmat.2016.08.044), and the manuscript submittal of this paper at https://espace.library.uq.edu.au/view/UQ:415622/UQ415622_OA.pdf.

METAL SYSTEMS AS TOOLS FOR SOIL REMEDIATION

Floris, B., P. Galloni, F. Sabuzi, and V. Conte. Inorganica Chimica Acta 455(pt 2):429-445(2017)

Review of research aimed at soil remediation with metal systems (as found in literature to the end of 2015) is presented with consideration of both inorganic and organic contaminants. The following technologies are reviewed: minerals and bulk metals systems as adsorbent materials in abiotic soil; metal nanoparticles; metal porphyrins-catalyzed chemical oxidation; metal-modified Fenton systems; and metal-enhanced electrokinetic methods. Both heterogeneous and homogeneous systems are discussed and illustrated with field applications, where available, with attention to the intrinsic difficulties of in situ application.

PHYTO-MYCOREMEDIATION OF BENZO[A]PYRENE IN SOIL BY COMBINING THE ROLE OF YEAST CONSORTIUM AND SUNFLOWER PLANT

Mandal, S.K. and N. Das. Journal of Environmental Biology 39:261-268(2018)

Biostimulation of soil with a yeast consortium enhanced the total activity of yeasts in the soil. Faster and maximum BAP degradation was obtained using the yeast consortium immobilized on rice husk combined with sunflower plant phytoremediation. http://www.jeb.in/journal_issues/201803_mar18/paper_16.pdf

POLYCYCLIC AROMATIC HYDROCARBONS: A REVIEW

Lawal, A.T. and P. Fanfike. Cogent Environmental Science 3(1):1339841(2017)

The authors present a review of recent literature that addresses PAHs toxicity and biomonitoring in air, water, soil, sediment, and waste sludge. Sample preparation, such as PAHs extraction, and analytical methods used, are also reviewed with commentary on developments in direct measurement techniques, such as UV absorption spectrometry and synchronous luminescence. In addition, biological and physico-chemical factors that influence PAHs degradation and remediation are discussed. <https://www.tandfonline.com/doi/full/10.1080/23311843.2017.1339841>

A REVIEW ON THE EFFICIENCY OF LANDFARMING INTEGRATED WITH COMPOSTING AS A SOIL REMEDIATION TREATMENT

Lukic, B., A. Panico, D. Huguenot, M. Fabbricchio, E.D. van Hullebusch, and G. Esposito. Environmental Technology Reviews 6(1):94-116(2017)

This paper reviews the efficiency and application conditions of landfarming as a suitable bioremediation treatment for soils contaminated with PAHs and discusses the feasibility of improving bioremediation performance by combining landfarming with biostimulation and bioaugmentation as promoted by the composting of organic waste.

DECHLORINATION OF HEXACHLOROBENZENE IN CONTAMINATED SOILS USING A NANOMETALLIC AL/CAO DISPERSION MIXTURE: OPTIMIZATION THROUGH RESPONSE SURFACE METHODOLOGY

Jiang, Y., Y. Shang, S. Yu, and J. Liu. International Journal of Environmental Research and Public Health 15(5):872(2018)

A nanometallic Al/CaO (n-Al/CaO) dispersion mixture was developed utilizing ball-milling technology to evaluate the reductive stabilization technique's effect on dechlorination of hexachlorobenzene (HCB) in contaminated soils. The optimal soil moisture content, n-Al/CaO dosage, and grinding time were found to be 7% (m/m), 17.7% (m/m), and 24 h, respectively, in the experimental ranges and levels. Under optimal conditions, dechlorination efficiency was 80%. Intermediate product analysis indicated that dechlorination was the process by stepwise loss of chloride atoms. The main pathway observed within 24 h was HCB > pentachlorobenzene > 1,2,3,4-tetrachlorobenzene (TeCB) and 1,2,4,5-TeCB. Results indicated that moderate soil moisture content was crucial for HCB hydrodechlorination. <http://www.mdpi.com/1660-4601/15/5/872/htm>

MECHANOCHEMICAL MECHANISM OF RAPID DECHLORINATION OF HEXACHLOROBENZENE

Deng, S., S. Kang, N. Feng, J. Zhu, B. Yu, X. Xie, and J. Chen. Journal of Hazardous Materials 333:116-127(2017)

In a study of mechanochemical (MC) dechlorination treatment, hexachlorobenzene (HCB) was chosen as a model pollutant with aluminum and alumina (Al+Al₂O₃) powders as the co-milling reagents. Both intermediate analysis and quantum chemical calculations were adopted to elucidate the free radical dechlorination mechanism of HCB. The researchers found that the intermediates and radical-related reactions in the mechanochemical dechlorination of HCB were quite different from what happens in a typical photocatalytic dechlorination process. Impacts of different radical reactions on HCB dechlorination were also compared.

DIOXINS DEGRADATION AND REFORMATION DURING MECHANOCHEMICAL TREATMENT

Chen, Z., Q. Mao, S. Lu, A. Buekens, S. Xu, X. Wang, and J. Yan. Chemosphere 180:130-140(2017)

Mechanochemical dechlorination and destruction of polychlorinated dioxins and furans (PCDD/F) on fly ash from municipal solid waste incineration was tested with and without addition of CaO and CaO/aluminum powder. Initially, obvious PCDD/F reformation occurred, and a second test series was conducted after removing soluble salts (e.g., NaCl, KCl) by thorough two-stage water washing. The second test series demonstrated good destruction results, especially with addition of CaO/aluminum powder.

FORMATION OF BROMINATED AND CHLORINATED DIOXINS AND ITS PREVENTION DURING A PILOT TEST OF MECHANOCHEMICAL TREATMENT OF PCB AND PBDE CONTAMINATED SOIL

Lu, M., T. Lv, Y. Li, Z. Peng, G. Cagnetta, S. Sheng, J. Huang, G. Yu, and R. Weber. Environmental Science and Pollution Research 24(24):20072-20081(2017)

During a pilot study of mechanochemical (MC) destruction technology conducted for PCBs and polybrominated diphenyl ethers (PBDEs) in contaminated soil, actual applied conditions of the pilot-scale MC destruction process indicated that the temperature increase inside the ball mills had the potential to form high levels of toxic polybrominated and polychlorinated dibenzo-p-dioxins and dibenzofurans (PXDD/Fs) in the presence of dioxin precursors. The MC technology therefore was modified for treatment of PCB- and PBDE-contaminated soil to include a cooling system to prevent PXDD/F formation during PCB/PBDE destruction. This heat-related issue might be relevant to any contaminated soils containing dioxin precursors during soil treatment with MC and perhaps other non-combustion technologies. [Erratum - Correction to Figure 4: Environ Sci Pollut Res Apr 18.]

General News

AVAILABILITY OF DRAFT TOXICOLOGICAL PROFILE: PERFLUOROALKYLS

Agency for Toxic Substances and Disease Registry (ATSDR). Federal Register 83(120):28849(2018)

ATSDR recently announced the release of the *Toxicological Profile for Perfluoroalkyls: Draft for Public Comment*. The profile characterizes the toxicology and adverse health effects information for perfluoroalkyls. Each ATSDR peer-reviewed profile identifies and reviews the key literature that describes a substance's toxicological properties. Visit <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?tid=1117&tid=237> for a copy of the draft profile. Comments can be submitted through Regulations.gov at <https://www.regulations.gov/docket?d=US-EPA-HQ-2018-0104>, until July 23, 2018.

ADDRESSING VAPOR INTRUSION AT REMEDIATION AND REDEVELOPMENT SITES IN WISCONSIN

Wisconsin Department of Natural Resources, 105 pp, 2018

This guide identifies the conditions where assessment of the vapor intrusion pathway is necessary at contaminated sites; sets out the criteria for evaluating health risk; identifies appropriate responses; explains long-term stewardship; and clarifies when sites with a complete or potential vapor migration pathway may achieve closure. The guide is applicable to contaminated sites where volatilization of subsurface contaminants has migrated or has the potential to migrate to current or future occupied buildings. <https://dnr.wis.gov/files/genfile/pubstr/r800.pdf>

ENVIRONMENTAL SAMPLING & ANALYTICAL METHODS (ESAM) PROGRAM

U.S. EPA, Homeland Security Research Website, 2018

EPA's Environmental Sampling and Analytical Methods (ESAM) website is a tool that supports the entire environmental characterization process for chemical, biological, radiochemical, and biotoxin contaminants from collection of samples all the way to their analyses. Collectively, ESAM's tools help local, state, and federal emergency response personnel and labs respond more efficiently to incidents, enabling smooth transitions of samples and data from field to lab to public health decision-makers. <https://www.epa.gov/homeland-security-research/environmental-sampling-analytical-methods-esam-program-home>

ASSESSING THE ECONOMIC AND SOCIETAL BENEFITS OF SRP-FUNDED RESEARCH

Suk, W.A., M.L. Heacock, B.A. Trottler, S.M. Amolegbe, M.D. Avakian, H.F. Henry, D.J. Carlin, and L.G. Reed. Environmental Health Perspectives 126(6):065002(2018)

The National Institute of Environmental Health Sciences Superfund Basic Research and Training Program (SRP) funds a wide range of transdisciplinary research projects, supporting and promoting the application of that research to solving real-world problems. Economic and societal benefits of SRP-funded research are illuminated in five case studies focused on the use of remediation and site monitoring tools: (1) phytoremediation with hybrid poplar and cypress trees; (2) vadose-zone characterization technology; (3) activated carbon to clean up contaminated sediment; (4) steam-enhanced extraction; and (5) bioremediation of MTBE. The analysis identifies added societal benefits of the program, such as creation of small businesses, land and water reuse, sustainable technologies, exposure reduction, and university-industry partnerships. The successes and challenges involved in translating SRP grantee research findings and advances into application are also discussed. <https://ehp.niehs.nih.gov/ehp3534/>

THE PATHWAY TO PHYTOECOTECHNOLOGIES

City of Montreal Botanical Garden, Space for Life Foundation Website, 2018

Thanks to many years of research and collaboration between scientists at the Montreal Botanical Garden and the *Institut de recherche en biologie végétale* (IRBV), thousands of live plants will demonstrate their abilities in the Pathway to Phytotechnologies Program in an ambitious project spread over seven stations integrated in the heart of the Botanical Garden. The objective is to use phytotechnologies to treat runoff and wastewater, reduce the heat island effect of its parking lot, stabilize the banks of ponds, control invasive plants, and demonstrate how to reduce the impact of city noise and decontaminate soils. Carried out progressively between 2017 and 2023, the seven stations of the project will be financed jointly by the City and the Space for Life Foundation. An additional amount estimated at \$1.6 million will be dedicated to an education component. To cover the estimated \$14.5 million cost, the City of Montreal will invest one dollar in the Pathway for every dollar raised by the Foundation. To date the Foundation has raised over \$1.1 million, making it possible to develop the Filtering Marshes station, in addition to donations that will go to promoting the educational aspects of the project. <http://espacepourlavie.ca/en/pathway-phytoecotechnologies>

ADAPTATION STRATEGIES FOR RESILIENT CLEANUP REMEDIES

Asher, C., T. Michelsen, S. O'Dowd, and H. Froyland. Washington State Department of Ecology, Toxics Cleanup Program, Olympia. 154 pp, 2017

Ecology conducted a vulnerability assessment for the State's cleanup sites to understand what types of sites are most vulnerable to specific types of environmental impacts: landslide and erosion; wildfire; drought; riverine flooding and extreme rain events; and shoreline changes and coastal inundation. This guide provides a framework and information for a cleanup project manager to (1) assess the risks associated with environmental extremes and with changes to a site's

environment by doing a site-specific vulnerability assessment, and 2) identify adaptation measures that increase resilience across a range of cleanup sites in the phases of site investigations; remedy selection, design, and implementation; and operation and maintenance. Implementing adaptation measures during early stages of the cleanup process may increase the feasible cleanup options, maximize their integrity, and reduce costs in some situations.
<https://progress.wa.gov/ecy/publications/SummaryPages/1709d52.html>

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.