2019 Project Abstract
For the Period Ending June 30, 2022

PROJECT TITLE: Minerals and Water Research - Subproject 3: Develop emerging hydrometallurgy technologies
PROJECT MANAGER: Rolf Weberg
AFFILIATION: University of Minnesota Duluth Natural Resources Research Institute
MAILING ADDRESS: 5013 Miller Trunk Hwy
CITY/STATE/ZIP: Duluth, MN 55811
PHONE: 218-788-2697
E-MAIL: rtweberg@d.umn.edu
WEBSITE: https://nrri.umn.edu
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APPROPRIATION AMOUNT: $158,000
AMOUNT SPENT: $111,759
AMOUNT REMAINING: $46,241

Sound bite of Project Outcomes and Results

Based on outcomes of "voice of customer survey" and funding opportunities available through federal agencies, the project has identified emerging hydrometallurgical innovations with potential for processing Minnesota's in-situ and waste mineral resources with a reduced water, energy, and environmental footprint. The project has also identified bench-top hydrometallurgical research equipment required to initiate development of next generation value-added products from under-utilized and under-valued in-situ mineral and waste resources in Minnesota, specifically low-grade ores, waste tailings, metallurgical residues, incinerator ash, power plant combustion residues, and waste electrical and electronic equipment.

Overall Project Outcome and Results

Minnesota has abundant in-situ mineral resources, including deposits of iron, iron manganese, copper-nickel-cobalt-platinum group elements, titanium-vanadium, copper-zinc, gold with and without silver, sand, and aggregate. Commercial and industrial byproducts such as mine tailings, industrial residues, and waste electrical and electronic equipment also contain valuable mineral resources. To address significant environmental impact concerns associated with mining, collection, and processing of these materials, new processing technology approaches with reduced water and energy consumption and minimal environmental footprints are needed to support production of value-added products. Emerging hydrometallurgical processing technologies offer promising opportunities. To evaluate the technical, economic, and environmental benefits of emerging hydrometallurgical innovations, the Minnesota Legislative-Citizen's Commission on Minnesota Resources provided funding to the Natural Resources Research Institute (NRRI) to evaluate how to best support the development of emerging hydrometallurgical technologies in the state. The study highlights Minnesota's mineral and waste resources that have the highest potential for hydrometallurgical processing. The report also highlights key challenges anticipated by stakeholders during the commercial development of mineral and waste resources using hydrometallurgical technologies. The emerging hydrometallurgical innovations that may resolve various challenges are also identified by means of the stakeholder engagement survey and funding opportunities available through the federal agencies. The report summarizes research priorities that support development of emerging hydrometallurgical technologies in applications ranging from high-value materials to water remediation to carbon sequestration. The report shortlists key bench-scale and semi-pilot laboratory tools that will help NRRI to advance the readiness level of emerging hydrometallurgical technologies in Minnesota. The capital estimates for bench-top and semi-pilot laboratory prototypes range from $600,000 to $1.2 million. The personnel, installation, and collaboration costs range from $300,000 to $400,000.

Project Results Use and Dissemination

NRRI conducted a “Voice of Customer” survey through interviews with a broad range of stakeholders around the country. These included current or prospective mineral/metal producers, metal recyclers, hydrometallurgical R&D labs, engineering and technology providers, consultants, academia and educators, regulators, and federal agencies. The study produced a report of investigations of interest to wide variety of stakeholders, including regulators, mineral rights holder, federal agencies, prospective manufacturing and resource extraction companies, and the community.

Technical Report: Rao, S., Mlinar, M., Hudak, G., Kangas, K., and Peterson, D., 2022. Developing Emerging Hydrometallurgical Technologies: Report to the Legislative-Citizen Commission on Minnesota Resources. Natural Resources Research Institute, University of Minnesota Duluth, Report of Investigations NRRI/RI-2022/10. 179 p.