**PROJECT TITLE: Storing Sulfide Produced from Sulfate-Containing Wastewater Safely**

**Project Management and Qualifications**: Dr. Lee Penn will lead the project and work closely with Drs. Joshua Feinberg, Chan Lan Chun, and Nathan Johnson in coordinating experiments geared towards developing a process for storing sulfide safely at MN mining sites. They will co-advise one graduate student.

***Prof. Lee Penn*** is the project manager and has extensive experience in materials synthesis of a broad diversity of technologically important materials, including metal oxides and hydroxides, metal sulfides, metals, and metal organic framework materials. In addition, the Penn research group uses a broad range of techniques to characterize the structure, properties, and reactivity/activity of both natural and engineered materials. In addition, the Penn research group uses a broad range of environmental chemistry methods in order to examine how minerals change in reactive conditions. Penn will be responsible for synthesis and characterization of reference minerals and characterizing the sulfate reduction biproducts (obtained from the Duluth investigators) and products of leaching experiments and heat treatments.  Current Position: Professor, Department of Chemistry, University of Minnesota – Twin Cities. Education: Beloit College, Chemistry B.S., 1988-1992; University of WI, M.S. and Ph.D. in Materials Science, 1992-1998; and Postgraduate Training at Johns Hopkins University, Sept. 1998 - April 2001.

***Prof. Joshua Feinberg*** is a mineralogist with over 19 years of experience working as a geoscience professional for state and federal natural resource agencies, for private environmental consulting corporations, and as a university professor overseeing federally funded scientific research. Feinberg uses a combination of geophysical and materials science approaches to characterize minerals. Feinberg will perform the rock magnetic measurements, which encompass a suite of techniques that can quantify trace amounts of Fe-oxide, Fe-sulfide, Fe-carbonate, and Fe-phosphate minerals at ppm concentrations, determine whether materials are crystalline or amorphous as well as quantify their average particle size. Current Position: Associate Professor, Department of Earth Sciences, University of Minnesota – Twin Cities. Education: Carleton College, Geology Major, 1993-1997; Univ. of California, Berkeley, Ph.D. in Earth and Planetary Sci, 2000-2005; and Postgraduate Training at the University of Cambridge, July 2005-October 2007.

***Profs. Chan Lan Chun and Nathan Johnson*** are environmental engineers in the Department of Civil Engineering at the University of Minnesota – Duluth campus. Their research focuses on the fate and transport of chemical contaminants in natural and engineered systems. **Chun and Johnson** are collaborators and will co-lead activities related to characterizing solutions from leaching experiments. Through the work funded by Chun’s Minnesota Mining Innovation Grant (Development of iron liberation methods to sustainable biological sulfate removal from mine water), the UMD team can provide the product of sulfate reduction to our team. In addition, Chun and Johnson have a large array of mining waste materials, including tailings, waste rock, and even waste ore and have access to providing additional materials as needed.

**Organization Description**: The University of Minnesota offers world-class facilities for the completion of this project. Materials characterization will be performed in the UMN Characterization Facility, which includes a variety of electron microscopes and X-ray diffractometers for inspection, and the Institute for Rock Magnetism, which includes a variety of magnetometers and Mössbauer spectrometers. Chun is a member of the NRRI (Natural Resources Research Institute), an applied research organization whose mission is to deliver research solutions to balance Minnesota's economy, resources and environment for resilient communities.