**PROJECT TITLE: Mobile Water Treatment Demonstration System for Sulfate Reduction**

**I. PROJECT STATEMENT**

Minnesota is globally unique in its need for a portfolio of viable approaches to reduce wastewater sulfate concentrations significantly below drinking water standards (250ppm) in wild rice regions. One technology, reverse osmosis, can reduce concentrations to 10ppm or lower, but at operating costs that provide significant financial challenges to municipalities, citizens and industry, and also produce significant waste sludge disposal issues. **We propose to build a flexible, mobile demonstration system to scale up and demonstrate two treatment processes in the field – at municipal wastewater treatment facilities and industrial sites.**

The Natural Resources Research Institute (NRRI), with 2016 Minnesota Legislative investment and in collaboration with colleagues from across the University of Minnesota system, has successfully demonstrated two sulfate reduction technologies in laboratory. A chemical system successfully reduces 50-200 ppm sulfate to less than 10 ppm – a scenario associated with many municipal water treatment facilities in Minnesota. This system will likely be able to utilize existing treatment infrastructure in this application. A second, biological system successfully reduced concentrations of 800-1500 ppm to 100-200 ppm – a scenario associated with some industrial waste streams.

The goal of this project is to build a trailer-based demonstration system to scale up and demonstrate these two processes at municipal water treatment facilities and industrial sites. The design will be flexible to accommodate/add other developing water treatment technologies that address other water challenges in Minnesota such as excess phosphorus and nitrogen.

Demonstration in real-world applications, in collaboration with partners and stakeholders, will reduce risk, establish confidence and provide a broader portfolio of viable approaches to address the different ranges of sulfate concentration present in Minnesota waters. The NRRI mobile water treatment demonstration system is a tool to accelerate demonstration, commercialization and deployment of emerging technologies associated with Minnesota water quality efforts around the state.

**II. PROJECT ACTIVITIES AND OUTCOMES**

|  |  |
| --- | --- |
| **Activity 1 Title: Construct trailer based mobile treatment system****Description:**Based on a system design developed by NRRI in 2019, we will construct a trailer-based mobile treatment system capable of supporting two treatment technologies. This mobile system will support a chemical precipitation system capable of reducing sulfate concentrations from ~100 ppm to < 10 ppm; a biological reactor can reduce concentrations of 800-1500 ppm to 100-200 ppm. The mobile treatment system will have real-time monitoring laboratory to evaluate their performance and operation. Test operation will be conducted at NRRI with synthetic or wastewater collected from facilities prior to the deployment. A collaboration plan and agreement with project partners for on-site deployment will be completed in this activity. **ENRTF BUDGET: $538,278** |  |

|  |  |
| --- | --- |
| **Outcome** | **Completion Date** |
| *1. Construct mobile treatment system* | *12/31/2020* |
| *2. Run test operation of the treatment system at NRRI*  | *6/30/2021* |
| *3. Finalize collaboration plan and agreement with project partner for on-site deployment* | *6/30/2021* |

|  |  |
| --- | --- |
| **Activity 2 Title: Deploy and demonstrate two sulfate treatment technologies on site****Description:**The mobile treatment system will be deployed at two municipal wastewater treatment plants and two industrial sites (e.g. paper and pulp mill or mine water) to test and refine the chemical treatment system and the biological reactor system on site. Each run will be conducted for a duration of 1-3 months at least two seasons (summer and cold season). The performance of treatment system will be evaluated through water chemistry, operational parameters, and waste management. **ENRTF BUDGET: $300,123** |  |

|  |  |
| --- | --- |
| **Outcome** | **Completion Date** |
| *1. Deploy mobile treatment system at two municipal treatment facilities* | *4/30/2022* |
| *2. Deploy mobile treatment system at two industrial facilities* | *4/30/2022* |
| *3. Refine the treatment system*  | *6/30/2022* |

**III. PROJECT PARTNERS AND COLLABORATORS:** Existing collaborators include: Dr. Chan Lan Chun (NRRI); Dr. Meijun Cai (NRRI); Dr. George Hudak (NRRI); Mr. Shashi Rao (NRRI); Dr. Lee Penn (UM-TC); Dr. Nate Johnson (UMD); and Dr. Adrian Hanson (UMD). Two unnamed wastewater treatment facilities and one industry are currently partnering with NRRI.

**IV. LONG-TERM IMPLEMENTATION AND FUNDING:**

Using a 2016 Minnesota Legislative investment the NRRI successfully demonstrated two sulfate reduction technologies. NRRI will provide bridge funding during 2019 – 2020 to refine these technologies and scale them from the lab bench to demonstration stage. NRRI will also provide funds for the system design and integration, in preparation for construction beginning in July 2020. We anticipate building partnerships with municipal treatment plant operators and industrial facilities to refine the treatment system once it is operational.