BUREAU OF RECLAMATION

2021 Desalination and Water Purification Research Program Pitch to Pilot Projects

California

Orange County Water District: Assessment of a Multi-Metals Continuous Water Analyzer Based on ED-XRF to Monitor Reverse Osmosis in Potable Water Reuse
Reclamation Funding: $102,700 Total Project Cost: $175,184

Potable reuse is increasingly implemented by cities to address water scarcity and bolster supply. Reverse osmosis (RO) has played an important role in the practice of potable reuse for its ability to preclude high levels of both dissolved constituents and pathogens. In this study, a test is proposed of a novel online continuous multi-metals water analyzer that can measure strontium and other constituents in RO feedwater and RO permeate in real or near real-time. The goal of this study is to determine the benefits and limitations of using the novel online analyzer to assess membrane integrity and mineral scaling potential in real or near real-time. Testing will be performed at Orange County Water District's Advanced Water Purification Facility in Fountain Valley, CA.

ORB XYZ, INC.: Real-time Microbial Monitoring for Water treatment
Reclamation Funding: $200,000 Total Project Cost: $200,000

Currently, methods used to directly measure microbial contamination are labor intensive and time insensitive. There is a need for a low cost, compact fully automated microbial detection system that can capture dynamic microbial activity in various forms of waters. In this study, fluorescence spectroscopy is used in combination with machine learning algorithms to detect and quantify a large range of contaminants in water. The goal of this study is to demonstrate the monitoring of microbiology against regulatory requirements, as well as determining maintenance scheduling that will be dictated by the types of waters being monitored. Testing will be performed at Reclamation's Water Quality Improvement Center (WQIC) in Yuma, AZ.

Waste Salt Technologies LLC: On-sun Demonstration of a Low-cost and Modular Thermal Energy Storage (TES) System using Re-purposed Concentrate Salt
Reclamation Funding: $200,000 Total Project Cost: $313,600

This project addresses the issue of concentrate disposal in the water industry along with low-cost thermal energy storage in the energy industry. The applicant proposes a novel approach for eliminating the concentrate of the desalination processes by recovering the

water content using a heat-driven absorption process, followed by repurposing the salt content of the concentrate as a medium for low-cost thermal energy storage. The thermal energy storage system can be used to store thermal energy for a variety of applications including concentrating solar power or solar desalination. Testing will be performed at Panoche Water District in Panoche, CA.

Florida

OceanSpace LLC: Environmental Monitoring of Desalination Feedwater: Application of a Novel Imaging System for Small Aquatic Organisms

Reclamation Funding: $110,920 Total Project Cost: $176,494

Seawater desalination continues to face a problem with entrainment of marine life through seawater intakes. To fully understand this problem acquisition of data on organism entrainment needs better resolution than allowed by the present methodologies. In this study, novel continuous-flow plankton imaging systems will be installed to obtain data on the composition and abundance of marine organisms in seawater desalination plant source water. This will enable a more refined approach to plant operation that better manages environmental impacts. Testing will be performed at Poseidon's seawater desalination plant in Carlsbad, CA.

New Jersey

GreenBlu: Zero discharge brine separation using multiple-effect vapor adsorption

Reclamation Funding: $200,000 Total Project Cost: $254,000

The need exists for improved methods of treating high salinity brines in a cost-effective manner for brackish groundwater desalination, water reuse, and other applications. This project will demonstrate a pilot-scale multiple-effect adsorption distillation system with a goal of reducing the cost and energy consumption required to treat high salinity brine. The proposed approach will also recover pure salts for beneficial use. Testing will be performed at a site to be selected from a list of six candidate sites.

North Carolina

University of North Carolina at Charlotte: Using Iron Oxide to Reduce Costs of H_2O_2 Quenching after Advanced Oxidation Processes

Reclamation Funding: $172,179 Total Project Cost: $185,179

Advanced oxidation processes (AOPs) are essential in potable water reuse multibarrier systems and serve a number of purposes in non-reuse drinking water treatment systems. The most commercially common AOP type is a combination of ultraviolet light and hydrogen peroxide (H_2O_2), but residual H_2O_2 must be quenched prior to disinfection. This pilot study will evaluate the feasibility of using a mineral quenching agent, iron (III) oxide, which may offer a less costly alternative to current methods used for quenching H_2O_2. Testing will be performed at a Charlotte Water drinking water treatment plant in Charlotte, NC.

Pennsylvania

Interphase Materials, Inc.: Improving Desalination Efficiency with Advanced Biomaterials and Biosignals Intelligence
Reclamation Funding: $200,000 Total Project Cost: $210,601

Desalination plant feedwater contains microorganisms which can foul reverse osmosis (RO) membranes and lead to reduced efficiency and increasing maintenance costs. This project proposes to reduce the cost and environmental impact of desalination by preventing biofouling on RO membranes and other key components through innovative biomaterials and biosignals intelligence solutions. A coating will be applied to RO membranes and other components to prevent the adhesion of organisms. A hardware and software system will also be used to monitor biofilm growth in real-time and improve maintenance operations. Testing will be performed at Reclamation's Water Quality Improvement Center (WQIC) in Yuma, AZ.

Utah

University of Utah: Concerted Reductive-Oxidative Degradation of PFAS at Micro/Nanobubble Interface
Reclamation Funding: $200,000 Total Project Cost: $260,000

Per- and poly-fluoroalkyl substances (PFAS) are prevalent contaminants in surface and ground waters for drinking and agriculture, an issue of national scale requiring effective solutions. This study proposes a pilot of a novel reductive-oxidative degradation process to completely eliminate PFAS from contaminated waters. The project aims to reduce the costs and environmental impacts of treating PFAS-impaired water for beneficial uses; and to improve treatment efficiency by demonstrating an innovative technology that is effective for PFAS removal. Testing will be performed at Hill Air Force Base in northern Utah.

Virginia

Ayon, LLC: Reducing Ion Exchange Waste Brine: Incorporating Forward Osmosis to Reduce Disposal Cost
Reclamation Funding: $192,000 Total Project Cost: $241,920

Many groundwater sources are impaired by individual trace contaminants but would otherwise be a suitable potable water supply. Technologies exist to remove these trace contaminants but can result in large volumes of waste brine that are costly to transport and dispose of. This study proposes the use of forward osmosis to concentrate the high salinity waste brine on-site and therefore decrease brine disposal costs. The project will evaluate the potential of this approach through modeling and technoeconomic analysis, validate the modeling results, and perform field testing at a utility in California.