Time & Location: June 15, 2012 at 1:00 PM in Eng II 211
Title: Evaluating Corrosion Control Alternatives for a Reverse Osmosis, Nanofiltration and Anion-Exchange Blended Water Supply

The research reported herein describes the study activities performed by University of Central Florida (UCF) on behalf of the Town of Jupiter Water Utilities (Town). The Town recently changed its water treatment operations from a combination of reverse osmosis (RO), lime softening (LS) and anion-exchange (IX) to a combination of RO, IX and nanofiltration (NF). Although this treatment change provided enhanced water to the surrounding community in terms of better contaminant removal, integration of the NF process altered finished water quality parameters including pH, alkalinity and hardness. There was concern that these changes could result in secondary impacts related to accelerated corrosion of distribution system components and subsequent regulatory compliance. In addition, replacement of the LS process altered the in-plant blending operations by creating an unstable intermediate blend composed of RO and IX waters. There were concerns that this intermediate blend was affecting the integrity of in-plant hydraulic conveyance components.

UCF developed a corrosion monitoring study to assess the potential impacts related to internal corrosion, water quality and regulatory compliance after integrating NF into the existing water supply. The intended purpose was to further highlight the complexities of corrosion, describe a unique approach to corrosion monitoring as well as offer various recommendations for corrosion control in a system that relies on a blended water supply. Research was conducted in three phases to address the in-plant and distribution system corrosion issues separately and identify appropriate corrosion control treatment alternatives. The three test phases included: a baseline conditions assessment to compare corrosion of the intermediate RO-IX blend with the finished water blend; an in-plant corrosion control evaluation; and a distribution system corrosion control evaluation.

A test apparatus was constructed and operated at the Town’s facilities to monitor corrosion activity of mild steel, copper and lead solder metal components. The test apparatus consisted of looped PVC pipe segments housed with electrochemical probes and metal coupons to monitor corrosion rates of the metallic components. Electrochemical probes containing metal electrodes were used to obtain instantaneous corrosion rates by means of the Linear Polarization Resistance technique while the metal coupons were gravimetrically evaluated for weight loss. The electrochemical probes permitted daily monitoring of each metal’s corrosion rates while metal coupons were analyzed at the conclusion of testing and used for comparison. Different test waters flowed through the corrosion rack according to each test phase and relative corrosion rates were compared to evaluate corrosion control techniques.

Study findings indicated that the intermediate blend was more corrosive, in general, than the final blend; however, research also indicated that the final blend of water was increasing lead and copper concentrations within the distribution system. Recommendations were made for modification of in-plant blending operations to eliminate the intermediate blend from the process allowing the RO, IX and NF treated waters to be blended in a common location. In addition, it was recommended that a poly/ortho blended phosphate be used to decrease lead and copper corrosion within the Town’s distribution system.

Major: Environmental Engineering

Educational Career:
Bachelor’s of Environmental Engineering, BS, 2010, University of Central Florida

Committee in Charge:
Dr. Steven J. Duranceau, Chair, Civil, Environmental and Construction Engineering
Dr. Andrew A. Randall, Civil, Environmental and Construction Engineering
Dr. Husen Zhang, Civil, Environmental and Construction Engineering

Approved for distribution by Dr. Steven J. Duranceau, Committee Chair, on May 31, 2012.

The public is welcome to attend.