A corrosion control study for two distinct water distribution systems (WDS) has been completed for the Pulama Lana'i Water Company (Pulama). This project evaluated the use of chemical inhibitors to control corrosion and tuberculation within the Manele Bay WDS and the Lana'i City WDS. Pulama provides water to a population of 3,100 residents and is considering incorporating alternative water supplies in the future. Hence, knowing baseline corrosion rates within the WDS was desired.

Several groundwater wells feed each of the WDS's; however, water quality between wells varies. Well water supplied to the WDS's is generally of high quality, therefore, the historical treatment method has been limited to disinfection prior to distribution. The distribution system consists of several materials of construction, which includes galvanized iron. Valves and pipes within the WDS were experiencing visible corrosion and tuberculation believed to be responsible for variable pressure drop throughout portions of the system.

In this work, two corrosion racks, each consisting of two parallel loops, were designed, constructed, and installed at each site. One loop was maintained as a control while the other loop was used for testing alternative corrosion inhibitors. The racks utilized metal sample coupons and linear polarization resistance probes to provide data on corrosion rates of selected metals of interest.

Results indicated that the water in Manele Bay experienced no noticeable change between the test loop and control loop when a corrosion inhibitor was added. A first experiment found the corrosion rates reached baseline steady-state at 4,000 operational hours. A second experiment found that the corrosion rates reached baseline steady-state at 2,200 operational hours. During these two experiments, the addition of a phosphate or silica-based inhibitor neither reduced nor increased the corrosion rates of mild steel, lead, and copper.

Results from Lana'i City indicated that inhibitors offered little to no positive effect between the control condition and the test condition. During the first experiment, baseline corrosion was reached after 2,400 hours. The addition of a phosphate inhibitor did not reduce nor increase the corrosion rates of mild steel and lead. However, the corrosion rate of copper increased to 1.0mpy from 0.22mpy. The corrosion rate remained elevated after inhibitor feed was terminated. The second experiment reached baseline corrosion rates at 1,400 operational hours. The use of silica inhibitor neither reduced nor increased the corrosion rate of mild steel, lead, and copper.

Since corrosion inhibitors were found to be ineffective, a valve exercise and replacement program for Pulama's assets was recommended. This program included: (1) developing a detailed asset inventory, (2) implementing operation and maintenance tasks, (3) forming a valve replacement plan, and (4) establishing long range financial planning. An opinion of probable replacement cost for 200 new valves was conceptually estimated to approximate 3.3 million dollars expended over a 20 year time frame.

Major: Environmental Engineering

Educational Career:
Bachelor's of Biology, BS, 2010, The University of Texas at Austin

Committee in Charge:
Steven J. Duranceau, Chair, Civil, Environmental, & Construction Engineering
Woo Hyoung Lee, Civil, Environmental, & Construction Engineering
Anwar Sadmani, Civil, Environmental, & Construction Engineering

Approved for distribution by Steven J. Duranceau, Committee Chair, on February 15, 2016.
The public is welcome to attend.