A modified two-element membrane pressure vessel assembly has been used to monitor process operational changes in a full-scale reverse osmosis (RO) water treatment plant (WTP). This study evaluated the effectiveness of the assembly as an on-line monitoring device intended to detect scale formation conditions when connected to an operating RO process train. This study was implemented to support the requirements of a larger University of Central Florida (UCF) research project ongoing at the city of Sarasota's Public Works and Utilities (City) water treatment facilities located in Sarasota, Florida. During the time-frame of this study, the City was in the process of eliminating their sulfuric acid feed from the pretreatment system of their existing 4.5 million gallon per day (MGD) RO membrane process. The City was motivated to eliminate its dependence on sulfuric acid to reduce operating costs as well as reduce operation health and safety risks associated with the use of the acid as a pretreatment chemical. Because the City was concerned with secondary process impacts associated with acid elimination, additional measures were desired in order to protect the full-scale process.

This thesis reports on the design, fabrication and installation of a third-stage two membrane element pressure vessel “canary” sentinel monitoring device (Canary), its effectiveness as an on-line scaling monitor during full-scale acid elimination, and presents the results of the study. The Canary sentinel device was controlled using the normalized specific flux of the two membrane elements fed by a portion of the second stage concentrate of one of the City's full-scale RO process skids. Although the Canary demonstrated the ability to detect changes in an RO process operation, scaling did not occur under the conditions evaluated in this study. An autopsy of one of the Canary elements revealed that no scaling had occurred during the acid elimination process. Therefore, the Canary was found to be useful in its function as a sentinel, even though no scaling was detected by the device after acid elimination at the City's full-scale plant had been accomplished.

Major: Environmental Engineering

Educational Career:
Bachelor's of Environmental Engineering, BS, 2010, University of Central Florida
Master's of Environmental Engineering, MS, 2012, University of Central Florida

Committee in Charge:
Dr. Steven J. Duranceau, Chair, Civil, Environmental and Construction Engineering
Dr. Andrew 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 29, 2012.

The public is welcome to attend.