

## Effects of orthophosphate corrosion inhibitor on copper in blended water quality environments

Erica D. Stone, Steven J. Duranceau\*, James S. Taylor

*Department of Civil, Environmental, and Construction Engineering, University of Central Florida,  
P.O. Box 162450, Orlando, FL 32816, USA  
Tel. +1 407 823-1440; Fax +1 407 823-3315; email: sdurance@mail.ucf.edu*

Received 17 January 2009; Accepted 11 June 2009

---

### ABSTRACT

This study evaluated the effects of orthophosphate (OP) inhibitor addition on copper corrosion on coupons exposed to different blends of groundwater (GW), surface water (SW), and desalinated seawater. The effectiveness of OP inhibitor addition on copper release was analyzed by statistical comparison between OP treated and untreated pilot distribution systems (PDSs). Four different doses of OP inhibitor, ranging from 0 (control) to 2 mg/L as P, were investigated and nonlinear empirical models were developed to predict copper release from the water quality and OP doses. Surface characterization evaluations were conducted using X-ray photoelectron spectroscopy (XPS) analyses for each copper coupon tested. A theoretical thermodynamic model was developed and used to validate the controlling solid phases determined by XPS. OP inhibitor addition was found to reduce copper release for the OP dosages evaluated and the water blends evaluated compared to pH adjustment alone. Empirical models showed increased total phosphorus, silica and pH reduced copper release while increased alkalinity and chloride contributed to copper release. Thermodynamic modeling suggested that  $\text{Cu}_3(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$  is the controlling solid that forms on copper surfaces, regardless of blend, when OP inhibitor is added for corrosion control.

*Keywords:* Copper release; Orthophosphate corrosion inhibitor; Blended source water; Distribution system water quality

---

\* Corresponding author.