



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

<b>Name(s)</b> Ryan D. Kmet	<b>Project Number</b>  34245
<b>Project Title</b> Copper Corrosion Solutions	
<b>Abstract</b> <p><b>Objectives/Goals</b> The purpose of the experiment was to determine effects of orthophosphate, polyphosphate, and blends of the two on copper levels in first-draw tap water. The hypothesis was that addition of polyphosphate to first-draw tap water would increase copper concentration in water secondary to initial sequestration effect and the unpredictability of when reversion to orthophosphate ions would occur to minimize copper release. It was also hypothesized that addition of orthophosphate and polyphosphate together would significantly decrease copper concentration in first-draw tap water.</p> <p><b>Methods/Materials</b> One control of distilled water and four samples of first-draw tap water were collected and placed in a total of five beakers. Initial copper levels were assessed and recorded in each beaker. Individual and combined orthophosphate and polyphosphate treatments were applied and copper levels were immediately assessed and recorded. This process was repeated nine times, for a total of 50 beakers and 10 sets of samples. The second round of tests utilized the same materials in the same amounts and repeated the same processes, but the copper levels were assessed 24 hours after the addition of the treatments instead of immediately.</p> <p><b>Results</b> The results supported the hypothesis that addition of polyphosphate to first-draw tap water would increase the copper concentration. Additionally demonstrated was that poly-ortho blends and orthophosphate alone added to first-draw tap water decreased copper concentrations, though orthophosphate alone provided greatest immediate reduction.</p> <p><b>Conclusions/Discussion</b> Orthophosphates are effective in lowering copper release into water from uniform corrosion, with copper reacting to form low-solubility solids on interiors of pipes. Polyphosphates and poly-ortho blends are also used in treatment of copper corrosion in potable water systems, creating corrosion-control barriers on pipe walls. Polyphosphates first introduced into a water distribution system are in polymeric form and sequester copper. The compounds eventually break into orthophosphate ions, and then copper release is minimized. There is no way to predict when this reversion will occur. Until then, copper ions are sequestered in water and form a bond, so during this waiting period there are likely locations in the water system when customers consume higher metal concentrations.</p>	
<b>Summary Statement</b> The effects of polyphosphate, orthophosphate, and poly-ortho blends are studied to achieve balance between metal sequestration and minimization of copper release in first-draw tap water.	
<b>Help Received</b> Mother purchased materials; CSUB supplied phosphates; Mr. Mark Hartsock advised	