

## Alexandra Cheng's Individual Contribution Page

[Stock Tank Mixing and Pipeline Cooling Teams](#)

### Spring 2014 Contributions

Stock Tank Mixing goals this semester focused on re-designing the stock tank mixing system to achieve goal density efficiently. A plate mixer and water injection system were developed and were found to be highly effective in properly making and mixing stock solutions.

Pipeline Cooling goals included analyzing the heat transferred to influent water via raw water pipelines and researching possible solutions. Cool roof coating solutions were found to be effective but all products researched were very expensive. Further research is required to understand the impact of water temperature changes on sedimentation tank performance before investing capital in cool roof coating solutions. It is possible that redesign of the plate settlers will be required to rectify the impact of warm influent water circulation in the sedimentation tank.

### Fall 2013 Contributions

Team goals this semester included purchasing non-lab environment appropriate (e.g. not easily breakable) hydrometers or other suitable measurement tools for PACI and chlorine stock solutions, testing and confirming the PACI concentration-density relationship, and designing and fabricating a centrifugal pump to be used in the stock tank to ensure complete mixing of stock solutions.

#### Hydrometer

The \$74 Krackeler Scientific 1.000-1.220 polycarbonate hydrometer was deemed the most appropriate model for measuring typical AguaClara PACI solutions and three were purchased and sent to Honduras with the team in January 2014. Chlorine solutions pose a more complicated problem - the specific gravity range required is very small, and thus a hydrometer with a small range was required. Currently, no polycarbonate hydrometers with an appropriately small specific gravity range are commercially available. The \$33.50 Cole Parmer 1.000-1.050 glass hydrometer was purchased to determine if a hydrometer is an accurate enough tool for chlorine solutions, and further evaluation determining a field appropriate tool should be performed.

Utilizing PACI from Honduras, the team performed tests to determine the concentration-density relationship of PACI; this relationship is important in giving actual meaning behind SG readings from the purchased hydrometer. The relationship was found to be  $\text{Density.PACI} = 0.492 * \text{Concentration.PACI} + \text{Density.Water}$

#### Centrifugal Pump

Previous teams' pumps were scaled down to allow for design evaluation and adjustment. The test setup utilized a 1/2" PVC plate screwed to a base tee joint to secure the bottom of the pump, with a wood plank with three holes clamped to the test tank to secure the top of the pump. The two holes located on the ends of the plank provided a surface for clamping and the pump itself was stabilized by being threaded through the middle hole. The pump had a rotating arm located just below the water surface that was meant to bring dense solution from the bottom of the tank to the top via the pressure gradient created during rotation. Sugar solutions of various concentrations were dyed with Red Dye #40 and a stratified solution was created in the tank to allow visualization of fluid movement. Through numerous tests, it was determined that the current design has large inefficiencies resulting from the major loss of input power due to drag on the arm.