

# AguaClara Foam Filtration Challenges

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## Abstract

The Foam Filtration team is designing an emergency response water treatment system that utilized polyurethane foam as a filter medium. The goals for this semester are to add a chemical dose controller for coagulant and chlorine to the filtration system, develop an operator friendly method of determining when to clean the filters, communicate with Agua Para el Pueblo about the best method to deploy this technology, and prepare to take a complete unit to Honduras in January.

- Skills: Fluids, Plumbing Design, Fabrication

## 1 Introduction

The foam filtration system has great potential for emergency response systems and possibly for use at schools or community centers. Foam filtration has exceptional solids handling capabilities that make it possible to treat up to 1000 NTU water and produce safe drinking water in a single unit process. The multistage filtration system uses a foam roughing and finishing filter to clean turbid water. The system will be designed to function as a small scale water treatment facility; including its own input reservoir, linear flow orifice meter (LFOM), chemical dose controller (CDC), filtration system, and disinfection tank. The system will be small enough so that individual filter units can easily be carried by one person.

## 2 System Evaluation and Final Improvements for Deployment

Add the necessary chemical stock tanks and chemical dosers using the latest chemical doser technologies including the straight dosing tubes. As the chemical dosing systems are added evaluate the frame design and consider using a frame system that can be obtained in Honduras. Explore other options for reducing the materials needed to build the frame. Would it be possible to design a system that is self supporting with the filter columns holding up the chemical dosing systems?

Test the system for ease of use by watching as a new team member sets up the filtration system and filters a batch of water. Record all of the difficulties encountered. Develop a set of recommendations to make chemical dosing, operation, start up and shutdown, and cleaning as user friendly as possible and create a 1 page illustrated user guide. Repeat this test with a new operator to see what additional items surface.

Run daily tests with the most used foam to determine the foam failure mode. If a piece of foam seems to have deteriorated, subject it to a more vigorous cleaning (perhaps with vinegar to raise the solubility of the aluminum) and determine if the foam properties have actually deteriorated. Foam can be tested for changes in compressive strength by stacking a new foam and an old foam on top of each other and then compressing them both and observing which one compresses first.

Test the performance of the completed system and collect any additional data needed for publishing a paper on foam filtration. Use the system in the same way that you anticipate that it will be used in the field. Develop protocols to minimize spikes in filtered water turbidity after cleaning. Develop guidelines for setting the coagulant dose. Determine what the operator will use as feedback to determine whether the coagulant dose should be increased or decreased. It is possible that excessively high coagulant dose will result in rapid clogging of the roughing filter and that low dose will result in high effluent turbidity even when the head loss through the filter is low.

Discuss and create plans for deployment of the filtration system with the team in Honduras. Determine how the system might be used in that context and explore options for using the filter system on a permanent basis for a small community or school. Coordinate plans so that there is an opportunity during the January trip to demonstrate the filtration technology at a small community or school.

Research suppliers for reticulated foam in Honduras.

Pack a filter system for transport to Honduras in January.

### 3 Documentation

- Create a 1 page illustrated user guide in Spanish
- Write a good first draft of the foam filtration paper for publication in the Journal of Environmental Engineering as the end of the semester report. The paper can include data collected in previous semesters and can build on the paper that Michael Adelman is preparing for an American Water Works Association presentation.