

## Chemical Dose Controller

Location: AguaClara lab 2

### Major findings in summer 2013

- variability over time (likely due to changes in CHT) Perhaps the float valve wasn't functioning properly.
- The 1/16" diameter tubing worked well

### Goals

The chemical dose controller is being adopted in India and in Honduras. It is the most critical AguaClara technology because without it none of our other treatment processes would work. It is critical that the chemical dose controller be easy to install, setup, and use. The dose controller with the lever and slider meets those requirements. The entire chemical dosing system is NOT yet easy to setup and use. The goal is to take a systems perspective and evaluate all of the components of the chemical dosing system and develop a set of dosers that can be shipped where needed.

Maysoon Sharif, principal of AguaClara LLC, says, *"it would be a huge logistical relief if we had a ready to install dosing system. That is exactly what the folks here at UNICEF want to install across the villages here; something you can just send off in a box with clear instructions for a technician to (minimally) assemble on their own. Also, almost anything that isn't related to simple agricultural plumbing, you need to make a longish trip out to Kolkata to see if it can even be found in the first place. I like the idea of keeping the level arm separate and a single mount for the rest. It allows for more flexibility."*

The final products for this team should be

- clear design documents for all of the system components
- an array of chemical dosing components based on the required chemical flow rate
- a proof of concept supply of components for several dosers ready to be shipped to wherever they are needed.
- use no quick connects and no components with tiny pieces that can easily be lost
- make sure that all components are chlorine resistant
- Ideally a complete package should cost
- Develop a method to fabricate the complete packages (outsourcing of all or some of the components)
- **First priority is the system for chlorinators for villages by October 1 for shipment to India (likely half size single lever using 1/16" ID dosing tube)**

### Next steps

- build new horizontal axis CHT using a nalgene drinking bottle. Verify or assess the compatibility with chlorine (especially the cap). Use the mini float valves from Kerick Valve and use the standard float provided with the valve.
- Measure the change in water level in the CHT as a function of flow rate and verify that it is less than 0.5 cm.
- Design a simple height adjustment system for CHT (not using 80-20)
- Integrate calibration columns into the drop tube. Print transparent labels.

- Determine if the half size doser is appropriate for chlorine dosing and if so, design a single lever, half size doser system for village level chlorinators. If the half size doser is not appropriate, then design a single lever, full size doser. Design the single lever system to use the same lever as the double lever system.
- Modify the doser design to use a slightly thicker lever so that it is more rigid. This is especially important for the single lever system. The slider will need to be redesigned. It is possible that the fabricator can make this change easily.
- Design a better experimental test rig that keeps the dosing tubes straight and tight
- Demonstrate the ability to swap components quickly and easily to adjust flow rate and to calibrate the doser.
- Explore better (lighter, easier to ship, less expensive) options than PVC pipe for the float that moves the doser lever. The parameter that matters for the accuracy of the doser is the horizontal projected area of the float where it pierces the water surface. The volume and mass of the float are NOT important parameters except to ensure that the float is stable. The float could even have a density greater than water given that the other end of the lever has a counterweight. Options include buoys, flat 1-2 cm thick disk of non porous concrete, PVC disk (<http://www.mcmaster.com/#8745k487/=o1twlh>) or plate (<http://www.mcmaster.com/#8747k107/=o1txrv>). The PVC disk could be perfect if we can find an easy way to cut the 6" diameter PVC rod into approximately 2 cm long disks. The PVC plate could be perfect if the square fits in the entrance tanks and if the weight is sufficient to match the counterweight. It might be necessary to add a weight hanging on the bottom of the plate or hanging on the cable on top of the plate.
- Determine the flow range for the mini float valve and then design for higher flow rates using a larger float valve
- Locate tubing connectors that are chlorine resistant from constant head tank to rapid mix
- Figure out the flow break points in the design that result in selection of different tubing sizes or different number of tubes.
- Assemble and test all the components for chemical dosers of different flow rates
- Test units at stock concentrations used at AguaClara facilities.

#### **Doser Package contents**

1. Lever arm including slider, drop tube, counter weight, adjustable connector to float, and float
2. calibration columns
3. Piece of aluminum or other corrosion resistant material that provides a mount for the calibration column and CHT. This piece will then be attached to the plant and thus should have holes for mounting.
4. constant head tanks with adjustable height system and float valves
5. tubing assembly that has connection to stock tanks and then connects with valves to calibration column and CHT float valve
6. Tubing assembly that connects CHT to dosing tube inlet manifold (always have n+1 dosing tubes installed on the manifold where n is the number required)
7. dosing tubes and inlet and outlet manifolds

8. Tubing assembly that connects dosing tube outlet manifold to drop tube on lever arm