

Hysham Notes for 1/24/2023
Chemical Optimization and Chlorine System

- **Fixed the chlorine vent issue:** The chlorine odor was present again in the water plant. Last time we noticed it all day and my eyes were scratch into the evening. Grayson and Roy did a nice job capping the vent inside and re-configuring the outside vent. The smell was gone shortly after.
- **Inspect filter and bead chambers:** Not completed today. We did get a look at the matted material Bill and Roy have been removing from the bottom of the bead chamber. It was a rusty color and looks like loosely bound fine particles.
- **Measure filter media volume removed:** We removed 24 inches of media from the filter. There should have been 30 inches of media in the bed plus approximately 5 inches to cover the angle iron block retaining structure. The filter was missing about 11 inches of media.
- **What prevents bead backflow to intake line?** No screen. A check valve and butterfly valve. Check valves are prone to failure. The butterfly may not be adequate with the air system issues being experienced.
- **Air System Issues:** We experienced an event where a valve failed to open during a bead air agitation cycle and another valve failed to open on the air line to the filter media. Follow up showed very low air volume to the manifold on the north side of the filters and low air pressure of about 40 psig. Troubleshooting identified a restriction at the dryer on the north side of the building. We were forced to bypass the drier which resolved the situation. It is possible that some of the instrumentation issues may be related to low air pressure and volume. A drier is recommended. In the interim, we discussed blowing down several points in the air system every day.
- **Air Scour:** We observed an air scour and flush of the west filter system bead chamber. Air distribution looked good. A good amount of collected material was purged until water ran clear which also looked good. We talked with Bill about the volume of media in the bed. He filled it with 3.5 ft of beads using painters tape to identify the proper level.
- **Filter Backwash:** We observed a backwash. The air scour did not work well due to a valve malfunction. We allowed the filter to backwash with water backflow and returned it to service. The filter effluent turbidity was running in the 0.1 NTU range. Clearwell effluent turbidity was in the 0.87 range. Bill said this was better than in a while.
- **Check head loss instruments. Is there a feed pressure gauge?** There are gauges, but they are older and need replacing. The head loss instruments appear to be pressure switches with digital outputs. We will have to study them to understand set points and confirm proper function. We will also have to check if the signals show up in the PLC. Backwashes are performed on a timed cycle now.

- **KMnO4:** We installed a down-gauge and tested feed rates. The peristaltic pump was not pumping consistent with Bill's observation that the tank level had not been changing for a few days. We found the pump struggling to pump when we tested it in the sink with no backpressure, so we replaced the hose and confirmed good flows of 8 ml/min consistent with the pump nameplate. We tested in with clean water in the sink.

We still had trouble getting permanganate to pump, so we pulled the connection from the influent pipe and found it heavily plugged. We cleaned the parts and rodded out the connection until we had a strong flow of water. We were able to get a stable flow of permanganate to the water system at 7-8 ml/min with two 5-minute tests. We noted that the feed tubing was full of air which we don't understand, but we purged the air and the system seemed to be working normally.

Bill mixes 0.7 lbs of permanganate per inch in the tank. This equates to 0.10 lb/gal. Forsyth blends at 0.14 lb/gal. There was a note in the Hysham manual that they used to blend at the Forsyth rate.

The pump is rated at 3 GPD or 8 ml/min. The pump was left at full capacity (10-chart). It was set at 35% or 3.5-chart when we arrived. The dosage at 100% is only 0.1 ppm compared to 1.0 ppm typically used in Forsyth. We never observed any pink in the bead chamber. We agreed to monitor clearwell effluent turbidity through Thursday for evidence that more permanganate was helping.

Target permanganate rates for Hysham may be in the 1.7-4.2 ppm range compared to their max dosages rate of 0.1 ppm with the current pump. Permanganate dosage from the Iron and manganese Removal Handbook are 1.92 mg/mg Mn + 0.94 mg KMnO4/mg Fe. Using the manganese and iron rates measured on 1/12/2023 yields a target dosage of 1.7 ppm = $(0.832 \text{ mg Mn})(1.92 \text{ mg KMnO}_4/\text{mg Mn}) + (0.14 \text{ mg Fe})(0.94 \text{ mg KMnO}_4/\text{mg Fe})$. There was a note in the manual that the target permanganate dosage used to be 4.2 ppm. A pump capable of 350 ml/min (5.5 GPH) would be required to achieve a 4.2 ppm permanganate dose. Forsyth has a spare permanganate pump rated at 4.3 GPH and an older spare pump we refurbished capable of 1 GPH we could share. Forsyth is also looking at an older 20 GPH pump from Hysham that we might be able to repair.

- **ALUM:** The diaphragm pump has a nameplate capacity of 20 GPH and was set at 27.5% stroke rate and 28% stroke length. $20 \text{ GPH} \times 0.275 \times 0.28 = 1.54 \text{ GPH}$ or 97 ml/min. We installed a down-gauge and measured 22.4 ml/min during a 5 minute test. We don't understand why the pump is moving only about 25% of the expected rate. I have seen issues at very low stroke length settings, but 27.5% is a reasonable setting. It is possible that a check valve is not seating fully and needs to be cleaned.

Bill blends 20 kg (44 lbs) in 10 inches of water (75 gallons total). This equates to an alum rate of 1.7 ppm. A note in the manual indicates a target dose of 0.9 ppm (4 lbs dry in 0.547 MG). Joe Schmidt indicated 20-40 ppm alum is in the typical range. We didn't adjust alum because the filter effluent turbidity was reasonable at 0.1 NTU and we wanted to consider an alum move further.

- **Polymer:** The polymer pump has a rated capacity of 4.5 GPH and was set at 23% rate and 60% stroke for an expected flow of 39 ml/min. A 5-minute test confirmed a flow of 36 ml/min or 0.4 ppm. A note in the manual indicated the target polymer dose used to be 0.13 ppm. Joe Schmidt indicated a target dosage of <1.0 ppm. We didn't adjust polymer rate.

We may want to check the blend rate on the polymer. Bill is mixing 11 lbs of polymer in 26 inches of water. An older note in the manual indicated 2.5 lbs in 27 inches of water.

- **Measure filter and bead chamber dimensions:** Bead chamber is 53.25" long, 94" wide, and 90.25" deep to the top of the overflow trough. The height to the lower screen support is 67".

The filter chamber is 107.5" long, 94" wide.

- **Measure lower garnet bed depth (top of blocks to top of angle iron supports):** Still need to check. One drawing indicates 5.25", but we need to double check.
- **Inventory Garnet, Sand, and Anthracite:** We decided not to reuse the small amount of material in the walkway due to particle size concerns with a history of being walked on. Grayson and Roy removed most of the bags from the walkway.
- **Sketch with parts list for chlorine system repairs:** Took pictures. I will work on this.
- **Get started with moving turbidity meter:** Not started yet.
- **Daily Paper Work:** Bill and I compared the daily paperwork both sites complete.