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Date on Site: 7/21/22	Tank(s) Inspected: Secondary Tank #3

Observations/Findings

Brentwood's evaluation is general and does not portray every possible condition.

Scope: Purpose of visit was general tank inspection. Customer was looking for evaluation of existing equipment and replacement recommendations. These recommendations will also be representative of the other tanks onsite as they are all similar vintage and size.

Professional Summary:

On September 21st, Brentwood was on-site to inspect the secondary clarifier #3 to determine the wear on the chain and flight equipment. The tank contained a 3-shaft longitudinal collector measuring approx. 150'x20'x10.8' AWD. The installation is a Polychem system from approx. 2008. Overall, the installation is in good installation and shows normal levels of wear expected of a secondary clarifier. Due to decreased flow, the plant has had to operate on less clarifiers meaning several are empty at any given time. This has caused degradation in the FRP products from UV exposure. All equipment that is bolted into the wall is in good shape and does not need replacement which will save the plant a lot of money. That equipment includes head shaft spindles, stub shafts, return rail and return rail brackets.

After doing the in-tank inspection in #3, we walked and did a quick walkthrough inspection of rest of the clarifiers. Tank #4 had new flights in it that will not need replacement but has an older style 40T bull sprocket that will need replacement. Tank #10 will need new drive chain. Tanks #4 and #5 have new weirs that do not need replacement that are 18" wide. Lastly, tanks #1/2 and #7/8 have dual drives that are older than the rest of the tanks.

Observations and Findings:

First, we will go over the components that will be discussed in this report. The headshaft has three sprockets, two 23T 720 series sprockets and one 40T NH-78 bull sprocket. The 720 series refers to the NCS-720 collector chain that the flights are attached to in the tank and the NH-78 is the chain that is driven via the 11T sprocket connected to the drive and drives the headshaft. The other four 720 series sprockets are the 17T sprockets located at the lower front and rear idler positions.

Starting with 720 collector chain, the barrels have reached the thickness at which we recommend planning on replacing the chain at an average of 1.35" OD. This conclusion was reached by also examining the flight-to-flight distance which gives us the amount of wear on the ID of the barrel. A plumb bob was used to confirm that sprockets were in alignment. All 720 sprockets showed expected

wear and no abnormal wear from misalignment. Stub shaft bearings were inspected and do not need immediate replacement but will require replacement in the near future. It is our recommendation to replace all collector chain, 720 series sprockets, and stub shaft bearings at the same time.



Headshaft tubes showed extreme blooming due to UV exposure and need to be replaced. Polychem FRP headshafts have an UV inhibitor but constant UV exposure over many years will cause a shorter life span. Headshafts that are not constantly exposed to routinely have a 20-30+ year service life. Some plants that have tanks down for extended periods of time utilize pool covers over the headshaft as a permanent solution or simple tarps as a temporary solution. Based off our first inspection, we recommend replacing all 23T 720 series sprockets, only replacing the 40T sprockets that are an older style (Tank #4). The older style 40T sprockets utilized a stainless-steel key that is smaller than the modern nylon key to connect the sprocket to the headshaft. All headshaft tubes will require replacement. So far only Tank #10 was observed to need new NH-78 drive chain.

Headshaft Degradation/Blooming

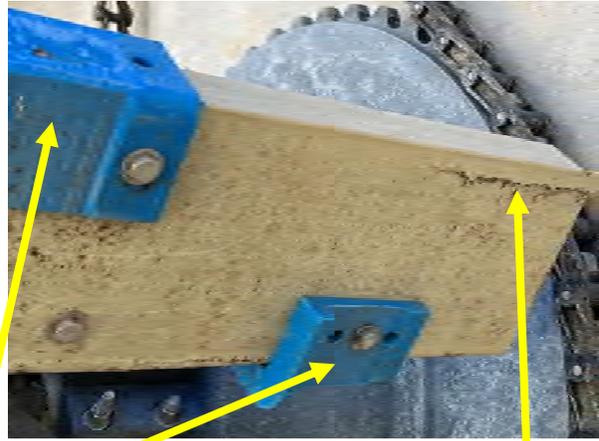


The flights in this tank have reached the end of their usable life. Along with wear from normal usage, flights in this tank showed blooming from UV exposure, cracking from contact with the old rusty T-rail and wear from contacting the bottom of the tank. From above deck it appears that all empty tanks have flights that are also showing blooming except number #4. Some wear shoes in #3 had been flipped so they have about 50% life left. The blue shoes present in the plant are NSF certified wear shoes designed for water treatment plants. Polychem now has black wear shoes specifically designed for wastewater plants that have a lubricant in them, increasing their lifespan. These black wear shoes also come at a cost savings since they do not have to go through the stringent NSF certification process. The wear strip in

the tank was 1/2" thick and while it has not worn to the point of replacement, it has dried up from UV exposure. This is visible from the cracking observed. It is recommended to replace flights, wear shoes, filler blocks and wear strip. Wear shoes could be reused but it would be a much more labor-intensive process. Typically, flights are assembled above deck with wear shoes, filler blocks, and attachment links and lowered into the tank to make the installation proceed quickly and smoothly. If reusing items, it is crucial to communicate with contractors/maintenance staff which items are being reused so they are not thrown away increasing the timeline until the tanks are back in service.



Cracked and Warped Wear Strip



Worn Wear Shoes

Cracked and Blooming Flight

The drive and gear box on this tank was a newer style dual drive equipped with torque limiters. Drives, torque limiters and drive chain are newer and do not require replacement in this tank. There were two drives noted that did not match the newer dual drives. They were on tanks #1/2 and #7/8. It was unclear while onsite if they were old spare stock or not. Those drives were in okay condition and do not need immediate replacement.



Older Dual Drive

Notes:

1. Sprocket Motion Monitoring (SMM) is recommended to help guard against in-tank failures. Whereas the shear-pin mechanism helps prevent excessive loads from damaging the above deck components SMM monitors the in-tank mechanisms, specifically sprocket rotation/chain travel. If one side or the other of a mechanisms chain stops the non-contact sensors send an alert to a deck level box. This can be configured to have stand-alone functionality or dry contacts for the plants SCADA. Each NEMA box can handle up to 6 mechanisms. Depending on the plant's requirements or level of customization budgetary costing can be provided.
2. Brentwood can provide yearly inspection contracts to provide onsite technical assistance during scheduled Periodic Maintenance (PM). The technician will work in conjunction with maintenance personnel to inspect and adjust equipment in line with manufacturers recommendations. As required, technician will provide updated product information and training of new employees. Incorporating these contracts into yearly budgets and renewal annually makes PM a simple but important aspect of plant performance. Brentwood can provide a quote for this option if desired.
3. Brentwood can provide manufacturers training on Periodic Maintenance procedures, product familiarization, and new product updates. This training is recommended every other year to keep technicians up to date and new technicians trained to insure product longevity.

Questions regarding this report should be directed to Drew Hess at Drew.Hess@brentwoodindustries.com or 610-347-9017

Regards,
Drew Hess