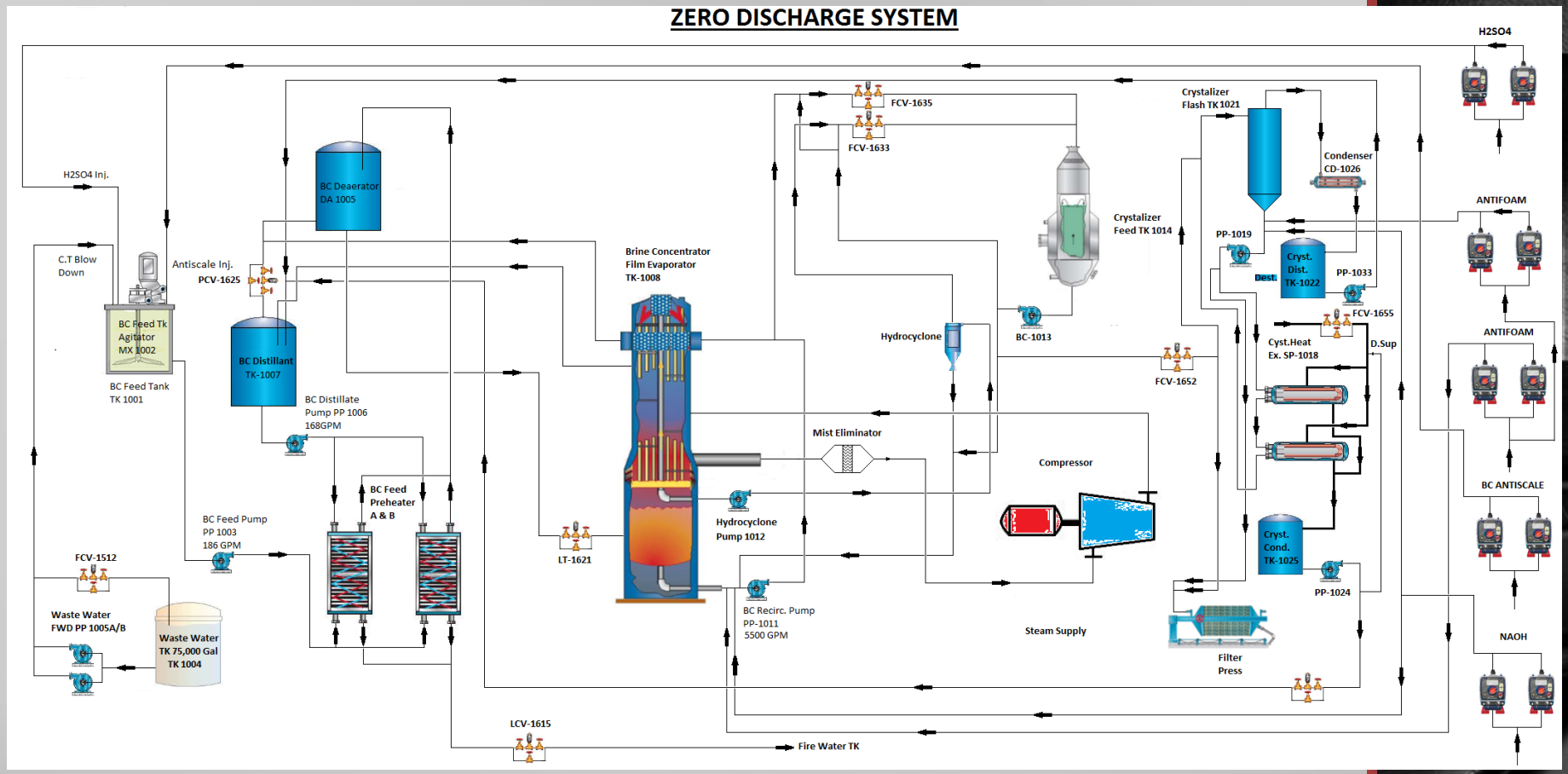
ZLD Outage Report April 2015



Day ONE (04/25/2015)

- Disassembled C. Tower blow down elbow to pump down basin into waste water tank.
- LOTO Crystallizer.
- Fittings for RO's lay up had been made.

Day two (04/26/2015)

- Maintenance modified connection with isolation valve was added.
- Inspected F. Press 3 way valve. Remove stationary belts, stationary belt and grating . Ready for inspection.
- Removed hydro cyclone (ceramic cone broke).
- Removed "new" antifoam injection coil.
- BC drains unplugged, ready for tomorrow cool down/drain. Stage needed hoses for this job.
- Sample room new cabinet assembled.

Hydro cyclone ceramic piece broke

Day three (04/27/2015)

- 0645: started BC draining.
- 1430: BC is completely drained. All doors are open and recirc. pump spool piece has been removed. Cooling down for distribution plate to be removed.
- Crystallizer feed tank door opened and elbow removed.
- Blank installed on ZDS supply steam from boiler.
- Drain lines from F Press disconnected .
- FCHE elbow removed.
- LOTO on BC. System ready for starting hydro-blast tomorrow.

Door at mist eliminator

Distribution plate

Bottom of BC tube sheet

BC sump

Day four (04/28/2015)

- Opened VC suction inspection door and wash out ports.
- Opened BC distribution header flange.
- 0800 : Veolia on site. Prep for BC hydro-blast in progress.
- 1015 : Veolia started hydro-blast BC distribution header, then they will move to tube sheet.
- 1130 : Inspected distribution header , not good enough. They will re-visit.
- 1310 : Veolia starting on BC tube sheet.
- Filter press under dome drain line leak has been repaired.
- Broken weld on F. Press, structure under the dome.

F. Press weld failure

Distribution header

Hard at work WTO's repairing F. P leak

Day five (04/29/2015)

- BC hydro-blast completed at 2300.
- Veolia hydro-blast ZLD lines and FHE (17 tubes were plug).
- Veolia finished hydro-blasting at 1700.
- A lot of build up on Crystallizer flash tank.
- New spool piece at VC have been installed.
- New check valves have been installed on RO caustic lines.
- Pre-heater HTR-1004 A has been opened and inspected. No build up.

BC tube sheet after hydro-blast

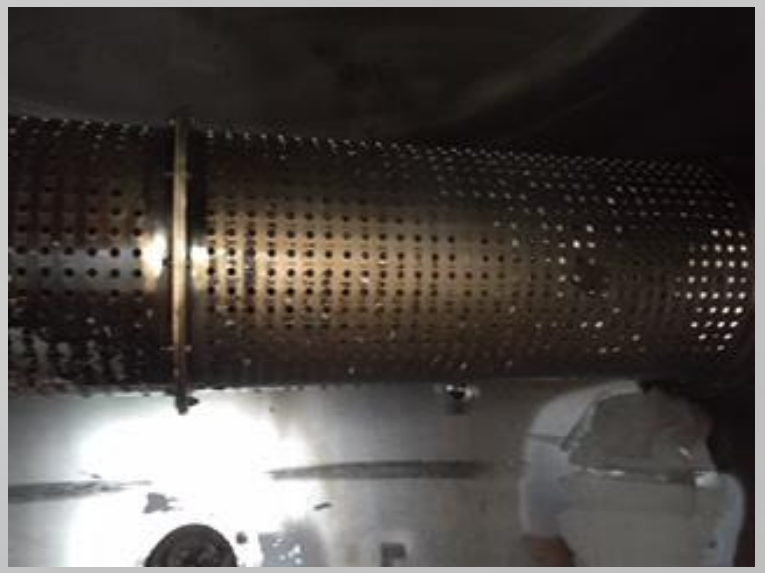
Crystallizer solids build up

Crystallizer missing rubber liner

Day six (04/30/2015)

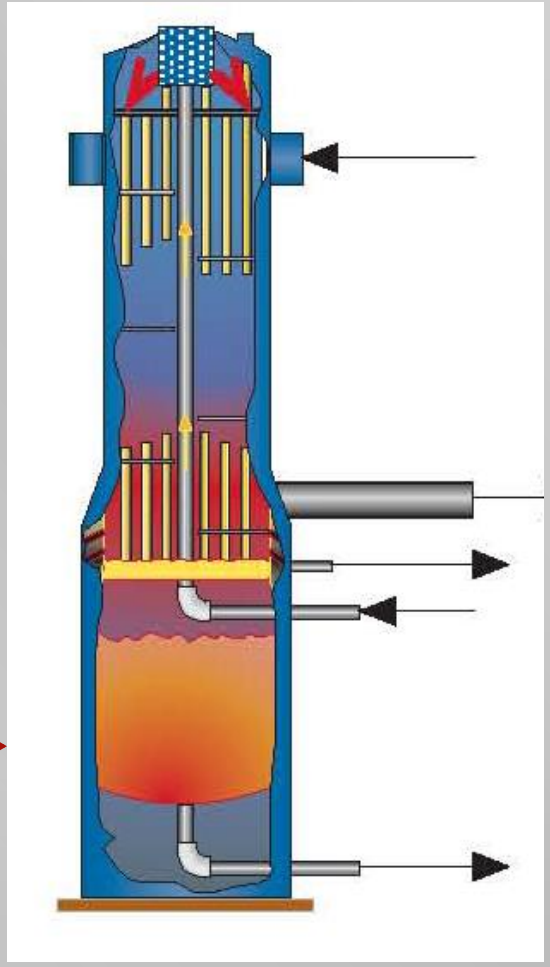
- Distribution header holes all open.
- BC closed up ready for chemical cleaning tomorrow.
- Crystallizer feed tank done.
- Filter press drain lines done.
- Pressurized pre-heater HTR-1004 A, distillate side ok, minor leak on feed side
- .

Distribution header after all holes manually opened



Day seven (05/01/2015)

- Veolia on site to start chemical cleaning.
- Veolia waiting on a new boiler blower motor.
- Veolia add 500 gal of EDTA 38% sol.
- Heating with recirc. pump, waiting on new motor blower.
- Recirc. temp. at 125 °F .



Day eight (05/02/2015)

- BC chemical cleaning started @ 2330 on 5/1 , EDTA residual 10 ppm.
- Veolia on site (0900) to sample BC. ; EDTA residual 6.6 ppm.
- Will let chemical circulate for another 24 hrs.
- Checked EDTA residual (1600) , 6.6 ppm

Water techs hard at work

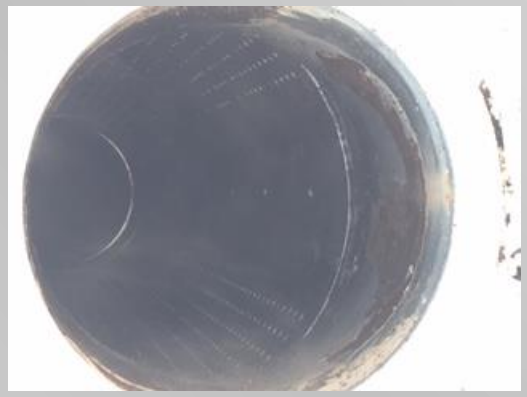
Day nine (05/03/2015)

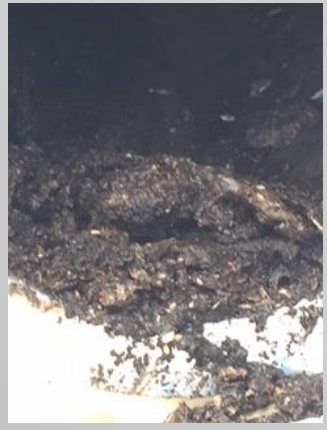
- Chemical clean will be done @ 2330 (minimum of 48 hrs circulating/contact time is needed).
- Instead of using frack tank as EDTA storage disposal ; started drain BC chemical solution to ZLD vault.

Day ten (5/04/2015)

- Veolia is done with BC chemical cleaning. Inspection completed; looks good.
- Vapor compressor impeller cleaned .
- Impeller wash nozzle installed.
- Crystallizer rubber liner repair started.. Cure time estimated to be 24 hrs.

BC distribution header after chemical cleaning



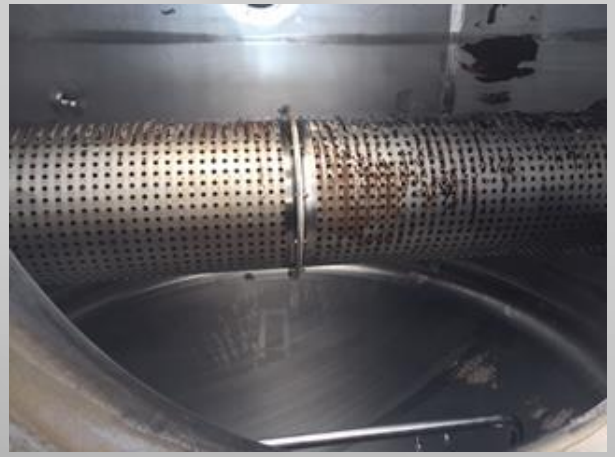


VC new wash nozzle installed and the proud installer

Day eleven (5/05/2015)

- BC seeding completed. Will recirculate until temp reaches 180 °F then the 20 hrs cure time will begin. After that that the evaporator is fully operationally.
- Crystallizer repair failed. Contractor will re-line .

BC distribution header and plates after chemical cleaning . Looking good , right Marcus?



Day eleven (5/06/2015)

- BC TS @ 3% wt achieved.
- Crystallizer re-lining completed successfully.
- Crystallizer condenser failed, tube leaks.

Tube sheet face plate; cooling water side

Condenser tube leaks.

Notes:

- OCTOBER 2014 OTAGE

- Cooling and diluting system down: 8hrs.
- Volume needed for this procedure : 20,000 gal.
- Hydro blasting completed in : 36 hrs.
- Waste generated from hydro blasting : 85,000 gal.
- Chemical cleaning completed : 50 hrs.
- Chemical used :495 gal of EDTA , 38 % .
- Waste generated by chemical cleaning : 7,000 gal.
- BC "seeding" completed in : 8 hrs.
- Terra alba used : 3,500 lbs.
- Terra alba expected to be used: 2950 lbs.
- Seed activation time: 20 hrs after temperature reaches 180 °F.
- Time needed to reach 180 °F with recirculation pump: 18hrs.
- Total "seeding" time : 38 hrs.

- APRIL 2015 OUTAGE

- Cooling and diluting system down: 6hrs.
- Volume needed for this procedure : 20,000 gal.
- Hydro blasting completed in : 16 hrs.
- Waste generated from hydro blasting : 38,000 gal.
- Chemical cleaning completed : 48 hrs.
- Chemical used :495 gal of EDTA , 38 % .
- Waste generated by chemical cleaning : 7,000 gal
- BC "seeding" completed in : 8 hrs.
- Terra alba used : 3,500 lbs.
- Seed activation time: 20 hrs after temperature reaches 180 °F.
- Time needed to reach 180 °F with recirculation pump: 18hrs.
- Total "seeding" time : 38 hrs.

BC Start up data (December 2013)

BC 1st shut down (October 2014)

BC 2nd shut down (April 2015)

BC start up after 1st outage

BC start up after 2nd outage

Lessons learned

- Starting with an empty vault will avoid the cost of the frack tank rental.
- Will also save the cost of hauling the chemical solution (7000 gal aprox.) off site plus the cost of lab analysis verifying it is not a hazardous chemical.
- I'm confident that the water department can perform the BC chemical cleaning. This way we will save all the labor involved in the cleaning, reducing our cost to only the price of the chemical.
- The cost of the rented boiler can also be avoided if in between the mechanical cleaning and the chemical cleaning we have 48hrs to bring BC chemical solution up to "seed activation" temperature of 180°F.
- After the temperature reaches 180°F additional 4-5 days is needed before BC is ready to process waste water.