1. EXECUTIVE SUMMARY

A CIP mapping session was performed on Circuit 16 - Main Unit, to assist the site in their quest to reduce time, water, and chemistry during the C&S process.

Much work has been accomplished since Ecolab last audited this circuit on March 2018. The combination of 3DTrasar insights and local efforts have improved the efficacy and efficiency of the CIP system. Further leveraging 3DTrasar data in conjunction with this November 2021 audit, the following recommendations could yield significant time and water savings, leading to even greater efficiency:

Parameter	Savings	Savings by %	Est. Value
Water	1,475,000 gal	33%	$44,270
Time	377 hours	35%	$6,642
Neutralization	Unknown (above water is sent through Neutralization system)		

2. OBSERVATIONS

1. The CIP freshwater tank ran empty at least 5 times during one CIP program cycle.
2. The CIP supply pump significantly overshoots the target during each pump start. Target is 100gpm, whereas pump speeds reached up to 300gpm and took approximately one full minute to stabilize (figure 1)
3. The freshwater tank was nearly emptied during the pump start-up instability, and struggled to recover during single pass rinses
4. The freshwater tank refill rate was variable, dependent on plant water draw (measured at 112gpm, 87.5gpm, 5.83gpm during this test)
5. The freshwater tank "high water level" was 8 inches below overflow.
6. The Circuit 16 volume was calculated using return pH and Conductivity meter during the caustic wash at 135gal
7. The air blow after each cycle step caused the CIP supply pump to become air bound, requiring manual prime or "burp" by the CIP Tech
8. The acid wash temperature had setpoint of 80F, drawing undesired steam during the acid wash step.
9. Caustic concentration titration was hard to achieve given sample color (figure 2).
   - Caustic Concentration measured 3 times: 2.4, 2.2, 2.2; target = 2.5 % v/v
   - Acid wash concentration measured 2 times: 2.12, 2.12; target = 2.0 % v/v
   - Sanitizer concentration measured 2 times: 1,782, 1,184; target = 1,900 – 2,500 ppm

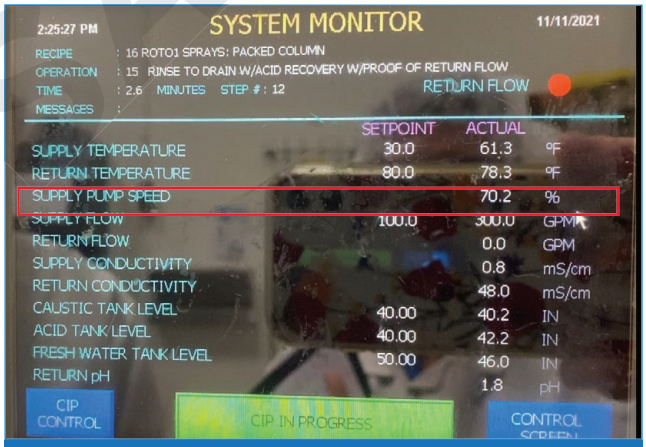

Figure 1.

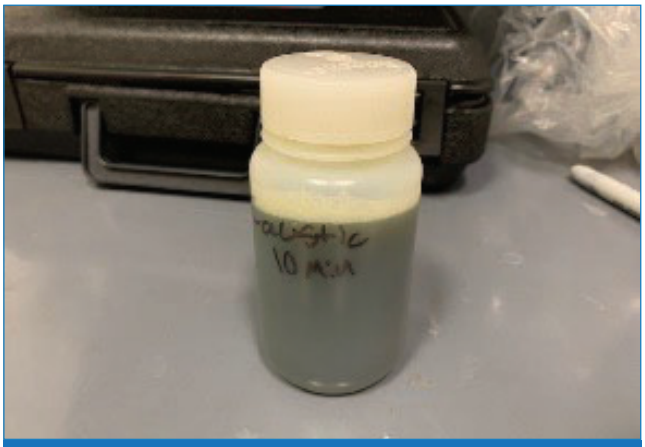

Figure 2.

3. RECOMMENDATIONS

1. Maximize the available freshwater volume in the tank by increasing the fill level and high-level alarm.
   - Adjusted to 50" during visit. We could not adjust higher due to high-level alarm.
2. Increase freshwater tank high level alarm to match overflow: Recommend 54"
3. Adjust Fill level to 51" (adjusted to 50" during visit - max allowable due to high-level alarm)
4. Adjust freshwater fill programming to refill freshwater tank during adjacent steps
5. Adjust CIP supply pump start up to prevent setpoint overshoot

4. CONCLUSION

CIP recipe #16 was executed effectively per the CIP skid and programming. There were a few modifications noted that will significantly improve efficiency of the cycles, reducing time and water required for the circuit. These savings extrapolated over all cycles can have a significant impact on water usage and plant capacity.

Specifically, the following corrections should be prioritized:

- Reduce rinse times following caustic wash and acid wash based on 3DTasar and CIP data
- Note, annualized estimated savings of 1.475 million gallons of water and 377 CIP skid hours per year do not include anticipated savings due to reduced freshwater tank refills and reduced neutralization volume associated with the savings.
- Improve supply pump controller PID programming to ramp up rate more gradually.
- Adjust Freshwater Tank fill setpoint to maximize tank volume
- Add "fill freshwater tank" to any "prep for" or "air blow" step so that freshwater tank is full and ready when rinse cycle starts.
- Inspect air blow ball check valve operation – ball presence and condition

One particularly exciting outcome of this event was the ability to pair 3DTrasar data with CIP mapping, and physically confirm observations from 3DTrasar. Specifically, the recommendations to reduce rinse times and to correct cycle temperatures were the result of this collaboration of tools.

We appreciate the opportunity to be of value to your site. Your CIP system has beautiful capabilities, with many opportunities for continued process improvement. We look forward to the journey and to being a part of your implementation strategy.

Figure 3. Ball Check Valve 1

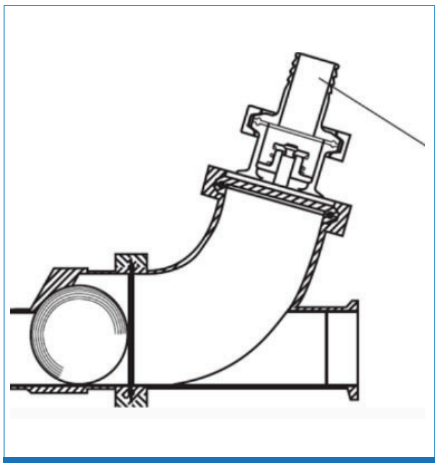

Figure 4. Ball Check Valve 1

5. PARTICIPANT CONTACT INFORMATION

ECOLAB LIFE SCIENCES

Xxxx

Xxxx
Xxxx
Xxxx
Xxxx

M xxx.xxx@ecolab.com

ECOLAB LIFE SCIENCES

Xxxx

Xxxx
Xxxx
Xxxx
Xxxx

M xxx.xxx@ecolab.com