

Log Book  
Campaign 03

**2014-08-10** Prep Work Day (Sunday SIP and Prop 2s)

- 11:30 Shutting things down to install new breakers in MCC Panel A
- 12:16 New breaker installed. Switching system back on.  
Make sure steam pressure regulators for Propagator Jackets are for 15 psi steam.
- 12:42 Waste Water Pump ON. Level~77.6%; pH~7.80; Cond~820  $\mu$ S/cm  
Still having issues with WW clogging.  
Make sure Propagator spargers are CLOSED before SIP.
- 13:03 Began putting steam into the jacket of Propagator 2B.
- 13:07 Prop 2B into Auto SIP mode  
Began adding steam into the vessel
- 13:12 Resetting some tripped devices  
Prop 2B at 5 psi  
Turned on Vacuum Pump
- 13:13 Hit 10psi in Prop 2B. VacPump OFF; Steam ON
- 13:20 CO<sub>2</sub> Scrubber levels going everywhere, but mostly UP.  
CO<sub>2</sub> Scrubber Pump turned ON
- 13:42 Reached 250.0°F in Prop 2B. Began 1 hour SIP wait for that tank.  
Had to turn ON CO<sub>2</sub> Scrubber Pump again.
- 13:49 Drain for 2B accidentally opened (Correction was opening steam to sterilize transfer lines). Lost  
Temp and Pressure in Prop 2B  
Will have to restart SIP for the tank.
- 13:52 Reached 250.0°F in Prop 2B.  
Began 1 hour SIP wait for that tank.
- 14:00 CO<sub>2</sub> Scrubber Pump turned ON
- 14:05 CO<sub>2</sub> Scrubber Pump turned OFF  
Turned off Cooling Water Supply to VacPump  
Level in CO<sub>2</sub> Scrubber going down now
- 14:53 Finished SIP wait for Prop 2B
- 14:58 Turned Temp Control to "Normal" and set it into Auto
- 15:04 Having WW flowrate issues again.
- 15:05 Getting weird level readings in Prop 2B (~66%)  
False readings
- 15:31 Began adding steam to Prop 2A
- 15:40 Cooling Water to VacPump ON
- 15:41 Reached 5psi in Prop 2A; VacPump ON
- 15:42 VacPump OFF; 2A at -10psi and steam to 2A ON
- 15:50 Opened up 2A transfer lines to steam
- 15:57 Cooling Water to VacPump OFF  
DID notice an increase in the level of CO<sub>2</sub> Scrubber while CW was on.
- 16:05 Reached 250.0°F in Prop 2A.  
Began 1 hour SIP wait  
Set watch timer to let Paul know for 30 min so he can sterilize inoculation port.
- 16:55 Prop 2B pH probe calibrated
- 17:05 Finished SIP wait for Prop 2A. Turned OFF steam to 2A.
- 17:08 2A Temp Control into "Normal" mode, set to Auto.

17:56 Based off of Marco's titration, the Phosphoric Acid readings follow:  
 Mix Tank Conductivity: 22.5 mS/cm (23.8 HMI); Concentration: 5.5 (w/w)  
 Hold Tank Conductivity: 23.0 mS/cm (24.9 HMI); Concentration: 5.5 (w/w)

18:40 Prop 2A and 2B need 0.05 ft<sup>3</sup>/min for tank spargers.

18:52 Began adding UV Water to Prop 2B. (Target~29% level)

19:04 Finished adding UV Water to Prop 2B. (Result level~29.5%)

19:05 Began adding UV Water to Prop 2A. (Target~14.0% level)

19:07 Finished adding UV Water to Prop 2A. (Result level~20.3%)

19:16 Began draining Prop 2A through sterile line slightly  
 Down to 16.8%

19:20 Down to 13.5%

19:21 Added enough UV Water to Prop 2A; Level at 14.2%  
 Just barely covers pH probe in side glass

19:39 Putting UV Water into C5 Tank and lines for rinsing out  
 Done by 19:43

19:53 Began adding Hydrolyzate to Prop 2A (Target~33% level)

19:59 Finished main addition of Hz to 2A. Lots of foam  
 Level ~31%  
 Will need to add Anti-foam  
 WHITE ANTIFOAM, 100mL in 1L with H<sub>2</sub>O from drum in the plant [Joe]

20:28 Pulsing Hz into 2A (final level~32.9%)

20:35 Began adding Hz to Prop 2B (Target ~44.5% level)

20:39 Brief pause. Having issues with level in 2B

20:41 Will have to add Antifoam to Prop 2B  
 Clear Antifoam from Lab ('204' 5 mL in 1L UV Water) [Joe]  
 In the future, make sure Agitators are OFF before adding Hydrolyzate

20:56 Resumed adding Hydrolyzate to Prop 2B

21:00 Paused again to reassess Prop 2B

21:02 Resumed add to Prop 2B

21:09 2A pH=3.43; Base B Pump#4 ON at 50%  
 2B pH=3.26

21:21 2A pH=8.08 [Joe]

21:33 pH increases for Prop 2B taking much longer [Joe]

21:40 Turned C5 Pump back ON so solids would not settle. [Joe]

21:47 2B pH=8.05 [Joe]

#### **2014-08-11 IT BEGINS (Monday Madness)**

08:25 Began heating up CIP tanks for doing CIP on pH Adjustment tank  
 Weights trumps all when mixing acid solution when in doubt

10:07 Began adding Process Water to Phosphoric Acid Mix Tank  
 Start Cond=23.7 mS/cm; Start Weight 4780 lbs; Target Cond=21.8 mS/cm  
 Flowrate between 4.5 GPM and 4.8 GPM

10:10 Flowrate stable at 4.8 GPM

10:12 Began adding steam into Prop 3B

10:18 Cooling Water Supply to VacPump ON

10:19 Finished adding Process Water to PA Mix Tank.  
 Cond~21.8 mS/cm; Weight=5351 lbs; Level~71.0%

10:21 Reached 5 psi in Prop 3B; Steam to vessel OFF

10:24 VacPump ON for Prop 3B

10:30 Hit 10 psi in Prop 3B. Steam to 3B ON; VacPump OFF  
Cooling Water to VacPump OFF

10:48 Reached 250.0°F in Prop 3B. Began 1 hour SIP wait.

10:56 Having to manually adjust steam valve for Prop 3B  
Pressure was getting around 24 psi

11:02 3B SIP Temp Control→Auto (pressure~22 psi)  
At some point, need to make changes to Phosphoric Acid SOP sheet to reflect how things are done more accurately.

11:19 3B's SIP Temp Control in MAN@5.01% to maintain steam flow into Prop 3B and prevent temp going below 250.0°F before done.

11:40 3B SIP Temp Control→Auto

11:49 Finished 1 hour SIP wait for Prop 3B. Steam to 3B OFF

11:56 3B Temp Control to "Normal" and set into Auto

13:08 Adding Trace Metals and Magnesium Sulfate to Prop 2A

13:12 Inoculating Prop 2A and 2B soon.

13:17 Glucose added to Prop 2A

13:32 Inoculating Propagator 2A; Currently:  
Level=34.1%; pH=6.86; Temp=100.2°F; Pressure=2.62 psi

14:02 Adding nutrients and glucose to Propagator 2B

14:10 Inoculating Propagator 2B; Currently:  
Level=45.1%; pH=6.97; Temp=99.6°F; Pressure=2.21 psi

14:15 Finished Inoculating Prop 2B

14:50 LATE t=0hr samples from Props 2A and 2B  
2A: (L) 33.0%; (pH) 6.91; (Temp) 98.1°F; (P) 2.68 psi  
2B: (L) 45.7%; (pH) 6.93; (Temp) 99.6°F; (P) 2.17 psi

15:37 Began transferring contents of C5 Tank into a drum so it can be empty and cleaned out.  
In the future for samples, get sparger airflow rates

15:53 Prop 2A and 2B spargers at 0.05 ACFM (Actual Cubic Feet per Minute)  
There might be a reason why Metso ran so poorly on 8/6/14.  
We only ran out the PSF and PSBTC for ten minutes on 8/5/14 and barely eight on 8/4/14.  
Possibly too many residuals?  
Will be testing this tomorrow, I guess [Chris]

18:00 Noticed decrease in the level of Prop 2B  
Apparently, there were no issues.

18:53 pH probe calibrated and in Prop 3B

19:20 Began adding UV Water into Prop 3B (Target~26.4%)  
UV Water pretty warm/hot. Maybe we need a heat exchanger for UV Water?

19:28 Finished adding UV Water to Prop 3B (Current Level~28.2%)  
Began draining 3B to get level down

19:33 Paused draining of 3B (Current Level~26.7%)  
Decided to stop here. Approximately 3 more gallons than planned.

19:36 Began adding Hydrolyzate to Prop 3B using C5 Pump (start pH=8.18)  
Pump started at 50% for seven seconds, then to 80%  
Target level~ 37.7%

19:44 Having some issues with Prop 3B level sensor.  
Lots of foam going on.  
Going to add Antifoam through Nutrient Line

20:01 Mixing 50mL of Antifoam with 1.5 gal of UV Water

*Shift Change*

20:13 Adding Antifoam to 3B via PT 3203

20:22 Agitation ON to 3B

20:44 Adding Hydrolyzate to 3B, Target 37.7%

Starting Level 26.5

21:28 Stopped H<sub>2</sub> addition to 3B, 37.7%

21:30 Started conditioning of 3B to 8pH

21:41 Base Pump#8 OFF, 3B at 8.04 pH

21:50 C5 Line to 3B backflushed; C5 Tank Rinsed

21:35 Starting CIP of pH Adj, level all over

Also, fluctuations in 2B level. Level checked and OK

23:10 Acid Samples Taken

Hold Tank 16.8% Level and Cond=24.8 mS/cm

Mix Tank 70.7% Level and Cond=21.7 mS/cm

23:27 Starting SIP of Liq. Tank

23:53 Coupling BAD on Caustic Pump. Shut it down.

**2014-08-12 Metso Start Up**

00:07 Trying to get 2A and 2B into Auto pH control.

Having to work to remember

00:35 Liq @ 250°F, holding

01:32 2B pH control working, having to do 2A manually

I'm probably missing something [Jeff]

01:38 12hr sample from 2A

Level=34.0%; Pressure=2.25 psi; Air Flow=0.052 ft<sup>3</sup>/min

pH=6.32; Temp=97.7°F

01:50 SIP complete on Liq

01:56 All of a sudden pH control on 2A working OK, not quite as 'tuned' as 2B

02:13 12hr sample from 2B

Level=45.17%; Pressure=2.17 psi; Air Flow=0.050 ft<sup>3</sup>/min

pH=6.28; Temp=99.6°F

02:20 Put Both 2A&B pH controls to 6.35 to keep it around 6.3

03:16 Temp Control ON to Liq

03:48 Acid Samples analyzed

Hold Tank Concentration=3.1%; Cond=24.8 mS/cm in HMI

Mix Tank Concentration=2.8%; Cond=21.7 mS/cm in HMI

04:53 Sending WW. pH=9.85; Cond=56.1 mS/cm; Level=83.1%

Erratic flow at first. Now~ 29-30 GPM

05:45 Liq/pH Adj Levels going Crazy

06:15 Finally done with pH Adj tank CIP

06:30 Starting SIP of pH A

07:15 Power Outage, long enough to shut down pumps

07:20 pH A @ 250°F.

WW FLEW at 37 GPM after outage

*Shift Change*

08:12 WW flowrate STILL 36+ GPM at 16% level

08:20 Finished 1 hour SIP Wait on pH Adj Tank

08:23 Will allow pH Afj Tank to cool down normally  
 08:29 WW Pump OFF; level at 10%  
 08:47 Turned ON Process Water to CO<sub>2</sub> Scrubber @ 1.25 GPM  
 08:54 Doing Override checks for Metso. C5 Agitator and Pump Overrides ON  
 08:58 HP Seal Water Pump ON  
 09:00 Starting Metso UP  
 09:05 CO<sub>2</sub> Scrubber Pump and Fan OFF. Hearing weird sounds.  
 09:08 CO<sub>2</sub> Scrubber Pump and Fan ON  
 09:10 Continuing Metso Start up  
 09:11 Steam to Metso ON  
 09:19 Starting up CV#2 @ 10%  
 09:25 Metso T-pipe vent CLOSED  
 09:27 CV#1 ON at 10%, just to check on safe side  
 09:33 CV#1&2 OFF  
 09:34 CV#2 ON @ 10%  
 09:35 Other vents for Metso CLOSED, except yellow cracked ¼  
 09:37 CV#2 OFF  
 09:38 CV#1&2 ON @ 100%; Feed Bin Conveyor ON  
 09:48 PSF & PSB TC ON (PSF @ 100%) @ 52.3 psi  
 09:54 FB Livebottoms ON in CAS  
 10:07 Began feeding Biomass to Metso (@100 psi)  
 Just realized that Base B set points get wiped after/as a result of power outages  
 Prop 2A pH~6.44, so it's on its way to being gone (no base added since power outage at 07:15).  
 10:13 PSF→115%, large spikes in PSB TC  
 10:14 FBLBs in MAN@50%; PSB level @81.5%  
 10:16 PSF→100%; Not really building up any additional pressure in Metso  
 10:17 PSF→105%; FBLBs→CAS  
 10:19 FBLBs OFF; High Urgency mode for inoculating 3B.  
 Acid Line to Metso LEAK; PA Meter Pump #2 OFF  
 10:27 PSF→102%  
 10:34 PA Metering Pump ON  
 10:38 ~~Still not seeing any acid flow.~~ Now, I AM seeing Acid Flow.  
 10:39 FBLBs ON→CAS  
 10:44 PSF→98%  
 10:45 t=21hr Sample taken from Prop 2B for Early Inoc. Of 3B.  
 (L) 43.2%; (pH) 6.31; (Temp) 99.6°F; (P) 1.99 psi  
 10:48 PSF→102%  
 10:49 PSF→110%  
 10:50 PSF→115%  
 10:59 PSF→112%  
 Metso Steam Valve Sweet Zone between 80% and 85% Open during normal operations  
 Normal Metso Boiler Pressure~225 psi  
 Screw Press Target Start~3.1RPMs  
 11:09 Need to keep an eye on PA Hold Tank's level  
 Probably need to transfer from Mix Tank within 1-2 hours  
 11:11 Trace Metals/MgSO<sub>4</sub> Pump#2 ON @ 75%  
 11:14 Ethanol Numbers for Prop 2B is 6.4 g/L  
 TMMS Pump@90%

11:16 pH Control in Prop 2A OFF (pH~6.78)  
11:27 About to inoculate Prop 3B with Prop 2B  
Prop 3B initial Temp~98.4°F; pH~7.09  
11:34 Began draining 2B to inoculate Prop 3B  
2B pH Control OFF  
11:39 Prop 2B now empty. Completed Transfer Prop 3B  
11:40 Turned on steam to Prop 3B's Sample Port  
Current Level~42%  
11:45 PSF→110%  
11:48 Began bringing CIP tanks up to Temp.  
11:50 PSF→108%  
11:51 t=0-hour Sample Taken (Not all glucose added yet though)  
Flowrate=0.50AFC/M  
(L) 41.9%; (pH) 6.94; (Temp) 98.9°F; (P) 0.86 psi  
11:53 PSF→104%  
11:55 PSF→100%  
11:59 PSF→97%  
12:15 PSF→92%  
12:25 PSF→90%; Paul going up to close yellow vent valve.  
12:27 At Temp & Pressure in Metso!  
Temp=185°C~365°F; Press~150 psi (MAN)  
FBLBs=54%(CAS); PSF=90%(MAN)  
CV#1&2=100%(MAN); Acid~6.67 GPM (CAS)  
Screw Press=5.0 RPMs; PreSteamBin=72%(A) & 110°F (A)  
12:29 Manually stepping down Metso Steam Valve  
Down to 84% in four 4% and then two 2% increments  
12:32 Metso Steam Valve back in Auto  
12:56 Base B Pump#5 (to Prop 3B) set @10% (still off though)  
13:29 Resolved some of the issues with TMMS Pump #2, but one pump port still not getting anything  
into 3B  
13:31 Will be taking t=24hr sample from Prop 2A soon.  
13:43 Screw Press→3.0 RPMs  
13:45 t=24hr Sample of Prop 2A  
Airflow=0.05AFC/M  
(L) 27.8%; (pH) 7.08; (Temp) 99.1°F; (P) 1.27 psi  
14:04 Began transferring solution from PA Mix Tank to Phosphoric Acid Hold Tank  
Mix Tank (L)70.7%; (C) 21.6 mS/cm  
Hold Tank (L)12.9%; (C) 24.7 mS/cm  
14:12 TMMS Pump#2 OFF  
14:15 Raised Temp Control Setpoint in Prop 2A to 140°F  
1 hour after hitting Temp point, take 1<sup>st</sup> kill sample  
For next four hours, take 1 (one) sample per hour  
14:20 PSF→80%  
14:23 PSF→85%  
14:24 PSF→88%; Prop 3B's pH=6.66. Moving right on in stride  
14:31 PSF→90%; Reached 140.0°F in Prop 2A. Started 1 hour timer  
14:33 PSF→94%  
14:34 PSF→97%

14:43 Turned off Temp Control for Prop 2B  
14:48 PSF→98%  
14:56 PSF→100%  
14:58 PSF→104%  
14:59 Began initial Rinse CIP of Prop 2B through C5 Line using Ferm C Pump to return  
**Initial Rinse Sample taken of Prop 2B.**  
Current increases in CV#1.  
15:02 Metso Flowrate test started; PSF→107%  
15:05 PSF→115%  
15:07 Started 15 min Rinse CIP of Prop 2B through Sprayballs  
Returning via Ferm C Pump  
15:08 Kinda flooding Sump Pumps  
15:12 Began pumping out Waste Water. pH=7.25; Cond~657μS/cm; Level~71.8%  
15:17 PA Mix Tank Agitator OFF  
15:19 PSF→113%  
15:20 Steam ON to Prop 2A Sample Port  
15:23 PSF→118%  
15:24 PSF→120%  
15:28→Finished Rinse CIP cycle of Prop 2B  
**2<sup>nd</sup> Rinse kill verification Sample taken of Prop 2B.**  
15:31 Began Caustic CIP of Prop 2B thru C5 Line  
Returning via Ferm C Pump  
15:33 Finished Caustic CIP of Prop 2B's C5 Line  
15:35 Began 15 min Caustic CIP of Prop 2B through Sprayballs.  
Returning via Ferm C Pump  
**1<sup>st</sup> Heat-kill verification Sample taken of Prop 2A @ 140°F after 1hr.**  
15:46 Overfilling Hold Tank for Phosphoric Acid. Mix Tank neareempty  
15:48 Screw Press→3.2 RPMs; Current was ~5.4 Amps. Don't want to squeeze too much right now.  
15:51 Finished 15 min Caustic CIP of Prop 2B through Sprayballs.  
16:00 Began UV Rinse of Prop 2B through C5 Line  
Set pH control @ 6.40 in Prop 3B and put into AUTO  
16:05 Started 15 min UV Rinse of Prop 2B through Sprayballs  
Still using Ferm C Pump  
16:14 Base B#8 set @50% now.  
16:05 Finished 15 min UV Rinse of Prop 2B  
16:28 Ferm C Pump OFF  
16:32 **t=2hr Heat kill verification Sample taken of Prop 2A @ 140°F**  
**(L) 29.8%; (pH) 6.80; (Temp) 139.0°F; (P) 1.99 psi**  
16:37 PSF→118%  
16:38 PSF→115%  
16:55 Began adding UV Water to Liq Tank through the bottom  
Target Level~20.0%  
16:56 Paused UV Water add to Liq Tank to calibrate pH probe  
17:09 PSF→110%  
17:16 Resumed adding UV water to Liq Tank  
Metso Flowrate~210 lbs/ hour  
17:21 Pausing UV Water add to Liq Tank  
17:24 Resumed adding UV Water to Liq Tank

New Target Level= 32.9%

17:28 Paused UV Water add to Liq Tank. Seeing at where we end.

17:31 UV Water in header for 45 seconds and then paused.  
Resulting Level~34.5%

17:36 t=3hr Heat kill verification Sample taken of Prop 2A @ 140°F  
(L) 29.2%; (pH) 6.77; (Temp) 139.0°F; (P) 1.91 psi

17:40 Did Initial Liquefaction Tank settings  
Enzyme Flowrate=0.0420 GPM  
First 7hrs of UV Water=1.0 GPM  
2.52 GPM after seven hours of operation  
Target Level Control=74.3%

17:46 Screw Press→3.4 RPMs

18:05 Changed setpoint for 3B pH Control to 6.37 (Current pH=6.34)  
Confirmed Base B#8 running fine

18:29 Getting odd, out of the blue sounds from Metso's vicinity

18:41 Screw Press→3.5 RPMs

18:44 PSF→108%

18:47 PSF→106%

Between 18:47 and 20:00 There MIGHT have been a sample taken from Blow Tank

19:29 Flowrate Test started (30min)

19:39 PSF→100%

20:01 Screw Press→3.7 RPMs  
BEGAN sending from Metso to Liq Tank  
Reversing Screw Discharge Valve to Liq Tank and Reversing Screw Overrides ON

20:03 UV Water ON to Liq Tank @1.0 GPM

*Shift Change*

20:15 pH for Liq in Auto

20:20 Started Enzyme Pump (~34% is close to 0.420 GPM flowrate)  
And C5 Pump

21:00 Large Spike @ Bin Collector, large clump went through

21:11 Screw Press→3.8 RPMs

21:15 PSF→97%

21:36 Screw Press→3.7 RPMs

22:05 Shut down Feed Bin to clear it up

22:10 Shut off Enzyme Pump to repair a leak

22:12 Enzyme Pump back ON  
Screw Press→3.8 RPMs

22:20 Finished draining ~30% of Cooling Water Tank to sump

22:29 Shut down Bin Collector again

22:38 Down to 58% in PSB

22:40 WW OFF

23:00 Feed OFF to Metso, Water/Enzyme OFF to Liq, PSB @ 31%

23:08 CV 1203 (Collector) bound up and tripped

23:18 Liq Agitator→30% before issues begin

23:21 Bin running again, finally clear

23:23 Spiking again. Shut down

23:43 Filling PSB back up

23:44 Steam going to Ferm C Jacket



23:55 Steam going into Ferm C Tank  
23:57 Feeding Metso

### **2014-08-13 Fun With Metso, Liquefaction, and Friends**

00:01 Acid for Metso/Enzyme & Water for Liq Tank back up to set point  
00:10 12hr Sample taken for 3B  
(L) 42.0%; (pH) 6.32; (Temp) 98.6°F; (P) 0.45 psi  
00:29 Rough Metso restart. PSF→120%  
At t=12hr, 3B @ 5.45 EtOH per Ismael  
00:30 Turn Temp down to 86°F to slow down for Prop 3B  
00:39 Ferm C pressure @-10 psi, VacPump OFF, Steam back on  
00:52 PSF→110%  
01:12 Stopped Bin Bottoms AGAIN for spiking  
01:15 Ferm C at 250°F  
Also stopped Collection Conveyor  
01:21 Bin back ON, PSB@79%, down again  
01:29 Back ON, going to try to catch PSB  
02:00 Bin in Cascade  
02:12 pH probes calibrated and in tank for pH Adj.  
Temp Control ON pH Adj  
02:15 SIP complete on Ferm C, spargers ON  
02:32 PSF→100%  
02:50 PSF→97% →95%  
03:09 Looks like possible build up on lower knifegate where air comes in  
03:15 Peter is prepping nutrients for Ferm C  
03:40 Trying Liq Agitator @ 50% (71.4% level)  
03:53 Trying Liq Agitator @ 75% (72.3% level)  
Went back to 50%, level started  
04:04 PSF→93%  
04:05 Liq Agitator to 30%, trying to get real reading  
04:18 Liq→pHADJ  
(L) 74.3%; (pH)5.02; (Temp) 122.1°F; (P) 0.47 psi; (UV)2.5 GPM; Agitation=100%  
04:40 Still no flow into pH ADJ 10+ minutes  
04:45 Shut off Liq Pump  
05:05 Solids plugging (Liq) tank.  
05:18 Finally pumping into pHADJ  
05:21 Visual flow into pHA, doing that pump reversal again  
05:31 pH Control ON, we are on probe  
05:48 NOW can't pump to pump to Ferm C  
My fault, valve closed. [Jeff]  
05:52 pH ADJ Level all over, looking @ AA Pump#3, not adjusting  
05:58 Nope, not working, switched to 'B' (Top)  
Overshot Base using other pH probe  
06:00 Finally pumping to C  
pHA level @ 85.5%  
06:09 Tried running pHA in autolevel NOPE, opened valve and adjusting pump  
06:13 Nevermind, lost plug. Not sure what happened, went from 11.5 Amps→7.5 Amps in PSF  
Enzymes OFF, Water OFF, Liq & pH pumps OFF

06:36 Running out METso, everything else 'paused'  
Had to tighten air to valve to bin OFF of reversing screw, wouldn't up.  
No power to solenoid

06:54 Can't get dampener to go back in to PSF  
Obviously, no 06:30 Metso sample  
Header drained from Liq→pH so won't settle

07:38 Not gaining pressure in Metso, steam coming out vent on top. Looks like a problem with dampener again.

07:48 Steam back to Metso

*Shift Change*

08:12 Began feeding Metso  
Temp~341°F; Press~109.7 psi  
FBLB ON in CAS

08:17 Lots of Thunder and rain outside

08:22 Going to add glucose to Prop 3B to keep it alive (pH=6.82)

08:24 Backpump pH Adj for 10 seconds then empty tank to Ferm C so bottom pH can be swapped.  
Blowback Dampener set @ ~59.5 psi

08:25 PSF→100%

08:28 Metso @ Temp and Pressure

08:31 Phosphoric Acid Pump#2 ON @ 840 RPMs (Used Auto to set), going to CAS

08:32 PSF→105%  
Lights flickered. One compressor went down but caught things in time  
Check Metso Temp & Press in 15 minutes and its steam valve value

08:35 Metso Settings:  
Temp=366°F=180°C ; Press=150 psi (A)  
Feed Bin LBs=72% (CAS); PSF=105% (M)  
CV#1&2=100% (M); Acid=6.67 GPM (CAS)  
Screw Press=5.0 RPMs; PSB=72%(A); 110°F

08:37 PSF→110%  
Gotta get things RIGHT! Or else this run ends early. [Chris]  
Yellow Vent closed slightly now

08:42 PSF→112%; pH Adjustment Agitator has been OFF whole time  
pH Adj bottom pH probe is apparently fine

08:46 PSF→115%; pH Adj Pump OFF

08:53 Yellow Vent closed just a bit more

09:02 PSF→~~105%~~ 102%

09:03 PSF→104%

09:04 PSF→98%

09:10 PSF→101%

09:22 PSF→99%

09:26 PSF→~~97%~~ 94%

09:30 Liq Pump ON @ 85% (M) going to pH Adj. AA Pump#3 ON, set @-6.9% (M)

09:36 Opening Reversing Screw Discharge Valve to Liq OPEN  
Set Reversing Screw to FORWARD  
Began feeding to Liq Tank  
Overrides still ON for Valve and Reversing Screw

09:39 UV Water @ 2.50 GPM, Enzyme Pump ON @ 0.0420 GPM (CAS)  
Liq Pump→CAS (pH Adj level=65.3%)

09:40 pH Control for pH Adj Tank ON in Auto; AA Pump#3→CAS  
 09:45 pH Adj Pump ON @ 85%. Pumping to Ferm C!  
 09:47 PSF→81%  
 09:48 PSF→75%  
 09:49 PSF→79%  
 09:50 PSF→81%  
 09:51 pH Adj Pump→60%  
 09:53 pAP→40% (3.5 GPM)  
 09:56 Screw Press→4.5 RPMs; Drain to C5 Tank OPEN.  
 Liq Pump to Auto @ 1.7 GPM.  
 09:58 pAP→30%, 3.0 GPM; Liq Pump→2.2 GPM  
 10:03 Liq Pump→2.6 GPM  
 10:04 pAP→Auto@2.3 GPM; PSF→85%  
 10:06 TMMgS Pump#2 ON @ 90%; Began adding glucose to Prop 3B (pH=6.94)  
 10:13 PSF→86%; Liq Pump→2.8 GPM  
 t=12 hours sample from Blow Tank started by Paul  
 10:15 PSF→88%  
 10:22 PSF→90%  
 10:23 PSF→93%  
 10:31 PSF→90%; Liq Level between 72.4% and 73.8%  
 10:38 PSF→~~85%~~ 87%  
 10:40 Screw Press→4.0 RPMs  
 Glucose Addition Complete to Prop 3B; Prop 3B pH=6.68; Temp@ 86°F  
 10:45 PSF→85%  
 10:50 pAP→2.5 GPM (Level~80%)  
 10:52 pAP→2.4 GPM (Trying to sweet spot)  
 t=12 hours sample from Blow Tank finished by Paul  
 10:56 TMMgS Pump#2 OFF  
 10:58 pAP→2.5 GPM; beginning hourly rock check  
 Steam to Liq Tank Sample Port ON  
 11:11 PSF→87%  
 11:20 Liq Pump→2.7 GPM; pAP→2.6 GPM  
 Might be having problems possibly with C5 Heat Exchanger  
 11:29 Screw Press→4.4 RPMs; pAP→2.8 GPM  
 T=24hr Sample Taken from 3B  
 (L) 44.1%; (pH)6.33; (Temp) 86.5°F; (P) 0.60 psi; Airflow=0.50ACFM  
 Ferm C inoculation=14.7% (Before 3B dump inoculation)  
 11:32 pAP→3.5 GPM  
 11:34 pAP→~~4.0 GPM~~ 5.0 GPM  
 11:38 PSF→89%; pAP→4.5 GPM; Liq Pump→CAS  
 11:40 pAP→4.0 GPM  
 11:43 PSF→90%; pAP→3.5 GPM  
 11:47 pAP→3.0 GPM  
 11:49 pAP→2.5 GPM; Liq Pump→Auto @2.7 GPM; AAP#3 OFF  
 11:53 pAP→2.4 GPM  
 12:00 Liq Pump→2.9 GPM; pAP→2.7 GPM  
 pH probe 'B' is all over the place. Probe 'A' is worthless. [Chris]  
 12:06 LP→3.1 GPM; pAP→2.9 GPM

T=6hr Samples taken from Liq and pH Adj (effectively, since restart)  
(L) 75.3%; (pH)5.06; (Temp) 121.8°F; (P) 0.43 psi; (UV)2.5 GPM[Liq]  
(L)84.5%; (pH)6.04; (Temp) 99.9°F; (P) 0.98 psi [pH Adj]

12:08 pAP→3.7 GPM; Liq Pump→3.4 GPM; AAP#3 ON (CAS)  
12:11 pAP→3.3 GPM  
12:13 ~~pAP→2.9 GPM~~; LP→3.1 GPM; pAP→3.2 GPM  
12:17 pAP→3.0 GPM; LP→3.0 GPM; AAP#3→Auto@0%>CAS  
12:19 pAP→3.3 GPM; pH Adj Agitator Override OFF  
12:22 pAP→3.6 GPM; One of the Base Addition lines to pH Adj CLOSED  
12:25 pAP→4.5 GPM; Might have just lost level sensor for pH Adjustment  
Got it back  
12:28 LP→3.3 GPM  
12:30 LP→3.6 GPM; pAP→4.2 GPM; AAP#3→MAN@ -6.90% and then OFF  
12:33 LP→4.2 GPM  
Got a weird smell in control room. All OKAY. Just someone heating up food in breakroom.  
12:43 pAP→4.7 GPM  
12:43 pAP→4.2 GPM  
12:48 pAP→4.0 GPM  
12:51 pAP→3.8 GPM  
12:57 pAP→4.0 GPM  
Ferm C inoculation target level=14.1% (1100 gal)  
13:00 pAP→4.1 GPM  
13:05 PSF→93%  
13:14 PSF→100%  
13:25 Opened top line for base addition into pH Adj. Tank and closed bottom one  
13:34 pAP→2.0 GPM; Noticed that some of the dips in Liq AND pH Adj levels are aligned and possibly proportional with each other. [Chris]  
13:39 PSF→93%  
13:40 PSF→90%; C5 Pump OFF  
13:41 LP→Auto@ 2.8GPM; pAP→ 2.3 GPM  
13:43 C5 Pump ON @ 50%  
13:45 Began heating up CIP tanks  
13:47 LP→3.5 GPM  
Lots of Thunder now and bad storm coming  
13:54 AAP#3 ON in CAS; TMMgS Pump#1→60%; pAP→4.0 GPM  
13:58 pAP→3.5 GPM  
14:03 pAP→3.2 GPM; C5 Tank Temp~126°F  
Super torrential downpour right now  
14:11 pAP→2.8GPM; LP→3.2 GPM  
14:14 About to inoculate Ferm C with Prop 3B.  
pAP→3.5 GPM  
14:15 pAP→5.5 GPM; AAP#3 into Auto @ 0.05 GPH  
14:18 pAP→6.5 GPM; LP→6.0 GPM; AAP#3→CAS  
14:20 pAP→2.5 GPM; pump had tripped and had to be reset  
14:21 pAP→3.5 GPM  
14:22 LP→3.5 GPM; pAP→~~4.2 GPM~~ 4.7 GPM  
14:23 LP→3.0 GPM; pAP→7.8 GPM  
14:26 AAP#3→Auto@0.07 GPH; pAP→6.5 GPM; LP→4.0 GPM

Ferm C pH=9.5; done via drain or sample port?

14:30 pAP→5.8 GPM; LP→4.5 GPM; pH Adj pH Control OFF  
14:33 pAP→6.5 GPM  
14:36 LP→4.5 GPM; pAP→4.8 GPM; Struggling with level sensor again  
Going to do a recirc. Loop for Ferm C with pump.  
14:41 Ferm C pump ON  
14:44 pAP→5.5 GPM; LP→4.0 GPM  
14:47 pAP→~~5.0 GPM~~ 5.3 GPM  
14:52 pAP→5.4 GPM  
14:54 pAP→5.6 GPM; Ferm C Pump OFF  
14:56 pAP→5.5 GPM  
14:58 Began inoculating Ferm C with Prop 3B  
15:00 LP→3.5 GPM; pAP→5.8 GPM; LP→CAS  
15:02 Ferm C Agitator ON; Turns out to be foam sticking to pH Adj level sensor  
pAP→4.0 GPM  
15:04 pAP→2.5 GPM  
15:12 Prop 3B Temp Control OFF; pAP→2.4 GPM  
15:05 t=0hr Ferm C Sample Taken  
(L)20.4%; (pH)7.90; (Temp) 106.3°F; (P) 0.42 psi; [Air] 11 AFC/M  
pAP→4.0GPM  
15:21 Phosphoric Acid Metering Pump#1 ON (Will be adding to Ferm C)  
15:23 Began adding Acid to Ferm C. Target pH=~~6.8~~ 7.4  
Please let the bugs not be dead.  
15:31 pH Adj Temp Control set to 90.0°F.  
Temp surge in Ferm C might be due to hot pipes during recirculation with Ferm C Pump  
Current Ferm C pH=7.85  
15:37 Closing Ferm C Phos Acid Addition Line  
Current Ferm C pH=7.40  
15:39 TMMgS Pump#1→90%  
15:40 PSF→88%; pAP→2.6 GPM  
15:46 pAP→3.5 GPM  
15:47 pAP→3.8 GPM; Metso pressure dropping (142 psi and going down)  
Metso Volume→85%  
15:49 pAP→ 4.9 GPM; Metso SV→87%, then into Auto  
pAP→4.8 GPM  
15:52 pH Adj Temp Control→80°F; Agitator is turning, but no mixing is occurring.  
15:54 pAP→~~6.5 GPM~~ 5.0 GPM  
15:56 pAP→5.5 GPM  
15:58 pAP→6.0 GPM  
15:59 pAP→6.5 GPM  
16:00 pAP→7.0 GPM  
16:03 pAP→7.5 GPM  
16:05 Ferm C Temp @ 103.5°F; pH=7.32  
16:12 pAP→8.0 GPM  
16:14 pAP OFF; pH Adj Level apparently SUPER LOW  
Set for 4.0 GPM when turned back on  
16:15 LP OFF  
There was, of course, a hole in LP's lines

16:21 LP ON (CAS)  
16:24 LP in MAN@50%; cleared out lines; LP→CAS again  
16:31 LP→Auto@5.7 GPM (~65%)  
16:41 pH Adj Pump ON @ 5.7 GPM (~65%).  
Pumping to Ferm C again  
16:42 pAP→6.5 GPM (~75%)  
16:47 Base Pump#1 set @ 50% speed (should be around 22-26 GPH)  
17:06 Need check valves for Trace Metals Pump Lines  
We have biomass coming out of the pumps  
17:07 TMMgS Pump#1 and Valves to Ferm C OFF and CLOSED  
17:17 pAP→5.0 GPM  
17:19 pAP→6.0 GPM  
17:25 LP→CAS (Level=76.0%)  
Does CAS mode for LP result in more tears/holes in the hosing due to its more fluid variable speeds than if someone controlled it manually with larger but less often (maybe?) speed shifts?  
Food for thought.  
17:29 pAP→6.5 GPM  
17:31 Getting 5.0+ Amps loads in FBLBs.  
LP OFF due to rigging up pH Adj Tank Bypass lines  
17:32 Bypass Rig done. LP ON in CAS  
Press reading from Liq Tank lines not relevant anymore.  
Can only use Liq Tank Level Readings  
17:37 Level visible in C5 sight glass. C5 Agitator ON  
17:38 PSF→91%  
17:42 pAP OFF  
17:43 pH Adj Temp Control set @ 120°F  
17:47 Ferm C's Liquefaction Slurry Line SHUT CLOSED  
17:57 Doing Rinse CIP of Liq→pH Adj transfer line without the tanks  
17:59 Began UV Rinse/flush of Liq→pH Adj transfer line without the tanks  
Finished @ 18:03  
18:04 Screw Press→4.6 RPMs  
18:12 PSF→94%  
18:23 PSF→97%  
18:29 t=12hr Liq Tank Sample Taken  
(L) 75.4%; (pH)5.02; (Temp) 122.0°F; (P) 0.37 psi; (UV)2.5 GPM  
18:35 Paul and Joe working on Blow Tank Sample for Metso.  
Maybe Jeff could start a daily version for the electronic spreadsheet @ midnight tonight for 2014-08-14?  
18:47 Still squeezing Hydrolyzate even at 4.6 RPMs.  
18:50 Lost pressure from compressors. 20 psi in plant  
18:52 Blowback Dampener back at pressure  
Both compressors shut off randomly?!?!?  
Both back up to 70 psi  
18:56 Plant Pressure back to Normal.  
One compressor now set to run continuously without cycling on-off like normal.  
18:57 t=24hr Metso Blow Tank sample done. T=188°F; (P) 0.43 psi [for Blow Tank]  
Metso seems to be doing alright for plant going down to 20 psi.  
19:00 BOTH compressors now set to run continuously

"Zero (0) per day" is how to do that

Never had a clue about lost pressure until I started losing control over Hot/Cooling water valves and the like. Somehow, knifegates kept on going with their only issues (to me) happening as we were regaining pressure.

- 19:14 Ferm C pH Control ON, set @ 6.55 to gauge working levels for pump and pH control.  
Current pH=6.48
- 19:17 Base addition for Ferm C IS running. Just need to see if I will need to increase pump speed or not.  
Base Pump#3 Ready @ 50% (~27.5 GPM)
- 19:20 WW pH=5.4. Will be dumping Caustic into it at some point
- 19:24 [Running Caustic to Sump for ten with one valve](#)
- 19:25 Base B Pump#3 set @ 75% (~41.5 GPH)  
That seems to be doing the trick now  
Ferm C pH control set @ 6.50 now
- 19:28 Blue Boiler just hit 400 psi. Shutting it down.
- 19:40 [Joe will be opening BOTH caustic valves to WW.](#)  
[5-minute timer](#)  
PSF→94%
- 19:47 Will have next WW pH & Cond. Check in five (5) minutes
- 19:48 Ferm C pH Control set @ 6.40
- 19:49 Phosphoric Acid Metering Pump#1 (Ferm and Props) OFF
- 19:53 Screw Press→4.8 RPMs; WW pH @ 10.
- 19:55 WW Pump ON; Level=94.8%; pH=9.88; Cond=1.00 mS/cm
- 19:57 Screw Press→5.0 RPMs
- Shift Change*
- 20:30 [CIP C5→3B](#)
- 20:53 Rinsing out Nutrient Lines→3B Pump#2
- 20:56 PSF→92%
- 21:12 Turned off pH Control on 3B, Temp→SIP
- 21:14 [Start CIP of 3B](#)
- 21:15 [t=6hr Ferm C Sample](#)  
[\(L\) 32.7%; \(pH\)6.32; \(Temp\)98.6°F; \(P\) 0.63 psi](#)
- 21:19 "Phantom" level in 3B, Liq Pump in CAS
- 21:27 Screw Press→4.8 RPMs
- 21:58 Took Temp Control OFF in pH Adj
- 22:12 PSF→90%
- 22:40 [CIP of 3B Complete](#)
- 23:02 pHA has been drained and rinsed
- 23:10 Shut Bin Live Bottoms DOWN, Collection plugged
- 23:12 Back ON, cleared out
- 23:19 Bottoms back OFF/Collection too
- 23:25 System back ON
- 23:30 PSF→95%

#### **2014-08-14 Filling Fermentor C & Liquefaction Freak-outs (and a Power Outage)**

- 00:05 [t=18hr Liq Tank Sample Taken](#)  
[\(L\) 73.6%; \(pH\)4.97; \(Temp\) 122.2°F; \(P\) 0.37 psi](#)  
END OF FIRST LOGBOOK. STARTING SECOND LOGBOOK\*

00:20 Rinsing Slurry Line→ pH ADJ  
00:28 Starting of pHADJ Rinse→Floor  
00:35 Sprayball#1 on pHA does not rotate  
01:07 PSF→95%  
01:25 Shut off FBLBs, Collection spiking  
01:30 PSF→92% → 90%  
01:35 Bin running again  
01:40 Starting Caustic Cycle of pHA, using Diaphragm pump back into header→Caustic Tank  
3/5min cycles per sprayball  
Nevermind, pump keeping. Doing each sprayball 15min  
02:03 Had to reverse LP  
02:22 UV Cycle to pHA  
02:30 PSF→94%  
02:54 pHA CIP Complete  
03:15 t=12hr Ferm C Sample  
(L) 44.7%; (pH)6.31; (Temp)98.7°F; (P) 0.79 psi  
03:28 Reversed LP  
03:35 Reversed LP Again  
04:01 Reversed LP Again  
12hr was 9.1 g/L. We also read 6.31, Lab got 6.32 pH  
04:57 Livebottoms OFF, Collection Spiking  
04:59 Reversed LP, don't know why all of a sudden, ran well for first 6 hours  
Also bottoms back ON  
06:05 t=24hr Liq Tank Sample Taken  
(L) 78.5%; (pH)5.01; (Temp) 121.9°F; (P) 0.35 psi  
06:30 [t=36] Blow Tank Sample Taken 185°C/7.5min  
06:31 Bin Bottoms OFF, clear out Collection  
Stopped Collection  
06:42 Bin running again  
06:49 Reversed LP  
06:56 Bin in MAN @ 110%, PSF→100%  
07:16 PSF back to 94%, too many changes to list after chasing the last stuff to come upstairs from clog  
on Collection  
07:26 Bin clogged again. Collection/Bottoms OFF  
07:30 PSF→92%  
07:31 Bin back ON  
07:32 LP back in CAS, flowing well again  
07:39 Bin back in CAS  
*Shift Change*  
08:01 PSF→90%  
08:06 PSF→88% 84%  
08:22 LP Stalled again. Joe's backflushing it  
08:26 PSF→86%  
08:45 CIP pumps and agitators OFF. Won't need them for at least ten hours after all.  
08:52 PSF→88%  
08:54 PSF→84%  
09:10 Ferm C steam to sample port ON (a little late)  
09:32 LP→Auto@3.0 GPM CAS was making LP shut down entirely



09:42 t=18hr Ferm C Sample (~30min late)  
(L) 57.1%; (pH)6.32; (Temp)98.7°F; (P) 1.00 psi; Airflow=9.5 ACFM  
Joe fixed Airflow rate after this

09:37 PSF→92%  
09:39 PSF→95%  
09:41 PSF→97%  
09:46 PSF→94%  
10:23 LP→CAS  
Should be able to shut down Metso~14:30 and just drain out Liq. Tank

11:04 PSF→93%  
11:08 PSF→90%  
Note for Future (according to Dr. Ingram):  
Trace Metals and Magnesium Sulfate pumps should be feeding to Fermentors continuously until the Fermentor is filled to designated level

11:38 PSF→88%  
11:42 PSF→86%  
11:52 Had to backflush LP again  
12:11 LP→MAN@65% (~5.7 GPM)  
12:12 LP→40%@3.5 GPM; Then CAS  
12:15 t=30hr Liq Tank Sample Taken  
(L) 75.9%; (pH)4.99; (Temp) 122.0°F; (P) 0.34 psi; (UVW)2.5 GPM

12:32 PSF→85%  
12:34 PSF→88%  
12:35 PSF→92%  
12:36 PSF→96%  
12:40 WW pH=7.07; Cond=1.42 mS/cm  
12:43 WW Pump ON; Level=83.5%  
12:46 Had some minor difficulties getting flow started, but it [WW flow] looks fine now

13:04 PSF→94%  
13:05 PSF→~~91%~~ 88%  
13:07 LP→MAN@75% (6.6 GPM)  
13:17 Base B Pump→85% (47.0 GPM)  
pH was starting to slip down. pH=6.31

13:19 PSF→91%  
13:23 LP had to be reset. LP ON @ 50% (4.5 GPM)  
13:30 PSF→93%  
13:40 PSF→91%  
13:41 PSF→~~88%~~ 85%  
13:43 POWER LOST  
All pumps down  
Compressors back ON

13:44 Potable Water and HP Seal Water Pumps ON  
13:46 Proc Water ON & Cooling Water  
13:48 UV Water ON & Hot Water ON  
13:49 Restarting Metso  
13:50 Repressurizing Metso  
13:53 Pretreatment ON  
13:54 Biomass Handling ON

13:56 Manually upping Steam to Metso  
Phosphoric Acid Hold Tank Agit & Pump#2 ON

13:59 Metso SV @ 90%(M); Pressure was 85 psi at one point I think  
Liq Agi ON; Enzyme Pump to 20% then CAS

14:00 Ferm C Pump ON

14:01 LP ON MAN@50%

14:03 PA MP#2→CAS

14:07 Ferm C Agi ON

14:08 Ferm C Pump OFF

14:10 PSF→89%

14:11 Bleach Scrub Pump & CO<sub>2</sub> Scrub Fan ON

14:12 CO<sub>2</sub> Scrub Pump ON

14:13 Base B Pump#3 set to 85%

These pumps lose their setting memory during a power outage  
Note for Self: During crises, make sure I articulate my useful ideas properly and coherently and then CONFIRM that the listener(s) heard me. Also, don't go rushing off to handle a problem.  
[Chris]

14:22 AAP#1→MAN@20%

14:24 AAP#1→40%; then CAS

14:25 PSF→87%

14:26 PSF→79%

14:28 LP→65% (5.7 GPM)

14:29 Beerwell Agi ON

14:31 PSF→~~75%~~ 77% 80%

14:33 C5 Agi ON; C5 Pump was running the whole time without a care

14:37 PSF→83%

14:39 PSF→85%

14:42 PSF→87%

14:43 LP→75% (6.6 GPM)

14:44 AAP#1→MAN @ 15% →Auto→CAS

14:46 PSF→85%; Boiler was ON whole time

14:48 PSF→82%

15:01 Prop 2A Agi ON

15:02 Steam to Ferm C Sample Port ON

15:13 WW pH=6.3; Will add Caustic to it for a few minutes (5-minute timer)

15:16 t=24hr Ferm C Sample Taken  
L) 66.7%; (pH)6.31; (Temp)98.6°F; (P) 0.86 psi; Airflow=11 ACFM

15:18 WEIRD squeally sounds (From Metso??)  
Went away quickly though (less than one minute long)

15:22 Giving Caustic in WW Sump 10 min timer before next sampling

15:28 @67.3% level in Ferm C. Setting up C6 Storage Dumpster

15:29 Switched Metso over to C6 Dumpster

15:30 UV Water and Cellulase Pump to Liq Tank OFF  
AAP#1 still ON; Discharge to Liq OFF

15:33 Practically out of Boiler Additive. Someone needs to go and pick up a package of it from  
Receiving at Buckeye

15:34 Overrides OFF for Reversing Screw and Discharge Valve to Liq Tank

15:36 Screw Press→4.6 RPMs

15:37 WW Sample pH 7.57; Cond=655  $\mu$ S/cm  
15:39 WW Pump ON; Level=89.1%  
15:49 PSF→80%  
15:55 16.93 g/L Ethanol concentration for t=24hr sample.  
16:02 PSF→82%  
16:05 PSF→85%  
16:20 PSF→87%  
16:23 LP had to be reset  
16:24 LP ON@50%; PSF→90%  
16:32 PSF→93%  
16:34 PSF→96%  
16:38 PSF→100%  
16:43 PSF→98%  
16:48 Screw Press→4.4 RPMs  
17:05 LP clogged again  
17:06 LP now TRIPPED; ON@40%  
17:07 LP→55% (4.9 GPM)  
17:08 Screw Press→4.1 RPMs  
17:09 PSF→97%  
17:13 PSF→95%  
17:31 LP→60% (5.3 GPM)  
17:32 Screw Press→3.8 RPMs  
Seems like LP clogs A LOT MORE once we stop feeding fresh biomass, UV Water, and enzyme to it. Makes Sense  
18:10 t=36hr Liq Tank Sample Taken  
(L) 64.7%; (pH)5.05; (Temp) 121.4°F; (P) 0.41 psi  
18:20 Screw Press→3.5 RPMs  
Liq Tank Agi→30%; Liq Tank Level=62%  
18:28 pSF→93%; Doing regular (~15 min) backflushes of LP  
18:31 Paul and Joe working on t=48hr Metso Blow Tank Sample (185°C; 7.5 retention time  
Blow Tank Temp=194°F; Press=1.35  
18:45 Liq Tank Agitator speed→100%; Liq Tank Level~54%  
18:50 Perhaps turned up Agi Speed too soon. Having issues with level indicator in Liq Tank.  
Liq Tank Agi→30%; Will turn up again ~50% level  
18:54 PSF→91%  
19:01 Screw Press→3.1 RPMs  
19:29 Having issues with Liq Tank Level Indicator periodically.  
19:30 Liq Tank Agitator Speed→100%  
19:33 Screw Press→3.1 RPMs  
19:34 Base B Pump#3 set @ 95% (51.9%)  
Hopefully this will catch pH; Current pH=6.28  
19:36 PSF→88%  
*Shift Change*  
20:30 Ferm C @ 76.2%=8000 gallons  
Rest (37.7%)→Decanter Feed Tank  
PSF→85%  
20:40 Now stopped filling C (Topped it off~76.5%)  
20:50 Pimping Liq→Decanter Feed Tank

CIP ON

21:00 Ferm C pH=6.33, Changed Pump#3 to 85%

21:04 pH Control OFF of Liq, Temp Control too

21:09 PSF→83%

21:15 **t=30hr Ferm C Sample Taken**  
**(L) 76.5%; (pH)6.33; (Temp)98.6°F; (P) 0.60 psi**

21:20 Draining 2A to floor, Temp Control OFF  
 Agitator OFF

22:00 ScrPPress to 3.0 RPMs

22:06 PSF→80%

22:15 Completely lost Liq level

22:20 **Starting CIP Rinse of 2A, C5 Line knuckle→tank**

22:20 WW OFF

22:44 Shut DOWN Liq, problem with pump

22:53 Switched to bottom of tank, level back reading 22.6%, can't pump it, keeps tripping

22:57 Decanter Agitator ON and in Bypass. Level was 10.3%, now bouncing in high 9s so it IS touching.

22:58 PSF→77% (Odd)

#### **2014-08-15**

00:14 Fought with Liq long enough, draining to floor

00:29 PSF→80% →83%

00:43 Liq Agitator OFF 15% Level

00:56 **Last Sample (30hr?) 19.1 g/L**

01:05 Psf→85%

01:50 **Caustic Cycle on 2A**

02:22 WW pH=7.55 Cond=1.36 mS/cm

02:24 ScPr→3.0 RPMs → 3.3 RPMs loading up

02:29 **2A CIP done, "Phantom" level showing 74%**

03:04 **Rinsing Enzyme Line to LIQ**

03:14 Sending out WW ~32 GPM

03:31 Bin to MAN @ 110%

03:35 **Last Sample (36hr) 20.89 g/L**

03:36 ScPr→3.5 RPM

03:43 Phantom Level gone from 2A

03:47 Bin back in Cascade

03:52 **CIP transfer line from pHA→ LIQ, even though it's been done Calvin insists. Rinse/Caustic/UV**

04:15 **CIP of Liq Rinse**

04:21 PSF→90%

04:28 Doing 3/5min cycles for Liq CIP, level isn't reliable

05:32 Shut down Rinse

05:47 **CIP of LIQ Caustic (Ferm A Pump)**

05:57 Bin in Manual@110%

06:20 Bin Live bottoms OFF, Collection spiking

06:21 Collection OFF

06:23 Bin Back ON, Bottoms in Cascade

06:46 Live bottoms OFF, Bin @80%, can't win with this thing.  
**Blow Tank Sample Taken**

07:00 Bottoms ON

07:17 Bin OFF (Transfer spiking)  
07:19 Bin ON  
07:20 PSF→95% to clear PSB transfer  
07:24 ScPr→4 RPM→sludge coming through system  
ScPr→5 RPM→clear out, Amps above 6  
07:45 PSF→92%  
07:53 PSF→88%  
07:55 Bin back in Cascade  
*Shift Change*  
08:02 PSF→86%  
08:04 Apparently, Caustic Tank Agitator DOES turn on automatically @ 20% or higher. Huh. [Chris]  
08:10 PSF→82%  
08:22 PSF→84%  
08:23 PSF→87%  
08:25 PSF→90%  
08:26 PSF→93%  
08:27 PSF→96%  
08:29 Screw Press→4.5 RPMs  
08:33 Ferm A Pump OFF  
08:35 PSF→98%  
08:38 PSF→95%  
08:41 Liq Pump has been replaced. Pump apparently works now?  
08:43 Got low level alarm in Biomass Feed Bin  
08:44 Test running Liq Pump. ON @ 50%  
Pump takes MUCH longer to get to 50% than before.  
08:46 Liq Pump OFF; Had to use Operating Value @ -6.9%  
Programming has been completely reset.  
Plan is to run out Biomass in Feed Bin and most in PSB  
08:52 PSF→92%  
09:12 Began UV Rinse Cycle for Liq Tank (1<sup>st</sup> 5 min)  
Ferm A Pump ON  
Going to try and see if Ferm B Pump will work better  
09:17 Finished first 5 min UV Rinse for Liq Tank  
09:24 Ferm A Pump OFF. Rigging things to go to Ferm B Pump  
09:30 **t=42hr Ferm C Sample Taken**  
**(L) 76.5%; (pH)6.32; (Temp)98.7°F; (P) 0.70 psi; Airflow=11 ACFM**  
09:34 Ferm B Pump ON  
09:40 Biomass Feed Bin EMPTY  
09:41 Ferm B Pump OFF and then ON  
Joe says pressure in lines are higher now than before (15 psi vs 5 psi)  
09:47 PSF→~~91%~~ 89%  
09:53 Biomass Handling OFF; Running down PSB to ~45%  
09:54 PSF→86%  
10:05 PSB LB, TC, PSF, Metso Steam, PA Metering Pump#2 OFF  
Began depressurizing Metso and running it out.  
10:06 Screw Press→5.0 RPMs; CLOSED Hydrolyzate drain to C5 Tank  
10:19 **t=42hr Ferm C Ethanol Concentration @ 21.0 g/L**  
10:45 Began UV Rinse Cycle for Liq Tank (2<sup>nd</sup> 5 min)

Ferm B Pump OFF  
10:47 Ferm B Pump ON  
10:50 PSF ON @100%; PSB TC ON  
10:51 Finished #2 UV Rinse of 5min  
11:05 PSB TC OFF  
11:15 PSF to C5 Hydrolyzer Discharger OFF  
Starting Wash down  
11:22 HP Seal Water Pump OFF  
11:25 Metso Shut down  
11:27 Still not getting flow from Liq Tank into Rinse Tank  
Ferm B Pump OFF  
11:28 Draining to Floor. "Nasty stuff in Return Header"  
11:32 Boiler shut down. Kevin is blowing it down  
11:48 Caustic Tank Agitator and Pump OFF  
11:52 Beginning final UV Rinse Cycle of 5min for Liq Tank thru sprayballs  
Joe needs to lock out/tag out CIP valves for tanks CIP'd during this campaign  
11:54 CO<sub>2</sub> Scrubber Pump OFF  
11:57 Finished final UV Rinse Cycle for Liq Tank  
12:16 Bleach Scrubber Level REALLY erratic  
Talk to Joe about Liq Tank Valves being open and he wants done with them.  
T=42hr has 1.6 g/L Xylose as only sugar left  
12:43 WW Pump OFF  
13:49 Decanter Flow Control set @ 2.50 GPM  
13:51 Decanter Feed Pump ON  
13:51 DFP→CAS  
13:55 DFP motor faulted  
13:58 DFP ON in MAN @20%  
13:59 DFP Faulted again. Might be jammed  
14:04 Phosphoric Acid Hold Tank Agitator OFF  
14:09 DFP ON @ 20% MAN (using water to flush out pump and lines)  
14:13 DFP→CAS  
14:16 Set Decanter FIC to 3.00 GPM (Flowrate was stable @ 2.32 GPM)  
14:18 Decanter Feed Tank Agitator OFF (Override OFF)  
Must remember to get Beer Pick Heater @ Temp  
Thunder and Lightning outside  
14:56 DFP OFF. Decanter shut down due to "Load differential speed"  
15:00 Going to run Decanter in CIP cycle  
15:15 Chute going from Decanter itself to Solids Bin clogged and blocked up.  
15:30 t=48hr Ferm C Sample Taken  
(L) 76.7%; (pH)6.33; (Temp)98.6°F; (P) 0.66 psi  
15:48 Ferm C Temp Control set @ 140.0°F  
Ferm C pH Control→MAN (OFF)  
Hot Water Heater set @ 185°F  
15:49 Base B Pump#3 OFF and set @ -6.9% (MAN)  
16:04 Decanter has been cleaned out.  
The chute has been unclogged  
CIP cycle is running for Decanter  
Decanter Feed Tank is being drained

16:22 Joe going up on top to decrease sparger to minimum  
16:36 DFP ON in MAN @20%  
16:37 DFP→50%  
16:44 DFP OFF  
16:46 DFP ON @ 50%  
16:47 DFP OFF  
16:48 DFP ON @ 20%; then OFF  
It's not ramping up properly  
16:49 DFP ON and then OFF due to faulting  
If DFP will not go above 168 RPMs, then it is likely ready to fault at any moment.  
16:51 DFP ON and then faulted after only 168 RPMs  
16:52 Decanter finished CIP cycle. Now OFF for a few moments  
16:54 DFP ON @ 75%! Unplugged as well!  
16:56 DFP OFF  
DFP Faults: 13 over course of shift

#### *Shift Change*

20:30 Moving Mix Tank→Hold Tank. Showing no level here. Hold started @ 23.15%, ended @ 34.31%  
20:51 Adding water to Mix Tank  
Start: (L) 0.3%; (W) 1 lbs  
1<sup>st</sup> Water: (L) 39.9%; (W) 3655 lbs  
Acid: 129.1 lbs  
Target Weight: 3784 lbs  
Addition: (L) 41.8%; (W) 3786 lbs (Cond) 20.7 mS/cm  
21:00 C5 Pump OFF  
21:47 Mix Tank Agitator ON  
22:20 Ferm C @ 140°F  
22:50 1<sup>st</sup> Kill sample of Ferm C  
23:30 Starting Weight 3655, 129 lbs Addition. Ended up @ 131 lbs. Conductivity 20.7 mS/cm (seems low but going to go by weight. Purging line  
2<sup>nd</sup> Kill sample of Ferm C

#### **2014-08-16**

00:15 Acid Mix Tank Work  
Start: (L) 41.8%; Cond=20.7 mS/cm; (W)3786 lbs  
Finish: (L) 54.4%; Cond=20.7 mS/cm; (W)4462 lbs  
00:30 2<sup>nd</sup> Kill sample of Ferm C  
00:53 Heat up CIP  
01:30 3<sup>rd</sup> Kill sample of Ferm C  
02:29 Sending Ferm C→Beerwell  
76.95% and 22.63% respectively  
02:30 4<sup>th</sup> Kill sample of Ferm C  
03:13 Turned off Mix Agitator  
03:15 Turned off Scrubber blower/Bleach Scrubber  
03:58 Transfer Done BW=72.7%  
04:30 Doing a pre-Rinse of Ferm C, Liq CIP was open so Rinse went there too. Adding water to Rinse Tank and heating up.  
05:53 We're straying a bit from the norm on CIP Rinse of Ferm C. Ran hose from drain to sump with a screen over it to catch solids. Doing multiple "bursts" until solids pushed out.

06:02 Rinsing nutrient lines to Ferm C  
06:05 Shut down Hot Water Pump, Temp to MAN and off  
Next time sending WW, draw some off  
06:37 Pumping out some of CO<sub>2</sub> Scrubber  
06:55 Trouble getting MgSO<sub>4</sub> Drum pumped to Ferm C  
07:03 Found problem, hose @ pump plugged with biomass, wondering how far up it goes  
07:20 Had to blow line out with a hose, turned pump back on  
07:42 WHY IS METSO BOILER ON? JUST NOTICED  
*Shift Change*  
Still need to do CIP on Ferm C Recirculation Loop  
08:00 TMMgS Pump#1 OFF; Valves to Ferm C CLOSED  
08:16 PA Mix Tank Agitator ON  
Hopefully for Marco to get a sample  
08:41 Began Rinse CIP of Ferm C  
09:18 Adding more Process Water to Rinse CIP Tank  
09:43 Paul is taking the hose off of the Ferm C drain  
10:00 Adding more Proc Water to Rinse CIP Tank  
10:22 WW pH=6.52. Adding Caustic to Sump  
10:37 Lost track of Rinse Temp. Caught it again @ 194°F  
10:42 WW Level @ 95%. Waiting on Sample  
pH=6.8  
10:45 Paul is planning pumping or dumping Caustic Soda into sump by WW Sump Pump  
Going to call Buckeye once level hits 97% and Paul will just have to get pH and conductivity later  
Really worried about WW pump clogging too  
10:50 WW Pump ON; Level=97.4%; Current pH=6.8  
And it clogs  
10:52 WW Pump ON; Level=98.0%  
Flow is MUCH better this time  
Flow~30.2 GPM  
11:01 WW level holding ~98%  
Have to add Caustic Soda & Process Water to Caustic Tank today. No chance to finish CIP otherwise  
11:06 Proposed idea to Paul that we go ahead re-doing UV Rinse on Liq Tank to get it done and also add some more water to Rinse Tank.  
11:27 First UV Rinse 5min for Liq Tank. Using Ferm A Pump  
11:32 Finished 1<sup>st</sup> UV Rinse for Liq Tank  
11:38 [Caustic Concentration=1.8%](#)  
11:52 Began 2<sup>nd</sup> UV Rinse 5min for Liq Tank  
11:56 [We have three FULL Caustic Drums](#)  
11:57 [Draining current Caustic Tank to the sump. Will mix new batch for Caustic Tank](#)  
Agitator and Pump OFF  
Finished 2<sup>nd</sup> UV Rinse for Liq Tank  
12:15 Ferm A Pump OFF  
12:19 Began 3<sup>rd</sup> (and final) UV Rinse Cycle for Liq Tank  
12:21 WW pH=11.6; Cond~5.44 mS/cm; Current Level=82.6%  
12:26 Finished UV Rinse of Liq Tank  
Sprayballs still OPEN  
Paul says he'll close them when he gets back from lunch.



Ferm A Pump ON  
12:42 Ferm A Pump OFF  
12:50 Liq Tank Level Sensor going nuts right now  
13:44 Drain for Caustic Tank CLOSED. Began adding Process Water  
Target Level=50%  
Liq Tank Sprayballs CLOSED  
14:14 Paul is getting the valves set so we can do a Rinse CIP on Ferm C Recirc Loop.  
14:18 Caustic Tank @ 49.5%  
14:21 Began Rinse CIP of Ferm C through Sprayballs  
Ferm C Pump ON @ 14:24  
14:30 Paul began adding Caustic Soda Drum #1 to Caustic Tank  
14:37 Rinse Agitator OFF  
14:40 Rinse Tank Pump OFF  
14:42 Caustic Pump ON; Ferm C Pump OFF  
14:54 Began adding Caustic Drum #2 to Caustic Tank  
15:02 Possible clog in Ferm C Recirc Loop.  
15:07 Began adding last 400 lbs from Drum #3  
15:11 Total Caustic Soda 1818 lbs pumped. Level~56.1%  
Began flushing Caustic addition line  
15:35 Ferm C Pump ON. Rinsing out Recirc Loop one more time  
15:42 Turned on Level Control for Caustic Tank set @73.9%  
Began adding Process Water. Target=75%  
15:44 Finished Rinse on Ferm C.  
15:53 Ferm C Pump OFF  
15:54 Caustic Tank Water addition done. Level=74.1%  
16:12 Ferm C Pump ON  
OFF @ 16:13  
16:35 Ferm C Line unclogged finally  
16:49 Sump Pump #1's line going TO Waste Water Tank is apparently clogged.  
Manually disconnected  
17:18 Noticed a random surge in level for Caustic Tank that happened around 17:09

#### **2014-08-17 Wrap-up Work**

13:35 Turned on UV Pump to try to unclog WW Sump #2 9505  
13:48 Steam ON. Getting CIP to Temp.  
13:57 Trying to rinse to sump. Pump @75%  
14:00 Rinse @ 100% Didn't work  
14:09 Tried again, looks like it worked  
14:53 WW pH=11.49, Cond=4.99 mS/c, 11.08% tank  
Going to take WW piping off and try to backflush W/UV  
14:58 Caustic Cycle Ferm C  
15:17 Header must have been full. Caustic @ 80%  
15:21 UV Cycle to Ferm C  
15:40 CIP Done  
16:00 Air Drying nutrient lines  
16:12 CIP 4.3%  
16:32 Hot Water Tank @ 91%, draining down  
17:19 Steam OFF, CIP OFF

17:26 UV OFF  
18:12 Opened Steam Valve to send WW and troubleshoot flow. Still off to plant  
Drained cooling water to 35%  
WW pH=11.49, Cond=4.99 mS/cm  
18:20 Pumping WW, ~34 GPM, purged tank, flushed pump  
20:18 WW Done

## Log Book Keys

### Color Coding

blue text

green text

purple text

red text

yellow highlight

tank refill log (i.e., bleach, caustic acid)

notes from field

problems

sampling/inoculation-related information

process notes, major issues

### Abbreviations

AAP	Aqueous Ammonia Pump
AG	Agitator
BT	Blow Tank
BW	Beerwell
BWP	Beerwell Pump
C5 Discharger	Hydrolyzer Discharge Screw
CIP	Clean in Place
CV	CableVey-Cable conVeyors
DFP	Decanter Feed Pump
FBLBs	Feed Bin Live Bottoms
FBTC/FBCC	Feed Bin Transfer/Collection Conveyor
GP	Gluconase Pump
HPSWP	High Pressure Seal Water Pump
HSMC	High Shear Mixing Conveyor
LIQ	Liquefaction Tank
LP/LIQP	Liquefaction Tank Pump
PA	Phosphoric Acid
PAHT	Phosphoric Acid Holding Tank
PAMP	Phosphoric Acid Metering Pump
PAMT	Phosphoric Acid Mix Tank
pAP	pH Adjustment Tank Pump
PATP	Phosphoric Acid Tote Pump
pHA	pH Adjustment Tank
Prop	Propagator
PSBLBs	Pre-Steam Bin Live Bottoms
PSF	Plug Screw Feeder
RevSc	Reversing Screw
ScPr	Screw Press
SIP	Sterilize in Place
SV	Steam Valve
WW	Waste Water