

Log Book  
Campaign 13

**2015-04-20**

08:00 Possible Power Loss over weekend, going through systems  
08:50 Rinse Rev. Conveyor→Liq, Liq sprayballs with UV on  
09:29 Steam into Liq Tank  
09:40 Vac to Liq  
09:48 Liq @ -10 psi, steam back on  
10:23 Steaming enzyme/transfer lines  
10:55 **Liq @ 250°F**  
90 min hold  
12:50 Steam OFF Liq  
14:15 Screws ON to Dump Chamber  
14:23 Rest of Conveyors/Handling ON  
14:29 Scrubbers/Acid Hold AG ON  
**Camera for Seal Water Gauges not feeding back.**  
14:51 Metso Vents CLOSED  
14:54 2B 90 minutes hold started  
15:03 UV→Liq @ 2 GPM, timing so we know just what we have  
15:04 pH probe calibrated and in for Liq  
15:06 **PSF bypassed due to pressure sensor. Also, Rev Conveyor and FBLB**  
15:08 PSF and Transfer ON, Metso @ 50 psi  
15:21 **Metso @ 100 psi, Feeding. PSBLBs @ 60%**  
PSF @ 100%  
Blow back set @ 40 psi  
15:26 PSBLBs→70%, PSF→110%  
15:28 PSF→120%, Amps 13+  
15:30 PSBLBs→80%  
15:33 PSF→110→100%  
15:35 **Troubleshooting Acid Pump, no flow**  
15:40 **Metso @ Temp and Pressure**  
**No acid yet, PSF→105%**  
15:49 PSF→110%  
15:50 Now 2B timer restarted  
16:26 PSF→115%  
16:32 Still no luck with Acid Pump  
16:35 Liq TC ON  
16:37 WW pH=10.33 Cond=1.74 mS/cm  
16:46 Acid Flow finally  
**Did priming sequence.**  
16:50 Manually adjusting Acid Pump for now  
16:56 Pump stroke set @ 74%, Pump→Cascade, S.P of 8 GPH  
WW going out  
17:08 Pump #2 stroke to 40% for 10 minutes (going by book)  
17:19 Pump #2 stroke back to 74%, trying Cascade again (~54%)  
17:24 **2B SIP Complete**  
17:49 Liq AG ON, help temp and hopefully level reading

Acid Con in Mix Tank=2.1%

- 18:15 Cooling down 2B
- 18:30 Stopped UV→Liq ~ 20% final level  
TBT after flow rate test-2 hours, starting at 19:00. Ran Liq UV for 200 minutes @ 2 GPM
- 18:36 Having guys check Metso, slow but steady pressure drop
- 19:00 **Metso flow rate started.**
- 19:05 Peroxiding Enzyme Pump Lines
- 19:36 PSF→110→100%
- 19:40 PSF→105%

*Shift Change*

- 20:18 PSF→108%
- 20:30 GP OFF
- 20:38 GP ON @ 100%
- 20:57 GP OFF
- 20:58 FBLBs→60%
- 21:08 FBLBs→65%
- 21:25 FBLBs→70%
- 21:51 **Metso Biomass Flow=134lbs/hour at 34.67% DW**

**Liquefaction Targets:**

7hr Initial Fill Time to 723 gallons (33.6% Level)  
Initial volume=400 gallons  
UV Flow after Initial Fill=1.00 GPM  
Enzyme Flow=0.0134 GPM, Pump @ 16.9% speed  
Filling Tank to 1600 gallons=71.4% Level

- 21:59 GP ON @ 30% (Flow-check/line-priming)→80%
- 22:04 Knifegate to Liquefaction Tank OPEN  
RevScr→"STOP"  
Direction set to "FORWARD"  
RevScr→"RUN FORWARD"

**Now Feeding Liquefaction Tank**

- 22:05 Had brief hiccup where almost everything tried shutting down in Metso.  
I [Chris] did not override ScPr, so I might have taken too long switching over to Liq Tank  
Caught everything in time
- 22:11 GP ON @ 30→50% to finish line priming
- 22:12 GP→30%
- 22:13 Enzyme flow looks good, GP→16.9%
- 22:17 Liq Tank pH Control ON (AAP#1 ON→CAS)
- 22:23 GP→30% for one minute
- 22:26 GP→40%
- 22:27 Having some difficulties with Enzyme Flow Check, GP→70%
- 22:30 GP→50%
- 22:31 GP→35%
- 22:32 GP→16.9% Flow is good now
- 23:00 **Began transferring from PAMT (95.4%) to PAHT (7.8%)**
- 23:09 FBLBs→60%
- 23:41 PSF→113%
- 23:45 FBLBs→65%
- 23:57 PSF→110%

## 2015-04-21

00:00 Metso Sample Taken  
Metso Pressure dropping (about 5 psi lower than set point)  
00:36 FBLBs→70%  
00:48 WW Pump OFF  
00:54 Stopped transferring from PAMT (23.1%) to PAHT (75.8%)  
01:09 C5 Pump ON @ 75%  
01:15 C5 Pump OFF  
01:22 Began UV Add→Prop 2B. Target= 25 gallons= 25.3% Level  
01:29 Paused UV Add→Prop 2B  
01:39 Resuming UV→Prop 2B Addition  
01:40 Paused UV→Prop 2B Addition  
02:13 Prop 2B AG ON @ 25% and OFF  
02:17 C5 Pump ON @ 50%. First few seconds to floor  
02:19 C5 Pum→Prop 2B started. Target=40.8% Level  
02:21 Prop 2B AG ON and OFF  
02:23 Prop 2B AG On @ 100% (Mixing in Antifoam now) and OFF  
02:26 Paused C5→Prop 2B  
02:27 C5 Pump→25%, Resuming C5→Prop 2B  
02:30 C5 Pump OFF  
02:32 C5 Pump ON @ 25%  
02:33 C5 Pump OFF. Final Level=41.6%. Prop 2B AG ON @ 100%

## 2015-04-22

17:09 Back in Recirc, Temp and pH OFF, nutrients in  
17:11 t=12hr Prop 3B Sample Taken  
(L) 64.4%; pH=6.35; (T) 98.6°F; 0.77 psi  
23:11 t=12hr pHA Sample Taken  
(L) 35.4%; pH=5.41; (T) 115.0°F; 1.95 psi  
18:05 0 Growth in 3B between 6hr and 12hr  
18:07 t=30hr Liq Sample Taken  
(L) ???%; pH=5.45; (T) 121.9°F; 1.70 psi  
18:45 Stopped pHA, T&pH ON  
19:10 Back in Recirc, Temp and pH OFF  
*Shift Change*  
20:52 pAP OFF; pHAT pHC and TC ON  
20:57 AAP#3 ON (got switched off fully at some point)  
21:01 LP→2.0 GPM  
21:05 pAP ON @ 6.5 GPM  
pHAT→Prop 3B  
Adding nutrients to Prop 3B. Target Level=74.5%  
21:09 LP→3.0 GPM  
21:15 Prop 3B @ 74.6%  
pHAT→LT.  
pHAT pHC and TC OFF  
21:16 pAP→4.0 GPM; LP→3.5 GPM  
21:26 pAP→3.5 GPM

22:48 pAP OFF; pHAT pH and TC ON; LP→2.5 GPM  
22:52 LP→2.0 GPM  
22:58 LP→2.5 GPM  
23:00 LP→3.0 GPM  
23:02 pAP ON @ 7.0 GPM  
pHAT→Prop 3B  
Target= 79.2% (800 gallons)  
LP→4.0 GPM→4.5 GPM  
23:08 Finished adding→Prop 3B  
23:09 LP→3.0 GPM; pHAT pH and TC OFF.  
Emptying pHAT→Liq  
23:11 t=18hr Prop 3B Sample Taken; 0.5 ACFM  
(L) 77.7%; pH=6.34; (T) 98.4°F; 1.57 psi  
Prop 3B airflow now set @ 1.1 ACFM  
23:23 pHAT AG, pAP, and LP OFF  
23:27 Rinsing out various pHAT, Liq Tank transfer lines  
23:41 LT TC OFF

#### 2015-04-23

00:28 LTAG OFF  
02:35 WW Pump ON @ 52.5%  
03:31 GP ON @ 30%  
04:05 GP OFF, Rinse CIP of pHAT and Liq Tank lines  
04:18 Began Rinse CIP of Liq Tank through sprayballs for 15 minutes  
Rinse Pump→85%  
04:25 RevScr ON and OFF and ON, going→Liq Tank  
04:29 Paused Rinse CIP of Liq Tank. RevScr OFF  
04:32 Refilling and reheating Rinse Tank  
WW pH=7.89 Cond=2.89 mS/cm Level=71.6%  
04:53 Heating up WW pick heater. Sending out @ 75.4% Level and Flow~33 GPM  
05:02 t=24hr Prop 3B Sample Taken; 1.0 ACFM  
(L) 77.7%; pH=6.34; (T) 98.4°F; 1.57 psi  
05:19 t=24hr Prop 3B [Ethol]=0.3 g/L  
06:15 BBP#8→20%  
06:31 Resuming Liq Rinse CIP. Rinse Pump→85%  
06:34 Finished Rinse CIP of Liq Tank. Rinse Pump→55%  
06:37 Began Rinse CIP of pHAT through sprayballs for 15 minutes  
Rinse Pump→85%  
06:52 Finished Rinse CIP of pHAT. Rinse Pump→55%  
06:57 Flipping CIP Header to Caustic.  
07:07 Doing various transfer lines for Liq Tank and pHAT  
07:31 Hearing strange sounds from plant. Field claims "sounds like exploding pipes"  
Later, were found to be rocks and such in the lines.

#### Shift Change

08:33 WW done  
08:35 Caustic to Liq first sprayball  
09:02 Draining Cooling  
09:03 Caustic to pH sprayball

09:53 Flipping Header→UV  
10:04 UV of transfer lines  
11:40 t=30hr Prop 3B Sample Taken  
(L) 77.5%; pH=6.32; (T) 98.5°F; 2.12 psi  
EtOH=0.57 g/L  
12:48 UV sprayball#1 pHA  
13:17 pHA UV done, steam/base popped  
13:20 Decanter AG ON  
15:58 Decanter Pump ON @ 30%, feeding Decanter  
16:29 Decanter Pump ON @ 35%, try to flatline level (56.4% now)  
17:00 t=36hr Prop 3B Sample Taken  
(L) 78.9%; pH=6.32; (T) 98.6°F; 2.07 psi  
EtOH=0.7 g/L  
18:38 WW in Recirc, 56.1%, ~51 GPM  
*Shift Change*  
20:37 WW pH=6.50; Cond==3.94 mS/cm; Level=77.1%  
20:38 Began 3-minute Addition of Caustic to WW  
20:42 Finished 3-minute Addition of Caustic to WW  
20:57 DFP faulted  
20:59 DFP might be clogged  
21:10 WW pH=6.55 @ 85.8% Level  
21:17 Began 7-minute Addition of Caustic to WW  
21:24 Finished 7-minute Addition of Caustic to WW  
21:40 WW pH=7.17; Cond==3.96 mS/cm; Level=91.4%  
21:41 Heating up WW pick heater. Sending out WW @ 91.6% Level  
Flow~33-34 GPM  
23:05 t=42hr Prop 3B Sample Taken; 1.1 ACFM  
(L) 79.0%; pH=6.32; (T) 98.7°F; 1.96 psi  
23:33 t=48hr Prop 3B [Ethol]=1.1 g/L  
23:50 BBP#8→25%

#### **2015-04-24**

00:30 Opened Prop 3B Vacuum Breaker and Maxed sparger flow  
00:40 Began Distillation Shutdown. Reflux and Rectifier Pumps and Steam OFF  
Ferm A below 16%  
01:07 Ferm A AG OFF  
02:11 DFP→60%; will be draining DFT to floor soon  
02:19 DFP OFF  
02:41 Decanter in CIP mode; WW Flow~25.5 GPM  
03:09 Ferm A Pump ON  
03:10 Ferm A Pump OFF  
03:13 Ferm A Pump ON  
04:03 Ferm A Pump OFF  
04:11 Ferm A Pump ON  
04:24 Ferm A Pump OFF  
04:45 Rinsing of Ferm A Nutrient lines, Valves OPEN  
05:10 Ferm A Pump ON  
05:13 Rinsing of Ferm A Slurry Line, valve OPEN

05:20 t=48hr Prop 3B Sample Taken; 1.7 ACFM  
(L) 78.3%; pH=6.34; (T) 98.7°F; 0.09 psi  
Lab pH=6.2  
Ferm A Pump OFF

05:23 Began Rinse CIP of Ferm A through sprayballs for 15 minutes  
Rinse Pump→85%, Ferm A Pump ON

05:39 Finished Rinse CIP of Ferm A. Rinse Pump→55%

05:42 t=48hr Prop 3B [Ethol]=1.1 g/L  
Began heating Prop 3B→140°F  
Prop 3B pH Control OFF

05:44 Ferm A Pump OFF

05:48 Refilling and heating up Rinse Tank

05:50 DFT AG OFF

06:10 UV Rinse of Ferm A Nutrient lines, Valves OPEN

06:15 Ferm A Pump ON

06:19 UV Rinse of Ferm A Slurry Line, valve OPEN

06:50 WW Pump clogging. Switching to Recirc Loop to narrow down possibilities

06:51 WW Pump in Recirc Loop now. Level @ 61.6%

06:55 Sending out WW again.

07:03 Began UV Rinse of Ferm A through sprayballs

07:35 UV Rinse of Ferm A done. Apparently still draining though.

07:39 Ferm A Pump OFF

08:02 Started Prop 3B heat-kill 3hr timer.

#### *Shift Change*

11:03 3B Kill Complete, TC OFF

11:07 CO<sub>2</sub> Scrubber Fan and Bleach Pump OFF

11:19 Draining 3B, draining Cooling Water at same time to dilute solids

12:31 Hot Water System OFF

12:34 3B AG OFF

14:38 Finished Rinse of 3B, starting 2A

15:12 Caustic of C5 3B/2A (after flip)

15:19 2A/3B vents/transfer lines

15:30 3B sprayballs  
Acid/Base/Steam

16:00 2A sprayballs  
Paused, 2A showing -0.0% but field reports a level, check fuse after cycle and going now.

16:09 2A resumed  
Acid/Base/Steam

16:40 Flipping Header to UV

16:44 Steam OFF to plant

16:51 UV cycle of 2A

17:13 2A done, starting 3B

17:45 3B Done  
Trying to blow a plug out of 3B drain, UV line was left open, draining UV tank.

18:13 UV Pump/Lamps OFF

18:32 Giving UV Tank a couple shots of water, looking like crap at the end

18:49 Turning UV Pump/Lamps back ON  
Prop 3B sparger pulled out, sonicated, and then re-installed.

## 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