

Log Book  
Campaign 06A

**2014-11-05 Prep Day**

07:50 Potable, Process, Steam, Chiller, Cooling Water ON  
07:55 UV ON  
08:20 Start SIP of 2B  
08:28 2B @ -10, heating back up  
Kevin retightened all wire lugs on Boiler  
08:40 Heating up Hot Water Tank  
08:55 2B @ 250°F, hold for 1 ½ hours  
09:06 Storage Tank now grounded  
10:27 SIP of 2B done, cooling off, air to tank  
13:13 Plan is to go 21% Hyd. (20 gallons), then Anti-foam+UV→43% (37 gallons total)  
13:30 Running C5 through loop  
13:33 Sending C5→2B, adding anti-foam  
Looks like overshoot C5, ~24%, letting set  
Level went from 14% up to 24% in a second  
Ismael said OK  
14:19 Level going crazy now, going to calculate  
Drop in C5 tank→23 gallons  
14:28 Adding UV→2B  
14:41 Stopped UV→~43, let sit to see where we end up  
Bouncing 41→45%, going with average  
15:12 Started Pump #5 for conditioning, set @ 75%  
15:26 Sending Mix Tank (26%)→Hold (43%)  
15:38 pH=8.06, shut off pump  
Taking sample from 2B for analysis because of trouble with level indicator  
15:40 Testing Metal Detector

**2014-11-06**

08:15 Starting SIP 3B  
08:23 Drawing Vacuum  
08:29 Vac Pump OFF  
PLAN FOR 3B: 200-gal Hyd. (22.6%)  
150 gal UV= Final of 36.8%  
08:49 3B @ 250°F, hold for 90 minutes  
Overnight 2B Level settled 43%-45% Range  
09:10 Steaming Nutrient Lines  
09:52 Running separate air for metal detector  
With all air on not fast enough  
10:42 SIP done on 3B, cooling down  
10:53 "Airing" nutrient Lines→Ferm C.  
13:51 Starting SIP of Liq  
14:03 Drawing Vacuum on Liq  
14:12 Vac Pump OFF-Stea ON  
14:52 Liq @ 250°F  
15:20 Liq @ 250°F again (Field valves opened too much, restarted timer)

Running Peroxide+water from drum through TMP#2  
15:44 Sending C5→3B  
16:00 Took break from addition, lost level reading.  
16:09 Antifoam→3B (level reading 1.6%) using TMP#2  
16:16 Resumed C5→3B  
16:50 Going extra 30 min on Liq SIP, one line got cold.  
17:00 **Inoculation of Prop 2B**  
Pre: 43.2%; pH=6.73; T 98.5°F; 1.61 psi  
After: 44.7%; pH=6.63; T 99.8°F; 1.52 psi  
17:13 C5 in loop, tank~20%, going to let sit for a few  
17:15 3B Agitator ON, Level went up, let mix a while  
17:21 SIP done on Liq, steam OFF, letting cool down on its own  
17:30 C5 Pump OFF, possible plug on Recirc Line  
18:00 3B now @ 31%, climbed 11%. Not liking it  
18:29 3B annoying me [Jeff]. Stopped @ 20% and now it's continually rising. Calculation show ~190 gallons moved there, so told to wait it out  
C5 Agitator on @ 1% Level, confirmed submerged, C5 Lines from 2B & 3B backflushed with UV Water  
18:52 Adding UV→3B (Even though level off,→PER ISMAEL)  
19:05 Conditioning C5 in 3B, we know the hydrolyzate is in there, working on correct water addition.  
**Going to sample later.**  
19:27 **3B @ 8.08, pump OFF**  
19:45 **3B Sample taken for analysis, level has dropped from 37% to 30% in 25 min**  
*Shift Change*  
20:35 Beerwell pump ON →32 psi (in-line gauge)  
20:53 Start steam to pH Adjustment Tank  
When reached 5 psi, turn on Vacuum pump  
When reached -10 psi, turn off Vacuum pump and start steam again  
22:17 Reached 250°F in pH Adj. Tank  
23:22 Start decanter pump @ 20% speed

#### **2014-11-07**

00:01 Increase speed of decanter pump to 25%.  
00:05 Completed Sterilization. Connected hoses to the tank drain to sterilize.  
00:56 Stopped steam going into pH Adj. Tank  
01:00 Metal Detector now works reliably  
05:00 **Prop 2B Sample Taken**  
*Shift Change*  
08:10 Recircing/heating CIP  
08:40 **WW 4.3 pH, adding Caustic 20 min**  
08:15 **Sample pulled from 3B**  
09:00 **Sample of 2B**  
Level-43.9%; pH=6.30; T 98.5°F; 0.19 psi  
09:15 **16hr Sample 2B 3.31 g/L**  
10:04 **WW pH~5.0 adding another 10 min**  
11:15 Still LOW pH, trying calcium hydroxide?  
From Lab into Sump with decanter running hard to keep up with caustic  
NOPE, all calcs show it would take two boxes

12:20 Put Caustic Straight from Barrel into Sump  
 13:07 BW→DFT, adjusted valve going into DFT, running heater in Auto~90%  
 13:19 WW only 5.34 after all this. Tank @ 87%  
 13:53 Topping 3B off with remaining water, level settled out overnight  
 14:02 WW going out  
 14:04 Nutrients→3B  
 14:05 3B Ready, 37%  
 14:13 Conveyors/steam ON to Metso  
 14:57 Beerwell pump OFF  
 Burned up coupling.  
 15:22 Nutrients done.  
 15:30 Draining down Cooling Water Tank  
 15:37 Handling ON  
 15:42 Feeding Metso, started PSBLB @90→100%, PSF→100%  
 15:48 Sample of 2B; 6.76 g/L ~22hr  
 15:52 Inoculating 3B  
 Level-40.0%; pH=6.69; (T)98.7°F; 11.54 psi  
 16:15 Started off Great, lost PSB TC in a HURRY. Feed OFF, steam. Had PSF→130%  
 16:30 Rinsing 2B (just a rinse, going to focus on Metso)  
 16:52 Sending BW→DFT  
 17:32 Rinse Water through C5 lines into 2B  
 17:42 BW Pump OFF (Looks like flow stopped, temp went up)  
 Sprayball Rinse 2B  
 18:00 BW pumping again  
 18:10 Flipping header to Caustic through 2B Sprayballs  
 Plan is to restart with PSBLB @ 80% and SLOWLY walk up.  
 Chute/TC were totally plugged with PSF @ 130%  
 18:17 Caustic of C5 Line into 2B  
 18:28 Finishing Caustic Cycle of 2B.  
 Someone @ sightglass because level is stuck @ 19%  
 18:31 Stopped BW→DFT. DFT-85.7% BW-33.7%  
 Goal is BW below 30%  
 18:47 Feeding Metso.  
 Steam blew past Blow-Back Damper ~ 58 psi, decision was to push biomass in and form plug.  
 PSBLB→80; PSF→100%  
 18:59 Starting UV Cycle of 2B  
 19:12 PSBLB→85%  
 Big slug through system because of untreated (low temp/press) feed  
 19:30 I [Jeff] made the call to stop  
 Same thing was happening. It was [coming in big clumps]  
*Shift Change*  
 19:42 Knifegate and C5 Discharger Overrides ON; Depressurizing Metso @ 17 psi  
 19:58 Venting some pressure from Liq Tank  
 20:02 Steam ON to Metso and PSB  
 20:05 All Metso Overrides OFF  
 20:20 pH probe 'B' 'A' put into Liq Tank  
 20:26 Metso T&P flatlining @ 296°F and 48 psi respectively  
 Having some minor issues with Metso Boiler apparently

Getting ODD bumps in PSF current too-Probably Biomass

20:51 Metso @ 107 psi, PSB LBs ON @ 70%; Feeding Metso

20:53 PSB LBs→60%; Compromise!

20:56 PSF→95→90%

21:00 FBLBs ON @ 80→50%

Leaking steam from Bottom Knifegate

21:03 Metso T&P bouncing back now; FBLBs→75%

21:14 Liq Tank Temp Control→'Normal'→Auto @ 150°F Set Point

21:15 Liq Tank Temp Control→SIP

PSB TC Backplate OFF and OPEN

21:16 Work being done on Liq Tank Jacket lines

PSF→87%

21:19 FBLBs→85%

21:22 FBLBs→100%; PSF→85%

21:24 Metso at Temp and Pressure!

Prop 3B pH Control ON @6.42SP; Base B Pump#8 @ 45%

Liq Tank Temp Control→"Normal" in Auto

21:25 Began adding UV Water to Liq Tank (Target Level=24.9%)

Stepping Metso SV down manually

Consider adding NEW Campaign procedure of emptying PSB at the end

21:30 FBLBs→90%

Metso Settings

Temp=185°C~365°F; Press~150 psi(A)

FBLBs=90%(MAN); PSF=85%(MAN)

CV#1&2=100%(MAN); Acid~4.00 GPH (CAS)

Screw Press=5.0 RPMs; PSB LBs=60%(MAN)

PreSteamBin=72%(A) & 110°F (A)

21:33 Hot Water Heater set @ 185°F

21:36 Liq Tank Agitator ON

21:40 Stopped UV Addition to Liq Tank from bottom. Adding last% via UV water line

21:44 PSB LBs→65%; Acid→4.33 GPH

21:47 FBLBs→35%

21:54 FBLBs→20%

22:03 PSB LBs→70%; Acid→4.67 GPH

Adding steam into Ferm C jacket

22:05 FBLBs→40%

22:08 Noticeably more biomass coming out of PSB TC chute

Not enough to be concerned at this time

PSF→88%

22:11 FBLBs→65%

22:19 FBLBs→80%

22:20 PSB LBs→75%

22:23 FBLBs→100%

22:27 Ferm C Sparger Valves CLOSED

Jacket Pressure for any tank during SIP should 15 psi

22:29 Prop 3B pH SP @ 6.37; Base B Pump#8 running GOOD

Ferm C SV→15%→Auto; Began SIP Procedures on Fermentor C

22:34 PSF→85%

22:37 PSF→82%  
 Ferm C @ +5 psi; SV CLOSED; Vac Pump ON  
 22:42 FBLBs→90%  
 22:46 PSF→78→74%; FBLBs→80%  
 22:52 All Liq Tank Transfer Lines are set  
 Liq Tank Temp Control set @ 122°F  
 22:54 PSB LBs→80%; Acid→5.33 GPH; FBLBs→65%  
 22:58 FBLBs→40%; Might be having a slight stacking starting in PSB TC  
 23:00 PSF→70%  
 Most biomass coming out of chute so far  
 23:02 LOTS of PSF numbers due to bridging in PSB TC  
 23:03 PSB LBs→75%; Acid→5.00 GPH  
 23:05 PSF→80→75%  
 23:06 PSB LBs→70%; Hopefully will help clear out PSB TC  
 Need to include how PSB LBs adjust should be done for Pretreatment SOP  
 23:08 PSB LBs→65%; PSF→75% (all over the place really)  
 23:11 Vacuum Pump OFF; Ferm C SV→15%→Auto  
 23:20 to 23:26 Speeding PSF up to 80%  
 23:29 PSB LBs→60%; Still trying to get TC to settle out  
 REALLY compacted right now according to Joe  
 23:31 PSB LBs to PSF, Metso Steam, and FBLBs OFF  
 23:36 C5 Discharger Override ON  
 23:38 Opening up Ferm C Steam to Transfer Lines  
 Ferm C @ 250.0°F. Hold for minimum of 90 minutes  
 23:44 PSF ON @ 100%  
 23:47 Both Knifegates OPEN; PSF OFF  
 Since May of 2014 when we got back the Plug Screw  
 We have more than doubled the run-time for the Plug Screw. Strange but interesting.

#### 2014-11-08

00:04 Knifegate cycle started; Overrides OFF  
 00:05 PSB TC ON and OFF. BAD Squealing  
 00:06 WW Pump OFF. Flushed Pump and Tank Valve CLOSED  
 00:07 PSB TC ON and OFF. Much better this time  
 Metso Steam ON  
 00:14 CIP Systems OFF; DFT @ 17% level; Mental FYI  
 00:19 All Metso Vents CLOSED  
 00:40 PSF (100%) and PSB TC ON  
 00:42 PSB SV→CAS (and ON)  
 00:52 DFP OFF  
 00:58 Bottom Knifegate or PSF at Blowback Damper leaking  
 Feeding Metso; PSB LBs ON @ 60%. Feeding at 70 psi!  
 FBLBs ON @ 40%  
 01:02 PSF→90%; FBLBs→CAS  
 01:10 Finished Ferm C SIP  
 And back to +10% for Vacuum Breaker Sterilization  
 Will run another 30 minutes  
 01:13 PSB TC chute gap "Looks good" according to Joe

01:16 "Good Flow of Biomass" from chute under Screw Press  
Top (Knifegate) Valve a bit sluggish for a moment

01:21 PSF→86%

01:30 PSF→82%

01:37 At Temp and Pressure in Metso  
All settings same as earlier except PSF @ 82% and FBLBs→100% (CAS)  
Temp=185°C~365°F; Press~150 psi(A)  
FBLBs=100%(CAS); PSF=82%(MAN)  
CV#1&2=100%(MAN); Acid~4.00 GPH (CAS)  
Screw Press=5.0 RPMs; PSB LBs=60%(MAN)  
PreSteamBin=72%(A) & 110°F (A)

01:47 PSF→78%

01:53 PSF→74%

02:06 PSB LBs→65%; Acid→4.33 GPH

02:14 Ended Ferm C SIP for good now. SV CLOSED

02:38 PSB LBs→70%; Acid→4.67 GPH; FBLBs→45%

02:39 PSF→78%

02:43 CLOSED drain on Cooling Water Tank. Had been overflowing

02:46 PSF→82→74→70→80%; Issues with PSB TC  
PSB LBs→65%

02:48 PSF→85→80%; Starting a really Bad Patch  
Holy CRUD these Amps.

02:49 PSF→90→95%

02:51 PSF→100; FBLBs→85→CAS

02:52 PSF→110→95→85%

02:54 PSF→90%

We might need to just empty and clean out PreStream Bin itself

02:55 PSF→85%

02:57 FBLBs MAN @ 120%; PSF→90%

03:02 PSB LBs to PSF, Metso Steam, and FBLBs OFF  
PER ISMAEL-Shutting down to clean out  
Going to remove chute and examine it

03:19 Biomass Handling OFF

03:32 C5 Discharger and Knifegate Overrides ON; Both Knifegates OPEN

03:36 Peter blowing down boiler

03:39 Getting FALSE readings for Ferm C level

03:45 Acid Systems OFF

03:47 Steam ON to Prop 3B Sample Port

04:03 T=12hr Prop 3B Sample Taken  
(L) 39.5%; pH=6.31; (T) 98.6°F; (P) 0.03 psi

04:07 Liq Tank Temp Control OFF; draining tank to floor

04:10 Boiler OFF

04:21 Liq Tank Agitator OFF

04:27 PSB TC Chute REMOVED  
Apparently, Joe and Peter were pumping Caustic Soda into sump to raise WW pH

04:31 PSB TC ON and OFF. Loads were okay!  
PSF ON @ 100%

04:42 PSF to C5 Discharger (and Overrides) OFF

04:47 Rest of Metso, HP Seal Water Pump, and CO<sub>2</sub> Scrubber Pump OFF  
04:49 WW pH=9.9; Cond=1.42 mS/cm  
04:54 WW Pump ON; Level=64.8%  
06:32 Noticed that Metso's PSB TC spikes went crazy after between 80 and 90 minutes after reaching Temperature and Pressure settings for Metso.  
06:49 C5 Agitator ON  
07:03 Drains on Screw Press were BADLY clogged.  
Joe and Peter cleared them though.  
07:42 WW Pump OFF  
*Shift Change*  
08:51 Boiler/HP Pump ON, starting conveyors  
09:06 Handling ON/Scrubbers ON  
09:51 Feeding Metso, PSB LB-65%, PSF-100%  
10:09 Started 140°F Kill of 3B  
10:19 PSF→95%  
10:34 Metso @ Temp and Pressure  
10:41 PSBLB→70%  
11:10 PSBLB→75%, PSF→98%  
11:18 Filled two 55-gallon drums from C5 tank, dumped rest.  
Going to open and pressure-wash, introduce Caustic to it (somehow) and steam it  
11:30 3B @ 140°F  
PSBLB→80%  
11:36 PSBLB→85%  
11:41 PSBLB→90%  
Changed PSB Level to 80% in (A), Bin (C)  
11:50 PSBLB→95%  
11:59 Hit Rough Spot. PSB→85%. PSF→95%  
12:07 PSF→110%  
12:12 About noon, EVERYTHING Went to Hell.  
12:20 Shut OFF feed and steam to Metso.  
High spikes in TC and PSF was @ 8.0  
Lose-Lose situation. Going to do normal shutdown  
12:47 System depressurized  
13:13 WW pH=11.69  
13:27 Going to start back up and try to stay steady @ 85% PSBLB  
WW going out  
13:40 Heating up Caustic/Rinse  
13:44 BW Pump OFF  
13:50 Change of plans. Possible plug where Rinse goes to PSF, going to investigate  
14:12 Metso down, CO<sub>2</sub> Scrubber OFF  
15:55 Rinse Water→C5 Tank through Hydrolyzate header  
16:15 Transferring 3B→BW  
16:30 UV Pump ON  
16:35 Start Rinse Cycle of 3B  
Stopped Fill of C5 (25.4%)  
16:52 Chiller OFF, Cooling Water OFF, Hot Water OFF  
17:20 All but Potable/Process OFF

## 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