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**STANDARD OPERATING PROCEDURE
STAN MAYFIELD BIOREFINERY PILOT PLANT**

TITLE: CIP System

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APPROVALS: Process Change Committee

DATE:

A. Scope

This SOP describes the procedure to start up and operate the dilute caustic and rinse water heating loops of the CIP system.

B. Safety and Training Requirements

Refer to UF lab safety policies regarding equipment listed in section D below before starting any process work.

Review the location of fire extinguishers, fire blankets, safety showers, spill cleanup equipment and protective gear before beginning any process work.

During operations in the plant, the following safety gear will be utilized at all times:

- Safety Goggles
- Protective Gloves
- Hard Hat

C. Related Documents and SOPs

1. CIP Return Filter manual XXXX
2. Process Water System Operation SOP-9505
3. UV Water System Operation SOP-9555
4. Air Supply System Operation SOP-9405
5. Steam Supply System Operation SOP (SOP-9305)

D. Preparation/Materials/Equipment

1. Base Weigh Scale (WS-8302)
2. Acid Weigh Scale (WS-8301)
3. Acidic Transfer Pump (PA-8301)
4. Basic Mix Pump (PA-8302)
5. 50% Caustic Solution

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E. Detailed Procedure

E.1 Startup and Operation

1. Initial valve positions settings are given in the table below.

CIP System				
Line	Line Number	Valve	Position	Check
Acidic Transfer Pump to Dilute Caustic Tank	ACID-8301-02-CS71	8301-V-04	Closed	
		8201-V-01	Closed	
		8301-V-06	Closed	
Basic Mix Pump to Dilute Caustic Tank	NAOH-8301-03-CS71	8301-V-15	Closed	
		8201-V-02	Open	
		8201-V-03	Open	
		8301-V-09	Closed	
CIP Return Filter to Dilute Caustic Tank to Dilute Rinse Tank Drain	CIPR-8202-12-SS10	8202-V-12	Open	
	CIPR-8201-02-SS10	8201-V-04	Closed	
	CIPR-8201-03-SS10	8201-V-30	Closed	
	CIPR-8202-12-SS10	8201-V-31	Closed	
Steam to CIP Rinse Heater	SL-9302-03-CS72	8201-V-07	Open	
	Pressure Indicator	8201-V-06	Open	
	Extra valve (Drain)		Closed	
Steam to CIP Dilute Caustic Heater	SL-8201-15-CS72	8201-V-08	Open	
		8201-V-19	Closed	
	Pressure Indicator	8201-V-18	Open	
	Extra valve (Drain)		Closed	

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Cont'd CIP System				
Line	Line Number	Valve	Position	Check
CIP Dilute Caustic /Rinse Heater to Condensate Return Dilute Caustic Tank Loop	CL-8201-18-CS72	8201-V-24	Open	
	CL-8201-05-CS72	8201-V-09	Open	
	CIPS-8201-11-SS10	8201-V-10	Open	
	CIPS-8201-17-SS10	8201-V-14	Open	
	CIPS-8201-10-SS10	8201-V-05	Open	
	Drain	8201-V-11	Closed	
		8201-V-17	Closed	
		8201-V-15	Closed	
Rinse Tank Loop	CIPS-8201-12-SS10	8201-V-26	Open	
	CIPS-8201-13-SS10	8201-V-21	Open	
	CIPS-8201-08-SS10	8201-V-27	Open	
	Drain	8201-V-23	Closed	
		8201-V-25	Closed	
CIP Distribution to Liquefaction Tank to Primary Propagator 1 to Primary Propagator 2 to other Propagators to Fermenter A to Fermenter B to Fermenter C to Beer Well to Distillation to Hydrolysate Adjustment Tank	UVW-9503-V-16	8201-V-12	Closed	
	CIPS-8201-16-SS10	8201-V-20	Closed	
	CIPS-8201-09-SS10	8201-V-13	Closed	
	CIPS-8202-01-SS10	8202-V-01	Open	
	CIPS-8202-02-SS10	8202-V-02	Open	
	CIPS-8202-14-SS10	8202-V-09	Open	
		8202-V-03	Open	
	CIPS-8202-06-SS10	8202-V-04	Open	
	CIPS-8202-07-SS10	8202-V-05	Open	
	CIPS-8202-08-SS10	8202-V-06	Open	
	CIPS-8202-10-SS10	8202-V-07	Open	
	CIPS-8202-11-SS10	8202-V-08	Open	
	CIPS-8202-18-SS10	8202-V-10	Open	

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Line	Line Number	Valve	Position	Check
CIP return to CIP Return Filter	CIPR-8202019-SS10	8202-V-16	Open	
	CIPR-3201-10-SS10	8202-V-17	Open	
	CIPR-2301-19-SS10	8202-V-18	Open	
	CIPR-3205-23-SS10	8202-V-19	Open	
	CIPR-3206-23-SS10	8202-V-20	Open	
	CIPR-3207-23-SS10	8202-V-21	Open	
	CIPR-4601-10-SS10	8202-V-22	Open	
	CIPR-4606-01-SS10	8202-V-23	Open	
	CIPR-2303-08-SS10	8202-V-24	Open	
	CIPR-8202-17-SS10	8202-V-13	Open	
		8202-V-15	Open	
	Drain	8202-V-14	Close	
CIP Filter Drain		8202-V-27	Open	
Process Water to CIP Return Filter Level Indicator	RCW-9501-34-SS10	8202-V-11	Open	
		8201-V-28	Open	
		8201-V-29	Open	

E.1.1 Rinse Tank Set Up

1. Assure the process water is ready according to the Process Water System Operation SOP-9505.
2. Assure that the steam system is ready according to SOP-9305.
3. Assure that the air system is ready according to SOP-9405.
4. If the tank level is below 80%,
 - a. At the HMI, set the Rinse Tank (TS-8203) level at 85% in LIC-8203-03.
 - b. At the HMI, turn the level control LIC-8203-03 to AUTO. Water will begin flowing into the tank.
 - c. Once the liquid level has reached 20%, at the HMI, turn on the Rinse Tank Agitator (AG-8203). The agitators can only start when the tank levels have exceeded 15%.
 - d. At HMI, monitor the Rinse Tank level in LIC-8203-03. The level indicator has the following alarms and interlocks.
 - i. On High Level (85%) an alarm will be activated only.

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- ii. On Low Level (10% full) an alarm will be activated, the Rinse Tank Agitator (AG-8203) and the CIP Rinse Pump (PC-8203) will be shut down. The agitator can only restart once the level has exceeded 15%.
5. Once the liquid level is >20%, at the HMI, start the Rinse Tank pump (PC-8203) to circulate rinse water through the heat exchanger.
- 6.

CAUTION: High steam pressure and temperature

7. Assure the steam pressure is 60 PSI on PI-8203-04.
8. Slowly open valve 8201-V-19 to supply steam to Rinse Tank Heat Exchanger.
9. At the HMI, set the temperature control to 180 °F in TIC-8203-01 and set to AUTO.
10. Once the temperature reaches 180 °F, the rinse tank is ready for normal operation.

E.1.2 Dilute Caustic Tank Set Up

1. The Dilute Caustic Tank receives 50% NaOH (1.515 kg/L) and process water to make 4% caustic solution. The table below specifies the amount 50% NaOH and water needed to make 2730 gallons of 4% solution. Caustic solution concentrations between 3 – 5% are acceptable.

50% NaOH Gal	Water Gal	4% NaOH Gal
73.7	2683	2730
lbs	lbs	lbs
928	22272	23200

2. When needed, prepare the caustic solution as follows:
 - a. Add water by:
 - i. At the HMI, set the Dilute Caustic Tank (TS-8202) level at 50% in LIC-8202-03.
 - ii. At the HMI, turn the level control LIC-8202-03 to AUTO. Water will begin flowing into the tank.
 - b. Once the water level has reached 20%, at HMI, turn on the Caustic Tank Agitator (AG-8202). The agitators can only start when the tank levels have exceeded 15%.
 - c. Assure the base drum is placed on the Base Weigh Scale (WS-8302).
 - d. Monitor the weight change locally or at the HMI using WI-8302-01.
 - e. Using a hose connection, connect the base drum to the Basic Mix Pump (PA-8302) and the base supply line.
 - f. Assure drain valve 8301-V-09 is closed.

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- g. Open valves 8301-V-15 to open the line connecting from the base drum to the Dilute Caustic Tank.
 - h. Manually start the Basic Mix Pump by opening 8301-V-07 to transfer calculated amount of base to the Dilute Caustic Tank. The weight of 73.7 gal of 50% NaOH is 928 lbs.
 - i. Stop the Basic Mix Pump when completed by closing the air supply valve 8301-V-07.
 - j. Close the transfer line valve 8301-V-15.
 - k. At the HMI, set the Dilute Caustic Tank (TS-8202) level at 85% in LIC-8202-03 and switch the level control LIC-8202-03 to AUTO.
 - l. When the level reaches the set point, at the HMI, switch the level controller LIC-8202-03 to MANUAL.
3. At HMI, start CIP Dilute Caustic pump (PC-8202) to circulate caustic solution through the heat exchanger.
4. At HMI, monitor the Dilute Caustic Tank level in LIC-8202-03. The level indicator has the following alarms and interlocks.
 - a. On High Level (85%) an alarm will be activated only.
 - b. On Low Level (10% full) an alarm will be activated, the Dilute Caustic Tank Agitator (AG-8202) and the Dilute Caustic Tank Pump (PC-8202) will be shut down. The agitator can only restart once the level has exceeded 15%.

CAUTION: High steam pressure and temperature

5. Assure the steam pressure is 60 PSI on PI-8202-04.
6. Slowly open valve 8201-V-07 to supply steam to Caustic Tank Heat Exchanger (HP-8202).
7. Once the temperature reaches 180 °F, the caustic tank is ready for normal operation.

E.2 Shutdown

1. At HMI, turn off the CIP Dilute Caustic Pump (PC-8202) and the CIP Rinse Pump (PC-8203).
2. Close Steam Valve 8201-V-19 for the Rinse water heat exchanger.
3. Close Steam Valve 8201-V-07 for the Dilute Caustic heat exchanger.
4. At the HMI, turn off controllers:
 - a. Switch Temperature controllers (TIC 8202-01, and 8203-01) to MANUAL and set output value to -5.
 - b. Switch Level Controllers (LIC-8202-03 and 8203-03) to MANUAL and set output value to -5.
 - c. Turn off agitation in both tanks (AG-8202 and AG-8203)