STANDARD OPERATING PROCEDURE
STAN MAYFIELD BIOREFINERY PILOT PLANT

TITLE: Compressed Air system

AUTHOR: Troy Tian **DATE: December 3rd, 2011**

APPROVALS: Process Change Committee **DATE**

A. Scope

This SOP describes the procedure to operate the Compressed Air System (PID-9401) and Sterile Air System (PID-9402) in order to provide air for use in plant instrumentation and processes.

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 or Face Shield
- Protective Gloves
- Hard Hat

C. Related Documents and SOPs

1. Compressed Air Package manual XXXX
2. Phosphoric Acid System SOP-8110
3. Base B System Operation SOP-8565
4. Hydrolysate pH Adjustment SOP-XXXX
5. Antifoam System Operation SOP-8310
6. Biomass Pretreatment SOP-2110
7. Biomass Liquefaction SOP-2305
8. Steam Supply System Operation SOP-9305
9. Fermentation Tank A SOP-3230
10. Fermentation Tank B SOP-3235
11. Fermentation Tank C SOP-3240
12. Primary Propagator 2A SOP-3210
13. Primary Propagator 2B SOP-3215
14. Secondary Propagator 3A SOP-3220
15. Secondary Propagator 3B SOP-3225

TITLE: Compressed Air system

D. Preparation/Materials/Equipment

1. Air Compressor 1 (AC-9401A)
2. Air Compressor 2 (AC-9401B)
3. Air Receiver 1 (VS-9401)
4. Coalescing Filter A (FL-9401A)
5. Coalescing Filter B (FL-940X)
6. Instrument Air Dryer (DR-9401)
7. Particulate Filter (FL-9401B)
8. Sterilizing Filter (FL-9403)
9. Steam Filter (FL-9405)

E. Detailed Procedure

E.1 Startup Procedure

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

Air Supply System				
Line	Line Number	Valve	Position	Check
Air to Air Receiver 1	AP-9401-XX-CS95	9401-V-02	Close	
	AP-9401-XX-CS95	9401-V-04	Close	
Air to Particulate Filter	AP-9401-XX-CS95	9401-V-05	Close	

STANDARD OPERATING PROCEDURE
STAN MAYFIELD BIOREFINERY PILOT PLANT

TITLE: Compressed Air system

Air Supply System				
Line	Line Number	Valve	Position	Check
Filtered Air to Downstream Process				
to Instrument	AP-9401-03-SS10	9401-V-10	~~Close~~	
to Hydrolyzer	AP-9401-18-SS10	9401-V-14	~~Close~~	
to Sterlizing Filter	AP-9401-17-SS10			
		9402-V-04	Close	
	Pressure Indicator	9402-V-05	Open	
	Drain	9402-V-11	Close	
Air to Downstream Process	AP-9401-01-CS95	9401-V-15	~~Close~~	
to H_3PO_4 Transfer Pump	AP-8101-08-CS95	9401-V-16	~~Close~~	
to Acidic Transfer Pump	AP-8301-07-CS95	~~9401-V-18~~	Close	
to Basic Mix Pump	AP-8301-08-CS95	9401-V-20	~~Close~~	
to Antifoam Pump	AP-8302-01-CS95	9401-V-19	~~Close~~	
Sterile Air to Downstream Process	AF-9402-01-SS10	9402-V-09	Close	
	Pressure Indicator	9402-V-08	Open	
	Steam Trap	9402-V-10	Open	
to Fermenter C	AF-9402-02-SS10	9402-V-24	~~Close~~	
to pH Adjustment Tank	AF-9402-17-SS10	9402-V-25	~~Close~~	
to Fermenter B	AF-9402-03-SS10	9402-V-26	~~Close~~	
to Fermenter A	AF-9402-04-SS10	9402-V-27	~~Close~~	
to Liquefaction Tank	AF-9402-16-SS10	9402-V-28	~~Close~~	
to Propagator 2B	AF-9402-14-SS10	9402-V-29	~~Close~~	
~~to Propagator 1B~~	~~AF-9402-13-SS10~~	~~9402-V-30~~	~~Close~~	
to Propagator 3A	AF-9402-08-SS10	9402-V-32	~~Close~~	
to Propagator 2A	AF-9402-09-SS10	9402-V-34	~~Close~~	
~~to Propagator 1A~~	~~AF-9402-10-SS10~~	~~9402-V-36~~	~~Close~~	
to Propagator 3B	AF-9402-11-SS10	9402-V-37	~~Close~~	
Spare Valve		9402-V-23	Close	
		9402-V-31	Close	
		9402-V-33	Close	
		9402-V-35	Close	

STANDARD OPERATING PROCEDURE
STAN MAYFIELD BIOREFINERY PILOT PLANT

TITLE: Compressed Air system

Air Supply System				
Line	Line Number	Valve	Position	Check
60 PSI Steam to Steam Filter	SL-9302-20-CS72			
		9402-V-17	Close	
	Pressure Indicator	9402-V-16	Open	
	Drain	9402-V-39	Close	
Drain		9401-V-21	Close	
		9402-V-39	Close	
Pressure Indicator		9401-V-22	Open	

2. Open valves 9401-V-02, -04 to open the air lines to the Air Receiver (VS-9401).
3. Locally, turn on the Air Compressor 1 (AC-9401 A) and the Air Compressor 2 (AC-9401 B) to fill the Air Receiver 1 (VS-9401).
   a. ~~Locally monitor the Air Receiver pressure in PI-9401-03 to be xxx.~~
4. ~~Open valve 9401-V-15 to supply the unfiltered air to downstream processes including air stations across the plant and diaphragm pumps.~~
5. ~~Open valves 9401-V-05 and -10 to let the air go through the first Particulate Filter (FL-9401A), the Coalescing Filter (FL-940X), the Instrument Air Dryer (DR-9401), the second Particulate Filter (FL-9401B), and provide instrument air to the plant~~.
6. Locally, monitor the pressure differential across the filters (PD-9401-05, -06, and -07).
   a. If the pressure differential exceeds the acceptable range for each filter, replace filter according to the Air Package manual (xxx).
7. The filtered air also supplies pretreatment. Refer to the respective SOP for valve operation.
8. When sterile air is needed:
   a. Open valves 9401-V-11 and 9402-V-04, -09 to let the filtered air go through the Sterilizing Filter (FL-9403).
      i. Make sure that PRV-9402-07 ~~(located between 9401-V-11 and 9401-V-12)~~ is set to 20 PSI.
   b. At HMI, monitor the pressure upstream and downstream of the Sterilizing Filter in PI-9403-01 and PI-9403-04, respectively. If the pressure difference exceeds xxx PSI, replace the filter elements according the manual.
   c. The Sterilizing Filter (FL-9403) should be sterilized using intermediate steam at least every week to make sure the filter is clean and sterile.
      i. Assure the steam supply system is ready according to the Steam Supply System Operation SOP (SOP-9305).

CAUTION: High pressure steam (60 PSI). Wear required personal protective equipment to prevent injury.

ii. Close valves 9402-V-04, and -09.
iii. Slowly open valves 9402-10, -13 to let the 60 PSI steam flow through the Sterilizing Filter (FL-9403).
iv. At HMI, monitor the pressure upstream and downstream of the Sterilizing Filter (FL-9405) in PI-9403-01 and PI-9403-04.
v. At HMI, monitor the temperature downstream of the Sterilizing Filter in TI-9403-03 to be 292 °F.
vi. Steam the filter for a total of 45 min.
vii. Close valves 9402-V-10, -13, to cut off the steam supply to the Sterilizing Filter (FL-9403).
viii. Open valves 9402-V-04, and -09 to resume the supply of sterile air.

9. The sterile air supplies air to relieve vacuum for sterile vessels and/or to sparge cultures during fermentation/propagation. Refer to the respective SOPs for valve operation.
10. ~~For short term shutdown (less than a week) of the air system,~~
    a. ~~Locally, turn off the Air Compressor 1 (AC-9401 A) and the Air Compressor 2 (AC-9401 B), and~~
    b. ~~Close valves 9401-V-10, V-11 and -15.~~
11. For ~~long term~~ shutdown of the air system,
    a. Locally, turn off the Air Compressor 1 (AC-9401 A) and the Air Compressor 2 (AC-9401 B), and
    b. Restore all valves to the initial positions according to the initial valve configuration table.