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C-A OPERATIONS PROCEDURES MANUAL

7.1.12 Compressor Room – Oil Processing System Operation

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Hand Processed Changes

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Approved: _____ *Signature on File* _____
Collider-Accelerator Department Chairman Date

F. Cullen

7.1.12 Compressor Room – Oil Processing System Operation

1. Purpose

This procedure covers the operation of the RHIC Compressor Oil Processing system. The system is designed to remove water and light molecular weight organic (hydrocarbon) impurities from synthetic compressor oil supplied by the manufacturer, particularly UCON LB-170-X. A Rosedale bag mechanical filter removes particulate matter down to 5 microns, depending on the specific bag used. We keep a variety of bag filter filtration sizes on hand. This “clean-up” of commercially supplied oil is vital to the operation of the RHIC Compressor Room helium screw compressors and, therefore, the RHIC refrigerator and cryogenic system. UCON LB-170-X is a synthetic, polyalkylene glycol based oil, manufactured by Union Carbide.

This OPM contains the following sections relating to the operation of the Compressor Oil Processing System:

| | | |
|-----------|-----|--|
| Sections: | 5.1 | Emergency Shutdown |
| | 5.2 | Oil Skid Initialization |
| | 5.3 | Oil Transfer into Processing Tank V-9102 |
| | 5.4 | Oil Processing Procedure |
| | 5.5 | Transfer of Processed Oil to Storage Tank V-9106 and Processing Shutdown |
| | 5.6 | Transfer from Storage Tank to 55 Gallon Drum |
| | 5.7 | Transfer from Storage Tank to Oil Management Skid |
| | 5.8 | System Shutdown |
| | 5.9 | Valve Tables |

2. Responsibilities

2.1 The Shift Supervisor or an Operator designated by the Shift Supervisor is responsible for conducting this procedure and completing documentation.

3. Prerequisites

3.1 Operator shall become familiar with drawing 3A995111, Oil Processing System P&ID, the physical location of components on the skid, and the skid's local control panel.

3.2 All personnel working on any electrical system or equipment in the C-AD shall be familiar with BNL [SBMS Electrical Safety](#), BNL [SBMS Lockout/Tagout \(LO/TO\)](#), [C-A-OPM 1.5, “Electrical Safety Implementation Plan”](#), [C-A-OPM 1.5.3 “Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs”](#), [C-A-OPM 2.36, “Lockout/Tagout for Control of Hazardous Energy”](#). C-AD will provide on-site/work specific training to individuals in the electrical safety aspects of their job functions and assignments.

4. Precautions

- 4.1 The Cryogenic Control Computer has no control of the Oil Processing Skid.
- 4.2 Notify the Cryogenic Control Room prior to putting the Oil Processing Skid online or offline.
- 4.3 Hearing protection shall be worn when the compressors are in operation.
- 4.4 Approved eye protection and safety shoes shall be worn at all times.

5. Procedure

5.1 Emergency Shutdown

The “Oil Processing System” ON/OFF switch, located on the control panel, is the main 120 VAC power switch for the control panel.

120 VAC Power to the control panel itself can be shut off with the circuit breaker #4 labeled: “Feed For Heater Control Box 120 VAC” in the circuit breaker box RP-1 located on the compressor room south wall near to the Oil Processing skid.

All 480 VAC power to the Oil Processing Skid can be simultaneously shut off by means of the ON/OFF switch located on the MCC-2 panel labeled: “480 Volts Feeds Oil Processing Skid,” located on the south wall of the compressor room next to the oil skid.

480 VAC Power to the following oil skid components can be shut off, on an individual basis, at the sub-panel, located just to the left of the control panel:

| <u>Safety Switch</u> | <u>Description</u> |
|----------------------|--------------------|
| S-9105 | Vacuum Pump |
| S-9101 | Processing Pump |
| S-9107 | Transfer Pump |
| SHTR | Tank Heaters |

5.2 Oil Skid Initialization

The objective of this section is to configure the Oil Skid into a “ready state” to receive unprocessed oil. If it is suspected that the Oil Storage Tank has been exposed to air, drain the tank through valve HV-9122. This oil can be reprocessed and used. If air was introduced into the Processing Tank, any oil in this tank may simply be reprocessed.

- _____ 5.2.1 Ensure the following sub-panel three position switches (located to left of control panel) are in the “OFF” position:
 - _____ K9105 (Vacuum Pump)
 - _____ K9107 (Transfer Pump)
 - _____ K9101 (Process Pump)

- _____ 5.2.2 Ensure that the MCC-2 “480 Volts Feeds Oil Processing Skid” power switch is ON. The MCC-2 is located on the compressor room south wall next to the Oil Processing Skid.

- _____ 5.2.3 Ensure that the 120 VAC circuit breaker #4 is ON. Circuit breaker panel “RP-1 Compressor Building” is located on the south wall next to the Oil Processing Skid. The circuit breaker is labeled: “Processing Skid.”

- _____ 5.2.4 Ensure the following safety switches located on the sub-panel are in the “ON” position:
 - _____ S9105 (Vacuum Pump)
 - _____ S9107 (Transfer Pump)
 - _____ S9101 (Process Pump)
 - _____ SHTR (Both Tank Heaters)

- _____ 5.2.5 Place “OIL PROCESS SYSTEM” switch located on the control panel to the “ON” position.

- _____ 5.2.6 Ensure the following valves are closed:

| | |
|--------------|--------------------------------------|
| HV-9111_____ | HV-9115_____ |
| HV-9103_____ | HV-9132_____ |
| HV-9113_____ | HV-9133_____ |
| HV-9117_____ | HV-9108_____ |
| HV-9122_____ | HV-9107_____ |
| NV-9119_____ | HV-9120_____ |
| HV-9116_____ | HV-9125_____ |
| HV-9124_____ | HV-9106_____ |
| HV-9101_____ | HV-9109_____ |
| HV-9102_____ | HV-9110_____ |
| HV-9104_____ | RV-9105_____ (on Control Panel) |
| HV-9131_____ | SOL-9104_____ (on Control Panel) |
| HV-9112_____ | E2104M_____ (to Oil Recovery System) |
| HV-9114_____ | |

_____ 5.2.7 Ensure the following valves are open:

| | |
|---------------|---------------|
| HV-9118 _____ | HV-9128 _____ |
| HV-9121 _____ | HV-9129 _____ |
| HV-9123 _____ | HV-9130 _____ |
| HV-9127 _____ | HV-9126 _____ |

Note 1:

The two oil pumps and the vacuum pump can be started/stopped from the sub-panel or locally. If the three-position switch on the sub-panel is placed in "Hand," the pump will start. If the three-position switch is placed in "Auto," control goes to the local switch. The pump will act in accordance with the last position of the local switch. If the last position was "OFF," the pump will stay off until the local switch is actuated. If the last position was "ON," the pump will start and continue to run until the local switch is actuated. Placing the three-position switch to "OFF" will stop the pump regardless of the position of the local switch.

Note 2:

As controls are presently wired, vacuum pump should be run from "Auto" on the three-position switch. Valve RV-9105 does not open if pump is operated in "Hand."

_____ 5.2.8 Start vacuum pump P-9105 _____ and check pump oil level _____.

_____ 5.2.9 When vacuum reading at PI-9105 (channel 2) is 0.1 mBar (75 millitorr) or less, open valve RV-9105.

_____ 5.2.10 If evacuating the system and the storage tank, open the following valves:

| | |
|---------------|---------------|
| HV-9106 _____ | HV-9115 _____ |
| HV-9112 _____ | HV-9107 _____ |
| HV-9131 _____ | HV-9108 _____ |

_____ 5.2.11 If evacuating the system without the storage tank, open the following valves:

HV-9106_____

HV-9112_____

HV-9131_____

_____ 5.2.12 When PI-9102 (channel 3) reads less than 0.15 mBar (115 millitorr), close valve RV-9105 (this pump down is to evacuate the system and as a leak check).

_____ 5.2.13 Using needle valve NV-9119, pressurize system and Processing Tank to 3 psig (1.2 Bar) as read on PI-9102.

_____ 5.2.14 Open storage tank helium supply valve HV-9120.

_____ 5.2.15 Set helium supply regulator PCV-9106 to approximately 7.5 psig (1.6 Bar).

_____ 5.2.16 Adjust storage tank back pressure regulator PCV-9105 to maintain 7 psig (1.5 Bar) in storage tank.

_____ 5.2.17 Back off regulator PCV-9106 and vent storage tank to approximately 4 psig (1.3 Bar) through valve HV-9125.

_____ 5.2.18 Adjust regulator PCV-9106 to maintain storage tank pressure at 5 psig (1.4 Bar).

_____ 5.2.19 Ensure closed the following valves:

HV-9112_____

HV-9107_____

HV-9114_____

HV-9108_____

HV-9131_____

1.9101 Transfer of Oil to be Processed From Drum to Tank V-9102

Note:

Processing tank V-9102 is designed to process 110 gallons per batch. Adding more than 110 gallons will cause the efficiency of the system to drop.

- _____ 5.3.1 Place transfer hose at valve HV-9101 over drum opening and open valve HV-9101.
- _____ 5.3.2 Purge the hose, using valve HV-9112 and ensure HV-9112 is closed.
- _____ 5.3.3 Place transfer hose into drum.
- _____ 5.3.4 Ensure the following valves are open:
HV-9102_____, HV-9104_____, HV-9106_____
- _____ 5.3.5 Start process pump P-9101.
- _____ 5.3.6 Monitor tank pressure while filling. Do not exceed 8 psig (1.6 Bar), vent through valve HV-9111, as necessary.
- _____ 5.3.7 When first drum is empty, stop pump P-9101_____ and close valve HV9101_____.
- _____ 5.3.8 Place transfer hose in second drum.
- _____ 5.3.9 Open valve HV-9101_____ and start pump P-9101_____.
- _____ 5.3.10 When second drum is empty, stop pump P-9101_____ and close valve HV-9101_____.
- _____ 5.3.11 Close valves HV-9104_____ and HV-9106_____.

1.9102 Oil Processing

- _____ 5.4.1 Ensure the following valves are open:
HV-9102_____
HV-9131_____
HV-9112_____
- _____ 5.4.2 Start process pump P-9101.

- _____ 5.4.3 Verify heater controller TIC-9102 is set to 250°F (120°C). Push “FUNC” button to display set point. Push “FUNC” button a second time to return to temperature display.
- _____ 5.4.4 Turn on processing tank heater (HTR-9102) (switch is located on control panel). Reset if necessary.
- _____ 5.4.5 Vent pressure from processing tank through valve HV-9111.
- _____ 5.4.6 Open vacuum valve RV-9105.
- _____ 5.4.7 Fill LN₂ cold trap by setting LN₂ switch (HV-9104) to “ON” (switch located on control panel).
- _____ 5.4.8 When cold trap vent line is frosted, open valve HV-9106.
- _____ 5.4.9 Monitor vacuum reading at PI-9102 (channel 3) and PI-9105 (channel 2) to ensure system is pumping down.
- _____ 5.4.10 After four to six hours of processing, the cold trap will need to be cleaned.
- _____ 5.4.11 Close LN₂ trap fill valve SOL-9104 by setting liquid LN₂ switch to “OFF.” [O] on AMI Model 186 Liquid Level Controller.
- _____ 5.4.12 Close valve RV-9105.
- _____ 5.4.1.3 Close valve HV-9106.
- _____ 5.4.14 Pressurize processing tank to 3 psig (1.2 Bar) through valve NV-9119, as read on PI9102.
- _____ 5.4.15 Open valves HV-9109_____ and HV-9110_____.
- _____ 5.4.16 Open vacuum pump gas ballast valve.
- _____ 5.4.17 Switch on LN₂ trap external strap heaters. It takes approximately six hours to warm the trap. Switch located west of trap.

Note:
As the cold trap warms up, gases will vent through the adsorbers.
Liquid waste will collect at the bottom of the cold trap.

- _____ 5.4.18 When bottom of trap is at ambient temperature, unplug LN₂ trap external strap heaters.

- _____ 5.4.19 Open valve HV-9111 to drain liquid waste.
- _____ 5.4.20 With valve HV-9111 open, crack and then close valve HV-9106 to purge liquid waste from trap.
- _____ 5.4.21 Close valve HV-9111.
- _____ 5.4.22 Close valves HV-9109_____, HV-9110_____ and gas ballast valve_____.
- _____ 5.4.23 Open valve RV-9105 to evacuate trap.
- _____ 5.4.24 Open LN₂ trap fill valve SOL-9104.
- _____ 5.4.25 When cold trap vent line is frosted, open valve HV-9106 to resume processing.
- _____ 5.4.26 After an additional 12 to 24 hours of processing, the cold trap will need to be cleaned.
- _____ 5.4.27 Close LN₂ trap/fill valve SOL-9104 by setting liquid LN₂ switch to “OFF.”
- _____ 5.4.28 Close valve RV-9105.
- _____ 5.4.29 Pressurize processing tank to 3 psig (1.2 Bar) through valve NV-9119.
- _____ 5.4.30 Close valve HV-9106.
- _____ 5.4.31 Open valves HV-9109_____ and HV-9110_____.
- _____ 5.4.32 Open vacuum pump gas ballast valve.
- _____ 5.4.33 Plug in LN₂ trap external strap heaters. It takes approximately six hours to warm the trap.

Note:
As the cold trap warms up, gases will vent through the adsorbers.
Liquid waste will collect at the bottom of the cold trap.

- _____ 5.4.34 When bottom of trap is at ambient temperature, unplug LN₂ trap external strap heaters.
- _____ 5.4.35 Open valve HV-9111 to drain liquid waste.

- _____ 5.4.36 With valve HV-9111 open, crack and then close valve HV-9106 to purge liquid waste from trap.
- _____ 5.4.37 Close valve HV-9111.
- _____ 5.4.38 Close valves HV-9109_____ and HV-9110_____ and gas ballast valve_____.
- _____ 5.4.39 Open valve RV-9105 to evacuate trap.
- _____ 5.4.40 Open LN₂ trap fill valve SOL-9104 .
- _____ 5.4.41 When cold trap vent line is frosted, open valve HV-9106 to resume processing.
- _____ 5.4.42 Continue processing until PI-9102 (channel 3) reads 0.1 mBar (75 millitorr) or less with an oil temperature of 200 – 250°F (100 – 120°C).
- _____ 5.4.43 When processing is complete, shut off processing tank heater (HTR-9102).

1.9103 Transfer of Clean Oil to Storage Tank V-9106 and Processing Shutdown

Note:
Storage tank V-9106 can hold two batches of processed oil. Capacity is 250 gallons.

- _____ 5.5.1 Close valve HV-9106_____ and LN₂ fill valve SOL-9104_____.
- _____ 5.5.2 Pressurize system to approximately 8 psig (1.6 Bar) through valve NV-9119, read pressure on PI-9102, monitor PI-9102 during transfer, and add gas as necessary to maintain approximately 3 psig (1.2 Bar).
- _____ 5.5.3 Open valve HV-9114.
- _____ 5.5.4 Close valve HV-9131.
- _____ 5.5.5 When tank V-9102 is empty (near bottom of sight glass), stop pump P-9101.
- _____ 5.5.6 Close the following valves:
 - HV-9114_____
 - HV-9112_____
 - HV-9102_____

- _____ 5.5.7 To start final cleaning of cold trap, close valve RV-9105.
- _____ 5.5.8 Open valves HV-9109_____ and HV-9110_____.
- _____ 5.5.9 Open vacuum pump gas ballast valve.
- _____ 5.5.10 Plug in LN₂ trap external strap heaters. It takes approximately six hours to warm the trap.

| |
|---|
| <p><u>Note:</u> As the cold trap warms up, gases will vent through the adsorbers. Liquid waste will collect at the bottom of the cold trap.</p> |
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- _____ 5.5.11 When bottom of trap is at ambient temperature, unplug LN₂ trap external strap heaters.
- _____ 5.5.12 Open valve HV-9111 to drain liquid waste.
- _____ 5.4.13 With valve HV-9111 open, crack and then close valve HV-9106 to purge liquid waste from trap.
- _____ 5.4.14 Close valve HV-9111.
- _____ 5.5.15 Close valves HV-9109_____, HV-9110_____ and gas ballast valve_____.
- _____ 5.5.16 Stop vacuum pump P-9105.
- _____ 5.5.17 Pressurize processing tank to 5 psig (1.4 Bar) through valve NV-9119.

5.6 Transferring Processed Oil from Storage Tank to 55 Gallon Drum

- _____ 5.6.1 Ensure storage tank heater (HTR-9106) is on (switch is located on the control panel). Reset heater, if necessary. The heater will maintain the oil at approximately 100°F (40°C) to keep its viscosity low enough for transfer (temperature is set using TIC-9106).
- _____ 5.6.2 Connect hose from valve HV-9122 to purged oil drum.
- _____ 5.6.3 Ensure pressure in tank V-9106 is approximately 5 psig (1.2 Bar).
- _____ 5.6.4 Open valve HV-9122.
- _____ 5.6.5 When drum is full, close valve HV-9122.

_____ 5.6.6 If storage tank is empty, turn off heater (HTR-9106).

5.7 Transferring Processed Oil from Oil Storage Tank to Oil Management Skid

_____ 5.7.1 Ensure storage tank heater (HTR-9106) is on (switch is located on the control panel). Reset heater, if necessary. The heater will maintain the oil at approximately 100°F (40°C) to keep its viscosity low enough for transfer (temperature is set using TIC-9106).

_____ 5.7.2 Ensure valve E2407M is open (isolation valve to oil recover line located near main compressor aftercooler).

_____ 5.7.3 Ensure path to compressor oil management skid is aligned.

_____ 5.7.4 Open valves HV-9108_____ and HV-9107_____.

_____ 5.7.5 Start transfer pump P-9107.

_____ 5.7.6 When desired amount of oil has been transferred, stop pump P-9107.

_____ 5.7.7 Close valves HV-9107_____, HV-9108_____ and E-2407M_____.

_____ 5.7.8 If empty, turn off storage tank heater (HTR-9106).

6. Documentation

6.1 The check-off lines on the procedure are for place keeping only. The procedure is not to be initialed or signed, it is not a record.

6.2 Log transfers of oil in the Oil Processing Skid log.

6.3 The Shift Supervisor shall document the completion of the procedure in the Cryogenics Control Room Log.

7. References

7.1 Drawing 3A995111, Oil Processing System P&ID

7.2 Drawing 3A995109, Helium Compressor Station P&ID

7.3 [C-A-OPM 1.5, "Electrical Safety Implementation Plan"](#).

7.4 [C-A-OPM 1.5.3 "Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs"](#).

7.5 [C-A-OPM 2.36, "Lockout/Tagout for Control of Hazardous Energy"](#).

7.6 [SBMS Electrical Safety](#).

7.7 [SBMS Lockout/Tagout \(LOTO\)](#).

8. Attachments

None