Rocky Mountain
Remediation Services, L.L.C.

FERNALD SILO 3 PROJECT

PROCESS CONTROL PLAN

RMR-0445-ENG-012-00

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REVISED PROCESS CONTROL PLAN

RD PACKAGE SECTION 2.3

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FERNALD SILO 3
PROCESS CONTROL PLAN

1.0 INTRODUCTION

1.1 Objective

The objective of this document is to provide a description of the equipment, instruments, controls, parameters, system alarms and alarm responses for the Silo 3 Project. The objective of the Silo 3 Project is to retrieve and treat 11(e)(2) by product material (cold metal oxides) from Silo 3 located at the DOE Fernald site. The Silo 3 material will be retrieved, conveyed, treated, and packaged to meet the Silo 3 Material Waste Acceptance Criteria (WAC).

1.2 Control Philosophy Summary

The Silo 3 Retrieval and Treatment Systems are continuous processes, which are controlled by Programmable Logic Controllers (PLCs). The majority Silo 3 material is sub-micron particles. The treatment system and control systems have been design to handle this sub-micron material. In general, the control philosophy for the treatment process will involve operator-initiated sequences controlled by interlocks. The Silo 3 material will be transferred from the silo to the Treatment System via a vacuum transfer system. The Silo 3 material will be ratiometrically mixed with Envirobond, a reducing agent and water in a continuous mixer. The Silo 3 material mixture will be formed into briquettes and packaged in disposal containers. The Envirobond process will allow high Silo 3 material loading resulting in overall volume reduction.

A central Programmable Logic Controller (PLC) controls the entire Treatment System. Both the Retrieval System and the Packaging System have separate control systems that communicate with the Treatment System PLC. The separate control system will allow each system to be operated separately and independently. The Treatment System PLC will monitor process parameters of all systems, and control those within the Treatment System. In addition, the Treatment System control system will record and time mark all alarms and system events.

Compliance with the Silo 3 WAC is met by proportional addition of binding agents to the Silo 3 material based upon laboratory testing and results. Statistical methods will be used to fine tune the process based on product analytical results. Silo 3 Material is fed into the mixing/ briquetting operation at a constant mass flow rate from the Silo 3 Material Feed Hoppers. The Additive Feeder will add additives at a proportional flow rate. The purpose of keeping both of these feed streams at constant flow rates is to provide a constant flow rate to the briquetting operation.

Moisture content of the Silo 3 material is a critical parameter. Moisture of the material will be measured as it is fed into the process, and water added to the Processor System proportionally. The speed of the Briquetting Press, and the feed rate of the Silo 3 material to the Briquetting Press are controlled and balanced by the Treatment System PLC. The Briquetting Press has a small hopper containing a feed screw to assure that the press is fed at a controlled flow rate.

The HVAC System is designed to control the migration of airborne contaminants. Airflow is from the least potentially contaminated area to the greatest potentially contaminated area. Key pieces of equipment are ventilated to prevent migration of contaminants.

1.3 Instrumentation and Controls

1.3.1 Treatment & Packaging System Controls

The following are general statements and apply to all process equipment within the Treatment and Packaging Systems.

1. Major motor-driven equipment may have a local or Motor Control Center (MCC) mounted HAND-OFF-AUTO (HOA) switch. Placing the HOA in the HAND position will energize the associated motor until the switch is placed in the OFF or AUTO position. Placing the HOA in the AUTO position will put the motor under the control of the Human-Machine Interface (HMI) and Programmable Logic Controller (PLC) interlocks, or the control of the vendor supplied controls with PLC interlocks. The HMI will provide an indication when a given HOA is in the AUTO position.

2. Motor controlled from a starter in the MCC will have an auxiliary contact input to the PLC. The auxiliary contact will inform the operator when the motor is running. When a start motor command is given from the HMI, the closing of the auxiliary contact is timed: if it does not close within the allowed time, a motor fault alarm indication is generated on the HMI screen to alert the operator of an abnormal condition, and the start command is cleared. In the same manner, when the operator issues a stop command from the HMI, the auxiliary contact is again timed: if it does not open within the given time, a fault alarm is issued and displayed on the HMI screen.

3. When a motor is controlled from a local panel, the following controls may be included on the panel: a HAND – OFF – AUTO switch, an OFF indicator, and a RUN indicator.

4. Motors controlled by the HMI can be started from the HMI screen. All motors can be stopped or prevented from starting automatically by the PLC. The motors are started sequentially by the PLC. If any given motor is disabled, all motors in the main process stream upstream of the disabled motor will be sequentially disabled, while the motors downstream of the disabled motor will continue operating.

5. Motor Control Center (MCC) starter compartments will have a RUN indicator and an OFF indicator mounted on the starter bucket door.

6. Pneumatically operated open / close valves will have limit switches to provide status to the PLC. Isolation dampers will have limit switches to provide indication that they are closed. Control dampers will have limit switches for both the open and closed positions.

7. Variable-frequency / variable-speed drives will have an enabling contact input. When this contact is closed the motor and drive will receive a speed reference from the potentiometer on the drive panel. When this contact is open, the speed reference is

provided by a 4-20 mA analog output from the PLC and the HMI. The enabling function is usually provided by a contact output from the PLC.

8. Feed Rate Control: the feed rate for reagents and additives are set from the HMI screen in units of lbs per hour. A PLC analog output is used to transfer this value to the set point input of the variable-speed drive controlling the speed of the screw conveyor paying out the material. Adjustment of this set point is also provided on the HMI screen. All feed rates are independently set with no interlocking or algorithmic ratio balancing. This independence allows the optimal ratios of reagent and additive to be determined and adjusted as Silo 3 material characteristics change.

9. Uniform Dispensing Rate Control: when the weight or level in a material container reaches a low weight reference or container level while the material is being paid out, its set point speed will be ramped down at a linear rate. At the same time the other container of the same material speed reference will be ramped up at the same rate to the set pay out speed. This provides uniform dispensing of materials into the mixer.

10. The startup sequence will be displayed on the HMI screen by a series of bars: each bar represents one equipment item and will contain the equipment function and identification code. Status boxes / indicators are provided for the run, stop, fault, auto, and ready / enabled conditions for each motor or drive.

11. Safety limit switches, safeties, or positional reference switches will be directly interlocked with the corresponding motor control circuit. Each switch will have a separate normally open contact for use as a PLC discreet input.

12. The operator will select the throughput rate (Silo 3 material pay out rate) from the appropriate HMI screen. All other material pay out rates and timing considerations will be automatically determined from this rate by the PLC and the HMI so the plant operation is smooth and is executed without frequent temporary equipment stops and hopper level fluctuations. A security-protected HMI engineering screen will be used to adjust the algorithm that determines the various time delays and pay out rates. The operator will not have access to this engineering screen. To maintain configuration control, only authorized personnel will have the ability to make changes to this screen.

1.3.2 Retrieval System Controls

The instrumentation and controls for the Retrieval System will be provided by an outside vendor, and will be controlled by its own Retrieval System PLC. The Treatment System PLC will monitor the process parameters from the Retrieval System, but will not control it other than having the ability to shut it down under certain alarm conditions.

1.4 Key Parameters and Alarm Responses

1.4.1 Key Regulatory Parameters

The following are key regulatory parameters and the alarm responses for the Silo 3 Project. These alarms limits are process indicators or regulatory requirements and will require reporting and restart.

Tag	Function	Range	Set Point	Alarm	Response	P & ID
PT-001	Silo Pressure	-2.0 -+0.5 WG	+0.5 in. W G	High	- Interlock-take Retrieval/Conveyance System off-line - Emergency Shut-Down Sequence	2003
PT-001	Silo Pressure	-2.0 -+0.5 WG	-2.0 in. W G	Low	-Interlock-take Retrieval/Conveyance System off-line - Emergency Shut-Down Sequence	2003
YT-857	Emissions from Stack (particulate & radioactive) Particulate concentration	0-10 ug/l	2 ug/l	High	- All Systems off-line	2011
	Gas Temperature	0-150 F	45 F 100F	Low High		
	Alpha Activity	0-1000 pCi/l (Rn gas)	400 pCi/l	High		
	Gas Velocity	0-4000 fpm	2000 fpm 3000 fpm	Low High		

TBD -- Based on final vendor data

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1.4.2 Key Process Operating Parameters

The following are key process operating parameters and the alarm responses for the Silo 3 Project. These alarms are process indicators and will not require reporting and restart.

Tag	Function	Range	Set Point	Alarm	Response	P & ID
AI-153 156	Moisture Indicator – Feed 16-TK-001A/B	0-40	--	20%	Absorbent addition required: -Ensure Absorbent System available -If Absorbent System not available, take Treatment System off-line	2004
IIR-204	Mixer Current Draw 17-MX-001	TBD	TBD	High Mixture too viscous/not complete mixing	-Water addition -Monitor -If it does not clear in 7 minutes take Treatment System off-line	2005
AI-202	Moisture Indicator – Mixer 17-MX-001	15-20	--	High 21% Water addition high or Absorbent addition low	-Cross reference AI-153/156 -Verify water addition rate -Verify absorbent addition rate -Make adjustments - If condition does not clear in 7 minutes take Treatment System off-line	2005
AI-202	Moisture Indicator -- Mixer 17-MX-001	15-20	--	Low 14% Water addition low or Absorbent addition high	-Cross reference AI-153/156 -Verify water addition rate -Verify absorbent addition rate -Make adjustments - If condition does not clear in 7 minutes take Treatment System off-line	2005
FI-604	Flow of Process Water 62-PM-001	0-3 gpm	Variable	Greater than 110% of set point	-Take Treatment System off-line -Maintenance pump/filters	2006
FI-604	Flow of Process Water 62-PM-001	0-3 gpm	Variable	Less than 90% of Set Point	-Take Treatment System off-line -Maintenance pump/filters	2006

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Tag	Function	Range	Set Point	Alarm	Response	P & ID
WKIT-507	Additive Feed Rate	--	--	Greater than 110% of Set Point	-Cross reference WQIR-152/155 -Verify Silo 3 material feed rate -If condition does not clear in 7 minutes take Treatment System off-line	2015
WKIT-507	Additive Feed Rate	--	--	Less than 90% of Set Point	-Cross reference WQIR-152/155 -Verify Silo 3 material feed rate -If condition does not clear in 7 minutes take Treatment System off-line	2015
WR-303	Drum Fill Level	TBD	TBD	High Drum Overfill	-Take Packaging System off-line ~~-Clean up mess~~	2016
PI-256	Hydraulic Pressure 23-ME-001	TBD	TBD	High	-Take Treatment System off-line	2005
PI-256	Hydraulic Pressure 23-ME-001	TBD	TBD	Low	-Take Treatment System off-line	2005
PT-001	Silo Pressure	-2.0 - +0.5 WG	+0.2 WG	High	-Interlock-take Retrieval/Conveyance System off-line after 90 seconds continuous positive pressure up to +0.2 WG	2003
PT-001	Silo Pressure	-2.0 - +0.5 WG	-2.0 WG	Low	-Interlock-take Retrieval/Conveyance System off-line	2003
YT-857	Emissions from Stack (particulate & radioactive)	TBD	TBD	High	-Monitor equipment for 5 minutes, if alarm doesn't clear take the Retrieval/Conveyance System off-line	2011
WQIR-152 155	Feed Weight 16-TK-001A/B	--	--	--	-Record weight of Silo 3 material input into the Treatment System	2004

TBD – Based on final vendor data

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1.5 Start-up and Shutdown Sequences

1.5.1 Treatment Facility HVAC Start-up Sequence

Permissive Conditions: The air discharge stack instrumentation and the isokinetic monitor must be active and be sending preliminary data to the plant data management system (DMS). The Treatment Facility HVAC is depicted on P&ID 55-2011 and 55-2017.

1. Open the Plenum Manual Damper to a 50 percent open position. Use the indicator located near the damper control handle.

2. Open the Treatment Enclosure Fan Outlet Isolation Damper (71-VA-014) to the fully opened position. The green DAMPER OPEN indicator lamp (L-658) will light on the local control panel.

3. Open the Treatment Enclosure Manual Makeup Air Damper to the 15 percent open position. Use the indicator located near the damper control handle.

4. Open the Treatment Enclosure Filter Module (71-FL-001) Isolation Dampers (CV-657, CV-665) using the damper open button (HS-668) on the HMI screen. The HMI screen indicators (ZIO-657, ZIO-665) will light when the dampers are fully open.

5. Select REMOTE on the local Remote-Off-Auto (ROA) switch (HS-656) for controlling the Treatment Enclosure Filter Module (71-FL-001) Control Damper (FCV-656) from the local panel.

6. Open the Treatment Enclosure Filter Module (71-FL-001) Control Damper (CV-656) to the 30 percent open position using the local JOG OPEN button (HS-656). The control damper position (ZI-656) is displayed on the HMI screen indicator.

7. Turn the local ROA switch (HS-656) back to the AUTO position. Note: the REMOTE-OFF-AUTO switch (HS-656) located on the local panel <u>must</u> be in the AUTO position before the system can be automatically balanced.

8. Select REMOTE on the local ROA switch (HS-670) for controlling the Treatment Enclosure Inlet Control Damper (FCV-670) from the local panel.

9. Open the Treatment Enclosure Inlet Control Damper (FCV-670) to the 30 percent open position using the JOG OPEN button (HS-670) on the HMI screen. The control damper position (ZI-670) is displayed on the HMI screen indicator. Note: the REMOTE-OFF-AUTO switch (HS-670) located on the local panel <u>must</u> be in the AUTO position before the above sequence can be executed.

10. Turn the local ROA switch (HS-670) back to the AUTO position. Note: the REMOTE-OFF-AUTO switch (HS-670) located on the local panel <u>must</u> be in the AUTO position before the system can be automatically balanced.

11. Select REMOTE on the local ROA switch (HS-671) for controlling the Treatment Enclosure Airborne Radioactivity Area Inlet Control Damper (FCV-671) from the local panel.

12. Open the Treatment Enclosure Airborne Radioactivity Area Inlet Control Damper (FCV-671) to the 15 percent open position using the JOG OPEN button (HS-671) on the HMI screen. The control damper position (ZI-671) is displayed on the HMI screen indicator. Note: the REMOTE-OFF-AUTO switch (HS-671) located on the local panel must be in the AUTO position before the above sequence can be executed.

13. Turn the local ROA switch (HS-671) back to the AUTO position. Note: the REMOTE-OFF-AUTO switch (HS-671) located on the local panel must be in the AUTO position before the system can be automatically balanced.

14. Select REMOTE on the local ROA switch (HS-667) for controlling the Treatment Enclosure Fan (71-FA-001) motor from the local panel.

15. Select START FAN / LOW SPEED on the local control switch (HS-667) for controlling the Treatment Enclosure Fan (71-FA-001) motor. The fan will accelerate to its low speed.

16. Turn the local ROA switch (HS-667) back to the AUTO position. Note: the REMOTE-OFF-AUTO switch (HS-667) located on the local panel must be in the AUTO position before the dampers will automatically adjust and balance the system.

17. Check the differential pressure (PDIT-673) developed across the Treatment Enclosure Inlet Control Damper and filter (FCV-670). The differential is displayed on the HMI screen (PDIR-673). If it is too high, the flow is restricted. The damper will open automatically, lowering the differential across the damper. If the differential is too low, the flow is excessive, and the damper will close automatically, raising the differential across the damper to the correct level.

18. Check the differential pressure (PDIT-672) developed across the Treatment Enclosure Airborne Radioactivity Area Inlet Control Damper (FCV-671). The differential is displayed on the HMI screen (PDIR-672). If it is too high, the flow is restricted. The damper will open automatically, lowering the differential across the damper. If the differential is too low, the flow is excessive, and the damper will close automatically, raising the differential across the damper to the correct level.

19. Readjust the Plenum Manual Damper until the pressures in the Contamination/Controlled Area and in the Airborne Radioactivity Area are at the approximate negative drafts required.

20. Check the differential pressure (PDIT-662) developed across the Treatment Enclosure Filter Module (71-FL-001). The differential is displayed on the HMI screen (PDI-662). If it is too high, the flow is excessive, and the Treatment Enclosure Filter Module Control Damper (CV-656) will automatically close slightly until the flow is at the correct level.

21. Select HAND on the local HOA switch (HS-674) for controlling the Air Conditioning Unit (71-AC-001) and the Circulation Air Outlet Damper (CV-675). The damper will fully open and the motor will start.

22. Adjust the Treatment Enclosure Manual Makeup Air Damper so the flow is about 920 acfm.

23. Turn the local HOA switch (HS-674) back to the AUTO position.

24. Read the differential pressure developed across the Air Conditioner outlet filter (PDIT-674). The local indicator (PDI-674) should read no more than about 0.1" W.G. vacuum.

Note: After this initial startup sequence is completed, during any re-start operation, the manual damper positions should remain unchanged. The Treatment Enclosure Filter Module Control Damper is used primarily to adjust the flow to the discharge stack. The other two control dampers are used to adjust the differential pressure drops to the correct levels.

1.5.2 Off-Gas Treatment System Start-Up Sequence

Permissive Conditions: The air discharge stack instrumentation and the isokinetic monitor must be active and be sending preliminary data to the plant data management system (DMS). The Off-Gas Treatment System is depicted on P&ID 55-2009.

1. Open the Off-Gas Fan Manual Outlet Isolation Damper (75-VA-001) to the fully opened position. The green DAMPER OPEN indicator lamp (L-755) will light on the local control panel. The HMI screen will also provide an indication (ZSO-755) that this damper is open.

2. Open the primary or secondary Off-Gas Filter Module (75-FL-001A, B) Isolation Dampers (CV-763, CV-754 & CV-767, CV-756) using the damper open button (HS-764, HS-763) on the HMI screen. The HMI screen indicators (ZIO-763, ZIO-754 & ZIO-767, ZIO-756) will light when the dampers are fully open.

3. Open the silo return line isolation knife gate (CV-053) using the open button (HS-053) on the HMI screen. The knife gate open position switch (ZSO-053) <u>must</u> be actuated within a specified time to proceed with this sequence. If the open position switch is not reached within the specified time, a fault alarm is displayed on the HMI screen. The HMI screen indicators will light when the gate is fully open.

4. Jog the Retrieval Enclosure Inlet Control Damper (FCV-708) to 15 percent open position using the jog open or close buttons (HS-708) on the HMI screen. A percent open indicator bar (ZI-708) is provided on the HMI screen to monitor damper position.

5. Open the Off-Gas Inlet Control Damper (FCV-775) to the 30 percent open position using the JOG OPEN button (HS-775) on the HMI display. The control damper position (ZI-775) is displayed on the HMI screen indicator.

6. Select START FAN / LOW SPEED on the HMI display (HS-766) for controlling the Off-Gas Fan (75-FA-001) motor. The fan will accelerate to its low speed. The Off-Gas Baghouse (75-FL-002) motor will start at the same time the Off-Gas Fan starts.

7. Read the silo pressure (PIR-001) on the HMI active display. The Off-Gas Inlet Control Damper (FCV-775) will automatically attempt to position itself until the silo pressure reads approximately 0.75" W.G. vacuum.

8. Check the differential pressure (PDIT-707) developed across the Retrieval Enclosure Inlet HEPA Filter (74-FL-005) and Inlet Control Damper (FCV-708). The differential is displayed on the HMI screen (PDI-707). If it is too high, the flow is restricted. Open the Retrieval Enclosure Inlet Control Damper (FCV-708), lowering the differential across the damper. If the differential is too low, the flow is excessive. Close the Inlet Control Damper, raising the differential across the damper to the correct level. The HMI display (PDI-707) should read about 0.1" W.G. vacuum. A lower differential will display a defective filter alarm on the HMI screen. A high differential of 0.7" W.G. or greater will display a maintenance alarm (PDAH-707) to change the filter.

9. Check the differential pressure (PDIT-773, PDIT-757) developed across the primary or secondary Off-Gas Filter Module (75-FL-001A, B). The differential is displayed on the HMI screen (PDI-773, 757). If it is too high, the filter is clogged and a filter change is required. If the differential pressure across the filter module is too low, the filter is defective and must be replaced. The high differential pressure alarm (PDAH-773, PDAH-757) is displayed on the HMI screen.

Note: After the initial startup sequence is completed, during any re-start operation, the Retrieval Enclosure Inlet Control Damper will return in its final adjusted position unless changed by the operator. The Off-Gas Inlet Control Damper will modulate to control the silo and retrieval enclosure negative pressures. Terminating the off-gas operation involves stopping the fan motor. The Baghouse will shut off automatically. The Inlet Control Damper will remain in its last position. The control operator will close the Isolation Dampers on the active Off-Gas Filter Module. The Off-Gas Filter Module change over sequence starts by the control room operator opening the isolation dampers on the standby filter module first, and then closing the isolation dampers on the active module.

1.5.3 Retrieval/Conveyance Initial Start-up Sequence

Permissive Conditions: The Off-Gas Treatment System must be operational prior to executing this sequence. The Retrieval/Conveyance System is depicted on P&ID 55-2003.

1. Start Chilled Water Pump (11-PM-002) from HMI screen motor control bar. The STARTED indication button should light on the HMI screen.

2. Move retrieval nozzle to a non-retrieval position using control room retrieval arm manipulator.

3. Open both silo isolation knife gates (FCV-053, FCV-054) using the open buttons on the HMI screen. The knife gate open limit switches (ZSO-053, ZSO-054) must be open to proceed with this sequence. The HMI screen indicators (HS-053, HS-054) will light when the gates are fully open.

4. Jog the Retrieval Enclosure Inlet Control Damper (CV-708) to 15 percent open position using the jog open or close pushbutton (HS-708) on the HMI screen. A percent open indicator bar (ZI-708) is provided on the HMI screen to monitor damper position.

5. Select START on the P/D Blower (11-BL-001) motor control bar located on the HMI screen. The blower discharge isolation valve will open prior to starting the motor drive. The valve open position switch must fully open within a specified time (½ second) or the blower drive will not ramp to rated speed. The valve open position is displayed on the HMI screen. The drive will start and accelerate to its rated speed after the valve is fully opened.

6. Read the silo pressure on the HMI active display. The Retrieval Enclosure Inlet Control Damper (FCV-708) will automatically position itself until the silo pressure reads approximately 0.5" W.G. vacuum.

7. Check the Retrieval Enclosure Inlet HEPA Filter (74-FL-005) differential pressure (PDIT-707). The HMI display (PDI-707) should read about 0.1" W.G. vacuum. A lower differential will display a defective filter alarm on the HMI screen. A high differential of 0.7" W.G. or greater will display a maintenance alarm (PDAH-707) to change the filter.

8. Check the displays for the double-wall pipe breach detection. A high pressure alarm (PAH-052) is provided for the silo return pipe, and a low pressure alarm (PAL-051) is provided for the silo exit/conveyance pipe.

Note: After this startup sequence is completed, during any retrieval operation, the Retrieval Enclosure Inlet Control Damper (CV-708) will remain in its pre-retrieval position, and the Off-Gas Inlet Control Damper (CV-775) will be modulated to maintain silo pressure (vacuum).

1.5.4 Treatment System Start-Up Sequence

The Treatment System is depicted on P&ID 55-2004, 55-2005, 55-2006, and 55-2012. Permissive Conditions: The Treatment Facility ventilation system must be fully operational. The Off-Gas and Retrieval/Conveyance ventilation systems may be shut down during the operation of the Treatment and Packaging Systems. Both Silo 3 Material Feed Hoppers cannot be empty.

1. Start the Briquette Conveyor (23-CY-001) using the start button (HS-257) on the HMI screen. This conveyor will not start if a high level condition (LAH-310) is detected in the Product Surge Hopper (24-BN-001) in the Packaging System.

2. Start the Briquette Screen (23-ME-002) using the start button (HS-259) on the HMI screen. The Briquette Screen motor will not start unless the Briquette Conveyor is running.

3. Check the differential pressure (PDIT-262) developed across the Briquette Screen Vent HEPA Filter (23-FL-002). This differential pressure (PDI-262) is displayed on the HMI screen. A high differential pressure alarm (PDAH-262) is provided on the HMI screen to alert the operator of a needed filter change.

4. Start the Hydraulic Power Unit (23-ME-004) using the start button (HS-255) on the HMI screen.

5. Check the Hydraulic Power Unit (23-ME-004) outlet pressure (PT-256) on the HMI screen (PI-256) for adequate operating level. Both high and low hydraulic pressure alarms (PAH-256, PAL-256) are provided on the HMI display.

6. Adjust the speed setting (SY-253) on the HMI screen for the Briquette Screw Feeder (23-ME-003) to the required pay out level. This will automatically adjust the pay out ratio (SY-254) for the Briquetting Press (23-ME-001).

7. Start the Briquetting Press (23-ME-001) using the start button (HS-254) on the HMI screen. The Briquetting Press (23-ME-001) speed (SI-254) is displayed on the HMI screen.

8. Start the Briquette Screw Feeder (23-ME-003) using the start button (HS-253) on the HMI screen. The Briquette Screw Feeder (23-ME-003) speed (SI-253) is displayed on the HMI screen.

9. Adjust the speed setting (SY-201) on the HMI screen for the Process Mixer (17-MX-001) to the required pay out level.

10. Start the Process Mixer (17-MX-001) using the start button (HS-201) on the HMI screen. The Process Mixer (17-MX-001) speed (SI-201) is displayed on the HMI screen. Both high and low Process Mixer speed alarms (SAH-201, SAL-201) are provided on the HMI display.

11. Read the Process Mixer motor current draw (II-204) on the HMI screen. High and low current level alarms (IAH-204, IAL-204) are provided on the HMI screen.

12. Check the differential pressure (PDIT-203) developed across the Process Mixer Vent HEPA Filter (17-FL-001). This differential pressure (PDI-203) is displayed on the HMI screen. A high differential pressure alarm (PDAH-203) is provided on the HMI screen to alert the operator of a needed filter change.

13. Adjust the speed setting (SY-164) on the HMI screen for the Mixer Feed Conveyor (16-CY-003) to the required pay out level.

14. Start the Mixer Feed Conveyor (16-CY-003) using the start button (HS-164) on the HMI screen. The Mixer Feed Conveyor (16-CY-003) speed (SI-164) is displayed on the HMI screen. Both high and low Mixer Feed Conveyor speed alarms (SAH-164, SAL-164) are provided on the HMI display.

15. Adjust the speed setting (SY-252) on the HMI screen for the Fines Feed Conveyor (23-CY-003) to the required low level pay out level.

16. Start the Fines Feed Conveyor (23-CY-003) using the start button (HS-252) on the HMI screen. The Fines Feed Conveyor speed (SI-252) is displayed on the HMI screen. Note: on detecting a high level condition (LSH-252) in the Fines Hopper (23-BN-002), the speed of the Fines Feed Conveyor (23-CY-003) will be increased automatically, and the high level condition will be timed. If the level returns to normal within the specified time, the speed will return to its original setting. If, however, the high level condition is not corrected within the given amount of time, the Fines Feed Conveyor will be stopped, and the conveyor speed will remain at its increased level.

17. Check the differential pressure (PDIT-261) developed across the Fines Hopper Vent HEPA Filter (23-FL-001). This differential pressure (PDI-261) is displayed on the HMI screen. A high differential pressure alarm (PDAH-164) is provided on the HMI screen to alert the operator of a needed filter change.

18. Start the Fines Conveyor (23-CY-002) using the start button (HS-258) on the HMI screen.

19. Start the Additive Conveyor (44-CY-003) and the Flexible Additive Conveyor (44-CY-005) using the start button (HS-508) on the HMI screen. These motors will start provided a high level condition (LSH-506) does not exist in the Additive Feeder (44-CY-004).

20. Touch the HMI auto sequence bar for Additive Feed:

- Net weights are determined for both Binder Totes. The Binder Tote that weighs the most on startup is enabled for loss-in-weight operation.
- If both Binder Totes weigh the same, Binder Tote A is enabled for loss-in-weight operation.
- If both Binder Totes are empty, the sequence is terminated with a service alarm on the HMI screen to alert the operator to replace the Binder Totes.
- Net weights are determined for both Reducer Totes. The Reducer Tote that weighs the most on startup is enabled for loss-in-weight operation.
- If both Reducer Totes weigh the same, Reducer Tote A is enabled for loss-in-weight operation.
- If both Reducer Totes are empty, the sequence is terminated with a service alarm on the HMI screen to alert the operator to replace the Reducer Totes.
- Using the predetermined pay out rate (WKY-501, WKY-502) the loss-in-weight controller (WKIT-501, WKIT-502) will cause the Binder Conveyor (44-CY-001A, B) to pay out the correct amount of binder per unit time.
- Using the predetermined pay out rate (WKY-503, WKY-504) the loss-in-weight controller (WKIT-503, WKIT-504) will cause the Reducer Conveyor (44-CY-002A, B) to pay out the correct amount of reducer per unit time.
- These two streams (binder and reducer) will be fed into the Additive Conveyor (44-CY-003). The Flexible Additive Conveyor (44-CY-005) will deliver the material mixture to the Additive Feeder (44-CY-004). This process will continue until the Additive Feeder high level condition (LSH-506) disables the Additive Feed loss-in-weight controllers.

- The controllers will not be enabled again until the Additive Feeder low level condition is sensed (LSL-506).
- When an active tote is emptied (either binder or reducer), the other tote of the same material is enabled to begin loss-in-weight operation. A service alarm is issued to the operator to replace the emptied tote.

21. Start the Feed Hopper Bin Activator (16-AG-001A) using the start button (HS-169) on the HMI screen.

22. Start the Feed Hopper Bin Activator (16-AG-001B) using the start button (HS-170) on the HMI screen.

23. Touch the HMI auto sequence bar for Material Feed:

- Net weights are determined for both Silo 3 Material Feed Hoppers (16-TK-001A, B). The Silo 3 Material Feed Hopper that weighs the most on startup is enabled for loss-in-weight operation.
- If both Feed Hoppers weigh the same, Silo 3 Material Feed Hopper A (16-TK-001A) is enabled for loss-in-weight operation.
- If both Feed Hoppers are empty, the sequence is terminated with a service alarm (LAL-171) on the HMI screen to alert the operator that there is no Silo 3 material coming into the system, and to monitor the remaining treatment activities.
- If both Feed Hoppers are filled to a high level, the Retrieval/Conveyance System is taken off-line.
- When the active Feed Hopper reaches low level, the other Feed Hopper is enabled to begin loss-in-weight operation. A service alarm (LAL-151, LAL-154) is issued to the operator to begin retrieval and conveyance operations to refill the Feed Hopper.
- The loss-in-weight controller (WKIT-152, WKIT-155) will cause the Rotary Valve (16-VA-001A, B) to pay out the correct amount of Silo 3 material per unit time.
- The measured percent moisture in the material (AT-153, AT-156) and material pay out rate (WKIT-152, WKIT-155) is used by the interlock I-6 to form a ratio speed set point (SY-507) that is used to drive the Additive Feeder loss-in-weight controller (WKIT-507). Note: this controller is enabled at the same time one of the Feed Hopper loss-in-weight controllers is enabled.

24. Adjust the material pay out rate using the HMI screen set point buttons (WKY-152 or WKY-155) to match production or schedule requirements.

25. Check the differential pressure (PDIT-509) developed across the Bin Filter Vent HEPA Filter (44-FL-001). This differential pressure is displayed (PDI-509) on the HMI screen. A high differential pressure alarm (PDAH-509) is provided on the HMI screen to alert the operator of a needed filter change.

26. Check the differential pressure (PDIT-167A) developed across the Feed Hopper Inlet HEPA Filter (16-FL-001A). This differential pressure is displayed (PDI-167A) on the HMI screen. A high differential pressure alarm (PDAH-167A) is provided on the HMI screen to alert the operator of a needed filter change.

27. Check the differential pressure (PDIT-167B) developed across the Feed Hopper Inlet HEPA Filter (16-FL-001B). This differential pressure is displayed (PDI-167B) on the HMI screen. A high differential pressure alarm (PDAH-167B) is provided on the HMI screen to alert the operator of a needed filter change.

28. After the loss-in-weight controller (WKIT-152, WKIT-155) causes the Rotary Valve (16-VA-001A, B) to pay out the Silo 3 material, and after a ten (10) minute delay, the PLC will issue an enable output to the Mixer Sampler (84-PE-006).

29. The retrieval and conveyance process must be in progress in order to fill the Silo 3 Material Feed Hoppers (16-TK-001A, B). Touch the HMI auto sequence bar for Silo 3 Material Feed Hopper fill:

- If one of the Silo 3 Material Feed Hoppers (16-TK-001A, B) is currently conducting a loss-in-weight operation, then the other Feed Hopper will be selected for a filling operation. Net weights are determined for both Silo 3 Material Feed Hoppers. The Feed Hopper that weighs the most on startup is enabled for loss-in-weight operation.
- The Silo 3 Material Feed Hopper inlet feed valve (FCV-157, FCV-158) and the Feed Hopper ventilation valve (CV-168, CV-172) will be opened automatically. The HMI screen will display the valve closed condition (YI-157, YI-158) for the hopper that is currently conducting a loss-in-weight operation.
- The fill process will continue until either the Feed Hopper high level condition (LSH-151, LSH-154) is reached, or the other Feed Hopper empties (LSL-151, LSL-154). At this time the system will transfer the loss-in-weight operation to the most recently filled Silo 3 Material Feed Hopper, or the Feed Hopper with the most material in it.

30. Start the Silo 3 Material Feed Conveyor (16-CY-001) using the start button (HS-163) on the HMI screen.

31. Start the Silo 3 Material Feed Screen (16-ME-001) using the start button (HS-164) on the HMI screen.

32. Start the Filter Receiver (11-ME-001) outlet Rotary Valve (11-VA-001) motor using the start button (HS-070) on the HMI screen.

33. After the Rotary Valve (11-VA-001) is started, and after a time delay the PLC will issue an enable output to the Feed Sampler (84-PE-001). The sampler will continue its operation as long as the Rotary Valve is in operation.

1.5.5 Packaging System Start-Up Sequence

The Packaging System is depicted on P&ID 55-2016.

1. Verify that the Drum Storage Gravity Conveyor (24-CY-002) is operational.

2. Start the Drum Delidding Station (24-CY-003) conveyor using a local pushbutton (HS-301). The conveyor motor will remain running until the position switch (ZS-301) is tripped and stops the conveyor.

3. Start the Barcode Labeling Station (24-CY-004) conveyor using a local pushbutton (HS-302). The conveyor motor will remain running until the position switch (ZS-302) is tripped and stops the conveyor.

4. Start the Drum Loading & Tare Gross Weigh Station (24-CY-005) conveyor using a local pushbutton (HS-303). The conveyor motor will remain running until the position switch (ZS-303) is tripped and stops the conveyor. When the drum is in position, the loading operation begins via the Fill Bucket/Loadout Station (24-ME-005).

5. Start the Drum Lidding Station (24-CY-006) conveyor using a local pushbutton (HS-304). The conveyor motor will remain running until the position switch (ZS-304) is tripped and stops the conveyor.

6. Start the Drum Banding & Primary Smear Station (24-CY-007) conveyor using a local pushbutton (HS-305). The conveyor motor will remain running until the position switch (ZS-305) is tripped and stops the conveyor.

7. Start the Shipping Weigh Station (24-CY-008) conveyor using a local pushbutton (HS-306). The conveyor motor will remain running until the position switch (ZS-306) is tripped and stops the conveyor.

8. Start the Drum Holding & Wipe Down Station (24-CY-009) conveyor using a local pushbutton (HS-307). The conveyor motor will remain running until the position switch (ZS-307) is tripped and stops the conveyor.

9. Start the Secondary Drum Smear Station (24-CY-010) using a local pushbutton (HS-308). The conveyor motor will remain running until the position switch (ZS-308) is tripped and stops the conveyor.

10. If the drum fails the Secondary Drum Smear Station, start the Drum Wipe Down & Inspection Station (24-CY-011) conveyor using a local pushbutton (HS-311). The conveyor motor will remain running until the position switch (ZS-311) is tripped and stops the conveyor. The drum is manually swabbed. After the drum passes inspection the sequence continues.

11. If the drum passes the Secondary Drum Smear Station (24-CY-010), or the Drum Wipe Down & Inspection Station (24-CY-011), start the Drum Storage Conveyor (24-CY-012) using a local pushbutton (HS-309). The conveyor motor will remain running until the position switch (ZS-309) is tripped and stops the conveyor.

12. Start the Palletizer (24-ME-001).

13. Start the Loaded Pallet Conveyor (24-CY-013) using a local pushbutton (HS-312). The conveyor motor will remain running until the position switch (ZS-312) is tripped and stops the conveyor.

Note: The rest of the Packaging sequence (e.g., pallet banding, forklift operation) is all operated manually.

1.5.6 Reject Product System Start-Up Sequence

The Reject Product System is depicted on P&ID 55-2012.

1. The Pallet Forklift (24-ME-002) brings the full reject drum pallet to the Jib Crane (26-CN-001) at the Pallet Unloading Station in the Controlled Area.

2. The operator uses the Jib Crane (26-CN-001) controls to pick up a full drum and position it at the start / final position (ZS-405) on the Reject Drum Conveyor (26-CY-002). A reverse start (HS-426R) command drives the Jib Crane drum holder mechanism to a position over the drum located on the pallet. A hold drum (HS-426A) command causes the drum to be secured by the holding mechanism. This allows the operator to use the forward start (HS-422F) control to move the drum from the pallet.

3. The operator then starts the Reject Drum Conveyor (26-CY-002) using the forward start control (HS-406F) to position the drum under the Delidding/Lidding Station (26-ME-003). The drum is stopped by the lid removal positioning pin and the drum is sensed by the Delidding/Lidding position switch (ZS-406). This stops the Reject Drum Conveyor.

4. The control system verifies the delidding mechanism (26-ME-003) is in its upper end of travel.

5. The screw motor is started, lowering the delidding mechanism, until the lid detected switch senses the lid and stops the screw motor. The Delidding/Lidding screw lower end of travel (ZSL-420) position switch is provided to protect the equipment from damage because of over-travel. If the lower end of travel position is reached before the lid is detected, the downward motion will be stopped, and a local alarm indication (PL-420) will be produced on the local control panel to alert the operator that a lid was not detected on the drum.

6. The lid is lifted from the drum lip by starting the screw motor in reverse. This is done if the lid is detected and continues to be detected.

7. The screw motor is stopped when the upper end of travel is reached. The lid remains in this position until the Lidding operation.

8. The stop pin is disengaged and the return stop pin to be engaged. The return stop pin engaged position switch (ZSL-420) must be made. At the same time, the Drum Unloader Conveyor (26-CY-005) starts in a forward direction, positioning the drum under the delivery chute.

9. At position 1, the Drum Unloader Hoist (26-CN-002) position limit switch (ZS-412) is made, a time delay is started, the Drum Unloader Conveyor (26-CY-005) is stopped and the cylinder control solenoid (SV-414) is de-energized, stroking the cylinder to its original, retracted position.

10. After the time delay, at vertical position 1, the Drum Unloader Hoist (26-CN-002) motor brake solenoid is energized to release the brake, and the hoist motor begins lifting the drum to vertical position 2. The lifting operation continues until the drum lip and transition and feed hopper (delivery chute) face meet with the required 1000 lbs_f force. At this point, the weight / force set point transmitter (WY-416) will cause the Drum Unloader Hoist (26-CN-002) motor to be turned off and the brake to be applied by de energizing the brake solenoid. This action maintains the seal between the drum lip and the hopper face so dust does not escape from the drum into the surrounding air while it is being emptied.

11. After the brake is applied, the drum rotation motor moves the drum through an upward arc.

12. When the drum reaches a horizontal position, at vertical position 3, a photo switch (YS-411) detects its presence and the Reject Screw Conveyor (26-CY-003) is started so the briquettes in the drum will be smoothly emptied into the moving screw conveyor and emptied into the Reject Hopper (26-BN-001).

13. The drum rotation motor will continue moving the drum through an arc until the drum reaches a final position, vertical position 4, at approximately 155 degrees from the original vertical position. At this position, the drum unload position switch (ZS-407) will be made, and the drum rotation motor will stop.

14. The drum remains in this position for approximately 4 minutes to allow the Reject Screw Conveyor (26-CY-003) to empty the briquettes into the Reject Hopper (26-BN-001).

15. After the 4-minute delay, the drum rotation motor will reverse the drum rotation so the mechanism moves the drum back toward vertical position 3.

16. As the drum moves through position 3, the photo switch (YS-411) circuit is again tripped, causing the Reject Screw Conveyor (26-CY-003) to stop.

17. As the drum is returned to vertical position 2, the drum rotation position switch (ZS-416) is made, and the drum rotation motor is stopped.

18. As soon as the drum is returned to vertical position 2, the Fixative Pump motor is started, causing the spray header pressure to increase. When the pressure reaches the required level, header pressure switch (PSH-418) transfer its contacts, energizing the spray control solenoid (SV-419) and starting a timed spray operation to coat the inside surfaces of the drum.

19. After the spray time is ends, the spray control solenoid is de-energized and the fixative pressure pump is stopped.

20. The Drum Unloader Hoist (26-CN-002) motor brake solenoid (SV-414) is energized to release the brake, and the Drum Unloader Hoist is started in reverse and the drum is lowered to vertical position 1.

21. When the drum arrives at vertical position 1, the Drum Unloader Hoist (26-CN-002) position switch (ZS-412) is made for the second time, the Drum Unloader Hoist motor is stopped, and the Hoist motor brake solenoid (SV-414) is de-energized, reapplying the brake.

22. After the brake is applied, the Drum Unloader Conveyor (26-CY-005) is started in reverse and the Drum Unloader Conveyor motor lift pneumatic cylinder solenoid (SV-414) is energized. The cylinder will move to the extended (lift) position and engage the motor shaft and conveyor rollers.

23. The drum will now travel away from position 1, toward the Reject Drum Conveyor Delidding/Lidding Station position (ZS-406).

24. When a drum reaches the Delidding/Lidding Station on the Reject Drum Conveyor and the position switch (ZS-406) is made, the Drum Unloader Conveyor motor lift pneumatic cylinder solenoid (SV-414) is de energized. The cylinder will move to the retracted position and disengage the motor shaft and conveyor rollers. The Drum Unloader Conveyor motor will stop.

25. The drum will be stopped on the Reject Drum Conveyor (26-CY-002) by the return pin and will be positioned under the Delidding/Lidding Station (26-ME-003). As soon as the position switch (ZS-406) is made, the Reject Drum Conveyor will be shut off.

26. The control system verifies the Lidding mechanism (26-ME-003) is in its upper end of travel.

27. The screw motor is started, lowering the Lidding mechanism, until the lid is replaced on the drum, and the Delidding/Lidding screw lower end of travel position switch (ZSL-420) is reached. The lid is released and the screw motor rotation is reversed. The lid detection switch will clear when the switch no longer senses the lid. The screw motor will drive the lid holder to its upper end of travel, and then the motor will stop.

28. At this point, control is returned to the operator. The operator starts the Reject Drum Conveyor (26-CY-002) using the reverse start (HS-406R) control to drive the drum to the end of the conveyor until the position switch (ZS-405) is made. At the same time the conveyor is started, the return pin is disengaged, and the removal position stop pin is re-engaged. The conveyor is stopped in reverse when the position switch (ZS-405) is made.

29. The position switch (ZS-404) is now made and this enables the Reject Staging Drum Conveyor (26-CY-001) controls. The operator starts the conveyor and positions the drum on the other end of the conveyor until the end of travel position switch (ZS-403) detects the drum and stops the Reject Staging Drum Conveyor.

30. The operator then places the emptied drum on the pallet.

31. The forklift operator will pick up the loaded pallets.

1.5.7 Emergency Shutdown Sequence

The following events are initiated automatically, in the sequence given, by the safety relay/emergency stop system during an Emergency Shutdown or fire alarm. The emergency shutdown sequence will be initiated by exceeding upper operating limits ~~for in~~ to ensure operator safety.

- Stop primary air receiver exit Rotary Valve (11-VA-001)
- Stop Positive Displacement (P / D) Blower (11-BL-001) drive motor
- Close silo exit isolation valve (FCV-054)
- Open disable contact input to Retrieval control system
- Stop Silo 3 Material Conveyor (16-CY-001)
- Stop Silo 3 Material Feed Hopper A (16-TK-001A) Bin Activator (16-AG-001A)
- Stop Silo 3 Material Feed Hopper B (16-TK-001B) Bin Activator (16-AG-001B)
- Stop Rotary Valve A (16-RV-001A)
- Stop Rotary Valve B (16-RV-001B)
- Close Silo 3 Material Hopper A (16-TK-001A) inlet valve (CV-157)
- Close Silo 3 Material Hopper B (16-TK-001B) inlet valve (CV-156)
- Stop Binder Conveyor (44-CY-001A, or B)
- Stop Reducer Conveyor (44-CY-002A, or B)
- Stop Additive Conveyor (44-CY-003)
- Stop Flexible Additive Conveyor (44-CY-005)
- Stop Additive Feeder (44-CY-004)
- Stop Fines Feed Conveyor (23-CY-003)
- Stop Mixer Feed Conveyor (16-CY-003)
- Stop Process Water Pump (62-PM-001)
- Stop Process Mixer (17-MX-001)
- Stop Briquetter Screw Feeder (23-ME-003)
- Stop Briquetting Press (23-ME-001)
- Stop the Hydraulic Power Unit (23-ME-004)
- Stop Briquette Screen (23-ME-002)
- Stop Fines Conveyor (23-CY-002)
- Stop Briquette Conveyor (23-CY-001)
- Stop feed from Briquette Surge Hopper (23-BN-001)
- Close contact to disable Product Sampler (84-PE-002)
- Close contact input to Packaging System PLC to stop conveyors
- Stop the Drum Unloader Hoist (26-CN-002)
- Stop the Drum Unloader (26-ME-002) rotation
- Stop the Reject Screw Conveyor (26-CY-003)
- Stop Off-Gas Fan (75-FA-001)
- Close filter train A (75-FL-001A) isolation damper (CV-754)
- Close filter train A (75-FL-001A) isolation damper (CV-763)
- Close filter train B (75-FL-001B) isolation damper (CV-756)
- Close filter train B (75-FL-001B) isolation damper (CV-767)
- Close silo return isolation valve (CV-053)

- Stop Treatment Enclosure fan (71-FA-001)
- Close filter train (71-FL-001) isolation damper (CV-657)
- Close filter train (75-FL-001) isolation damper (CV-665)
- Open contact to disable Chilled Water Coil (11-HE-001)
- Stop Chilled Water Pump (11-PM-002)
- Stop Plant Water Pressure Pump (50-PM-001)

1.6 Off-line & Shutdown

This section defines the requirements for shutdowns and taking equipment off-line.

1.6.1 Equipment Off-line

Equipment may be taken off-line if operating parameters are exceeded: Equipment is divided into four groups: Retrieval/Conveyance, Treatment, Packaging, and HVAC.

1.6.1.1 Retrieval/Conveyance Systems

The Silo 3 Material Retrieval System (System 10) and Conveyance System (System 11) consists of a mechanical arm to retrieve the Silo 3 material and a vacuum conveyance system to transport the Silo 3 material to the Treatment System. The retrieval mechanical arm will use end effectors to mobilize the Silo 3 material and deploy the conveyance vacuum system. The vacuum system piping will be double contained between the retrieval enclosure and the treatment enclosure.

1.6.1.2 Treatment System

The Silo 3 Material Treatment System consists of a Processor Feed System (System 16), Processor System (System 17), Product Forming System (System 23), Product Additive System (System 44) and a Radioactive Liquid Waste System (System 62). The Silo 3 material will be metered by a loss-in-weight feed system and fed into a continuous Process Mixer. The continuous mixing process will produce a mixture with the consistency of dry soil and will discharge to the Briquetting Press. The Silo 3 material is rolled into briquettes and then the briquettes discharged from the press are screened to separate fines from the briquettes. The fines are conveyed to the fines recycle system and are eventually introduced back into the treatment process. When the Treatment System is taken off-line the Process Mixer and the Briquette Hopper should be emptied, requiring approximately 7 minutes of operation.

1.6.1.3 Packaging System

The formed briquettes are transferred to the Packaging System (System 24). Samples will be taken periodically from the Product Surge Hopper. Following the product forming process, the briquettes will be weighed and packaged into shipping containers. The briquettes will be placed in 55-gallon drums by utilizing a feed chute. When the Packaging System is taken off-line drums on conveyors 24-CY-005 and 24-CY-006 should be filled, lidded, and moved to 24-CY-007 and have clamp bands secured.

1.6.1.4 HVAC System

The HVAC System (Systems 71 & 75) consists of two main systems, which are, the Process Enclosure HVAC System (System 71) and the Off-Gas Treatment HVAC System (System 75). The Conveyance System (System 11) also contributes to the HVAC system, but is operated as part of the Retrieval System (System 10). The HVAC system utilizes filter modules, ductwork, fans, and air distribution and control devices. The air filtration system is comprised of multiple filters of increasing levels of efficiency to assure that the quality of the exiting air is in compliance with all applicable requirements. After being treated, the air streams are directed into a common plenum and discharged through the monitored Exhaust Stack.

1.6.2 Shutdown

Shutdown of the operations shall be defined by three modes, depending on the reason for and the length of the shutdown and the required elements of the shutdown.

1.6.2.1 Shutdown Mode 1: Immediate Shutdown

In the event of a catastrophic system failure or threat to human health, safety, or the environment, the shutdown of operations shall be abrupt and immediate. All systems and operations shall be stopped and placed in a safe configuration and no equipment decontamination shall be required. This mode can be initiated by any project personnel in the event of threat to worker safety, public health, and/or the environment. Operations will remain shutdown until the cause is identified, corrective action completed, and a mutual restart date is agreed upon by the Contractor, Fluor Fernald, and if necessary, DOE and the EPA's.

1.6.2.2 Shutdown Mode 2: Short-Term Shutdown

A short-term shutdown would occur to repair or replace failed equipment, perform scheduled system maintenance, resolve technical problems, or wait for materials. Maintenance performed outside of normal first-shift operating hours will not be considered a shutdown. Maintenance during the normal work day will not be considered a shutdown or a standdown, unless eleven consecutive work days pass without waste processing activity. This mode shall be initiated by the Contractor in coordination with Fluor Fernald. A determination will be made by Fluor Fernald, based upon the nature, extent, and duration of the shutdown, as to the requirements for restart of the operations under DOE Order 425.1 (Section C.5.5, Pre-operational Assessment Process). The operations shall remain shutdown until a mutual restart date is agreed upon by the Contractor, Fluor Fernald, and DOE.

Short-term shutdown would require the Contractor to shutdown the processing equipment in a safe, controlled manner leaving all equipment, facilities, and/or process areas in a configuration that ensures safety of workers and protection of the environment. Upon entering into a short-term shutdown, the Contractor shall revise the Maintenance Plan to include requirements for inspection and interim maintenance of shutdown equipment (e.g., turning motors and lubrication) to prevent deterioration of the equipment and facilitate restart. The Contractor shall perform any required periodic or routine maintenance during the shutdown periods as necessary to protect the

equipment and facilitate rapid restart. The Contractor shall also ensure operations and facilities restart without major equipment replacements or maintenance delays.

1.6.2.3 Shutdown Mode 3: Long-Term (Greater than Six Months) or Final Shutdown Prior to Facility Shutdown and Dismantlement

Long-Term shutdown will be directed by Fluor Fernald. This mode of shutdown shall require the Contractor to cease operations for a prolonged period of time, or at the completion of the project prior to facility shutdown and dismantling of the equipment. Operations shall remain shutdown until a mutual restart date and restart approach are agreed upon by the Contractor, Fluor Fernald, and DOE. The restart of the operations and facilities after a long-term shutdown shall comply with DOE order 425.1 as discussed in the Short-Term Shutdown section.

Long-term shutdown shall require the Contractor to shutdown the processing equipment in a safe, controlled manner to ensure all equipment, facilities, and/or process areas are in a configuration that promotes safety of workers and protection of the environment. Additionally, the internal components of equipment shall be emptied to the extent possible and decontaminated. Waste removed from the treatment process equipment must be managed in accordance with the requirements in the ARARs and TBCs in Attachment J.4.1 of the contract. During long-term shutdown, except for final shutdown, the Contractor shall revise the Maintenance Plan to include requirements for inspection and interim maintenance of shutdown equipment (e.g. turning motors and lubrication) to prevent deterioration of equipment and facilitate restart. The Contractor shall perform any required periodic or routine maintenance during the shutdown periods as necessary to protect the equipment and facilitate rapid restart. Long-term shutdown, excluding final shutdown, will also ensure operations and facilities restart without major equipment replacements or maintenance delays.

2.0 SILO 3 MATERIAL CHARACTERISTICS

2.1 Description of Silo 3 material

2.1.1 Silo 3 Material Characteristics

The Silo 3 material to be treated is 11(e)(2) material. The material consists of dried cold metal oxides produced from a spray calciner. As a result of the evaporation and calcination of this material, the water content is very low, ranging between 3.7 and 10.2 percent. Approximately 90 percent of the Silo 3 material, based on a weight fraction of the material, passed through a 200-mesh sieve (0.074 mm) during testing for the OU4 RI, indicating the presence of sub-micron particles. The density of the material in Silo 3 ranges from approximately 29 lbs/ft^3 to 58 lbs/ft^3.

2.2 Silo 3 Waste Acceptance Criteria (WAC)

2.2.1 Heavy Metals

Silo 3 briquettes offered for disposal must not exhibit characteristics of, or be listed as, hazardous waste as identified in Title 40 CFR Part 261 and OAC 3745-51, and must comply with the Silo 3 Material WAC.

The concentration of the following metals in leachate exceeded its respective toxicity characteristic limit established in 40 CFR Part 261.24: arsenic, cadmium, chromium and selenium. The Silo 3 project will use a treatment process to decrease the leachability of these metals to meet the Silo 3 WAC.

The Envirobond process will treat the heavy metals of concern to levels that meet the Silo 3 WAC. The treatment binder formula specification is: reducing agent - 2 to 4 percent by weight of dry Silo 3 material, Envirobond - 3 to 5 percent by weight of dry Silo 3 material. If necessary due to excess moisture in the Silo 3 material, absorbent will be added to the mixture. This binder formula has been developed to treat the Silo 3 material as follows:

- Reducing Agent –The reducing agent (i.e. ferrous sulfate) is used to reduce the chromium VI present in the Silo 3 material. The reduction reduces chromium VI to chromium III.
- Envirobond – Envirobond is a polyphosphate, which chemically binds with the metals to reduce the solubility of the metals of concern.
- Absorbent – The absorbent (i.e. bentonite) is used to absorb excess water in the product.

Laboratory results demonstrate the effectiveness of the treatment formula. The values shown below are in units of mg/L TCLP.

Regulated Constituent	Silo 3 Mean Concentration	Post-Treatment Concentration	Silo 3 WAC Requirements
Arsenic	9.481	0.35	5.0
Barium	0.080	Not Tested	100.0
Cadmium	0.847	< 0.01	1.0
Chromium	5.05	1.49	5.0
Lead	0.239	Not Tested	5.0

Mercury	0.0005	Not Tested	0.25
Selenium	2.65	0.86	1.0
Silver	0.007	Not Tested	5.0

2.2.2 Leaching of Radioactive Elements

Although the raw samples are within the WAC requirements, (alpha-emitting nuclides must not exceed 100 nCi/g), the gross alpha and gross beta were further reduced in the Toxicity Characteristic Leaching Procedure (TCLP) extract, as displayed in following table.

	Silo 3 material (pCi/g)	Silo 3 TCLP Extract (pCi/l)
Gross Alpha	17,900	297
Gross Beta	5,010	988

2.2.3 Waste Loading Range

Studies show that Envirobond has a very high waste loading capacity. The additives (i.e. binder and reducing agent) are responsible for the majority of any additional volume of Silo 3 material, which is negligible after compaction. The waste loading of the briquettes is nominally 85%.

2.2.4 Free Liquids

The final product free liquid levels must not exceed 1% of the volume of the Silo 3 material when the Silo 3 briquettes are in the disposal drums; or 0.5% of the volume of the Silo 3 material processed in stable form. As a result of the evaporation and calcination of the Silo 3 material, the water content is very low, ranging between 3.7 and 10.2 percent bound water before treatment, with no freestanding liquids. The treatment process operates with low moisture levels. The treated Silo 3 material final product will be well below the specified free liquid criteria.

2.2.5 Particulate

Fine particulate Silo 3 materials will be immobilized so that the Silo 3 material package contains no more than 1 weight percent of less-than-10-micrometer-diameter particles, or 15 weight percent of less-than-200-micrometer-diameter particles. The treated Silo 3 material briquettes and fines are separated on a screen and the fines are reprocessed. The material processing ensures the final product form meets these immobilization requirements.

2.2.6 Waste Package Criteria

The final product containers must meet requirements for radioactive material storage, shipping, handling and disposal. The following criteria will be met during treatment and packaging operations:

- Weight – Packages shall not exceed 1200 lbs. per 55 gallon drum, and shall have even weight distribution.

- Loading (Void Space) – Waste packages must be loaded to ensure that the interior volume is efficiently and compactly loaded to minimize void space. More than one waste stream may be packaged in a disposal container. High-density loading will allow efficient space utilization and provide a more stable waste form that will reduce subsidence and enhance the long-term performance of the disposal site.

- Closure – The package closure must be sturdy enough that it will not be breached under normal handling conditions.

3.0 PROCESS CONTROL

3.1 Retrieval System (System 10)

3.1.1 Operations

The Retrieval System is designed to remove the Silo 3 material from Silo 3 and convey it to the Treatment System Filter Receiver. The Retrieval/Conveyance system operates independently form the Treatment and Packaging Systems. Silo 3 material will be removed from Silo 3 using a vacuum conveyance system deployed by a remote manipulator arm. The Retrieval System is depicted on P&ID 55-2003, and is called the Reeled Cable Incremental Link Extending Vacuuming Robot (ReTRIEVR). The ReTRIEVR arm maneuvers an 8" diameter flex hose connected to the Conveyance System (System 11). The end of the arm will be fitted with a 7" diameter nozzle and various tools to mobilize the Silo 3 material for transport by the Conveyance System. To extract material, the vacuum conveyance piping and ReTRIEVR enter Silo 3 through the existing 20" diameter center silo access port. The ReTRIEVR mechanical system will also be used to remove residue from the silo walls once the Silo 3 material is removed. For a more complete description of the Retrieval System refer to the "Retrieval Technology Description" document (RMR-0445-ENG-03).

3.1.2 Control Philosophy

The Retrieval System is controlled by a control system provided by the ReTRIEVR manufacturer. Operating indication and emergency shut off signals are provided to the Treatment System Human Machine Interface (HMI) by the Retrieval System control system.

3.1.2.1 Alarm System

If the Retrieval System shuts down then the Treatment System HMI will receive the Retrieval System shut down alarm and shut down the Conveyance System (System 11).

3.1.2.2 Data Acquisition System

No data is recorded from the Retrieval System by the Treatment System PLC.

3.2 Conveyance System (System 11)

3.2.1 Operations

The Conveyance System (System 11) is designed to move material from Silo 3 to the Treatment Facility. The Retrieval/Conveyance system operates independently form the Treatment and Packaging Systems. Once the powder is removed, the same system will be used in conjunction with the Retrieval System to remove as much loose material from the walls of the silo as possible.

The Conveyance System, depicted on P&ID 55-2003, is a pneumatic conveying system, driven by a Positive/Displacement (P/D) Blower (11-BL-001). Ambient make-up air is brought into the

Retrieval Enclosure to be utilized by the Conveyance System. The ambient air is filtered by the Retrieval Enclosure Inlet HEPA Filter (74-FL-005) before entering Silo 3. The P/D Blower creates a vacuum, which enables the transfer of the Silo 3 material to the Treatment System via double walled piping. In the Treatment Facility, a Filter Receiver (11-ME-001) will separate the solids from the air stream. The Silo 3 material will be discharged through a Rotary Valve (11-VA-001) from the Filter Receiver. The Silo 3 material discharges out of the rotary valve into the Processor Feed System (System 16). The air stream leaves the Filter Receiver (11-ME-001) and passes through the P/D Blower (11-BL-001). As a result of transporting the Silo 3 material, the temperature of the air discharged from the P/D Blower will be elevated. The air will be cooled by the Chilled Water Coil (11-HE-001). Following the chiller, the air stream is split into two streams: one stream will recycle back to the silo, and the other stream will go into the Off-gas Treatment HVAC System (System 75) to induce a negative pressure in the silo and Retrieval Enclosure.

3.2.2 Control Philosophy

During normal removal operations, the silo pressure will be maintained between –2.0 and ~~+0.5~~ +0.0 inches water gauge differential to the atmosphere to prevent damage to the silo. Minor transient fluctuations above 0.0 inches of water gauge due to normal component and systems operations will be allowed to prevent automatic shutdowns in response to short-term minor pressure fluctuations. The control system will be programmed to allow the pressure to rise above 0.0 inches water gauge, up to +0.2 inches of water gauge for up to 90 seconds without initiating automatic shutdown. The maximum allowable pressure differential for the silo is +0.5 inches water gauge. These pressure differentials are summarized below.

Normal Operating Pressure Differential:	-2.0 to 0.0 inches of water gauge
Allowable Operating Pressure Differential:	-2.0 to +0.2 inches of water gauge*
Silo Maximum Pressure Differential:	-2.0 to +0.5 inches of water gauge

*Note: positive pressure up to +0.2 inches water gauge allowable for continuous 90 seconds or less

The silo pressure will be controlled by interlocks between pressure switches in the silo and the P/D Blower. In addition, pressure/vacuum relief device will be used to maintain silo pressure within the safety limits. The pipe between Silo 3 and the Treatment Facility is a double pipe to provide secondary containment. The interstitial space between the pipes is monitored for leaks. The Filter Receiver will be maintained at no greater than 16 inches water pressure differential to the discharge pipe.

Silo 3 will be connected to the HVAC System to control silo pressure and particulate emissions. The P/D Blower in the Conveyance System is separated from the Treatment System by use of a Rotary Valve (11-VA-001). The overriding operating parameter for the Conveyance System is the pressure (or vacuum) created in Silo 3 and the Filter Receiver (11-ME-001). This parameter however will not effect the Treatment System product quality.

The P/D Blower (11-BL-001) will be used to convey the Silo 3 material and also to place the silo under negative pressure during operation. Air flows through a HEPA filter into the Retrieval Enclosure then into the silo due to negative pressure placed on the silo by the P/D Blower. On the off-shift the negative pressure is achieved by the Off-Gas Fan (75-FA-001).

3.2.2.1 Automatic Controls

- See P/D Blower interlock I-15 (section 3.2.4.1)

3.2.2.2 Alarm System

Alarm: PDAH-061 Filter Receiver pressure differential high 16 W.G.
Response: See Filter Receiver pressure differential alarm PDAH-061 (section 3.2.5.2)

Alarm: PAL-001 Silo pressure differential low -2.0 W.G.
Response: Take the P/D Blower (11-BL-001) off-line.

Alarm: PAH-001 Silo pressure differential high +0.2 W.G.
Response: If alarm is continuous for 90 seconds the P/D Blower (11-BL-001) is taken off-line.

3.2.3 Transfer Piping

3.2.3.1 Automatic Controls

- The discharge valve, 11-VA-001, of the Filter Receiver (11-ME-001) operates automatically. The valve maintains the vacuum in the Filter Receiver while delivering the Silo 3 material to the Treatment System.

3.2.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values based on final vendor data.

Alarm: PAL-051 Interstitial Space Pressure Low TBD
Response: Monitor system for 5 minutes and if alarm doesn't clear then take the P/D Blower (11-BL-001) off-line.

Alarm: PAH-052 Interstitial Space Pressure High TBD
Response: Monitor system for 5 minutes and if alarm doesn't clear then take the P/D Blower (11-BL-001) off-line.

3.2.3.3 Data Acquisition System

No data is recorded from the Transfer Pipe by the Treatment System PLC.

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3.2.4 P/D Blower (11-BL-001)

3.2.4.1 Automatic Controls

- I-14 is an interlock, which connects the Filter Receiver (11-ME-001) with the P/D Blower (11-BL-001). If the material level in the Filter Receiver (11-ME-001) reaches a high-high level (LSHH-062), the P/D Blower (11-BL-001) drive will be taken off-line.

- I-15 is an interlock, which connects the pressure in the silo with the P/D Blower (11-BL-001). If silo pressure exceeds the high limit (PSH-001) or drops below safe vacuum limit (PSL-001), the P/D Blower drive will reduce the blower to a safe speed/pressure head to compensate.

- I-054 is an interlock, which connects the solenoid valve (SV-054) with the P/D Blower. The silo discharge line (11-WA-8-002) isolation valve (FCV-054) is energized via solenoid (SV-054) to open. The interlock (I-054) provides a check on the knife gate opening after the solenoid is energized. If the knife gate does not reach the fully open position (ZSO-054) within the allowed time after the solenoid is energized, the P/D Blower drive is taken off-line, or prevented from starting.

- I-053 is an interlock, which connects the solenoid valve (SV-053) with the P/D Blower. The silo return line (11-WA-8-009) isolation valve (FCV-053) is energized via solenoid (SV-053) to open. The interlock provides a check on the knife gate opening after the solenoid is energized. If the knife gate does not reach the fully open position (ZSO-053) within the allowed time after the solenoid is energized, the P/D Blower drive is taken off-line.

- I-708 is an interlock, which controls the Retrieval Enclosure Inlet Damper. The interlock (I-708) for the retrieval enclosure inlet damper controls the two modes of damper operation. Auto mode, in which the damper is controlled from the PLC and HMI screen, and local mode where only the local damper controls are active.

3.2.4.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI.

Alarm:	YSAH-060	Particle Count high/burst filter sack	1000 ppm
Response:	Monitor system for ~~5 minutes~~ 90 seconds and if alarm doesn't clear then take the P/D Blower (11-BL-001) off-line.		

3.2.4.3 Data Acquisition System

The Data Acquisition System will record the power draw from the Blower (IT-065).

3.2.5 Filter Receiver (11-ME-001)

3.2.5.1 Automatic Controls

- The discharge valve, 11-VA-001, of the Filter Receiver (11-ME-001) operates automatically. The valve maintains the vacuum in the Filter Receiver while delivering the Silo 3 material to the Treatment System.

3.2.5.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI.

Alarm:	SAL-152	Rotary valve shaft speed low	20% underspeed
Response:	Monitor system for 5 minutes and if alarm doesn't clear then take the Retrieval/Conveyance System off-line.		
Alarm:	LSAH-062	Filter Receiver level high	3% of Volume
Response:	Monitor system equipment.		
Alarm:	LAHH-062	Filter Receiver level high-high	7% of Volume
Response:	Interlock I-14 takes P/D Blower (11-BL-001) off-line.		
Alarm:	PDAH-061	Filter Receiver pressure differential high	16 W.G.
Response:	Monitor equipment for 5 minutes, if alarm doesn't clear, take Retrieval/Conveyance System off-line and check filter pulse cleaner system operation.		

3.2.5.3 Data Acquisition System

No data is recorded from the Filter Receiver by the Treatment System PLC.

3.2.6 Chilled Water Coil (11-HE-001)

3.2.6.1 Automatic Controls

- The Chilled Water Coil is operated in automatic, no operator intervention is required. The following information is displayed on the HMI:

  1. TI-067 Inlet air temperature to chiller
  2. TI-068 Outlet air temperature from chiller
  3. PI-069 Outlet air pressure from chiller
  4. HS-076 Chilled Water Pump (11-PM-002) hand switch indication

- High temperature on the chiller outlet (TI-068) will take the P/D Blower (11-BL-001) off-line.

- System operation will start after enable signal is received from Treatment System PLC.

3.2.6.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values based on final vendor data.

Alarm:	TAH-067	Inlet air temperature to chiller high	TBD
Response:	Monitor system equipment.		

Alarm:	TAH-068	Outlet air temperature from chiller high	TBD
Response:	Monitor system for 5 minutes and if alarm doesn't clear take the P/D Blower (11-BL-001) off-line, and check Chilled Water System.		

3.2.6.3 Data Acquisition System

No data is recorded from the Chilled Water Coil by the Treatment System PLC.

3.3 Processor Feed System (System 16)

3.3.1 Operations

The Processor Feed System receives the Silo 3 material from the Conveyance System (System 11) and delivers the material to the Processor System (System 17). The Silo 3 material is deposited in one of the two Silo 3 Material Feed Hoppers (16-TK-001A, or B) from the Conveyance System. These hoppers are used as surge hoppers to provide a nominally constant flow rate of feed material to the Processor System (System 17). The pay out weight from the hoppers is monitored as well as the discharge mass flow rate, and moisture content.

The Processor Feed System consists of the Silo 3 Material Feed Screen (16-ME-001), Silo 3 Material Feed Hoppers (16-TK-001A, B), and a delivery system as described on P&IDs 55-2004 and 55-2005. The Silo 3 material is received from the Conveyance System Rotary Valve, (11-VA-001) from the Filter Receiver (11-ME-001) and dropped through the Silo 3 Material Feed Screen (16-ME-001) to filter out any debris; the debris will be collected in the Debris Collection Drums. Debris will be sorted; Silo 3 material will be reintroduced into the process, and remaining material will be characterized and treated appropriately. The Silo 3 material is then fed to the Silo 3 Material Feed Conveyor (16-CY-001), and is conveyed to the Silo 3 Material Feed Hoppers (16-TK-001A, B). Each Feed Hopper is equipped with a Feed Hopper Bin Activator (16-AG-001A, B) to enhance the flowability of Silo 3 material from the Silo 3 Material Feed Hoppers (16-TK-001A, B). Moisture content of the Silo 3 material is measured at the exit of the Silo 3 Material Feed Hoppers. From the Silo 3 Material Feed Hoppers, the Silo 3 material is fed through a Rotary Valve (16-VA-001A, B) into the Mixer Feed Conveyor (16-CY-003), and then delivered to the Processor System (System 17). The Silo 3 Material Feed Hoppers and discharge operate as a loss-in-weight feed system.

3.3.2 Control Philosophy

The Silo 3 Material Feed Hoppers (16-TK-001A, B) are maintained between a low and a high level through the use of high and low level indicators and interlocks to Silo 3 material inlet valves (CV-157, CV-158) and outlet valves (16-VA-001A, B). High level alarms (LAHH-151, LAHH-154) provide the operator early indication of a rising level, and are interlocked (I-5) to the Retrieval System to prevent overflowing the hoppers. A loss-in-weight feed system on the hoppers will maintain an approximate flow rate of nominally 12,800 lb/hr of Silo 3 material fed to the Mixer Feed Conveyor. This flow rate will cause an alarm (WRAH-152, WRAL-152 & WRAH-155, WRAL-155) if it goes beyond the boundaries of the process envelope. The weight of Silo 3 material (WKIT-152, WKIT-155) added to the Mixer Feed Conveyor (16-CY-003), and the moisture content (AT-153, AT-156) are transmitted to the PLC. Based on this information, the PLC will determine the amount of binder, reducing agent and water required and transmit signals accordingly to the Additive System (System 44) and the Radioactive Liquid Waste System (System 62).

3.3.3 Silo 3 Material Feed Hoppers (16-TK-001A, B)

3.3.3.1 Automatic Controls

- The Silo 3 Material Feed Hoppers are operated in automatic; no operator interaction is required. The operator is provided indication through the HMI of the following:

1.	LIL-151	Silo 3 Material Feed Hopper A level low	20% of Hopper Volume
2.	LIH-151	Silo 3 Material Feed Hopper A level high	80% of Hopper Volume
3.	AI-153	Moisture content of Silo 3 material in Hopper A	expected range 3-10%
4.	WKY-152	Mass Flow rate of Hopper A discharge	12,800 lbs./hr (nominally)
5.	LIL-154	Silo 3 Material Feed Hopper B level low	20% of Hopper Volume
6.	LIH-154	Silo 3 Material Feed Hopper B level high	80% of Hopper Volume
7.	AI-156	Moisture content of Silo 3 material in Hopper B	expected range 3-10%
8.	WKY-155	Mass flow rate of Hopper B discharge	12,800 lbs./hr (nominally)

- The Silo 3 Material Feed Hopper (16-TK-001A, B) discharge valves, 16-VA-001A, B respectively, are speed controlled (WKIT-152, WKIT-155) to maintain the correct feed rate of material into the system. This will provide a constant flow of material to the Processor System (System 17).

- The bin activators (16-AG-001A, B) run at constant speed when energized.

- Control loops on the Rotary Valves (16-VA-001A, B) are used for process verification. Speed controllers (WKIT-152, WKIT-155) tell the valves how fast to discharge material from the hoppers, and speed transmitters (ST-152, ST-155) verify that the discharge is as specified.

- Process verification is also performed on the mass flow rate (WKY-152 & WKY-155) of material discharged from the hoppers. The mass flow rate is monitored to verify that it is within the operating process envelope, and the correct mass of binder, reducer and water are added.

- The P/D Blower (11-BL-001) in the Conveyance System is interlocked (I-5) to the Silo 3 Material Feed Hoppers to take the Blower off-line.

  1. If either of the Silo 3 Material Feed Hoppers (16-TK-001A, B) reach a high-high level, then they will alarm (LAHH-151 & LAHH-154), and take the P/D Blower off-line.
  2. If both hoppers are at high levels (LSH-151, LSH-154) then the P/D Blower will be taken off-line.
  3. Silo 3 Material Feed Screen high level (LSH-159) will take the P/D Blower off-line.
  4. Silo 3 Material Feed Screen high level (LSH-160) will take the P/D Blower off-line.

- The levels in the Silo 3 Material Feed Hoppers (16-TK-001A, B) are controlled by an interlock (I-01) between the solenoid valves (CV-157 & CV-158) on the inlet of the hoppers, level switches on the hoppers (LSH-151, LSL-151 & LSH-154, LSL-154), and the discharge Rotary Valves (16-VA-001A, B).

  1. As Hopper A is being filled by the Silo 3 Material Feed Conveyor (16-CY-001), when it hits a high level (LSH-151), the inlet valve to Hopper A (CV-157) closes, and Hopper B level is checked for a high level (LSH-154) condition.

     a. If Hopper B is not showing a high level (LSH-154), then the Rotary Valve on Hopper B (16-VA-001B) is checked to see if it is running. If it is running, the Rotary Valve (16-VA-001B) will be taken off-line, and the Silo 3 material will feed into Hopper B by opening the inlet valve (CV-158).

     b. If Hopper B also shows a high level (LSH-154) then the hopper level alarm is tripped thus taking the P/D Blower (11-BL-001) off-line.

  2. The discharge of the Silo 3 Feed Hoppers will be handled in the same manner as they are filled. As Hopper A is feeding the Mixer Feed Conveyor (16-CY-003) and trips the low level switch (LSL-151), the Rotary Valve (16-VA-001A) will be taken off-line. Hopper B level is checked for a low level (LSL-154) condition.

a. If Hopper B is not at a low level, then it will check to see if the inlet valve to Hopper B (FCV-158) is open. If the inlet valve is open, it will be shut, the Rotary Valve (16-VA-001B) will be enabled, and then the Silo 3 material will be fed from Hopper B instead of Hopper A.

b. If Hopper B is at a low level (LSL-154), an alarm will be displayed on the HMI screen.

- The Silo 3 Material Feed Hopper (16-TK-001A, B) pay out rate (WKY-152, WKY-155) and percent moisture (AT-153, AT-156) readings are used (I-04) to determine the Process Water Pump (System 62) feed rate to the Process Mixer (System 17).

- The Silo 3 Material Feed Hopper (16-TK-001A, B) pay out rate (WKY-152, WKY-155) is interlocked (I-06) with the Additive System (System 44). The Silo 3 pay out rate is used to determine the pay out rate of the Additive Feeder (System 44).

- The Additive Feeder (System 44) level switch (LSLL-506) is used to disable the Silo 3 Material Feed Hopper (16-TK-001A, B) pay out. The variable speed drives are taken off-line, stopping the pay out Rotary Valves (16-VA-001A, B) when no additives are being fed from the Additive Feeder (44-CY-005).

- If both Silo 3 Material Hoppers are at a low level (LSL-151 and LSL-154) an alarm (LAL-171) is displayed on the HMI screen.

- An interlock (I-3) controls the enable inputs to WKIT-152 and WKIT-155. Any one of the following inputs will take both drives off-line:
  1. Additive Feeder (44-CY-005) surge hopper low-low level (LSLL-506)
  2. Fines Hopper (23-TK-001) high level (LSH-252)
  3. Process Water Tank (62-TK-001) low-low level (LSLL-601)
  4. Briquette Surge Hopper (23-BN-001) high level (LSH-251)

3.3.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI.

Alarm:	LAHH-151	Silo 3 Material Feed Hopper A level high-high	90% of Hopper Volume
Response:	Interlock I-5 takes the P/D Blower (11-BL-001) off-line.		
Alarm:	LAHH-154	Silo 3 Material Feed Hopper B level high-high	90% of Hopper Volume
Response:	Interlock I-5 takes the P/D Blower (11-BL-001) off-line.		
Alarm:	WRAH-152	Discharge from Hopper A mass flow rate high	Set Point ÷10% (Set Point nominally 12800 lb/hr)
Response:	Operator takes the Silo 3 material feed operation off-line.		

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Alarm:	WRAL-152	Discharge from Hopper A mass flow rate low	Set Point -10% (Set Point nominally 12800 lb/hr)
Response:	Operator takes the Silo 3 material feed operation off-line.		
Alarm:	WRAH-155	Discharge from Hopper B mass flow rate high	Set Point +10% (Set Point nominally 12800 lb/hr)
Response:	Operator takes the Silo 3 material feed operation off-line.		
Alarm:	WRAL-155	Discharge from Hopper B mass flow rate low	Set Point -10% (Set Point nominally 12800 lb/hr)
Response:	Operator takes the Silo 3 material feed operation off-line.		
Alarm:	LAL-171	Both Silo 3 Material Feed Hoppers at low level	10% of Hopper Volume
Response:	Display on HMI screen that there is no Silo 3 material coming into the system; operator intervention. Monitor remaining treatment activities.		

3.3.3.3 Data Acquisition System

The Data Acquisition System will record the following data from the Silo 3 Material Feed Hoppers (16-TK-001A, B):

1. WKY-152 Discharge mass flow rate from Hopper A
2. AR-153 Moisture content of Silo 3 material discharged from Hopper A
3. WKY-155 Discharge mass flow rate from Hopper B
4. AR-156 Moisture content of Silo 3 material discharged from Hopper B

3.3.4 Silo 3 Material Feed Screen (16-ME-001)

3.3.4.1 Automatic Controls

- The Silo 3 Material Feed Screen is operated in automatic; no operator interaction is required. The operator is provided indication of whether the screen is on or off through the HMI, and whether a high level condition (LSH-159, or LSH-160) exists on either Material Feed Screen or in the Debris Collection Drums.

- The Silo 3 Material Feed Screen runs at a constant speed when energized.

- Interlock I-5 takes the P/D Blower (11-BL-001) off-line on a high level indication in the Material Feed Screen (LSH-159, LSH-160).

3.3.4.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values based on final vendor data.

Alarm:	LAH-159	Screen deck one level high	TBD
Response:	Interlock I-5 takes the P/D Blower (11-BL-001) off-line.		
Alarm:	LAH-160	Screen deck two level high	TBD
Response:	Interlock I-5 takes the P/D Blower (11-BL-001) off-line.		
Alarm:	LAH-161	Debris Drum one level high	80% of Drum Volume
Response:	Take Retrieval System off-line and switch out debris drum.		
Alarm:	LAH-162	Debris Drum two level high	80% of Drum Volume
Response:	Take Retrieval System off-line and switch out debris drum.		

3.3.4.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Silo 3 Material Feed Screen.

3.3.5 Silo 3 Material Feed Conveyor (16-CY-001)

3.3.5.1 Automatic Controls

- The Silo 3 Material Feed Conveyor is operated in automatic; the only operator interaction is to start or stop the conveyor. The operator is provided indication of whether the conveyor is on or off through the HMI.

- The Silo 3 Material Feed Conveyor has a nominally constant flow rate of material to the Processor System (System 17).

3.3.5.2 Alarm System

There are no alarms associated with the Silo 3 Material Feed Conveyor.

3.3.5.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Silo 3 Material Feed Conveyor.

3.3.6 Mixer Feed Conveyor (16-CY-003)

3.3.6.1 Automatic Controls

- The Mixer Feed Conveyor is operated in automatic; the only operator interaction is to start or stop the conveyor, as well as to adjust the pay-out speed. The HMI screen

provides indication of whether the conveyor is on or off, as well as the speed of the conveyor.

- The Mixer Feed Conveyor runs at a predetermined speed (SY-164) when energized.

3.3.6.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI screen. TBD values based on final vendor data.

Alarm:	SAL-164	Mixer Feed Conveyor low speed	TBD
Response:	Increase speed on conveyor.		
Alarm:	SAH-164	Mixer Feed Conveyor high speed	TBD
Response:	Decrease speed on conveyor.		

3.3.6.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Mixer Feed Conveyor.

3.4 Processor System (System 17)

3.4.1 Operations

The Processor System, consisting of the Process Mixer (17-MX-001), is depicted on P&ID 55-2005. The feed streams to the mixer are a combined stream of Silo 3 material, binder, reducing agent, absorbent (as required), briquetting fines, and water. The Process Mixer is a continuous mixer and will combine all the materials as they progress towards the Briquetting Press (System 23). The mixer has speed control to aid the continuous mixing process. The Process Mixer will require cleaning periodically. The cleaning operation is controlled by System 62.

3.4.2 Control Philosophy

The Process Mixer is a variable speed mixer, which the operator starts (HS-201) from the HMI. Although the mixer has speed control (SC-201) to allow for process slow down, a Set Point (SY-201) for the mixer will be chosen during plant start-up, only to be changed if problems with the mixing operation occur. A Process Mixer high level alarm (LAH-203) will be used to signal the PLC that adjustments are required and the feed flow rate to the mixer needs to be decreased. The moisture of material at the exit end of the mixer will be monitored (AT-202) to ensure that the material remains within the process envelope (less than AAH-202 and more than AAL-202). The material will travel through the mixer at a nominal rate of 13,500 lb/hr.

3.4.3 Process Mixer (17-MX-001)

3.4.3.1 Automatic Controls

- The Process Mixer is operated in automatic; start/stop operator interaction is required. The operator is provided indication through the HMI of the following:

1.	II-204	Current fed to mixer	See Section 1.4
2.	AI-202	Moisture of material in mixer	See Section 1.4
3.	SI-201	Mixer shaft speed	

- The mixer will have speed control (SC-201), but it will run at a constant rate (SY-201) unless operating experience demonstrates that changes are necessary.

- The operation of the mixer is not controlled by any interlocks.

- The current supplied to the mixer will monitor (II-204) the mixing operation within the mixer.

3.4.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values based on final vendor data.

Alarm:	IAH-204	High current to mixer	TBD
Response:	Operator to monitor process water feed to mixer and mixer discharge moisture content for 7 minutes, if alarm doesn't clear take Process Mixer off-line.		
Alarm:	IAL-204	Low current to mixer	TBD
Response:	Operator to monitor process water feed to mixer and mixer discharge moisture content for 7 minutes, if alarm doesn't clear take Silo 3 Material Feed System off-line.		
Alarm:	LAH-203	High level in mixer	80% of Mixer Volume
Response:	Operator to monitor system for 7 minutes, if alarm doesn't clear take Process Mixer off-line.		
Alarm:	AAH-202	High moisture content in mixer	20%
Response:	Operator to verify water addition rate, verify absorbent addition rate, make necessary adjustments, if condition doesn't clear in 7 minutes take Treatment System off-line after running it empty.		
Alarm:	AAL-202	Low moisture content in mixer	15%
Response:	Operator to verify water addition rate, verify absorbent addition rate, make necessary adjustments, if condition doesn't clear in 7 minutes take Treatment System off-line after running it empty.		
Alarm:	SAL-201	Low mixer speed	TBD

Response: Operator to verify feed to mixer, increase mixer speed. If alarm doesn't clear in 7 minutes, take Process Mixer off-line.

Alarm: SAH-2201 High mixer speed TBD
Response: Operator to verify feed to mixer, decrease mixer speed. If alarm doesn't clear in 7 minutes, take Process Mixer off-line.

3.4.3.3 Data Acquisition System

The moisture content (AIR-202) of the Silo 3 material is recorded from the Processor System by the HMI, as well as the power draw from the mixer (II-204).

3.5 Product Forming (System 23)

3.5.1 Operations

The Product Forming System will receive materials from the Process Mixer (System 17) as depicted on P&ID 55-2005. The Product Forming System consists of the Briquetting Press (23-ME-001), the Briquette Screen (23-ME-002), the Briquette Conveyor (23-CY-001), and the briquetting fines recycle system. The Briquetting Press will operate on a continuous basis, with the rate being controlled from the PLC. The Product Forming System will decrease the volume of the Silo 3 material mixture, which will aid in product stability and volume reduction as well as making the material easier to handle. The size of each briquette will be approximately 2" X 2" X 1 ½".

The Briquette Screen (23-ME-002) after the Briquetting Press (23-ME-001) separates the fines from the briquetting process. The fines passing through the screen are fed to the Fines Conveyor (23-CY-002) and deposited in the Fines Hopper (23-TK-001). From the Fines Hopper, the material drops into the Fines Feed Conveyor (23-CY-003), and from there is metered into the Mixer Feed Conveyor (System 16) at a rate consistent with the other Silo 3 material feed streams.

3.5.2 Control Philosophy

The Briquetting Press (23-ME-001) is an automatically controlled operation. The operator starts the operation of the Briquetting Press from the HMI. Both the speed of the press and the rate of material fed are controlled by the PLC. The press has a Feed Screw (23-ME-003) to control the rate at which material is fed, and a Briquette Hopper (23-BN-001) to aid in feeding material at a constant rate. The controls for these two pieces of equipment are linked, and they aid in making briquettes which will be within the Silo 3 WAC guidelines, as well as minimizing the fines recycle stream and the air pockets within the briquettes. The flow rate of material through the Product Forming System will be nominally 13,500 lb/hr. The expected fines recycle flow rate is nominally 680 lb/hr. The briquetting operation is controlled by the Treatment System PLC.

3.5.3 Briquetting System

3.5.3.1 Automatic Controls

- The Briquetting System is operated in automatic; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the following:

  1. SI-253 Speed indication for Feed Screw
  2. SI-254 Briquetting Press speed indicator
  3. PI-256 Briquetting Press pressure indicator See Section 1.4

- The Briquette Screen (23-ME-002) and the Briquette Conveyor (23-CY-001) run at constant speed when energized.

- The Briquette Surge Hopper (23-BN-001) high level switch (LSH-251) is interlocked (I-03) with the Rotary Valves (16-VA-001A, B) on the discharge of the Silo 3 Material Feed Hoppers (16-TK-001A, B). If the high level switch in the Briquette Surge Hopper (LSH-251) is tripped, the Rotary Valves on the discharge from the Silo 3 Material Feed Hoppers are taken off-line.

- The speed control (WKIT-254) on the Briquetting Press (23-ME-001) and the speed control (WKIT-253) on the Feed Screw (23-ME-003) are linked to ensure that the briquetting operation runs smoothly.

3.5.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values based on final vendor data.

Alarm:	LAH-251	Briquette Hopper (23-BN-001) high level	80% of Hopper Volume
Response:	Interlock I-3 takes Rotary Valve (16-VA-001A, B) off-line to stop discharge from Silo 3 Material Hoppers (System 16)		
Alarm:	SAH-253	Feed Screw (23-ME-003) speed high	TBD
Response:	Monitor equipment, decrease Feed Screw speed. If alarm doesn't clear in 7 minutes take Briquetting Press off-line.		
Alarm:	SAL-253	Feed Screw (23-ME-003) speed low	TBD
Response:	Monitor equipment, increase Feed Screw speed. If alarm doesn't clear in 7 minutes take Briquetting Press off-line.		
Alarm:	SAH-254	Briquetting Press (23-ME-001) roller speed high	TBD
Response:	Monitor equipment, decrease roller speed. If alarm doesn't clear in 7 minutes take Briquetting Press off-line.		

Alarm:	SAL-254	Briquetting Press (23-ME-001) roller speed low	TBD
Response:	Monitor equipment, increase roller speed. If alarm doesn't clear in 7 minutes take Briquetting Press off-line.		
Alarm:	PAH-256	Briquetting Press (23-ME-001) hydraulic pressure high	TBD
Response:	Monitor equipment, if alarm doesn't clear in 7 minutes take Treatment System off-line.		
Alarm:	PAL-256	Briquetting Press (23-ME-001) hydraulic pressure low	TBD
Response:	Monitor equipment, if alarm doesn't clear in 7 minutes take Treatment System off-line.		

3.5.3.3 Data Acquisition System

No data is recorded by the acquisition System from the Briquetting System.

3.5.4 Fines Recycle System

3.5.4.1 Automatic Controls

- The Fines Conveyor (23-CY-002) runs at constant speed when energized.
- The Fines Hopper (23-TK-001) discharges to a Screw Conveyor (23-CY-003) by gravity feed.
- The Screw Conveyor (23-CY-003) has a speed indicator (SI-252).
- The high level switch (LSH-252) in the Fines Hopper (23-TK-001) is interlocked (I-08) to the speed control (WKIT-252) on its Screw Conveyor (23-CY-003) to ensure the Fines Hopper doesn't reach a high level. I-08 controls the Fines Hopper pay out Screw Conveyor (23-CY-003) speed; from Hopper high level (LSH-252) for high speed to Hopper low level (empty) for nominal speed.
- The level switches (LSH-252, LSL-252) in the Fines Hopper (23-TK-001) are interlocked (I-03) with the Rotary Valves (16-VA-001A, B) on the discharge of the Silo 3 Material Feed Hoppers (16-TK-001A, B). If the high level switch (LSH-252) is tripped, the Rotary Valves on the discharge from the Feed Hoppers are taken off-line. If the low level switch (LSL-252) is tripped, the speed (WKIT-152, WKIT-155) of the discharge are enabled.

3.5.4.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values based on final vendor data.

Alarm:	LAH-252	Fines Hopper high level	80% of Hopper Volume
Response:	Interlock (I-3) takes Rotary Valve (WKIT-152, WKIT-155) off-line to stop the discharge from the Silo 3 Material Hoppers (16-TK-001A, B).		
Alarm:	SAH-252	Screw Conveyor speed high	TBD
Response:	Monitor equipment, decrease Screw Conveyor speed. If alarm doesn't clear in 7 minutes take Fines Recycle System off-line.		
Alarm:	SAL-252	Screw Conveyor speed low	TBD
Response:	Monitor equipment, increase Screw Conveyor speed. If alarm doesn't clear in 7 minutes take Fines Recycle System off-line.		

3.5.4.3 Data Acquisition System

No data is recorded by the Data Acquisition System from the Fines Recycle System.

3.6 Packaging System (System 24)

3.6.1 Operations

The Packaging System is a continuous operating system controlled by its own PLC, which is in communication with the Treatment System PLC. The Silo 3 material will be in the form of briquettes when it comes from the Product Forming System (System 23). The Packaging System takes the briquettes and loads them into drums, and then palletizes the drums. The Packaging System is depicted on P&ID 55-2016. The weight of briquettes placed in the drums is monitored by the PLC at the Drum Loading / Tare Gross Weight Station. The drums will be sealed and put on pallets and then stored in the Interim Storage Area (ISA) until the sample test results are returned and found to be satisfactory. The container loading area is sealed by a door and uses HVAC controls to prevent the spread of contamination from the loading area.

3.6.2 Control Philosophy

The Packaging System is controlled by a PLC provided by the equipment manufacturer. The briquettes are weighed before they are deposited in the Silo 3 drum. The drum will be weighed in its fully loaded condition for final verification. The loading area is sealed by a door, the door position is verified by position switches. The scale used for the final/transportation weight will comply with site scale requirements.

3.6.3 Product Surge Hopper (24-BN-001)

3.6.3.1 Automatic Controls

- The Product Surge Hopper is operated in automatic; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of a high level in the Hopper (LI-310).

- The Product Surge Hopper is interlocked (I-03) with the Processor Feed System (System 16). As the Product Surge Hopper hits a high level (LI-310), the variable speed drives (WKIT-152, WKIT-155) on the discharge Rotary Valves (16-VA-001A, B) are taken off-line to stop the pay-out of material from the Silo 3 Material Feed Hoppers (16-TK-001A, B).

3.6.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI.

Alarm:	LAH-310	Product Surge Hopper high level	80% of hopper volume
Response:	Interlock (I-3) takes Rotary Valve (WKIT-152, WKIT-155) off-line to stop the discharge from the Silo 3 Material Hoppers (16-TK-001A, B).		

3.6.3.3 Data Acquisition System

No data is transferred to the Data Acquisition System from the Product Surge Hopper.

3.6.4 Entry Conveyors

3.6.4.1 Automatic Controls

- The Drum Storage Gravity Conveyor (24-CY-002) delivers empty drums by gravity feed to the Drum Delidding Station (24-CY-003) in the Contamination/Controlled Area.

- The Conveyors are operated manually via auxiliary hand switches; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the following:

  1. YI-301 Drum present on Drum Delidding Station
  2. YI-302 Drum present on Barcode Labeling Station

- Drums are brought to the Drum Delidding Station (24-CY-003) by use of a hand switch (HS-301) to start the conveyor motor.
- An interlock (I-39) between the Drum Delidding Station conveyor motor (24-CY-003) and the position indicator (ZS-301) stops the conveyor to position the empty drums.

- Drums are brought to the Barcode Labeling Station (24-CY-004) by use of a hand switch (HS-302) to start the conveyor motor.

- An interlock (I-40) between the Barcode Labeling Station conveyor motor (24-CY-004) and the position indicator (ZS-302) stops the conveyor to position the delidded drums.

3.6.4.2 Alarm System

There are no alarms associated with the operation of the entry conveyors.

3.6.4.3 Data Acquisition System

No data is transferred to the Data Acquisition System from the entry conveyors.

3.6.5 Drum Loading Operation

3.6.5.1 Automatic Controls

- The Drum Loading Operation is operated automatically; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the drum present on Drum Loading & Tare Gross Weigh Station (YI-303).

- Drums are brought to the Drum Loading & Tare Gross Weigh Station (24-CY-005) by use of a hand switch (HS-303) to start the conveyor motor.

- An interlock (I-41) between the Drum Loading & Tare Gross Weigh Station conveyor motor (24-CY-005) and the position indicator (ZS-303) stops the conveyor to position the barcode labeled drums.

- The drum position (ZS-303) at the Drum Loading & Tare Gross Weight Station (24-CY-005), is interlocked (I-48) with the motor on the Fill Bucket Loadout Station (24-ME-005) such that when an empty, delidded, barcode labeled drum is in position it will be filled automatically.

- Indication will be given locally as to whether the loading chute is in the Retracted Position (ZSH-313) or in the Load Position (ZSL-313).

3.6.5.2 Alarm System

There are no alarms associated with the drum loading operation.

3.6.5.3 Data Acquisition System

The Data Acquisition System will record the tare weight/filled weight of drum (WR-303) from the drum loading operation.

3.6.6 Exit Conveyors

3.6.6.1 Automatic Controls

- The Conveyors are operated manually via auxiliary hand switches; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the following:

1.	YI-304	Drum present on Drum Lidding Station
2.	YI-305	Drum present on Drum Banding & Primary Smear Station
3.	YI-306	Drum present on Shipping Weigh Station
4.	YI-307	Drum present on Drum Holding & Wipe Down Station
5.	YI-308	Drum present on Secondary Drum Smear Station
6.	YI-309	Drum present on Drum Storage Conveyor
7.	YI-311	Drum present on Drum Wipe Down & Inspection Station

- Drums are brought to the Drum Lidding Station (24-CY-006) by use of a hand switch (HS-304) to start the conveyor motor.

- An interlock (I-42) between the Drum Lidding Station conveyor motor (24-CY-006) and the position indicator (ZS-304) stops the conveyor to position the loaded drums.

- Drums are brought through the exit door to the Drum Banding and Primary Smear Station (24-CY-007) by use of a hand switch (HS-305) to start the conveyor motor.

- An interlock (I-43) between the Drum Banding and Primary Smear Station conveyor motor (24-CY-007) and the position indicator (ZS-305) stops the conveyor to position the lidded drums.

- Drums are brought to the Shipping Weigh Station (24-CY-008) by use of a hand switch (HS-306) to start the conveyor motor.

- An interlock (I-44) between the Shipping Weigh Station conveyor motor (24-CY-008) and the position indicator (ZS-306) stops the conveyor to position the banded drums.

- Drums are brought to the Drum Holding & Wipe Down Station (24-CY-009) by use of a hand switch (HS-307) to start the conveyor motor.

- An interlock (I-45) between the Drum Holding & Wipe Down Station conveyor motor (24-CY-009) and the position indicator (ZS-307) stops the conveyor to position the weighed drums.

- Drums are brought to the Secondary Drum Smear Station (24-CY-010) by use of a hand switch (HS-308) to start the conveyor motor.

- An interlock (I-46) between the Secondary Drum Smear Station conveyor motor (24-CY-010) and the position indicator (ZS-308) stops the conveyor to position the wiped down drums.

- If drums fail the Secondary Drum Smear, they go to the Drum Wipe Down & Inspection Station (24-CY-011) by use of a hand switch (HS-311) to start the conveyor motor.

- An interlock (I-50) between the Drum Wipe Down & Inspection Station conveyor motor (24-CY-011) and the position indicator (ZS-311) stops the conveyor to position the wiped down drums.

- If drums pass the Secondary Drum Smear, or after the Drum Wipe Down & Inspection Station, they go to the Drum Storage Conveyor (24-CY-012) by use of a hand switch (HS-309) to start the conveyor motor.

- An interlock (I-47) between the Drum Storage Conveyor motor (24-CY-012) and the position indicator (ZS-309) stops the conveyor to position the clean drums.

3.6.6.2 Alarm System

There are no alarms associated with the exit conveyors.

3.6.6.3 Data Acquisition System

The Data Acquisition System records the shipping weight of the drums (WR-306) from the exit conveyors system.

3.6.7 Palletizing

3.6.7.1 Automatic Controls

- The Palletizing operation has both automatic and manual controls. The Palletizer is automatic, and the conveyor is operated manually via an auxiliary hand switch; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the drum present on Loaded Pallet Conveyor (YI-312).

- Empty pallets are delivered by the Empty Pallet Mover (24-ME-004) to the Empty Pallet Conveyor (24-CY-001), and conveyed to the Palletizer (24-ME-001).

- Loaded pallets exit the Palletizer (24-ME-001) and are moved by the Loaded Pallet Conveyor (24-CY-013) through the use of a hand switch (HS-312) to start the conveyor motor.

- An interlock (I-49) between the Loaded Pallet Conveyor motor (24-CY-013) and its position indicator (ZS-312) stops the conveyor to position the pallets for transfer to the Pallet Banding Station (24-ME-003).

3.6.7.2 Alarm System

There are no alarms associated with the palletizing equipment.

3.6.7.3 Data Acquisition System

No data is transmitted to the Data Acquisition System from the palletizing equipment.

3.7 Reject Product System (System 26)

3.7.1 Operations

If product samples fail to meet the Silo 3 WAC, the affected drums will be removed from the ISA and returned to the Treatment Facility for reprocessing. The Reject Product System is depicted on P&ID 55-2012. The drums of reject material will be brought by the Pallet Forklift (24-ME-002) to the Pallet Unloading Station. After the bands have been manually removed, the Jib Crane (26-CN-001) will lift the drums off the pallet and place them on the Reject Drum Conveyor (26-CY-002) outside of the Treatment Facility. The drums will be conveyed into the Treatment Facility and onto the Delidding / Lidding Station (26-ME-003) where the drum lids will be removed. The drums will then move into position for Drum Unloading (26-ME-002) on the Drum Unloader Conveyor (26-CY-005).

The Drum Unloader (26-ME-002) will be up-turned, and empty the briquettes from the drum into the Reject Hopper (26-BN-001) via an Integral Screw Conveyor (26-CY-003). The Reject Hopper will act as a surge hopper for the Reject Crusher (26-ME-001) to smooth the reject reprocessing operation. The reject briquettes will flow from the Reject Hopper into the Reject Crusher. The crushed reject briquettes will be conveyed from the crusher by the Crushed Reject Conveyor (26-CY-004) to the Silo 3 Material Feed Conveyor (System 16). The crushed reject briquettes will be re-processed to meet the Silo 3 Material WAC requirements through the same process as the original Silo 3 material. The used empty drums are returned to the Reject Drum Conveyor (26-CY-002) from the Drum Unloader Conveyor (26-CY-005) where the drum lids and bands are replaced at the De-lidding/Lidding Station, and the drums are smeared for external contamination. Once cleared, the drums will be conveyed outside the ARA and onto the Reject Staging Drum Conveyor (26-CY-001) from where they will be put back onto pallets at the Pallet Loading Station.

3.7.2 Control Philosophy

The Reject System is controlled by the Treatment System PLC. Indications if the system is operating and emergency shut off signals are provided by the PLC to the HMI. The control of the Reject System is operator initiated by local controls. The system is controlled to make positions throughout the process.

3.7.3 Jib Crane (26-CN-001)

3.7.3.1 Automatic Controls

- The Jib Crane is operated manually by the operator from the HMI; no operator interaction is required with the machinery itself. The operator is provided indication through the remote HMI of the following:

1.	HS-426	Hand switch
2.	HS-406	Hand switch for Reject Drum Conveyor (26-CY-002)
3.	HS-423	Hand switch
4.	HS-424	Hand switch
5.	HS-422	Hand switch

- Full drums of reject material are placed on the Reject Drum Conveyor (26-CY-002) by the Jib Crane (26-CN-001). A hand switch (HS-406) on the HMI is used to start the conveyor motor.

- The Jib Crane operation is not controlled by any interlocks.

3.7.3.2 Alarm System

There are no alarms associated with the Jib Crane.

3.7.3.3 Data Acquisition System

No data is transmitted to the Data Acquisition System from the Jib Crane.

3.7.4 Drum Unloader (26-ME-002)

3.7.4.1 Automatic Controls

- The Drum Unloading System is operated both automatically, and manually by the operator from the HMI; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the motor retracted position indicator (ZI-414).

- I-31: This interlock connects the motor on the Drum Unloader Conveyor (26-CY-005) with the pressure switch (PS-414), and the solenoid valve (SV-414) to attach and retract the motor from the conveyor.

- I-32: Interlock 32 connects the start/end hand switch (HS-411) for the Drum Unloader Conveyor (26-CY-005) with a running indicator light, a position switch (ZS-411), the retractor motor and the solenoid valve (SV-414).

- I-33: This interlock connects the Position 1 position switch (ZS-412) with an indicator light and a hand switch (HS-412).
- I-34: Interlock 34 connects the Position 2 position switch (ZS-416) with the motor on the Drum Unloader Hoist (26-CN-002).

- I-36: Interlock 36 connects the motor on the Drum Unloader (26-ME-002) with the Unloaded Position 4 position switch (ZS-407) to display when the Drum Unloader is in operation.

- I:37: This interlock connects a hand-off-auto switch (HS-417) with an indicator light, the Position 3 position indicator (YS-411) and the motor on the Reject Screw Conveyor (26-CY-003).

3.7.4.2 Alarm System

There are no alarms associated with the Drum Unloader.

3.7.4.3 Data Acquisition System

No data is transmitted to the Data Acquisition System by the Drum Unloader.

3.7.5 Hopper/Crusher System

3.7.5.1 Automatic Controls

- The Hopper/Crusher System is started and stopped manually by the operator from the HMI; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the following:

  1. HS-408 Hand switch for Crusher motor
  2. HS-410 Hand switch for Crushed Reject Conveyor motor

- No interlocks control the operation of the Hopper/Crusher System, but the feed to the system is directly controlled by the discharge from the Crushed Reject Conveyor (26-CY-004).

3.7.5.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI.

Alarm:	LAH-409	Reject Hopper high level	80% of hopper volume
Response:	Monitor system, verify that material is entering the Silo 3 Material Feed Hoppers. If alarm doesn't clear in 5 minutes take reject system off-line.		

3.7.5.3 Data Acquisition System

No data is transmitted to the Data Acquisition System from the Hopper/Crusher system.

3.7.6 Empty Drum Disposal

3.7.6.1 Automatic Controls

- The Empty Drum Disposal System is operated manually by the operator from the HMI; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the hand switch for Reject Staging Drum Conveyor motor (HS-403).

- There are no interlocks associated with this system.

3.7.6.2 Alarm System

There are no alarms associated with the operation of this equipment.

3.7.6.3 Data Acquisition System

No data is transmitted to the Data Acquisition System from the Empty Drum Disposal System.

3.8 Plant Air System (System 40)

3.8.1 Operations

The Plant Air System supplies both plant air for the retrieval and treatment operation facilities as well as dry instrument air for equipment. The Plant Air System is depicted on P&ID 55-2020. Air exits the Process Air Compressor (40-CM-001A, B) and goes one of two ways. The first stream is split again between the Pipe, Bridge, Gantry and Headhouse Plant Air Header, and the Treatment Area Plant Air Header. The second stream is filtered by the Air Filter (40-FL-001) and then enters the Instrument Air Dryer (40-ME-001). This dry stream is split between the Treatment Area Instrument Air Header and the Air Receiver (11-TK-001).

3.8.2 Control Philosophy

The Plant Air System is controlled by a series of interlocks, hand switches, instruments and valves.

3.8.3 Process Air Compressor (40-CM-001A, B)

3.8.3.1 Automatic Controls

- The Process Air Compressor is operated automatically and manually from an auxiliary hand switch; no operator interaction is required with the machinery itself. The operator is provided indication through the HMI of the pressure indicator of air to Plant Air Header (PI-458).

- The operation of the Process Air Compressor is controlled by an interlock (I-53). This interlock takes the motor on the compressor off-line when the high pressure level switch (PSHL-455A) is tripped. This interlock also controls the indicators which display "Compressor Running" and "Compressor Stopped" indication. The auxiliary hand switch for the vendor control package (HS-455A) is also connected to this interlock.

3.8.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values are based on final vendor data.

Alarm:	PAH-458	Air Pressure of air to Plant Air Header high	TBD
Response:	Switch over to back up Air Compressor.		

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Alarm:	PAL-458	Air Pressure of air to Plant Air Header low	TBD
Response:	Switch over to back up Air Compressor.		

3.8.3.3 Data Acquisition System

No data is transmitted to the Data Acquisition System from the Process Air Compressor.

3.8.4 Instrument Air Dryer (40-ME-001)

3.8.4.1 Automatic Controls

- The Instrument Air Dryer is operated automatically and manually from an auxiliary hand switch; no operator interaction is required with the machinery itself. The operator is only provided indication through the HMI of whether the Instrument Air Dryer is in operation or not.

- An interlock (I-54) controls the operation of the Instrument Air Dryer. The high air temperature switch (TSH-457) is interlocked with the motor on the Dryer. The auxiliary hand switch (HS-457) is also interlocked with the motor on the Dryer.

3.8.4.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values are based on final vendor data.

Alarm:	TAH-457	Air temperature exiting Air Dryer high	TBD
Response:	Switch over to back up Air System.		
Alarm:	PAL-452	Air pressure to Air Receiver (11-TK-001) low	TBD
Response:	Switch over to back up Air System.		

3.8.4.3 Data Acquisition System

No data is transmitted to the Data Acquisition System from the Instrument Air Dryer.

3.9 Product Additive System (System 44)

3.9.1 Operations

The Product Additive Bulk Storage System receives and transfers bulk feed materials (e.g. Envirobond) used in the Silo 3 material stabilization process and is depicted on P&ID 55-2015. The system consists of totes and conveyors. Both the binder and the reducing agent will be stored outside in reusable totes. Both binder and reducer will be stored in separate totes, there will be two tote feed systems for binder and two tote feed systems for reducer. Space is also available for an absorbent system to be incorporated into the control architecture, if needed.

The binder is Envirobond, a phosphate based stabilizer. The binder will be delivered to the site in totes, which will be stored in the storage yard. The reducing agent (which is needed to aid in the stabilization of metals, e.g. chromium, which are present in the Silo 3 material) will also be delivered to the site in totes and be stored in the storage yard. Each tote (both binder and reducing agent) will have the capacity to support approximately one day of treatment operations.

The PLC will control the amount of binder and reducing agent proportionally added to the system by a loss-in-weight feed system based on weight of Silo 3 material added from the Silo 3 Processor Feed System (System 16). If required due to high moisture content of the Silo 3 material, absorbent (e.g. bentonite) will be introduced into the system in the same manner as the other two additives, through its own system of totes and conveyors or through the binder or reducing agent system. As high moisture is not expected in the Silo 3 material, the absorbent tote feed system will not be installed unless moisture levels show a statistical increase as the Silo 3 material is being processed.

The binder and the reducing agent are fed to the Processor Feed System (System 16) by a series of conveyors. The Envirobond exits the Binder Tote and then enters the binder conveyors (44-CY-001A, B). The reducing agent exits the Reducer Tote and enters the reducer conveyors (44-CY-002A, B). Both the binder and the reducing agent feed into the additive conveyors (44-CY-003 & 44-CY-005) and then into a hopper from where they are metered by the Additive Feeder (44-CY-004) to the Processor Feed System (System 16).

3.9.2 Control Philosophy

The PLC will control the amount of binder and reducing agent proportionally added to the system by a loss-in-weight feed system based on the weight of Silo 3 material added to the system from the Silo 3 Material Feed Hoppers (16-TK-001A, B). After shut down, the system will use previously provided set points.

The screw feeders for additive addition are speed controlled. The speed of the screw feeders is controlled by the PLC ratiometerically by the set binding formulation. The screw feeders are volumetric feeders and require an accuracy of.+/- 5%. The addition of the additives, and thus the speed of the screw feeders are controlled by the PLC. The level in the Additive Feeder (44-CY-004) is controlled through level switches and interlocks. The Product Additive System is interlocked with the Processor Feed System (System 16) to control the quantity of Binder and Reducing Agent to be discharged from the Additive Feeder proportional to the feed from the Processor Feed System (System 16).

3.9.3 Binder & Reducer Conveyors (44-CY-001 & 44-CY-002)

3.9.3.1 Automatic Controls

- The Binder Conveyors / Totes (44-CY-001A, B) are operated in automatic; no operator interaction is required. The operator is provided indication through the HMI of the following:

  1. WQI-501 Mass Flow rate of Binder from Tote A

2. WQI-502 Mass Flow rate of Binder from Tote B

- The Reducer Conveyors / Totes (44-CY-002A, B) are operated in automatic; no operator interaction is required. The operator is provided indication through the HMI of the following:

  1. WQI-503 Mass Flow rate of Reducing Agent from Tote A
  2. WQI-504 Mass Flow rate of Reducing Agent from Tote B

- The discharge of binder from the Binder Totes through the Binder Conveyors (44-CY-001A, B) and reducer from the Reducer Totes through the Reducer Conveyors (44-CY-002A, B) operates automatically.

- An interlock (I-25) controls the level of material in the Additive Feeder (44-CY-004). The Additive Feeder high level (LSH-506) is used to take the binder weight rate transmitters (WKIT-501 & WKIT-502) and the reducer weight rate transmitters (WKIT-503 & WKIT-504) off-line. Future provisions will be made to take the absorbent weight rate transmitter (WKIT-505) off-line. If the Additive Feeder level is low (LSL-506), the following equipment will be enabled:

  1. WKIT-501 Binder Conveyor A (44-CY-001A)
  2. WKIT-502 Binder Conveyor B (44-CY-001B)
  3. WKIT-503 Reducer Conveyor A (44-CY-002A)
  4. WKIT-504 Reducer Conveyor B (44-CY-002B)
  5. I-20 Additive Conveyor (44-CY-003) and Flexible Additive Conveyor (44-CY-005)

3.9.3.2 Alarm Systems

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values are based on final vendor data.

Alarm: WKAL-501 Binder Conveyor A (44-CY-001A) low level TBD
Response: Switches binder feed from Conveyor A to Conveyor B (44-CY-001B). Operator arrange for Binder Tote A to be replaced.

Alarm: WKAL-502 Binder Conveyor B (44-CY-001B) low level TBD
Response: Switches binder feed from Conveyor B to Conveyor A (44-CY-001A). Operator arrange for Binder Tote B to be replaced.

Alarm: WKAL-503 Reducer Conveyor A (44-CY-002A) low level TBD
Response: Switches reducer feed from Conveyor A to Conveyor B (44-CY-002B). Operator arrange for Reducer Tote A to be replaced.

Alarm: WKAL-504 Reducer Conveyor B (44-CY-002B) low level TBD

Response: Switches reducer feed from Conveyor B to Conveyor A (44-CY-002A). Operator arrange for Reducer Tote B to be replaced.

3.9.3.3 Data Acquisition System

The Data Acquisition System will record the following data from the Binder Conveyors / Totes:

1. WQR-501 Weight of Binder in Binder Tote A
2. WQR-502 Weight of Binder in Binder Tote B

The Data Acquisition System will record the following data from the Reducer Conveyor / Totes:

1. WQR-503 Weight of Reducing Agent in Reducer Tote A
2. WQR-504 Weight of Reducing Agent in Reducer Tote B

3.9.4 Additive Conveying System

3.9.4.1 Automatic Control

- The Additive Conveying System is operated in automatic; no operator interaction is required. The operator is only provided indication through the HMI of whether the Additive Conveyor (44-CY-003) and Flexible Additive Conveyor (44-CY-005) are on or off, and whether the Additive Feeder (44-CY-004) is running.

- The Additive Feeder (44-CY-004) is interlocked to the Processor Feed System (System 16) for two distinct purposes. The first interlock, I-6, ensures that the correct amount of additives are fed to the Processor System (System 17) based on the pay out rate of Silo 3 Material. Second interlock (I-3): the Additive Feeder (System 44) is used to disable the Silo 3 Material Feed Hopper (16-TK-001A, B) pay out. The variable speed drives WKIT-152 and WKIT-155 are taken off-line, stopping the pay out Rotary Valves (16-VA-001A, B) when no additives are being fed from the Additive Feeder (44-CY-004).

  I-6
  1. WT-152 Weight of material discharged from Hopper A
  2. WT-155 Weight of material discharged from Hopper B
  3. WKIT-507 Additive Feeder speed

  I-3
  1. LSLL-506 Additive Feeder low-low level
  2. WKIT-152 Silo 3 Hopper A Rotary Valve speed
  3. WKIT-155 Silo 3 Hopper B Rotary Valve speed

3.9.4.2 Alarm Systems

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI:

Alarm:	LAL-506	Additive Feeder (44-CY-004) low level	25% of feeder volume
Response:	Operator to check additive feed. Interlock I-25 automatically increase additive feed from totes.		
Alarm:	LALL-506	Additive Feeder low-low level	10%of feeder volume
Response:	Interlock I-3 to take the Silo 3 Material Feed System off-line.		

3.9.4.3 Data Acquisition System

The Data Acquisition System will record the Weight of Additive Feeder (44-CY-004) discharge (WRI-507) from the Additive Conveying System.

3.10 Plant Water System (System 50)

3.10.1 Operations

All water utilized in the water system will come from the Fernald domestic water distribution system. The Plant Water System, as depicted on P&ID 55-2019, utilizes tanks, pumps, and control devices. The Fernald domestic water will enter the Treatment Facility through the Plant Water Feed Tank (50-TK-001). Water is drawn from the tank by the Plant Water Pressure Pump (50-PM-001) and distributed throughout the plant.

3.10.2 Control Philosophy

The Fernald domestic water will enter the Treatment Facility through the Plant Water Feed Tank (50-TK-001). A float valve controls the level of the tank, and an air gap is maintained between the surface of the water and the discharge pipe of the float valve. Water is drawn from the tank by the Plant Water Pressure Pump (50-PM-001). The Plant Water Pressure Pump is manually started and stopped from the control room (and local start/stop switch), and runs continuously to maintain pressure within the Plant Water System. The pressure in the pipeline is controlled by a pressure regulating valve (set at 75 psig) on the tank return loop, which opens if the pump is pumping against a closed circuit. Water flow rate into the plant is therefore dependent upon the demand within the plant and the capacity of the pump. The pump motor will be sized to operate the pump at the end of the pump curve to prevent possible overload.

A back flow preventer, a double check-valve assembly, is installed to prevent water from the Airborne Radiation Area flowing back into the Plant Water Feed Tank.

3.10.3 Plant Water Equipment

3.10.3.1 Automatic Control

- The Plant Water System is operated manually from the HMI; no operator interaction is required with the machinery itself. The operator is provided the indication of the hand switch (HS-553) for the Plant Water Pressure Pump (50-PM-001) through the HMI.

- An interlock (I-38) controls the operation of the Plant Water Pressure Pump (50-PM-001). Both a hand switch at the HMI and an auxiliary hand switch (HS-553) will start and stop the motor for the pump. Indicators as to whether the pump is running or stopped are also connected with this interlock.

- A Back Flow Preventer (50-VA-004) ensures that no potentially contaminated water from the Radioactive Liquid Waste System (System 62) can flow back into the Plant Water System.

3.10.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI:

Alarm:	LAH-551	Plant Water Feed Tank (50-TK-001) level high	80% of tank volume
Response:	Operator manually shut valve 50-VA-001 from the Fernald domestic water distribution system.		
Alarm:	LAL-551	Plant Water Feed Tank (50-TK-001) level low	20% of tank volume
Response:	Operator verify position of valve 50-VA-001. If valve is closed open it. If valve is open, take Plant Water Pressure Pump (50-PM-001) off-line.		

3.10.3.3 Data Acquisition System

No data is transmitted to the Data Acquisition System from the Plant Water System.

3.11 Radioactive Liquid Waste System (System 62)

3.11.1 Operations

The Radioactive Liquid Waste System is designed to collect water from the intermittent cleaning of the Process Mixer (System 17) and to provide process water to the Processor System (System 17). The Radioactive Liquid Waste System collects the process water and wash water in the Process Water Tank (62-TK-001) as depicted on P&ID 55-2006. Process water will consist of wash water, and plant water from the Plant Water System (System 50).

The Process Water Tank (62-TK-001) is filled from the Plant Water System (System 50), as necessary. The Plant Water System provides an air gap back flow preventer to protect the Fernald domestic water distribution system. Another feed stream to the Process Water Tank is from the Chilled Water Coil (11-HE-001) which cools the return air to the silo, in the Conveyance System (System 11).

The Silo 3 material is anticipated to have a moisture content of between 3-10%. At this moisture level, water will have to be added to the Silo 3 material/binder mixture in order to form briquettes and to aid the stabilization process. The PLC will monitor the weight of Silo 3

material added to the mixer and its moisture content, and from this information control the amount of water added. Process water from the Process Water Tank (62-TK-001) will be metered by the Process Water Pump (62-PM-001) through a Filter (62-FL-001) into the Process Mixer (System 17) through a spray bar.

Periodically during operation, the facility, primarily the mixer, will be washed down to remove built up Silo 3 Material. General area wash down will be accomplished using plant water, however the Process Mixer (System 17) wash down will be accomplished using process water. Process water will be pumped by the Process Water Pump (62-PM-001) to the mixer for cleaning, and will return by gravity feed back to the Process Water Tank (62-TK-001).

3.11.2 Control Philosophy

The Process Water Tank (62-TK-001) level is maintained by a float switch (50-VA-009). A high level alarm provides the operator indication of rising level. The flow rate of the water discharged to the Processor System (System 17) is controlled by the PLC by an interlock with the weight of materials added and moisture content of the Silo 3 material (System 16). This flow rate is anticipated to be nominally 1500 lb/hr.

3.11.3 Process Water Tank (62-TK-001)

3.11.3.1 Automatic Controls

- The operator is provided indication through the HMI of the following:

1.	LAH-601	Process Water Tank level high	80% of tank volume
2.	LAL-601	Process Water Tank level Low	20% of tank volume

- Process water discharge operates automatically via the Process Water Pump (62-PM-001), and is controlled by interlock I-04. Interlock I-04, transmits the moisture content (AT-153, AT-156) and the pay out rate (WKIT-152, WKIT-155) of material discharged from the Silo 3 Material Feed Hoppers (System 16) to transmit the amount of water which needs to be added to the Silo 3 material from the Process Water Tank (62-TK-001). This will ensure correct addition of water to the Processor System (System 17).

- The filling of the Process Water Tank (62-TK-001) with process water is an automatic operation controlled by a float valve (50-VA-009).

- The Process Water Tank is interlocked (I-03) with the discharge rotary valves (16-VA-001A, B) on the Silo 3 Material Feed Hoppers (System 16). If the Process Water Tank trips the low level switch (LSL-601), then the discharge of Silo 3 material from the Feed Hoppers will be stopped by taking the Rotary Valves speed control (WKIT-152, WKIT-155) off-line.

- A flow transmitter (FT-604) after the Filter (62-FL-001) on the Process Water Pump is used for process verification. The speed controller (SC-604) on the pump is set at a certain rate, and the flow transmitter (FT-604) is used to verify that that rate is actually what is being pumped.

3.11.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values are based on final vendor data.

Alarm:	LAH-601	Process Water Tank level high	80% of tank volume
Response:	Operator manually shut the tank fill valve (50-VA-007).		
Alarm:	LAL-601	Process Water Tank level low	20% of tank volume
Response:	Operator verify that tank fill valve (50-VA-007) is open and that the Plant Water System (System 50) is operational.		
Alarm:	PDAH-605	Pressure drop across the filter high	TBD
Response:	Monitor system for 5 minutes, if alarm doesn't clear take Process Water Tank System off-line.		

3.11.3.3 Data Acquisition System

The Data Acquisition System will record the water flow rate pumped to mixer (FQR-604) from the Process Water Tank System.

3.11.4 Sump Pump (62-PM-002)

3.11.4.1 Automatic Control

- The Sump Pump operates automatically through use of a flow switch in the Enclosure Sump. The switch opens to send water to the Process Water Tank (62-TK-001) at a level of 12" and closes to stop flow at a level of 3".

- The operator is not provided with any indications through the HMI for this process.

3.11.4.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI.

Alarm:	LAH-605	Enclosure Sump level high	80% of sump volume
Response:	Operator manually check flow switch in the Enclosure Sump, and verify that it is open. If flow switch is closed, manually open to send water to Process Water Tank (62-TK-001).		

3.11.4.3 Data Acquisition System

No data is recorded from this System by the Data Acquisition System.

3.12 Treatment Facility (System 71)

3.12.1 Operations

The HVAC System, as depicted on P&ID 55-2011, and utilizes filter modules, ductwork, fans, and air distribution and control devices. The air filtration system is comprised of pre-filters (or roughing filters), ASHRAE 95% filters and 2 (two) HEPA filters to assure that the quality of the exiting air is in compliance with all applicable requirements. After being treated, all of the air streams are directed into a common plenum and discharged through the monitored Exhaust Stack.

The Treatment Facility ventilation system must be capable of providing a safe environment for the production and Treatment Facility workers, as well as providing effective contamination control. The air from the building will be ducted into the Treatment Enclosure Filter Module (71-FL-001) located on the HVAC pad. The airflow through the filters will be induced by a fan (71-FA-001). From the filters, the air will be conducted through the Exhaust Stack and Plenum (75-ST-001) and discharged to the atmosphere.

3.12.2 Control Philosophy

Inside the Treatment Facility, a partition will be erected to provide an enclosure for the Airborne Radioactivity Area (ARA). Air flows into the building through the Controlled Area to the ARA, always flowing from the lowest level of contamination to the highest. The ARA must maintain a minimum negative pressure of 0.1" W.G., or six (6) air changes of the building's volume per hour. The pressure zones will be accomplished by modulating dampers between the Airborne Radiation Area and the Controlled Area. The air from the building will be ducted into the Treatment Enclosure Filter Module (71-FL-001) located on the HVAC pad. This module will contain both pre-filters and HEPA filters. The airflow through the filters will be induced by a fan (71-FA-001). From the filters, the air will be ducted to the Exhaust Stack and Plenum (75-ST-001) and discharged to the atmosphere. The packaging area will be cooled by the re-circulation of air at 55°F. The building make-up air will be modulated by dampers.

3.12.3 Treatment Enclosure Filter Module (71-FL-001)

3.12.3.1 Automatic Control

- The Filter Module is operated in automatic, no operator intervention is required. The following data is shown on the HMI:

1.	HS-656	Jog Open/Jog Closed hand switch for the control damper
2.	ZI-656	Position indicator for the control damper
3.	HS-668	Open/Close hand switch for solenoid valve
4.	ZI-657	Position indicator for filter inlet damper

5.	HS-664	Release pin from HMI for filter enclosure door
6.	ZI-664	Position indicator for filter enclosure door
7.	PDI-662	Pressure differential indicator for 98% filter
8.	PDI-663	Pressure differential indicator for 99% filter

- Interlock I-66 is a relay which controls the Treatment Enclosure Filter Module Control Damper (FCV-656).

3.12.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values are based on final vendor data.

Alarm:	PDAH-662	Pressure differential high	TBD
Response:	Operator monitor system for 5 minutes, if alarm doesn't clear take Treatment Enclosure Filter Module off-line.		

Alarm:	PDAH-663	Pressure differential high	TBD
Response:	Operator monitor system for 5 minutes, if alarm doesn't clear take Treatment Enclosure Filter Module off-line.		

3.12.3.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Treatment Enclosure Filter Module.

3.12.4 Treatment Enclosure Fan (71-FA-001)

3.12.4.1 Automatic Control

- The Treatment Enclosure Fan is operated in automatic, no operator intervention is required. The following data is shown on the HMI:

1.	ZI-665	Filter outlet damper position indicator
2.	ZIO-658	Treatment Enclosure Fan outlet isolation damper position open
3.	ZIC-658	Treatment Enclosure Fan outlet isolation damper position closed
4.	HS-667	Fan low speed start/stop & high speed start/stop

- Interlock I-67 controls the Treatment Enclosure Fan and displays a 'Fan Running' light (L-667) on the HMI.

3.12.4.2 Alarm System

There are no alarms associated with the Treatment Enclosure Fan.

3.12.4.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Treatment Enclosure Fan.

3.13 Off-Gas Treatment HVAC System (System 75)

3.13.1 Operations

The Off-Gas Treatment System as depicted on P&IDs 55-2009 and 55-2011, is used to treat the air, which has been used and potentially contaminated during treatment of the Silo 3 material. Air enters the Off-Gas Baghouse (75-FL-002) from the Conveyance System (System 11) where the solid material is filtered out of it. From the baghouse, the air is ducted into one of two Silo Process Filter Modules (75-FL-001A, B). These modules will contain both pre-filters (and roughing filters), ASHRAE 95% filters and HEPA filters. The airflow through the system is drawn by the Silo Process Fan (75-FA-001). From the filters, the air will be conducted through the Exhaust Stack and Plenum (75-ST-001) and discharged to the atmosphere. The air discharged from the stack will be monitored for particle count by size as described in the "Point Source Air Emission Data" document (RMR-0445-ENG-010).

3.13.2 Control Philosophy

The dust-laden air will enter into the sub-system at the split from the Silo return branch. The driving force to move the Off-Gas comes from the Off-Gas Fan (75-FA-001). The desired pressure/volume ratio will be achieved by the operation of a modulating damper.

3.13.3 Off-Gas Baghouse (75-FL-002)

3.13.3.1 Automatic Control

- I-65: On Baghouse high level (LSH-771) the exit Rotary Valve (75-VA-003) will start and will remain running for a specified duration of time, then the motor will be taken off-line. The motor will be taken off-line if it is commanded to RUN and zero speed condition remains for more than allowed time, or if motor is running and zero speed (SSL-769) is detected.

- The Baghouse is operated in automatic, no operator intervention is required. The following information will be shown on the HMI:

  1. PDI-770 Baghouse pressure differential indicator.
  2. HS-769 Hand switch for the Rotary Valve (75-VA-003)
  3. ZI-775 Off-Gas Inlet Control Damper (FCV-775) position indicator
  4. HS-775 Off-Gas Inlet Control Damper Jog Open/Jog Closed hand switch

- Interlock I-62 is a relay which controls the Off-Gas Inlet Control Damper (FCV-775).

3.13.3.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values are based on final vendor data.

Alarm:	SAL-769	Rotary Valve (75-VA-003) shaft speed low	TBD

Response: Monitor equipment, increase Rotary Valve speed. If alarm doesn't clear in 5 minutes take Off-Gas Baghouse System off-line.

Alarm: PDAH-770 Baghouse pressure differential high TBD
Response: Interlock to disable 75-FL-002.

Alarm: PDAL-770 Baghouse pressure differential low TBD
Response: Interlock to disable 75-FL-002.

Alarm: LSAH-771 Baghouse high level TBD
Response: Interlock I-769 to increase Rotary Valve (75-VA-003) speed. If alarm does not clear in 5 minutes, take Off-Gas Baghouse off-line.

3.13.3.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Off-Gas Baghouse.

3.13.4 Off-Gas Filter Modules (75-FL-001A, B)

3.13.4.1 Automatic Control

- The Off-Gas Filter Modules are operated in automatic, no operator intervention is required. The following items will be shown on the HMI:

  1. ZI-756 Inlet Damper B position indicator
  2. ZI-754 Inlet Damper A position indicator
  3. ZI-759 Filter Enclosure B Door-Secured position indicator
  4. ZI-763 Outlet Damper A position indicator
  5. ZI-774 Filter Enclosure A Door-Secured position indicator
  6. ZI-767 Outlet Damper B position indicator
  7. HS-764 Solenoid valve (SV-764) open/close hand switch
  8. HS-774 Release pin from HMI for Filter Enclosure A door
  9. PDI-773 Pressure differential indicator for Off-Gas Filter Module A
  10. HS-763 Solenoid valve (SV-763) open/close hand switch
  11. HS-759 Release pin from HMI for Filter Enclosure B door
  12. PDI-757 Pressure differential indicator for Off-Gas Filter Module B
- Interlock I-63 controls the operation of the solenoid valves (SV-763, SV-764) which control the Off-Gas Filter Modules inlet and outlet dampers.

3.13.4.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values are based on final vendor data.

Alarm: PDAH-773 Pressure differential Filter Module A (75-FL-001A) high TBD
Response: Operator monitor system for 5 minutes, if alarm doesn't clear, switch over to Off-Gas Filter Module B (75-FL-001B).

Alarm:	PDAH-757	Pressure differential Filter Module B (75-FL-001B) high	TBD
Response:	Operator monitor system for 5 minutes, if alarm doesn't clear, switch over to Off-Gas Filter Module A (75-FL-001A).		

3.13.4.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Off-Gas Filter Modules.

3.13.5 Off-Gas Fan (75-FA-001)

3.13.5.1 Automatic Control

- The Off-Gas Fan is operated in automatic, no operator intervention is required. The following items will be shown on the HMI:

  1. ZSO-755 Damper position open indicator
  2. ZSC-755 Damper position closed indicator
  3. HS-766 Low RPM start, high RPM start

- Interlock I-64 controls the operation of the Off-Gas Fan.

3.13.5.2 Alarm System

There are no alarms associated with the Off-Gas Fan.

3.13.5.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Off-Gas Fan.

3.13.6 Exhaust Stack and Plenum (75-ST-001)

3.13.6.1 Automatic Control

- The Exhaust Stack and Plenum are operated in automatic, no operator intervention is required. The following items will be shown on the HMI:
  1. PIR-855 Pressure of stack discharge
  2. TIR-856 Temperature of stack discharge
  3. YQIAR-857 Total radionuclide count

- There are no interlocks associated with the operation of this equipment.

3.13.6.2 Alarm System

The following alarms display on the alarm summary and alarm, sound audible alarms, and/or display on the HMI. TBD values are based on final vendor data.

Alarm:	YQAH-857	Total radionuclide count high	TBD

Response: Monitor equipment for 5 minutes, if alarm doesn't clear take the Exhaust Stack and Plenum off-line.

3.13.6.3 Data Acquisition System

No data is sent to the Data Acquisition System from the Exhaust Stack and Plenum.

3.14 Sample Management System (System 84)

3.14.1 Operations

The Sample Management System consists of a Product Sampler on the Product Surge Hopper (System 24) as depicted on P&ID 55-2016. A representative number of samples may be collected throughout an operating day, based on specified requirements. The Product Samples of processed Silo 3 material will be transferred to Fluor Fernald and analyzed to verify that the material meets the Silo 3 Material Waste Acceptance Criteria (WAC).

The briquettes must undergo sampling and analysis to ensure that it is in compliance with the Silo 3 Material Waste Acceptance Criteria. Systematic random sampling will be implemented at a frequency as specified by Fluor Fernald. The processed Silo 3 material briquettes will be sampled (84-PE-002) from the Product Surge Hopper (24-BN-001), after chemical treatment and physical consolidation of the final waste form. The sampling mechanism will collect the material from the Product Surge Hopper and deliver the sample by gravity feed to a collection container. Product Samples will be collected in sample containers in a sample cabinet local to the sampler. The samples of processed material will be transferred to Fluor Fernald for analysis and results used to certify that the Silo 3 Final Product material meets the requirements of the Silo 3 WAC. Operations personnel will collect the sample containers from the cabinet on a regular basis.

3.14.2 Control Philosophy

The Sample Management System is controlled automatically based on time.

3.14.3 Sampling System

3.14.3.1 Automatic Control

- The sampling system is operated in automatic; no operator interaction is required to collect samples. The operator is provided no indication through the HMI from the Sample Management System.

- The sampler is controlled by internal clocks to control the sampling operation. The sampler will collect a predetermined number of sub-samples and then move the sample container carousel to the next position.

- Operations personnel will pick up samples after collection as needed.

3.14.3.2 Alarm System

There are no alarms associated with the operation of this system.

3.14.3.3 Data Acquisition System

No data is recorded from this system by the Treatment System PLC.

3.15 Management Information System (System 91)

3.15.1 Operations

The Management Information System (MIS) periodically gathers plant compliance, performance, and production data, and stores this information long-term, on a dedicated hard drive system, along with the time and date that each datum was taken. The HMI system is used to retrieve the data in date blocks for screen review and formatted report generation. Information flow and data sampling rates will be determined from a data controller/router unit.

Discharge stack emission data such as particle size and count will be used to support Environmental Protection Agency (EPA) reporting requirements. Radiological data from the radon monitors will also support the EPA and plant compliance requirements. Silo 3 material container identification codes and stabilized Silo 3 material weights will support throughput and system performance criteria. The product sampler bottles will be bar coded for system performance checking and verification.

The MIS will consist of a controller/router unit with programmable sample or scanner rates for each data channel, and a high-capacity hard drive for data storage. The controller will interface with the HMI, the stack emissions data system, the radon monitors, the bar code readers, and the weight measurement systems using appropriate serial interfaces (RS-232C, 422, etc). Generally, the MIS controller will receive its send-data commands from the HMI unit under operator control, or under automatic, time mark control at the end of each shift when the HMI will transfer production data from storage in order to compile the shift production report. The MIS controller will be programmable from the HMI keyboard/mouse.

3.15.2 Control Philosophy

The HMI hard drive will provide temporary storage and date and time marking for the data. Data will be collected via the HMI initially. Collected data is available for trend analysis. Trending of operations data may be analyzed for process control purposes.. A permanent hard drive will be used to provide backup storage for data from the following sources:

- Silo 3 Material Feed Sampler bar code reader
- Product Sampler bar code reader
- Stack monitoring instrumentation from particle concentrations for four different size ranges, stack temperature, and stack flow
- Drum weights and bar code identification numbers

- Drum smear contamination level data will also be collected and stored

The HMI will automatically transfer data to the Data Management System (DMS) at the end of each work shift. The operator may request data from a given date from the HMI screen and have this information printed if necessary.

3.15.3 System Equipment Requirements

The following equipment will make up the MIS:

- Hard drive capable of storing at least one year of data from the sources listed above.
- The sampling frequency for the stack data is assumed to by every 4 seconds.
- Temporary hard drive is already supplied with the HMI.
- Bar code readers and their processing units.
- The HMI functions as the data management processing unit, with emergency backup power.
- The report printer is already supplied as part of the HMI System.
- Drum label generation and printing equipment.
- Sampler container label generation and printing equipment.
- The permanent hard drive must be provided with a means of down loading the data to removable data storage media and/or computer network, LAN or Internet for automatic system back-up.