Savannah River Site
Solid Waste Management Department
Consolidated Incinerator Facility
Operator Training Program

SOLID WASTE HANDLING SYSTEM(U)

Study Guide

ZIOITX03

Revision 01

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Training Manager / Date

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Engineering / Date

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Facility Manager / Date

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REVISION LOG

REV.	AFFECTED SECTION(S)	SUMMARY OF CHANGE
01	All	New Issue

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REFERENCES

1. 261-SOP-SWHS-01, *Solid Waste Handling Operations,* Rev. 3

2. DOE Order 4330.4B, *Conduct of Maintenance,* Chapter 6

3. Manual 1S, Procedure 3.13, *Consolidated Incineration Facility Waste Acceptance Criteria,* Rev. 0

4. *Savannah River Site Consolidated Incineration Facility Functional Description, Container Handling,* Rev. 0

5. *Savannah River Site Solid Waste Training System Design Description, Solid Waste Handling,* Rev. 0

6. SE5-2-2003289*, Instrument Control Diagram, Portal Monitor Rad. Monitoring,* Rev. 0

7. SRP03000, *Savannah River Project Container Handling Facility,* Rev. 5

8. W830334, *Instrument Control Diagram, Container Handling* Sheet 1, Rev. 3

9. W830341, *Instrument Control Diagram, Container Handling* Sheet 2, Rev. 3

10. W830363, *Instrument Control Diagram, Container Handling* Sheet 3, Rev. 3

11. WSRC-SA-17, *Consolidated Incineration Facility Safety Analysis Report,* (DOE Approval Copy 12/94)

LEARNING OBJECTIVES

TERMINAL OBJECTIVE

1.0 Without references, **EXPLAIN** the significance of the Solid Waste Handling System to Consolidated Incinerator Facility operations, including it's importance to safety, and the impact on operations of a failure of the system.

ENABLING LEARNING OBJECTIVES

1.1 **STATE** the purpose of the Solid Waste Handling System.

1.2 Briefly **DESCRIBE** how the Solid Waste Handling System accomplishes it's intended purpose.

1.3 **EXPLAIN** the consequences of a failure of the Solid Waste Handling System to fulfill it's intended purpose, including the effects on other systems or components and overall plant operation.

TERMINAL OBJECTIVE

2.0 Using system diagrams, **EVALUATE** potential problems which could interfere with normal Solid Waste Handling System flowpaths to determine their significance on overall system operation and the corrective actions needed to return the system to normal.

ENABLING LEARNING OBJECTIVES

2.1 **DESCRIBE** the physical layout of the Solid Waste Handling System components including, the general location, how many there are, and functional relationship for each of the following major components:

a. Portal Monitor
b. X-Ray Machine
c. Conveyors
d. Line Scanners
e. Emergency Stop Push-buttons
f. Box Lift

2.2 **DESCRIBE** the Solid Waste Handling System arrangement to include a drawing showing the following system components and interfaces with other systems:

a. Portal Monitor
b. X-Ray Machine
c. Line Scanners
d. Emergency Stop Push-buttons
e. Box Lift

2.3 Given a description of the Solid Waste Handling System equipment status, **STATE** any corrective actions required to return system operation to a normal condition.

TERMINAL OBJECTIVE

3.0 Given values of Solid Waste System operation parameters, **EVALUATE** potential problems that could effect the normal functioning of the system or it's components to determine the significance of the existing condition and the actions required to return the system to normal operation.

ENABLING LEARNING OBJECTIVES

3.1 **DESCRIBE** the following major components of the Solid Waste Handling System including their functions, principles of operation, and basic construction:

a. Portal Monitor
b. X-Ray Machine
c. Box Lift
d. Conveyors

3.2 **STATE** the design capacities and operational limitations for the following Solid Waste Handling System major components:

a. Portal Monitor
b. X-Ray Machine
c. Box Lift
d. Conveyors

3.3 **DESCRIBE** the following Solid Waste Handling System instrumentation including, indicator location (local or Control Room) sensing points and associated instrument controls.

a. Conveyor Clear/Full Lights
b. Photoelectric eyes
c. Bar Code Label Scanners
d. Portal Monitor Indicators
e. Toledo Scale Readout
f. X-Ray Machine
g. Emergency Stop Indicators
h. Limit Switches
i. DCS Indications
j. Fire Detection
k. Radiation Monitoring System

3.4 **INTERPRET** the following Solid Waste Handling System alarms, including the conditions causing alarm actuation and the basis for the alarms:

a. Conveyor Emergency Stop
b. Hinged Passage Gate Open
c. Fire Protection Alarm
d. Portal Monitor Alarm
e. Bar Code Scanner Alarm
f. Conveyor Full Alarm

3.5 **EXPLAIN** how the following Solid Waste Handling System equipment is controlled in all operating modes or conditions to include: control locations (local or Control Room), basic operating principles of control devices, and the effects of each control on the component operation.

a. Portal Monitor
b. X-Ray Machine
c. Conveyors
d. Box Lift

3.6 **DESCRIBE** the interlocks associated with the following Solid Waste Handling System equipment to include the interlock actuating conditions, effects of interlock actuation, and the reason the interlock is necessary.

a. Fire Shutdown
b. Hinged Passage Gates
c. Box Lift Status

TERMINAL OBJECTIVE

4.0 Given necessary procedures or other technical documents and system conditions, **DETERMINE** the operator actions required for normal and off normal operation of the Solid Waste Handling System including problem recognition and resolution.

ENABLING LEARNING OBJECTIVES

4.1 **STATE** the personnel safety concerns associated with the Solid Waste Handling System.

4.2 Given applicable procedures and plant conditions, **DETERMINE** the actions necessary to perform the following Solid Waste Handling System operations:

a. Startup
b. Manual Operation of Equipment
c. Shutdown

4.3 **DETERMINE** the effects on the Solid Waste Handling System and the integrated plant response when given any of the following:

a. Indications/alarms

b. Malfunctions/failure of components

c. Operator Actions

SYSTEM OVERVIEW

ELO 4.1	**STATE the personnel safety concerns associated with the Solid Waste Handling System.**

Safety

1. Beware of pinch points while handling boxes and working around conveyors.
2. Use proper work gloves (e.g. leather) when handling boxes.
3. Follow safety practices as required in Manual 8Q, Employee Safety Manual.
4. Operators are routinely called upon to physically lift materials. Proper lifting techniques and protective gear should be used when performing any lifting.
5. Comply with radiation and contamination control requirements identified in the applicable Radiation Work Permits (RWP) and/or Standing Radiation Work Permit(s)

Introduction

Solid waste is generated by the diverse operations of the Savannah River Site. Some of the solid waste will be transported to the Consolidated Incineration Facility (CIF) for burning. The solid waste received by the CIF for incineration is generally comprised of beta-gamma Low Level Radioactive Waste (LLRW) and Non-Radioactive Hazardous Waste (NRHW) packaged in 21" cardboard boxes averaging 25 pounds each. Waste typically consists of cotton overalls, rags, wipes, cotton and rubber gloves, plastic suits, PVC sheets and shoe covers, polyethylene bags, mops, brushes, floor cleaning material and foot gear. The Waste Acceptance Criteria (WAC) Manual provides details on the type of material that can be accepted and the requisite record keeping. Average composition by weight of materials delivered is shown in Table 1, Material Composition by Weight. It is expected that common waste streams will be incinerated during specific campaigns.

Campaigns are defined as cycles in which only selected waste streams will be accepted from individual generators allowing coordinated waste management and efficient, cost effective disposal.

The purpose of the Solid Waste Handling (SWH) System is to receive, inspect, store and track the boxes of LLRW and NRHW shipped to the CIF. Containers of waste are unloaded from the trucks, moved into the building 261-H Receiving Area, and transferred by a series of conveyors, turntables, a lift, and segmented hydraulic rams to the Rotary Kiln (RK) for incineration. The containers are centered, monitored, weighed, and x-rayed while on the conveyors. Containers which do not meet predetermined criteria are rejected and removed from the process manually by the operator. The SWH System interfaces with the Solid Waste Feed (SWF) System at the Box Lift Conveyor where they are transported by the SWF System to the RK for incineration.

Material	Weight %
Cellulose	40
PVC	8
Polyethylene	23
Latex	19
Water	5
Ash	5

Table 1 Material Composition by Weight

The facility is designed to operate continuously 24 hours per day, 7 days a week. The facilities normal handling rate is 30 containers per hour. Containers are tracked through the facility using a Bar Code Label and Scanner system. A shutdown of the Solid Waste Handling System will halt the incineration of solid waste, but continued operation of the incinerator to burn liquid waste is possible at the discretion of the Shift Supervisor.

Except for the operator manually off-loading containers from trucks, handling rejects, and local operation of the X-ray Machine, the SWH System will operate in an automatic mode. The system is controlled and monitored by the Distributed Control System (DCS) which communicates with the Label Scanner/Bar Coding Computer.

Summary

1. Safety is a primary concern and care should be taken to lift properly and wear proper personal safety gear.
2. The SWHS is designed to handle specifically sized boxes of Low Level Radioactive Waste (LLRW) and Non-Radioactive Hazardous Waste (NRHW).
3. The SWHS receives, inspects, stores, and tracks boxes shipped to the CIF for incineration.
4. The facility is designed to operate continuously and normal handling rate is 30 containers per hour.
5. The SWHS system is totally automatic, controlled and monitored by DCS, with the exception of manual off-loading of the boxes from the truck, operation of the X-Ray machine, and removal of rejected boxes.

Review Questions

1. What safety concerns exist when operating the Solid Waste Handling System?

SYSTEM PURPOSE

ELO 1.1 STATE the purpose of the Solid Waste Handling System

System Purpose

The Solid Waste Handling system is designed for receiving, inspecting, processing, labeling, and storing low-level radioactive waste (LLRW) and non-radioactive hazardous waste (NRHW).

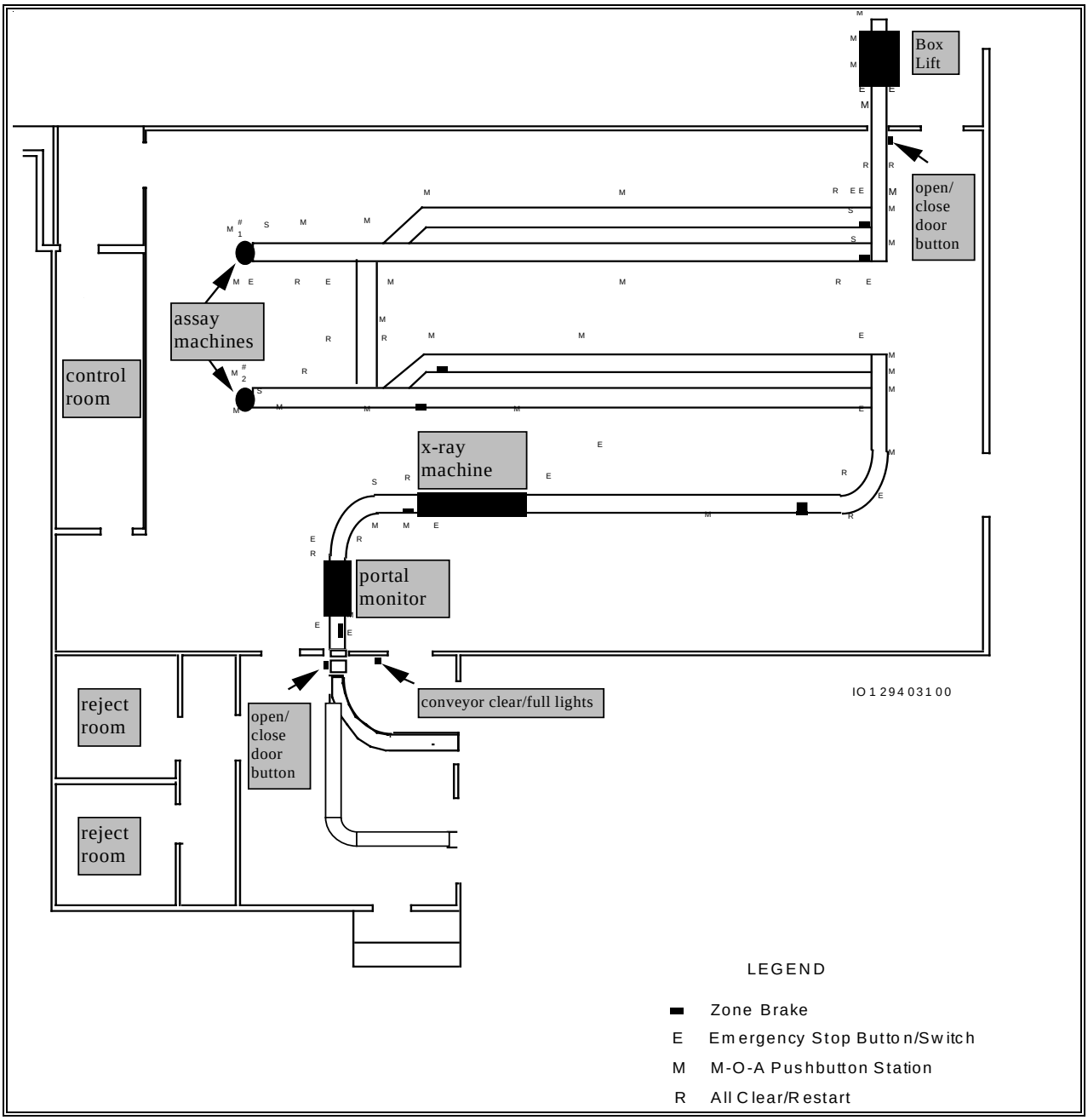

Figure 1 Solid Waste Handling System Process Flow Diagram

DESCRIPTION AND FLOWPATH

ELO 1.2	**Briefly DESCRIBE how the Solid Waste Handling System accomplishes it's intended purpose.**

System Description

(See Figure 1, Solid Waste Handling System Process Flow Diagram). The SWH System is located in the enclosed portion of Building 261-H. The receipt of containers occurs at the Truck Off-Loading Area, where a flexible gravity type conveyor can be shifted from one truck to another. Containers are then routed to the Portal Monitor Feed Conveyor where the container is scanned and inspected. When the container has successfully completed all the operations on the portal monitor, it is transferred to the X-ray Machine. After the X-ray Machine, the container will go to either one of two accumulating conveyors. The accumulating conveyors discharge to the assay discharge conveyors, and containers are sent to the Box Lift Conveyor which routes them to the SWF System. A series of six bar code scanners are positioned at various locations to identify the container at key processing positions in the system. Air-operated brakes are used to stop a zone (zone brake) of conveyor rollers to regulate the flow of containers. Hinged passage conveyors are positioned at strategic locations to allow personnel access to various processing areas.

ELO 2.1	**DESCRIBE the physical layout of the Solid Waste Handling System components including, the general location, how many there are, and functional relationship for each of the following major components:** **a. Portal Monitor** **b. X-Ray Machine** **c. Line Scanners** **d. Emergency Stop Push-buttons** **e. Box Lift**

System Flowpath

The system starts at the Truck Off-Loading Area which is located at the Northeast corner of Building 261-H. Containers of solid waste in the form of 21 inches cubed cardboard boxes are delivered to the facility by way of truck transports. There are two truck unloading area bay doors to accommodate the deliveries. Portable gravity-type conveyors can be positioned for convenient off-loading of the shipments. Containers are manually placed onto the portable conveyors and will roll down the sloped track of the gravity conveyors onto the stationary conveyors of the SWH System. The containers will enter the handling area through a motor-operated door which is normally cycled by a photoelectric eye but may be operated manually by a local push-button station. The door circuit has a one minute time delay to allow a continuous flow of containers during the off-loading process without cycling each time a container arrives.

Containers enter the handling area on the Portal Monitor Feed Conveyor. The feed conveyor utilizes a zone brake at the discharge end to regulate boxes one at a time (singulation) to the Portal Monitor. The operations performed by the Portal Monitor will slow the flow of containers resulting in an accumulation of boxes on the feed and portable conveyors. Four operations, activated by the photoelectric eyes, are performed by the Portal Monitor. The container is first centered on the conveyor to align it for the other three operations. After the container is centered, it is scanned to verify that the label can be read as well as to provide input to the DCS. After the container is scanned, it is monitored for approximately two seconds to verify the radiation level emitted by the container is within limits. The final operation performed by the Portal Monitor is the weighing of the container. When box is determined to be in position by a photoelectric eye, scale sensor bars rise through the conveyor roller spaces to capture the container, weigh it and record the weight. Any scan, monitor or weight reject will indicate on the Portal Monitor control panel and require the operator to manually remove the container from the process. If all of the tests on the Portal Monitor are passed, the scale sensor bars will lower and allow the container to go down a hinged passage conveyor, around a 90° curve and accumulate in front of the zone brake for the X-Ray Machine. If additional containers have accumulated at the entrance to the Portal Monitor, the process will repeat.

The zone brake at the entrance to the X-Ray Machine is provided for singulation of the containers through the X-Ray process. Each container is label-scanned, x-rayed and then held at the X-Ray Machine outlet until the operator accepts or rejects and manually removes it. If the operator accepts the container at the X-Ray Machine control panel, the X-Ray Machine will allow it to continue onto the X-Ray Discharge Conveyor and finally onto one of the two Box Storage Conveyors.

If the photoelectric eyes for Box Storage Conveyors indicate that containers can be received, the container will flow straight through to one of these Box Storage Conveyors. If both Box Storage Conveyors are full, a zone brake will stop the container at the end of the X-Ray Discharge Storage Conveyors.

If X-Ray Discharge Storage Conveyor is full, the X-Ray Machine operator is prevented from releasing the container. The X-Ray Machine operator's call for a new container will be ignored by the PLC until the previous container has been released (by either accepting or rejecting it).

Based upon scanning and weight data from the DCS, batches of between one to three containers are assembled at the discharge end of Assay Discharge. When DCS has assembled an acceptable batch by weight, the Box Lift is down and the vertical inlet door is open, the batch of containers will be moved to the Box Lift Conveyor for transfer to the SWF System

ELO 2.2	**DESCRIBE the Solid Waste Handling System arrangement to include a drawing showing the following system components and interfaces with other systems:** **a. Portal Monitor** **b. X-Ray Machine**

c. Line Scanners
d. Emergency Stop Push-buttons
e. Box Lift

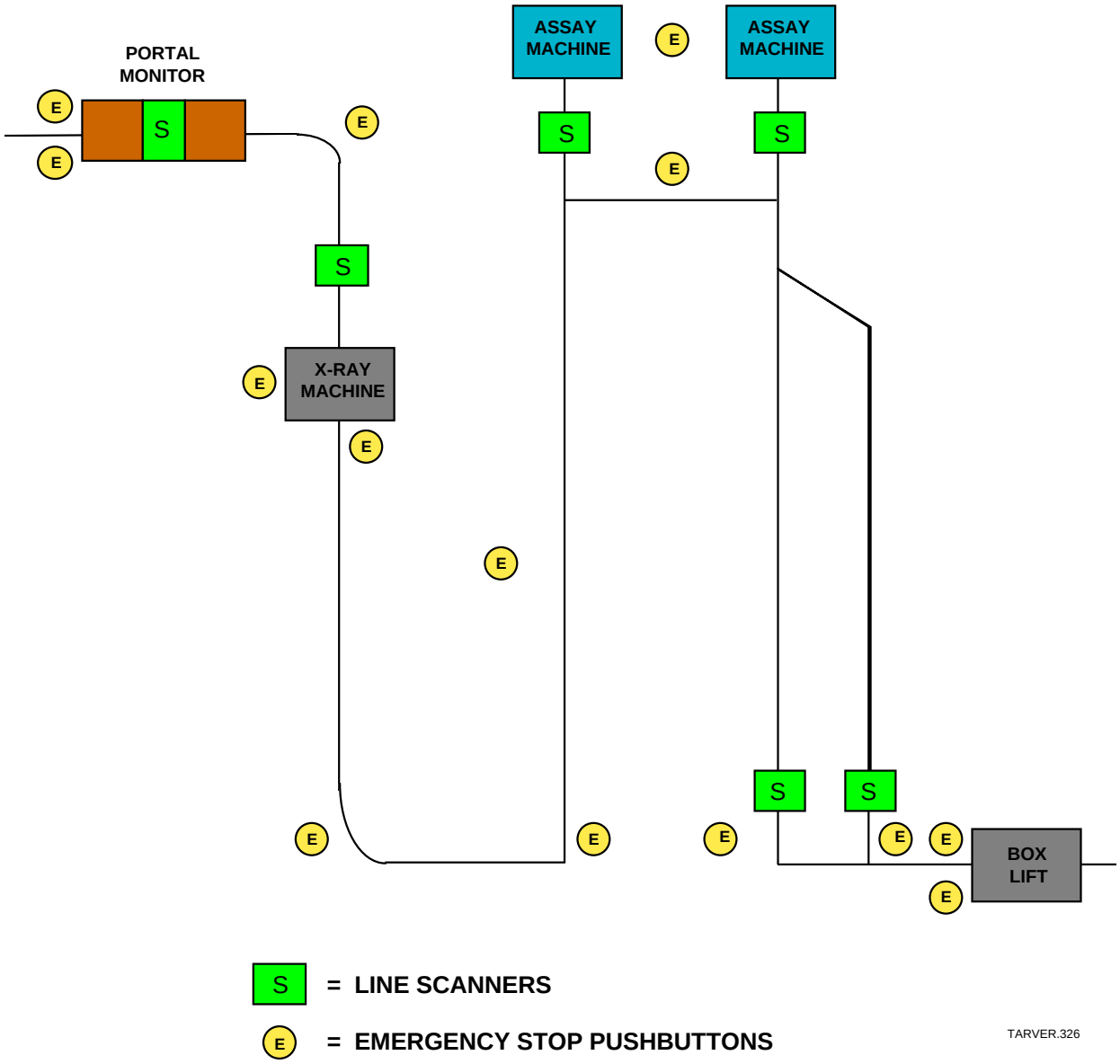

Figure 2 Solid Waste Handling Diagram

Summary

1. Boxes are received at the truck unloading area and transported by a flexible gravity type conveyor to the Portal Monitor where the container is scanned and inspected.
2. When the container passes all operations on the portal monitor it is routed to the X-Ray machine and then to one of two accumulating conveyors.
3. After the accumulating conveyors, a series of conveyors arranges boxes in batches and routes the batches to the SWF system.
4. A series of bar code scanners are positioned at various locations to identify the container at key positions. Air operated brakes are used to stop a zone to regulate flow.
5. Hinged passage conveyors are positioned to allow personnel access to various areas.

Review Questions

1. What is the purpose of the Solid Waste Handling System?
2. Describe the basic flowpath from when the boxes are unloaded from the truck to the box lift.
3. How are boxes tracked through the system and identified at key processing points in the system?
4. What purpose does the zone brakes perform for the various major components?
5. What three conditions must be met before the SWHS will move a batch of boxes into the box lift?
6. Draw a one line diagram of the SWHS including major components and connections to other systems.

MAJOR COMPONENTS

ELO 3.1	**DESCRIBE the following major components of the Solid Waste Handling System including their functions, principles of operation, and basic construction:** **a. Portal Monitor** **b. X-Ray Machine** **c. Conveyors** **d. Box Lift**
ELO 3.2	**STATE the design capacities and operational limitations for the following Solid Waste Handling System major components:** **a. Portal Monitor** **b. X-Ray Machine** **c. Box Lift** **d. Conveyors**

Truck Unloading Conveyor

The Truck Unloading Conveyor H-261-SWHS-CNVR-6001, is used to aid in the off-loading of containers delivered to the facility and transport them into the Container Handling Facility (See Figure 3, Truck Unloading Area). The conveyor is a two section, flexible, accordion type roller conveyor. The conveyor requires manual positioning while unloading containers from incoming trucks. Conveyors are light weight and on casters to allow easy movement within the unloading bays.

Portal Monitor Feed Conveyor

The Portal Monitor Feed Conveyor H-261-SWHS-CNVR-6002 is an accumulating-type conveyor that will run at 30 ft./min. It contains two 30 inch exciter pads (exciter pads are the motor-driven belt sections of the conveyors) and a zone brake at the discharge end to provide singulation for the Portal Monitor. Singulation means that only one box at a time is allowed to enter the Portal Monitor. This is accomplished by utilizing the different speeds in Portal Monitor Feed Conveyor H-261-SWHS-CNVR-6002 and Portal Monitor Conveyor H-261-SWHS-CNVR-6007, which runs at 60 ft./min. When a gap is sensed by a photoelectric eye between boxes, the zone brake is energized and holds the box at the end of the feed conveyor until the previous box clears the weigh scale on the monitor.

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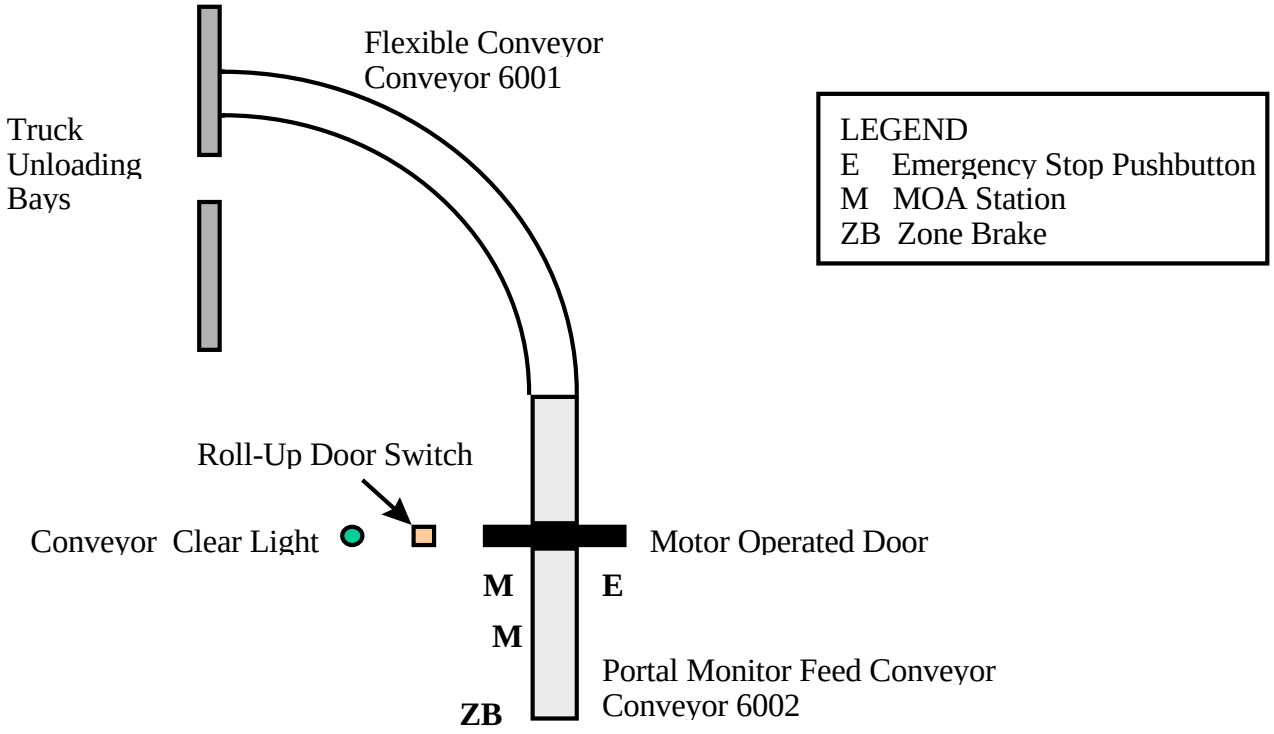

Figure 3 **Truck Unloading Area (Top View)**

Portal Monitor and Scale

(See Figure 4, Portal Monitoring Area). The Portal Monitor consists of a radiation detector, a box centering assembly, a line scanner, and a Toledo
scale.

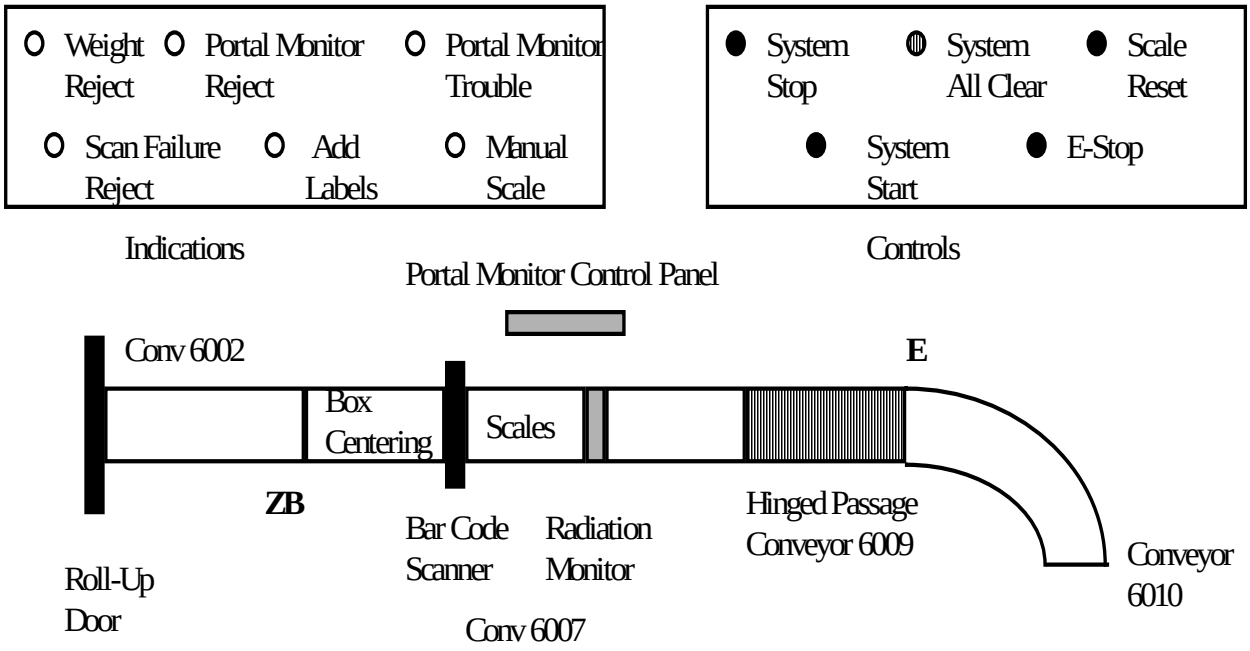

Figure 4 Portal Monitoring Area (Top View)

The box centering assembly uses four pneumatic cylinders activated by a photoelectric eye to center the box within ±1/2". Centering is done to align the containers evenly between the Portal Monitor side sensors and position it for weighing on the scale.

The label applicator has been retired in place and boxes will be labeled with a "4 x 4" in size label applied by the generator. If the label is missing or illegible, a label can be applied manually by the operator.

The label scanner will read the labels and transmit identification data to the DCS/PLC.

The Portal Monitor will operate after the box is sensed in position by a photoelectric eye. Radiation detectors are arranged to view the underside of the box between the rollers and the sides and top of the box encircling the conveyor.

The Scale is a Toledo Model with a digital indicator and input to the DCS/PLC controls. When the containers are delivered to the scale, pneumatically-operated sensor bars rise through the conveyor spaces to capture the containers for weighing. Operation of the scale is automatic but the operator may manually weigh the containers by placing the local MAN/OFF/AUTOMATIC (MOA) selector switch in the MAN (MANUAL) position.

X-Ray Machine Feed Conveyor

(See Figure 5, X-Ray Machine Area). X-Ray Machine Feed conveyor H-261-SWHS-CNVR-6010 is an accumulating-type conveyor that allows containers to flow to and accumulate at the entrance of the X-ray machine. The conveyor runs at 30 ft./min. and contains two 30 inch exciter

pads and a zone brake at the end of the conveyor for singulation to the X-Ray Machine.

X-Ray Machine

The X-Ray Machine H-261-SWHS-XRAY-001 is similar to the cabinet machines used to perform baggage inspections at airports. The machine is provided with a shielding enclosure and is certified to comply with all requirements of the U. S. Bureau of Radiological Health Standard for cabinet X-ray machines.

The major components of the machine are the Digital Video Store (DVS), the X-Ray Generator, the E-Scan Linear X-Ray Detector Array (LXDA), Conveyor, Control Panel, and the Color Video Monitor.

The DVS controls the operation of the other machine components and holds the image displayed on the Color Video Monitor.

The operator control panel buttons are depressed to allow containers to move along the conveyor through the machine. When a photoelectric eye senses that a container is in the machine, the DVS activates the X-Ray Generator. The X-Ray beam generated falls upon the LXDA causing an image to be formed. The image is formed one line at a time with the final image stored in the DVS as well as on the Color Video Display for the operators inspection.

Two images are simultaneously stored and processed in the X-Ray Machine: a high energy and a low energy image. Through digital processing of the two types of images, the actual types of atoms in the container can be determined. The atoms are "classified" as either organic (if the atomic number is less than 10) or inorganic (if the atomic number is 10 or greater) in nature. Displays of the materials will appear as either red (indicating dense organic materials), blue (indicating dense inorganic materials), or black (indicating a compound of organic and inorganic

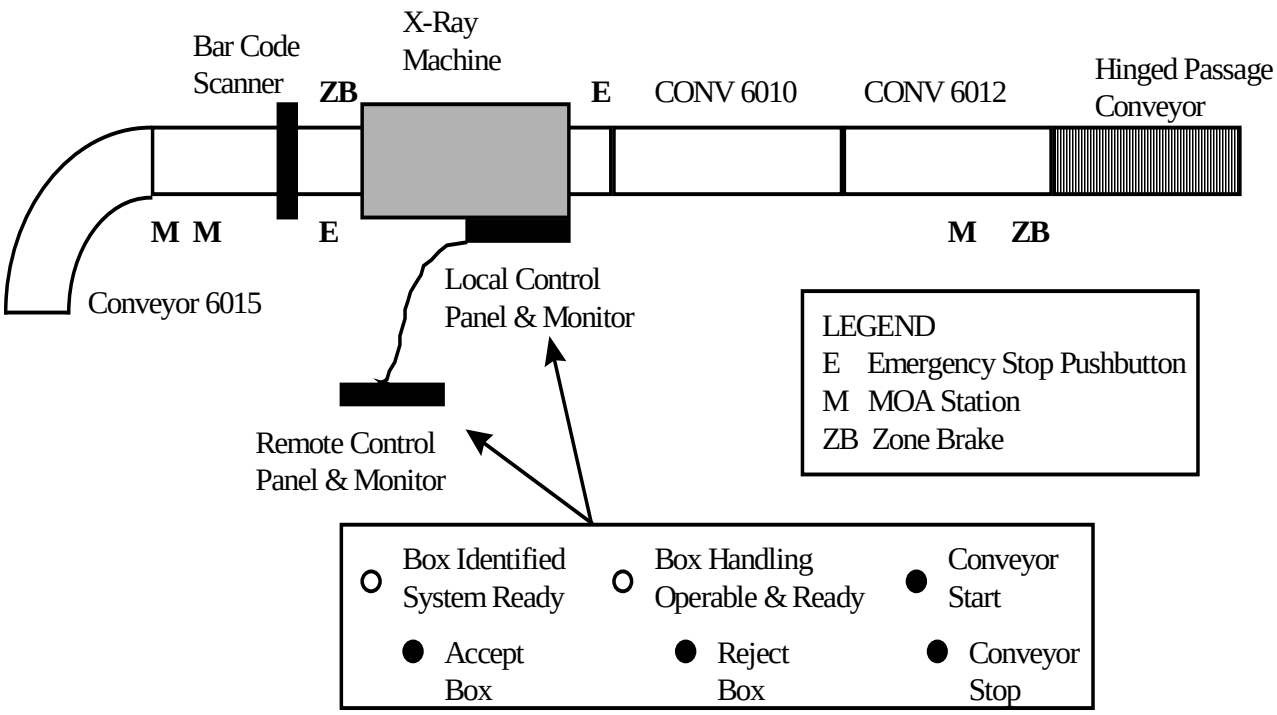

Figure 5 X-Ray Machine Area (Top View)

materials) or combinations of red and blue(indicating mixtures of organic and inorganic).

The operator will check for items not suitable for incineration. Such items include (but are not limited to) paint cans, aerosol cans, tools, glass or plastic bottles containing liquids, nails, wire and other similar items. If the ACCEPT push-button is depressed on the local control panel, the box will be delivered to the storage conveyors. If the REJECT push-button is depressed on the local control panel, the box will move out of the X-Ray Machine to allow the operator to manually remove it.

X-Ray Discharge Conveyor

X-Ray Discharge Conveyor H-261-SWHS-CNVR-6012 runs at 30 ft./min., has five 30" exciter pads and contains a zone brake at the discharge end. Containers will accumulate at the end of the storage conveyor until space is available downstream.

Box Storage Conveyors

Both Box Storage Conveyors H-261-SWHS-CNVR-6052 and H-261-SWHS-CNVR-6053 run at 30 ft./min. Both conveyors have nine 30" exciter pads. The conveyors also have zone brakes at the discharge end.

Assay Machine

The Assay Machines have been retired in place.

Assay Discharge Conveyors

(See Figure 6, Assay Discharge Area). The Assay Discharge Conveyors H-261-SWHS-CNVR-6101 and H-261-SWHS-CNVR-6102 provide the capacity to compensate for irregular flow of boxes and minor delays which may occur. The storage capacity of the discharge conveyors are 77 boxes. The conveyors are in parallel and fill, in sequence, with containers from the assay machines. Conveyors H-261-SWHS-CNVR-6101 and H-261-SWHS-CNVR-6102 run at 30 ft/min. and are equipped with a zone brake. A pneumatic deflector assembly is included in the system to divert the containers to fill Conveyor H-261-SWHS-CNVR-6101 if Conveyor H-261-SWHS-CNVR-6102 is full or out of service.

Box Lift Conveyor

The Box Lift Conveyor H-261-SWHS-CNVR-6107 has a frame, drive base, moving platform carriage, and interlocked safety gates. The Box Lift receives boxes from the Assay Discharge conveyors when the DCS signals require another batch for incineration. Together with the container identification and weight previously supplied to the DCS/PLC a batch between one to three boxes is assembled. When the box lift is in position to receive another batch, the vertical lift door will open, the transfer conveyor will start, and the batch will be moved onto the Box Lift.

Power Supply

480V components, such as conveyor motors, coiling doors, box lift, and transfer conveyors, are powered directly from MCC 1 & 2. 120V loads are powered from ELLV-PNL-005 (Power Panel B in the SWHS area) which is supplied by a step-down transformer powered from MCC 1.

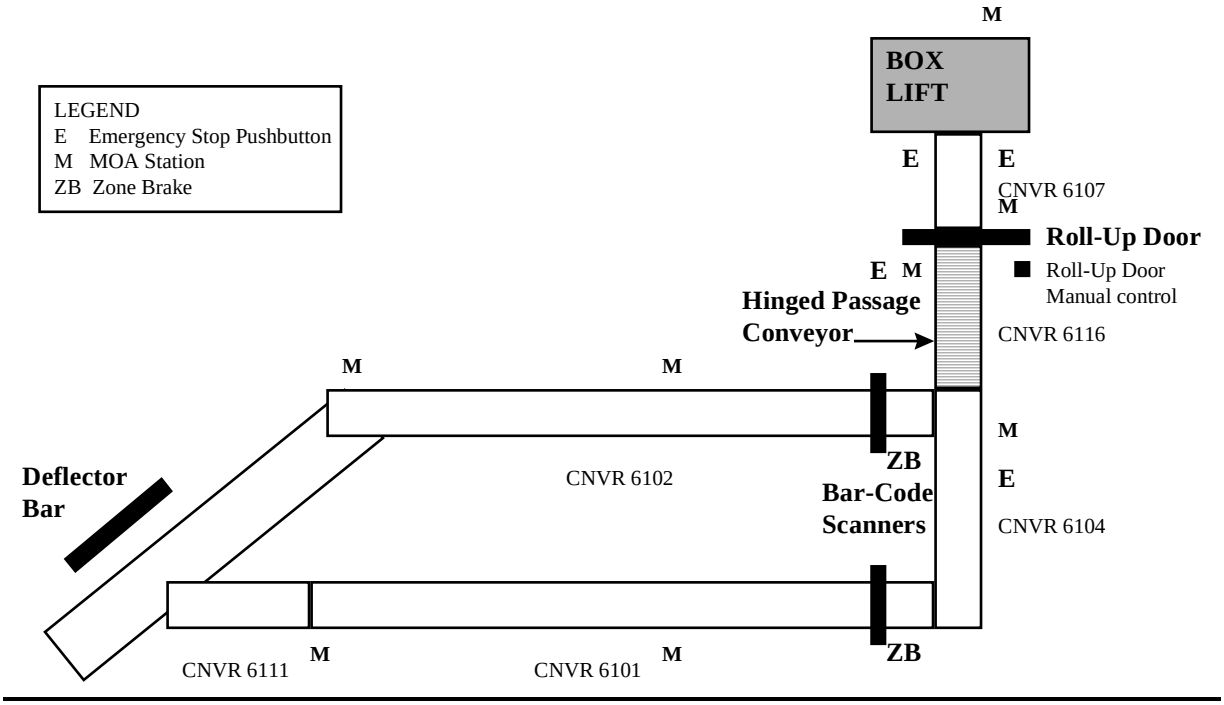

Figure 6 Assay Discharge Area (Top View)

Summary

1. The Truck Unloading Conveyor is a two section flexible accordion type roller conveyor used to transport boxes from trucks to the Portal Monitor Feed Conveyor.
2. The Portal Monitor Feed Conveyor transports boxes and provides singulation for boxes to enter the Portal Monitor.
3. The Portal Monitor centers, scans the label, measures radiation, and weighs each box.
4. The X-Ray Machine Conveyor provides transport and singulation for the X-Ray machine.
5. The X-Ray Machine provides a visual indication of the type of materials inside a box. It allows the operator to check for items not suitable for incineration. The machine is operated manually.
6. The X-Ray Discharge, Box Storage, and Assay Discharge conveyors transport boxes to the Box Lift Conveyor.
7. The Box Lift Conveyor receives boxes from the Assay Discharge conveyors in batches for delivery to the Box Lift.

Review Questions

1. How does the Portal Monitor Feed Conveyor and the Portal Monitor Conveyor act together to provide singulation of the boxes for the Portal Monitor?
2. What 4 functions does the Portal Monitor perform?
3. Describe the operation of the Portal Monitor Scale and how it is normally controlled.
4. What 2 types of images are stored in the X-Ray Machine and how are these used to identify various materials?
5. Name 6 examples of items deemed not suitable for incineration.
6. (Using Drawing #W833026) Determine the total storage capacity of the SWHS conveyors.
7. How are batches of boxes arranged for loading onto the Box Lift?
8. What are the power supplies for the SWHS components?

INSTRUMENTATION

ELO 3.3	**DESCRIBE the following Solid Waste Handling System instrumentation including indicator location (local or Control Room) sensing points and associated instrument controls:** **a. Conveyor Clear/Full Lights** **b. Photoelectric Eyes** **c. Bar Code Label Scanners** **d. Portal Monitor Indicators** **e. Toledo Scale Readout** **f. X-Ray Machine** **g. Emergency Stop Indicators** **h. Limit Switches** **i. DCS Indications** **j. Fire Detection** **k. Radiation Monitoring System**

Conveyor Clear/Full Lights

CONVEYOR CLEAR (Green) and CONVEYOR FULL (Red) indicating lights are provided in the truck unloading bay next to the wall door separating the flexible unloading conveyors from the Portal Monitor Feed Conveyor and at the door leading to the Box Lift. Prior to off-loading of containers from the trucks, the CONVEYOR CLEAR light in the Box Unloading area should be verified illuminated, indicating that the system is operating. If the CONVEYOR FULL light is illuminated, an audible alarm will sound indicating the conveyor is full up to the photoelectric eye. An ACKNOWLEDGE push-button is located on the wall next to the door under the indicating lights.

Photoelectric Eyes

Photoelectric eyes are provided at the entrance of each inspection station and at strategic locations along the Conveyor System. The photoelectric eyes provide interlocks and controls for equipment associated with the inspection stations (i.e., allowing bar code scanners to scan the container label) and allow movement of containers onto the storage conveyors.

Bar Code Label Scanners

Bar code label scanners are located at the portal monitor, at the entrance to the X-ray Machine, at the entrance to the both assay machines, and at the end of the Assay Discharge Accumulator Conveyors. The six bar code label scanners transmit 7-bit ASCII data to the DCS. The DCS decodes this data, determines its validity, and stores the identification number in the container

status register and/or verifies that a register has already been created. If the data is unreadable, a visual and audible alarm occurs and the container will not move to the next operation until the problem is corrected or the container is removed.

Portal Monitor Indicators

(See Figure 3, Portal Monitor Area). Displays and indicators are provided on the Portal Monitor local control panel. Indications are for:

- Portal Monitor Trouble -(H-261-SWHS-YI 6006-(B) general indication of component failure
- Weight Reject - H-261-SWHS-YI-6007-container out of specified weight limits (between 7 and 75 pounds)
- Portal Monitor Reject -H-261-SWHS-YI-6006-(A)- surface radiation measured out of specified limits (greater than 10 mR/Hr 2" from surface of container)
- Scan Failure Reject -H-261-SWHS-YI-6005-(A)- no label read or illegible label applied
- Add Labels - label applicator is retired in place and does not apply
- Manual Scale -H-261-SWHS-WI-6007- weight scale in manual mode of control by positioning of MOA selector switch
- E-STOP -H-261-SWHS-HS-6008-(B)- indicating light shows activation of system E-Stop push-button

Toledo Scale Readout

The scale provides a digital readout- H-261-SWHS-WI-6007- at the local control station. The scale readouts are for:

- Scale zero - either adjusted zero for container weight or calibrated zero
- Weight in pounds - any weight scale read in standard measure
- Weight in kilograms - any weight scale read in metric measure
- Gross weight - weight of container and contents
- Tare weight - weight of contents after scale has been reset to give indication of zero for container weight

X-Ray Machine

The X-Ray Machine has a local control panel. Indications (Green lights) are provided for:

- System Ready -H-261-SWHS-YI-6011-(A)- box is acceptable up to the machine, all X-Ray Machine interlocks satisfied
- Conveyor Ready -H-261-SWHS-YI-6011-(B)- X-Ray Machine Conveyor is operable and ready to pass another container through X-Ray Machine

Emergency Stop Indications

The system E-Stop push-buttons have red indicating lights to show when they have been actuated and provide an alarm and display on DCS. The conveyor pull cords tie into a junction box that is equipped with a red indicating light to show when a pull cord has been actuated and provide a DCS alarm and display.

Limit Switches

Limit switches are provided on the top and bottom of the Box Lift to prevent overtravel and to allow alignment of containers being loaded from the feed conveyor and discharged to the SWF System.

DCS Indications

Indications and alarms for the SWH System are provided on the DCS in the control room. Indications and alarms are shown in Table 2, SWH System DCS Indications and Alarms.

Conveyor Fire Detection

Conveyor fire detection is accomplished using a temperature sensitive wire installed above the entire length of the conveyor. As discussed in the Fire Protection system it consists of two wires in a cable seperated by a temperature sensitive insulation. If a fire occurs and the insulation melts, the two wires contact and provide an electrical signal to the Fire Protection System.

Radiation Monitoring Systems

A Gamma Monitor is provided for container dose rates at the Portal Monitor. Indicating lights are also provided for indications of power available (Amber) and alarm condition (Blue). Monitoring the boxes prior to entry of the SWHS will prevent excessive radiation levels by limiting the radiation level of each box.

The presence of radioactive, airborne particulates is indicative of leaks or spills resulting from container breakage. Radioactive airborne contaminants are periodically checked for by sampling with portable monitors. Explosive gas monitors are not installed in the Container Handling Area because there is a low probability that flammable gas accumulation will reach explosive levels in this area. The Radiation Monitoring will be discussed in detail in, Radiation Monitoring System.

Summary

1. Conveyor Clear/Full lights let the operator know if the conveyor is operating and if the conveyor is full or not.
2. Photoelectric eyes are placed at strategic locations and provide interlocks and controls for equipment and conveyors.
3. Bar Code Label Scanners are used by DCS to track the boxes through the system and use

the stored information on each to form batches to send to the SWF system.

4. Portal Monitor local control panel provides indications for various alarms, rejects, and failures.
5. Toledo Scale Readout provides a digital readout at the local control station.
6. The X-Ray machine local control panel is used to manually operate the X-Ray station and provides ready lights.
7. Emergency Stop push-buttons have indicating lights to show when actuated. The conveyor pull cords junction box has an indicating light to show pull cord usage.
8. Limit switches are used on the Box Lift to limit travel and allow alignment of containers.
9. Conveyor Fire Protection is provided by a temperature sensitive wire running the length of the conveyor system.
10. Radiation Monitoring Systems include a gamma monitor at the Portal Monitor area, radiation monitors, continuous air monitors, and a Kanne chamber.

Review Questions

1. What is the purpose of the Conveyor Indicator lights located in the truck unloading bay?
2. How are the locations of the Bar Code Label Scanners arranged in the SWHS?
3. What reject indications are available on the Portal Monitor Control Panel?
4. What indications would the operator have if a E-stop push-button or conveyor pull cord has been actuated?
5. How does opening a hinged passage gate affect the operation of the SWHS?
6. How would a conveyor motor fire be detected?
7. What condition would cause a Bar Code Scanner Alarm?

Table 2 SWH System DCS Indications and Alarms

CLI NUMBER *	DESCRIPTION	INDICATION/ ALARM
H-261-SWHS-YA-6014	Conveyor Emergency Stop	Alarm
H-261-SWHS-YI-6001	Door 001 Open	Indication
H-261-SWHS-QI-6002(A)	Conveyor 6002 Brake On	Indication
H-261-SWHS-QI-6002(E)	Conveyor 6002 Motor Running	Indication
H-261-SWHS-ZA-6004	Label Out	Alarm
H-261-SWHS-QI-6007	Conveyor 6007 Running	Indication
H-261-SWHS-ZA-6009	Hinged Passage Gate Open	Alarm
H-261-SWHS-QI-6015	Conveyor 6015 Running	Indication
H-261-SWHS-YI-6010	Conveyor 6010 Full	Indication
H-261-SWHS-QI-6010(A)	Conveyor 6010 Running	Indication
H-261-SWHS-QI-6010(B)	Conveyor 6010 Brake On	Indication
H-261-SWHS-YI-6012(A)	Conveyor 6012 Full	Indication
H-261-SWHS-QI-6012(A)	Conveyor 6012 Running	Indication
H-261-SWHS-QI-6012(B)	Conveyor 6012 Brake On	Indication
H-261-SWHS-ZA-6013	Hinged Passage Gate Open	Alarm
H-261-SWHS-QI-6061	Transfer Conveyor Running (6061)	Indication
H-261-SWHS-QI-6065	Transfer Conveyor Running (6065)	Indication
H-261-SWHS-QI-6058	ACT 6058 Running	Indication
H-261-SWHS-QI-6051	ACT 6051 Running	Indication
H-261-SWHS-YI-6053	Conveyor 6053 Full	Indication
H-261-SWHS-YI-6052	Conveyor 6052 Full	Indication
H-261-SWHS-QI-6052(A)	Conveyor 6052 Brake On	Indication
H-261-SWHS-QI-6052	Conveyor 6052 Running	Indication

Table 2 SWH System DCS Indications and Alarms (Cont.)

CLI NUMBER *	DESCRIPTION	INDICATION/ ALARM
H-261-SWHS-QI-6053(A)	Conveyor 6053 Brake On	Indication
H-261-SWHS-QI-6053	Conveyor 6053 Running	Indication
H-261-SWHS-QI-6063	Transfer Conveyor 6063 Actuator Running	Indication
H-261-SWHS-QI-6062	Conveyor 6062 Running	Indication
H-261-SWHS-QI-6054(A)	Conveyor 6054 Running Forward	Indication
H-261-SWHS-QI-6054(B)	Conveyor 6054 Running Reverse	Indication
H-261-SWHS-ZI-6056	Hinged Passage Gate Closed	Indication
H-261-SWHS-QI-6055(A)	Turntable 001 Motor Running	Indication
H-261-SWHS-QI-6055(B)	Turntable 002 Running	Indication
H-261-SWHS-QI-6057	Conveyor 6057 Running	Indication
H-261-SWHS-QI-6064	Transfer Conveyor Running	Indication
H-261-SWHS-QI-6058(B)	Conveyor 6058 Running Reverse	Indication
H-261-SWHS-QI-6058(A)	Conveyor 6058 Running Forward	Indication
H-261-SWHS-QI-6059(B)	Turntable 002 Motor Running	Indication
H-261-SWHS-QI-6059(A)	Turntable 002 Running	Indication
H-261-SWHS-QI-6110	Conveyor 6110 Running	Indication
H-261-SWHS-QI-6111	Conveyor 6111 Running	Indication
H-261-SWHS-YI 6102	Conveyor 6102 Full	Indication
H-261-SWHS-YI-6101	Conveyor 6101 Full	Indication
H-261-SWHS-QI-6102	Conveyor 6102 Running	Indication
H-261-SWHS-QI-6101	Conveyor 6101 Running	Indication
H-261-SWHS-QI-6101(A)	Conveyor 6101 Brake On	Indication
H-261-SWHS-QI-6102(A)	Conveyor 6102 Brake On	Indication
H-261-SWHS-QI-6104	Transfer Conveyor Actuator 6104 Running	Indication

Table 2 SWH System DCS Indications and Alarms (Cont.)

CLI NUMBER *	DESCRIPTION	INDICATION/ ALARM
H-261-SWHS-QI-6104(A)	Transfer Conveyor Actuator 6104(B) Running	Indication
H-261-SWHS-QI-6104(B)	Conveyor 6104(C) Running	Indication
H-261-SWHS-ZI-6105(A)	Hinged Passage Gate Closed	Indication
H-261-SWHS-YI-6106	Hinged Passage Gate Open	Indication
H-261-SWHS-QI-6107	Conveyor 6107 Running	Indication
H-261-SWHS-ZI-6108	Lift 001 Down	Indication
H-261-SWHS-QI-6108	Lift 001 Running	Indication
H-261-SWHS-QI-6108(A)	Lift 001 Motor Run Up	Indication
H-261-SWHS-YI-6109(A)	Box Jam	Indication
H-261-SWHS-QI-6108(B)	Lift 001 Motor Run Down	Indication
H-261-SWHS-YI-6109(B)	Batch Ready	Indication
H-261-SWHS-QI-6109	Conveyor 6109 Running	Indication

CONTROLS, INTERLOCKS AND ALARMS

ELO 3.5 EXPLAIN how the following Solid Waste Handling System equipment is controlled in all operating modes or conditions to include: control locations (local or Control Room), basic operating principles of control devices, and the effects of each control on the component operation.

a. Portal Monitor

b. X-Ray Machine

c. Conveyors

e. Box Lift

Controls

Portal Monitor Feed Door

The door will cycle with a time delay of one minute when the presence of a container is sensed. A photoelectric eye inputs to an interlock that prevents closure of the door when a container is beneath it. A local OPEN/CLOSE push-button control may be utilized to override the automatic function but it will not override the interlock.

Local Push-button Stations

A local push-button station is provided at each area where the presence of a reject can shut down the upstream portions of the system. The station includes an ALL CLEAR push-button and a CONVEYOR RESTART push-button. The ALL CLEAR push-button permits restarting the system and the CONVEYOR RESTART push-button permits placing the system in automatic mode after the reject(s) is/are removed.

Emergency Stop controls

Emergency Stop (ESTOP) push-buttons and pull cords are also provided. Push-buttons are located at the Portal Monitor and the X-Ray Machine. Pull cords are located alongside of the conveyors. These are used by operator in the event of an incident that requires immediate halting of all process equipment. Depressing the push-button or pulling the cord causes all equipment to stop instantly. After the problem is corrected, to restart the system, the E-Stop push-button must be reset and the entire system restarted. If the pull cord was used, the pull cord junction box must be reset by pulling the T-handle at the junction box, the ALL CLEAR push-button activated, and the CONVEYOR RESTART push-button activated.

Manual-Off-Automatic (MOA) Switches

There are also local MANUAL/OFF/AUTOMATIC (MOA) stations to permit the operator to run and configure the conveyors in the required mode of operation. When the MOA switch is placed in the MANUAL position, the motor may be started by the local START push-button.

The motor cannot be operated through the DCS when the MOA is in MANUAL. Motor operation in MANUAL mode will provide no interlock permissive information to the DCS.

When the MOA switch is placed in the OFF position, the motor stops and cannot be started by either the local control or the DCS.

When the MOA switch is placed in AUTOMATIC, the motor may be started by the local control when the DCS/PLC permissives are satisfied. The motor may also be started from the DCS/PLC controls if the permissive are satisfied and the running motor will also generate operating permissives to the DCS/PLC.

Next to the MOA switch on the conveyors is a JOG switch. The JOG switch is used to locally jog the conveyors when the MOA switch is in MANUAL.

Portal Monitoring System

As containers enter the SWH System, the portal monitor verifies that radiation emitted from contained waste is within the acceptance criteria, and the scale weighs the containers to ensure that container weight is within acceptable limits. Containers are held on the scale while the DCS checks the container status register. The container status is checked to verify that the label was readable and that the radiation level and container weight were acceptable. If the container passes these tests, the scale lift is released and the container moves to the X-ray Feed Accumulator Conveyor. If the container fails any of these tests, an alarm sounds and the operator manually removes the container to the appropriate reject room. The cause of failure can be determined by checking the failure lights on the Portal Monitor Control Panel.

The Portal Monitor local control panel has push-button controls for:

- WEIGH SCALE RESET - zeroes out the scale for initial weighing or for tare load
- SYSTEM STOP - stops all operations after completion of in progress process (monitor, conveyor, scale, scanner,)
- SYSTEM START - starts the process; if in progress, completes operation before beginning new cycle
- RESET/ALL CLEAR - reset for equipment after a shutdown, stop or trip
- E-STOP - stops all operations immediately; Reset and All clear required to be actuated after an E-Stop. E-Stop push-button activation requires a restart of the entire system.
- Weigh Scale MOA switch - normally run in AUTO but manual weighing can be performed for operator determined rejects.

The Portal Monitor weigh scale has controls for:

- Zeroing scale - will either set up initial scale setting or used to tare load
- Clearing tare weight - used to reset scale to zero
- Printing scale stored data - gives data printout of all registered data in scale

- Entering data from an entry - inputs scale readout data into scale memory then into DCS which inputs the PLC to set up the register for the scale data
- Recall previous data entered - input from PLC register
- Entering numeric ID - can be used to input identification number into registry

X-Ray System

The X-Ray Machine is provided with a Local Control Panel and monitor as well as a Remote Control Panel and monitor. Controls on the panels include:

- Conveyor start - starts X-Ray Machine Conveyor to allow operator to observe contents of container
- Accept Box - when inspection of container satisfies the X-ray criteria, operator presses this button to allow the machine to pass the container through (if room is available on the Box Storage Conveyors)
- Reject Box - when inspection of the container does not satisfy the X-ray criteria, the operator presses this button and the process will stop until the operator manually removes the box from the machine, resets the system, and depresses the All Clear push-button
- Conveyor Stop - stops the X-Ray Machine Conveyor

The control panels provide an operator interface to the PLC of the Container Handling System. The X-ray Machine operator uses the local controls to move containers one at a time from the upstream accumulating conveyor the X-ray Machine Conveyor. When the operator calls for a container, the zone brake on the X-ray Feed Conveyor is released to permit a container to enter the X-ray Machine. The operator must remain on the Step-On pad at the X-Ray station for the conveyor to operate. Each container on the conveyor moves through the X-ray Machine and is stopped at the discharge end of the conveyor. There it is held momentarily in this position to allow the operator to push either a REJECT or ACCEPT push-button. A photoelectric eye indicates that the X-Ray Discharge Conveyor can accept additional containers and that the operator has pressed the ACCEPT push-button. The container will then flow onto the X-ray Discharge Conveyor. If photoelectric eyes for the Box Storage Conveyors indicate that the containers can be received, the container will flow right through to these conveyors.

Assay System

Assay Machines are retired in place.

DCS

The DCS is the primary control center for the Container Handling System. The automatic control functions of the DCS, which affect safety in the Container Handling Area, include identification and rejection of containers containing hazardous wastes that do not meet acceptance criteria. Container status registers are created in the DCS and are used to store the following information:

- Container identification number
- Portal monitor status, accept or reject
- Container weight, accept or reject
- X-ray status, accept or reject

As the containers move past the bar code label scanners, the label is read and the DCS checks the container status register to verify that all test have been performed and passed up to that inspection station. If a container is detected that does not have a register already created, the DCS sounds an alarm and stops the Conveyor System until the container is removed and the Conveyor System restarted.

The DCS performs the logic to assemble a batch of containers to be incinerated. A batch contains three containers or less and must weigh no more than 75 pounds. The container lift must be in the down position to assemble the container batch. A container is loaded on the Box Lift Conveyor from one of the Assay Discharge Conveyors. Label scanners identify the next two containers ready to move to the elevator, and the DCS obtains container weight from the container status register. The DCS selects the lightest of the two containers available, which when added to the container already loaded on the elevator will not exceed the 75 pound maximum batch weight. The DCS then selects the container that will provide a batch close to 75 pounds (if available), discharges it to the Box Lift Conveyor, and signals when the batch is complete.

The components in the DCS are designed with a redundant operation philosophy (excluding I/O). The philosophy extends to power supplies, processors, and communications as required. The DCS reliability is designed so that system downtime does not exceed 4.5 accumulated hr/yr. (i.e., three shutdowns with a 90 minute maximum duration). The DCS conducts continuous self-diagnostics and indicates malfunctions or communications failure as an audible alarm.

ELO 3.6	**DESCRIBE the interlocks associated with the following Solid Waste Handling System equipment to include the interlock actuating conditions, effects of interlock actuation, and the reason the interlock is necessary.** **a. Fire Shutdown** **b. Hinged Passage Gates** **c. Box Lift Status**

Interlocks

Fire Shutdown (B3)

An interlock from the fire protection system is hardwired to the emergency stop circuit that shuts down the SWH System Conveyors when a fire is detected in the CIF zones 3, 4, 5, or 6.

Hinged Passage Gates

Operation of the system is interlocked to the position of the hinged passage gates. The gates must remain down for the system to operate. If any one of the hinged gates is opened, the system will automatically shut down.

Box Lift Status (B13)

An interlock exists to prevent a batch from being assembled unless the box lift is in the down position as per limit switch 6108 WS-1. Interlocks are also provided on the Box Lift to prevent conveyor and or lift operation if the vertical doors are not in the required positions.

3.4	**INTERPRET the following Solid Waste Handling System alarms, including the conditions causing alarm actuation and the basis for the alarms:** **a. Conveyor Emergency Stop** **b. Hinged Passage Gate Open** **c. Fire Protection Alarm** **d. Portal Monitor Alarm** **e. Bar Code Scanner Alarm** **f. Conveyor Full Alarm**

Alarms

Conveyor Emergency Stop

The Emergency Stop is actuated by the operator when a situation occurs which requires stopping the conveyors. Depressing the push-button or pulling the cord causes all equipment to stop instantly and causes an audible alarm. After the problem is corrected, to restart the system, the E-Stop push-button must be reset by the keyswitch on the Control Panel and the entire system restarted. If the pull cord was used, the pull cord junction box must be reset, the ALL CLEAR push-button activated, and the CONVEYOR RESTART push-button activated.

Hinged Passage Gate Open

If any one of the hinged passage gates is opened, an alarm will sound locally, at DCS, and the system will automatically shut down. To restart, the ALL CLEAR push-button must be activated and the CONVEYOR RESTART push-button activated.

Fire Protection Alarm

Anytime a fire is detected at CIF Fire Zones 3, 4, 5, or 6, a Fire Protection Alarm sounds and

DCS automatically stops the SWHS Conveyors.

Portal Monitor Alarm

If a box fails any of the Portal Monitor checks (label readability, weight, radiation) then an audible alarm sounds and the operator must remove the box at fault and restart the conveyors.

Bar Code Scanner Alarm

If the bar code cannot be read by the any of the Bar Code Scanners, an audible alarm sounds and the operator must remove the faulty box, apply a new label, and restart the conveyor system.

Conveyor Full Alarm

An audible alarm and red rotating light in the truck unloading bay which sounds indicating the conveyor is full up to the photoelectric eye. A second light is located just prior to the Box Lift. An ACKNOWLEDGE push-button is located on the wall next to the door under the indicating lights for silencing the alarm.

Limits

Radioactive Limits

The portal monitor will reject containers with a radiation level greater than 10 mR/hr measured 2" from the container surface. The portal monitor has a high radiation contact closure that is hardwired to the PLC.

Size Limit

Container size is limited due to the clearances provided in the SWF System gates (24"), for scanning and label reading requirements and for centering limitations. Container size limits are 21" X 21” X 21”.

Review Questions

1. How are conveyors restarted after they have stopped for removal of a reject?
2. Describe the process for restarting the system after a E-Stop push-button is used of a conveyor pull cord activated.
3. What are four different types of information the DCS container status registers contain?
4. What would a Portal Monitor Alarm indicate?
5. How is a conveyor full alarm silenced?
6. What are the radiation and size limits for the SWHS?

SYSTEM INTERRELATIONS

ELO 1.3	**EXPLAIN the consequences of a failure of the Solid Waste Handling System to fulfill its' intended purpose, including the effects on other systems or components and overall plant operation.**

DCS

There are interfaces to the DCS from the bar code scanners, the scale, and the local computers at the operator consoles. The DCS also signals the SWH System when boxes are ready to be fed to the RK. The DCS System monitors equipment status and directs conveyor operations. The DCS-operated Conveyor System can be overridden by manual operation of emergency pull cords and by MOA switches. A failure of the DCS system will render the SWH system inoperable since DCS and the PLC's control the movement of boxes through the system. A failure of the SWH system instrumentation could interfere with the ability of DCS to control the movement of boxes through the system.

Fire Protection System

If a fire occurs in the Container Handling Area, a hardwired connection from the fire alarm shuts down the SWH System. A failure of the fire protection system would leave the SWH system unprotected from detection of a fire should one occur in the SWH area. A failure of the SWH system would have no effect on the Fire Protection System except in case of a fire.

Solid Waste Feed (SWF) System

The SWH System interfaces with the SWF System at the Box Lift Conveyor discharge. SWF System requirements for containers will be sent to the DCS which will control the amount of containers processed through the SWH System. If the SWHS fails, depending on the type of failure and the ability of the system to continue operations (i.e. if the component is redundant or singular) the SWF system could continue to operate only as long as boxes were available from the storage conveyors. A failure of the SWF system would cause the SWHS system to cease operations once the storage conveyors were full.

Radiation Monitoring System

Radioactive airborne contaminants are detected by continuous radiation monitors and by a Kanne chamber located with the Container Handling Area. Area radiation levels are monitored by Area Radiation Monitors located within the Container Handling Area. A failure of the Radiation Monitoring System would cause the SWHS to be unprotected in case of high airborne casualty, but would not prevent operation. A failure of the SWHS would not interfere with the operation of the Radiation Monitoring System.

HVAC

The HVAC System is used to maintain a negative ventilation in the Box Handling facility which prevents any possible releases of contaminants from leaky boxes to the atmosphere. A failure of the HVAC system to maintain the negative pressure in the Box Handling Area could result in a release to atmosphere outside of the building if a leaking or damaged box resulted in a airborne radioactive condition. A failure of the SWHS would not have an effect on the HVAC system.

Plant Air System

Plant air is supplied for the operation of the SWH System pneumatic components. Components include the Portal Monitor centering pistons, Portal Monitor Scale lift pistons, transverse conveyor track lifts, the Assay Discharge Conveyor deflector bar, and the box labeler. A failure of the Plant Air System would prevent the SWHS from operating because of the components normally supplied from the Plant Air System. A failure of the SWHS would not affect the Plant Air System.

Incinerator

The SWHS provides the flow of solid waste to the Solid Waste Feed System. If all or part of the SWHS is secured, solid waste to the incinerator will run out depending on what component of the SWHS secured and the amount of boxes on the storage conveyors. If solid waste feed cannot continue, the incinerator can continue to operate burn liquid waste at the discretion of the Shift Supervisor.

Review Questions

1. How would a failure of the SWHS affect the operation of the Solid Waste Feed System?
2. How would a loss of the Plant Air System affect the operation of the SWHS?
3. How would a failure of the SWHS affect the operation of the Incinerator?

INTEGRATED PLANT OPERATIONS

ELO 4.2	**Given applicable procedures and plant conditions, DETERMINE the actions necessary to perform the following Solid Waste Handling System operations:** **a. Startup** **b. Manual operation of equipment** **c. Shutdown**

System Startup

The system is first aligned for operation by placing applicable electrical equipment, controls and instruments in the SWH, DCS and Electrical Distribution Systems in the required positions and/or configurations per procedure 261-SOP-SWHS-01, Solid Waste Handling Operations. Then the operator should ensure all hinged passage gates are down and the conveyors are free from obstructions. The operator then verifies the Conveyor Clear light at the Portal monitor is illuminated. Next, turn the Conveyor System All Clear key switch (H-261-SWHS-HS-6008-(D)) on the local control panel (H-261-SWHS-PNL-001) to the right and then back to the left. The All Clear push-button on the Portal Monitor panel is depressed and the Conveyor Start push-button (H-261-SWHS-6008-(C)) is depressed. The operator should notify the Shift Supervisor that the Solid Waste Handling System is in operation and that truck unloading may commence.

Normal Operations

When the Portal monitor Conveyor is started, truck unloading may begin. All documentation should be reviewed through the Waste Tracking System (WITS) to verify that the waste being unloaded from the trucks is qualified to be burned in the incinerator. When the boxes are being off-loaded, the operator should place any boxes that feel too heavy(greater than 75 lbs) or light (less than 7 lbs.) into the reject room. If any of the labels affixed to the boxes are missing or illegible, the operator should replace the label. Any boxes removed during unloading for weight, label, or box integrity should be marked to identify the problem for later verification and/or correction if possible (see 261-SOP-SWHS-01). When the first box on the portable truck unloading conveyors activates the photoelectric cell in the front of the Box Handling Door, the door should open. When the door opens, the Portal Monitor Conveyor should start. The operator will continue to unload boxes from the trucks until all the boxes have been unloaded, stopping unloading operations any time.

The system will normally operate automatically with the only manual operator actions being unloading deliveries from the trucks, removal of rejected containers and operation of the X-Ray Machine. The SWHS is controlled and monitored by the DCS and the central PLC. Boxes are tracked through the facility using bar code labels.

If any problem arises that requires a conveyor system shutdown, then pull the emergency stop

cord, or actuate the nearest Emergency Stop switch. Once the problem has been corrected, an ALL CLEAR must be initiated by resetting E-Stop switches for the effected conveyor(s).

System Shutdown

Routine system shutdown will be accomplished by sequentially placing all equipment MOA switches in the OFF position as per 261-SOP-SWHS-01, Solid Waste Handling Operations.

Waste Tracking System

The Waste Tracking System is used to record applicable waste data such as source/generator, composition, and disposition. The operators are responsible for reviewing the Waste Tracking System to determine if the incinerated waste received meets predetermined criteria. Criteria of special significance to solid waste processing are:

- Incineration of a waste stream that had not been previously processed
- Incineration of a waste from a generator that had not previously sent waste to the CIF
- Incineration of previously processed waste in which the waste composition has changed significantly

If any of these criteria are met, operators will sample the ashcrete from the waste run when it has been processed.

Infrequent Operations

Manual Operation of Automatic Components

Manual operation of the components may be accomplished by placing the MANUAL-OFF-AUTOMATIC (MOA) switches in the MANUAL position. Any automatic sequence in progress will be allowed to finish. Operator then performs any required manual processing, manipulations or transporting. The conveyor Jog Switches are interlocked with the MOA switch so that JOG Switch is operable only when the conveyor MOA switch is in manual. The DCS/PLC will complete the equipment operation for the affected process if and when operator depresses applicable push-buttons at local control stations. When manual processing is completed, operator returns MOA switch position to AUTOMATIC.

ELO 2.3	**Given a description of the Solid Waste Handling System equipment status, STATE any corrective actions required to return system operation to a normal condition.**
ELO 4.3	**DETERMINE the effects on the Solid Waste Handling System and the integrated plant response when given any of the following:** **a. Indications/alarms** **b. Malfunctions/failure of components**

Abnormal Operations

Radiation Alarm

Any area radiation alarms should be treated no differently than other radiation-related alarm conditions. The system may be shut down remotely from the DCS if conditions do not permit the operator to safely perform system shutdown locally.

Jammed Equipment

Jammed equipment will/could result in the loss of handling capability. Any equipment found to be jammed should be stopped in the safest, most expedient manner available. If a redundant piece of equipment is supplied (e.g. Box Discharge Conveyors, Assay Discharge Conveyors) the system may continue to run at altered or reduced capacity and in manual control if required. Determination of continued operation will be at the discretion of the Shift Supervisor. If the jammed equipment required the system to be tripped or shutdown, the operator will reset applicable controls, depress applicable All Clear controls, and restart affected portions of the system.

Container Leaks

Any containers suspected to be leaking during box unloading should be manually removed to the Reject Room. If the spill or leak occurs during operations due to a damaged box, the equipment will be stopped in a safe and expedient manner, notify the Shift Supervisor, and Radiological Control Operations (RCO) should be contacted. At earliest possible time, the operator should update the container information in the register.

Loss of Plant Air Pressure

Plant air is used for the operation of the Portal Monitor centering pistons, Portal Monitor Scale lift pistons, transverse conveyor track lifts, the Assay Discharge Conveyor deflector bar, and the box labeler. If the loss of pressure will affect continued operation, the system should be manually shut down by the local controls (preferably the applicable stop selector switch). When air pressure is restored to normal operational value, the system may be restarted. If required, Conveyor Clear and Reset push-buttons will be actuated prior to starting the affected equipment.

Loss of Normal Power

A UPS is provided that supplies the PLC should the facility lose power. Conveyors are shut down automatically, in the event of an emergency, thereby reducing the risk of containers breaking and spilling their contents in the Container Handling Area. DCS monitoring is maintained during facility shutdown for all systems, including the radiation detectors in the Container.

Review Questions

1. What are the required manual operations during operation of the SWHS?

2. How is the SWHS shutdown?
3. What three conditions will require that ashcrete from the waste run must be sampled?
4. If the system is operating, what effect will placing the M-O-A switch in manual have on system components?
5. What must be accomplished to allow use of the conveyor Jog Switches?
6. Who should be notified if a container has or is suspected to have a spill or leak?
7. How is the system affected on a loss of normal power?

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ANSWERS TO REVIEW QUESTIONS BY CHAPTER

System Overview

1. Safety Concerns:
    - Beware of pinch points while handling boxes and working around conveyors.
    - Use proper work gloves (e.g. leather) when handling boxes.
    - Follow safety practices as required in Manual 8Q, Employee Safety Manual.
    - Operators are routinely called upon to physically lift materials. Proper lifting techniques and protective gear should be used when performing any lifting.
    - Comply with radiation and contamination control requirements identified in the applicable Radiation Work Permits (RWP) and/or Standing Radiation Work Permit(s)

Description and Flowpath

1. The Purpose of the Solid Waste Handling System is designed for receiving, inspecting, processing, and storing low-level radioactive waste (LLRW) and non-radioactive hazardous waste (NRHW).
2. Boxes are unloaded from the truck and placed on flexible conveyors which deliver the boxes to the Portal Monitor Feed Conveyor. Upon delivery to the Portal Monitor the boxes are inspected and sent to the X-Ray machine and onto the storage conveyors. From the storage conveyors, the boxes are arranged into batches and sent to the Box Lift.
3. The boxes are tracked and identified by a series of Bar Code Label Scanners which read the labels and with the data stored by the DCS can keep track of a box from receipt until it is loaded onto the Box Lift.
4. The Zone Brakes are used to provide singulation (one at a time) to the various major components.
5. The three conditions are:
    - optimum weight conditions met
    - Box Lift is down
    - Vertical door is open
6. See one line diagram page 19.

Major Components

1. The Portal Monitor Feed Conveyor operates at 30 ft/min and the Portal Monitor Conveyor runs at 60 ft/min. The difference in speeds provide gaps between boxes and the zone brake is energized and holds the box.
2. The Portal Monitor:
    - Centers the boxes

- Scans the label
- Weighs the box
- Measures for radiation

3. The scale has pneumatically-operated sensor bars which rise through the conveyor spaces to weigh the container. Operation of the scale is normally automatic.
4. The X-Ray Machine stores a high energy and a low energy image. By digital processing the actual types of atoms can be determined and are classified as organic or inorganic and displayed by color. Red (organic materials), Blue (inorganic materials), Black (compound), or combination of Red and Blue.
5. Items not suitable for incineration:
   - paint cans
   - aerosol cans
   - tools
   - glass or plastic bottles containing liquids
   - nails
   - wire
   - Lab packs
   - wood chips > 3" in diameter
6. Assay Discharge Conveyors will store 38 on one and 39 on the other.
   - Box Storage Conveyors will store 39 and 41.
   - X-Ray Discharge Conveyor will store 20
   - Portal Monitor Discharge Conveyor will store 5.
   - 38 + 39 + 39 + 41 + 20 + 5 = 182 boxes
7. Batches are arranged by the DCS system onto the Box Lift Conveyor using the label scanners to track boxes and zone brakes on the Assay Discharge Conveyors.
8. All major components of the SWH system are powered from MCC 1 and MCC 2.

Instrumentation

1. The Conveyor Clear (Green) light indicates that the system is operating and there is room on the conveyor. If the Conveyor Full (Red) light is illuminated, this indicates that the conveyor is full up to the photoelectric eye.
2. Scanners are provided at the Portal Monitor, entrance to the X-Ray Machine, entrance to both assay machines, and at the end of both Assay Discharge Accumulator Conveyors.
3. Indications are:
   - Weight Reject
   - Portal Monitor Reject
   - Scan Failure Reject
4. There are red indicating lights to show when E-Stop push-buttons or conveyor pull cords

have been actuated.

5. Opening a hinged passage gate will stop the conveyors and cause a hinged passage gate open alarm.
6. A temperature sensitive wire is installed the entire length of the conveyor system which is hard wired into the Fire Alarm System.
7. A Bar Code Scanner Alarm would indicate that a Bar Code Scanner detected a box with a label which was missing or could not be read.

Controls, Interlocks, and Alarms

1. At a local push-button station, the ALL CLEAR push-button must be depressed and then the CONVEYOR RESTART push-button pushed placing the system in automatic mode.
2. If and E-Stop push-button or conveyor pull cord was used, it must be reset, the ALL CLEAR push-button activated and the CONVEYOR RESTART push-button activated.
3. Information includes:
    - Container identification number
    - Portal monitor status, accept or reject
    - Container weight, accept or reject
    - X-Ray status, accept or reject
4. A Portal Monitor Alarm would indicate that a box had been rejected for label readability, weight, or radiation levels.
5. A Conveyor Full Alarm is silenced by pushing the ACKNOWLEDGE push-button in the truck offloading area next to the door.
6. Radioactive limit is 10 mR/hr measured 2" from the box.
   Size is limited to < 24". Size of a standard box is 21 inches on each side.

System Interrelations

1. The SWHS interfaces with the SWF system at the Box Lift. If the SWHS fails to operate boxes may not be able to be delivered to the Box Lift depending on the type , severity, and location of the failure. The Solid Waste Feed System may have to be secured as a result.
2. The Plant Air System supplies the Portal Monitor centering pistons, Portal Monitor Scale pistons, conveyor track lifts, and Conveyor deflector bar. If the Plant air system is lost the SWHS would have to be secured.
3. If a failure of the SWHS system occurred, depending on the type, severity, and amount of boxes on storage conveyors, solid waste could continue to be processed. If not, the incinerator could continue to operate burning liquid waste at the discretion of the Shift Supervisor.

Integrated Plant Operations

1. Manual operations include:
    - Unloading of boxes from the truck

- Removal of rejects
- Operation of the X-Ray machine

2. System shutdown is accomplished by sequentially placing all equipment M-O-S switches in the OFF position.
3. Three conditions are
   - Incineration of a waste stream that has not been previously processed
   - Incineration of waste from a generator not previously sent to CIF
   - Incineration of previously processed waste in which waste composition has changed significantly
4. Any automatic sequence in progress will be allowed to finish, then operator can perform any required manual processing, manipulations, or transporting.
5. In order to use the conveyor Jog Switches, due to an interlock, the M-O-A switch must be in manual.
6. The Shift Supervisor and the RCO.
7. A UPS will supply the PLC. Conveyors are shut down automatically.