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OPERABLE UNIT 4
SILO 3 PROJECT
REMEDIAL DESIGN PACKAGE

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
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U.S. DEPARTMENT OF ENERGY

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SILO 3 PROJECT
REMEDIAL DESIGN PACKAGE

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1.0 INTRODUCTION

The format and content of this Silo 3 Project Remedial Design (RD) Package is defined in the *Remedial Design Work Plan for Operable Unit 4 / Silo 3 Project, 40400-WP-0001, April 1998*, which was approved by the United States Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (OEPA) June 17, 1998, and June 10, 1998, respectively. As defined by the RD Work Plan, the intent of the RD Package is to provide U.S. EPA and OEPA with the necessary substantive information from the detailed engineering, design, and operations documentation. The stated intent of the RD Package is to "provide the EPAs with an understanding of the design, retrieval, operation, and controls necessary in the contractor's treatment facility to ensure protection of the workers, public, health, safety, and the environment." Consistent with the content outlined in the RD Work Plan and the subsequent modification, which created a Site Preparation Package, the following principal design elements are presented in this RD Package:

Section 2.0 - Detailed Description of Process Operations

Section 2.1 - Process Description, RMR-0445-ENG-06
Section 2.2 - Retrieval Technology Description, RMR-0445-ENG-03
Section 2.3 - Process Control Plan, RMR-0445-ENG-01
Section 2.4 - Transportation and Disposal Plan for Operable Unit 4 – Silo 3, 40400-PL-0004

Section 3.0 - Sampling and Analysis Plan for Silo 3 Treated Waste Material, 40420-PL-0001

Section 4.0 - Silo 3 Gross Decontamination Plan, RMR-0445-ENG-016

Section 5.0 - Operational Environmental Control Plan, RMR-0445-ENG-015

Section 6.0 - ARARS Compliance Strategy, RMR-0445-ENG-024

Section 7.0 – Health and Safety Controls, RMR-0445-H&S-001

Section 8.0 – Contingency Plan, RMR-0445-ENG-013

Appendix A – Process Flow Diagrams (PFD)

Appendix B – General Arrangement Drawings

Appendix C – Heat and Material Balance Calculation, RMR-0445-ENG-001

Appendix D – Silos Projects Environmental Monitoring Plan, 40000-PL-0010

Although not specified in the RD Work Plan, the Silos Projects Environmental Monitoring Plan is included in this RD Package to ensure that the complete environmental protection strategy for the Silos Projects is presented to U.S. EPA, OEPA, and the public.

Following receipt of U.S. EPA and OEPA approval of this RD Package, a Final Design Report will be prepared documenting the detailed, Certified for Construction (CFC) design. Any changes to the design will be documented, reviewed, and approved through a formal change control process. Design Change Notices (DCNs) documenting changes that impact the approved RD Package will be provided to U.S. EPA and OEPA for review and approval.

SECTION 2.0 - DETAILED DESCRIPTION OF PROCESS OPERATIONS

Section 2.1 - Process Description

The Process Description document provides an overview description of each of the systems that comprise the Silo 3 treatment process. The purpose of the Silo 3 Project is to retrieve and treat Silo 3 material. The Silo 3 material will be retrieved, conveyed, treated, and packaged to meet the Silo 3 waste acceptance criteria (WAC). The narrative descriptions presented in this document are intended to provide a guide to the more detailed information presented in subsequent RD Package documents and in the PFDs. The Silo 3 treatment process is depicted in Appendix A - Process Flow Diagrams.

The Silo 3 treatment system is a continuous process controlled by a programmable logic control (PLC). The Silo 3 material is a dry powder and will be transferred from the silo to a treatment system by the vacuum transfer system. The Silo 3 material will be mixed with Envirobond™, additives, and water in a continuous mixer. The Silo 3 material will be formed into briquettes and placed into 55-gallon drums. The drums will be palletized and moved to the Interim Storage Area (ISA) for ultimate disposal off-site.

Section 2.2 - Retrieval Technology Description

Silo 3 material will be removed using a vacuum conveyance system deployed by a remote manipulator system. The retrieval system is called the reeled cable incremental link extending vacuuming robot (ReTRIEVR). The ReTRIEVR will deliver the flexible portion of the conveyance system vacuum hose into Silo 3. The conveyance system will extract material from Silo 3 and transfer the material to the Treatment Facility. The Silo 3 Project will retrieve material from Silo 3 using the existing access port centered on the Silo 3 dome. To extract material, the vacuum conveyance piping and ReTRIEVR will enter Silo 3 through the center access port. A segmented, flexible hose will be the only part of the conveyance system that will enter Silo 3 through the ReTRIEVR.

Section 2.3 - Process Control Plan

The Process Control Plan describes the control system for the Silo 3 treatment process. The Silo 3 Project will retrieve and treat the Silo 3 material in accordance with the Silo 3 WAC. The treatment process contains four subsystems: control, retrieval and conveyance, treatment, and product forming and packaging.

A central PLC will control the treatment system. The retrieval and packaging systems have separate PLCs that share information with the treatment system PLC. The treatment system PLC will control the treatment process and record alarms and system upsets.

The retrieval and conveyance system is a continuous pneumatic retrieval system. The retrieval system will mobilize the Silo 3 material and the conveyance system will pneumatically transport the Silo 3 material to the treatment facility. The retrieval and conveyance system works in conjunction with the retrieval mechanical arm and the vacuum pump.

The treatment system operates in a continuous basis in conjunction with the surge hopper. The Silo 3 material is weighed and analyzed for moisture content prior to introduction onto the mixer. The treatment system PLC will add the correct quantities of Envirobond™, additives, and water to the mixer.

The product forming and packaging system operates on a continuous basis. The Silo 3 material will be formed into briquettes and packaged into 55-gallon drums, stored in the ISA, and transported off-site for disposal. The briquette maker is controlled by the treatment system PLC. The packaging system has a separate PLC and is electronically linked to the treatment system PLC.

Section 2.4 - Transportation and Disposal Plan

This plan provides a detailed description of transportation and disposal operations to be evaluated to ensure safe and successful transportation of treated Silo 3 material from the Fernald Environmental Management Project (FEMP) to an appropriately permitted commercial disposal facility (PCDF) or the Nevada Test Site (NTS). Interim storage, container inspections, container movements and shipment loading operations are also described.

SECTION 3.0 - SAMPLING AND ANALYSIS PLAN FOR TREATED SILO 3 MATERIAL

This plan describes sampling and analysis for waste acceptance criteria (WAC) attainment for the treated Silo 3 material. The plan addresses sampling and analysis requirements for disposal criteria for the NTS, as well as Envirocare of Utah. Envirocare of Utah is included as a representative of a PCDF, if that route is chosen for disposal of treated Silo 3 material. Sampling and analysis requirements for process control purposes are addressed in the Process Control Plan (RMR-0445-ENG-012).

SECTION 4.0 - SILO 3 GROSS DECONTAMINATION PLAN

The Gross Decontamination Plan describes the proposed methods to remove the "visible Silo 3 material" remaining and apply a fixative to the interior of Silo 3 prior to shutdown of the Silo 3 treatment facility, leaving the silo in safe configuration for final dismantlement. The definition of "visible Silo 3 material" is material that is obvious to the naked eye and that, if rubbed or rinsed, would be easily removed. The visible Silo 3 material includes bottom and side heel material adhering to the interior surface of Silo 3.

RMRS will use a camera to inspect the interior of Silo 3 prior to removal of visible Silo 3 material. Areas where visible Silo 3 material is suspected will be cleaned using a low pressure (less than 50 pounds per square inch (psi) air lance with or without a brush attached to the ReTRIEVR. The visible Silo 3 material will then be vacuumed and processed. The ReTRIEVR will then apply fixative to the interior surfaces of Silo 3 (RMR-0445-ENG-003).

SECTION 5.0 - OPERATIONAL ENVIRONMENTAL CONTROL PLAN

The Operational Environmental Control Plan describes the methods and materials to be used during operations to control air emissions, fugitive dust, wastewater, stormwater, erosion, and waste. This plan addresses the remediation of Silo 3 material including material retrieval, staging, treatment and storage, processing, material management, and transportation at the Silo 3 Retrieval Facility, Treatment Facility, and the ISA. The Operational Environmental Control Plan also includes estimates of the air emissions anticipated to result from operation activities.

SECTION 6.0 - ARARs COMPLIANCE STRATEGY

Applicable or Relevant and Appropriate Requirements (ARARs) and to-be-considered (TBC) requirements for the Silo 3 Project were identified in the December 7, 1994, Record of Decision (ROD) for remedial actions at Operable Unit 4 (OU4) at the FEMP. The ARARs Compliance Strategy identifies each ARAR and TBC requirement, the strategy used by the Silo 3 Project to meet the requirement, and provides a cross reference to the documentation within the RD Package where compliance with the ARAR is documented.

SECTION 7.0 - HEALTH AND SAFETY CONTROLS

The Health and Safety Controls (H&SC) section describes the overall process for the development of the safety documentation to support the operations phase of the Silo 3 Project. The H&SC is an upper-tier document that identifies specific Silo 3 documents that detail the preventative measures, safety controls, and actions to be taken to mitigate the consequences of occupational, public, and environmental hazards associated with the operations phase of the Silo 3 Project. The flow down documents used to develop the H&SC, that are referenced for the Silo 3 Project overall safety process, will be revised as the project moves into phases subsequent to operations.

SECTION 8.0 - CONTINGENCY PLAN

The Silo 3 Project Contingency Plan provides instruction for Silo 3 Project personnel in responding to unusual and emergency events in the project area. The Contingency Plan is the interface of the Silo 3 Project with the FEMP emergency organization, as identified in the FEMP Emergency Plan. The Contingency Plan fulfills the requirements of the Silo 3 Project, the Ohio Administrative Code (OAC), and the Resource Conservation and Recovery Act (RCRA). Information from the Project-Specific Health and Safety Plan (PSHSP) regarding safety, spill control, decontamination, emergency response, and evacuation are provided in the Contingency Plan.

APPENDIX A – PROCESS FLOW DIAGRAMS

The material retrieval and conveyance system is depicted in Drawing 55-2000. The retrieval and conveyance systems are designed to remove Silo 3 material and convey it to the treatment facility. After the Silo 3 material has been removed, the retrieval and conveyance systems will remove the "visible Silo 3 material." Silo 3 will be equipped with a heating, ventilation, and air conditioning (HVAC) system that will control the silo pressure and particulate emissions. The HVAC and building ventilation systems are depicted on Drawings 55-2008 and 55-2010, respectively.

The RMRS design will maximize the flexibility of the facility by logically disconnecting the retrieval process from the treatment process. To limit impacts of the retrieval process on the treatment process the two systems have been designed to operate independently of each other. There is surge capacity designed into the interface of the systems that will enable the treatment system to continue to operate for up to seven hours without the need for the retrieval system to operate. With this design, it is anticipated that interruptions that may occur in the retrieval process will have little impact on the treatment system. The surge capacity will allow the treatment activities to continue during the anticipated brief outages of the retrieval system. The process flow diagrams have been developed to provide the entire retrieval system on a single diagram while the processing system is shown on a separate diagram.

The treatment system is depicted on Drawing 55-2001. The treatment system is composed of five subsystems: product additive, processor feed, processor, product forming, and radioactive liquid waste. The product additive system will store the binder and additive for the Silo 3 material treatment operation. The processor feed system is a Silo 3 material feed hopper and delivery system. The product forming system is the briquette maker, as depicted on PFD 55-2001. The radioactive liquid waste system will collect the water from the periodic cleaning of the mixer and briquette maker and make this cleaning water available for the process system.

APPENDIX B – GENERAL ARRANGEMENTS

General Arrangements in Appendix B include: plan, elevation and section drawings of the gantry structure; three different elevation drawings of the process building; a section drawing of the process building; and a general arrangement of the off-gas treatment system.

APPENDIX C - HEAT AND MATERIAL BALANCE CALCULATIONS

The heat and material balance calculations show the mass flow and balance for each material stream anticipated, along with the assumptions supporting the calculations. The summary of mass flows is depicted on the PFD for the material retrieval and conveyance, and treatment systems. The calculations presented include:

- Time to process Silo 3 material
- Volume of Silo 3 material to treat
- Quantity of briquettes produced
- Volume of briquettes produced
- Flow rate for the treatment system
- Absorbent requirements for saturated Silo 3 material
- Air recycle back to Silo 3
- 55-gallon drums of briquettes
- Summary of mass flows

APPENDIX D - SILOS PROJECTS ENVIRONMENTAL MONITORING PLAN

The current focus of environmental monitoring at the FEMP is the implementation of site-wide environmental monitoring and project-specific environmental monitoring. Site-wide environmental monitoring is addressed in the Integrated Environmental Monitoring Plan (IEMP), while project-specific requirements are addressed within the environmental control plans, process control plans, and other design documents that constitute the project's RD Package. For the Silo 3 Project and the Silos 1 and 2 Accelerated Waste Retrieval (AWR) Project, modifications to the site-wide environmental program are necessary to support project activities. Therefore, the focus of this plan is to establish the integrated environmental monitoring requirements for OU4 during the conduct of both projects.

Section 2.0

Section 2.0 contains four sub-sections that comprise the Detailed Description Of Process Operations. These four sub-sections were combined into one section to allow the reviewer a logical sequence to follow the detailed process description. They are as follows:

Section 2.1 Process Description

Section 2.2 Retrieval Technology Description

Section 2.3 Process Control Plan

Section 2.4 Transportation And Disposal Plan For Operable Unit 4 – Silo 3

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FERNALD SILO 3 PROJECT

PROCESS DESCRIPTION

RMR-0445-ENG-06-01

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FERNALD SILO 3 TREATMENT PROCESS
PROCESS DESCRIPTION

1.0 OVERALL REVIEW

1.1 Overview

The purpose of this document is to provide a description of the Silo 3 treatment process as depicted on Process Flow Diagrams (PFD) 55-2000, 55-2001, 55-2008, 55-2010, and 55-2018. The Silo 3 retrieval and treatment system control philosophy is discussed in the Process Control Plan (RMR-0445-ENG-012). The purpose 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).

The Silo 3 retrieval and treatment system is a continuous process, which is controlled by the Treatment System Programmable Logic Controller (PLC), with input from the Retrieval System PLC and the Packaging System PLC. In general the control philosophy for the treatment process will be operator initiated sequences controlled by interlocks. The material in Silo 3 is a dry powder and will be transferred from the silo to the treatment system via a vacuum transfer system. The Silo 3 material will be 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 a disposal container. The Envirobond process will allow high Silo 3 material loading resulting in overall volume reduction. Contamination control within the process is achieved by operating major pieces of equipment under a slightly negative pressure.

1.2 Silo 3 Material Retrieval / Conveyance System (Systems 10 &11)

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. A gantry will be constructed over Silo 3 to support the Retrieval System and provide a work/service platform. 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 Facility. The conveyance vacuum system is connected to the silo HVAC System (System 75). The Silo 3 material will be transferred from the silo and separated from the transport air by a filter receiver and mechanically conveyed to the Silo 3 Material Feed Hoppers.

1.3 Treatment System (Systems 16, 17, 23, 44, & 62)

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. Reducing agent, binder, absorbent (if necessary), and process water will be fed to the 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.

1.4 Packaging System (System 24)

The formed briquettes are transferred to the Packaging System (System 24). Samples will be taken periodically from the Product Surge Hopper and sent to Fluor Fernald for analysis to assure the product meets the Silo 3 Waste Acceptance Criteria (WAC). 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. The drums will be weighed and stored on pallets on the Interim Storage Area pad until the WAC sample test results are returned and found to be satisfactory.

1.5 Reject Material System (System 26)

The Reject Material System (System 26) is designed to reprocess treated Silo 3 material that failed to meet the WAC. The reject material will enter the Treatment Facility in drums on pallets, the drums will be removed from the pallet then opened and emptied. The WAC failed briquettes will be crushed and introduced back into the Processor Feed System (System16).

1.6 Sample Management System (System 84)

The Sample Management System (System 84) consists of two sample ports, and a Product Sampler on the Product Surge Hopper. The Product Samples (briquettes) will be analyzed to determine if the product meets the WAC.

1.7 HVAC System (Systems 71 & 75)

The HVAC System (Systems 71 & 75) consists of two main systems, which are, the Treatment Facility (System 71) and the Off-Gas Treatment 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. The exhaust will be monitored as described in the "Point Source Air Emission Data" document (RMR-0445-ENG-010).

1.8 Plant Water System (System 50)

All water utilized in the Plant Water System will come from the Fernald domestic water distribution system. The water will enter the Treatment Facility through the Plant Water Feed Tank. The Plant Water System (System 50) utilizes tanks, pumps, settling vessels, in-line filter modules, and control devices.

1.9 Management Information System (System 91)

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 Human Machine Interface (HMI) system is used to retrieve the data in date blocks for screen review and formatted report generation.

2.0 RETRIEVAL / CONVEYANCE SYSTEM (Systems 10 & 11)

2.1 Overview

The Retrieval (System 10) and Conveyance (System 11) Systems are designed to remove the Silo 3 material from Silo 3 and convey it to the Treatment Facility. Once the Silo 3 material is removed, the same system will be used to remove the loose contamination from the walls of the silo.

2.2 Retrieval System (System 10)

The Retrieval System consists of a Mechanical Retrieval Arm, controlled by the Retrieval System PLC. The arm will be fitted with various tools at the end of the arm, to mobilize the Silo 3 material for transport by the Conveyance System. The Retrieval System will enter the silo through the center access port on top of the silo dome. This same mechanical system will be used to remove residue from the silo walls. For a more complete description of the Silo 3 Retrieval System, refer to the "Retrieval Technology Description" document (RMR-0445-ENG-03).

2.3 Conveyance System (System 11)

The Conveyance System, depicted on PFD 55-2000, 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 for the Conveyance System. The P/D Blower creates a vacuum, which enables the transfer of the Silo 3 material to the Treatment System via double contained piping instrumented for leak detection. In the Treatment Facility, a Filter Receiver (11-ME-001) will separate the Silo 3 material from the air stream. From the Filter Receiver, the Silo 3 material will be gravity fed into a Rotary Valve (11-VA-001). The Silo 3 material will drop out of the Rotary Valve, and 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 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 HVAC System (System 75) to help maintain a negative pressure on the silo and Retrieval Enclosure.

The P/D Blower (11-BL-001) will be used to convey the Silo 3 material and also 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 (11-BL-001). On the off-shift the negative pressure is achieved by the Off-Gas Fan (75-FA-001).

3.0 TREATMENT SYSTEM (Systems 44, 16, 17, 23, 62)

3.1 Overview

The Silo 3 Material Treatment System is composed of five sub-systems: Product Additive System (System 44), Processor Feed System (System 16), Processor System (System 17), Product Forming System (System 23), and the Radioactive Liquid Waste System (System 62). The Product Additive System (System 44) will store the binder and reducing agent in reusable totes outside and convey the additives by screw conveyors to the Processor Feed System (System 16). The Silo 3 material and additives will be metered into the Mixer Feed Conveyor and then gravity fed into the Process Mixer (System 17). Process water will be metered into the mixer via the Process Water Pump (System 62). The ratio of all material added to the mixer will be controlled by the Treatment System PLC. All the feed streams to the Mixer Feed Conveyor are dry powders, thus the two inlets to the Process Mixer a powder mixture, and process water. The material discharged from the Process Mixer will be introduced into the Product Forming System (System 23). The Product Forming System reduces the volume of Silo 3 material by forming it into briquettes. The briquettes will be conveyed to the Packaging System (System 24). Periodically, the Process Mixer will be cleaned with plant water. The wash water will then be collected and used to process Silo 3 material.

3.2 Product Additive System (System 44)

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 PFD 55-2001. The system consists of totes and conveyors. Both the binder and the reducing agent will be stored outside of the Treatment Facility 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.

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

The Treatment System 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 (i.e. bentonite) will be introduced into the system in the same manner as the other two additives, through its own system of totes and conveyors. As high moisture is not expected in the Silo 3 material the absorbent tote feed system will not be installed unless moisture levels are seen to be increasing 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 Conveyor (44-CY-001A,B). The reducing agent exits the Reducer Tote and enters the Reducer Conveyor (44-

CY-002A,B). Both the binder and the reducing agent feed into the Additive Conveyor (44-CY-003) and then through the Additive Flexible Conveyor (44-CY-005) into a hopper from where they are metered by the Additive Feeder (44-CY-004) to the Processor Feed System (System 16).

3.3 Processor Feed System (System 16)

The Processor Feed System consists of the Silo 3 Material Feed Screen (16-ME-001), Debris Collection Drums, two Silo 3 Material Feed Hoppers (16-TK-001A,B), and a delivery system as described on PFDs 55-2000 and 55-2001. The Silo 3 material is received from the Conveyance System Rotary Valve (11-VA-001), on the Filter Receiver (11-ME-001) and dropped through the Silo 3 Material Feed Screen (16-ME-001) to screen 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 contains a Feed Hopper Bin Activator (16-AG-001 A, B) to enhance the flowibility of Silo 3 material from the Silo 3 Material Feed Hoppers. Moisture content of the Silo 3 material is measured in the Silo 3 Material Feed Hoppers (16-TK-001 A, B). From the Silo 3 Material Feed Hoppers, the Silo 3 material is fed through a Rotary Valve (16-RV-001A,B) to a loss-in-weight feed system which deposits the Silo 3 material into the Mixer Feed Conveyor (16-CY-003), and then on to the Processor System (System 17).

The weight of Silo 3 material added to the Mixer Feed Conveyor (16-CY-003) over a given time interval, as well as the moisture content are transmitted to the Treatment System PLC. Based on this information, the Treatment System PLC will determine the feed rates of binder, reducing agent and water required and transmits speed control signals accordingly.

3.4 Processor System (System 17)

The Processor System, consisting of the Process Mixer (17-MX-001), is described on PFD 55-2001. 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 the Radioactive Liquid Waste System (System 62).

3.5 Product Forming System (System 23)

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 Product Forming System will receive materials from the Process Mixer (System 17) as described on PFD 55-2001. The Briquetting Press will operate on a continuous basis, with the rate being controlled from the Treatment System PLC. The Product Forming System will decrease the volume of the Silo 3 material, binder mixture, which will aid in volume reduction as

well as making the material easier to handle. The size of briquette will be approximately 2" X 2" X 1 ½".

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

3.6 Radioactive Liquid Waste System (System 62)

The Radioactive Liquid Waste System is designed to collect water from the intermittent cleaning of the mixer 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 described on PFD 55-2001. Process water will consist of wash water, and will be replenished when necessary by 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 (System 50) 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 Packaged Water Chiller (11-RF-001) which cools the return air to the silo, in the Conveyance System (System 11).

The Silo 3 material is anticipated to have 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 Treatment System 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-001A, B) into the Process Mixer (System 17) through a spray bar.

During operation the facility, primarily the mixer, will be washed down periodically 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).

4.0 PACKAGING SYSTEM (System 24)

4.1 Overview

Treated Silo 3 material will be in the form of briquettes when it comes to the Packaging System (System 24) 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 described on PFD 55-2001, and is controlled by the Packaging System PLC. The weight of briquettes placed in the drums is monitored by the Treatment System PLC at the Drum Loading / Tare Gross Weigh Station (24-CY-005).

4.2 Conveyance

Treated Silo 3 material will be in the form of briquettes when it comes from the Product Forming System (System 23). The Briquette Conveyor (23-CY-001) deposits the briquettes of compacted Silo 3 material in the Product Surge Hopper (24-BN-001). The Briquette Conveyor speed control will be designed to allow a smooth conveyance of material. The briquettes will then drop from the Surge Hopper into the Loadout Station (24-ME-005).

4.3 Drum Movement

A limited number (one-half day worth) of empty drums will be stored within the Treatment Facility. The drums will be transported by truck to the Drum Storage Gravity Conveyor (24-CY-002). The empty drums will be conveyed to the Drum Delidding Station (24-CY-003). The drums are labeled with an identifying barcode at the Barcode Labeling Station (24-CY-004). The drums will then be moved into the Drum Loading / Tare Gross Weigh Station (24-CY-005) where a tare weight will be recorded. Once the drum tare weight is recorded, the loading operation will begin.

4.4 Loading

The briquettes are deposited into drums from the Loadout Station (24-ME-005). A feed chute will be utilized to load the briquettes. The drums will be sitting on a conveyor at the Drum Loading / Tare Gross Weigh Station (24-CY-005). The conveyance and loading of the briquettes will be controlled by the Packaging System PLC. The Packaging System PLC will communicate with the Treatment System PLC to coordinate the movement of material. Due to the low moisture content of the Silo 3 material, no free water is anticipated in the final product. Absorbent will be added to the drums prior to loading the briquettes.

4.5 Weigh and Transport

The drum of briquettes will be weighed at the Drum Loading / Tare Gross Weigh Station (24-CY-005), and lids placed on the drums at the Drum Lidding Station (24-CY-006) using the Drum Lidder (24-ME-006). Through use of a barcode reader, the weight of the drum, the fill time and date, and a station stamp will be recorded for each drum. From the Drum Lidding Station, they go to the Drum Banding / Primary Smear Station (24-CY-007) where the clamp band will be manually applied, the drum smeared, and the smears monitored for surface contamination. The

drums then go on to the Shipping Weigh Station (24-CY-008) where the shipping weight of the drums will be recorded. The drums are then conveyed to the Drum Holding & Wipe Down Station (24-CY-009), followed by the Secondary Drum Smear Station (24-CY-010). If a drum passes the Secondary Drum Smear Station (24-CY-010) then it is conveyed to the Drum Stage Conveyor (24-CY-012) for staging. If a drum fails the Secondary Drum Smear Station (24-CY-010), it is sent to the Drum Wipe Down / Inspection Station (24-CY-011) where it will be manually swabbed. When a drum passes inspection, it is conveyed up to the Drum Stage Conveyor (24-CY-012) to re-join the main stream of drums. After the drum has been determined to be clean, it will go on to the Palletizer (24-ME-001) and be loaded onto a pallet. The pallet of drums will then be conveyed by the Loaded Pallet Conveyor (24-CY-013) out of the building where it will be picked up outside of the Treatment Facility by the Loaded Pallet Mover (24-ME-003). From the Loaded Pallet Mover, the pallets get banded at the Pallet Banding Station and are then picked up by the Pallet Forklift (24-ME-002) and transported to the Interim Storage Area.

5.0 REJECT MATERIAL SYSTEM (System 26)

5.1 Overview

Product Samples will be taken by the Product Sampler (84-PE-002) from the Product Surge Hopper (24-BN-001). Product Samples will be taken at a frequency as determined by the Fluor Fernald Sampling and Analysis Plan. During the time of analysis, the product drums will be stored in the Interim Storage Area (ISA) adjacent to the East Side of the Treatment Facility. If a set of sample results do not meet the Waste Acceptance Criteria (WAC) requirements, the lot of drums must be reprocessed by the Reject Material System (System 26) as described on PFD 55-2018. Reject material will be reprocessed after all of the Silo 3 material has been treated. Design and details of the ISA are provided in the Site Preparation Package documentation.

5.2 Reject Material Handling

If product samples fail to meet the WAC, the affected drums will be removed from the Interim Storage Area and returned to the Treatment Facility for reprocessing. The drums of reject material will be brought to the Treatment Facility by the Pallet Forklift (24-ME-002) and moved to the Pallet Unloading Station using the Pallet Mover (24-ME-003). After the pallet bands have been 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 where the drum lid will be removed at the Delidding / Lidding Station (26-ME-003). The drum will then be conveyed to the Drum Unloader Conveyor (26-CY-005) at the Drum Unloader (26-ME-002).

5.3 Reject Material Processing

The Drum Unloader (26-ME-002) will empty the briquettes from the drum into the Reject Hopper (26-BN-001) via the Reject Screw Conveyor (26-CY-003). The Reject Hopper (26-BN-001) will act as a surge hopper for the Reject Crusher (26-ME-001) to smooth the reject reprocessing operation. The material will flow from the Reject Hopper (26-BN-001) into the Reject Crusher (26-ME-001). The crushed reject material will be conveyed from the crusher by the Crushed Reject Conveyor (26-CY-004) to the Silo 3 Material Feed Conveyor (System 16). The reject material will be processed to meet the Silo 3 WAC requirements through the same process as the original Silo 3 material. The empty drums will exit the reject system, be smeared and cleaned as required, lids and clamp bands replaced and the drum monitored for external contamination and placed back onto pallets at the Pallet Loading Station. Drums will be re-labeled as "empty - fixed contamination."

6.0 SAMPLE MANAGEMENT SYSTEM (System 84)

6.1 Overview

The Sample Management System (System 84) consists of a Product Sampler on the Product Surge Hopper (System 24) as shown on PFD 55-2001. A representative number of Product Samples will be taken throughout an operating day at a frequency as determined by the Fluor Fernald Sampling and Analysis Plan. The Product Samples of processed Silo 3 material will be sent to Fluor Fernald and analyzed to verify that the material meets the Silo 3 Material Waste Acceptance Criteria (WAC).

6.2 Product Samples

The Final Product for offsite disposal must undergo sampling and analysis to ensure that it is in compliance with the Silo 3 Waste Acceptance Criteria. Systematic random sampling will be implemented at a frequency as specified within the Fluor Fernald Sampling and Analysis Plan. 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 processed material will be sent to a lab 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 at the end of each operating day.

7.0 HVAC SYSTEM (Systems 71 & 75)

7.1 Overview

The HVAC system as depicted on PFDs 55-2000, 55-2008 and 55-2010 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 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.

7.2 Treatment Facility (System 71)

The Treatment Facility ventilation system must be capable of providing a safe environment for the production and maintenance workers, as well as providing effective contamination control. 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 lowest level of contamination to highest. The ARA must maintain a minimum negative pressure of 0.1" W.G. with respect to the surrounding area, or six (6) air changes of the building's volume per hour. The air from the building will be ducted into the Treatment Facility Filter Module (71-FL-001) located on the HVAC pad. This module will contain pre-filters (or roughing filters), ASHRAE 95% filters and HEPA filters. The air is drawn through the filters by the Treatment Enclosure Fan (71-FA-001) inducing negative pressure in the enclosure. From the filters, 15,000 CFM will be conducted through the Exhaust Stack and Plenum (75-ST-001) and discharged to the atmosphere. The loadout area will be cooled by the re-circulation of filtered refrigerated air.

7.3 Off-Gas Treatment System (System 75)

The Off-Gas Treatment System is used to treat the air, which has been used and potentially contaminated during treatment of the Silo 3 material, as well as to maintain a negative pressure on the silo. 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 pre-filters (or roughing filters), ASHRAE 95% filters and HEPA filters. The air flow through the system is drawn by the Off-Gas 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 exhaust from the stack will be monitored as described in the "Point Source Air Emission Data" document (RMR-0445-ENG-010).

8.0 PLANT WATER SYSTEM (System 50)

8.1 Overview

All water utilized in the Process and Plant Water Systems will come from the Fernald domestic water distribution system. The Process Water System, as depicted on PFD 55-2001

8.2 Plant Water

All water utilized in the Plant Water System will come from the Fernald domestic water distribution system. The water will enter the Treatment Facility through the Plant Water Feed Tank 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. A back flow preventer (a double check-valve assembly) is installed to prevent potentially contaminated water from flowing from the Contamination Area into the Plant Water Feed Tank.

9.0 MANAGEMENT INFORMATION SYSTEM (System 91)

9.1 Overview

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 Human Machine Interface (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.

9.2 Purpose

The data acquisition and storage system is used to satisfy regulatory, plant accountability and reporting requirements. Discharge stack emission data such as particle size and count will be used to support 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.

9.3 Description

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 and cursor control.

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2.2 Retrieval
Tech. Desc.

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Remediation Services, L.L.C
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FERNALD SILO 3 PROJECT

Retrieval Technology Description
RMR-0445-ENG-003-000

May 12, 2000

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Acronyms and Abbreviations

AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
CFR	Code of Federal Regulations
ft	feet (foot)
ft^3	cubic feet
Fluor Fernald	Fluor Fernald, Inc.
FTI	Framatome Technologies, Inc.
GPM	gallons per minute
HEPA	High-Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
hr.	hour
in.	inch
in^2	square inches
min.	minute
lbs.	pounds
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OU4 RI	Operable Unit 4 Remedial Investigation
PFD	process flow diagram
PPE	Personal Protective Equipment
psi	pounds per square inch
PTZ	pan tilt zoom camera
ReTRIEVR	Reeled Cable Incremental Link Extending Vacuuming Robot
RCRA	Resource Conservation and Recovery Act
RMRS	Rocky Mountain Remediation Services, L. L. C
rpm	revolutions per minute
scfm	standard cubic feet per minute
sec.	second
yd^3	cubic yards
%	percent
°	degree
11(e)(2)	Byproduct material under the Atomic Energy Act, as amended
>	greater than

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FERNALD SILO 3 PROJECT
RETRIEVAL TECHNOLOGY DESCRIPTION

1.0 INTRODUCTION

Silo 3 material will be removed from Silo 3 using a vacuum conveyance system deployed by a remote manipulator system developed by Framatome Technologies, Inc. (FTI). The retrieval system is called the Reeled Cable Incremental Link Extending Vacuuming Robot (ReTRIEVR). The ReTRIEVR will deliver the flexible portion of the conveyance system vacuum hose into Silo 3. The conveyance system will extract material from Silo 3 and transfer the material to the Treatment Facility. Rocky Mountain Remediation Services L.L.C. (RMRS) will retrieve material from Silo 3 using the existing access port centered on the Silo 3 dome. To extract material the vacuum conveyance piping and ReTRIEVR will enter Silo 3 through the center access port. A segmented, flexible hose will be the only part of the conveyance system that enters Silo 3 through the ReTRIEVR. Section 4.0, Retrieval Technology Description, discusses the retrieval technology to be used to remove material from Silo 3.

2.0 PURPOSE

The purpose of this Retrieval Technology Description document is as follows:

- Describe the material retrieval technology performance specification; and
- Document the contamination control philosophy for entering Silo 3.

3.0 RETRIEVAL TECHNOLOGY PERFORMANCE SPECIFICATION

To determine an acceptable material retrieval technology, it is necessary to establish the performance specification to which the material retrieval system shall operate. The performance specification defines parameters relating to:

- Silo 3 and the material it contains; and
- Retrieval system requirements.

3.1 Silo 3 and Material Contents

Silo 3 is an above-grade concrete walled tank approximately 35 feet (ft.) high and 80 ft. in diameter. The Silo 3 circumference is restrained radially with steel ties.

There are five access ports on the dome of Silo 3. One is approximately geometrically centered and four access ports are arranged radially across the dome of Silo 3. The ReTRIEVR and

Conveyance System's flexible hose shall be deployed through the center access port of the Silo 3 dome. The center access port has a 20 inch (in.) internal diameter. A clearance of one inch is required around the circumference of the center access port. The overall allowable access available for the ReTRIEVR is 18 in. in diameter.

The overall target for the dead loads on the Silo 3 dome is to be zero. Dead or static loads in excess of zero must be reviewed and approved by Fluor Fernald, Inc. (Fluor Fernald) prior to implementation. Where a zero load is not possible, the load will be minimized. Fluor Fernald's reviewed and approved live or dynamic load on the Silo 3 dome is limited to 700 pounds, or three persons over a circular area no less than three ft. in diameter.

Silo 3 has a total of 46 decant ports, each with a weir and baffle system. There are 23 decant ports located on the east side of the Silo 3 and 23 decant ports located on the west side of Silo 3. The ReTRIEVR will be able to maneuver around the decant ports and remove hold-up material on, and around, the decant ports.

Silo 3 material is classified as 11(e)(2) byproduct material under the Atomic Energy Act (AEA) of 1954, as amended. This material resulted from the processing of uranium ore concentrate and is specifically exempt, as defined, from regulation as solid or hazardous waste under the Resource Conservation and Recovery Act (RCRA), 40 Code of Federal Regulations (CFR) Part 261.4(a)(4). Silo 3 material is not a solid waste. Therefore, the requirements under RCRA are "not applicable" as that term is used in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Silo 3 material does not contain listed hazardous waste as identified in 40 CFR Part 261.31–261.34. Several of the inorganic metals comprising the Silo 3 material are suspect or known carcinogens.

Sample analysis for the Operable Unit 4 Remedial Investigation (OU4 RI) indicate that no organic constituents are present in the Silo 3 material.

Silo 3 contains 5,100 cubic yards (yd^3) of material that is predominantly metal oxides. The material density range is approximately 29 pounds per cubic feet ($lbs./ft^3$) to 58 $lbs./ft^3$. The physical composition of the Silo 3 material contents is assumed to range as follows:

- Dry loose fine powder at the top of Silo 3.
- Compacted powder towards the middle and bottom portions of Silo 3.
- Potentially saturated powder at bottom one ft. of Silo 3.
- Miscellaneous debris material less than two ft. in length in any given direction or less than 20 lbs. in weight at full extension and 100 lbs. straight dead lift. It is anticipated that debris will be in the form of simple hand tools, personal protective equipment (PPE), plastic bags, and other similar debris.

Approximately 90 percent (%) by weight of Silo 3 material passes through a 200-mesh sieve indicating that the majority of contents are silt size or less. Silo 3 material is easily fluidized and dispersible. Recent particle size analysis showed that Silo 3 material consists of particles mostly greater than one micron, however, these particles are aggregates of submicron size particles that may be easily dispersed during retrieval operations.

Retrieved Silo 3 material is expected to have variability in particle size and composition, but is not expected to be a significantly different material than found in previous and recent testing that has identified particle size, physical characteristics, and chemical constituents.

Typically, the material moisture content is eight % by weight, potentially reaching saturation in the lower one ft. of material in Silo 3.

The chemical constituents of the Silo 3 material are predominantly inorganic metal compounds. The majority (> 50%) of the Silo 3 radioactivity is from Thorium-230 and the balance natural uranium decay chain radionuclides

3.2 Retrieval System Requirements

The ReTRIEVR will be deployed from a weatherproof enclosure supported above Silo 3 on a structural gantry. The weatherproof enclosure in conjunction with the Retrieval and Conveyance System heating, ventilation and air conditioning (HVAC) system will ensure Silo 3 material is contained and not released to the environment.

The ReTRIEVR will have access to the internal working envelope of Silo 3.

The ReTRIEVR can be retracted from Silo 3 into the confinement enclosure for decontamination, maintenance, and removal.

The ReTRIEVR will have remote tooling to perform the following functions:

- Break up compacted and potentially saturated material within Silo 3.
- Retrieve miscellaneous debris less than two ft. in length in any one direction or less than 20 lbs. in weight at full extension or 100 lbs. straight dead lift. It is anticipated that debris will be in the form of simple hand tools, PPE, plastic bags, and other similar debris.
- Deliver an eight-in. flexible hose capable of conveying approximately 15,000 lbs./hr.
- Clean interior surfaces of Silo 3 to remove "visible Silo 3 material."
- Apply fixative to the interior surface of Silo 3.

Operators dressed in PPE, will decontaminate the ReTRIEVR, using a HEPA vacuum and wipes. Additionally, the ReTRIEVR is designed so that maintenance may be performed manually with the system retracted in the confinement enclosure. The ReTRIEVR is designed not to require maintenance more frequently than every six months.

The ReTRIEVR will not directly or indirectly apply a pressure of more than 100 lbs. on the internal walls of Silo 3. It is assumed that any contact area will be greater than two square inches (in^2), the size of the Raptor's gripper. Therefore, the effective force limit on the ReTRIEVR will be 100 lbs. This is the same force limit that has been established for lift and lateral loads on

ReTRIEVR arm fully extended to silo wall. The ReTRIEVR hydraulic pressure sensors will provide alarm notification at control panel if load limits are near range limits.

The ReTRIEVR will be controlled remotely from the control room adjacent to the Treatment Facility located approximately 150 ft. from Silo 3.

The ReTRIEVR will have a minimum operating life of three years.

No liquids or solids will be added to Silo 3 material to facilitate material retrieval.

To minimize the size of the confinement enclosure housing, the ReTRIEVR will use sectioned links that are joined in the confinement enclosure prior to being lowered into Silo 3.

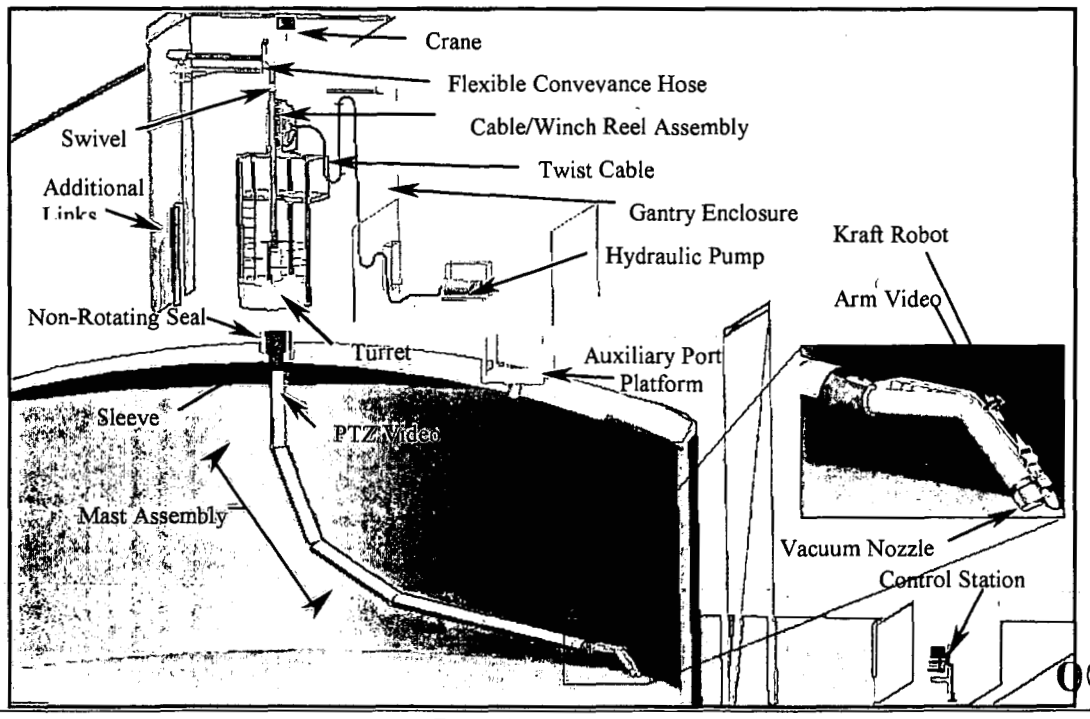
The as low as reasonably achievable (ALARA) approach for radiological exposure will be used to design the ReTRIEVR, particularly in the areas associated with manual extraction, tool changing, and maintenance operations.

4.0 RETRIEVAL TECHNOLOGY DESCRIPTION

4.1 Retrieval System Description

The Silo 3 retrieval system is illustrated in Exhibit 4.1-1. The ReTRIEVR will consist of a six degree-of-freedom, hydraulic, robotic arm mounted on the end of an articulated segmented mast. The arm will be a Kraft Telerobotics Raptor arm with the force-feedback option. The Raptor robotic system consists of the slave arm located inside Silo 3, and a master controller arm used to command the slave motions located in the Silo 3 Treatment Facility control room.

Exhibit 4.1-1: ReTRIEVR System Overview



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The Raptor slave will have a reach of 70 in., weighs 160 lbs., and have a lift capacity of 200 lbs. (see the Raptor arm specifications in Exhibit 4.1-2 and Exhibit 4.1-3). The joints will be encoded by potentiometers and can be programmed to follow a predetermined path. The material retrieval nozzle will be mounted to the side of the Raptor arm (Exhibit 4.1-4) with a hydraulically-actuated sliding attachment. This will permit normal operation with the retrieval nozzle extended ahead of the gripper. If, however, the gripper is needed to retrieve debris or to carry other end effectors, such as the tool for loosening compacted material, then the nozzle will be retracted to a less obtrusive position. Gripper and vacuuming activities will be aided with the use of the camera mounted on the robot forearm.

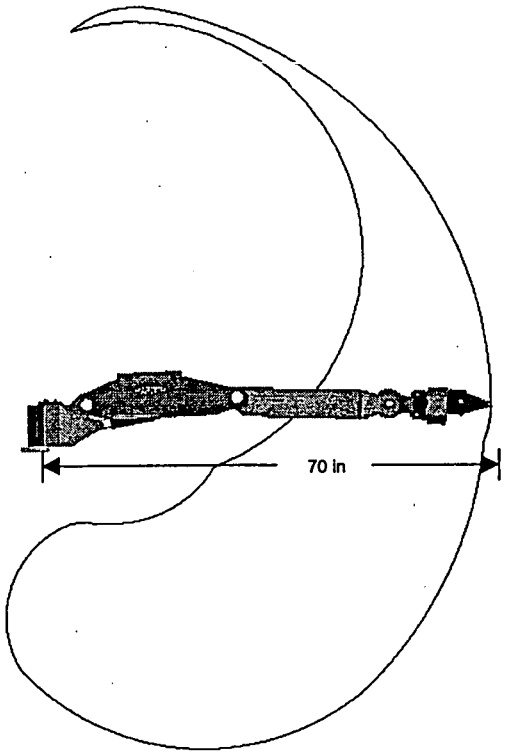
The material retrieval nozzle will have a carborated shroud to allow some flow to originate several inches behind the primary nozzle opening. The primary nozzle opening will be protected by a screen mesh to limit the size of particles that enter the material retrieval nozzle vacuum hose. If the primary nozzle opening is plugged, then a vacuum breaker will relieve the vacuum and cause normal flow across the silo return line and retrieval line. The vacuum breaker will provide a quick return to the pressure conditions existing prior to clogging. A limit switch will detect the vacuum break transfer and signal the control room of this abnormal condition. The operator will then turn off the vacuum and open the air jets, blowing air across the face of the primary nozzle opening. If the blowing of air across the primary nozzle does not clear the primary nozzle, then the arm shall be retracted into the confinement enclosure and manually cleared. Due to the low volume (nominal 25 standard cubic feet per minute (scfm), ¼ inch air supply line), pressure and short time duration of the air pulsed through air jets on nozzle, the air jets cannot over-pressurize the silo.

The suction nozzle is designed to introduce the waste material into the vacuum conveyance hose. Special design considerations for the suction nozzle include:

- A ½ inch screen mesh at the opening;
- A carburated design geometry that assures a mixture of air and waste is introduced to the hose;
- A retraction feature to pull the hose back from the gripper to support special manipulation functions; and
- The nozzle must fit through the turret sleeve in parallel with the arm.

The design plan for this nozzle is shown in Exhibit 4.1-5.

Exhibit 4.1-2: Geometry and Motion Range for Kraft Raptor Manipulator with Modified Forearm



Note: The vacuum hose restricts arm motion.

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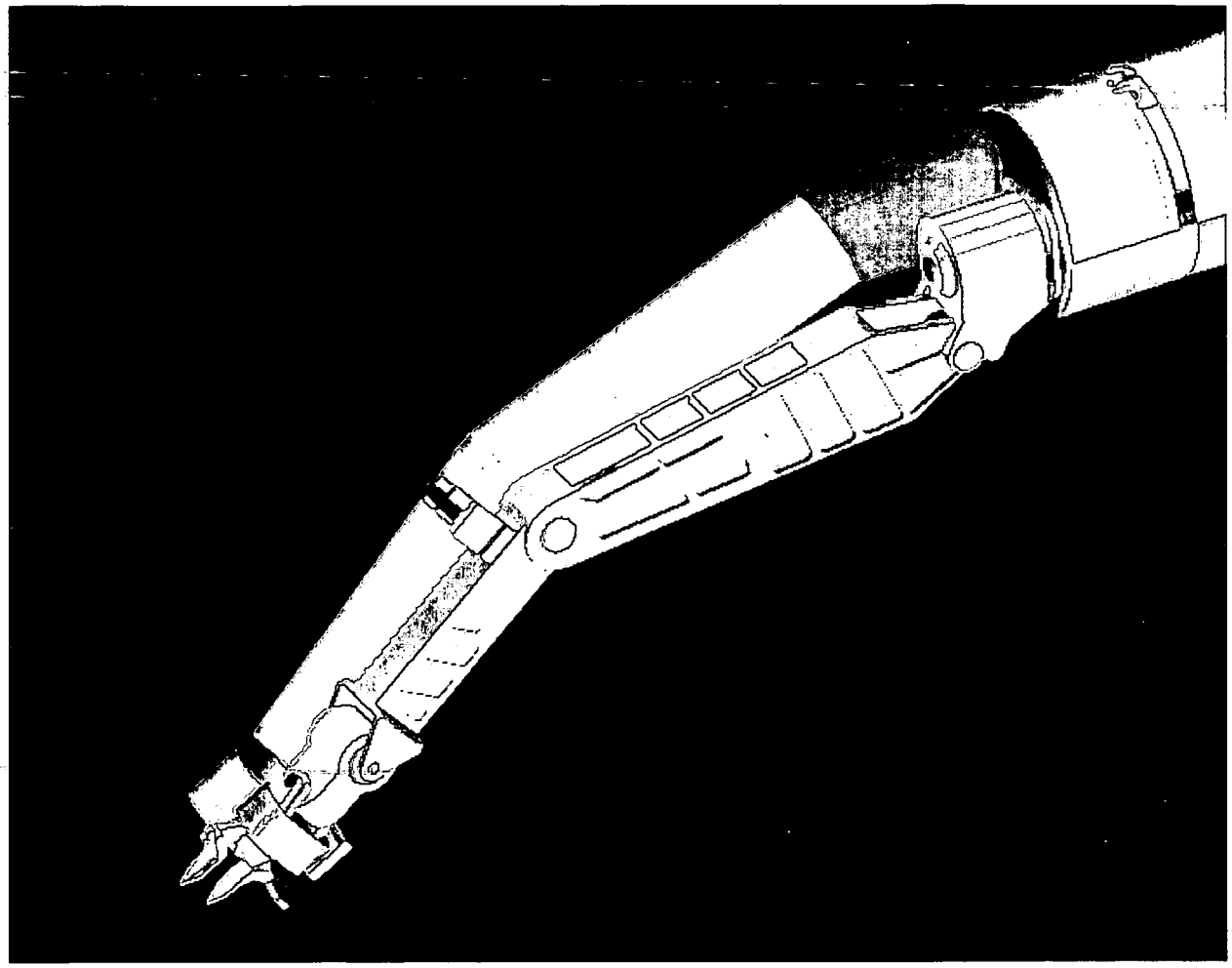
Exhibit 4.1-3: Manipulator Specifications

Degrees freedom-of-motion		6 plus gripper
Maximum reach		70 in.
Lift capacity		200 lbs.
Jaw closure force		300 lbs.
Wrist torque		100 ft. lbs.
Weight in air		160 lbs.
Weight In seawater		98 lbs.
Hydraulic Power Requirement		
Operating pressure		1500-3000 psi
Flow requirement		5 GPM (19 liters/min.)
Filtration		25 micron absolute
Joint Motion	**Total Angular Travel**	**Angular Slew Rate**
Shoulder Azimuth	275°	80°/sec.
Shoulder Elevation	120°	65°/sec.
Elbow Pivot	130°	50°/sec.
Wrist Pitch	200°	100°/sec.
Wrist Yaw	200°	100°/sec.
Wrist Rotate (slaved mode)	340°	330°/sec.
Wrist Rotate (continuous)	variable to	55 rpm max

Exhibit 4.1-4: Kraft Save Arm with 8-in. Hose and Retractable Nozzle



The segmented mast, that supports the arm, will consist of one to seven links. Each link will be ten ft. long and 17 in. in diameter (Exhibit 4.1-6). The average link weight will be less than 500 lbs. with individual hoses and cylinders attached. Cylinders will be hinged down one side in a piano-type hinge arrangement and hoses will be secured with a series of latches down the other side. The piano-type hinge will permit the segments to be opened for assembly around the conveyance system tube and the hydraulic hoses for the arm and lower extension segments. The segments will attach to each other with a pivot pin on one side and will be actuated with a hydraulic cylinder on the other side. The hydraulic umbilical hose will contain connection points appropriately spaced along its length, so that each extension segment can be connected as it is added to the assembly.

Exhibit 4.1-5 Carburated vacuum nozzle maintains an opening of at least 7 inches in diameter.

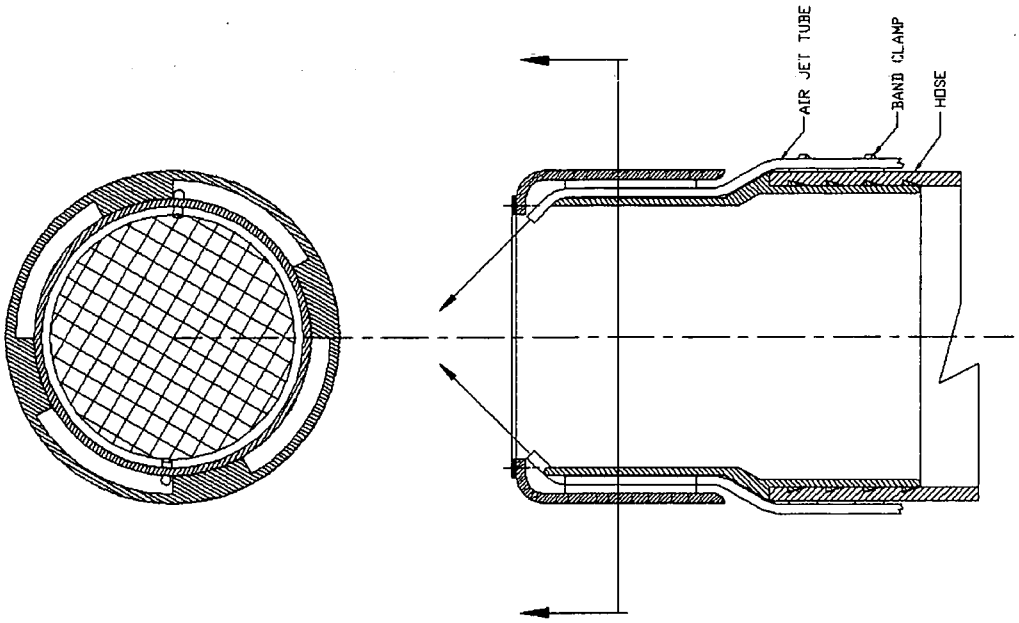
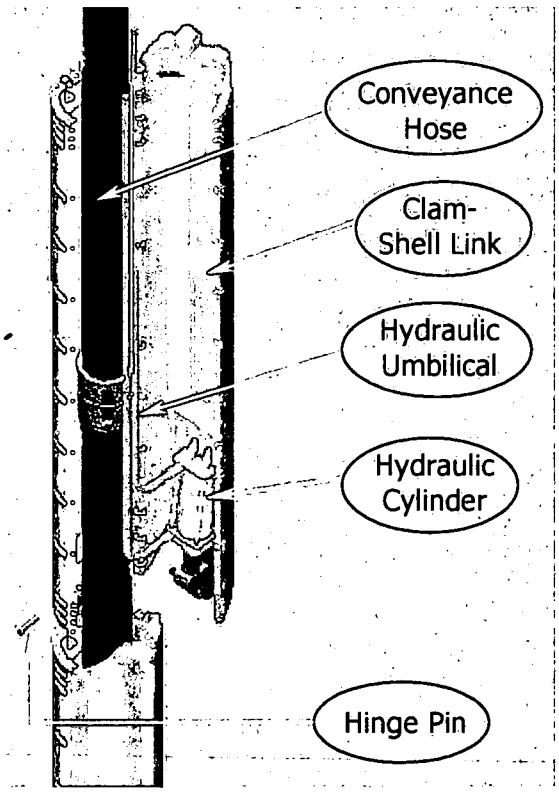


Exhibit 4.1-6: Link Assembly Showing Clamshell Closure Feature to Close Around the System Cables



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A cable winch will support the assembly during insertion or removal of link segments. A winch and umbilical reel assembly will be provided to manage the excess cable, hydraulic hose, and retrieval system hose (Exhibit 4.1-7). The hose reel assembly will contain sufficient twist cables and fluid conveyance swivels to permit continuous rotation without disconnecting and reconnecting the control hoses and cables. This equipment will be located in the containment enclosure located atop the support gantry. After a new link and hose segment have been added to the assembly, the Raptor arm will be able to reach an additional ten ft. into Silo 3 (Exhibit 4.1-8). As the arm is maneuvered to remove the material that it can reach, the upper most link will be supported by a clamp and swiveled with the turret. This method of operation will permit the arm to remove another ten ft. incremental spherical radius of material from Silo 3.

Exhibit 4.1-7: Segmented Hose Turret and Reel Assembly

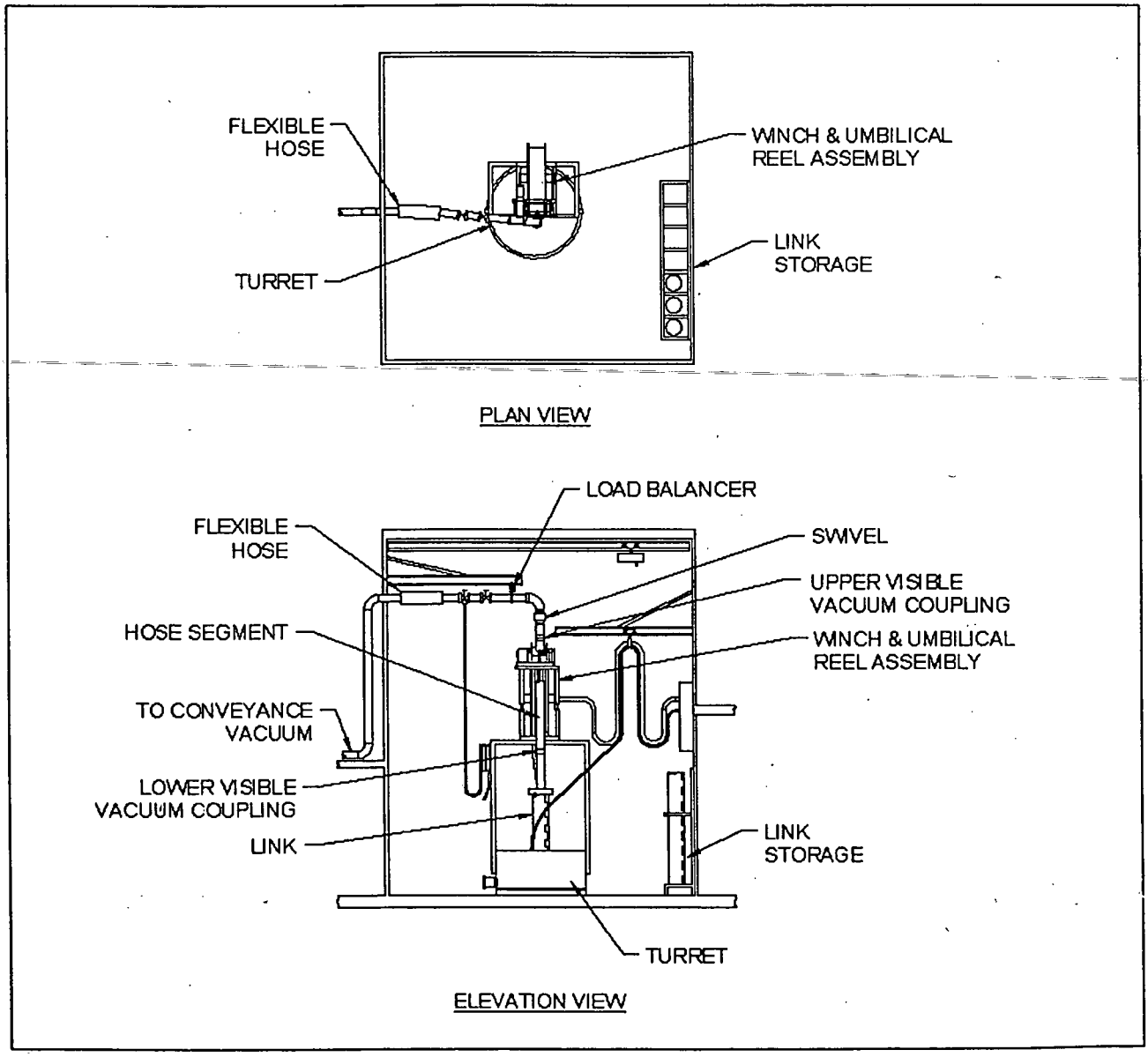
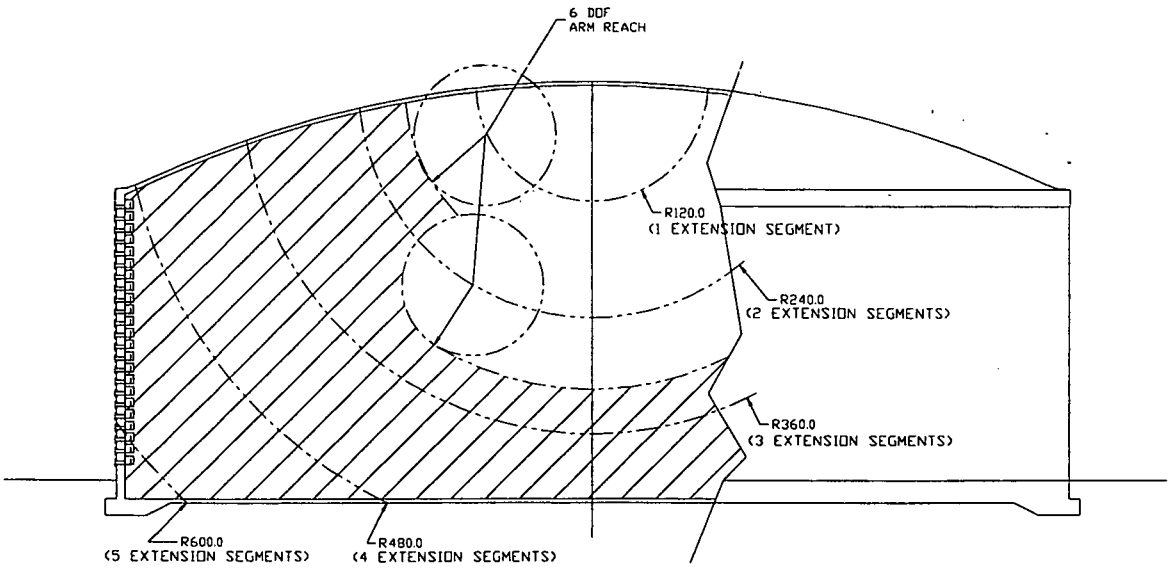


Exhibit 4.1-8: Illustration of Mast and Arm Reach Capability During Mining Operation



When lightly compacted material is encountered, the retrieval nozzle can be retracted. The material will be broken up by probing and crushing with the Raptor arm's gripper. The nozzle would then be extended and retrieval will continue with minimal disruption. If, however, a significant amount of densely compacted material is encountered, then the arm can be raised to the auxiliary Silo 3 opening accessible from the gantry where the de-lumping end effector can be passed manually into Silo 3 through the tool change enclosure shown in Exhibit 4.1-9 using long reach poles. The long reach poles will position the de-lumper tool for the Raptor arm's gripper to bracket on the de-lumping tool inside the silo.

The de-lumping tool (Exhibit 4.1-10) will be used for breaking up lumps and compacted material. The de-lumping tool consists of two counter-rotating shafts, each containing several wheels. This tool will be driven by a hydraulic motor and will be able to operate simultaneously with the retrieval system. Consequently, the vacuum system will continue to remove the material as the de-lumping tool loosens the compacted material. The hydraulic motor will be remotely reversible, to allow for the discharge of objects that jam the de-lumping tool.

When material retrieval efforts are complete, the Raptor arm may be returned to the auxiliary Silo 3 opening with the Tool Change Enclosure to attach the fixative-spraying tool to the Raptor arm.

The primary motion for the vacuum retrieval system will be the dexterous Raptor robot arm. The Raptor slave arm will be controlled by a master control unit that allows the in-silo slave to behave as an extension of the operator's arm (Exhibit 4.1-11). The ten-ft. long links will be controlled individually, without any coordinated motion control. The ten-ft. links will be adjusted to their target position for coarse location of the Raptor robot arm by extending or retracting the joint actuator from the control panel in the control room. The position of the links will be monitored

with the Silo 3 video camera and represented on a computer console showing the robot arm position.

Exhibit 4.1-9: Auxiliary Port, Tool Change Enclosure

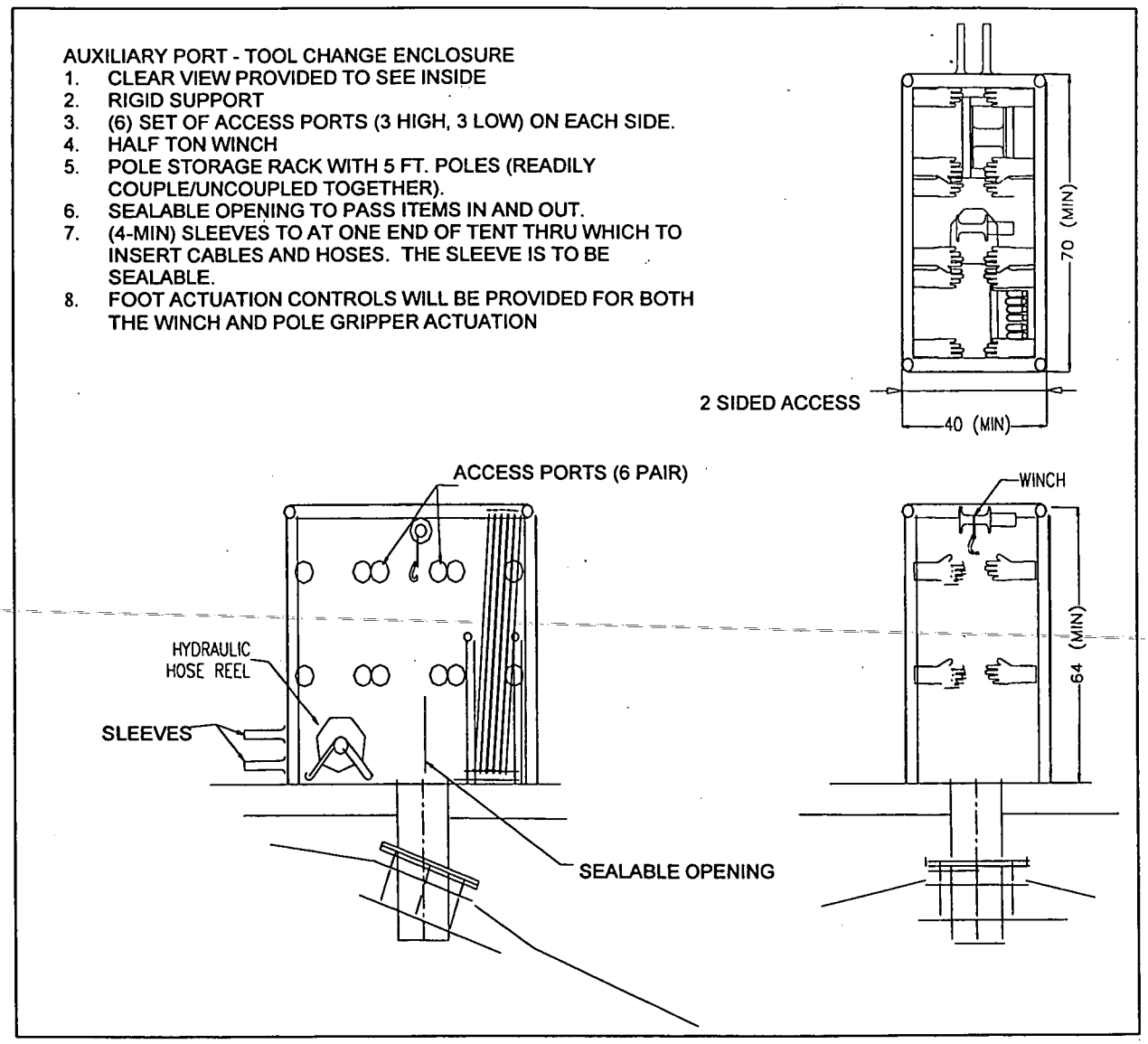


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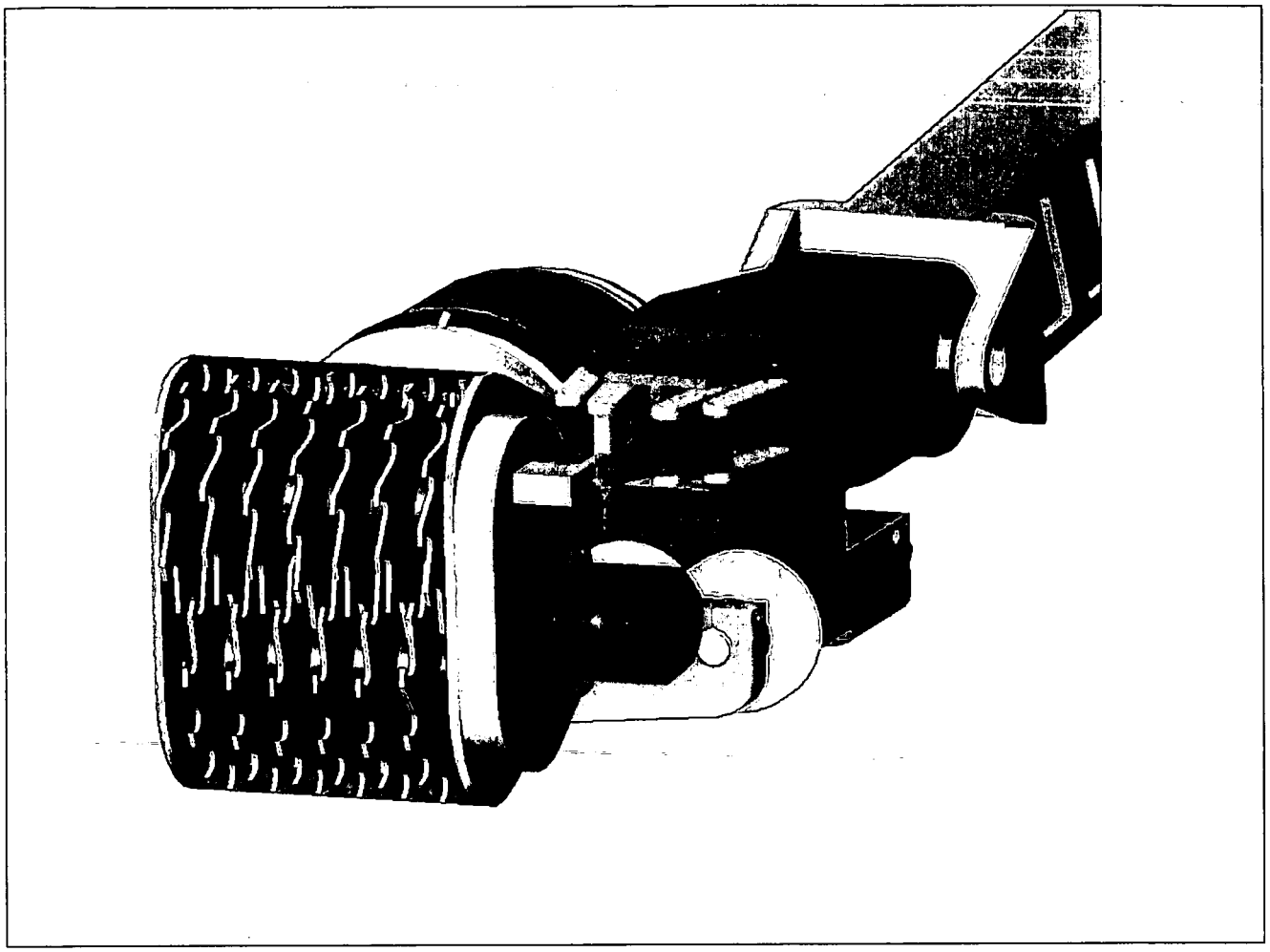
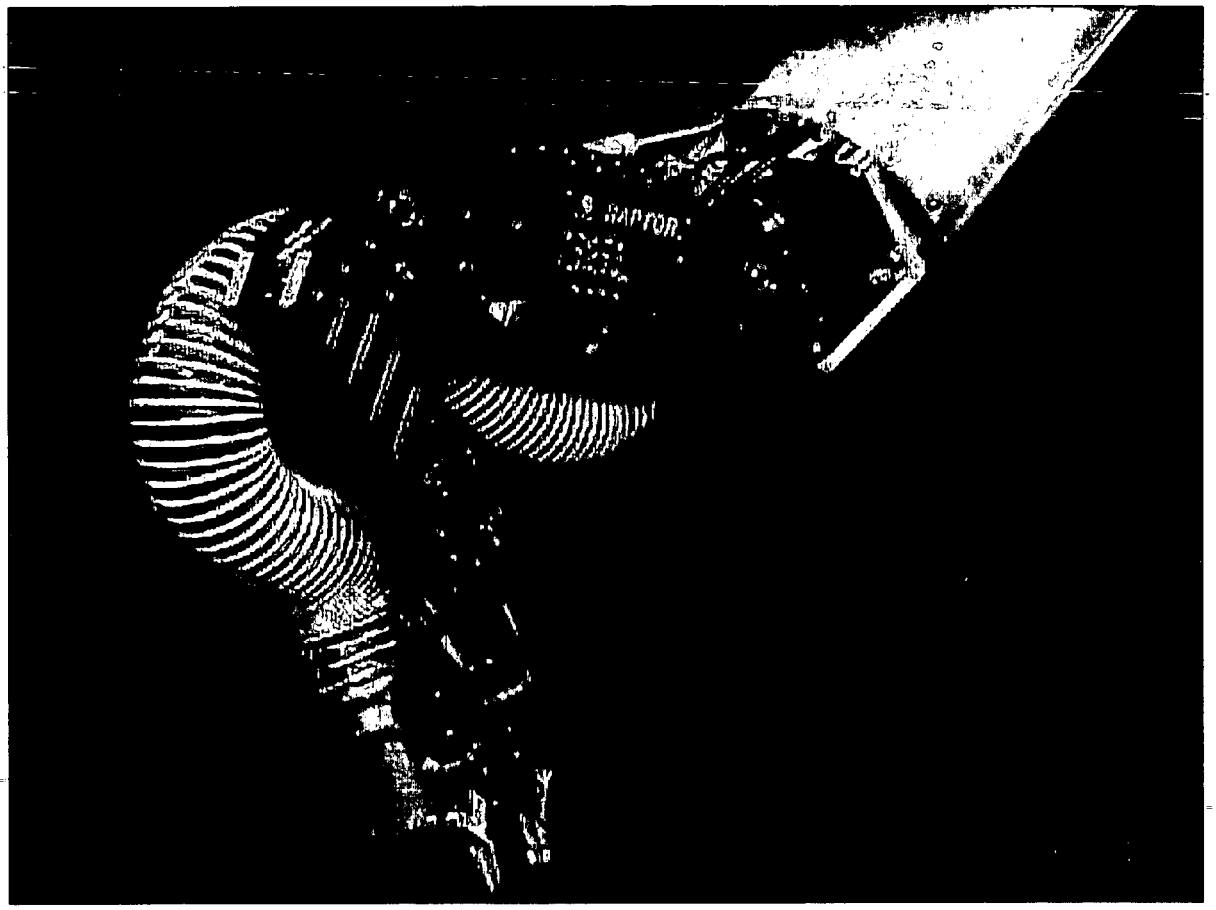
Exhibit 4.1-10: De-lumping Tool Concept



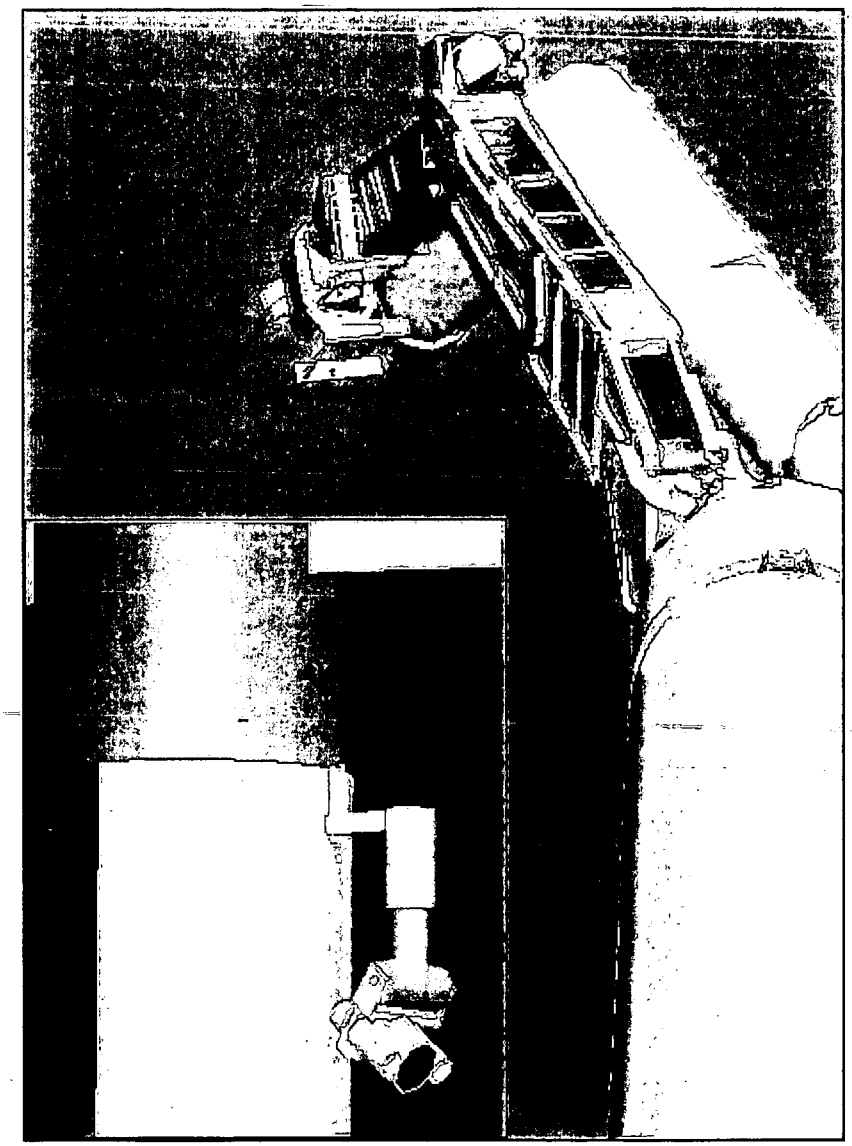
Additional feedback will be provided to the operator via two cameras: one area Pan Tilt Zoom (PTZ) camera located on the arm side of the center access opening, and the second camera on the arm (Exhibit 4.1-12). The color cameras will supply their own lighting and the lenses will be kept clear of loose material by an air curtain. The ReTRIEVR supplied cameras will be installed to ReTRIEVR hardware prior to introducing into Silo 3. Two additional cameras, independent of the retrieval system will be provided through other auxiliary ports to assist in retrieval and silo inspection. The cameras at the auxiliary ports will be installed after the Silo 3 retrieval and conveyance HVAC system is operational and the headspace radon has been evacuated through HVAC system. A camera located in the gantry enclosure will provide observation during retrieval and ReTRIEVR maintenance operations inside enclosure.

Exhibit 4.1-11: Kraft Raptor Arm with 8-in. Vacuum Hose Attached



Note: ReTRIEVR arm is a modified forearm and will not be fully folded because of the vacuum hose.

Exhibit 4.1-12: Simulated view of the arm from the PTZ camera (lower-left inset)



4.2 Sequence of Material Removal

The retrieval mining strategy and retrieval system operation sequence shall be as follows (refer to Exhibit 4.1-8).

Step 1 The dexterous Raptor arm will be attached to the first link and lowered through the Silo 3 center access port opening, vacuuming as it is lowered into Silo 3. As joints enter the Silo 3 plenum, the arm will be swept to mine the accessible area in front of, and around the arm. When the arm is fully inserted into Silo 3, a hemisphere of

over six ft. should be clear. This approach will accommodate Silo 3 material even if the silo is full to the top of the dome.

Step 2 After the arm is secured with the turret clap, the second arm segment will be attached. Segment attachment will consist of inserting a ten ft. section of conveyance hose, lifting the second segment into position with the gantry crane, connecting the hydraulic and electrical connections, closing the hinged clamshell cylinders around the vacuum and umbilical supply lines and inserting the hinge and hydraulic cylinder clevis pins at the attachment points. Removal or attachment of an arm segment should take approximately one hour per segment. Arm attachment will require two operators dressed in PPE.

Step 3 When the second segment attachment is complete, the assembly will be lowered into Silo 3. The Raptor arm will be lifted to allow room for the extended mast segment to be lowered. Generally, when the large segments are moving (either vertically, rotationally, or being articulated) the Raptor does not move. Once the first segment joint is in the plenum, the first segment will be raised to access the top of the material pile. The Raptor accessible area will be mined, and then the entire assembly will be rotated to the next position. The operator will minimize the possibility for cave-ins that can impose impact loads on the joints by mining from the top down. Although the Raptor arm and the large links have sufficient strength to withstand any expected cave-in loads; it is generally prudent to minimize the stresses on robotic joints.

Step 4 When the top of the second segment reaches the access sleeve, the third segment will be attached and Step 3 will be repeated. Generally, the strategy will be to keep the arm above the material pile and mine from the top. After each spherical volume around the Raptor base is cleared, the assembly will be rotated about the center access port. When a circumferential swath is cleared, the link segment will be lowered and another circumferential swath will be cleared. This procedure will be repeated until the accessible hemisphere with this segment is completely cleared. The circumferential swath clearing sequence will be continued until the bulk of the material is vacuumed from Silo 3 (Exhibit 4.1-8).

Step 5 Air-jets mounted in the vacuum nozzle will be used to help dislodge material from the weir and baffle system on the decant ports and to sweep the last of the material into a more confined area for final vacuuming. This air-sweep and vacuum sequence will continue until Silo 3 is visually determined to be clean using the video cameras.

Step 6 The arm and mast can be removed and re-installed with the fixative tool attached. The interior of Silo 3 will be sprayed with fixative again using the dexterous Raptor arm. Progress of the fixative spray activity will be tracked with the computer position verification system.

4.3 ReTRIEVR Tool Change

There are two methods to change or add the ReTRIEVR arm tooling. The preferred method is to use the Tool Change Enclosure located at the auxiliary Silo 3 opening and to introduce tooling into the silo for remote hand-off to the Raptor arm gripper. This can only be accomplished after 4 link masks have been added to the ReTRIEVR arm. Personnel will wear appropriate PPE as required to perform tool changes at the sealed Tool Change Enclosure, using long reach poles to lower the tool into the silo for Raptor gripper pick-up and attachment. The enclosed auxiliary Silo 3 Port will be accessible from the gantry structure.

The second method to change the ReTRIEVR arm tooling is by retracting the ReTRIEVR into the confinement enclosure. The tooling will then be changed or added manually. To change tooling manually, personnel will enter the confinement enclosure wearing appropriate PPE. They will manually vacuum the outside mast of the ReTRIEVR when removing the masts from Silo 3. The insides of the links may be vacuumed after the links are opened and on the storage racks. Therefore, manual changing of the remote tooling will be minimized. Manual changing will include both changing tooling for function, wear, maintenance, or decontamination.

4.4 Silo 3 Debris Removal

Debris removal techniques vary depending on the type and quantity of debris encountered in the Silo. Debris removed will be package and disposition dependent on characteristics of the specific debris. The preferred method is to retrieve debris through the Tool Change Enclosure located at the auxiliary port. There are three independent debris removal methods available to remove debris and are listed below:

- Lower a bucket or net into Silo through the sealed Tool Change Enclosure at the auxiliary port and allow ReTRIEVR to grip the debris and place the debris in the bucket or net. Remove the bucket or net through the Tool Change Enclosure for bag out.

- Lower a hook into Silo through the sealed Tool Change Enclosure at the auxiliary port and allow ReTRIEVR to grip the hook and attach the hook to the debris. Remove the hook and debris through the Tool Change Enclosure for bag out.

- Have ReTRIEVR grab and hold the debris while arm is being extracted from the Silo through the enclosure. Decontaminate the arm as it is removed from silo. Bag out debris in the enclosure.

4.5 ReTRIEVR Decontamination Methods

Decontamination of the retrieval arm is required whenever the arm is removed from the silo. Personnel wearing appropriate PPE will enter the enclosure and manually use HEPA vacuum to vacuum the outside mast of the ReTRIEVR when removing the masts from Silo 3. Wipes and brushing may be used to assist in the decontamination. The insides of the links will be vacuumed and wiped after the links are opened. Additional cleaning of the links can be provided when they are placed on the storage racks inside the enclosure. To maintain containment during

decontamination or link addition, the retrieval and conveyance system HVAC will be operating, the ReTRIEVR hose will be in the by pass mode, and the silo and enclosure ventilation will flow through the silo return air line (flow reversed).

5.0 CONTAMINATION CONTROL PHILOSOPHY WHEN ENTERING THE SILO

The sequence of installation for the retrieval equipment into Silo 3 to ensure contamination control is as follows:

Stage 1: Erect support gantry and weatherproof retrieval system enclosure. The retrieval and conveyance HVAC system will be installed and operating to provide a controlled environment in Silo 3 and the retrieval enclosure [drawing 55-2000, Silo 3 Retrieval and Conveyance Process Flow Diagram (PFD)].

Stage 2: Install and seal the annular space between gantry enclosure and Silo 3.

Stage 3: Physically break confinement of Silo 3 with overall confinement maintained in enclosure and Silo through retrieval and conveyance HVAC system. Localized temporary confinement will be used to minimize the spread of contamination into the weatherproof enclosure.

Stage 4: The turret assembly and sleeve will be raised over the Silo 3 center opening. Lower the turret through the silo opening. Note: the camera mounted on the turret assembly is fragile, camera will be tilted into the sleeve during sleeve installation. A long-handled pole will be used to move the camera away from the mast plane into its normal position, after the turret assembly is inside Silo 3.

Stage 5: The turret sleeve opening will be remain open to provide ventilation to enclosure and Silo 3 through retrieval and conveyance HVAC system. The remainder of the turret assembly will be connected. Note: The flexible seal between Silo 3 and the hatch access enclosure will be airtight.

During routine operations, Silo 3 opening and the retrieval system confinement enclosure will have dedicated HVAC system with high-efficiency particulate air (HEPA) filtration and continuous emission monitoring. During mast extraction operations, confinement enclosure personnel dressed in PPE can decontaminate the segments and arm with a local HEPA vacuum and other methods including wiping and brushing. The HEPA vacuum will be used to vacuum the link and arm as it is removed from Silo 3. Open the links and vacuum the outside of the material conveyance tubes. To clean the insides of the tubes, draw clean Silo 3 air through the tubes prior to removing from silo.

6.0 REFERENCES

Atomic Energy Act of 1954, as amended.

40 CFR Part 261.4(a)(4).

40 CFR Part 251.31-263.34.

RMRS Drawing 55-2000, Silo 3 Retrieval and Conveyance PFD.

Rocky Mountain
Remediation Services, L.L.C
. . . protecting the environment

FERNALD SILO 3 PROJECT

PROCESS CONTROL PLAN

RMR-0445-ENG-012-00

May 12, 2000

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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	TBD	+0.5 in. W G	High	-Interlock-take Retrieval/Conveyance System off-line - Emergency Shut-Down Sequence	2003
PT-001	Silo Pressure	TBD	-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)	TBD	TBD	High	- All Systems off-line	2011

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	TBD	TBD	High	-Interlock-take Retrieval/Conveyance System off-line	2003
PT-001	Silo Pressure	TBD	TBD	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) must 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 regulatory limits for in 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 (System 71) and the Off-Gas Treatment 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

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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 HVAC System (System 75) to induce a negative pressure in the silo and Retrieval Enclosure.

3.2.2 Control Philosophy

During removal operations, the silo pressure will be maintained between –2.0 and +0.5 inches water gauge differential to the atmosphere to prevent damage to the silo. 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).

3.2.3 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.

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 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.

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3.2.6 Chilled Water Coil (11-HE-001)

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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-

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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

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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.		
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).

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- 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.		
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 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)

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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.

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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.

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TRANSPORTATION AND DISPOSAL PLAN FOR OPERABLE UNIT 4 – SILO 3

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 2000

U.S. DEPARTMENT OF ENERGY

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TRANSPORTATION AND DISPOSAL PLAN FOR OPERABLE UNIT 4 – SILO 3

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 2000

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ACRONYMS

AEA	Atomic Energy Act
AEDO	Assistant Emergency Duty Officer
ALARA	As Low As Reasonably Achievable
ARAR	Appropriate, Relevant and Applicable Requirement
ATMS	Automated Transportation Management System
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	Department of Energy
DOT	Department of Transportation
EMS	Emergency Management System
EOC	Emergency Operations Center
FAT&LC	Fernald Atomic Trades and Labor Council
FEMP	Fernald Environmental Management Project
FS	Feasibility Study
GCBCTC	Greater Cincinnati Building and Construction Trades Council
HMR	Hazardous Materials Regulation
IHA	Integrated Hazard Analysis
IP-2	Industrial Packaging-Type 2
ISA	Interim Storage Area
LSA	Low Specific Activity
MCEP	Motor Carrier Evaluation Program
NCP	National Contingency Plan
NRC	Nuclear Regulatory Commission
NSS	Nuclear Systems Safety
NTS	Nevada Test Site
NTS WAC	Nevada Test Site Waste Acceptance Criteria
OTP	Operator Training Program
OU4	Operable Unit 4
PCDF	Permitted Commercial Disposal Facility
QA	Quality Assurance
QAJSP	Quality Assurance Job Specific Plan
Ra-226	Radium 226
Ra-228	Radium 228
RCRA	Resource Conservation Recovery Act
RCT	Radiological Control Technician
RI	Remedial Investigation
RMRS	Rocky Mountain Remediation Services
RPP	Radiological Protection Program
RWP	Radiological Work Permit

ACRONYMS (Continued)

SPR	Safety Performance Requirement
TC	Toxicity Characteristic
TEP	Transportation Emergency Plan
Th-230	Thorium 230
U.S. EPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Transportation and Disposal Plan describes how transportation and disposal operations will be evaluated to ensure safe and successful storage, staging and transportation of Operable Unit 4 (OU4) treated Silo 3 material from the Fernald Environmental Management Project (FEMP) to a permitted commercial disposal facility (PCDF) or the Nevada Test Site (NTS). Modes of transportation may include motor carrier, rail, or intermodal (i.e., a combination of rail and truck). This plan was prepared by Fluor Fernald, Inc. (Fluor Fernald) as a component of the overall Silo 3 Project Remedial Design (RD) Package.

This plan serves to: (1) describe the transportation logistics associated with the treated Silo 3 material; (2) generally describe operational aspects of transportation plans to demonstrate that treated Silo 3 material can be transported to the designated disposal site safely, and in accordance with applicable regulations, and; (3) provide a transition between design and implementation of transportation operations.

Submittal of this Transportation and Disposal Plan complies with the requirements put forth in the Silo 3 Remedial Design Work Plan (40400-WP-0001, Rev. 0, April 1998), which require an "operational description of Fluor Fernald's responsibility for transportation and disposal of treated waste."

Because the destination and mode of transportation have not yet been determined, this plan will include descriptions of the various options. Currently, Silo 3 Project is evaluating a PCDF and the NTS for disposal of this waste. The final decision regarding which facility will receive this waste is in part based on the transportation methods selected.

Operable Unit 1 is currently using rail to transport bulk waste to a PCDF. Shipments to the NTS are currently being performed exclusively by truck. The FEMP is evaluating the direct shipment of treated Silo 3 material to a PCDF by rail versus either the direct shipment by truck or intermodal shipment to the NTS (the NTS cannot accept direct rail shipments). The criteria used to select the mode of transportation will be based on safety, feasibility, and cost-effectiveness. Currently, the preferred transportation method is direct rail to a PCDF. A cost estimate is being developed for rail transportation of drums to a PCDF and will be used in the overall decision regarding transportation. Although the current preference is to dispose of the treated Silo 3 material at a PCDF, the criteria listed above (safety, feasibility, and cost-effectiveness) will be the determining factors in the final decision.

1.2 PROJECT APPROACH

Retrieval from Silo 3 and stabilization of Silo 3 material is being performed by Rocky Mountain Remediation Services (RMRS). Plans and requirements for completing RMRS' scope are described in the remainder of the RD Package.

Fluor Fernald will be responsible for selection of the disposal facility and mode of transportation, analysis of the treated Silo 3 material for Waste Acceptance Criteria (WAC) compliance, loading the treated Silo 3 material for shipment, and transportation of the treated Silo 3 material to the disposal facility.

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2.0 OFF-SITE TRANSPORTATION

2.1 INTRODUCTION

The FEMP will conduct its operations in compliance with applicable international, federal, state, local, and tribal requirements governing materials transportation, unless exemptions or alternatives are approved in accordance with the Department of Energy (DOE) Order 460.1A. A description of the pre- and post-treated waste form is included in Section 6.2. The treated Silo 3 material disposal strategy is to maintain the potential to transport and dispose of the material at either a PCDF or NTS in the event one of these options becomes unavailable.

2.2 DEPARTMENT OF TRANSPORTATION (DOT) REQUIREMENTS

The Low Specific Activity (LSA) determination drives the container requirements for packaging the treated Silo 3 material for off-site shipment to a disposal facility. Based on the evaluation performed, the minimum packaging requirement for the treated Silo 3 material is an IP-2 container. RMRS will use a 55-gallon steel drum to containerize the treated Silo 3 material for storage and subsequent shipment. The table below provides the rationale for the LSA determination.

LSA-I*	Meets Criteria	RATIONALE	REFERENCE
i	No	Silo 3 contents are identified as waste by-products from the refining of ore and ore concentrates. This waste consists of neither ore nor ore concentrates.	FEMP-OU4RI-6 FINAL, November 3, 1994
ii	No	Silo 3 contents are characterized as waste by-products from the refining of ore and ore concentrates. This waste consists of neither uranium nor thorium compounds per se. The waste contains some uranium and thorium; however, the regulation intends to regulate concentrated uranium compounds, such as U_3O_8. Silo 3 material consists of waste products removed from ore materials. The waste products include small quantities of uranium compounds not retained with the ore concentrates.	FEMP-OU4RI-6 FINAL, November 3, 1994
iii	No	The A_2 values of Th-230 and Ra-226 are NOT unlimited.	FEMP-OU4RI-6 FINAL, November 3, 1994
iv	No	The Silo 3 material exhibits non-homogeneity for Th-230. The waste exceeds the $10E^{-6}$ A_2/g.	FEMP-OU4RI-6 FINAL, November 3, 1994

*LSA-I definitional criteria are identified at 49 Code of Federal Regulations (CFR) 173.403, Definition of LSA-I Material. (1) LSA-I.

A review of the available analytical data for Silo 3 material indicates that this material does not meet any of the definitional criteria for LSA-I material, as defined in 49 CFR 173.403. Four subcategories [i-iv] of LSA-I material are identified in the regulations. Subcategory (i) is not appropriate because the relative radionuclide concentrations in the Silo 3 material are not consistent with that of an ore or ore concentrate. Subcategory (ii) is not appropriate because the Silo 3 material contains radionuclides [Ra-226 and Ra-228] other than uranium or thorium and their compounds. Subcategory (iii) is inappropriate since this material contains radioisotopes [e.g., Th-230 and Ra-226], whose A_2 values are NOT unlimited. Subcategory (iv) is not appropriate to Silo 3 material because this material contains Th-230 at a concentration exceeding 1E-6 A_2/gm.

Definitional and analytical criteria indicate that this material does not meet the regulatory criteria specified for LSA-I material. The Silo 3 material meets the LSA-II criteria in 49 CFR 173.403, (2) LSA-II, subparagraph (ii). Material in which the Class 7 (radioactive) material is distributed throughout and the average specific activity does not exceed 10^{-4} A_2/g for solids and gases, and 10^{-5} A_2/g for liquids. Therefore, this material is appropriately classified as LSA-II material.

2.2 OVER-THE-ROAD (TRUCK)

The mode of carriage (rail, highway, air, or water) and carrier will be selected to meet the requirements of each shipment and provide safe, expeditious, and economical delivery to the final destination. For any truckload (i.e., full load) quantities of radioactive material, and hazardous waste in any quantity, only motor carriers with satisfactory ratings under the DOE Motor Carrier Evaluation Program (MCEP) will be considered.

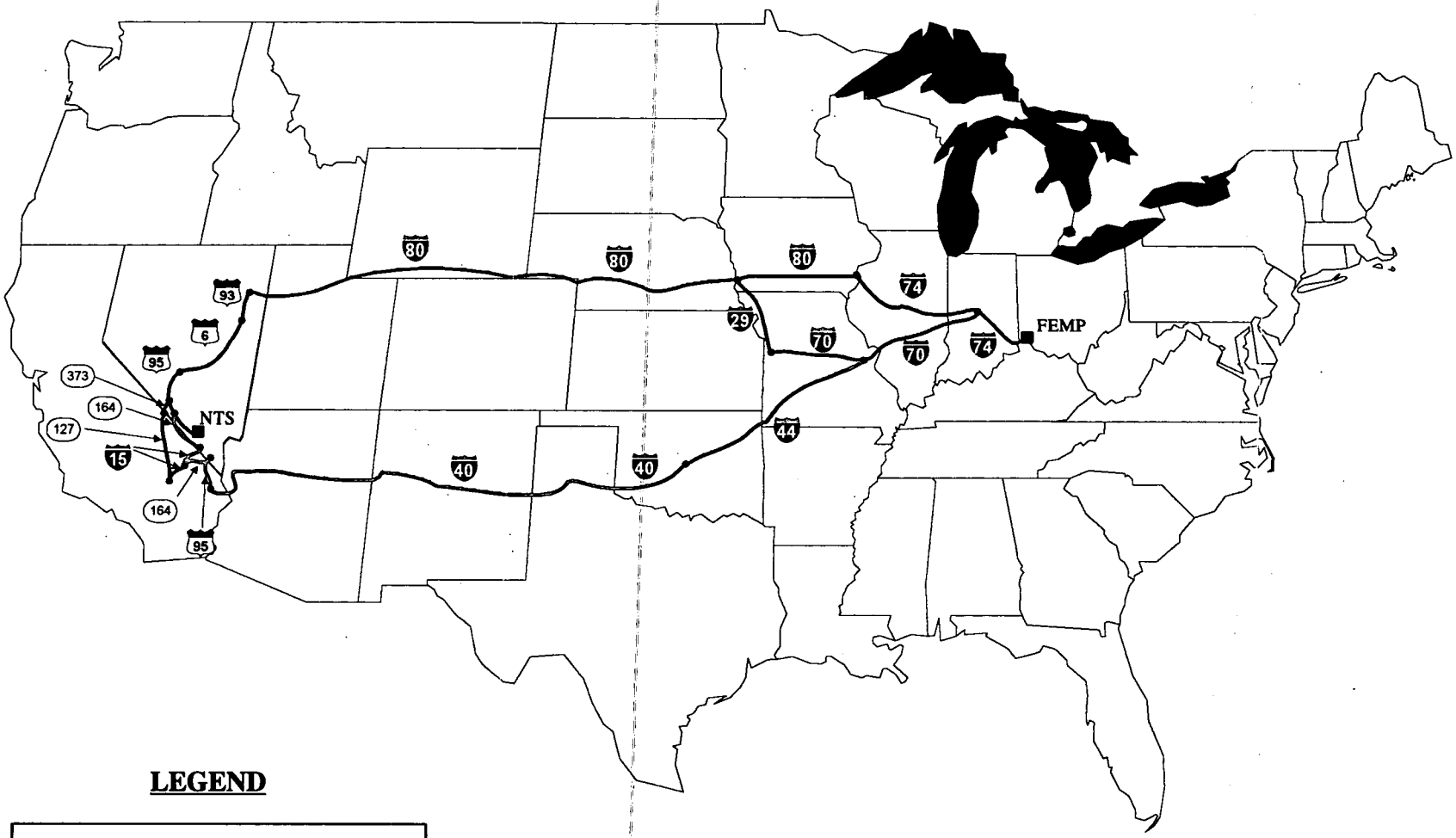
2.2.1 Over-The-Road to the NTS

2.2.1.1 Routes

There are one northern route and two southern routes that could be used for transportation of treated Silo 3 material to the NTS via truck. Figure 2-1 shows the three different routes to the NTS.

Northern Route – Route No. 1
South on Route 128 to I-74, to I-80 or Route 128 to I-74, I-70, to I-29, to I-80. I-80 West to Alternate US 93 south to US 93. At Ely, NV, take US 6 to Tonopah, NV. At Tonopah, NV, take US95 to the NTS Mercury Gate.

Figure 2 - 1
NTS Over-The-Road Routes



LEGEND

- Northern Route
- Southern Route #1
- Southern Route #2

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The Northern Route traverses the following states: Ohio, Indiana, Illinois, Missouri, Iowa, Nebraska, Wyoming, Utah, and Nevada.

Southern Route - Route No. 1

South on Route 128 from the FEMP. Take I-74 west to Indianapolis, IN. Take I-70 west to St. Louis, MO. From St. Louis, MO, follow I-44 to Oklahoma City, OK. Take I-40 through Kingman, AZ to Needles, CA. Proceed North on US 95 into Nevada. Go West on NV 164/Nipton Road to I-15. Proceed north on I-15 and west on Route 160 to Route 95. Take Route 95 East to Mercury, NV.

The Southern Route No. 1 traverses the following states: Ohio, Indiana, Illinois, Missouri, Oklahoma, Texas, New Mexico, Arizona, California, and Nevada.

Southern Route - Route No. 2

South on Route 128 from the FEMP. Take I-74 west to Indianapolis, IN. Take I-70 west to St. Louis, MO. From St. Louis, MO, take I-44 to Oklahoma City, OK. Take I-40 through Kingman, AZ to Needles, CA. Proceed North on US 95 into Nevada. At NV 164/Nipton Road proceed west to I-15 at Baker, CA. Travel southwest on I-15 to Baker, CA. Go North on CA 127 and NV 373 to Amargosa Valley, NV. Take US 95 East from Amargosa Valley to Mercury, NV.

The Southern Route No. 2 traverses the following states: Ohio, Indiana, Illinois, Missouri, Oklahoma, Texas, New Mexico, Arizona, California, and Nevada.

2.2.1.2 Risk and Safety Requirements

A transportation risk assessment comparing the risks associated with intermodal shipments to the NTS for Silo 3 remedial alternatives is provided in Appendix D of the OU4 Feasibility Study (FS), dated February 1994. The assessment evaluated both potential risks associated with accident-free waste transportation (direct radiation) and the risks associated with an accident scenario. As documented in the FS, the calculated excess cancer risk to members of the general public for both scenarios is within the range considered to be acceptable by the United States Environmental Protection Agency (U.S. EPA).

Per 49 CFR 397 Subpart D, Routing of Class 7 (Radioactive) Materials, the routes selected for shipment of radioactive material shall ensure that the radiological risk is minimized. Accident rates, transit time, population density and activities, and the time of day and week during which transportation will occur will be included in the radiological risk determination.

2.2.1.3 Shipping Requirements

Department of Transportation Requirements

The FEMP shall comply with 49 CFR and applicable tribal, state, and local regulations. Each package and shipment of hazardous materials for off-site shipment shall be prepared in compliance with 49 CFR 100-185, Hazardous Materials Regulations and applicable tribal, state, and local regulations.

2.2.1.4 Department of Energy Requirements

The primary DOE transportation and packaging requirements are contained in DOE Orders 460.1A, Packaging and Transportation Safety, and 460.2, Departmental Materials Transportation and Packaging Management.

The FEMP will participate in and use the DOE MCEP in the selection of motor carriers as needed, or upon request from the DOE Field Element. Upon request from the DOE Field Element, the FEMP shall evaluate carriers, in accordance with the DOE MCEP. Carrier selection will be performed consistent with DOE Orders and 41 CFR 101-40, Transportation and Traffic Management. Shipments will be consolidated to the extent practicable into larger shipping quantities or units whenever such arrangements will result in transportation or administrative economies. To the maximum extent practicable, the FEMP shall utilize the Automated Transportation Management System (ATMS) to perform transportation tasks.

2.2.2 Over-The-Road to PCDF

Until a contract is in place for disposal of Silo 3 treated material at a PCDF, specific routes cannot be provided for transportation to a PCDF. However, the mechanism for determining the requirements for establishing routes and the shipping requirements (DOT and DOE requirements) are identical to Section 2.2.1.

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2.3 RAIL TRANSPORTATION

Rail transportation (intermodal) to the NTS was evaluated as part of the risk assessment for Silo 3 remedial alternatives and is provided in Appendix D of the OU4 FS, dated February 1994. The assessment evaluated potential risks associated with accident-free waste transportation (direct radiation) and the risks associated with an accident scenario. As documented in the FS, the calculated excess cancer risk to members of the general public for both accident scenarios is within the guidelines established by CERCLA.

Per 49 CFR 397, Subpart D, the routes selected for shipment of radioactive material shall ensure that the radiological risk is minimized. Accident rates, transit time, population density and activities, and the time of day and week during which transportation will occur should be included in the radiological risk determination.

The mechanism for determining the requirements for establishing routes and shipping requirements (DOT and DOE requirements) is identical to Section 2.2.1 if rail transportation is chosen for Silo 3 treated material to an off-site disposal facility (the NTS or a PCDF).

Silo 3 Project personnel are participating in the Intermodal Transportation Planning Project. This project is evaluating the potential for intermodal shipments to the NTS, direct rail shipments to a PCDF, and defining the necessary infrastructure improvements to initiate such activities.

If rail transportation is chosen, shipments would be coordinated with the existing FEMP site rail infrastructure established to ship waste material off-site. The use of existing rail shipment processes and infrastructure would be evaluated.

3.0 ON-SITE WASTE MANAGEMENT

3.1 INTRODUCTION

This section addresses the on-site management of the treated Silo 3 material, including the facilities, storage, inspections and treated Silo 3 material container movements. RMRS has the responsibility to treat, containerize, and label the treated Silo 3 material utilizing Fluor Fernald-supplied labor. As part of the treatment operations, Fluor Fernald Quality Assurance personnel will verify that disposal facility requirements have been met. The containers of treated material will be weighed prior to turning them over to Fluor Fernald. Once Fluor Fernald receives from RMRS the containers of treated material verified to have met the Silo 3 WAC (NTS WAC, DOE/NV-325), the containers will be stored and managed by Fluor Fernald until shipment to the off-site disposal facility (the NTS or a PCDF). Individual containers of material will be tracked using the existing on-site waste tracking databases.

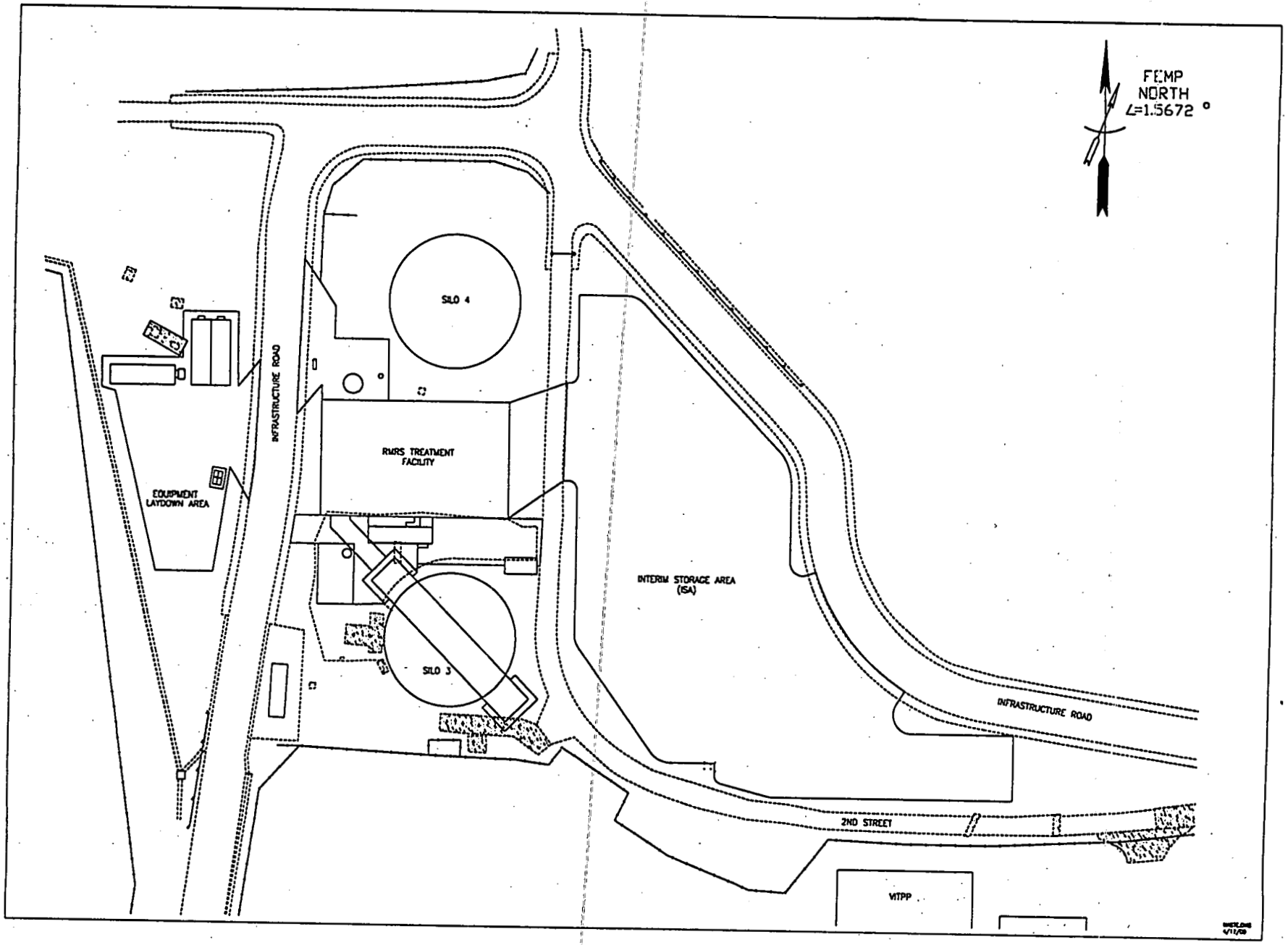
3.2 FACILITIES

The facilities used for staging and shipping Silo 3 treated material will require up to two storage pads. The first is the interim storage area (ISA) pad that will be used for staging treated Silo 3 material containers while awaiting results of confirmatory sampling. The concrete ISA pad will be approximately one acre in size and will be located east of the Silo 3 treatment facility. See Figure 3-1 for the planned location of the ISA pad in relation to the Silo 3 treatment facility. Once the waste containers have been approved for disposal, they will either be prepared for shipment on the ISA pad or transferred to a second pad for continued staging for shipment. The second pad will be an existing pad (e.g., Plant 1 Pad) or a new pad constructed for storage and loading of containers for shipment once confirmatory sampling results are received and Silo 3 WAC attainment is confirmed. Another storage/staging pad alternative being evaluated is loading treated Silo 3 material containers for shipment from the existing OU1 rail facilities. The Silo 3 Project continues to evaluate options available for the staging/storing of treated Silo 3 material relative to changing site funding and land use scenarios.

3.3 STORAGE AND INSPECTIONS

Storage and inspections will be performed consistent with applicable site procedures and substantive Resource Conservation and Recovery Act (RCRA) container management requirements. Although the Silo 3 material is 11(e)(2) by-product material and therefore exempt

Figure 3 - 1
Interim Storage Area Layout



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from regulation under RCRA, the OU4 applicable, relevant and appropriate requirements (ARARs) require compliance with certain substantive requirements of the RCRA regulations. The following are the substantive requirements from the RCRA container management regulations that need to be met for management of containers of treated Silo 3 material, and secondary waste containing, or contaminated with, Silo 3 material.

- The containers must be made of, or lined with, materials that will not react with, and are otherwise compatible with the material stored in the container.
- Access to the container storage area must be controlled (e.g., locked building, fenced or roped off pad, etc.). The area must be marked with "Danger - Authorized Personnel Only" signs, visible from at least 25 feet away.
- Documented inspections of the storage area for deteriorated containers, leaks, etc. must be conducted on a weekly basis.
- Documentation of inspections must be retained and available.
- Spill response equipment must be located in the area.
- Minimum aisle space of 22 inches must be maintained between rows of containers; a four-foot main aisle space must be maintained.
- Emergency procedures must define response to emergencies (fires, etc.) in the storage area; these procedures must be incorporated into the RCRA Contingency Plan.
- Secondary containment (e.g., dike, overpack containers) must be provided for containers that contain/may contain free liquids.
- The storage area must be constructed/operated in a manner that protects the containers from the contact with liquid accumulated precipitation.

Containers must be handled in a way that prevents rupture, leakage, or spillage and must remain closed during storage.

Interim (outdoor) storage of containers will be minimized to the extent possible. Approximately 30 calendar days will elapse from the point of generation until the time results from confirmatory sampling indicate the treated Silo 3 material meets the Silo 3 WAC. During this time the containers will be stored on the ISA Pad. Once the characterization and manifest paperwork is completed and the containers approved for disposal, the containers will be loaded for shipment. The longest duration any one container will be in storage on the ISA Pad is 75 calendar days from the day the container was filled with treated Silo 3 material.

3.4 CONTAINER MOVEMENTS

Once the treated Silo 3 material is sampled, containerized, weighed and labeled, the containers will be moved to the ISA pad. The containers will remain there until the sampling data shows that the treated Silo 3 material meets the Silo 3 WAC. Containers not meeting these requirements will remain on the ISA pad for rework or reprocessing by RMRS. Containers meeting the requirements will be shipped directly from the ISA Pad or transported to a second pad to be constructed or an existing pad, such as Plant 1, for storage until shipment off-site.

RMRS will access the ISA pad via the apron on the west side of the pad (see Figure 3-1) to transport drums of treated Silo 3 material for storage. The containers will remain in storage on the ISA pad, under RMRS oversight, until confirmatory samples indicate the treated material meets the Silo 3 WAC. RMRS will manage the containers in accordance with the requirements (ARARs) of Section 3.3.

Access to the ISA pad for Fluor Fernald personnel to remove containers that have met the Silo 3 WAC will be via the apron on the east side of the pad from the Infrastructure Road. An area will be established on the ISA pad for loading drums of treated material verified to have met the Silo 3 WAC. The drums will be loaded directly for shipment (depending on the mode of transportation) or transported to a secondary storage area (second pad or Plant 1) if direct shipment is not possible.

Once an inventory of material is approved for shipment, the final shipping certification will occur prior to loading. Depending on the transportation mode chosen (truck or rail), containers will be loaded onto acceptable transport conveyance, such as flat bed rail cars, box cars, gondola cars, flat bed trucks, or vans using Fluor Fernald-supplied fork trucks or necessary heavy equipment. Silo 3 rail shipments would be coordinated with the existing FEMP site rail infrastructure established to ship treated Silo 3 material off-site as described in Section 2.3.

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4.0 HEALTH AND SAFETY

4.1 INTRODUCTION

The focus of this section will be the Health and Safety approach for on-site transportation operations-related activities. The overall on-site project Health and Safety responsibility lies directly with the DOE and its contractors. The specific functional areas of safety addressed in this section are Nuclear and Systems Safety, Occupational Safety and Health, Radiological Protection, and Security.

4.2 NUCLEAR AND SYSTEMS SAFETY

The FEMP Nuclear and System Safety Program is identified in RM-2116, System Safety Requirements and is implemented by Fluor Fernald through site procedures. An evaluation will be required of any existing safety analysis documentation for applicability. Safety analysis is performed to help ensure the health and safety of the public, the workers, and the environment.

Fluor Fernald will categorize the shipping area in accordance with DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports. Based on the categorization, the level of safety basis documentation required will be identified. Safety analysis documentation has been developed and approved for storage of material, over-the-road, and rail shipping activities. However, this will be a new shipping facility that will require new safety analysis documentation. The Fluor Fernald Silo 3 Project team will use as much of the existing analysis as possible for developing the safety basis.

4.3 OCCUPATIONAL SAFETY AND HEALTH

The FEMP Occupational Safety and Health Program requirements are defined in the RM-0021, Safety Performance Requirements (SPR) Manual. The SPRs apply to activities at the FEMP. SPRs identify requirements established by federal, state, and local regulations. In addition, requirements from DOE Orders and Best Management Practices established by Fluor Fernald through experience, lessons learned, and employee input. SPRs identify safety and health standards for assessing and planning work at the FEMP. They contain specific information on

what must be done to safely execute work and are not intended to specify how to execute work. The Fluor Fernald Silo 3 Project team will implement the SPRs by incorporating their requirements into procedures that will be developed to guide the performance of transportation activities.

Specific safety and health requirements may need to be developed as the details of the project unfold. For planning purposes, however, existing SPRs are being used as the basis for Health and Safety on this project. The SPRs and additional project-specific safety requirements are incorporated into planning documents and implementing procedures.

4.4 SAFETY PRECAUTIONS

This section addresses safety precautions related to storage, rail operations, and over-the-road activities involving treated Silo 3 material.

4.4.1 Storage of the Treated Silo 3 Material

The treated Silo 3 material will be transported directly from the treatment area to the ISA pad. From there, the containers may be transported to the proposed second pad for staging for shipment, or prepared and loaded for shipment from the ISA pad.

A hazard analysis has been performed for these types of activities in other areas of the FEMP. The Silo 3 Project team will use as much of the existing analyses as possible. Further project-specific hazard analyses will be performed, as necessary and the results will be used to identify controls and mitigators, as necessary. The controls and mitigators will be incorporated into project documentation (e.g., design, plans, and procedures).

4.4.2 Railyard Activities

If shipping by rail is determined to be the approach for shipping the Silo 3 material, the FEMP plans to employ the existing site rail service, including plans and procedures.

Hazard analyses have been performed, and controls and mitigators identified, for these activities. The FEMP will review and update these analyses, as necessary, to identify specific hazards and incorporate controls and mitigators identified for the shipping operations.

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4.4.3 Over-The-Road

If it is determined that over-the-road shipping is the preferred method of transport, the FEMP will use existing FEMP programs and procedures for these activities.

Hazard analyses have been performed, and controls and mitigators identified, for these activities. The FEMP will review and update these analyses, as necessary, to identify specific hazards and incorporate controls and mitigators identified for the shipping operations.

4.5 RADIOLOGICAL SAFETY

Equipment and material, including containers with treated Silo 3 material, will be released from the treatment facility when the exterior of the containers are free of loose contamination. Therefore, it is planned that shipping activities will take place in a Controlled Area. FEMP Radiological Control Technicians (RCTs) will conduct routine radiological surveys to ensure contamination levels are maintained below Contamination Area limits.

If the equipment or material in the Controlled Area exceeds Contamination Area levels, a Contamination Area will be established and a new Radiation Work Permit (RWP) will be issued. The RWP will define the level of anti-contamination clothing and RCT coverage required. If decontamination is feasible, decontaminating the work surface to a level below Contamination Area limits will eliminate the need for routine wearing of anti-contamination clothing and reduce the RCT coverage requirements. If/when Contamination Areas are established, whole body monitoring will be required for exiting the area. Immediately following the completion of work, the area will be decontaminated, as necessary, and surveyed for the purpose of down-posting.

As the shipment loading area for the treated Silo 3 material is identified and constructed, more detailed project specific radiological control requirements will be developed. These requirements will be incorporated into procedures and work permits.

4.6 ACCESS OF PERSONNEL

Only necessary personnel with the appropriate training will be given access to the radiologically-controlled areas. The crew will ingress/egress through a radiological control point and will be subject to personal contamination monitoring upon exit. Incidents of personal contamination will be addressed per existing, approved site procedures.

4.7 SUBCONTRACTOR/FEMP OPERATIONS BOUNDARY

RMRS will maintain access control and establish identifiable boundaries for their work area. Before accepting containers of treated material from RMRS, the exterior of each container will be surveyed by FEMP Radiological Control for compliance with DOT regulations and Fluor Fernald RPP requirements. Exterior non-fixed contamination levels will be determined per 49 CFR 173.443, Contamination Control for shipments and 10 CFR 835, Occupational Radiation Protection for storage. Once the containers have been surveyed and are ready for release, RMRS will notify Fluor Fernald and provide the necessary documentation.

4.8 SECURITY

Areas where treated Silo 3 material will be loaded and stored pending the completion of shipment, will be fenced and provided with the appropriate levels of security and lighting. FEMP security monitors site access by using stationary posts, conducting walking, driving, and perimeter patrols on a 24-hour basis.

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5.0 EMERGENCY RESPONSE

5.1 INTRODUCTION

This section documents the emergency response procedures that are in place to respond to transportation accidents involving shipments of treated Silo 3 material. The scope of this discussion focuses on off-site occurrences and references procedures for on-site occurrences.

DOE Order 151.1, Comprehensive Emergency Management, provides for a DOE Emergency Management System (EMS). Pursuant to this order, DOE must maintain a Transportation Emergency Preparedness Program that enhances and integrates transportation emergency preparedness capabilities within the EMS. The Transportation Emergency Preparedness Program has been established at DOE headquarters. The FEMP has a similar program. The Transportation Emergency Preparedness Program ensures that an adequate DOE response to transportation incidents involving DOE materials is performed and that DOE's responsibilities under the National Contingency Plan (NCP) and the Federal Radiological Emergency Response Plan are adequate. The Transportation Emergency Preparedness Program also provides technical advice and assistance as required for transportation incidents involving radioactive wastes.

5.1.1 Department of Energy Requirements

The primary DOE requirements are contained in DOE Orders 460.1A, Packaging and Transportation Safety, and 460.2, Departmental Materials Transportation and Packaging Management, which cover DOT requirements that regulate the operations and activities associated with the transportation and packaging of hazardous materials in interstate and intrastate commerce.

DOE Order 435.1, Radioactive Waste Management and associated manual DOE M 435.1-1, Chapter IV, Section L.2., Transportation, also state, "To the extent practical, the volume of waste and number of low-level waste shipments shall be minimized." The requirement will be considered in development of the treated Silo 3 material form and associated transportation planning. The treatment process by RMRS will provide a volume reduction of the material in its final form, which supports waste minimization objectives.

5.2 FEMP EMERGENCY RESPONSE PREPAREDNESS PLANS

The FEMP Transportation Emergency Plan (TEP), PL-3043, is part of the DOE-FEMP Transportation Emergency Preparedness Program. The FEMP TEP provides a centralized program approach to off-site transportation emergency response including products, samples, waste, and rail shipments.

The FEMP TEP describes the overall DOE/FEMP process developed for the coordination of response efforts to off-site transportation incidents. This assistance planning is accomplished by adherence to applicable federal, state, and local transportation-related emergency response requirements, plus utilizing existing DOE programs designed to protect the well-being of citizens and the environment from accidental release of transported materials.

Procedures for on-site emergencies are addressed in PL-3020, FEMP Emergency Plan, which details the procedures to be followed at the FEMP in the event of an accident or emergency, highlights FEMP safety features, and governs the spill response actions. The FEMP Emergency Plan is distributed to participating mutual aid organizations, such as local fire departments and hospitals, in the general vicinity of the FEMP. Additionally, PL-2194, the FEMP Spill Prevention Control and Countermeasure Plan will be implemented accordingly for incidents on, or in close proximity to, the FEMP.

5.3 EMERGENCY RESPONSE FOR THE FEMP OFF-SITE SHIPMENTS

A treated Silo 3 material shipment will become an off-site shipment at the point when the entire shipment crosses the facility boundary. When the shipment is off-site, the rail or motor carrier will be responsible for providing emergency response support to the local authorities in proximity of any incident. The carrier also has contractors available for containment and cleanup as necessary. DOE will advise and provide support as requested by the local response authority (49 CFR 174.750). Local response personnel including police, firefighters, and emergency responders, typically are the first to arrive on the scene of an incident. They must be provided the technical information needed by first responders to accurately identify the hazards involved in the incident. Information contained in the shipping papers includes source terms, health and safety concerns, and recommended protective actions. The information is consistent with the DOT, Research and Special Programs Administration publication, North American Emergency Response Guidebook, Guide 162.

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The following is an overview of the emergency response responsibilities of the rail and motor carriers, DOE, individual states and the FEMP to support local authorities at an accident scene.

1. Carriers
   - Trained in accordance with DOT Emergency Response Guidebook
   - Stabilize situation
   - Provide notification of incident to carrier home office
   - Provide notification to FEMP/DOE

2. Carrier Emergency Response Organization
   - Make appropriate additional notification (local authorities, DOE, etc.)
   - Dispatch Emergency Response Personnel to the scene to support On-Scene Commander
   - Mobilize strategically positioned emergency response subcontractors, if necessary
   - Responsible for Recovery Actions

3. Local Authorities
   - Typically function as the On-Scene Commander

4. State Emergency Response Organizations
   - Each state possesses an Emergency Response Organization capable of responding to radiological emergencies

5. DOE Regional Radiological Assistance Teams
   - Eight Radiological Assistance Teams across the United States
   - Provide On-Scene Commanders with support in terms of radiological monitoring, communications, and information coordination during an emergency
   - Consist of DOE and contracted personnel possessing expertise in health physics, public information, and communications

The FEMP TEP is activated when the carrier or the local response organization contacts the FEMP to notify DOE that an incident has occurred. The 24-hour emergency phone number provided on the bill of lading, as required by 49 CFR 172.604, Emergency Response Telephone Number, is a direct telephone line to the FEMP Communications Center.

The FEMP Communications Center provides communication capability for the FEMP, monitors conditions, and makes notifications as required. The FEMP Communication Center establishes and maintains direct communication with the on-scene Incident Commander and the FEMP Assistant Emergency Duty Officer (AEDO) until the Emergency Operations Center (EOC) is activated.

The FEMP EOC is activated at the direction of the AEDO or EDO for events categorized at the emergency level, including transportation events and for non-emergency events at the discretion of the EDO. The EOC officially becomes operational when the Emergency Director or Deputy Emergency Director arrives on the scene, determines that sufficient personnel are available to manage the response and declares the EOC operational. The combined efforts of EOC staff members provide support, guidance, and direction to the Incident Commander in the field. The EOC staff assumes responsibilities such as making protective action recommendations, providing notifications, and obtaining necessary resources, as required by the specific circumstances of the event.

5.3.2 Rail/Motor Carriers

Rail and motor carriers maintain an Emergency Response Plan, which outlines the procedures the carrier's employees must take in the event of an incident. The plan includes notification responsibilities, emergency response procedures for personnel on the scene, environmental considerations, and additional precautions to take in the event of an incident. DOE, as the shipper, will be notified by the carrier immediately should an incident occur. Both the carrier and DOE will initiate emergency procedures simultaneously upon notification.

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6.0 WASTE DISPOSAL

6.1 INTRODUCTION

This section discusses disposal of treated Silo 3 material at the NTS and a PCDF and the related regulatory and waste acceptance information.

6.2 SILO 3 MATERIAL QUANTITIES/CHARACTERISTICS

Silo 3 contains approximately 5,100 yd^3 of material that was generated at the FEMP during uranium extraction operations in the 1950s. Samples collected from Silo 3 indicate the presence of significant activity and concentrations of the radionuclides within the uranium decay series, confirming prior process knowledge. The predominant radionuclide of concern identified within Silo 3 is Th-230, a radionuclide produced from the natural decay of Uranium-238. Approximately 450 curies of Th-230 are distributed within the Silo 3 material. (Note: The 450 curies is a mean inventory value. The 95% upper confidence limit inventory value is approximately 530 curies. For most determinations, the upper confidence limit values are used for conservatism.)

The Silo 3 material is classified as 11(e)(2) by-product material under the Atomic Energy Act (AEA), of 1954, as amended, because the material resulted from the processing of uranium ore concentrate and is specifically exempt, as defined, from regulation as solid waste under RCRA, 40 CFR 261.4(a)(4), Identification and Listing of Hazardous Waste, Exclusions. Since Silo 3 material is not a solid waste, requirements under RCRA are not "applicable".

Based on data from the OU4 RI, Silo 3 material includes the following RCRA-regulated metals; arsenic, cadmium, chromium and selenium at levels that exceed the RCRA Toxicity Characteristic (TC) limits. Data from the OU4 RI also identifies that Silo 3 material contains other RCRA-regulated metals such as beryllium, nickel, and thallium. The levels of these other metals do not exceed the RCRA TC limit. Concentrations of beryllium are below the 0.1 percent level as defined in 10 CFR 850, Chronic Beryllium Disease Prevention Program. Although Silo 3 material is not regulated by RCRA, the Silo 3 material is considered sufficiently similar to hazardous waste under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidelines. Therefore, some RCRA requirements have been identified as "relevant and appropriate" for the management and remediation of the material.

The treatment process proposed by RMRS will provide a volume reduction of the waste in its final form, which supports waste minimization objectives. The volume reduction realized from this process will equate to approximately 40-50%.

6.3 NEVADA TEST SITE

This section provides information pertinent to disposal of treated Silo 3 material at the NTS. This section describes regulatory requirements, the NTS waste acceptance, and the receipt of waste at the NTS.

6.3.1 Regulatory Information

In agreement with the State of Nevada, the NTS is permitted to accept low-level radioactive waste and mixed waste from DOE affiliated on-site and off-site generators for storage or disposal at its Area 3 and Area 5 radioactive waste management sites. However, mixed waste will only be accepted from State of Nevada DOE affiliated generators. The DOE, Nevada Operations Office Waste Acceptance Criteria, Nevada Test Site Waste Acceptance Criteria (NTSWAC) establishes the requirements for disposition of waste at the NTS. Additionally, the NTS WAC, DOE/NV-325 Revision 2, requires that packaging and shipments to the NTS be performed in accordance with DOE Order 435.1, "Radioactive Waste Management", 40 CFR, and 49 CFR. As applicable, other federal, state, and local requirements, including generator site requirements, must be met.

The DOE derives authority from the AEA to manage small quantities of 11(e)(2) by-product material as "low-level waste" so that it may dispose of such small quantities at DOE low-level waste facilities (NTS). Such quantities must not be "too large for acceptance at DOE low-level waste disposal sites," and such wastes must meet the requirements for low-level waste in accordance with DOE Order 435.1, Chapter IV(B)(4).

The treated Silo 3 material is 11(e)(2) by-product material and may be managed as a low-level waste pursuant to DOE Order 435.1. As a low-level waste, it must meet the NTS WAC and, therefore, may not contain a RCRA-listed waste, or exhibit a RCRA characteristic, regardless of the exclusion defined for by-product material at 40 CFR Part 261.4(a)(4).

The CERCLA off-site rule (found in CERLCA Section 121(d)(3) and promulgated at 40 CFR Part 300.440, Procedures for Planning and Implementing Off-Site Response Actions) requires that waste from a remedial action that is shipped off-site for treatment and/or disposal be transferred only to those units at a facility that (1) are operating in compliance with RCRA and other applicable federal and state requirements, and (2) do not have any uncontrolled releases of hazardous waste or constituents. The rule applies to any remedial action involving the transfer of

hazardous substances, pollutants, or contaminants as defined under CERCLA Sections 101(14) and (33) pursuant to any CERCLA authority, including cleanups at federal facilities [40 CFR Part 300.440(a)(1)].

In a letter dated July 7, 1998, the EPA Region 9 granted approval to the NTS to dispose of CERCLA waste from DOE facilities in waste management areas 3 and 5, in accordance with the Off-site Rule (40 CFR 300.440). As clarification, the EPA Region 9, in a letter dated December 4, 1998, stated that the CERCLA Off-site Rule approval for the NTS waste management areas 3 and 5, included management of small volumes of 11(e)(2) by-product materials from Fernald OU4 as low-level waste under the provisions of Chapters III and IV of DOE Order 435.1, or any subsequent applicable DOE directive.

6.3.2 NTS Waste Acceptance

DOE/Nevada Operations Office requires that prior to generator approval to ship waste to the NTS, they must develop a certification program to ensure waste is compliant with the requirements of the NTSWAC. The process used by DOE/Nevada Operations Office for approval of a generators certification program includes program reviews and evaluations of implementation at the generators' facility.

Once the generator has an approved program, a waste profile must be developed and submitted for each waste stream that is to be disposed at the NTS. These profiles provide NTS with an understanding of the characterization and quantities of the material. If the profiles as stated are approved, the generator is then notified in writing of the authorization and packaging and shipment may commence.

The generator's Waste Certification Official and his designees, in accordance with the Waste Certification Program Plan, will provide oversight of any packaging and shipping operations that are performed to ensure and document that requirements have been met for waste disposal at the NTS. If requirements are met then the waste packages, the documentation packages, and the transport vehicles are "certified" in accordance with the NTSWAC and Fluor Fernald requirements and released for transport to the NTS.

Nevada Test Site performed a Performance Assessment per DOE Order 435.1 on Area 5 which established volumetric radionuclide concentration limits. Informal review indicates Silo 3 material meets the radionuclide concentration limits and could be disposed in Area 5.

6.3.3 Receipt of Waste at the NTS

Once the waste generator has received approval to ship and has performed certification activities to release shipments for disposal, the generator must notify the Nevada Site Manager to arrange for transfer of the waste and accompanying records.

Prior to shipment, certain records must be sent electronically. Pre-notification information such as time of departure, estimated time of arrival; carrier, trailer and security seal numbers; description of load; waste type; and a copy of the Package Storage and Disposal Request.

Once the shipment arrives at the NTS, Mercury location the driver must provide a copy of the Nuclear Materials Transaction Report, completed proper shipping papers with shippers certification, original Package Storage Disposal Request, and an appropriate Waste Certification Statement signed by the Waste Certification Official or an alternate designee (Alternate Waste Certification Official). Once these documents are reviewed and accepted, the shipment may be unloaded at the disposal location.

6.4 PERMITTED COMMERCIAL DISPOSAL FACILITY

6.4.1 Introduction

This section provides regulatory information pertaining to the disposal of treated Silo 3 material at a PCDF. This section description is based on existing FEMP experiences. Specific requirements may change depending on the PCDF selected.

As stated before, Silo 3 material is not regulated under RCRA. However it is sufficiently similar to hazardous waste under CERCLA guidelines that some of the RCRA requirements have been identified as "relevant and appropriate" for the remediation and management of Silo 3 material.

To address these "relevant and appropriate" requirements, a treatment process is proposed by RMRS to chemically immobilize associated RCRA metals. In addition, sampling and analysis of the subject treated Silo 3 material will be performed to ensure waste being offered for disposal meets the PCDF WAC. Therefore, only waste that meets the disposal facility's WAC will be accepted for transportation and disposal under this plan.

6.4.2 Regulatory Information

The PCDF selected for disposal of the subject material shall be licensed to receive and dispose of Uranium and Thorium Mill Tailings By-product Material as defined by Section 11(e)(2) of the AEA of 1954, as amended. Disposal of this material shall comply with the with the regulations set forth in 10 CFR Chapter I, Nuclear Regulatory Commission, Parts 19; 20; 21; 40, including Appendix A; 51; 61.80; and 61.82 and is subject to the additional conditions specified or incorporated. The PCDF must also have approval under the CERCLA Off-Site Rule (40 CFR 300.440)
Accordingly, packaging and transportation of shipments to a PCDF for disposal must be in compliance with DOE Order 435.1, "Radioactive Waste Management," 40 and 49 CFRs." As applicable, other federal, state, and local requirements including generator site requirements must be met.

6.4.3 PCDF Acceptance

Prior to determining waste stream acceptability at the PCDF for disposal, the proposed waste stream would be completely and accurately characterized, including appropriate sampling and analysis. Once the waste is adequately characterized, a waste profile would be developed and submitted for each waste stream proposed for disposal at the PCDF. Information entered into these profiles provides the PCDF with an understanding of the physical, chemical, and radiological properties of the waste material. Additionally, the history of the waste and the process by which the waste was generated would be fully documented in the profile.

Once the information is documented, the profile will be submitted to the PCDF for review and approval. The technical review will evaluate the waste stream based on its physical, chemical, and radiological properties. In addition, the waste stream will be evaluated upon existing or desired shipment packaging and mode of transportation. This portion of the review process is to help determine if the waste stream is acceptable and if any special handling is necessary to accept and dispose of the waste. Following this technical review process, a pre-shipment sample of the subject waste stream may be sent to the PCDF site for analysis. The purpose of this sample would be to establish "bounding parameters" for incoming waste shipments prior to receiving the PCDF's approval of a waste stream for disposal.

Incoming waste shipments may be sampled and analyzed at the PCDF site according to an established Waste Characterization Plan to verify compliance with the approved profile, and for compliance with the disposal facility's WAC.

6.4.4 Receipt of Waste at the PCDF

Once the generator has received profile/waste stream approval, delivery must be scheduled. The first step would be contacting the Scheduling Department at the disposal site. A minimum of five working days written request must be provided prior to the arrival of each shipment. In addition to this advance notice, the generator must provide advance copies of the Uniform low-level Radioactive Waste Manifest (Nuclear Regulatory Commission [NRC] 540 and 541) and other shipping documents at least three days prior to the scheduled arrival date.

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7.0 REFERENCES

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Code of Federal Regulations, 10 CFR 850, "Chronic Beryllium Disease Prevention Program"

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Code of Federal Regulations, 40 CFR 261.4, "Identification and Listing of Hazardous Waste, Exclusions"

Code of Federal Regulations, 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan"

Code of Federal Regulations, 40 CFR 300.440, "Procedures for Planning and Implementing Off-Site Response Actions"

Code of Federal Regulations, 41 CFR 101-40, "Transportation and Traffic Management"

Code of Federal Regulations, 49 CFR 106-199, "Hazardous Materials and Oil Transportation"

Code of Federal Regulations, 49 CFR 107.103, "Hazardous Materials Program Procedures"

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SAMPLING AND ANALYSIS PLAN FOR SILO 3 TREATED WASTE MATERIAL

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 2000

U.S. DEPARTMENT OF ENERGY

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ACRONYM LIST

ASL	Analytical Support Level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Constituent of concern
DOE	Department of Energy
DOT	Department of Transportation
DQOs	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
EP Tox	Extraction Procedure Toxicity (analysis)
ESD	Explanation of Significant Differences (for Operable Unit 4 Silo 3 Remedial Action)
FACTS	Fernald Analytical Computerized Tracking System
FAT&LC	Fernald Atomic Trades and Labor Council
FEMP	Fernald Environmental Management Plan
GFAA	Graphite Furnace Atomic Absorption Spectrometry
ICP-MS	Inductively coupled plasma – mass spectroscopy
IIMS	Integrated Information Management System
mg/L	milligrams per Liter
NTS	Nevada Test Site
OEPA	Ohio Environmental Protection Agency
OU4	Operable Unit 4
pCi/g	picoCurie per gram
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RMRS	Rocky Mountain Remediation Services
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SCQ	Sitewide CERCLA Quality Assurance Project Plan
SED	Sitewide Environmental Database
SVOCs	Semivolatile organic compounds
TAL	Target analyte list
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substance Control Act
VOCs	Volatile organic compounds
WAC	Waste acceptance criteria
WISDM	Windows Integrated Sample and Data Management system

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been developed to document sampling and analysis activities to be performed in support of remedial action activities for the Silo 3 Project. Specifically, this SAP has been prepared for U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA) review, to provide details associated with the sampling and analysis of the Silo 3 materials to support the transportation of waste, and its subsequent disposition at either the Nevada Test Site (NTS) or at Envirocare of Utah, Inc. (Envirocare).

Existing analytical data were reviewed in determining the analytes to be monitored and the frequency of sampling required. Techniques to be used for collecting and analyzing samples, as well as general methodologies, are described in this Plan. Details necessary to implement the program identified in this Plan are currently covered under existing procedures or will be written into standard analytical operating procedures to meet the objectives reflected in this Plan.

1.1 PROJECT BACKGROUND

The Fernald Environmental Management Project (FEMP) is a 1,050-acre government-owned, contractor-operated facility located in southwestern Ohio approximately 18 miles northwest of the city of Cincinnati. The facility is located just north of Fernald, Ohio, a small farming community, and lies on the boundary between Hamilton and Butler Counties. The FEMP, which operated under the name of the Feed Materials Production Center, produced high purity uranium metal products for the United States Department of Energy (DOE) and its predecessor agencies from 1952 to 1989. Former uranium processing operations at the FEMP were limited to a fenced, 136-acre tract, closed to public access, known as the production area. In June 1991, the site was officially closed for production by an Act of Congress. The Fernald site was included on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List in 1989. The current mission of the site is the safe environmental restoration of the site in accordance with all applicable requirements.

Silo 3 is part of Operable Unit 4 (OU4) which is situated in the southwestern portion of the Waste Storage Area, west of the former Production Area. Silos 1, 2, and 4, which are also part of OU4, will not be discussed in this SAP; details on those silos can be found in the OU4 Record of Decision (ROD).

The material in Silo 3 is classified as byproduct material, as defined in Section 11e.(2) of the Atomic Energy Act of 1954. This material is known as cold metal oxides and were generated at the FEMP site during uranium extraction operations in the 1950s. These oxides were formed by calcining residues from

the solvent extraction process used to extract uranium from ore concentrates and residues. The material in Silo 3 is substantially different from that in Silos 1 and 2. Silo 3 material is dry and powdery and contains similar radiological constituents as those found in Silos 1 and 2. However, certain radionuclides (such as radium) are present in much lower concentrations. On an activity basis, the predominant radiological constituent of the Silo 3 material is thorium-230 (Th-230). Data from the OU4 Remedial Investigation (RI) (Extraction Procedure Toxicity [EP Tox] analysis, since replaced by the Toxicity Characteristic Leaching Procedure [TCLP]) indicates Silo 3 material contains eight metals, with the highest mean concentrations being attributed to arsenic (9.48 milligrams per Liter [mg/L]), cadmium (0.85 mg/L), chromium (5.05 mg/L), and selenium (2.65 mg/L). Although one sample exhibited a total lead concentration above the EPA 20x limit, the corresponding EP Tox result for the sample did not leach lead above the EP Tox limits. Therefore, lead will not be retained as a Constituent of Concern (COC).

As detailed in the OU4 ROD, the identified remedy for Silos 1,2, and 3 material was retrieval, vitrification, and disposal at NTS. The Explanation of Significant Differences (ESD) for OU4 Silo 3 Remedial Action, approved March 1998, documented the change in remedy for Silo 3 material to retrieval, treatment by polymer encapsulation or chemical stabilization, and off-site disposal at NTS or an appropriately permitted commercial disposal facility.

1.2 SCOPE OF ACTIVITIES

This Plan describes the sampling and analysis strategy to satisfy Waste Acceptance Criteria (WAC) requirements at either NTS or the Envirocare commercial disposal facility in Clive, Utah and demonstrate treatment requirements in the ROD are met. Since this plan is specific to NTS and Envirocare WAC, disposal at any other government or commercial site will require a revision of this SAP to reflect the receiving facility's licenses and permits.

1.2.1 Nevada Test Site

If the ultimate disposition for the Silo 3 material is NTS, this Plan will fulfill contractual SAP requirements contained in DOE's disposal contract with NTS. As required by the contract, this plan will undergo a concurrence review by NTS to ensure that mutually agreeable approaches and procedures for material characterization are being implemented.

1.2.2 Envirocare

If the ultimate disposition for the Silo 3 material is Envirocare, this Plan will fulfill contractual SAP requirements contained in the Army Corps of Engineering disposal contract with Envirocare.

The Army Corps of Engineering disposal contract with Envirocare requires that this SAP remain current at all times and be updated whenever necessary to address current operating conditions. In keeping with this "living document" obligation, this initial version of the Silo 3 SAP is written to apply conceptually to all of the processed Silo 3 wastes eligible for disposal at Envirocare. Should direct operating experience indicate a need later to revise the plan, the revision will be provided to Envirocare for information and to EPA and OEPA for approval as part of this "living document" obligation.

The Silo 3 sampling will be conducted on the final processed waste stream on a daily production basis as the processed materials are accumulated for disposition. This SAP does not include the sampling and analysis of anything other than the treated/processed Silo 3 material.

1.3 SAMPLING AND ANALYSIS PLAN OBJECTIVES

The objectives for this SAP are as follows:

- To satisfy the requirements of the OU4 ROD.
- To satisfy the analytical requirements for NTS OR Envirocare waste disposal.
- To satisfy a managerial need for key "risk management" sampling, where such sampling is considered appropriate, to further minimize the possibility or ramifications of material rejection upon its arrival at either NTS or Envirocare.
- To provide accurate Department of Transportation (DOT) waste packaging and shipping determination.

Each of these objectives has been considered in the formulation of the sampling protocols behind this SAP and the selection of an appropriate suite of analytical parameters and sample collection frequency to accomplish the ex-situ characterization of the materials prior to disposition. The sampling and analysis strategy contained in this SAP also considers the license and permits restrictions for WAC compliance at NTS and Envirocare.

1.4 ASSUMPTIONS

Because of a lack of final project definition at the time this SAP is being developed, several assumptions are being made. These assumptions include the following:

- Archive samples collected by the Fernald Atomic Trades and Labor Council (FAT & LC) from the untreated Silo 3 material for Rocky Mountain Remediation Services (RMRS) purposes will be maintained and stored by RMRS and are not covered by this SAP.
- Process capability of the treatment system is approximately 120 drums per day.

- The final processed material will be approximately 2.5- x 1.5- x 1-inch briquettes, weighing approximately 0.25 pounds each.
- Primary containers will be 55-gallon drums.
- Transportation will be by rail or by truck.
- Process material sampling will be done by the FAT&LC under RMRS procedures.
- Sample collection will be from treated (post-process) material.
- Analytes of concern are isotopic uranium (U-235 and U-238 [U-234 to be calculated]), isotopic thorium (Th-230 and Th-232), radium-226, actinium-227 (calculated), protactinium-231 (calculated), lead-210 (calculated), TCLP metals (arsenic, cadmium, chromium, and selenium), and pH.

If any of these assumptions change, a variance to this SAP explaining the significant differences will be generated and distributed.

1.5 PLAN ORGANIZATION

This plan consists of the following seven sections:

Section 1.0 Introduction – This section discusses the purpose of this plan, presents a project background, identifies the scope of activities relative to this plan (as well as identifying activities not covered by this plan, provides an overall presentation of the sampling and analysis objectives, and describes the organization of this plan.

Section 2.0 Sampling and Analysis Approach – This section provides the background and basis for the development of the sampling and analysis strategy for the Silo 3 materials. This section discusses the objectives and expectations which drive the need for data, the specifics of a sampling and analysis strategy needed to provide that data (i.e., the selection of analytical parameters, sampling frequency, and laboratories), and defines the approach to be used to collect and analyze the samples.

Section 3.0 Sample Identification, Labeling, and Chain of Custody – This section discusses the sample identification approach, the sample labeling process/approach, and the chain of custody process, which will be used in support of all Silo 3 sampling activities.

Section 4.0 Equipment Decontamination – This section provides a general discussion of the activities which will be performed relative to the decontamination of sampling equipment, used in support of the sampling program.

Section 5.0 Quality Assurance/Quality Control Requirements – This section provides a general discussion of the quality controls to be put in place relative to the collection of samples in the field, and in sample analysis.

Section 6.0 Record Keeping – This section provides a discussion of the documentation process to be used in the field and in the laboratory as a means for recording activities, observations, and findings relative to sample collection and analysis.

Section 7.0 Data Management and Reporting – This section provides a discussion of the need for, and the basis of, the planned data management system to be developed in support of the project, for the sampling and analysis program.

2.0 SAMPLING AND ANALYSIS APPROACH

Prior to developing the specific requirements of the sampling and analysis approach for the Silo 3 materials, the requirements, agreements, and criteria which drive the need for the data to be generated through the sampling and analysis program must be assessed. The purpose of this section is to assess the information which drives the data needs for the management of these waste materials and then, based on this assessment, verify the treated waste meets WAC and DOT requirements. Specifically, this section discusses the objectives, expectations, and specifics of a sampling and analysis strategy (i.e., the selection of analytical parameters, sampling frequency, and laboratories). This section details the approach to be used to collect and analyze the samples by identifying the analytical requirements for the Silo 3 materials.

2.1 NEVADA TEST SITE

If the chosen disposition site is determined to be the NTS, the Prototype Sampling and Analysis Plan for Waste at the FEMP, PL-3048, will be used for characterization of the Silo 3 materials (see Appendix A). The current version of PL-3048 is attached; however, since sampling of the Silo 3 material is not expected to commence immediately and the plan is controlled, it is imperative that the plan revision in place at the time of the sampling event be used.

2.2 ENVIROCARE

As previously mentioned, the Silo 3 material is characterized as 11e.(2) byproduct material. Envirocare is licensed by the Nuclear Regulatory Commission to receive this type of waste for disposal. The Envirocare 11e.(2) license allows an average concentration per transport vehicle rather than a "not to exceed" concentration limit.

This section discusses the requirements to verify the treated Silo 3 waste meets Envirocare's established WAC prior to disposition at Envirocare. The information contained in this section is based upon Envirocare guidelines and associated permit/license requirements.

2.2.1 Envirocare's Expectations of the Waste Generator

Envirocare requires that the waste generator perform sufficient sampling to verify the acceptance status of the waste. In general, these requirements can be summarized as follows:

- Obtain sufficient samples such that any/all radionuclides present in the material have been identified and quantitated; this information will be used to determine the range and weighted average activities of the radionuclides present in the material.

- Provide pH results as required by Envirocare's "11e.(2) Waste Profile Record, EC-3200."

- Provide "worst case" or "range" (as required by Envirocare's Radioactive Waste Profile Record) analytical results for the 8 Resource Conservation and Recovery Act (RCRA) TCLP metals (plus zinc), the 32 RCRA characteristic organics (listed in Table 1 of 40CFR261), and reactive cyanide/sulfide.

Upon review and approval of the FEMP's completed Radioactive Waste Profile Record, Envirocare will issue a "Notice to Transport, EC-1800". An update to the approved profile will be necessary if the reported concentration ranges exceed those originally reported on the Radioactive Waste Profile Record.

Table 2-1 summarizes Envirocare's WAC constituent list for radioactive materials (such Silo 3 materials) as contained in Envirocare's October 1998 facility license renewal and accompanying implementation guidance documents. Only those constituents expected to be present in the waste stream (by historical data, current sampling, or process knowledge) must be accounted for by the waste generator.

2.2.2 Envirocare's Receipt Sampling of Generator Shipments

In addition to the sampling conducted by the waste generator, Envirocare conducts receipt sampling for waste materials shipped to the facility. This receipt sampling is conducted independently from the waste generator's sampling. A summary of this receipt sampling for shipments is provided in the following subsections.

2.2.2.1 Receipt Sampling Parameters

Two types of parameters are considered by Envirocare during 11e.(2) receipt sampling: radiological parameters and visual comparison. A brief description of each of these parameters are listed below.

- Radiological parameters: gamma scan plus non-gamma analysis for specific constituents identified by the generator on the EC-3200 11e.(2) Waste Profile Record that require methods other than gamma spectroscopy; site scaling factors and calculations are acceptable where appropriate

- Visual comparison of the waste materials against the Profile Record physical description.

2.2.2.2 Receipt Sampling Frequencies

The following receipt sampling frequencies reflect the minimum frequencies for waste shipments conducted by Envirocare as part of their State of Utah operating license. While these represent the minimum frequencies, Envirocare can elect to conduct additional sampling whenever deemed appropriate. For each conveyance that is selected for sampling, Envirocare generally obtains six random

"grab" samples composited into one sample from which all the subsequent analyses are performed. The only receipt sample to be collected by Envirocare will be analyzed for radiological parameters. The sample(s) will be collected at a rate of 1 sample per 5000 yd^3 or may be collected up to 2 times per month.

Envirocare's receipt sampling program for WAC attainment serves as useful guidance for establishing sampling frequencies and analytical parameters for consideration in this SAP, particularly to frame the level of "risk management" sampling that is considered appropriate for satisfying the third objective identified in Section 1.3 (i.e., risk management sampling). Table 2-2 lists the analytical constituents and sample frequencies selected.

2.2.2.3 Relationship of Sampling and Analysis Activities to the EC-3200 11e.(2) Waste Profiling Process

For the Silo 3 material, the initial Envirocare EC-3200 form will be generated from existing data taken from the OU4 RI. As progressive sampling results are obtained under this SAP, the Profile Record will be updated under a "living document" approach, if and when maximum concentrations during operations supercede those delineated in the Envirocare profile. If this situation occurs, Envirocare will be notified and a new profile update will be submitted to reflect the new radiological ranges observed during operations. Materials affected by this situation will not be shipped until authorization is provided by Envirocare.

As stated above, operational decisions that rely on ex-situ information need to be made under conditions that offer less lead time for updates to the Profile Record and/or adjustment of screening-parameter tolerance limits compared to an in-situ approach. Successful implementation requires effective coordination of the Profile Record updates with appropriate "hold points" for retaining affected material while Envirocare's update approvals are pending. Typical hold points include profile approval, analytical exceedances which require profile revision, analytical exceedances which demonstrate treatment of metals was unsuccessful, and radiological exceedances requiring loading geometry configuration. Operating procedures will be prepared outside this SAP to describe this coordination and use of material hold points during operations.

2.2.3 Silo 3 Treated Material Sampling and Analysis Strategy

This section summarizes the sampling and analysis strategy (selection of analytes and sampling frequency) for the Silo 3 materials under the SAP. The overall intent is to verify or demonstrate compliance with Envirocare disposal requirements, the OU4 ROD, and DOT requirements.

A key ingredient to the success of the analytical evaluations involves the use of appropriate analytical methods and laboratories that can provide quick-response turnaround times to support real-time material dispositioning decisions. The processed materials will typically reside in the containers in a specified staging area until analytical results are received. Therefore, quick response laboratory methods and capabilities are imperative to disposition materials in a timely manner.

This version of the Silo 3 SAP presents those elements considered necessary to initiate the detailed WAC attainment demonstration process. If actual direct operating experience with the materials indicates a need to revise any elements of the approach, an updated variance or, depending upon significance of the change(s), a revised SAP will be submitted to key affected parties (Envirocare, EPA, and OEPA).

2.2.3.1 Selection of an Appropriate Sampling Frequency

The sampling frequency chosen for this SAP is focused primarily on satisfying the third objective identified in Section 1.3 (i.e., risk management sampling). The conservative managerial approach adopted for this objective meets the intentions of the first and second objectives (satisfy the OU4 ROD requirements and satisfy the off-site receiving facility's requirements, respectively).

The FEMP has elected to use the material quantities associated with daily production to select a sampling frequency for this plan. These quantities fulfill the most intensive sampling required by NTS and exceeds that required for Envirocare. Since it has not yet been decided which disposition option will be exercised, the more restrictive sample quantity will be used.

Samples will be collected from the containers at a frequency discussed in Section 2.2.6 to conduct the necessary radiological, chemical, and physical analyses required for Envirocare disposition. The basis for the frequency of the sampling is to ensure the treatment process is homogenous and does not exceed Envirocare's permit and license limits.

2.2.3.2 Selection of Appropriate Analytical Parameters

A graded approach has been utilized to select appropriate analytes for material characterization, based on an adoption of Envirocare's receipt sampling analytes and a general knowledge of contaminant concentration levels indicated by the OU4 RI. This graded approach is summarized below.

Radiological Parameters

- Conduct radiological analyses for 100 percent of the samples
- Adopt existing data defaults for minor radiological constituents or perform calculations from concentrations of known radionuclides.

Alternate approaches utilizing a combination of gamma spectroscopy, alpha spectroscopy, and inductively coupled plasma-mass spectroscopy (ICP-MS) may also be considered, if necessary.

Chemical Parameters

- Conduct RCRA characteristic analyses (D001 through D043) on the first collected sample of treated material
- Conduct analysis for four TCLP metals (arsenic, cadmium, chromium, and selenium [the four inorganic parameters identified as above the RCRA Toxicity Characteristic limits in the OU4 ROD]) on 100 percent of the samples.

2.2.3.3 Selection of Appropriate Laboratories

All radiological analyses, inorganics, physical tests, and pH measurements will be conducted by the FEMP laboratory. All RCRA TCLP organic analyses will be conducted by an outside laboratory under contract to the FEMP. This outside laboratory will be expected to meet the analytical turnaround times demanded by the project's needs, as well as meet requirements for Utah laboratory certification.

2.2.3.4 Approach for Failure

In sampling the Silo 3 processed material for the analytical parameters discussed in Section 2.2.3.2, there may be an occasion when the material is identified as exhibiting radionuclide activities different than that submitted under the Envirocare profile but still within the Envirocare license and permit requirements. If this happens, the Envirocare profile will be modified to reflect the current concentrations exhibited by the Silo 3 processed waste.

The Data Quality Objectives (DQOs) for this SAP detail the consequences of failure [analytical results exceeding the Envirocare profile/permit/license (see Appendix B)]. Additionally, Figures 2-1 and 2-2 illustrate decision trees to be used for disposal determination. With the exception of the radionuclide constituents, if analytical data indicates exceedance of allowable constituent concentrations, the material will be reprocessed and retreated until the concentrations are acceptable.

2.2.4 Department of Transportation Hazard Class Determination

The radiological data collected under this SAP will also be used for determining the appropriate DOT hazard class. This will be accomplished by verifying that the material meets the definition of LSA-II waste, as defined in 49CFR173.403, through determining if the material is essentially uniformly distributed, and through the analytical data by performing the following calculation:

$$\sum_{i=1}^{n}(a_i / A_{2i}) < 10^{-6}$$

Where a_i is the activity per gram of the i radioisotope and A_{2i} is the DOT A_2 value of the i isotope. The data collected under this SAP will provide the information required for DOT shipping determination.

2.2.5 Analytical Requirements

As previously discussed, the number and type of analyses specified are designed to ensure with a reasonable degree of certainty that the Silo 3 materials will meet the Envirocare WAC. Table 2-3 provides summary information on the sampling requirements associated with these samples, while Table 2-4 provides information on the proposed radiological and chemical analytical methodologies. Table 2-5 lists the minimum detection concentrations for radionuclides. The method detection limits for the nonradiological parameters are delineated in the Sitewide CERCLA Quality Assurance Project Plan (SCQ).

The first treated material sample collected will be analyzed to affirm the Silo 3 treated materials are not RCRA characteristic (see Tables 2-2 and Table 2-6, Target Analyte List A). This sample will be sent to an off-site Utah-certified laboratory for TCLP inorganic analyses (TCLP 8 metals plus zinc), TCLP organic constituents (32 constituents), reactive cyanide/sulfide, and pH. Subsequent samples will be sampled and analyzed at the frequency and for the Target Analyte Lists (TALs) listed in Table 2-2.

2.2.6 Sample Collection Approach

The sample collection approach employed by this SAP is based on a total waste stream volume of 5100 yd^3 of untreated Silo 3 material which is expected to be volume reduced by 50 percent to a total treated volume of 2550 yd^3. Three samples will be collected daily (one grab sample collected from the 40th drum of treated material representing the beginning of the daily treatment process, one from the 80th drum representing the middle of the process, and one from the 120th drum of material representing the end of the process or at the last drum produced at the end of the day's run) and composited for appropriate analyses.

Since the treated material is shaped as briquettes, sample collection for TCLP metals will consist of placing two randomly chosen briquettes from each drum (the 40th, the 80th, and the 120th) in a wide-mouth glass container with a Teflon-lined closure. The samples will be appropriately labeled (see Section 3.2) and submitted to the on-site FEMP Sample Processing Lab (SPL). Upon receipt in the FEMP analytical laboratory, one briquette from each of the samples submitted for the day's run will comprise the composite sample (total of three separately identified briquettes). Excess briquettes designated for TCLP metals analysis will be retained in the original sample collection container and archived in the analytical laboratory for potential future analyses. If analytical results on the composite sample are acceptable, the corresponding individual samples may be returned to the treatment process for disposition. Tables 2-2 and 2-6 list the applicable TCLP metal parameters.

For daily radiological analysis, one randomly chosen briquette from each drum (the 40th, 80th, and 120th) will be placed in a wide-mouth glass container with a Teflon-lined closure. The samples will be appropriately labeled (see Section 3.2) and submitted to the SPL. Upon receipt in the FEMP analytical laboratory, the three daily collected samples will be composited and analyzed for the appropriate radionuclides (see Table 2-6).

Duplicate samples will be collected, for quality assurance purposes, at a 1 in 20 frequency, as required by the SCQ for Analytical Support Level (ASL) B data.

TABLE 2-1

ENVIROCARE FACILITY WASTE ACCEPTANCE CRITERIA CONSTITUENT LIST

Radiological:		TCLP Organics:
Americium-241	Plutonium-241	1,4-dichlorobenzene
Americium-243	Plutonium-242	2,4,5-trichlorophenol
Antimony-124	Polonium-210	2,4,6-trichlorophenol
Antimony-125	Potassium-40	2,4-dinitrotoluene
Barium-133	Promethium-147	Cresol
Beryllium-7	Radium-226	Hexachlorobenzene
Bismuth-207	Radium-228	Hexachlorobutadiene
Cadmium-109	Rubidium-83	Hexachloroethane
Calcium-45	Ruthenium-106	m-Cresol
Carbon-14	Samarium-151	Nitrobenzene
Cerium-139	Scandium-46	o-Cresol
Cerium-141	Selenium-75	p-Cresol
Cesium-134	Silver-108m	Pentachlorophenol
Cesium-135	Silver-110m	1,1-dichlorethylene
Cesium-137	Sodium-22	1,2-dichlorethane
Chromium-51	Strontium-85	Chlordane
Cobalt-56	Strontium-89	Endrin
Cobalt-57	Strontium-90	Heptachlor
Cobalt-58	Sulfur-35	Heptachlor epoxide
Cobalt-60	Tantalum-182	Lindane
Copper-67	Technetium-99	Methoxychlor
Curium-242	Thallium-204	Toxaphene
Curium-243	Thorium-230	Benzene
Curium-244	Thorium-232	Carbon tetrachloride
Europium-152	Tin-113	Chlorobenzene
Europium-154	Uranium-233	Chloroform
Europium-155	Uranium-234	Methyl ethyl ketone
Gadolinium-153	Uranium-235	Pyridine
Germanium-68	Uranium-236	Tetracholorethylene
Gold-195	Uranium-238	Trichloroethylene
Hafnium-181	Uranium-depleted	Vinyl chloride
Hydrogen-3 (Tritium)	Uranium-natural	2,4,5-TP (Silvex)
Iodine-125	Yttrium-88	2,4-D
Iodine-129	Yttrium-91	
Iridium-192	Zinc-65	**TSCA CONSTITUENTS:**
Iron-55	Zirconium-95	Polychlorinated biphenyls
Iron-59		
Lead-210	**TCLP INORGANICS:**	**GENERAL INDICATORS:**
Manganese-54	Arsenic	Solid/soil pH
Mercury-203	Barium	Paint Filter Liquids Test
Neptunium-237	Cadmium	Oxidizer/reducer test
Nickel-59	Chromium	Cyanide/sulfide test
Nickel-63	Copper	Photoionizer "sniffer" test
Niobium-94	Lead	Pyrophoricity
Plutonium-238	Mercury	Shock sensitivity
Plutonium-239	Selenium	Air reactive
Plutonium-240	Silver	Water reactive
	Zinc	

TABLE 2-2

SAMPLING FREQUENCY FOR SILO 3 TREATED MATERIAL

Parameter	Target Analyte List (See Table 2-6)
1st sample:	
Radionuclides	A
RCRA Characteristics (D001 through D043)	B
Subsequent samples:	
Radionuclides	A
TCLP metals	C

TABLE 2-3

SUMMARY OF SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIME FOR SILO 3 SAMPLES

Parameter	Container	Preservative	Hold Time
Radionuclides	250 mL widemouth glass	None	12 months
TCLP metals	500 mL amber glass with Teflon-line closure	Cool (2-6 degrees C)	180/180 days[a]
TCLP organics	VOCs-120 mL widemouth glass with Teflon-lined closure SVOCs-120 mL glass with Teflon-lined closure	Cool (2-6 degrees C) for both VOCs and SVOCs	14/40 days[a]
Reactive cyanide, reactive sulfide, corrosivity, ignitability	250 mL widemouth amber glass with Teflon-lined closure	Cool (2-6 degrees C)	28 days

[a]For holding times listed as xx/yy days, the first number is the allowed holding time for extraction or preparation of the sample for analysis and the second number is the allowed holding time for analysis of the extract.

TABLE 2-4

SUMMARY OF SILO 3 SAMPLE ANALYSES METHODS

Parameter	Standard Analytical Method	FEMP Method	Turnaround Time	Laboratory	Analytical Support Level
Radionuclides	See SCQ, Appendix G	See note	14 days	FEMP	E
Reactive cyanide, Reactive sulfide	SW-846, Parts 7.3.3 and 7.3.4	--	--	Off-Site	B
Ignitability (flash point)	SW-846 1010	6519	2 days	Off-Site	B
TCLP Metals					
Extraction	SW-846, 1311	6505	3 days	Off-Site	B
ICP	SW-846, 3010A	6523	3 days	Off-Site	B
GFAA	SW-846, 3020A	6517	3 days	Off-Site	B
Mercury	SW-846, 7470A	6526	3 days	Off-Site	B
pH (corrosivity)	9040B	6516	3 days	Off-site	B
TCLP organics	SW-846 8260, 8270, 8082, 8150	Not applicable	10 days	Off-site	B

NOTE: FEMP methods for radionuclide analyses are as follows:
Isotopic uranium – 4508
Isotopic thorium – 4512
Radium-226 – 4509
Actinium-227 – 4518 (read from gamma peak)
Protactinium-231 – 4518 (read from gamma peak)
Lead-210 – will be calculated from radium-226
ICP = Inductively coupled plasma
GFAA = Graphite Furnace Atomic Absorption Spectrometry
As = Arsenic
Cd = Cadmium
Cr = Chromium
Se = Selenium

TABLE 2-5

RADIOCHEMICAL MINIMUM DETECTION CONCENTRATIONS FOR SILO 3 SAMPLES[a]

Isotope	Minimum Detection Concentration (pCi/g)
Uranium-235	6 – 9
Uranium-238	30 – 102
Thorium-230	Approximately 660
Thorium-232	0.9 – 1.5
Radium-226	15 – 30
Actinium-227[b]	3 – 9
Protactinium-231[b]	15 – 21
Lead-210	Calculated from radium-226

[a]Assumes 180 grams of sample, 20-minute count time, and a total uranium activity of 30,000 pCi/g. Minimum detection concentration will be elevated if less sample is packed and/or sample activity increases (>30,000 pCi/g).
[b]If the gamma spec MDCs for Actinium-227 and Protactinium-231 are not achievable, then a ratio will be calculated from existing RI/FS data based on the constituent's relationship with uranium-235.

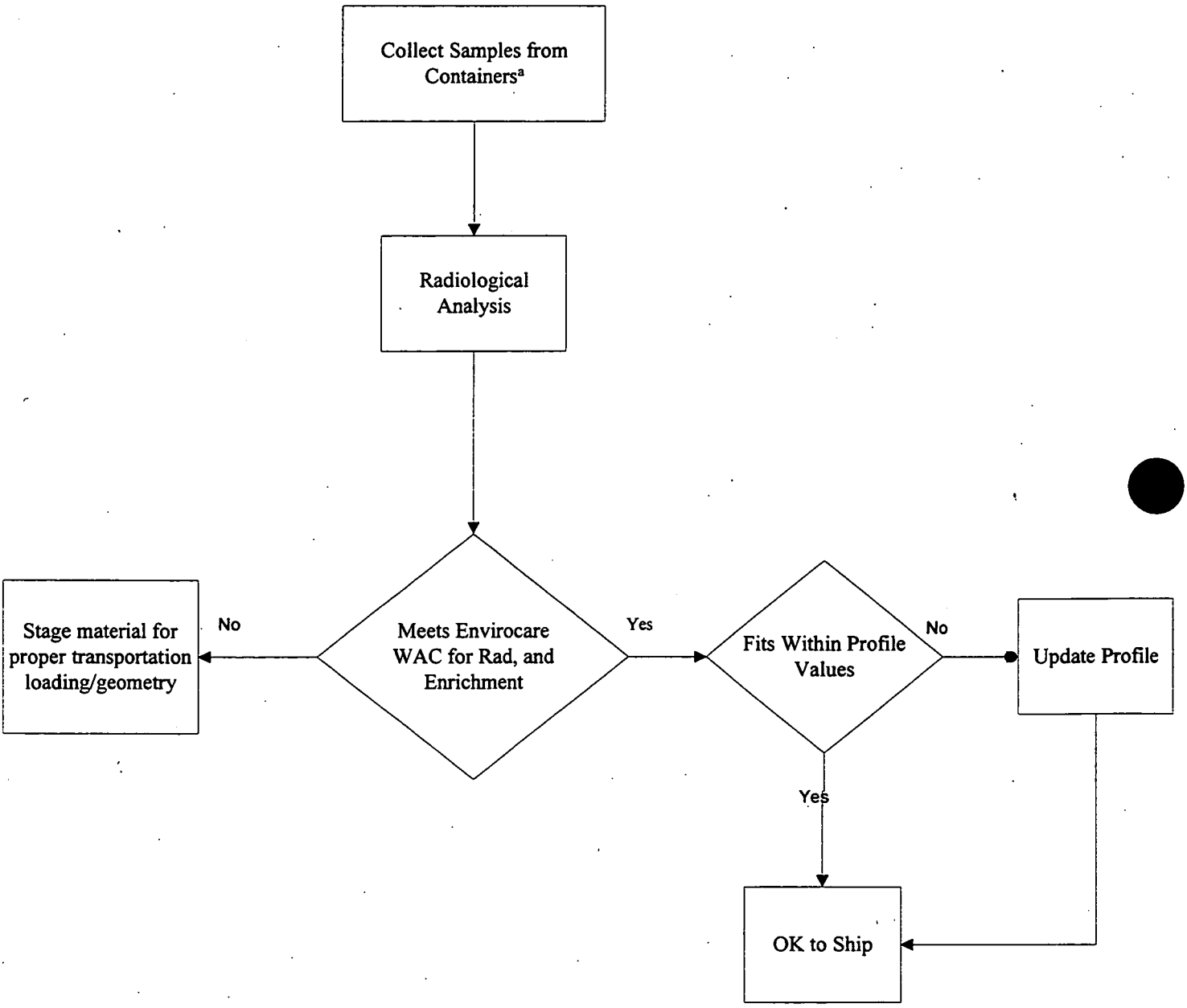
TABLE 2-6

TARGET ANALYTE LIST

TAL A **Radiological:**	TAL B **RCRA Characteristic:**	TAL C **TCLP Metals:**
Uranium 235	Ignitability	Arsenic
Uranium 238	Corrosivity	Cadmium
Thorium 230	Reactivity	Chromium
Thorium 232	TCLP:	Selenium
Radium 226	Arsenic; Barium; Cadmium; Chromium; Lead; Mercury; Selenium; Silver; Endrin; Lindane; Methoxychlor; Toxaphene; 2,4-D; 2,4,5-TP (Silvex); Benzene; Carbon tetrachloride; Chlordane; Chlorobenzene; Chloroform; 0-Cresol; m-Cresol; p-Cresol: Cresol; 1,4-Dichlorobenzene; 1,2-Dichloroethane; 1,1-Dichloroethylene; 2,4-Dinitrotoluene; Heptachlor (and its epoxide); Hexachlorobenzene; Hexachlorobutadiene; Hexachloroethane; Methyl ethyl ketone; Nitrobenzene; Pentachlorophenol; Pyridine; Tetrachloroethylene; Trichloroethylene; 2,4,5-Trichlorophenol; 2,4,6-Trichlorophenol; Vinyl chloride	
Actinium 227		
Protactinium 231		

FIGURE 2-1

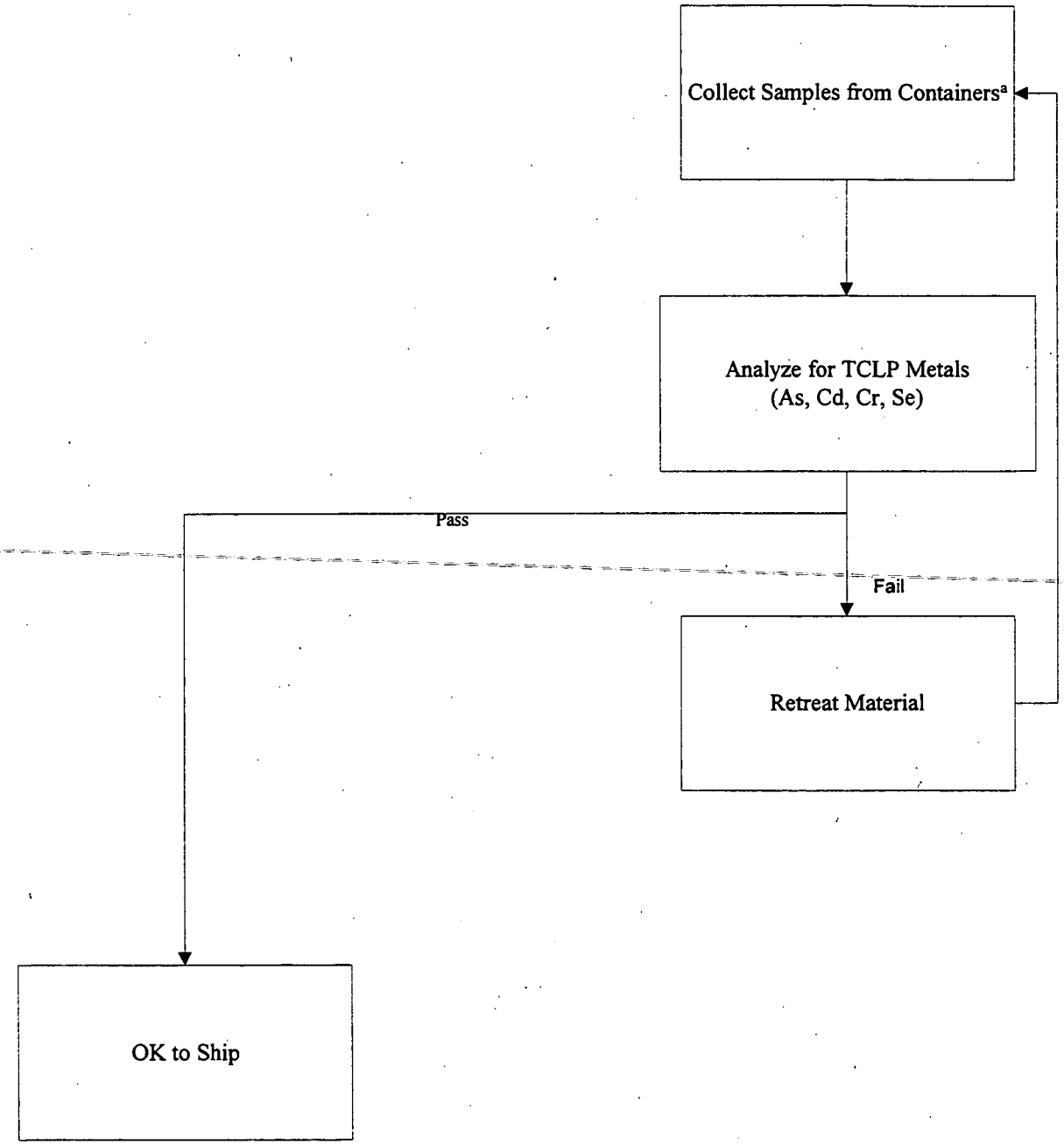
RADIOLOGICAL DECISION TREE FOR SILO 3 WASTE TO BE DISPOSED AT ENVIROCARE



[a]For the purposes of this SAP, a container is defined as a drum. If a drum is used as the container, samples will be collected from the 40th, 80th, and 120th (or end of day) drum of each daily production.

FIGURE 2-2

TCLP METALS DECISION TREE FOR SILO 3 WASTE TO BE DISPOSED AT ENVIROCARE



[a]For the purposes of this SAP, a container is defined as a drum. If a drum is used as the container, samples will be collected from the 40th, 80th, and 120th drum (or end of day) of each daily production.

3.0 SAMPLE IDENTIFICATION, LABELING, AND CHAIN OF CUSTODY

The data generated from the Silo 3 material sampling effort represents the waste stream to be sent off-site for disposal. This material must meet the receiving facility's requirements, permits, and licenses. In order to accomplish that, the data must be defensible, thereby requiring integrity of the sample and resulting data. The following sections discuss the means to ensure these requirements are met.

3.1 SAMPLE IDENTIFICATION

All samples collected for laboratory analysis will be assigned a unique sample identifier. This identifier will consist of a prefix designating the area name (Silo 3), followed by the drum number, the sample sequence (1 through X, with a "-D" identifier for duplicate samples), and the type of sample ("R" for radionuclides, "TM" for TCLP metals, "P" for pesticides/polychlorinated biphenyls (PCBs), " L" for VOCs, " SV" for SVOCs, "AB" for alpha/beta screen, "TB" for trip blank). For example:

- Silo3-80-2-TM is the Silo 3 treated materials from Drum #80, the second sample collected from the process, to be analyzed for TCLP metals.
- Silo3-40-1-R-D is the Silo 3 treated materials from Drum #40, is a duplicate of the first sample collected from the process, to be analyzed for radionuclides.
- Silo3-TB-1 is the first trip blank collected and is associated with specific Silo 3 treated material samples (identified through the chain of custody and field logs).

3.2 SAMPLE LABELING

Sample labeling will be conducted as directed in the RMRS procedure to be generated separate from this SAP.

3.3 CHAIN OF CUSTODY

Although the Silo 3 treated material samples will be collected by FAT&LC under RMRS procedures, the samples collected for WAC attainment analyses at the FEMP laboratory or forwarded to an off-site laboratory for analyses will be entered onto a separate chain of custody than that completed for the RMRS archived samples. The procedure for completing and routing the chain of custody form can be found in FEMP procedure EW-0002 and in Section 7 of the SCQ.

4.0 SAMPLE EQUIPMENT DECONTAMINATION

Sample equipment decontamination will be conducted as specified by the RMRS procedure to be generated separate from this SAP.

5.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

5.1 QUALITY CONTROL SAMPLES, ANALYTICAL REQUIREMENTS, AND DATA VALIDATION

Field quality control samples include trip blanks and duplicate samples. The trip blanks will be associated with the collection of samples for volatile organic compound analyses and will accompany the associated samples from the field to the laboratory. Trip blanks will identify any external volatile organic compound contaminants that the associated field samples may be exposed to during sample collection, processing, or analysis. Trip blanks will be collected once per each shipping container of VOC samples transmitted to an off-site laboratory. Duplicate samples will be collected for quality assurance purposes, at a 1 in 20 frequency, as required by the SCQ for ASL B data.

All sampling and laboratory analysis will be performed at ASL B for nonradiological parameters and at ASL E for radiological parameters, in accordance with DQO WS-012 (see Appendix B).

Analytical data will undergo a verification review as described in Section 7.0. The extent of the quality review will be based on the ASL for the analytical data as identified in the SCQ.

A Quality Assurance (QA) representative will conduct independent assessments of the work process and operations by conducting surveillances. The assessments will encompass technical and procedural requirements of this SAP and the SCQ. Surveillances will be implemented by monitoring/observing ongoing project activities and work areas to verify conformance to specified requirements. Surveillances will be planned and documented according to the SCQ.

5.2 PROJECT-SPECIFIC PROCEDURES AND MANUALS

To assure consistency and data integrity, field activities in support of this SAP will follow the requirements and responsibilities outlined in controlled procedures (both RMRS and FEMP) and manufacturers' operational manuals.

5.3 IMPLEMENTATION OF FIELD CHANGES

If field conditions require changes or variances to this SAP, verbal or written approval (electronic mail is acceptable) must be obtained from the appropriate managers and the appropriate Quality Control (QC) representative before the changes may be implemented. Changes to the SAP will be noted in the

applicable field or laboratory logs and on a Variance/Field Change Notice Form. The completed form, including the required signatures, must be completed and distributed to the appropriate personnel within seven working days of the granting of the verbal approval.

Laboratory variances will be handled and documented as specified in the SCQ.

6.0 RECORD KEEPING

Field documentation of recorded observations and findings during field activities will be conducted according to RMRS procedures to be generated separate from this SAP.

All FEMP-generated records and documents will be generated, stored, and filed in accordance with the SCQ (which incorporates applicable DOE Orders) and FEMP procedures.

7.0 DATA MANAGEMENT

Data management will be conducted to meet the requirements of the project. The objective of the Silo 3 data management process is to compile field and analytical data, to develop a database for data retrieval, and to maintain records which can be used to demonstrate compliance with the specific (regulatory and contractual) requirements/criteria for shipment of Silo 3 wastes to Envirocare. The data management system utilized by the project is designed to ensure the following:

- Data and records accessibility.
- Correctness and completeness of information.
- Documented change control.
- Timely data reporting.

Existing integrated site database infrastructure will serve as the primary data management tools for the project and will be utilized to generate summary reports directly to meet operational needs and compliance reporting obligations. Specifically,

- the Fernald Analytical Computerized Tracking System (FACTS) will be utilized to manage on-site analytical data.
- the Windows Integrated Sample and Data Management (WISDM) system will be utilized to track the sample process through the system.
- the Sitewide Environmental Database (SED) will serve as repository for both off- and on-site analytical data and related sampling and processing information.

The appropriate waste tracking system will depend on the off-site disposal option and shipping container configuration. The Integrated Information Management System (IIMS) is used for bulk waste and SWIFTS is used for containerized waste. Use of these systems will be as directed by existing FEMP procedures.

7.1 DATA REDUCTION AND MANAGEMENT

Data reduction involves the process and the calculations used to convert raw field or laboratory measurements/analytical data into final results with proper reporting units. All data reduction processes and calculations will be documented in the project files, as necessary, to ensure that the final data output is reproducible and defensible.

7.1.1 Field Data Reduction and Management

Field measurements that are direct readouts require no reduction or calculation. Such data will be entered into field logbooks immediately after the measurements are taken, as directed by the RMRS procedure generated separate from this SAP.

7.1.2 Laboratory Data Reduction and Management

Analytical data are generated and reduced by extracting required information from laboratory worksheets, run logs, and instrument printouts and making necessary calculations to reduce the data to its final reporting concentrations. Sample results are calculated by using the equations provided in the approved analytical methods. In many cases, this is performed by proprietary equipment manufacturer software. All raw data necessary to support the calculations and quality assurance are archived at the laboratory. This raw data must be readily available for inspection and auditing by interested parties such as regulatory agencies or quality oversight personnel. Data reduction and management will be conducted in accordance with Section 11 of the SCQ.

7.2 Data Validation

The following sections provide a general discussion of the data validation process as it will be applied in the field and in the laboratory.

7.2.1 Procedures Used to Validate Field Data

All field data generated will be validated (see Section 7 of DQO WS-012 [Appendix B]).

7.2.2 Procedures Used to Validate Laboratory Data

A minimum of 10 percent of the analytical data from each laboratory will be subject to analytical validation to ASL B requirements in the SCQ.

7.3 SUMMARY REPORTING

Summary reports will be generated for each sample or sample set as needed to fulfill regulatory and contractual obligations for the characterization and shipment of waste materials. The reports may be issued electronically and/or hard copy to meet the operational needs and regulatory commitments of the Silo 3 project. Summary reports will be generated directly from the existing site database systems, which are integrated such that they allow for the easy development of individual reports that display data from all the systems. Precise reporting requirements will be refined as they become specifically known.

APPENDIX A

PROTOTYPE SAMPLING AND ANALYSIS PLAN FOR WASTE AT THE FEMP
PL-3048, REVISION 2, JANUARY 31, 2000

Fernald Environmental Management Project Fluor Daniel Fernald Inc. Functional Area Document Program	Plan Number: PL-3048 Effective Date: 01-31-2000 Revision No. 2 UDC No. None UDC Effective Date: N/A
PROTOTYPE SAMPLING AND ANALYSIS PLAN FOR WASTE AT THE FEMP	Page 1 of 42
Issue Authorization Signature: T J Walsh Date 01-19-2000 Tom Walsh, Environmental Restoration and Waste Management FAM	Supersedes: PL-3050

SUBJECT EXPERT: Bill Neyer, x5469

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RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	PCN No.	REV. No.	DESCRIPTION
N/A	09-21-95		0	Issued the Plan for Prototype Sampling and Analysis.
02-24-98	02-25-98	1	0	Added Record and revision page; Section for Special Requirements for Enriched Nuclear Material Sampling; Added Notes for Maximum Total Grams of U-235 to be collected in attachments.
06-15-99	06-23-99		1	Major rewrite of the plan to reformat to conform to the latest format requirements of MS-2001; update references; change forms for sample request, box plan and drum plan; and to reflect current practices. This plan also supersedes plan PL-3050.
ISSUE AUTHORIZATION DATE	**EFFECTIVE DATE**	**UDC No.**	**REV. No.**	**DESCRIPTION**
01-19-2000	01-31-2000		2	Change all references from Environmental Monitoring to Waste Characterization and incorporate comments resulting from review.

1.0 INTRODUCTION

1.1 Purpose

1.1.1 The purpose of this Plan is to provide a master Sampling and Analysis Plan (SAP) for characterization of containerized and non-containerized waste (which will be containerized) and materials at the Fernald Environmental Management Project (FEMP).

1.1.2 This plan provides reference information on sampling design, field and analytical quality control, collection methods, and analytical methods to develop condensed, project-specific SAPs.

1.2 Scope

1.2.1 This plan applies to all sampling and analysis requirements for all containerized waste and materials stored within cans or pails, drums, metal boxes, T-Hoppers or J-Hoppers, International Shipping Organization (ISO) containers or Top Load Boxes, Tank/Sump Materials, and other miscellaneous container types being sampled at the FEMP.

1.2.2 This plan applies to product and residues which require characterization (items declared or which may be declared waste).

1.2.3 Project-specific Sampling and Analysis Plans (PSAPs) will be developed based on the requirements of this Sampling and Analysis Plan (SAP).

1.3 SAP Objectives

1.3.1 The primary objective of this SAP is to generate data of sufficient quality to identify the regulatory status of, and safely manage containerized waste materials.

1.3.1.1 Secondary objectives are to develop information required to determine appropriate waste disposition options, including disposal and/or treatment.

1.3.1.2 This SAP has been developed to meet the requirements for waste management and disposal within the DOE complex and at commercial facilities. Specifically, it meets the requirements of NTS-WAC, "Nevada Test Site (NTS) Waste Acceptance Criteria".

1.3.2 Specific objectives of this SAP are as follows:

1.3.2.1 Determine the presence and concentrations of RCRA hazardous constituents and radiological activities to support waste characterization.

1.3.2.2 Provide sufficient information to ensure that the sub-waste stream is managed safely.

1.3.2.3 Support identification of the appropriate disposal or treatment option (e.g., determine if the sub-waste stream meets NTS-WAC waste acceptance criteria).

1.3.2.4 Identify potential hazards or risks to public health or the environment associated with storage of the sub-waste stream, if disposal or treatment is not feasible or practical.

1.4 Description of Containerized Waste Sampling Locations

1.4.1 Containerized waste may be sampled at one of following general locations:

1.4.1.1 the container storage area,

1.4.1.2 a container staging area established for sampling activities, or

1.4.1.3 an established container sampling line.

1.4.2 The sample plan writer determines the appropriate container sampling location based on the environmental setting, the contaminants of concern, the logistics and feasibility of transporting containers from their staging/storage area to a different site location. The selected container sampling location shall be identified in Section A.8 of the PSAP. If the container sampling location identified in Section A.8 of the PSAP must be changed, the sampling crew shall contact the PSAP writer to obtain verbal approval of the change. This variance will be documented on the PSAP and the associated field logbook page(s).

1.5 Use of Process Knowledge/Existing Analytical Data/Visual Inspections

1.5.1 In general, the use of process knowledge (PK) alone (without confirmatory sampling and analyses) shall be appropriate for waste characterization when one or more of the following conditions exist:

1.5.1.1 The sub-waste stream is difficult to sample because of physical form. This primarily applies to solid matrix waste such as metal, glass, or wood, rather than as a residue that could be removed for testing or in a decontamination process.

1.5.1.2 Sampling and analysis (S&A) of sub-waste stream would result in unacceptable risk of radiation exposure, (i.e., violate the As Low As Reasonably Achievable, ALARA, precept of the DOE).

1.5.1.3 Sub-waste stream is too heterogenous in composition (e.g., compactible trash containing clothing, booties, plastic, paper, experiment-driven, and decontamination and decommissioning waste).

1.5.2 PK is used to provide information related to the waste materials and their generation process(es). This information may be used for waste material segregation to ensure that representative samples are collected for sub-waste stream characterization. In addition, PK may be used to support "non-RCRA" (not RCRA hazardous) or "RCRA" (RCRA hazardous) determinations for appropriate waste materials.

1.5.3 Previous analytical data may be used for waste material segregation to ensure that representative samples are collected for sub-waste stream characterization. In addition, these data may be used to determine the number of samples required to characterize the waste materials (using the SW-846 equation, or parametric method), determine the appropriate analyses required for waste characterization, and determine the appropriate level of personal protective equipment (PPE) required during sampling activities.

1.5.4 Visual inspections are typically used to verify that the container's contents match the description provided on the MEF and document the physical characteristics of the waste materials. In addition, visual inspections may be used for waste material segregation to ensure that representative samples are collected for sub-waste stream characterization.

1.5.5 PK, previous analytical data, and visual inspection review documentation is prepared by Waste Characterization (WC). A brief summary of this document is incorporated into Section A.9 of the PSAP. The entire PK/previous analytical data/visual inspection review document is in the waste characterization file.

1.6 Sampling and Analysis Schedule

1.6.1 To manage the large amount of sampling and analyses conducted by the FEMP, schedules for individual projects are controlled by an independent support organization within Project and Configuration Control (P&CC). Start and end dates associated with the following specific milestones are generally tracked:

1.6.1.1 Request Sampling and Analysis

1.6.1.2 Prepare PSAP

1.6.1.3 Collect Samples

1.6.1.4 Analyze Samples

1.6.1.5 Conduct Data Review and Validation

1.6.1.6 Prepare Statistical Analysis Report

1.6.1.7 Completion and transfer of file record.

2.0 REFERENCES

2.1 EW-0002, Chain of Custody/Request for Analysis Record for Sample Control

2.2 EW-0010, FEMP Data Validation Procedure

2.3 EW-0015, FEMP RCRA Operating Records

2.4 EW-1016, Waste Management Task Order Planning Process

2.5 RM-0005, FEMP Lot Marking Codes and Color Coding System

2.6 FD-1000, (SCQ) Sitewide CERCLA Quality Assurance Project Plan

2.7 WM:CHAR-T-0006, Sampling Material and Waste

2.8 34-00-002, Soil & Water Project Control of Fissile Special Source Materials Within The Laboratory Building

3.0 RESPONSIBILITIES

3.1 Waste Characterization

3.1.1 Receives an FS-F-3787, "FEMP Request for Sampling and Analysis/Field Activities" (RSA), from requestor.

3.1.2 Prepares a PSAP based on information supplied on the RSA.

3.1.3 Obtains the required concurrences and approvals prior to initiating sampling activities.

3.1.4 Initiates Task Order, in accordance with EW-1016, to direct container movement and sampling implementation.

3.1.5 Maintains supporting documentation traceable to the sub-waste stream and characterization file.

3.2 Waste Storage & Sampling

3.2.1 Collects and delivers the wastes samples to Analytical Laboratory Services (ALS) for analysis or shipment to FEMP approved laboratories.

3.3 Analytical Laboratory Services/Sample Data Management (ALS/SDM)

3.3.1 Performs laboratory analysis of samples or prepares Task Order for analysis to be performed by an off-site subcontract laboratory. Also prepares samples for shipment to off-site laboratories.

3.3.2 Upon completion of sample analysis, reviews the data package and forwards data package to Waste Characterization for statistical analysis.

4.0 GENERAL

4.1 Objectives

4.1.1 Containerized waste and surface impoundment material sampling and analysis is required to satisfy the following data needs:

4.1.1.1 Determine the regulatory status of the waste materials (at a 90% confidence level) and ensure compliance with NTS-WAC, Envirocare WAC, OSDF WAC,or other applicable requirements

4.1.1.2 Determine the appropriate level of health and safety requirements for protection of site workers during waste handling, disposal, treatment, or storage

4.1.1.3 Determine the waste characteristics to evaluate the proper disposal, treatment, or storage option

4.1.1.4 Assess risks to human health or the environment if wastes must be stored at the FEMP.

4.1.2 Data Quality Objectives (DQOs) are defined in Appendix C of FD-1000, "(SCQ) Sitewide CERCLA Quality Assurance Project Plan." Appropriate Analytical Support Levels (ASLs) for each data needed are presented in Table 4.1.

Table 4.1
Summary of Analytic Parameters and Appropriate ASLs

Analytical Parameter	ASL (s)
Organic/Radiologic Screening	A
Total/TCLP VOAs, SVOAs, Metals, Pesticides/Herbicides	B
Flash Point, pH, Corrosivity	B
F001 - F005 Solvents, Cyanides, Sulfides, PCBs	B
Paint Filter Liquids Test	B
Total/Isotopic U and Th	B
TAL VOAs, SVOAS, Pesticides/PCBs, Inorganics	B, C and D
Full Radiological	B, D and E

4.1.3 DQO NTW-003, ACharacterization Sampling and Analysis of Containerized Wastes for Final Disposition or Treatment@ was developed for containerized waste material sampling, analysis, and characterization.

4.1.4 In general, the DQO provides a technically-sound sampling and analysis approach capable of satisfying the following items: representativeness, sampling accuracy, sampling precision, analytical method detection limits, completeness, and comparability. These items are addressed in the following sections of this sampling and analysis plan

4.2 Representativeness

4.2.1 Representativeness, or the collection of samples that are unbiased and exhibit average properties of the population sampled, is achieved by segregating the containerized wastes into sub-waste streams. A sub-waste stream is generally comprised of a group of containers labeled with the same Material Type and Source Code. Material Type and Source Code identifiers are provided in each PSAP, in Sections A.5 and A.6, respectively. Requirements Manual RM-0005 identifies the applicable material types and source codes.

4.3 Sampling Accuracy

4.3.1 Sampling accuracy, or the closeness of a sample value to its true value, is achieved through randomized sampling of the waste containers within a given sub-waste stream. Randomized sampling minimizes bias in the sample selection process by giving each container an equal probability of being sampled.

4.4 Sampling Precision

4.4.1 Sampling precision, or the closeness of repeated sample values, is achieved by increasing the number of samples to be collected, increasing the actual volume of the samples, or dividing a population into appropriate strata prior to sampling. Additional samples may be collected when the uniformity of the waste is not known and when sample collection is difficult. In general, the volume of sample material collected at the FEMP exceeds the minimum amount needed for analytical sample preparation and analysis. Lastly, when a sub-waste stream is suspected or known to contain separate physical phases (i.e., solids and liquids), the number of samples required is calculated for each waste phase. During sample collection activities, a sample is collected from each waste phase from the randomly selected waste containers.

4.5 Analytical Method Detection Limits

4.5.1 In general, analytical method detection limits are provided in Appendix G of FD-1000. Method detection limits for solid- and liquid-phased non-radiological analyses, are based upon EPA SW-846 or Contract Laboratory Program (CLP) protocol. Method detection limits for radiological analyses are based on typical laboratory detection compatibilities and are presented in FD-1000.

4.6 Completeness

4.6.1 To satisfy FD-1000 completeness requirements of 90%, the number of samples required to be collected will be calculated in accordance with methods described in EPA/230-02-89-042, Feb. 1989, "Methods for Evaluating the Attainment of Cleanup Standards, Vol. I, Soils and Solid Media". The following equation will be used to determine the number of samples to obtain a 90% completeness level:

Minimum number of samples required

$$\#\ \text{of Samples}_{(90\%\ \text{comp})} = \frac{\text{Minimum number of samples required}}{(1 - R)}$$

where,

R = 0.20 (20%), the expected percent of missing or unusable data (i.e., sample holding times exceeded, improper preservation of samples, sample container breakage during shipment to laboratory, etc.)

4.6.2 An R-value of 0.20 (20%) was selected to take the most conservative approach for minimization or elimination of the potential need for resampling activities.

4.7 Comparability

4.7.1 Laboratory facilities contracted to provide chemical analytical services are required to comply with all provisions in FD-1000. Therefore, data sets from differing laboratory facilities should be comparable since the same analytical method and method detection limit is required. However, in order to measure comparability between data sets from distinct laboratories, the FEMP may periodically use split samples. Split sample analytical data may also be used to identify false negative or false positive errors.

5.0 SAP/PSAP DEVELOPMENT CRITERIA

5.1 Sampling Approach

5.1.1 The sampling approach for containerized wastes at the FEMP is dependent on the characteristics of the sub-waste stream as determined by PK/previous analytical data/visual inspection reviews.

5.1.1.1 Sub-waste streams which contain heterogenous materials and lack sufficient PK data will be subjected to "comprehensive" sampling and analysis (i.e., rate of 10% or cube root).

5.1.1.2 Sub-waste streams which contain homogenous materials and/or have preliminary determinations based on PK/previous analytical/visual inspection reviews may be subjected to "confirmatory" sampling and analyses (i.e., log base 10 + 1).

5.1.2 The sampling approach for surface impoundment material is dependent on the following factors:

5.1.2.1 matrix of surface impoundment materials (e.g., liquids only, solids only, or combination thereof),

5.1.2.2 target analytes of concern,

5.1.2.3 number and lateral/vertical extent of distinct solid layers,

5.1.2.4 basin geometry, and

5.1.2.5 location of waste generation source(s) and loading rate(s) to surface impoundment.

5.1.3 In order to increase the probability that representative samples are collected from the respective surface impoundment, extensive PK/analytical data/visual inspection reviews will be conducted. Data generated by these reviews will be used for evaluation of the previously-mentioned variables and determination of the appropriate sampling approach.

5.1.4 Simple-, systematic-, or stratified-random sampling techniques may be employed based upon the material characteristics, process history, and project-specific data needs.

5.1.4.1 Systematic or stratified random sampling methods will be used for containerized waste for sub-waste streams that have been segregated into multiple container groups (lots).

5.1.4.2 "Stratified" simple- or systematic-random sampling methods will be used for surface impoundment materials that have been segregated into multiple "strata".

5.1.4.3 Containerized waste and surface impoundment materials sampling methods will be based upon differences in: physical characteristics (i.e., phase and degree of homogeneity) of the waste materials, origin (time and location) of waste materials and their generation processes, or distribution and concentration of contaminants.

5.1.5 Methods of determining simple random sample locations include using a random number generator program or random number lists. In order to maintain representativeness and sampling accuracy, sample depths shall be randomly selected using computer algorithms. If the surface impoundment contains multiple strata or media types, samples will be collected at randomized depths within each distinct stratum or media type.

5.2 Sampling Approach for Previously Generated Wastes

5.2.1 Sub-waste streams generated by previous FMPC/FEMP operations which contain homogenous waste materials or have preliminary determinations based on PK/previous analytical data/visual inspections, may be subjected to "confirmatory" sampling and analysis using simple-random sample selection techniques. Heterogenous sub-waste streams which lack sufficient PK/previous analytical/visual inspection data will be subjected to comprehensive sampling and analysis using simple-, systematic-, or stratified-random sample selection techniques.

5.3 Sampling Approach for Currently Generated Wastes

5.3.1 Sub-waste streams generated by current FEMP operations which contain homogenous waste materials based on PK/previous analytical data/visual inspection reviews may be subjected to "confirmatory" sampling and analysis. Appropriate process control will be identified and documented in WC files to demonstrate that the process generates homogenous sub-waste stream materials.

5.3.2 Heterogenous sub-waste streams which lack sufficient PK/previous analytical/ visual inspection data will be subjected to "comprehensive" sampling and analysis using simple- or systematic-random sample selection techniques. Comprehensive samples will be collected at random time intervals from initiation to completion of respective material processing operations. Comprehensive samples may be collected in distinct batches for long-term processes that may generate volumes of waste materials in excess of respective storage capacities.

5.4 Number of Samples for Containerized Waste

5.4.1 For drummed waste sampling at the FEMP, typically the number of samples required equals 10% of the number of drums in a sub-waste stream. However, for sub-waste streams containing more than 100 drums, collecting samples for analyses at a rate of 10% may not be economically feasible or practical. Therefore, the FEMP intends to use the 10% method for sub-waste streams with < 100 drums and the cube root method for sub-waste streams with > 100 drums. Using this approach, the number of samples required for waste characterization is as follows:

Number of Drums	Min. # of Samples for Analysis	Number of Samples for Completeness*
1 to 20	2	3
21 to 100	10%	12.5%
101 to 1000	10	13
1001 to 10000	22	28

* - Total number of samples required to maintain 90% completeness using a conservative R-value of 0.20 (20%).

5.4.2 For metal box, ISO, or Top Load container sampling, the proposed number of samples required shall be as follows:

Number of Boxes	Min. # of Boxes to be Sampled	Number of Samples/Boxes for Completeness*
1	1	3
2 to 100	10% + 1	12.5% + 1.25
101 to 1000	11	14
1001 to 10000	23	29

* - Total number of samples required to maintain 90% completeness using a conservative R-value of 0.20 (20%). This number includes collecting one random sample from metal box, ISO, or Top Load containers in addition to the minimum number of containers to be sampled.

5.4.3 For sub-waste streams that have been characterized by process knowledge but do not meet one of the conditions in Section 1.5 of this SAP, the number of required confirmatory samples per sub-waste stream is as follows:

Number of Containers	Min. # of Samples for Analysis	Number of Samples for Completeness*
1 to 10	2	3
11 to 100	3	4
101 to 1000	4	5
over 1001	5	6

* - Total number of samples required to maintain 90% completeness using a conservative R-value of 0.20 (20%). If the containers are white metal, Sea/Land[R], or Top Load boxes, the required number of samples is equal to the number of samples in this table plus one additional sample.

5.4.4 For larger container lots (> 100), an alternate method for determining the sample number may be applied dependent on the waste stream=s homogeneity. This alternate determination method will be documented in the PSAP where applicable.

5.4.5 Parametric analysis, or EPA SW-846 Equation 8, is the preferred method to determine the required number of samples required to satisfy the NTS WAC 90% confidence level requirement. However, EPA SW-846 Equation 8 requires previous analytical data to determine the mean and associated standard deviation for the analyte with the most restrictive regulatory threshold level. EPA SW-846 Equation 8 may be used as a secondary method, in situations where the upper limit of a 90% confidence level approximates or exceeds the regulatory threshold value for a given analyte, to determine if additional sample collection and analysis is warranted. In addition, in situations where sufficient previous analytical data exists for a sub-waste stream, EPA SW-846 Equation 8 may be used in lieu of the sample frequency identified above.

5.5 Number of Samples for Surface Impoundment Materials

5.5.1 Parametric analysis, or EPA SW-846 Equation 8, is the preferred method to determine the required number of samples to satisfy the NTSWAC 90% confidence level requirement. This method requires either previous analytical data, the collection and analysis of a minimum of four samples, or extensive process knowledge to determine an estimate of the mean and standard deviation for the analyte with the most restrictive regulatory threshold level. Since a majority of the surface impoundments at the FEMP have been investigated as part of the Remedial Investigation/Feasibility Study, the use of this method may be practical or feasible. As mentioned previously, computer algorithms employing EPA SW-846 Equation 8 may be used to determine the number of samples required. The computer program applies the correction factor "R" described in Step 4.6.1 for missing or unusable data.

5.5.2 For containerized waste sampling at the FEMP that have not been characterized by PK, typically the number of samples required equals 10% of the number of containers in a waste stream. However, sample areas for surface impoundments may contain material volumes of several thousand to several hundred thousand drum equivalents. Collecting samples at a rate equal to 10% of the drum equivalents is not economically feasible or practical. However the cube root method may be substituted to determine the number of required sample points as follows:

Number of Drum Equivalents	Min. # of Samples for Analysis	Number of Samples for Completeness*
1 to 100	4	5
101 to 1000	10	13
1001 to 10000	22	28
10001 to 100000	46	58
100001 to 500000	75	94
over 500000	100	125

* - Total number of samples required to maintain 90% completeness using a conservative R-value of 0.20 (20%).

5.5.3 For surface impoundment materials that have been characterized by process knowledge and do not meet one of the conditions in Section 1.5 of this SAP, the number of required samples, per media or strata, is as follows:

Number of Drum Equivalents	Min. # of Samples for Analysis	Number of Samples for Completeness*
1 to 100	3	4
101 to 1000	4	5
1001 to 10000	5	6
10001 to 100000	6	8
100001 to 1000000	7	9

* - Total number of samples required to maintain 90% completeness using a conservative R-value of 0.20 (20%).

5.5.4 Regardless of the primary method for determining sample size, EPA SW-846 Equation 8 is used as a secondary method (i.e., incorporated into statistical spreadsheets), to determine if additional sample collection and analysis is warranted.

5.6 Sample Volumes, Containers, Preservation and Holding Times

5.6.1 Required sample volumes, containers, preservatives, and holding times are provided in Appendix A, Table 6.1 of FD-1000. Sample volumes, containers, preservatives, and holding times are presented in Section 7.0 of this SAP, and in Sections B.2, B.3, and C of each PSAP.

5.6.2 Sample Collection Procedures/Equipment

▼Note: **Drummed waste sample collection procedures and appropriate sampling equipment, in accordance with Appendix K of FD-1000 and FEMP Waste Management Projects Sampling Procedures.**

5.6.3 Sample collection procedures and appropriate sampling equipment are contained in Appendix K of FD-1000 and Waste Management Projects Division Procedure WM:CHAR-T-0006.

5.7 Sample Handling and Shipment

5.7.1 Field storage and shipment of samples procedures are presented in Section 6.7 and Appendix K of FD-1000.

6.0 DOCUMENTATION AND SAMPLE CUSTODY

6.1 Sample Identification and Labeling

6.1.1 Sample identification and labeling procedures are presented in Section 7.1.3 and Appendix K of FD-1000, Laboratory, and WMP procedures.

6.2 Recordkeeping

6.2.1 Field activities will be recorded on sequentially-numbered pages in logbooks or individual log sheets. Media-specific sample collection logs, calibration logs, sketches, and photographs may also be used to document field activities, site conditions, or unusual observations.

6.2.2 Detailed recordkeeping requirements are provided EW-0015

6.3 Sample Custody and Analysis Requests

6.3.1 Pertinent sample collection data will be recorded on the FS-F-3361, AChain of Custody/Request for Analysis Record@ (COC/RFA), in accordance with EW-0002, which will accompany the respective samples to the FEMP analytical laboratory facility for analysis or shipment to a FEMP-contracted laboratory for analysis. Samples shipped to offsite laboratories are accompanied the COC/RFA.

6.4 Other Miscellaneous Forms

6.4.1 All sampling and analysis projects at the FEMP require a Work Permit as a minimum. Other forms, such as a Chemical Hazard/Confined Space Entry Permit or a Construction/Excavation Permit may be required based on the nature of the project. In addition, sample line personnel complete a Task Order Briefing at the initiation of each project. This briefing is valid for the duration of the project or until project conditions change.

6.4.2 Special Requirements for Enriched Nuclear Material Sampling

6.4.3 When Enriched Nuclear Materials are sampled, special notifications are required. These notifications are outlined in WMP sampling procedures. A calculation, performed by the Waste Characterization PSAP developer, will determine the total possible amount of U-235 in grams to be contained in the samples to be collected. After collection, an additional calculation will determine the actual maximum amount of U-235 grams contained in the samples. All calculations are based on best available information as described in 34-00-002, ASoil & Water Project Control of Fissile Special Source Materials Within The Laboratory Building@. The PSAP developer will include maximum total U-235 grams to be collected during sampling in the PSAP.

7.0 ANALYSIS OF WASTE SAMPLES

7.1 Waste Analytical Parameters and Methods

7.1.1 In general, WC personnel or other requesters determine the appropriate waste analytical parameters based on PK and/or reviews of previous analytical data. This information is incorporated into the PSAP.

7.2 Non-Radiological Parameters and Methods

7.2.1 Based on PK and/or previous analytical data reviews, one or more of the following non-radiological analyses may be performed to characterize the chemical constituents within, and identify the regulatory status of the waste materials:

Analytical Parameter	Test Method(s)
RCRA Analyses	
Ignitability	EPA 1010/1020
Reactivity	40 CFR 261.23
Corrosivity	EPA 9040
Toxicity Characteristic	EPA 1311
LDR Solvents TCLP (F001-F005)	
LDR Halogenated Org.	EPA 9020
Cyanides	EPA 9010/9012
Sulfides	EPA 9030

Other NTS-WAC Analyses
Free Liquids EPA 9095
PCBs EPA 8080

7.2.2 The FEMP intends to use analytical methods (Total concentrations) to determine if Toxicity Characteristic Leaching Procedure (TCLP) or Land Disposal Restriction (LDR) analyses are warranted. The proposed analytical methods are as follows:

Analytical Parameter	Test Methods (EPA)
Organics (Gas Chromatography) 8080, 8090, 8120 8140, 8150	8010, 8015, 8020 8030, 8040, 8060
Organics (Gas Chromatography/ Mass Spectroscopy)	8240, 8250 8270, 8280
Inorganics/Metals (Atomic Absorption Spectroscopy)	40 CFR 261, App. III
Inorganics/Metals (Inductively Coupled Plasma/ Atomic Emission Spectroscopy)	6010

7.2.3 In general, the FEMP uses a 20:1 ratio of Total concentration results for solid matrix samples to TCLP regulatory threshold limits to determine if TCLP analyses are required. If the analyte-specific upper limit of the 90% confidence interval exceeds the 20:1 ratio to its associated TCLP regulatory value, WC will evaluate the leachability of this analyte to determine if TCLP analyses are warranted. If additional analyses are not warranted, WC will prepare a letter to the waste characterization file documenting the reason(s) for this decision.

7.2.4 Additional analytical parameters may be required to satisfy secondary objectives identified in this SAP. For example, if the sub-waste stream is determined to be "mixed hazardous waste", then Target Analyte List (TAL) or Target Compound List (TCL) analytical data may be required to assess the potential risks of storing these containers at the FEMP. The need for these parameters will be reviewed on a case-by-case basis.

7.3 Radiological Parameters and Methods

7.3.1 Based on PK and/or previous analytical data reviews, one or more of the following radiological analyses may be performed to characterize the radiological component of the waste materials:

Analytical Parameter

Total/Isotopic Uranium
Total/Isotopic Thorium

7.3.2 To satisfy secondary objectives identified in this SAP, additional waste samples may be collected and analyzed for ASL B or D Total Radiological Parameter analyses to determine the following constituents:

7.3.2.1 Uranium (U-234, U-235, U-238), in pCi/g
7.3.2.2 Thorium (Th-230, Th-232), in pCi/g
7.3.2.3 Radium (Ra-226, Ra-228), in pCi/g
7.3.2.4 Actinium (Ac-230, Ac-232), in pCi/g
7.3.2.5 Lead (Pb-210), in pCi/g
7.3.2.6 Polonium (Po-210), in pCi/g
7.3.2.7 Technetium (Tc-99), in pCi/g
7.3.2.8 Neptunium (Np-237), in pCi/g
7.3.2.9 Plutonium (Pu-238, Pu-239, Pu-240), in pCi/g
7.3.2.10 Strontium (Sr-90), in pCi/g
7.3.2.11 Ruthenium (Ru-106), in pCi/g
7.3.2.12 Cesium (Cs-137), in pCi/g

7.4 Sample Container, Preservation, and Holding Time Requirements

7.4.1 Non-Radiological Analyses

7.4.1.1 Sample container, preservation, and holding time requirements for non-radiological analyses are provided in Table 7.1.

7.4.2 Radiological Analyses

7.4.2.1 Sample container, preservation, and holding time requirements for radiological analyses are provided in Table 7.2.

Table 7.1
Sample Container, Preservation, and Holding Time Requirements
Non-Radiological Samples

Analytical Parameter	Sample Matrix	Sample Container	Preservation	Holding Time
Total/TCLP VOAs	Liquid	3 x 40-mL VOA vials; TLS	HCl to pH < 2 Cool 4 deg. C	14 days
Total/TCLP SVOAs/Pest. Herb./PCBs	Liquid	1 Gal. Amber Glass, TLC	Cool 4 deg. C	7 days
Total/TCLP Metals	Liquid	1 x 1-liter polyethylene	50% HNO_3 to pH < 2	180 days 28 days (Hg)
Cyanide	Liquid	1 x 1-liter polyethylene	NaOH to pH > 12 Cool 4 deg. C	14 days
Flash Point pH	Liquid	8-oz. widemouth Glass, TLC	None	28 days, ASAP for pH
Sulfides	Liquid	1 x 1-liter polyethylene	NaOH to pH > 9 Cool 4 deg. C	7 days
Total/TCLP VOAs	Solid	3 x 4-oz. jars* glass, TLC	Cool 4 deg. C	14 days
Total/TCLP SVOAs/Pest. Herb./PCBs	Solid	1 x 8-oz jar** Amber Glass, TLC	Cool 4 deg. C	14 days
Total/TCLP Metals	Solid	1 x 8-oz jar** Glass, TLC	Cool 4 deg. C	180 days 28 days (Hg)
PFLT	Solid	1 x 4-oz. glass or polyethylene	None	28 days

Notes:
VOA, SVOA = Volatile Organic Analysis, Semi-Volatile Organic Analysis
Pest., Herb., PCBs = Pesticides, Herbicides, Polychlorinated Biphenols
PFLT = Paint Filter Liquids Test
TLC, TLS = Teflon-Lined Closure, Teflon-Lined Septum
HCl, HNO_3, NaOH = Hydrochloric acid, Nitric acid, Sodium hydroxide
* - Minimum of 25 grams/container for low-density waste materials
** - Minimum of 100 grams/container for low-density waste materials

Table 7.2
Sample Container, Preservation, and Holding Time Requirements
Radiological Samples

Analytical Parameter	Sample Matrix	Sample Container	Preservation	Holding Time
Total Uranium	Solid	8-ounce jar Plastic/Glass	None	180 days
Total Uranium	Liquid	1-liter bottle Plastic/Glass	HNO_3 to pH <2	180 days
Isotopic Uranium	Solid	8-ounce jar Plastic/Glass	None	180 days
Isotopic Uranium	Liquid	1-liter bottle Plastic/Glass	HNO_3 to pH <2	180 days
Total Thorium	Solid	8-ounce jar Plastic/Glass	None	180 days
Total Thorium	Liquid	1-liter bottle Plastic/Glass	HNO_3 to pH <2	180 days
Isotopic Thorium	Solid	8-ounce jar Plastic/Glass	None	180 days
Isotopic Thorium	Liquid	1-liter bottle Plastic/Glass	HNO_3 to pH <2	180 days
Total Radiological Parameter	Solid	1-Quart Jar Plastic/Glass	None	180 days
Total Radiological Parameter	Liquid	4-Liter Cubetainer	HNO_3 to pH <2	180 days

8.0 QUALITY ASSURANCE/QUALITY CONTROL

8.1 Field QC Samples

8.1.1 The following field QC samples may be collected (types selected based on the project-specific needs and identified in Section B.11 of the PSAP) and analyzed for the constituents identified in Section 7.0:

8.1.1.1 Container blanks - not required when vendor-supplied assay data is provided with container shipment. When required, collect one blank per each container batch or one per sampling round, whichever is more frequent.

8.1.1.2 Duplicate samples - one per every twenty samples per media matrix or one per sampling round per media matrix, whichever is more frequent.

8.1.1.3 Equipment rinsates - one per twenty pieces of a type of equipment cleaned by a specific decontamination method or one per sampling round, whichever is more frequent.

8.1.1.4 Field Blanks - one per twenty samples or one per sampling round, whichever is more frequent.

8.1.1.5 Preservative blanks - not required when vendor-supplied assay data is provided with preservative shipment. When required, collect one blank per each container batch or one per sampling round, whichever is more frequent.

8.1.1.6 Split samples - if required, one per every twenty samples per media matrix or one per sampling round per media matrix.

8.1.1.7 Trip blanks - daily, one trip blank per cooler containing Volatile Organics samples sent to laboratory. Analyzed for Volatile Organics only.

8.1.2 In accordance with Appendix D of FD-1000, field duplicate sample analytical data may be used to calculate the relative percent difference (RPD) for evaluation of sampling precision or degree of homogeneity/heterogeneity of the waste materials.

8.1.3 Equipment rinsate analytical data may be used to evaluate the effectiveness of the decontamination procedure or estimate the amount of cross contamination between sample point locations.

8.1.4 Field blank analytical data may be used to estimate the amount of contamination associated with the sampling environment.

8.1.5 Split sample analytical data may be used to evaluate the accuracy of analytical performance between two distinct laboratory facilities and identify the potential for false positives or false negatives.

8.2 Field Screening Equipment Calibration and Documentation

8.2.1 Field screening instrumentation, such as radiation detection and photoionization detection (PID) devices, will be checked on a daily basis for proper operation. Any equipment that fails calibration (limit of +/- 10% of calibration gas value) or becomes inoperable will be tagged and taken out of service. Such equipment will be repaired and recalibrated before reuse.

8.2.2 Radiation detection devices will be checked before each use to ensure that the date of required calibration has not been exceeded. PID devices will be calibrated, on a daily basis and prior to use, to a known concentration of volatile gas in air mixture (i.e., isobutylene, etc.). Subsequent to completion of field activities, on a daily basis, the PID instrument will be checked by analyzing the respective gas-air mixture used for calibration. Field screening instrumentation checks and calibration will be recorded in bound field logbooks or field activity daily logs and instrument-specific calibration logs.

8.3 Field Audits/Surveillances

8.3.1 In accordance with NTS WAC, DOE-NV may conduct a triannual audit of the sampling activities covered under this SAP. In addition, the FEMP may conduct surveillances of sampling activities to verify conformance with the requirements and procedures identified in this SAP. These surveillances will be documented in accordance with Section 12 of FD-1000.

8.3.2 Upon completion of each sampling event, QC shall review field logbook entries, COC/RFAs, etc., to ensure that sample collection and documentation were conducted in accordance with requirements of this SAP, its respective PSAP, and FD-1000. The completed field-generated documentation will be retained in WC MEF files.

8.4 Laboratory QC Samples

8.4.1 Laboratory QC sample requirements are provided in Appendix A (Table 2-2) and Appendix G of FD-1000 and based upon the requested ASL. In general, the types of laboratory QC samples will be selected based on project-specific needs.

8.5 Analytical Instrumentation/Equipment Calibration and Documentation

8.5.1 Analytical laboratory instrument and equipment calibration procedures are provided in Section 8.0 and Appendix E of FD-1000. The FEMP and FEMP-contracted analytical laboratory facilities will be responsible for ensuring that all analytical instrumentation and equipment is operating properly and is within prescribed calibration limits.

8.6 QA/QC Checks and Procedures

8.6.1 Laboratory quality control checks and procedures for inorganic, organic, and radiological analyses are provided in Section 10.0 and Appendices A, B and E of FD-1000. The FEMP and FEMP-contracted laboratory facilities will be responsible for adherence to these quality control checks and procedures.

8.6.2 In accordance with NTS WAC and Section 12.4 of FD-1000, the FEMP will conduct a laboratory qualification audit prior to contract award for analytical services. In addition, a system audit will be conducted for each FEMP-contract laboratory on an annual basis to assure continued acceptable performance. Each data package submitted by a FEMP-contract laboratory is reviewed by Analytical Data Management to ensure that contractual issues have been satisfied.

8.7 Data Reporting and Validation

8.7.1 The FEMP laboratory and FEMP-contracted laboratory facilities shall provide data packages on floppy disk and/or hard copy in such a fashion that allows for DOE-NV to validate data. In addition, field- and laboratory-generated data packages shall be validated in accordance with the FEMP Validation Plan in Appendix D of FD-1000 and EW-0010, "FEMP Data Validation Procedure". Validated data shall be used to support waste determinations.

8.8 Waste Disposition

8.8.1 Contact Wastes

8.8.1.1 Contact wastes, such as personal protective equipment (PPE) and rags or wipes (paper towels, Chemwipes[R], etc.), are typically placed in 5-gallon pails or 55-gallon drums, lot marked so that they can be traced to (associated with) the waste stream sampled, and stored at the FEMP for appropriate disposition. Separate 55-gallon drums will be provided, for segregation of PPE wastes, and labeled as follows:

A. Used Respirators

B. Used Rubber Shoe Covers

C. Used Tyvek/Saranex, Cartridges, Tape, Gloves

8.8.2 Decontamination Solutions

8.8.2.1 Equipment decontamination solutions are typically transferred to DOT-approved, bung-type, 55-gallon drums or 5-gallon pails, lot marked so that they can be traced to (associated with) the waste stream being sampled. The drums are placed within a Satellite Accumulation Area (SAA) with diked Herculite sheeting or containment devices, capable of capturing 2 the capacity of the drum volume, to prevent contaminant migration resulting from spills, or leaks. The drummed decontamination solutions are stored at the FEMP until the appropriate disposal or placement option can be identified.

9.0 DISTRIBUTION AND CONTROL OF PSAPS

9.1 Control of PSAPs

9.1.1 Once a PSAP is generated, approved and signed by an authorized individual, the PSAP shall be controlled by Waste Characterization.

9.1.2 An individual project-specific file shall be maintained, and contain, at a minimum, the following:

9.1.2.1 FEMP Waste Program Management/Waste Sampling Request for sampling

9.1.2.2 Project Sampling Plan Development/Sampling and Analysis/Field Activities

9.1.2.3 Master copy of the PSAP

9.1.2.4 Associated documentation (i.e. copies of logbook, log forms, chain of custody, data reports, etc.).

9.1.3 Upon completion of a project, this project-specific file will either be:

9.1.3.1 Forwarded by Waste Characterization to the requestor, or

9.1.3.2 Waste Characterization will maintain the file for approximately one year, then the file will be archived.

9.2 Distribution of PSAPs

9.2.1 Once a PSAP is generated, distribution will be controlled by Waste Characterization.

9.2.2 Distribution will be as follows:

9.2.2.1 One working copy shall be forwarded to ACS

9.2.2.2 One working copy shall be forwarded with the Task Order.

9.2.3 In the event of a revision or addendum, Waste Characterization shall distribute the revised copies or addendum with instructions to the distribution points listed in Step 9.2.2

9.2.4 All revisions and addendums shall include an effective date.

10.0 APPLICABLE DOCUMENTS

10.1 Drivers

10.1.1 NTS WAC, Nevada Test Site Waste Acceptance Criteria

10.1.2 Environcare WAC

10.1.3 Onsite Disposal Facility (OSDF) WAC

10.1.4 TSCA Inc. WAC

10.1.5 FD-1000, (SCQ) Sitewide CERCLA Quality Assurance Project Plan

10.2 Forms

10.2.1 FS-F-3361, Chain of Custody/Request for Analysis Record

10.2.2 FS-F-3787, FEMP Request for Sampling and Analysis/Field Activities

10.3 Information Sources

10.3.1 PL-3078, Waste Characterization Program Plan

10.3.2 D22-11-001, Statistical Report Writing For Waste Acceptance Criteria

10.3.3 EPA SW-846, Test Methods for Evaluating Solid Wastes

10.3.4 EPA 230-02-89-042, Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Soils and Soiled Media

10.3.5 EPA 600/R-92/033, Characterizing Heterogenous Wastes: Methods and Recommendations

10.3.6 34-00-002, Soil & Water Project Control of Fissile Special Source Materials Within The Laboratory Building

10.3.7 34-10-504, Dispositioning Samples from the On-Site Laboratory (and Retrieving Sample From) the Sampling Disposition Facility

10.3.8 DQO NTW-003, Characterization Sampling and Analysis of Containerized Wastes for Final Disposition or Treatment

11.0 DEFINITIONS

11.1 Characterization: The determination of the physical, chemical, radiological, and biological properties of a material to the extent necessary to support informed decision making regarding the management of a waste.

11.2 Confidence Coefficient: The probability statement that accompanies a confidence interval and is equal to unity minus the associated type I error rate (false positive rate). A confidence coefficient of 0.90 implies that 90% of the intervals resulting from repeated sampling of a population will include the unknown (true) population parameter.

11.3 Confidence Interval: The numerical interval constructed around a point estimate of a population parameter, combined with the probability statement (the confidence coefficient) linking the interval to the population's true parameter value.

11.4 Disposal: The systematic and orderly placement, long term storage, distribution, or transformation of wastes (treatment).

11.5 Disposal: (NTS-WAC): The emplacement of low-level radioactive wastes in a manner which is considered permanent in that routine recovery is not provided for.

11.6 Facility - RCRA: (EPA 40 CFR 260.10): All contiguous land, and structures, other appurtenances and improvements on the land used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them).

11.7 Facility - Waste: (EPA 40 CFR 260.10): All contiguous land, and structures, other appurtenances and improvements on the land used for treating, storing, or disposing of waste. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them).

11.8 Hazardous Waste: (DOT 49 CFR 171.8): Any material that is subject to the Hazardous Waste Manifest Requirements of the Environmental Protection Agency specified in 40 CFR Part 262.

11.9 Hazardous Waste: (DOE EH-231-003/0191): A solid waste that must be treated, stored, or transported, and disposed of in accordance with applicable requirements under Subtitle C of RCRA.

11.10 Low-Level Waste: (NTS-WAC): All radioactive waste not classified as high-level waste, spent nuclear fuel, transuranic waste, uranium mill tailings, mixed waste, or 11e(2) by-product material as defined in DOE Order 5820.2a. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentrations of transuranics is less than 100 nanocuries (nCi/g).

11.11 Mixed Waste: (NTS-WAC): Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the RCRA, respectively. Mixed waste must meet the Land Disposal Restrictions (LDR) as listed in 40 CFR 268.

11.12 Operable Unit: (EPA 40 CFR 300.6) A discrete part of the entire response action that decreases a release, threat of release, or pathway of exposure.

11.13 Radioactive Waste: (NTS-WAC): Solid, liquid, or gaseous material that contains radioactive nuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value considering costs of recovery.

11.14 Radioactive Waste: (DOE 5480.2): Solid or fluid materials of no value containing radioactivity; discarded items such as clothing, containers, equipment, rubble, residues, or soils contaminated with radioactivity; or soils, rubble, equipment or other items containing induced radioactivity such that the levels exceed safe limits for unconditional release.

11.15 Solid Waste: (NTS-WAC): Waste material that is an essentially dry, solid form. The waste stream may include well-drained containers or liquids which have been entrapped or otherwise solidified so that they will retain their solid form without the presence of free liquids during handling, transportation, storage, or disposal. Viscous material is determined to be a solid by testing in accordance with American Society for testing Materials Standard D 4359, "Standard Test Method for Determining Whether a Material is a Liquid or a Solid."

11.16 Solid Waste: (EPA 40 CFR 260.10, 261.2): Garbage, refuse, and other discarded solid materials, including solid waste materials resulting from industrial, commercial, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial wastewater effluent, dissolved materials in irrigation return flows, or other common water pollutants. It generally does not include mining, agricultural, and industrial solid wastes; hazardous wastes; sludges; construction and demolition wastes; and infectious wastes.

11.17 Sub-Waste Stream: A group of containers that contain similar material based on process knowledge and are labeled with the same Material Type and Source Code as part of the FEMP's Lot Marking System Number.

11.18 Waste Stream: (NTS-WAC): The categorization of waste defined by the ability or method of characterization and certification. Examples are (1) by matrix; e.g., compactible trash, metal, wood, sludge, filter cakes, glass; and (2) by process; e.g., controlled experiments, decommissioning activities as described in DOE Order 5820.2A, Section V.

Attachment 1
Format for Boxed Waste Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page 1 of 4

A. Identifying Information

1) Project Name:
2) Plan No.:
3) Material Description/Matrix Code(s):
4) Number of Boxes in Sub-Waste Stream:
5) Material Type:
6) Source Code:
7) Material Evaluation Form #:
8) Sampling Location for Boxes:
9) Process Knowledge:

B. Sampling Information

1) General: Samples taken will be contained in glass or polyethylene jars with Teflon lined lids.
2) Preservation Method: See Analytical Requirements in Section C.
3) Holding Times: See Preservative and Holding Time Requirements in Section G Holding times and sample volume/container requirements for media-specific analyses not listed in FD-1000 are provided by the FEMP laboratory facility.
4) Sample Technique:
5) Number of Boxes to be Sampled and Analyzed: , see page 2.
6) Composite Samples: No
7) Visual Inspection Performed?: No
8) Field Contact:
9) Send Results to: Bill Neyer, ext. 5469, MS 46
10) Charge No./Project Manager:
11) Required QA/QC Samples:

Field QC	Yes	No	Notes
Trip Blank	___	___	volatile organic samples
Field Blank	___	___	1 per 20 samples or 1 per sampling event
Equipment Rinsate	___	___	1 per 20 samples or 1 per sampling event
Duplicate	___	___	1 per 20 samples or 1 per sampling event
Container Blank	___	X	analytical data supplied by supplier
Preserv. Blank	___	X	assay data supplied by supplier

Laboratory QC
Laboratory QC sample type and frequency requirements are provided in Appendix G of FD-1000.

Attachment 1
Format for Boxed Waste Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page 2 of 4
Charge:

B. Sampling Information

12) **Box/Grid/Random Depth Information:** See Appendix A for grid layout. The duplicate sample is to be taken from the container noted with an asterisk (*). The duplicate sample will be given the next consecutive sample number.

Sample Number	Lot Number	Inv. Number	Grid Number	Random Depth (ft)
FIELD(1)-1				
FIELD(1)-1				
FIELD(1)-1-				
FIELD(1)-1				
FIELD(1)-1				
FIELD(1)-1				

NOTE: If the material in the box does not match the material description, do not sample. Perform a visual inspection of the contents of the box.

If there is not enough material to meet the volume requirements, do not sample the box. Perform a visual inspection of the contents of the box.

Refer to page 1, Section B-7 for requested visuals. These will be performed regardless of the contents of the box.

When Enriched Materials is sampled, include the following as a note: "Material to be sampled is enriched, notifications per WMP Sampling Procedures are required."

Attachment 1
Format for Boxed Waste Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page 3 of 4

C. Analytical Requirements

In order to satisfy waste characterization requirements the following analyses may be performed.

Analysis Requested ASL B	Solid Matrix Samples Container and Preservative/Units		Liquid Waste Samples Container and Preservative/Units		Quality Control Samples Container and Preservative/Units	
Total VOA Table 5 (off-site)	200 g, GTL	Cool 4°C/ mg/kg	(4) x 40 mL GTS	Cool 4°C/ mg/L	(4) x 40 mL GTS	Cool 4°C & HCl to pH < 2/mg/L
Volatiles Table 26 (off-site)		Cool 4°C/ mg/Kg		Cool 4°C/ mg/L		Cool 4°C & HCl to pH < 2 /mg/L
TCLP VOA Table 4 (off-site)	200 g GTL	Cool 4°C/mg/L	---	---	---	---
Total Alcohols Table 6 (off-site)	200 g AGTL	Cool 4°C/ mg/kg	(2) x 1 L AGTL	Cool 4°C/mg/L	(2) x 1 L AGTL	Cool 4°C/ mg/L
Total SVOA Table 8 (off-site)	-----	---	(3) x 1 L AGTL	Cool 4°C/ mg/L	(3) x 1 L AGTL	Cool 4°C/ mg/L
TCLP SVOA Table 7 (off-site)	200 g AGTL	Cool 4°C/ mg/L	---	---	---	---
Total SVOA Table 8 (off-site)	---	---	4.5 L AGTL	Cool 4°C/ mg/L	4.5 L AGTL	Cool 4°C/ mg/L
Total Pest/Herbicides Table 10 & 12 (off-site)		---		Cool 4°C/ mg/L		Cool 4°C/ mg/L
Total Metal Table 3 (off-site)	-----	---	(1) x 1 L GTL	Cool 4°C/ mg/L	(1) x 1 L jar, P	Cool 4°C & HNO_3 to pH < 2/mg/L
TCLP Metal Table 2 (off-site)	250 g G or P	Cool 4°C/ mg/L	-----	---	-----	---
TCLP Pest/Herbicides Table 9 & 11 (off-site)	100 g AGTL	Cool 4°C/ mg/L	---	---	---	---
Flashpoint (on-site)	-----	---	(1) x 250 mL GTL	None/ °F	-----	---
Total U (on-site)	350 g G or P	None/ ppm	(1) x 120 mL G or P	None/ ppm	(1) x 250 mL G or P	HNO_3 to pH < 2/mg/L
pH (on-site)		---		None/ pH units		---
Quantitative PFLT (on-site)		None/ present/ absent		---		---
Percent Moisture (on-site)		None/ Wt%		---		---
U-235 (on-site)	250 g G or P	None/ Wt%	(1) x 250 mL G or P	None/ Wt%	(1) x 250 mL G or P	HNO_3 to pH < 2/mg/L
Alpha-Beta (on-site)		None/ pCi/g		None/ pCi/L		---
Description of material (Color, appearance, consistency, etc.)						

ATTACH COPY OF THIS PAGE TO THE CHAIN-OF-CUSTODY.
** - NOTE TO LAB: IF PFLT FAILS, PERFORM pH AND FLASHPOINT.
ACS CONTACT: JENNY VANCE, EXT. 5372

Lab Information:
Requested TAT -- 30 days (analysis)
-- 14 days (validation)
Send Data Validation Summary to Jenny Vance.

NOTE: When Enriched Material is sampled, included the following as a note:
"Maximum total grams of U-235 to be collected = _____ grams"

Attachment 1
Format for Boxed Waste Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page 4 of 4

D. Waste Stream Description

The sub-waste stream consists of box(e's) in lot(s). The material type of "" and the source code of "" indicate that this material is .

E. Precautions and Limitations

See WMP Sampling Procedures for precautions and limitations. Also see Job Safety Analysis 272 for on-site metal box sampling.

F. Representative Sampling Procedure

The boxes chosen at random are listed on page 2 of this form. If visual inspection indicates that the material has free liquid or is completely dry, then a quantitative P.F.L.T and Percent Moisture are not necessary. Record pertinent information in the Field Log Book for each box sampled as specified in WMP Sampling Procedures. Excess sample material from samples analyzed on-site will be dispositioned as per 34-10-504, "Dispositioning Samples from the On-Site Laboratory (and Retrieving Sample From) the Sampling Disposition Facility."

G. Preservative and Holding Time Guidelines

See Tables 7.1 and 7.2 of the "Prototype Sampling and Analysis Plan for Containerized Waste at the FEMP" and/or Table 6-1 "Sample Container and Preservation Requirements," of the Sitewide CERCLA Quality Assurance Project Plan (FD-1000). Sample container , preservative, and holding time requirements for analytical parameters not provided in these tables have been obtained from federal or state of generation policies/directives, or from the FEMP or FEMP-contracted laboratory facility; and incorporated into this PSAP as permitted in Section 3.3.2 of FD-1000.

H. Variances

The grids within the boxes indicated on page 2 of this PSAP, may be replaced with an adjacent grid due to the following: material cannot be sampled or there is inadequate volume to meet the specified volume requirements. A formal variance is not required, logbook entries will record the specific variance(s).

This form must be dated and signed by an authorized individual.

If this Sub-Waste Stream is sampled and analyzed according to the information on this form, the results generated will be in agreement with the sampling and analysis requirements of PL-3048, "Prototype Sampling and Analysis Plan for Containerized Waste at the FEMP;" NTSWAC, "Nevada Test Site Defense Waste Acceptance Criteria" and the Fernald Environmental Management Project (FEMP) "(SCQ) Sitewide CERCLA Quality Assurance Project Plan (FD-1000)".

Sampling & Analysis Requestor	Date	PSAP Developer	Date	Project Manager	Date

ATTACHMENT A to Attachment 1
Diagram of Metal Boxes for Sampling

1	2	3	4
F 5	6	7	8
R 9	10	11	B 12
O 13	14	15	A 16
N 17	18	19	C 20
T 21	22	23	K 24
25	26	27	28

NOT TO SCALE
This diagram represents a metal box with dimensions of 7 ft. X 4 ft. Each sample location is approximately 1 ft. X 1 ft.

Attachment 2
Format for Surface Impoundment Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page: 1 of 4

A. Identifying Information

1) **Project Name:**
2) **Surface Impoundment:**
3) **Material Description/Matrix Code(s):**
4) **Estimated Volume of Surface Impoundment Materials:**
   Surface Water = gallons (gals)
   Sludge = cubic feet (ft^3)
5) **Dimensions of Surface Impoundment:**
   East - West = feet
   North - South = feet
   Depth = feet (maximum)
6) **Process Knowledge:**

B. Sampling Information

1) **Containers/Preservative/Holding Times:** See Tables 6.1 and 6.2 of "Prototype Sampling and Analysis Plan for Surface Impoundment Materials. "Holding times for analyses not provided in these tables may be provided in Table 6-1, Appendix A, of the (SCQ) Sitewide CERCLA Quality Assurance Project Plan (FD-1000).
2) **Sample Technique:** See Section 4.4 of "Prototype Sampling and Analysis Plan for Surface Impoundment Materials at the FEMP."
3) **Sample Point Locations:** sludge and water, see pages 2 and 3.
4) **Composite Samples:** No
5) **Field Contact:**
6) **Send Results to:**
7) **Charge No./Project Manager:**
8) **Required QC Samples:**

Field QC	Yes No	Notes
Trip Blank	____	daily, for Total VOA samples only
Field Blank	____	1 per 20 samples or 1 per sampling round
Equipment Rinsate	____	1 per 20 samples or 1 per sampling round
Duplicate/Split	____	1 per 20 samples or 1 per sampling round
Field Spike	____	1 per sixty days or 1 per project

Laboratory QC

Laboratory QC sample type and frequency requirements are provided in Appendix A (Table 2-4), and Appendix G of FD-1000.

Attachment 2
Format for Surface Impoundment Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page: 2 of 4

Sampling Information

B.9) Start with Sample Number 93-xxx # for the first sample, then number consecutively until sampling is completed. The sample point location that is to be sampled in duplicate will be indicated with an asterisk (*). The duplicate samples will be given different sample numbers.

Sample Number	Sample Type	Sample Matrix	Sample Point Location@ Northing	Easting
93-xxx-*	Grab	Sludge	xxx'	xxx'
93-xxx-*	Grab	Sludge	xxx'	xxx'
93-xxx-	Grab	Sludge	xxx'	xxx'
93-xxx-	Grab	Sludge	xxx'	xxx'
93-xxx-	Grab	Sludge	xxx'	xxx'
93-xxx-	Grab	Sludge	xxx'	xxx'
93-xxx-	Grab	Liquid	xxx'	xxx'
93-xxx-	Grab	Liquid	xxx'	xxx'
93-xxx-	Grab	Liquid	xxx'	xxx'
93-xxx-	Grab	Liquid	xxx'	xxx'
93-xxx-*	Grab	Liquid	xxx'	xxx'
93-xxx-*	Grab	Liquid	xxx'	xxx'
93-xxx-	Grab	Liquid	xxx'	xxx'
93-xxx-	Grab	Liquid	xxx'	xxx'
93-xxx-	Trip	Water		
93-xxx-	Trip	Water		
93-xxx-	Trip	Water		
93-xxx-	Trip	Water		
93-xxx-	Field	Water		
93-xxx-	Rinse	Water		

Note: @ - Easting and Northing coordinates are relative to an origin point assumed to be located on top of the dike at the southwestern corner of the surface impoundment. See attached map for illustration of these sample points.

Attachment 2
Format for Surface Impoundment Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page: 3 of 4

C. Analytical Requirements

In order to satisfy waste characterization requirements the following analyses shall be performed:

Analysis Requested (Analysis Code) ASL = Analytical Support Level VOA = Volatile Organic Analysis SVOA = Semi-Volatile Organic Analysis	Solid Matrix Samples Container and Preservative/Unit Codes oz., g = ounce, gram mg, ug = milligram, microgram kg = kilograms P00 = No preservation needed P01 = Cool 4 deg. C U02, U04 = mg/L, mg/kg U06, U19 = ug/L, pCi/g TLC = Teflon-Lined Closure		QC/Liquid Matrix Samples Container and Preservative/Unit Codes mL, L = milliliter, Liter P01 = Cool 4 deg C P09 = HCl to pH < 2 P11 = HNO_3 to pH < 2 U02, U06 = mg/L, ug/L U18 = pCi/L TLS = Teflon-Lined Septum TLC = Teflon-Lined Closure	
Total VOAs (2411)* TCLP VOAs (2459)** ASL B	(3) x 4-oz. glass, TLC	P01/U04 U06 for TCLP	(3) x 40-mL VOA vials, TLS	P09 & P01 /U06
Total SVOAs (2470)/ Pesticides (2486)* TCLP SVOAs (2471)/ Pesticides (2487)** ASL B	(1) x 8-oz. amber glass, TLC	P01/U04 U06 for TCLP	(1) x 1 gal amber glass, TLC	P01/U06
Total Metals (2402)* TCLP Metals (2401)** ASL B	(1) x 8-oz. glass or polyethylene	P01/U04 U02 for TCLP	(1) x 1 L polyethylene	P11 & P01 /U02
Alpha-Beta (2005)	(1) x 4-oz. glass or polyethylene	P00/U19	(1) * 120 mL glass or polyethylene	P11/U18
Description of material (Color, appearance, consistency, etc.)				

Note: * Analyze for QC/liquid matrix samples only.
** Solid matrix samples only. Prepare extract immediately. Use sample from a separate container for Total concentrations. If Total concentrations exceed 20 times the TCLP regulatory value, perform analysis of sample extract.

Attachment 2
Format for Surface Impoundment Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page: 4 of 4

D. Surface Impoundment Description

The surface impoundment, approximate dimensions of __ feet (east-west) by __ feet (north-south) by __ feet depth, consists of a plastic- and clay-lined structure used for _____. This structure is considered as a component of CERCLA/RCRA Unit x (CRUx), and is located between _____.

E. Safety Concerns
See project-specific health and safety plan for _____.

F. Representative Sampling Procedure

1. The number of samples per each surface impoundment material phase (i.e., liquids and solids) were calculated by the use of the following equation:

2. The spatial location of the water/sludge sample points were determined by using computer algorithms developed based upon guidance provided in EPA/230-02-89-042, "Methods for Evaluating the Attainment of Cleanup Standards, Vol. I, Soils and Solid Media", February 1989.

3. The sample area for the sludge materials was limited to the area identified in the attached map, since this area contains sufficient material thicknesses to allow for sample collection.

4. The sludge/water samples will be collected in accordance with methodology provided in Section 4.4 of "Prototype Sampling and Analysis Plan for Surface Impoundment Materials at the FEMP," using the following sequence:

   Total VOAs
   Total SVOAs/Pesticides
   Total Metals
   Alpha/Beta Screen

This form must be dated and signed by an authorized individual.

If this Sub-Waste Stream is sampled and analyzed according to the information on this form, the results generated will be in agreement with the sampling and analysis requirements of PL-3048, "Prototype Sampling and Analysis Plan for Containerized Waste at the FEMP;" NTSWAC, "Nevada Test Site Defense Waste Acceptance Criteria" and the Fernald Environmental Management Project (FEMP) "(SCQ) Sitewide CERCLA Quality Assurance Project Plan (FD-1000)".

Sampling & Analysis Requestor	Date	PSAP Developer	Date	Project Manager	Date

Attachment 3
Format for Drummed Waste Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page 1 of 4

A. Identifying Information

1) **Project Name:**
2) **Plan No.:**
3) **Material Description/Matrix Code(s):**
4) **Number of Drums in Sub-Waste Stream:**
5) **Material Type:**
6) **Source Code:**
7) **Material Evaluation Form #:**
8) **Sampling Location for Drums:**
9) **Process Knowledge:**

B. Sampling Information

1) **General:** Samples taken will be contained in glass or polyethylene jars with Teflon lined lids.
2) **Preservation Method:** See Analytical Requirements in Section C.
3) **Holding Times:** See Preservative and Holding Time Guidelines in Section G. Holding times and sample volume/container requirements for media-specific analyses not listed in FD-1000 are provided by the FEMP laboratory facility.
4) **Sample Technique:**
5) **Number of Drums to be Sampled and Analyzed:** , see page 2.
6) **Composite Samples:** No
7) **Visual Inspection Performed (# of visuals)?:** Yes ( ).
8) **Field Contact:**
9) **Send Results to:** Bill Neyer, ext. 5469, MS 46
10) **Charge No./Project Manager:**
11) **Required QA/QC Samples:**

Field QC	Yes	No	Notes
Trip Blank	___	___	volatile organic samples
Field Blank	___	___	1 per 20 samples or 1 per sampling event
Equipment Rinsate	___	___	1 per 20 samples or 1 per sampling event
Duplicate	___	___	1 per 20 samples or 1 per sampling event
Container Blank	___	X	analytical data supplied by supplier
Preserv. Blank	___	X	assay data supplied by supplier

Laboratory QC

Laboratory QC sample type and frequency requirements are provided in Appendix G of FD-1000.

Attachment 3
Format for Drummed Waste Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page 2 of 4
Charge:

Sampling Information

Start with Sample Number -1 for the first drum sample, then number consecutively until sampling is completed. The drum that is to be sampled in duplicate will be indicated with an asterisk (*). The duplicate samples will be given different sample numbers.

Sample Number	Inv. Number	Lot Number	Drum Number
FIELD (1)-1			
FIELD (1)			
FIELD (1)			
FIELD (1)			
FIELD (1)			
FIELD (1)			
FIELD (1)			
FIELD (1)			
FIELD (1)			

NOTE: If the material in the drum does not match the material description, do not sample. Perform a visual inspection of the contents of the drum.

If there is not enough material to meet the volume requirements, do not sample the drum. Perform a visual inspection of the contents of the drum.

Refer to page 1, Section B-7, for requested visuals. These will be performed regardless of the contents of the drum.

NOTE: When Enriched Material is sampled, include the following as a note:
"Material to be sampled is enriched, notifications per WMP Sampling Procedures are required."

Attachment 3
Format for Drummed Waste Material PSAP
Project-Specific Sampling and Analysis Plan

TAL Number:
Date:
Page: 3 of 4

C. Analytical Requirements

In order to satisfy waste characterization requirements the following analyses shall be performed:

Analysis Requested ASL B	Solid Matrix Samples Container and Preservative/Units		Liquid Waste Samples Container and Preservative/Units		Quality Control Samples Container and Preservative/Units	
Total VOA (off-site)	200 g, GTL	Cool 4°C/ mg/kg	(3) x 40 mL GTS	Cool 4°C/ mg/L	(3) x 40 mL GTS	Cool 4°C & HCl to pH < 2/ mg/L
TCLP VOA (off-site)	200 g GTL	Cool 4°C/ mg/L	---	---	---	---
Total Alcohols (off-site)	200 g AGTL	Cool 4°C/mg/kg	(2) x 1 L AGTL	Cool 4°C/mg/L	(2) x 1 L AGTL	Cool 4°C/ mg/L
Total SVOA (off-site)	-----	---	(3) x 1 L AGTL	Cool 4°C/ mg/L	(3) x 1 L AGTL	Cool 4°C/ mg/L
TCLP SVOA (off-site)	200 g AGTL	Cool 4°C/ mg/L	---	---	---	---
Total SVOA (off-site)	---	---	4.5 L AGTL	Cool 4°C/ mg/L	4.5 L AGTL	Cool 4°C/ mg/L
Total Pest/Herbicides (off-site)		---		Cool 4°C/ mg/L		Cool 4°C/ mg/L
Total Metal (on-site)	-----	---	(1) x 1 L GTL	Cool 4°C/ mg/L	(1) x 1 L jar, P	Cool 4°C & HNO_3 to pH < 2/mg/L
TCLP Metal (on-site)	250 g G or P	Cool 4°C/ mg/L	-----	---	-----	---
TCLP Pest/Herbicides (off-site)	100 g AGTL	Cool 4°C/ mg/L	---	---	---	---
Flashpoint (on-site)	-----	---	(1) x 250 mL GTL	None/ °F	-----	---
Total U (on-site)	350 g G or P	None/ ppm	(1) x 120 mL G or P	None/ ppm	(1) x 250 mL G or P	HNO_3 to pH < 2/mg/L
pH (on-site)		---		None/ pH units		---
Quantitative PFLT** (on-site)		None/ present/ absent		---		---
Percent Moisture (on-site)		None/ Wt%		---		---
U-235 (on-site)	250 g G or P	None/ Wt%	(1) x 250 mL G or P	None/ Wt%	(1) x 250 mL G or P	HNO_3 to pH < 2/mg/L
Alpha-Beta (on-site)		None/ pCi/g		None/ pCi/L		---
Description of material (Color, appearance, consistency, etc.)						

ATTACH COPY OF THIS PAGE TO THE CHAIN-OF-CUSTODY.
** - NOTE TO LAB: IF PFLT FAILS, PERFORM pH AND FLASHPOINT.
ACS CONTACT: JENNY VANCE, EXT. 5372

Lab Information:
Requested TAT– 30 days (analysis)
—14 days (validation)
Send Data Validation Summary to Jenny Vance.

NOTE: When Enriched Material is sampled, included the following as a note:
"Maximum total grams of U-235 to be collected =_____ grams"

Attachment 3
Format for Drummed Waste Material PSAP
Project-Specific Sampling and Analysis Plan

Number:
Date:
Page: 4 of 4

D. Sub-Waste Stream Description

The sub-waste stream consists of drum(s) in lot(s). The material type of "" and the source code of "" indicate that this material is .

E. Precautions and Limitations

See WMP Sampling Procedures for Precautions and Limitations.

F. Representative Sampling Procedure

The drums to be sampled are listed on page 2 of this form. If visual inspection indicates that the material has free liquid or is completely dry, then a P.F.L.T and Percent Moisture is not necessary. Record pertinent information in the Field Log Book for each drum sampled as specified in WMP Sampling Procedures. Excess sample material from samples analyzed on-site will be dispositioned as per 34-10-504, "Dispositioning Samples from the On-Site Laboratory (and Retrieving Sample From) the Sampling Disposition Facility."

G. Preservative and Holding Time Guidelines

See Tables 6.1 and 6.2 of the "Prototype Sampling and Analysis Plan for Containerized Waste at the FEMP" and/or Table 6-1 "Sample Container and Preservation Requirements," of (SCQ) Sitewide CERCLA Quality Assurance Project Plan (FD-1000). Sample container, preservative, and holding time requirements for analytical parameters not provided in these tables have been obtained from federal or state of generation policies/directives, or from the FEMP or FEMP-contracted laboratory facility; and incorporated into this PSAP as permitted in Section 3.3.2 of FD-1000.

H. Variances

Drums specified on page 2 of this PSAP, may be replaced due to the following: matrix can't be sampled, matrix does not match Material Type, or there is inadequate volume to meet the specified volume requirements. A formal variance is not required, logbook entries will record the specific variance.

This form must be dated and signed by an authorized individual.

If this Sub-Waste Stream is sampled and analyzed according to the information on this form, the results generated will be in agreement with the sampling and analysis requirements of PL-3048, NTSWAC, "Nevada Test Site Defense Waste Acceptance Criteria", and the Fernald Environmental Management Project (FEMP) "(SCQ) Sitewide CERCLA Quality Assurance Project Plan (FD-1000)".

Sampling & Analysis Requestor	Date	PSAP Developer	Date	Project Manager	Date

Attachment - 4
Statistical Calculations

Sampling Plan/MEF: 97-1507 NPDS
Mat. Type: cement-stabilized, solution of UNH and other uranium contaminated liquids.
Revised: 03/09/98

Analyte	Reg. Level (ppm)	Number of Samples	Statistical Mean (ppm)	Standard Deviation	Sample Variance	Standard Error	Upper CI Limit (90%)	COV sx/x	COV x/s2	# of additional samples required
TCLP Metal										
Constituent(s):										
Barium	100	3	0.718	0.085493	0.0073	0.0494	0.8111	0.0687	98.2343	0
Chromium	5	3	0.412833	0.02175	0.0005	0.0126	0.4365	0.0304	872.6817	0
Silver	5	3	0.006233	0.001595	0.0000	0.0009	0.0080	0.1477	2450.0545	0
Gamma Spectrometry										
Constituent(s):										
Uranium-238		3	861.66666	640.16274	409808.3337	369.5981	1548.7287	0.4340	0.0021	0
Thorium-232		3	0.648333	0.137143	0.0188	0.0792	0.7977	0.1221	34.4708	0
Radium-226		3	0.501667	0.179606	0.0323	0.1037	0.6972	0.2067	15.5516	0
Uranium-235		3	53.666667	35.92121	1290.3333	20.7391	92.7806	0.3864	0.0416	0
Potassium-40		3	2.375	1.67276	2.7981	0.9658	4.1964	0.4066	0.8488	0
Neptunium-237		3	0.526667	0.756593	0.5724	0.4368	1.3505	0.8294	0.9201	4
Gross Alpha (pCi/g)		3	1333.3333	960.90235	923333.3339	554.7772	2379.6432	0.4161	0.0014	0
Gross Beta (pCi/g)		3	1376.6666	962.09840	925633.3332	555.4678	2424.2789	0.4035	0.0015	0
Total U (ICP-MS) (PPM)		3	2455.3333	1572.2182	2471870.3325	907.7206	4167.2945	0.3697	0.0010	0

Discussion:

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APPENDIX B

DQO WS-012
SILO 3 SAMPLING AND ANALYSIS OF TREATED WASTE MATERIAL

Fernald Environmental Management Project

Data Quality Objectives

Title: Silo 3 Sampling and Analysis of Treated Waste Material

Number: WS-012

Revision: 1

Effective Date: Draft

Contact Name: James Cross

Approval: _____ Date: 4/12/00
James Chambers
DQO Coordinator

Approval: _____ Date: 4/12/00
Karen Wintz
Silo 3 Project Director

Rev. #	0						
Effective Date:	4/14/2000						

DATA QUALITY OBJECTIVES
Sitewide Certification Sampling and Analysis

Members of Data Quality Objectives (DQO) Scoping Team

The members of the scoping team included individuals with expertise in Quality Assurance (QA), analytical methods, field sampling, statistics, laboratory analytical methods and data management.

Conceptual Model of the Site

Sampling of Silo 3 was originally conducted at the Fernald Environmental Management Project (FEMP), during the Operable Unit 4 (OU4) Remedial Investigation/Feasibility Study (RI/FS). Silos 1, 2, and 4, which are also part of OU4, will not be discussed in this DQO; details on those silos can be found in the OU4 Record of Decision (ROD).

The material in Silo 3 is classified as byproduct material, as defined in Section 11(e)(2) of the Atomic Energy Act of 1954. This material is known as cold metal oxides, which were generated at the FEMP site during uranium extraction operations in the 1950s. These oxides were formed by calcining residues from the solvent extraction process used to extract uranium from ore concentrates and residues. Silo 3 material is dry and powdery and contains similar radiological constituents as those found in Silos 1 and 2. However, certain radionuclides (such as radium) are present in much lower concentrations. On an activity basis, the predominant radiological constituent of the Silo 3 material is thorium-230 (^{230}Th). Other radionuclides seen in the material are thorium-232 (^{232}Th), uranium-235 (^{235}U), uranium-238 (^{238}U), actinium-227 (^{227}Ac), radium-226 (^{226}Ra), protactinium-231 (^{231}Pa), and lead-210 (^{210}Pb). Data from the OU4 Record of Decision [Extraction Procedure Toxicity analysis, since replaced by the Toxicity Characteristic Leaching Procedure (TCLP)] indicates Silo 3 material contains the eight Resource Conservation and Recovery Act (RCRA) metals. By agreement with the Ohio Environmental Protection Agency (OEPA), those with mean concentrations high enough to be considered constituents of concern are arsenic, cadmium, chromium, and selenium.

The OU4 Explanation of Significant Differences resulted in a recommendation to remediate and treat the material contained in Silo 3 separately from the materials contained in Silos 1 and 2. The recommended treatment for the Silo 3 materials is chemical stabilization.

1.0 Statement of Problem

After the Silo 3 material is stabilized, it must be tested to determine whether the stabilized material meets the more conservative of the Nevada Test Site (NTS) or Envirocare disposal requirements, since these are the two possible disposal locations. Additionally, the OU4 ROD commits the FEMP to perform TCLP testing for arsenic, cadmium, chromium, and selenium. Material not meeting the requirements cannot be sent to either location.

Appropriate sampling, analysis, and information management criteria must be developed to provide the required qualified data necessary to demonstrate compliance with disposal criteria. A sampling and analysis plan must be in place directing appropriate batch sampling frequency and analytical methodologies to provide the required data.

Available Resources
Project Constraints: Sampling and analytical testing must be performed with existing manpower, materials, and equipment. Fluor Fernald must demonstrate compliance with NTS and/or Envirocare disposal requirements and the RCRA limits for metals.

2.0 Identify the Decision

Decision
Demonstrate within each day's production/treatment that all constituents of concern pass the disposal criteria for NTS or Envirocare (whichever is used), and demonstrate the material passes the TCLP metals requirements. The Envirocare acceptance criteria are contained in *Envirocare Waste Acceptance Guidelines*, July 28, 1999. The NTS waste acceptance criteria are contained in Fernald plan PL-3048. For TCLP metals, the levels of concern are the RCRA limits.

Possible Results

1. The average concentration of each constituent of concern is demonstrated to be below the level of concern within the confidence level. The material then meets the waste disposal criteria.

2. The average concentration of at least one constituent of concern is demonstrated to be above the level of concern at the given confidence level.

3.0 Inputs That Affect the Decision

Required Information
Data will be obtained through physical sampling. Based on the analytical results, the average concentrations of each batch will be determined.

Levels of Concern
Specific radionuclide and characteristic action levels are contained in the Envirocare and NTS guidances. Organic and metals limits are the RCRA TCLP limits.

Methods of Sampling and Analysis
Samples will be collected in accordance with RMRS sampling procedures, which meet the intent of site requirements. Laboratory analysis will be conducted at Analytical Support Level (ASL) E for radiological constituents and ASL B for all other laboratory analyses using QA/QC protocols specified in the Siteewide CERCLA Quality Assurance Project Plan (SCQ). For FEMP-approved on- and off-site laboratories, the analytical method used will meet the required precision, accuracy and detection capabilities necessary to achieve waste acceptance criteria (WAC) analyte ranges.

4.0 The Boundaries of the Situation

Spatial Boundaries
Domain of the Decision: The boundaries of this DQO extend to all Silo 3 material.

Population of Material: Each day's production/treatment of silo material will consist of 120 drums of material.

5.0 Decision Rule

The material can only be released for disposal if it meets the waste disposal criteria for the applicable disposal location and the RCRA limits for TCLP metals agreed upon with the Ohio EPA.

Parameters of Interest
An agreement with Envirocare allows the testing for a subset of the list of analytes contained in their acceptance guidance. This agreement was possible due to the characterization of the material in the OU4 ROD. Specifically, each day's production of material must be tested for pH, pyrophoricity, and radionuclides (^{230}Th, ^{232}Th, ^{235}U, ^{238}U, ^{227}Ac, ^{226}Ra, ^{231}Pa, and ^{210}Pb). Analysis must also be performed for the 32 RCRA organics plus PCBs in the event of positive PID readings. Each day's production must also be analyzed to determine leachable arsenic, cadmium, chromium, and selenium by agreement with the Ohio EPA.

Action Levels
Specific radionuclide and characteristic action levels are contained in the Envirocare and NTS guidances. Organic and metals limits are the RCRA TCLP limits.

Decision Rules
If the average concentration of radiological constituents in a day's production is below the level of concern, the material may be disposed. If the average concentration of radiological constituents of a particular day's production exceeds the disposal criterion, the drums must be shipped with other drums of lower concentration such that the average concentration of all drums shipped together is less than the disposal criteria.

If the RCRA TCLP limits are exceeded in a day's production, individual samples making up the composite will be analyzed to determine which drums must be reprocessed, retreated, and reanalyzed until such time as the material meets the RCRA TCP limits.

6.0 Limits on Decision Errors

Types of Decision Errors and Consequences

Definition
Decision Error 1: This decision error occurs when the decision-maker decides that a day's production has met the disposal criteria, when in reality, the disposal criteria have not been met. This situation could result in refusal by an off-site facility to dispose of the waste and an increased risk to human health and the environment. In addition, this type of error could result in increased disposal fees or a return of the waste from the off-site facility to the FEMP. This error may also result in misidentification of DOT shipping determination.

Decision Error 2: This decision error occurs when the decision-maker decides a day's production does not meet the disposal criteria, when actually, the disposal criteria have been met. This error would result in unnecessary added costs and/or delays, and may also result in misidentification of DOT shipping determination.

True State of Nature for the Decision Errors
The true state of nature for Decision Error 1 is that the disposal criteria are not met. The true state of nature for Decision Error 2 is that disposal criteria are met. Decision Error 1 is the more severe error due to the potential threat this poses to human health and the environment.

7.0 Design for Obtaining Quality Data

Sample Locations
After treatment, the Silo 3 material will be staged in drums (approximately 120 drums per day). Samples will be taken from material from the beginning (40th drum), middle (80th drum), and end (120th drum or the last drum produced in a day) to ensure process consistency. These samples will be composited prior to analysis.

Laboratory Analysis

The samples will be submitted to the on-site laboratory or a FDF approved off-site laboratory for analysis. All analyses will meet ASL B requirements per the SCQ except for the HAMDCs of the radiological parameters. Analysis of the radiological parameters will be considered ASL E.

Validation

All field data generated will be validated. Also, a minimum of 10 percent of the analytical data from each laboratory will be subject to analytical validation to ASL B requirements in the SCQ.

Data Quality Objectives
Sitewide Certification Sampling and Analysis

1A. Task Description:

1B. Project Phase: (Put an X in the appropriate selection.)

RI☐ FS☐ RD☐ RA☒ RvA☐ Other (specify) _____

1C. DQO No.: _____ DQO Reference No.: _____

---

2. Media Characterization: (Put an X in the appropriate selection.)

Air☐ Biological☐ Groundwater☐ Sediment☐ Soil☐
Waste☒ Wastewater☐ Surface Water☐ Other (specify) _____

---

3. Data Use with Ananlytical Support Level (A-E): (Put an X in the appropriate Analytical Support Level selection(s) beside each applicable data use)

Site Characterization A☐ B☐ C☐ D☐ E☐	Risk Assessment A☐ B☐ C☐ D☐ E☐
Evaluation of Alternatives A☐ B☐ C☐ D☐ E☐	Engineering Design A☐ B☐ C☐ D☐ E☐
Monitoring During Remediation A☐ B☐ C☐ D☐ E☐	Other A☐ B☒ C☐ D☐ E☒

4A. Drivers: Remediation Area Remedial Action Work Plans, Applicable or Relevant and Appropriate Requirements (ARARs) and Operable Unit 4 Record of Decision (ROD).

4B. Objective: Confirmation that the treated Silo 3 waste meets the appropriate off-site disposal facility waste acceptance criteria requirements.

---

5. Site Information (Description):

Silo 3 materials are classified as byproduct material as defined in Section II (e)(2) of the Atomic Energy Act of 1954. This material is known as cold metal oxides and was generated at the FEMP during uranium extraction operations in the 1950s. The OU4 Explanation of Significant Difference recommended remediation and treatment (chemical stabilization) for the material in Silo 3. The sampling and analysis performed under this DQO will provide the data required by the appropriate licensed off-site disposal facility.

6A. Data Types with appropriate Analytical Support Level Equipment Selection and SCQ Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the SCQ Section.)

1. pH	☒	2. Uranium	☒[1]	3. BTX	☐
Temperature	☐	Full Radiological	☒[2]	TPH	☐
Specific Conductance	☐	Metals	☒	Oil/Grease	☐
Dissolved Oxygen	☐	Cyanide	☐		
Pyrophoricity	☒	Silica	☐		
4. Cations	☐	5. VOA	☒	6. Other (specify)	
Anions	☐	BNA	☒		
TOC	☐	PEST	☒		
TCLP	☐	PCB	☐		
CEC	☐	COD	☐		

1 ^{235}U and ^{238}U
2 ^{230}Th, ^{232}Th, ^{227}Ac, ^{226}Ra, ^{231}Pa, and ^{210}Pb(value calculated)

6.B. Equipment Selection and SCQ Reference:

Equipment Selection		Refer to SCQ Section
ASL A		SCQ Section
ASL B	Per SAP	SCQ Section Appendix G, Tbls. 1&3
ASL C		SCQ Section
ASL D		SCQ Section
ASL E	Per SAP	SCQ Section Appendix H (final)

7A. Sampling Methods: (Put an X in the appropriate selection.)

Biased☐ Composite☐ Grab☒ Environmental☐ Grid☐
Intrusive☒ Non-Intrusive☐ Phased☐ Source☐ Random☐

7B. Sample Work Plan Reference: Sampling and Analysis Plan for Silo 3 Treated Waste Material

Background samples: OU4 RI/FS

7C. Sample Collection Reference: RMRS Procedures

8. Quality Control Samples: (Put an X in the appropriate selection.)

8A. Field Quality Control Samples:

Trip Blanks	☒[1]	Container Blanks	☐
Field Blanks	☐	Duplicate Samples	☒
Equipment Rinsate Blanks	☐	Split Samples	☐
Preservative Blanks	☐	Performance Evaluation Samples	☐

Other (specify) _____

1) Collected for volatile organic sampling

8B. Laboratory Quality Control Samples:

Method Blank	☒	Matrix Duplicate/Replicate	☒
Matrix Spike	☒	Surrogate Spikes	☒
Tracer Spike	☒	Other (specify) _____	

---

9. Other: Please identify any other germane information that may impact the data quality or gathering of this particular objective, task, or data use.

4.0 Silo 3 Gross
Decon. Plan

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Rocky Mountain
Remediation Services, L.L.C
. . . protecting the environment

FERNALD SILO 3 PROJECT

Silo 3 Gross Decontamination Plan
RMR-0445-ENG-016-000

May 12, 2000

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5.0 APPLICATION METHODS 2

6.0 REFERENCES 2

Acronyms and Abbreviations

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Fluor Fernald	Fluor Fernald, Inc.
psi	pounds per square inch
ReTRIEVR	Reeled Cable Incremental Link Extending Vacuuming Robot
RMRS	Rocky Mountain Remediation Services, L.L.C.

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1.0 PURPOSE

Rocky Mountain Remediation Services (RMRS) will remove visible Silo 3 material and apply a fixative to the interior of Silo 3 prior to shutdown and dismantlement of the Silo 3 Project. The definition of "visible Silo 3 material" is material that is obvious to the naked eye and that, if rubbed or rinsed, would be easily removed. The visible Silo 3 material includes bottom and side heel material adhering to the interior surface of Silo 3. RMRS will not decontaminate the Silo 3 walls to remove fixed contamination.

The general method for the removal of the visible Silo 3 material is described in this plan. The Retrieval Technology Description (RMR-0445-ENG-003) details the planned approach, material removal sequence, and retrieval system components to accomplish the removal of the Silo 3 material. The physical condition of the silo and the amount of visible Silo 3 material remaining after retrieval are not known at this time.

As the Silo 3 Project progresses, this plan will be updated to address removal of visible Silo 3 material. This plan will be revised to reflect the methodology for inspection of the Silo 3 interior and provide information to support the safety basis documentation that confirms the inspection method as safe and effective.

The plan is presented in terms of:

- Methods and equipment,
- Material Management (methods to control, handle, segregate, and minimize secondary waste as well as characterize, treat, and storage of secondary waste),
- Product data (manufacturer's technical information, the material to be used, its intended use, and its application instructions), and
- Application methods of coatings and sealers.

2.0 METHODS AND EQUIPMENT

RMRS will supply the equipment required to remove visible Silo 3 material and apply a fixative to the Silo 3 interior after the material retrieval and treatment is complete, but prior to shutdown and dismantlement of the Silo 3 Project.

RMRS will use a camera to inspect the interior of Silo 3 prior to removal of visible Silo 3 material. Visible Silo 3 material may be recognized as wall irregularities, discoloration, or by other acceptable means.

Areas where visible Silo 3 material is suspected, will be cleaned using a low pressure (less than 50 pounds per square inch (psi) air lance with or without a brush attached to the reeled cable

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incremental link extending vacuuming robot (ReTRIEVR). The visible Silo 3 material will then be vacuumed and processed. The ReTRIEVR will then apply fixative to the interior surfaces of Silo 3 (RMR-0445-ENG-003).

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2.1 Removing Contamination

Air jets mounted on the ReTRIEVR will be used to help dislodge visible Silo 3 material and to sweep the material into a more confined area to be vacuumed. The air-sweep and vacuum sequence will continue until Silo 3 is determined to be clean. Fluor Fernald, Inc. (Fluor Fernald) will provide verification and written concurrence, to RMRS, that Silo 3 is determined to be clean.

2.2 Fixing Contamination

The ReTRIEVR, retrieval arm and mast, will be removed and a fixative application tool will be attached and the interior of Silo 3 will be sprayed with fixative. Application of the fixative spray may be monitored using the computer position verification system. Fluor Fernald will provide verification and written concurrence, to RMRS, that Silo 3 fixative has been applied.

3.0 MATERIAL MANAGEMENT

Secondary waste, associated with removal of material in Silo 3, is not anticipated because no solids or liquids will be added to facilitate removal of the Silo 3 material. If secondary waste is generated, management of the secondary waste will be consistent with waste management practices described in the Operational Environmental Control Plan (RMR-0445-ENG-015).

4.0 PRODUCT DATA

A Fluor Fernald approved stabilizer or non-strippable coating will be applied to the Silo 3 interior. Carboline D3358, or its approved equivalent, will be used if a stabilizer coating is applied. Polymeric Barrier System, or its approved equivalent, will be used if a non-strippable coating is applied.

5.0 APPLICATION METHODS

Application methods for stabilizers or non-strippable coatings will be consistent with manufacturer's instructions.

6.0 REFERENCES

RMR-0445-ENG-003, Retrieval Technology Description

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RMR-0445-ENG-015, Operational Environmental Control Plan

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Rocky Mountain
Remediation Services, L.L.C.

FERNALD SILO 3 PROJECT

Operational Environmental Control Plan RMR-0445-ENG-015-001

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ACRONYMS AND ABBREVIATIONS

Ag	silver
ALARA	as low as reasonably achievable
anti-Cs	anti-contamination clothing
ARARs	applicable or relevant and appropriate requirements
As	arsenic
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AWWT	advanced wastewater treatment
Ba	barium
BAT	best available technology
Cd	cadmium
CDF	commercial disposal facility
CFR	Code of Federal Regulations
Cr	chromium
DCGs	derived concentration guides
DOE	Department of Energy
DOT	Department of Transportation
EDE	effective dose equivalent
Fe	iron
Fluor Fernald	Fluor Fernald, Inc.
FEMP	Fernald Environmental Management Project
ft.	feet
ft^3	cubic feet
gal./day	gallons per day
gal./min.	gallons per minute
HEPA	high-efficiency particulate air
Hg	mercury
HVAC	heating, ventilation, and air conditioning
in.	inch
kg./day	kilograms per day
lb.	pound
lb./day	pounds per day
lbs/drum	pounds per drum
ISA	Interim Storage Area
LLW	Low-Level Waste
microgram/m^3	microgram per cubic meter
min.	minute
mph	miles her hour
mrem	millirem
mrem/yr.	millirem per year
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System

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ACRONYMS AND ABBREVIATIONS (CONTINUED)

OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	off-site disposal facility
Pb	lead
pCi/L	picocuries per liter
PFD	process flow diagram
PPE	personal protective equipment
ppm	parts per million
P/D	positive displacement
PQP	project quality procedure
RCA	Radiological Control Area
RCRA	Resource Conservation and Recovery Act
ReTRIEVR	rolled cable incremental link extending vacuuming robot
RMRS	Rocky Mountain Remediation Services, L.L.C.
Rn	radon
ROB	roll-off box
Se	selenium
SWIFTS	site-wide inventory forecasting and tracking system
TSS	total suspended solids
WAC	waste acceptance criteria
°F	degrees Fahrenheit
%	percent
#	number

1.0 PURPOSE

This plan describes the methods and materials that Rocky Mountain Remediation Services, L.L.C. (RMRS) shall use during Silo 3 Project operations to control: air emissions, fugitive dust, wastewater, stormwater, erosion, and waste. The methods and materials will be designed to minimize the impact of Silo 3 Project operations on the environment. This plan addresses the remediation of Silo 3 material including material retrieval, staging, treatment and storage, processing, material management, and transportation at the Silo 3 Retrieval Facility, Treatment Facility, and the Interim Storage Area (ISA) at the U.S. Department of Energy (DOE) Fernald Environmental Management Project (FEMP) site, Fernald, Ohio. This plan contains the following:

- Air Emissions Control–Description of the process controls to be used for planned stack or other air monitoring. This includes a description of how Silo 3 operations will ensure that emissions from material handling and processing equipment meet applicable or relevant and appropriate requirements (ARARs) and as low as reasonably achievable (ALARA) requirements.

- Fugitive Dust Control–Description of the methods and materials to be used by the Silo 3 Project to suppress and minimize the creation and dispersion of dust.

- Wastewater Control–Description of the design features and methods to be used to eliminate, minimize, or recycle the wastewater produced during Silo 3 Project operations. The wastewater control description will identify where wastewater will be generated, explain the pretreatment methods to be used, and cover the methods that will be used to segregate wastewater containing listed waste from other wastewater streams.

- Stormwater Control–Description of the methods, material and existing site features to be used by the Silo 3 Project to capture and control stormwater.

- Erosion Control–Description of the methods and material to be used to prevent erosion of soil either by wind or surface water in the Silo 3 Project area to reduce sediment loading in the stormwater.

- Waste Management–Description of the methods to be used to manage secondary waste and debris generated during the Silo 3 Project operations, including tracking of the secondary waste through the Fluor Fernald, Inc. (Fluor Fernald) site wide inventory forecasting and tracking system (SWIFTS) database.

The Silo 3 Project facility layouts are illustrated in the general arrangement plan, drawing 53-3230.

2.0 AIR EMISSIONS CONTROL

The point source air emission data, document RMR-0445-ENG-010, (Appendix, A) describes the processes by which both area and point source emissions of air contaminants are controlled and monitored during the operation of the Silo 3 Project. It is anticipated that air contaminants, from two main sources, could occur: (1) Silo 3 and (2) the Treatment Facility. The design basis, specific air discharge points include:

- Silo 3's air evacuation discharge point.
- Air locks.
- Treatment Facility's air evacuation discharge point.

The locations of the probable air emissions are illustrated on the civil site plan, and the process flow diagram (PFD) 55-2008. Air emission control requirements include the control of fugitive and point source air contaminants in accordance with the FEMP's best available technology (BAT). The use of BAT is a substantive requirement of the Ohio Administrative Code (OAC), Section 3745-31-05(a)(3).

The Silo 3 gas treatment HVAC is presented in drawing 55-2008. Elements of the design for Silo 3 gas treatment operation, that minimize the potential for release of radioactive air emissions to the environment with respect to the retrieval and conveyance system, treatment system and ISA for treated Silo 3 material, are presented in Sections 2.1.1 to 2.1.3.

For radionuclide particulate emission sources at the FEMP, the Ohio Environmental Protection Agency (OEPA) has specified that BAT is the use of high-efficiency particulate air (HEPA) filters. The use of HEPA filters is also required for compliance with 40 Code of Federal Regulations (CFR) 61, Subpart H. HEPA filters, pre-filters, and housing assemblies will be obtained in accordance with Silo 3 Project Technical Specifications and Project Quality Procedure (PQP) 7.1, Control of Purchased Items and Services.

Emission of radionuclide particulate materials, excluding radon, will meet the requirements of 40 CFR Part 61, Subpart H, National Emission Standards for Hazardous Air Pollutants (NESHAP). 40 CFR Part 61.92, states that emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent (EDE) of 10 millirem (mrem)/year or greater.

Provisions will be provided to monitor radon, emissions, during the Silo 3 Project, to verify that the site fence line radon concentration will not exceed the annual background average of 0.5 picocuries per liter (pCi/L) above background.

The headspace above the waste material in Silo 3 is known to contain elevated radon concentrations. The OU4 RI reports the Silo 3 headspace radon concentration at the 95 percent upper confidence limit (UCL) at 239,000 pCi/L. The OU4 RI reports the Silo 3 headspace volume at between 17,100 ft^3 and 17,754 ft^3.

Prior to initial access to the Silo, air flow will be established into the silo through a HEPA-filtered air inlet line hot-tapped into the center manway. Air flow will be established out of the Silo through the return air line connected to one of the auxiliary Silo ports (stream 5 on drawing 55-2000). The flow from this line will continue to the off gas baghouse filter and the remainder of the HVAC system. This airflow will allow a slightly negative pressure to be established in the silo prior to initial access and will assure that any emissions are routed through the HVAC system. This air stream is HEPA filtered to control particulate emissions, and is continuously monitored for both particulate radionuclides and radon. The flow from the Silo headspace to the HVAC system during this initial establishment of air flow will be closely metered to assure that exhaust stack emissions and resultant fence line impacts are within the steady-state emission estimates documented in Section 2.1.4 and Appendix A of this Plan. Weather conditions will be evaluated before the start of the radon release to assure that atmospheric stability and inversion conditions are consistent with the As Low As Reasonably Achievable (ALARA) principle.

2.1 Air Emissions Controls

The Silo 3 Project design controls air emissions through containment of the untreated Silo 3 material. Containment will be achieved as follows:

- Primary containment will consist of Silo 3, the retrieval hose, the inner conveyance pipe, and a double-walled pipe connected to the Treatment Facility equipment.

- Secondary containment is the associated equipment that will provide a seal to the Silo 3 dome, the reeled cable incremental link extending vacuuming robot (ReTRIEVR), the outer conveyance pipe, and the Treatment Facility inner enclosure.

- Tertiary containment is the Treatment Facility outer enclosure and the Retrieval Facility enclosure that will prevent environmental contamination and protect equipment from the weather.

The Treatment Facility will have inner and outer enclosures and will contain the filter receiver, processing system, reject material crushers, mixer, briquette maker, filter bag houses, a series of drag conveyors to move Silo 3 material through the system, and several process-related tanks. In addition, a ventilation module will provide a negative atmosphere to the contamination control barriers of the equipment and Silo 3. HEPA-filtered air, from the ventilation module, will be exhausted to the atmosphere through a series of multiple filters and single stage of HEPA filtration. After the Silo 3 material is processed, the briquettes will be placed into Department of Transportation (DOT) IP-2-metal 55-gallon drums. The filled drums will then be sealed and surveyed for surface radiological contamination prior to being palletized and transported, by forklift, to the ISA.

2.1.1 Retrieval and Conveyance System

The Silo 3 retrieval and conveyance system will be designed to minimize:

- Airborne contamination and, as a result, minimize a release of radioactive emissions by using a vacuum pump and double-walled pipe to convey untreated Silo 3 material to the treatment system and HEPA filters.

- Radioactive particulate release using a multiple filter HVAC system; filter air through the filter module made up of roughing filters, 95 percent (%) American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) filters, HEPA filters, and using isolation valves installed on Silo 3 equipment.

2.1.2 Treatment System

The Silo 3 treatment system will be designed to minimize:

- Airborne contamination and, as a result, minimize a release of radioactive emissions by using ventilated, sealed and closed conveying systems, hoppers and feeders during the handling of untreated Silo 3 material inside of the Process and Treatment Facilities.

- Airborne contamination and, as a result, minimize a release of radioactive emissions by using a non-cyclic briquette maker, venting and filtering equipment, and providing air hoods in potentially dusty areas.

- Particulate release using a multiple filter HVAC system and using isolation valves installed on Silo 3 treatment equipment.

2.1.3 Interim Storage Area

The Silo 3 ISA will be designed to:

- Minimize airborne contamination and, as a result, minimize a release of particulate and radon emissions by placing the briquettes in 55-gallon drums, sealing the drums, and requiring that the filed drums will not be opened outside of the Treatment Facility.

- Minimize particulate release using only approved 55-gallon drums constructed of high integrity steel and by sealing the drums prior to transporting them to the ISA.

- Maintain package integrity by palletizing drums and stack pallets to a maximum of two high on the paved ISA.

2.1.4 Estimated Point Source Air Emission Data

goes to a common plenum for release to the environment through the monitored Silo 3 Treatment Facility exhaust stack. The Silo 3 Treatment Facility exhaust stack is equipped with an air particulate monitor and a continuous radon monitor. The air particulate monitor is continuous and the monitor results will be electronically recorded in the control room on the data management system.

Exhibit 2.1-1: Estimate of Release from the Silo 3 Treatment Facility Exhaust Stack

Exhaust stack flow	16,003 ft.^{3}/min. (actual)
Off-gas density	0.0664 lb./ft.^{3}
Off-gas temperature	115°F (no stack effect)
Stack exit velocity	35 mph
Stack diameter	32 in.
Stack height	60 ft.
Particulate emission	2.329 micrograms/m^3
Radionuclide emission	0.001047 pCi/L (Rn not included)
Radon (Rn) emission	653.73 pCi/L (unabated)

To determine Silo 3 Project compliance with 40 CFR 61, Subpart H, and other ARARs, dispersion modeling was performed to quantify the emissions from the Silo 3 Treatment Facility exhaust stack. Dispersion modeling, of the Silo 3 Treatment Facility exhaust stack emissions, was also used to determine the Silo 3 Project impact on off-site emissions. The dispersion modeling, for the Silo 3 Treatment Facility exhaust stack emissions, used the FEMP site-specific metrology data and the CAP88-PC modeling package, to be consistent with the requirements of 40 CFR 61, Subpart H. The results of the dispersion modeling for the Silo 3 Treatment Facility exhaust stack emissions are summarized in Exhibit 2.1-2.

Exhibit 2.1-2: Results of Dispersion Modeling for Releases from the Silo 3 Treatment Facility Exhaust Stack

Maximum EDE to off-site receptor (excluding Rn) uncontrolled	2.6 mrem/yr.
Maximum annual average FEMP fence line Rn concentration	0.003 pCi/L
Maximum hourly average FEMP fence line Rn concentration	0.21 pCi/L

Modeling of radionuclide emissions, not including radon, without credit for control equipment, predicted a maximum EDE off-site of 2.6 mrem/year. Therefore, the HVAC system has a continuous isokinetic stack sampler, as required by 40 CFR 61.93. Modeling of radon emissions, predict a fence line impact significantly below the 0.5 pCi/L annual average criterion. The HVAC system will, however, include a continuous radon monitor.

predicted a maximum EDE off-site of 0.1 mrem/year. Therefore, the HVAC system has a continuous isokinetic stack sampler, as required by 40 CFR 61.93. Modeling of radon emissions, predict a fence line impact significantly below the 0.5 pCi/L annual average criterion. The HVAC system will, however, include a continuous radon monitor.

3.0 FUGITIVE DUST CONTROL

This section describes the methodology to be used to control fugitive dust emissions and ensure compliance with applicable regulatory requirements, OAC-3745-17, and the site-specific limits in the Silo 3 Project area. When the Silo 3 Project is operating, generation of fugitive dust will be minimized by the containment systems to control air emissions as discussed in Section 2.0. Silo 3 material processing will be performed in negative pressure containment buildings. Site-specific BAT measures, for the control of fugitive dust, are defined in FEMP Fugitive Dust Control Requirements, RM-0047. Application of these requirements to the Silo 3 Project is defined in the Pre-Operational Environmental Control Plan, RMR-0445-0060. These same measures will be used to ensure that dust suppression is maintained during Silo 3 Project operations.

4.0 WASTEWATER CONTROL

This section describes the design features that will eliminate wastewater produced during Silo 3 Project operations. The Silo 3 treatment system is designed to use process wastewaters to the maximum extent possible. Water is not used in the retrieval and conveyance system; therefore process wastewater controls are not applicable to this component of Silo 3 Project operations. Water is not used within the ISA; therefore process wastewater controls do not apply to this component of Silo 3 Project operations.

The Silo 3 treatment system will use water from the FEMP water system (nominal 1650gal./day for a four-day week) and is to be supplemented by process washwater. The process washwater will be generated as the mixer is rinsed to remove residual material, collected in the process water tank, and recycled back to the treatment system. To accommodate the process washwater, a 500-gallon tank will be placed in the Treatment Facility.

The Silo 3 Project design promotes waste minimization and recycling: to limit the volume of Silo 3 material impacted wastewaters generated during the treatment process. However, if the amount of wastewater generated exceeds process needs, then the wastewater in the tanks will be characterized to assess if the FEMP advanced wastewater treatment (AWWT) system pretreatment criteria, as identified in Exhibit 4.0-1, are met. If the wastewater meets the pretreatment standards, then the wastewater can be released directly to the AWWT system for final treatment. If the wastewater does not meet the pretreatment criteria, then the wastewater will be pretreated to meet the requirements of the AWWT. It is anticipated that Envirobond™ and flocculent will be added to wastewater that does not meet the pretreatment criteria, and the residual wastewater will be processed through the Treatment Facility radioactive liquid waste system in accordance with the AWWT pretreatment criteria.

Exhibit-4.0-1: Pretreatment Limits for Silo 3 Project Wastewater Discharge

MAXIMUM FLOW:			5 gal./min. (7,200 gal./day)	
TOTAL SUSPENDED SOLIDS (TSS)			1,000 parts per million (ppm)	
METALS PARAMETER	***DISCHARGE LIMITS*** kilograms per day (kg/day)	pounds per day (lb./day)	**RADIONUCLIDE PARAMETER**	**DISCHARGE LIMITS** picocuries per liter **(pCi/L)**
Arsenic (As)	0.14	0.3	Actinium-227	10
Barium (Ba)	2.7	6.0	Lead-210	30
Cadmium (Cd)	0.006	0.013	Polonium-210	80
Chromium (Cr)	0.14	0.3	Protactinium-231	10
Lead (Pb)	0.03	0.07	Radium-226	100
Mercury (Hg)	0	0	Radium-228	100
Selenium (Se)	0.03	0.06	Thorium-228	400
Silver (Ag)	0.0014	0.003	Thorium-230	300
Iron (Fe)	0.03	0.06	Thorium-232	50
			Uranium-243	5 ppm
			Uranium-235/236	
			Uranium-238	

Liquid wastes, discharged from the Silo 3 Treatment Facility, will be sent to the FEMP AWWT and meet the acceptance criteria of the AWWT. Wastewater will be retained for characterization prior to batch discharge to the AWWT. Wastewater that does not meet the AWWT criteria will be processed through the Treatment Facility radioactive liquid waste system. Envirobond™ and flocculent will be added to wastewater that does not meet the AWWT criteria, and the residual wastewater will be processed through the Treatment Facility radioactive liquid waste system.

Based on the mass balance data (and confirmed by analytical data during operations), and process knowledge, wastewater from the Treatment Facility may be able to be sent, without pretreatment, to the AWWT system for final treatment prior to discharge under the site National Pollutant Discharge Elimination System (NPDES) permit.

The following criteria will be implemented for excess wastewater handling:

- No listed or characteristic hazardous waste, as defined under Resource Conservation and Recovery Act (RCRA), may be discharged in the wastewater.
- Discharge of TSS, in excess of 1,000 ppm, shall not be allowed.

- Wastewater discharges shall be monitored and reported to Fluor Fernald for the following constituents:

Metal and Anions:

Arsenic	Lead	Chloride
Barium	Mercury	Nitrates
Cadmium	Selenium	Carbonate
Chromium	Silver	Sulfate

Limits for radionuclide concentrations (except uranium) are based on DOE Order 5400.5 derived concentration guides (DCGs) for water. The limit for total uranium is based on treatability at the AWWT facility.

Wastewater, meeting the AWWT, will be batched and wastewater discharge volumes and analytical results shall be recorded. The records of discharge volumes and analytical results shall be maintained. Prior to discharge of wastewater, RMRS will collect the required samples of wastewater and provide them promptly to Fluor Fernald for analysis.

Process wastewater shall be discharged to an existing line that feeds the headworks of the AWWT or other method that is provided by Fluor Fernald.

If excess wastewater does not meet the AWWT acceptance guidelines, then the water will be treated with Envirobond™ and flocculent and processed through the Treatment Facility radioactive liquid waste system. If the treated wastewater still does not meet the AWWT acceptance criteria, then the water will be solidified and stabilized with cement or bentonite in 55-gallon drums inside the Treatment Facility.

It is estimated that 500 gallons of Silo 3 Project process and decontamination wastewaters will be generated, primarily as a component of shutdown and dismantlement, by project completion. The decontamination wastewater will be recycled through the decontamination process to minimize the total quantities of water generated and then treated, as necessary, to ensure compliance with the AWWT pretreatment criteria. The final decontamination water will be collected, sampled for characterization, and tanked for disposal on-site depending on whether the acceptance criteria for the AWWT facility can be met. If the final decontamination water (anticipated 500 gallons) exhibits the characteristics of a hazardous waste for cadmium, chromium, lead, or selenium, then the tank will be decontaminated to meet the applicable RCRA closure requirements. The final decontamination water, in the holding tanks, will be removed as completely as practicable. The tanks will be washed with approximately five percent or less of each tank's volume and the rinsates managed in the AWWT. The decontaminated empty tank will be disposed of as Low-Level waste (LLW).

If process, raw, or decontamination water generated during project closure does not meet the AWWT pretreatment criteria and the water cannot be used as process water, then the water will be pretreated and dispositioned as described above for excess wastewater. Regardless of their hazardous characteristics, the wastewaters will be sampled and analyzed to determine whether

the materials, in isolation, meet input restrictions for the AWWT. If any individual wastewater stream contains either radionuclides or hazardous substances above discharge limits, then the waters may be combined with other wastewaters generated during project closure so that plant input criteria are not exceeded.

When spills or leaks of water contain sufficient concentrations of Silo 3 material to exceed RCRA a characteristic hazardous waste limit, then the water will be pretreated and dispositioned as described above for other wastewater streams. The Silo 3 material treatment process, or alternate treatment methods, identified previously, to remove the hazardous waste characteristics in preparation for off-site disposal, will process solids impacted by spills or leaks.

5.0 EROSION AND STORMWATER CONTROL

Surface water management practices will be implemented by RMRS in the Silo 3 Project work areas that include the Retrieval Facility, Treatment Facility and the ISA. The development of stormwater management practices is in accordance with FEMP stormwater pollution prevention plan and Ohio Department of Natural Resources regulations. The Silo 3 Project stormwater drainage plan is described in RMR-0445-ENG-09. Run-on stormwater will be diverted before it enters the Silo 3 Project work area. Run-on stormwater flows will be directed to Paddy's Run. Stormwater generated from RMRS' roofing and paved areas will be vectored to the non-contaminated basin. The operational environmental control plan is consistent with the expectations of FEMP's stormwater pollution prevention plan. To facilitate surface drainage away from Silo 3 Project work area, areas adjacent to structures will be designed to have a one-percent minimum slope away from the structures. Unpaved areas will be designed to have a two-percent minimum slope. Concrete slabs, door stoops, truck ramps and other similar sources, will be designed to slope at least two-percent, where feasible. Splash pads will be provided below roof drains, gutters, and other similar sources.

The ISA is to be paved to prevent the formation of standing of water. Rain or snow will not impact the integrity of the drums in the ISA for the duration of the Silo 3 Project.

Existing Silo 3 Project stormwater control features and control methods will be maintained, including permanent or temporary erosion and sediment controls installed during Silo 3 Project site preparation and construction. The Silo 3 Treatment Facility will be engineered with berms to divert stormwater into an existing retention basin for subsequent management by FEMP. Stormwater generated from paved areas (to include roofing and paving) associated with RMRS Silo 3 Treatment Facility will be routed to the non-contaminated basin.

5.1 Functional Requirements

The stormwater and erosion and sediment controls will be designed to satisfy the criteria outlined below:

- Route surface-water to designated locations where it can be appropriately managed.

- Protect Infrastructure Road, 2nd Street, Silo 3 Treatment Facility, Silo 3 Project work area, and ISA areas from damage caused by precipitation and stormwater run-on and run-off.

- Discharge surface-water to existing watercourses in accordance with applicable regulatory and DOE requirements.

The Pre-Operational Environmental Control Plan, RMR-0445-ENG-0060, describes the run-on and run-off control features designed to satisfy the erosion and sediment control criteria. A description of the run-off and run-on control features, that are to be installed during the Silo 3 site preparation and construction, is provided in the pre-operational environmental control plan (drawing 52-3012). Stormwater and erosion control during the pre-operational phase of the Silo 3 Project will be provided by monitoring these same control features. In summary, these features will include:

- Installation of silt fence on downslope sides of construction areas.

- Construction of sediment traps, as required.

- Installation of silt fences below sump discharge, where applicable.

- Installation of temporary culverts along roads next to construction site, as required.

- Installation of check dams in drainage channels and swales, as required

- Installation of additional permanent riprap, as required.

- Construction drainage channels as shown on drawing 52-3012, and the Pre-Operational Environmental Control Plan, RMR-0445-0060.

- Maintenance, repair or replacement of existing surface water and erosion control features, as required.

- Stabilization, in seven days of their final use, excavations that are expected to be inactive for 45 days or more.

- Dewatering.

6.0 WASTE MANAGEMENT REQUIREMENTS

Management of secondary wastes, generated as a result of Silo 3 Project operations, shall be consistent with applicable FEMP site procedures and regulatory guidance. Silo 3 secondary wastes will be managed, recycled, treated, and disposed in a manner that promotes waste minimization and consistency with environmental and ALARA goals. Systems and activities will be evaluated to estimate the anticipated secondary waste volumes associated with the Silo 3 Project operation. Systems and activities to be considered, include: waste generation from

system testing, product forming, packaging, material retrieval, material conveyance, processor feed, processing, packaging, product recycling, product additive, radioactive liquid waste, HVAC, sampling, replacement parts and miscellaneous tooling, and personal protective equipment (PPE). It is estimated that the Silo 3 Project will generate, approximately 227 cubic feet of secondary waste. The secondary waste will be segregated, characterized and packaged in accordance with FEMP procedures. During the Silo 3 Project operations, secondary waste will be used, to the extent possible, to fill void space in the drums. RMRS will provide input for tracking of secondary waste to Fluor Fernald SWIFTS database.

Fluor Fernald, radiological control, will survey Silo 3 Project debris to ensure that the debris meets FEMP free-release criteria. RMRS will arrange for the delivery and pickup of commercial disposal facility (CDF) containers or dumpsters for the disposition of waste deemed free releasable. RMRS personnel will be responsible for tracking the volume of debris sent to a CDF.

6.1 Treatment System Testing

The Silo 3 treatment system will be cold tested on-site using non-hazardous materials. Waste generated by testing will be sent to a non-hazardous waste facility. It is estimated that the treatment system testing will generate 100 gallons of non-hazardous water and 16,000 pounds of non-hazardous surrogate briquettes. This estimate is based on one hour of operation and one cleaning of the treatment system.

6.2 Material Retrieval and Conveyance System

The material retrieval and conveyance system does not generate secondary waste. The system is a closed flow through system. Any secondary waste generated, would be failed components. Due to the short duration (six-month operation) of the job, no component failures are expected. Routine secondary waste generation is estimated to be two 55-gallon drums of PPE from maintenance and from personnel support, or retriever and conveyance operations.

6.3 Silo 3 Material Conveyance

The material conveyance system includes the filter receiver and the P/D (positive displacement) blower. The Silo 3 material conveyance system, described on drawing 55-2000, is not expected to generate waste filters from the filter separator, as secondary process waste. The filter life is 2000 operating hours compared to the 509 hours (six-month operation) of expected operating time. Filters may be generated, on a non-routine basis, due to filter blow out or clogging (because of an increase in material moisture content). It is estimated that routine secondary waste generation is to be zero.

6.4 Processor Feed System

The processor feed system, as described on drawing 55-2001, consists of; the Silo 3 material feed screen, debris collection drums, two Silo 3 material feed hoppers, and a delivery system. The Silo 3 material will go from the filter receiver and be dropped through the Silo 3 material feed screen, to remove debris. The filtered debris will be collected in a debris collection drum. It is expected that two 55-gallon drums, of debris, will be generated during the Silo 3 Project operations. If the debris material collected is harden or caked Silo 3 material, then it will be

processed through the rejected material system for size reduction and re-introduced into treatment system. Debris material, that is not compatible with the treatment system, will be segregated as secondary waste and dispositioned by characterization. It is expected that two 55-gallon drums of non-compatible debris, including two used screens from screener will be generated during Silo 3 operations. Due to the short duration (6-month operation) of the Silo 3 treatment operations, no component failures are expected. It is estimated that other waste generated from processes feed system equipment is to be zero.

6.5 Processor System

The processor system, consists of the Silo 3 material mixer, and is described on drawing 55-2001. The feed streams to the Silo 3 material mixer are: a combined stream of Silo 3 material, binder, reducing agent, absorbent (as required), briquetting fines, and water. The Silo 3 material mixer is a continuous mixer and will combine the materials as it passes through the mixer on its way to the briquetting press. It is expected that the Silo 3 material mixer will require periodic cleaning with process water. Required periodic cleaning was discussed in Section 4.0. Due to the short duration (6-month operation) of the Silo 3 treatment operations, no component failures are expected. It is estimated that routine secondary waste generation is to be zero.

6.6 Product Forming

The product forming system consists of the briquetting press, the briquette screen, the briquette conveyor, and the briquetting fines recycle system. The product forming system will receive materials from the Silo 3 material mixer as described on drawing 55-2001. The briquetting press will operate on a continuous basis. The product forming system will decrease the volume of the Silo 3 material binder mixture, to aid in volume reduction and make the material easier to handle. The size of briquette will be approximately two-in. by two-in. by 1.5-in..

Downstream of the briquetting press is a briquette screen, which separates the fines from the briquette product. The fines, collected on the briquette screen, are fed to the fines conveyor and deposited in the fines hopper. Next, the collected fines drop into the fines feed conveyor, and are then metered into the mixer feed conveyor at a rate consistent with the other Silo 3 material feed streams.

Due to the short duration (6-month operation) of the Silo 3 treatment operations, no component failures are expected. It is estimated that routine secondary waste generation is to be zero.

6.7 Packaging System

Treated Silo 3 material will be in the form of briquettes, when it comes from the product forming system. The packaging system loads briquettes into drums, and then palletizes the drums. The packaging system is described on drawing 55-2001.

Due to the low moisture content of the Silo 3 material, no free water is anticipated in the final product, therefore no absorbent will be added to the drums. The filled drums will then be moved to the drum lidding station where they will be sealed, for contamination control. Next, the drums

go to the drum banding station and primary smear station where a clamp band will be applied and the drum smeared and the smears monitored for surface contamination.

The drums, that pass the smear check, move to the drum weigh and shipping station. If a drum fails the smear check, it will be cleaned. If the drum can not be easily cleaned, then the drum is diverted to the drum wipe down and inspection station. The diverted drum will be wiped down and smear checked. The diverted drum, that passes the smear check, is moved to the drum weigh and shipping station where it will join the other drums. Drums that fail the first wipe down and swipe, will be re-wiped and swiped until clean. Drums that have been determined to be clean and within weight specifications (1200 lbs./drum.), will go on to the palletizer and be loaded onto a pallet. The pallet of drums will then be moved by the loaded pallet conveyor out of the Treatment Facility where the pallet will be picked up by the loaded pallet mover. Next, the pallets will be banded at the pallet banding station and picked up by the full drum forklift and transported to the ISA.

Due to the short duration (6-month operation) of the Silo 3 treatment operations, no component failures are expected. It is estimated that routine secondary waste generation is to be zero.

It is estimated that 50 ft^3 of routine secondary waste will be generated during the packaging operation. Expected waste will include; PPE, plastic bags, used smears, wipes, tape and small containers, and packaging material debris. The routine secondary waste will be segregated, characterized and packaged in accordance with FEMP procedures.

6.8 Reject Material System

If product sample briquettes fail to meet the Silo 3 waste acceptance criteria (WAC), then the rejected drum lot will be removed from the ISA and returned to the Treatment Facility for reprocessing. The drum unloader will dump the rejected briquettes from the drum into the reject hopper. Using the integral screw conveyor, the briquettes will then move from the reject hopper into the reject crusher. The crushed reject briquettes will be moved from the crusher to the Silo 3 material feed conveyor, by the crushed reject conveyor. Crushed reject briquettes will be processed to meet the Silo 3 WAC requirements, through the same process as the original Silo 3 material. It is estimated that one % of the processed material will require reprocessing, or approximately 120 (55)-gallon drums of briquettes.

The empty drums will be reused for reprocessed or treated Silo 3 material. Due to the short duration (6-month operation) of the Silo 3 treatment operations, no component failures and subsequent waste are expected.

It is estimated that 12 drums of secondary waste will be generated, during recycle operations. This waste will be characterized and packaged in accordance with FEMP procedures.

6.9 Product Additives

The product additive system includes the binder storage tote, binder screw feeder, binder feeder screw feeder, additive tote, and additive feed screw feeder. The product additive system does not generate secondary waste. The product additive system is a closed flow through system and the

totes are re-usable. Any product additive material left over at the end of the Silo 3 Project, will be non-hazardous waste. It is estimated that routine secondary waste generation is to be zero.

6.10 Radioactive Liquid Waste System

The radioactive liquid waste system includes the wash water recycle tank, wash water recycle tank mixer, process water pump, wash water recycle pump, and sump pump. The mixing equipment is anticipated to require washing down two times over the six-month operating period, to prevent the build up of Silo 3 material. The water used to washdown the mixing equipment, will be water from the process water tank. The briquette machine is not expected to require a washdown. If the briquette machine does require washdown, then the washdown wastewater will be treated as mixer wash water. The washdown water will be cycled through the process equipment where it will dissolve the bonded Silo 3 material and return with the suspended Silo 3 material to the process water tank. The washdown water and Silo 3 material, in the process water tank, will create approximately a three- percent solids solution. The washdown water and Silo 3 mixture will be used in the next operating days as process water. The routine washing down of the briquetting and mixing equipment will not generate secondary waste, because washdown water is reused. The system is a closed flow through system. Any waste generated would be failed components. Due to the short duration (six-month operation) of the job, no component failures are expected. It is estimated that routine secondary waste generation is to be zero.

6.11 HVAC Systems

The HVAC system includes the Treatment Facility exhaust air system, and material retrieval HVAC. The HVAC system has three HVAC filter banks to control emissions from the Silo 3 Project: Treatment Facility, and conveyance system (duplicate filters banks). The filter banks contain a pre-filter, 95 % ASHRAE filter, and HEPA filter. The expected number of filter changes is listed in Exhibit 6.11-1.
Additional secondary waste will be generated from non-routine or process sampling. The sample secondary waste is expected to include: PPE, plastic sample bottles, and tools used to collect the samples. This additional secondary waste volume is expected to be 6 ft.^{3}.

Exhibit 6.11-1. Filter Waste Volume Estimate

System	# of changes per 6-month operation	Waste generated (cubic ft)
Off-Gas Treatment	8	128
Treatment Facility HVAC	4	768
Total Filter Waste		896

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6.11.1 Treatment Facility Exhaust Air System

The Treatment Facility system is the air treatment system for the process enclosure. It is estimated that the Treatment Facility HVAC filters will have to be changed four times during the planned six-month operation of the Treatment Facility, Exhibit 6.11-1.

6.11.2 Off-Gas Treatment System

The Silo 3 material retrieval system will be the most heavily laden air stream in the Silo 3 Project. The Silo 3 conveyance air stream will pass through two filter separators and a filter module. Duplicate filter modules are on the off-gas treatment system. The filter modules are made up of: two cubic feet of roughing filter media, the 95 % four cubic feet ASHRAE filter, and the four cubic feet HEPA. Based on a seven hours of operation per operating day the roughing filters will be changed every 22.6 operating days, the 95 % ASHRAE filter every 22.6 operating days, and the HEPA filters every 192.5 operating days. It is estimated that the off-gas treatment filters will have to be changed eight times during the planned six-month operation of the off-gas treatment system, Exhibit 6.11-1.

6.11.3 Silo Contamination Control

The inlet filters for the air treatment system for the retrieval enclosure will not have to be changed during the planned six-month operation of the Treatment Facility.

6.12 Sampling System

The sampling system includes the feed sampler and product sampler. The sampling system does not generate secondary waste. The sampling system is a closed system. A dropped sample container may generate secondary waste. Any sampling system contaminated waste generated, would be failed components. Samples, returned after analysis, will be packaged in 55-gallon drums with briquettes or PPE. Due to the short duration (six–month operation) of the job, no sampling system component failures are expected. It is estimated that routine secondary waste generation is to be zero.

6.13 Replacement Parts and Miscellaneous Tooling

During the Silo 3 project operations, the careful elimination of excess materials introduced into the radiological control area (RCA) will prevent the unnecessary generation of secondary waste. Decontamination of materials, to be removed from the RCA, will be considered. Silo 3 equipment is designed for ease in decontamination, but not all equipment and material can be decontaminated to free release levels. If equipment, such as replacement parts and tooling, can not be decontaminated, then these items will be size-reduced and compacted, if necessary and as much as practical, to reduce the volume of secondary waste generated. The non-decontaminated secondary waste will be managed as radioactive waste.

6.14 Personal Protective Equipment

The Silo 3 material retrieval and conveyance system will emphasize the use of recyclable and reusable materials. PPE and miscellaneous materials (e.g., rags, and swipes) generated by the Silo 3 Project, will be evaluated for both chemical and radiological contamination. Disposable anti-contamination clothing (anti-Cs) will be bagged and placed in a roll-off box (ROB) for disposal at the off-site disposal facility (OSDF), as Category-4 material. The inner layer of launderable anti-Cs will be bagged and sent to a laundry facility, for cleaning. The laundry facility will monitor anti-Cs after cleaning. Other PPE, cleared as non-radiological through routine scans or surveys by hand-held instrumentation, will be considered clean. If PPE or other fabrics appear stained or heavily soiled, then the fabric will be decontaminated to eliminate the staining or soiling. PPE not suitable for laundering (i.e., disposable PPE, rubber gloves, plastic, and tape) will be packaged in acceptable material containers. Certain components of the processing system will be decontaminated and made available for reuse. Materials used to decontaminate other equipment or materials will be bagged and put in a ROB for disposal at the on-site disposal facility.

7.0 REFERENCES

DOE Order, 5400.5, Derived Concentration Guides (DCGs) for Water

Fluor Fernald, Stormwater Pollution Prevention Plan, PL-3083, Rev 0, Fernald Environmental Management Project, Fernald, OH (May 1996)

Project Quality Procedure (PQP), 7.1, Control of Purchased Items and Services
RM-0047, FEMP Fugitive Dust Control Requirements

RMR-0445-ENG-010, The Point Source Air Emission Data

RMR-0445-0060, Pre-Operational Environmental Control Plan

RMR-0445-ENG-09, Storm Water Drainage Plan

RMRS Drawing, 52-3002, Civil Site Plan

RMRS Drawing, 52-3012, Erosion Control Plan

RMRS, Drawing 53-3230, General Arrangement Plan, Process Building

RMRS Drawing, 55-2000, Retrieval and Conveyance PFD

RMRS Drawing, 55-2001, Treatment System PFD

RMRS Drawing, 55-2006, Process Water Recycle P&ID

RMRS Drawing, 55-2008, Silo 3 Gas Treatment HVAC PFD

RMRS Drawing, 55-2010, Silo 3 Process Building Ventilation PFD

40 CFR: Part 61, Subpart H; Part 61 Subpart Q; Part 60, Appendix A, Methods 22, Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares, Part 268.1(4); and Part 268.3.

APPENDIX A

The Point Source Air Emission Data,
RMR-0445-ENG-010

3079

RMRS Rocky Mountain Remediation Services, L.L.C.

FERNALD SILO-3 PROJECT

Point Source Air Emission Data

RMR – 0445 – ENG – 010

Rev. 1

May 17, 2000

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DICTIONARY OF TERMS AND ABBREVIATIONS

ADSE	Atmospheric Dust Spot Efficiency
ALARA	As Low As Reasonably Achievable (A DOE Policy on reducing radiation
AMAD	Aerosol Mean Aerodynamic Diameter
ASHRAE	American Society of Heating, Refrigeration and Air-conditioning Engineers
BAT	Best Available Technology
BHP	Brake Horsepower
BNFL	British Nuclear Fuels
CCA	Contamination Control Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFM	Cubic Feet per Minute
DCE	Dust Collection Efficiency
DHC	Dust-Holding Capacity
Dia.	Diameter
DOE	U.S. Department of Energy
DOP	Dioctyphthalate (An aerosol fog used to test filter penetration rate)
FFI	Fluor Fernald, Inc.
Fig.	Figure
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation and Air Conditioning
MIL-STD	Military Standard governed by U.S. Department of Defense
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standards (40 CFR Part 50)
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Standards for Hazardous Air Pollutants (40 CFR Part 63)
NSPS	New Source Performance Standard (40 CFR Part 60)
NSR	New Source Review
OEPA	State of Ohio Environmental protection Agency
P&ID	Process (Piping) and Instrumentation Diagram
P/D	Positive Displacement
PFD	Process Flow Diagram
PSD	Prevention of Significant Deterioration
Ref.	Reference
Rev.	Revision
RFP	Request for proposal
RMRS	Rocky Mountain Remedial Services, LLC
Tab.	Table
USEPA	U.S. Environmental Protection Agency
W.G.	Water Gauge
W.G.	Water Gauge
WAP	Weigh Arrestance Percent
WDA	Weight Dust Arrestance

LETTER SYMBOLS AND UNITS USED IN CALCULATIONS

μ	Micron, also micrometer (One millionth of a meter)
π	Pi-number (approximately 3.141593)
ϕ	Diameter
τ	Time constant
Δ	Delta (Difference)
σ_p	Particle density, lb/ft^3
'	Foot
"	Inch (Unit of distance, or length)
°F	Temperature in degrees Fahrenheit
°R	Temperature in degrees Rankine
a	Acceleration, ft/s^2
A	Area, ft^2
acfm	Actual cubic feet per minute, f^3/min (Volumetric flow at actual density)
C	Concentration factor
C_D	Coefficient of drag (Dimensionless)
Ci	Curie (Unit of radiation emission)
c_p	Specific heat coefficient, Btu/lb-°F (0.24 for air)
σ	Density, lb/ft^3
D_p	Particle diameter, ft
f	Friction factor (Dimensionless)
ft	Foot (Unit of distance)
g	Acceleration of gravity, 32.2 ft/s^2; or Gram (Metric unit of mass or weight)
gpm	Gallons per minute (Unit of liquid flow)
H	Height, ft
HP	Horsepower (Nominal unit of power)
hr	Hour (Unit of time)
i	Enthalpy, $Btu/lb_{dry\ air}$ (Unit of heat content)
in	Inch (Unit of distance)
K	Kilo (Prefix designating 1000 times or 10^3 magnitude of base unit)
kg	Kilogram (Unit of mass)
L	Distance, ft
lb	Pound (Unit of weight)
min	Minute (Unit of time)
N	Number, count of
P	Pressure
pCi	Pico-Curie (Unit of radiation emission; one billionth of a Curie)
Q	Volumetric flow, cfm
R	Material loading factor (Dimensionless)
s	Second (Unit of time), or distance
SP	Static pressure, inch W.G.
T	Absolute temperature, °R (equals °F + 460)
t	Time
TP	Total pressure, inch W.G.
V	Velocity, ft/min
VP	Velocity pressure, inches of water gauge

1.0 INTRODUCTION

This study assesses the characteristics of Silo-3 material together with the operating parameters of the retrieval, conveyance and treatment facilities and provides estimates of air emissions from the stack.

There are two main functions of the air system; air-conveyance and off-gas treatment. Both functions are achieved by the same hardware configuration, with different process controls. The suction side serves as a silo material retrieval, transport and collection system, the pressure side delivers portion of the off-gas into the air treatment plant and returns rest of the flow back into the silo.

The material particle size analysis showed that more than 35.5% of the total mass is smaller than 5μ and about 1% might exist in sub-micron range. Design of the off-gas system will reflect the requirement of being capable of removing small-size particulate in order to minimize the emission rates.

2.0 PURPOSE

The purpose of this document is to provide data on predicted discharges into the surrounding environment and other relevant information described below:

• Estimate of concentrations of air pollutants that are reasonably expected to be emitted from each point source, without taking credit for any reduction in emission levels due to installation of air pollution control equipment.

• Estimate of the concentrations of air pollutants that are reasonably expected to be present in the off-gas from each point source, including radionuclides, radon gas, and particulate matter.

• Assumptions used to develop this report, including:
- Source term (material stream and additives) constituents and their release rates
- Stack location in the silo material processing plant
- Stack height, diameter and off-gas dispersion
- Expected off-gas flow rate and corresponding exit velocity
- Air ambient conditions that affect the design

• Select, design and configure pollution control equipment that represents the best available control technology and its application and performance adheres to the principles of ALARA such that the exposure to the workers and the general public would be kept as low as reasonable achievable.

• Predict the pollutant releases from the silo material processing along with the assumptions used to develop emission estimates and associated stack parameters.

3.0 PROCESS OVERVIEW

3.1 Material Retrieval From Silo-3

The material retrieval system is delineated between the tip of the material collection nozzle and the inlet of the P/D blower. Flow in the inlet branch of the blower creates vacuum at the end of the nozzle and thus negative pressure in the silo. A 7" I.D. nozzle will be used, resulting in the intake velocity of 7,858 fpm, at a design volumetric flow of 2,100 ft^3/min at 14.0 lb/in^2 and 94°F (dry-bulb) ambient conditions (see Design Basis Document, Ref. 9.1).

The nominal retrieval capacity is approximately 15,000 lb/hr; the material removal operations will be conducted on average 7.0 hours per day, in a single shift. This would result in the length of the entire retrieval/processing campaign of 78.2 days (@ 58 lb/ft^3 max. material density), or 39.1 days (@ 29 lb/ft^3 min. material density). The total volume of the material in the Silo-3 is estimated to be 5,100 yd^3. (see Design Basis Document, Ref. 9.1).

During the retrieval operation, the material will be conveyed in an ϕ 8" double-contained pipe via the airflow of 2,100 ft^3/min. This volumetric capacity multiplied by the maximum length of the campaign (72.8 days) represents the total volume into which all the pollutants would be diluted.

3.2 Material Separation

The Silo-3 material will be conveyed by the means of a vacuum placed by a retrieval system. A pneumatic filter-receiver will be placed on the suction side of the main P/D blower (pump) to separate the material from the air stream by the pulsating action of fabric bags. The bags are equipped with absolute membrane filter having the overall dust arrestance coefficient of 99.99% for particles up to 0.2 micron.

3.3 Material Processing

The silo material will be metered by a loss-in-weight feed system and fed into a mixer. Periodic samples will be taken from the feed hopper, to verify its composition. Binder, reducing agent and process water will be added to the mixer prior to mixing action. At the end of the mixing process, the material will have the consistency of moist soil and will be discharged to a briquetter. At this point, samples will be taken periodically, to assure that the final product meets the Waste Acceptance Criteria (WAC).

The material will be formed into 2" x 2" x 1½" briquettes (as calculated in RMR-0445-ENG-085), each weighing about 0.26 lb, and having the surface area of 83 cm^3 (Ref. 9.2). The briquetter will be equipped with a hopper to allow continuous operation. The final products will be transferred to the packaging system. The briquettes will be transferred into a product storage hopper and placed into 55-gal drums. The unit net weight of the material in the drum is 900 lb. Each drum and the palette holding 4 drums will be weighed and placed into the Interim Storage Area prior to transfer to the FFI inventory and permanent storage.

3.4 Off-gas Treatment System

The off-gas stream is ducted into the off-gas treatment system. The dust-laden air will be first treated in a secondary bag-house. The overall dust arrestance of the off-gas bag-house is identical with the primary material receiver equipped with membrane filter, or 99.99% by weight up to particle size of 0.2 micron.

4.0 BASELINE AIR EMISSIONS

The investigation of the air emissions from Silo-3 project will concentrate on three (3) major components:

- Total Radionuclides
- Radon Gas Component (included in the Total radionuclides)
- Dust Particles

4.1 Radiation from Radionuclides

The quantity of radionuclides emitted to atmosphere is measured as an emission rate in pico-curies per liter. This emission rate is calculated from:

- The total activity of the Silo-3 material based on the mass of the Silo-3 material,
- The total volume of air discharged to atmosphere.

These calculations are depicted in Fig. 1 together with the total emission estimate in grams of Silo-3 material per volume in liter of air discharged during the entire retrieval and treatment campaign. The governing relation can be expressed as follows:

Maximum Activity = Maximum Mass x Activity per Unit Mass, or Volume x Bulk Density x Activity per Unit Mass:

$= 3{,}899.7\ m^3 \times 928\ kg/m^3 \times 1{,}000\ g/kg \times 112{,}434\ pCi/g$

$= 4.0688 \times 10^{14}\ pCi$

Since the bulk density conversion is 58 lb/ft^3 = 928 kg/m^3, the radionuclide content

= 117,596 pCi/g (total) – 5,162 pCi/g (Radon component)
[Total radionuclide potential derived from RMRS Alara Plan, Ref. 9.10; Rn component potential taken from Attachment "J" of the Contract, Ref. 9.7]

= 112,434 pCi/g

Discharge volume= 2,100 ft^3/min x 60 min/hr x 7 hr/day x 72.8 days

= 64,209,600 ft^3

= 1.872×10^9 liters at 0.0343 ft^3/liter

Baseline Emission Rate can be determined from:

$$= 1.872 \times 10^{14} \text{ pCi} / 1.872 \times 10^{9} \text{ liters}$$

$$= \underline{2.1735 \times 10^{5} \text{ pCi/l}}$$

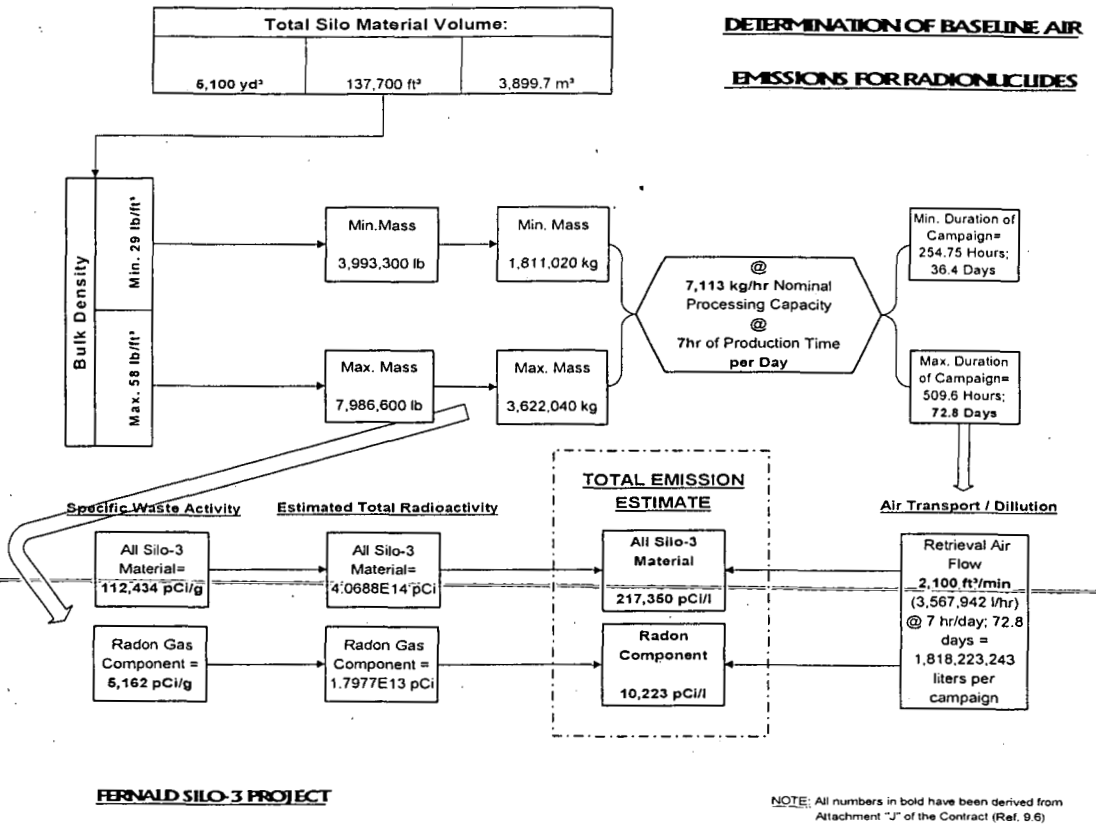

Figure 1.

4.2 Radon Liberation

The total amount of the gas generated equals the sum of radon that is liberated from the drums during the process and the radon flux that is emitted from the silo material in bulk. The radon-attributable radiation that can be emitted into the atmosphere from the material retrieval and conveyance can be assumed conservatively by multiplying the radon specific activity of the silo material by the total mass of material in grams.

Following the same logic as above for Fig. 1 the total amount of radioactivity from radon that can be emitted into environment without any control devices is 1.7977E13 of pCi; when diluted into the total flow of 1,818,223,243 liters of air that will be transported through the system during the entire production campaign, the baseline point source emission would be 10,223 pCi/l for the radon gas component. This number represents the baseline used throughout all associated calculations and as input for Fig. 4.

The amount of radon gas off-gas during the briquette production is based on the

surface diffusivity factor of 20.04 pCi/m^2.s; this coefficient has been derived from laboratory data of compressed Silo-3 material with 15% moisture and 3% of Envirobond® added. Calculation RMR-0445-ENG-085 shows the assumptions and radon liberation rates from the entire process facility based on the briquette residency time using the following equation:

$$C_{Rn} = N_{briq} \cdot A_{briq} \cdot 20.02\ pCi/m^2 \cdot s \cdot cfm\ /\ 28.3\ liter/ft^3$$

- From the briquetter and the screen ..... 0.0093 pCi/l
- From the hopper ..... 43.85 pCi/l
- From the product loading ..... 0.75 pCi/l
- From the general building space ..... 20.00 pCi/l

Note: All the above numbers have been obtained by calculation, however, the building Rn concentration has been conservatively assumed and transferred into Fig. 5.

4.3 Particulate Matter Generation

The same approach will be employed as described in the two above paragraphs; if all material would be transported into the atmosphere, such an enormous emission would be determined by dividing the maximum mass of the material into the volumetric dilution into the total air stream. From Fig. 2, the total mass of the stored material is 3,622,040,000 grams, and if diluted into the total ventilation volume of 1,818,223,243 liters. This would result in an emission rate of 1.99208 grams per liter for the entire retrieval campaign if no control devices would be used. This number represents to the Total Specific Dust Loading used in all associated calculations.

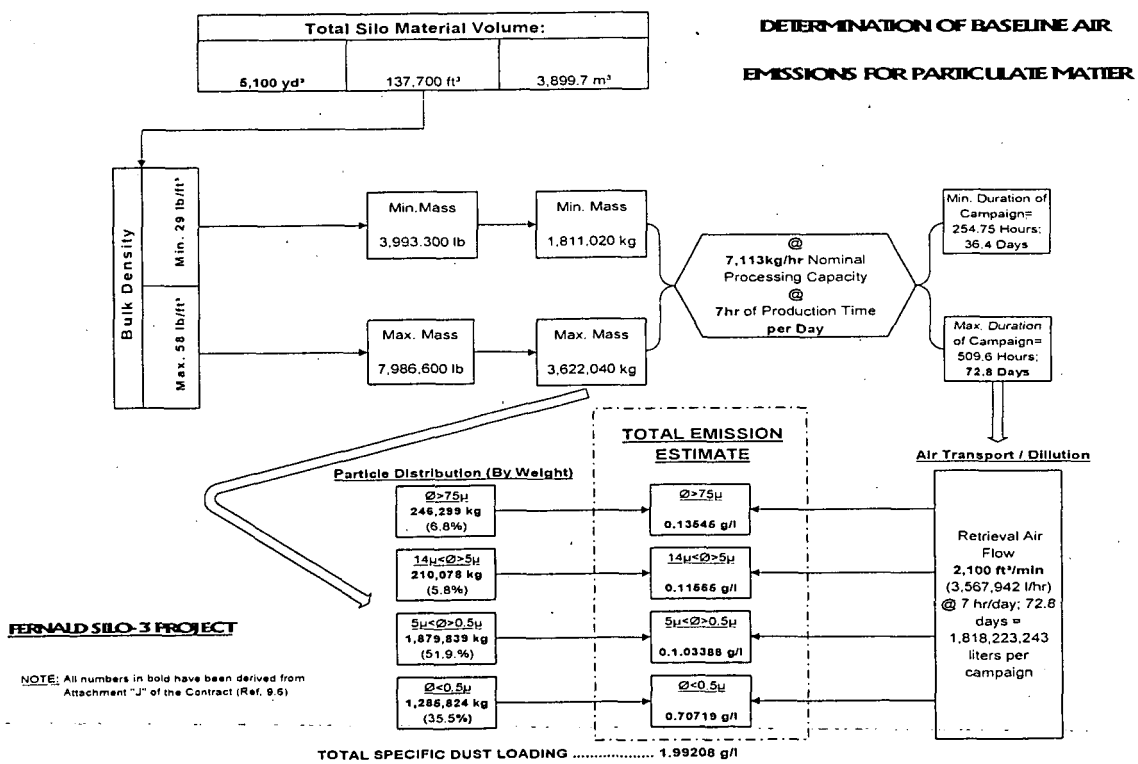

Figure 2.

Derivation of input per a particle size group is also shown in Fig. 3. The four major groups of particle size distribution per weight are:

- Larger Than 75μ 6.8 %
- Larger Than 5μ but Smaller Than 14μ 5.8 %
- Larger Than 14μ but Smaller Than 75μ 57.7 %
- Smaller Than 5μ 29.7 %

The above information has been compiled using from various data from Attachment 'J' of the Contract (Ref. 9.6), namely, page 5-3 of RSDATA, titled "Silo-3 Distribution of Particle Diameters." Argon's studies on both small and large particle occurrence in the material was also used (same reference). The above mentioned particle size distribution is an estimate based on previous laboratory studies which are not all-encompassing, therefore, the dust control design is based on the overall dust arrestance at the most penetrating particle sizes.

The Project Team understands that the Silo-3 material contains a substantial fraction of sub-micron particles, some below 0.1μ AMAD. High efficiency particulate air (HEPA) filters selected for the off-gas treatment have their dust collection performance certified at the industry standard "most penetrating particle size" in the range of 0.12μ to 0.3μ AMAD.

However, this does not mean that the filters are not capable of capturing particles below the above stated range of performance certification. On the contrary, studies indicate that filtering efficiency for given face velocity increases with decreasing particle size for sub-micron particle size (Spurny at al, Ref. 9.11). The filter removes particles from the off-gas stream by a number of mechanisms including direct interception, inertial deposition, diffusion deposition, electrical attraction, and gravitational attraction. The mechanisms that predominate will depend on particle velocity, the nature of the filter, and the nature of the aerosol.

Put into simplified terms, it means that there may be many extremely small particles released through the HEPA/ULPA filter, however, their combined mass is also extremely small. Since both the particulate and radionuclide emissions are directly proportional to the overall amount of mass emitted, the effect of this extremely small particle size component is negligible. The overall dust arrestance coefficients, however, are between 96 and 98%, which are the numbers used in our Silo-3 Air Emission Model (Fig. 4). We believe that this is a conservative approach for predicting the emission levels.

5.0 EMISSION CONTROL TECHNOLOGY OVERVIEW

The Silo-3 ventilation system will carry the major pollution components and treat these by the emission control devices. Again, the pollution contributing components are:

- Particulate Matter
- Radionuclides (in the form of particles), and
- Radon Gas

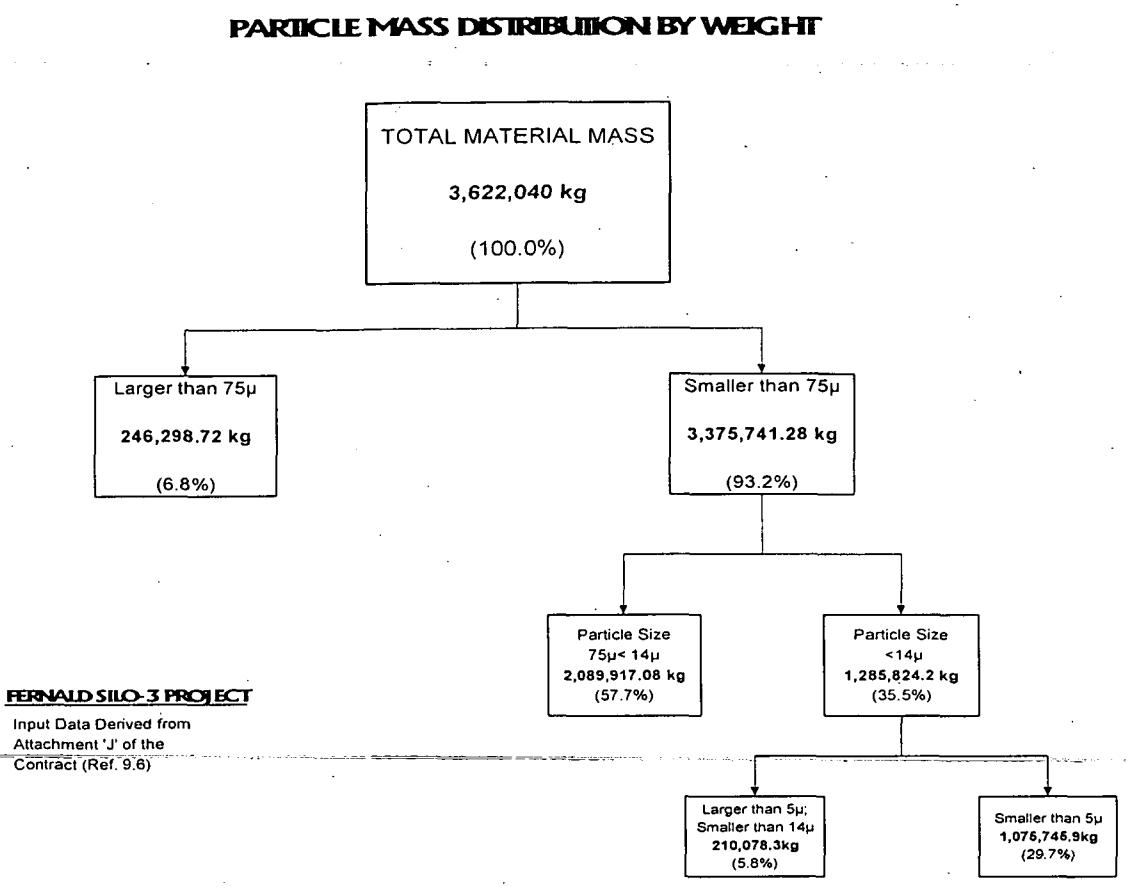

Figure 3.

A simple correlation can be drawn between controlling the radionuclides and the dust particles such that, when controlling the dust particles, the radionuclide reduction is inherent to such control process since all radiological activities are derived from the particulate matter.

Controlling the radon gas is generally considered a very difficult task. Radon adsorption devices for large-scale remediation and their principles are not common or well understood. Some experience can be derived from FFI's Silo 1 and 2 design and operations.

For the sake of simplicity, both possible and feasible technologies will be listed and evaluated herein.

5.1 Dust Particle Control Technology

The major types of dust control devices considered as candidates for emission control system are:

- Filters
  - Pre-filters
  - ASHRAE Filters
  - High Efficiency Particulate Air (HEPA) Filters, and
  - Ultra Efficiency Particulate Air (ULPA) Filters
- Dust Collectors
  - Filter Receivers
  - Centrifugal Separators, and
  - Venturi Devices
- Electrostatic Dust Cleaners

The performance parameters of these devices is discussed below:

5.1.1 FILTERS

5.1.1.1 Pre-Filters or Roughing Filters
Made of finer, open cell foams and textile denier, non-woven; typical Weight Dust Arrestance (WDA) 70 to 80%,Atmospheric Dust Spot Efficiency (ADSE) 15 to 30%, MIL-STD-282 DOP (DOP) 0%, Dust-holding Capacity (DHC) 0.25 g/ft^3 (of cell volume)

5.1.1.2 95% ASHRAE Filter
Constructed of mats of 1 to 4μ fibers; over 95% WDA, 60 – 80% ADSE and 50 – 55% DOP, 0.275 g/ft^3 HDC.

5.1.1.3 HEPA Filter
Made of pleated laid paper, mostly sub-micron glass or paper fibers; over 95% WDA and ADSE, 95 to 99.99% DOP @ 0.5μ.

5.1.1.4 ULPA Filter
Also made from a pleated interwoven fiberglass paper of sub-micron openings; over 97% ADSE and WDA, over 99.999 DOP@ 0.12μ, 0.5 DHC.

5.1.1.5 Membrane Filter
A fine film or synthetic sheet made of cellulose acetate, nylon, etc., having about 1μ openings; WAP and ADSE about 98%, however, the DOP approaches nearly 100%, DHC not applicable.

5.1.2 DUST COLLECTORS

5.1.2.1 Filter Receiver (Large Diameter), or Secondary Baghouse
Considered as single body over 3 ft in diameter; gases and dust particles should be relatively dry; air-tight dust bins or continuous material removal must be provided. Dust Collection Efficiency (DCE) is very high for particle sizes over 100μ, moderate for medium size particles and low for very small particles. Equipment pressure drop is relatively low.

5.1.2.2 Refined-design Centrifugal Separators
Made of the series of small-diameter tubes, scroll-shape bodies and multiple louvers. The collected material should be dry. Have relatively high DCE for large and medium size particles, medium for very small particles; the pressure drop is considered moderate.

5.1.2.3 Venturi Scrubber
Constructed of a simple venturi tube with low-pressure sprays and throat followed by a cyclone type separator. If properly designed, these devices have very high DCE for all particle sizes, but also very high system pressure resistance.

5.1.3 ELECTROSTATIC DUST CLEANERS

5.1.3.1 Electrostatic Precipitators
Employs an assembly of parallel collector electrodes, which can be, i.g., corrugated plate, rod curtains, or parallel plate. Overall dust collection efficiency is around 97%, however, higher degree of DCE can be achieved by using a wet, high-voltage collector (25K to 75K Volts).

5.2 Radon Adsorption Technology

The possible technology candidates to be used for radon gas adsorption are:

5.2.1 Activated Carbon Industrial Filters

5.2.2 Charcoal-filed Canisters

5.2.3 Large Activated Carbon Beds

5.2.4 Gas Adsorption Enhancement (Cooling and drying of the off-gas)
Radon adsorption technology would only be used if determined necessary based on the Air Emission Model and FFI modeling.

In defining BAT controls for a specific source, the Ohio Revised Code (ORC 3704.11) includes consideration of the impacts of achieving a given level of emission reduction. As illustrated by the dispersion modeling results, the annual average impact of radon emissions from HVAC system exhaust stack, with no credit for control equipment, is minimal. The modeling results predict a maximum annual average impact several orders of magnitude below both the average background radon concentration and the 0.5 pCi/L criteria established by proposed rule 10CFR834.

Evaluation of the radon gas adsorption options identified above indicates that in addition to the impact on project cost, the impacts of installing sufficient carbon adsorption capability to achieve further reduction in radon emissions would include increased worker exposure during maintenance, future decontamination and decommissioning of the carbon adsorption system and an increased secondary waste burden due to the need to treat, package and dispose of the

contaminated carbon. Therefore, in consideration of the already minimal impact of radon emissions without credit for control equipment, and the impacts of providing sufficient equipment to accomplish further reduction, installation of radon adsorption equipment is not justified to attain BAT emission control.

5.3 Best Available Control Technology Selection

Summary of available control technology is shown in Table 1. Based on the particulate collection efficiencies and cost, the following configuration has been selected as BDAT system that will be capable of reducing the radiation and particulate emissions from the baseline conditions to acceptable levels:

5.3.1 Filter Receiver and Secondary Bag House connected in series, each rated at 99.99% overall dust arrestance, thus reducing the amount of radionuclides and particulate downstream by the factor of 100,000,000.

5.3.2 Filter Modules containing the following components in series:

5.3.2.1 Pre-filter (or Roughing Filter)
5.3.2.2 ASHREA Filter
5.3.2.3 HEPA Filter
5.3.2.4 HEPA or ULPA Filter (optional)
5.3.2.5 Provision for the capability of inserting Activated-carbon Filters

5.3.3 Continuous Isokinetic Stack Sampling for particulate radionuclides and continuous stack monitoring for radionuclides

6.0 PROPOSED POLLUTION CONTROL SYSTEM

Following the equipment efficiency / cost / ease of operation data evaluation the following emission control system is proposed for the Silo-3 off-gas treatment:

6.1 Material Conveyance Branch

6.1.1 FILTER RECEIVER in the form of a cyclone with fabric bags and membrane impregnation; overall weighed dust arrestance (WDA) of 99.99%

6.2 Off-gas Return to Silo – No emission control devices installed

6.3 Process Treatment Building

6.3.1 ROUGHING FILTER; WDA of 25%, DHC 0.25 g/ft^3
6.3.2 ASHRAE FILTER, WDA of 95%, DHC .275 g/ft^3
6.3.3 99.97% @ 0.3μ HEPA FILTER, WDA of 96%, DHC .5 g/ft^3
6.3.4 99.99% @ 0.12μ ULPA FILTER, WDA of 98%, DHC 0.75 g/ft^3

TABLE 1

Technology Assessment

Component		UNIT COST	COLLECTION EFFECTIVENESS	
NO.	TYPE	$/sq.ft. [1]	Rn [3] Capture, %	Overall Dust Arrestance [4]
1	Roughing Prefilter	$50.00	n/a	75.00%
2	ASHRAE Filter	$110.00	n/a	95.00%
3	99.9% HEPA Filter @ 0.5μ	$200.00	n/a	97.00%
4	99.95% HEPA Filter @ 0.5 μ	$500.00	n/a	98.00%
5	99.99 HEPA Filter @ 0.3 μ	$650.00	n/a	99.00%
6	9.999 HEPA Filter @ 0.12μ	$750.00	n/a	99.50%
7	Membrane Filters	$150.00	n/a	99.99%
8	Venturi Scrubber	$625.00	n/a	95.00%
9	Centrifugal Seperator	$500.00	n/a/	95.00%
10	Electrostatic Precipitator	$2,000.00	n/a	98.50%
11	Activated-carbon Filters	$450.00	90.00%	n/a
12	Charcoal Canisters	$950.00	99.00%	n/a
13	Activated-carbon Beds	$5,000.00	99.99%	n/a

NOTE: 1) Unit costs are for installed equipment, based on the device face area
2) Derived from Reference 3, p. 118
3) For media filters, Radon daughters only are considered; A unit adsorption of charcoal is such that 1g of charcoal can adsorb 1 liter of rn-laden gas, of any concentration in piC
4) Overall particulate removal by weight, per ASHRAE, Equipment 1969

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6.4 Off-Gas Treatment Branch

6.4.1 SECONDARY BAGHOUSE, WDA of 99.99%
6.4.2 ROUGHING FILTER, WDA of 25%, DHC .25 g/ft^3
6.4.3 ASHRAE FILTER, WDA of 95%, DHC 0.275 g/ft^3
6.4.4 99.97% HEPA FILTER @ 0.3μ, WDA of 98%, DHC 0.75g/ft^3

6.5 Point Source Emission at the Stack Outlet

An Excel spread sheet (Fig. 4) has been prepared based on the actual configuration of the ventilation system. The input into this spread sheet is based on the baseline emission assumptions showed in Fig. 1 and 2. Ensuing calculations in the individual spread sheet cells are using the principles of overall particle removal via filtration, stream mixing and concentration dilution in the streams, i.e.:

$C_2 = C_1$ x filter arrestance, where 1 denotes upstream and 2 downstream

$C_x = (cfm_1 \times C_1) + (cfm_2 \times C_2) + \ldots\ldots + (cfm_n \times C_n)/(cfm_1 + cfm_2 + \ldots = cfm_n)$;

where Cx is the final concentration of a system having n-number of confluence streams.

The Air Emission Model is documented in calculation RMR-0445-ENG-083.

A summary of estimated releases from the plant's stack are shown in Table 2. below and referenced on PFD 55-2000/2008 (Ref. 9.3 and 9.4) and Mass & Energy Balance (Ref. 9.5).

6.5.1	Exhaust Stack Flow	16,003	ft^3/min (actual)
6.5.2	Off-Gas Density	0.0664 lb/ft^3	
6.5.3	Off-Gas temperature	115	°F (no stack effect)
6.5.4	Stack Exit Velocity	32.5	mph
6.5.5	Stack Diameter	32	in
6.5.6	Stack Height	60	ft
6.5.7	Particulate Emission	2.329	microgram/m^3
6.5.8	Radio-nuclides Emission	0.001047	pCi/liter (Rn not incl.)
6.5.9	Radon Emission	653.73	pCi/liter (Unabated)

Table 2: Summary of Estimated Emission Data from Silo-3

FIGURE 4

Silo-3 Air Emission Model

Flow Component:	WASTE RETRIEVAL*		CYCLONE RECEIVER		COOLING COILS
Emission Paramenter:	Factor/Effy	Parameter	Factor/Effy	Parameter	
FLOW, cfm	100.00%	2100	100.00%	2100	
TOTAL RADIATION, pCi/l	100.00%	217,350	99.99%	22	
RADON RADIATION, pCi/l	100.00%	10,223	0.00%	10223	
DUST LOADING, g/l	100.00%	1.9921	99.99%	0.0001992	

AIR SPLIT		AIR RECIRCULATION	
Factor/Effy	Parameter	Factor/Effy	Parameter
50.19%	1054	100%	1056
100.00%	21.73	100%	21.73
100.00%	10223	100%	10223.0
100.00%	0.0001992	100%	0.0001992

→ Return Back To Silo

NOTE: Some Gas Streams Have Different Densities!

Flow Component:
Emission Paramenter:
FLOW, cfm
TOTAL RADIATION, pCi/l
RADON RADIATION, pCi/l
DUST LOADING, g/l

AIR SPLIT	
Factor/Effy	Parameter
46.38%	974
100.00%	21.73
100.00%	10223
100.00%	0.0001992

2ND BAGHOUSE	
Factor/Effy	Parameter
100.00%	996
99.99%	0.0022
0.00%	10223
99.00%	0.0000

PRE-FILTERS		ASHREA FILTER		99.97 HEPA @ 0.3µ		99.99 HEPA @ 0.3µ		STACK DISCHARGE	
Factor/Effy	Parameter	Factor/Effy	Parameter	Factor/Effy	Parameter	Factor/Effy	Parameter	Factor/Effy	Parameter
100.00%	996	100%	996	100.00%	996	100%	996	100.00%	**996**
25.00%	0.0016	95.00%	0.0001	98%	0.000002	0.00%	0.000002	0.00%	**0.000002**
0.00%	10223	0.00%	10223	0.00%	10223	0.00%	10223	0.00%	**10223**
25.00%	0.0000014941	95.00%	7.47037E-08	98.00%	1.49407E-09	0.00%	1.49407E-09	0.00%	**1.49407E-09**
								µg/m³	1.494075

Flow Component:	BRIQUETTER **	
Emission Paramenter:	Factor/Effy	Parameter
FLOW, cfm	100.00%	550
TOTAL RADIATION, pCi/l	100.00%	7.1904
RADON RADIATION, pCi/l	100.00%	0.0093
DUST LOADING, g/l	100.00%	0.0000642

Flow Component:	PRODUCT HOPPER **	
Emission Paramenter:	Factor/Effy	Parameter
FLOW, cfm	100.00%	150
TOTAL RADIATION, pCi/l	100.00%	300
RADON RADIATION, pCi/l	100.00%	43.85
DUST LOADING, g/l	100.00%	0.00001

Flow Component:	DRUM LOADOUT **	
Emission Paramenter:	Factor/Effy	Parameter
FLOW, cfm	100.00%	150
TOTAL RADIATION, pCi/l	100.00%	1.12
RADON RADIATION, pCi/l	100.00%	0.75
DUST LOADING, g/l	100.00%	0.00001

Flow Component:	SCREENS **	
Emission Paramenter:	Factor/Effy	Parameter
FLOW, cfm	100.00%	300
TOTAL RADIATION, pCi/l	100.00%	45
RADON RADIATION, pCi/l	100.00%	0
DUST LOADING, g/l	100.00%	0.00005

Flow Component:	FEED HOPPERS **	
Emission Paramenter:	Factor/Effy	Parameter
FLOW, cfm	100.00%	500
TOTAL RADIATION, pCi/l	100.00%	8.4
RADON RADIATION, pCi/l	100.00%	0
DUST LOADING, g/l	100.00%	0.000075

Flow Component:	BUILDING SPACE ***	
Emission Paramenter:	Factor/Effy	Parameter
FLOW, cfm	100.00%	13650
TOTAL RADIATION, pCi/l	100.00%	0.56
RADON RADIATION, pCi/l	100.00%	20
DUST LOADING, g/l	100.00%	0.000005

AIR JUNCTION	
Factor/Effy	Parameter
100.00%	15000
100.00%	4.96
100.00%	18.65
100.00%	1.0604E-05

ASHRAE FILTER		99.97 HEPA @ 0.3		99.99 UEPA @ 0.12		STACK DISCHARGE	
Factor/Effy	Parameter	Factor/Effy	Parameter	Factor/Effy	Parameter	Factor/Effy	Parameter
100%	15000	100.00%	15000	100%	15000	100.00%	**15000**
25.00%	3.7233	97.00%	0.1117	99.00%	0.0011	0.00%	**0.00112**
0.00%	18.6463	0.00%	18.6463	0.00%	18.6463	0.00%	**19**
25.00%	7.9530E-06	97.00%	2.38590E-07	99.00%	2.38590E-09	0.00%	**0.00000**
						µg/m³	2.3859

TOTAL STACK EMISSIONS FROM SILO-3 OPERATIONS:

Volumetric Flow	ft³/min	16,003
General Radiation	pCi/l	0.00105
Radon Radiation	pCi/l	653.73
Total particulate	g/l	2.3293E-09
	µg/m³ =	2.32932
	Revision 1	

NOTE:
- * Input Data from Tab.1 and Tab. 2
- ** Data on Rn concentarion derived from Ref. 9.8; dust loading based on communications with vendors
- *** Building space data was estimated

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May 17, 2000

The summary of the estimated emission data from Silo-3 is presented in Tab. 2. was used as an input to EPA compliant model particulate and radon gas emission to determine the exposure levels at the Fernald Site boundaries. The model summary is provided in Ref. 9.8. FFI intends to provide continuous Radon monitoring equipment at the facility exhaust stack.

Stack location is depicted in Fig. 5. The stack height has been determined as the Process Building width plus ½ of its width. The minimum stack discharge velocity was set as 1.5 times the velocity of normally prevailing winds in the area.

7.0 REGULATORY REVIEW

The environmental standards for the 5.103 Stabilization Facility are presented in the ARAR matrix (Ref.9.9)

8.0 REFERENCES

8.1 Ref.1: ***Fan Engineering***, Seventh Edition, Buffalo Forge Company 1970
8.2 Ref. 2: ***Handbook of Fundamentals***, ASHRAE, 1967
8.3 Ref. 3: **Guide & Data Book: *Equipment***, ASHRAE, 1969
8.4 Ref. 4: **Guide & Data Book: *Systems***, ASHRAE, 1973
8.5 Ref. 5: ***Code on Nuclear Air and Gas Treatment***, ASME Std. AG-1-1991
8.6 Ref. 6: ***Nuclear Air Cleaning Handbook***, ORNL, 1976
8.7 Ref. 7: ***Industrial Ventilation***, 13th Edition, ACIGH, 1980

9.0 REFERENCED DOCUMETS

9.1 Design Basis Document RMR-0445-0123
9.2 Calculation RMR-0445-ENG-085
9.3 Process Flow Diagram 55-2000
9.4 Process Flow Diagram 55-2008
9.5 Mass & Energy Balance, RMR-0445-ENG-066
9.6 Attachment 'J' of the Contract
9.7 Fernald Silo-3 Project Envirobond® Treatment and Briquetting System *Process Criteria*
9.8 BEE-Line Software: BEEST for Windows
9.9 Applicable Relevant and Appropriate Requirement Strategy, RMR-0445-ENG-024
9.10 Spurny, K.R.: Aerosol Filtration by Means of Nucleopore Filters, 1969

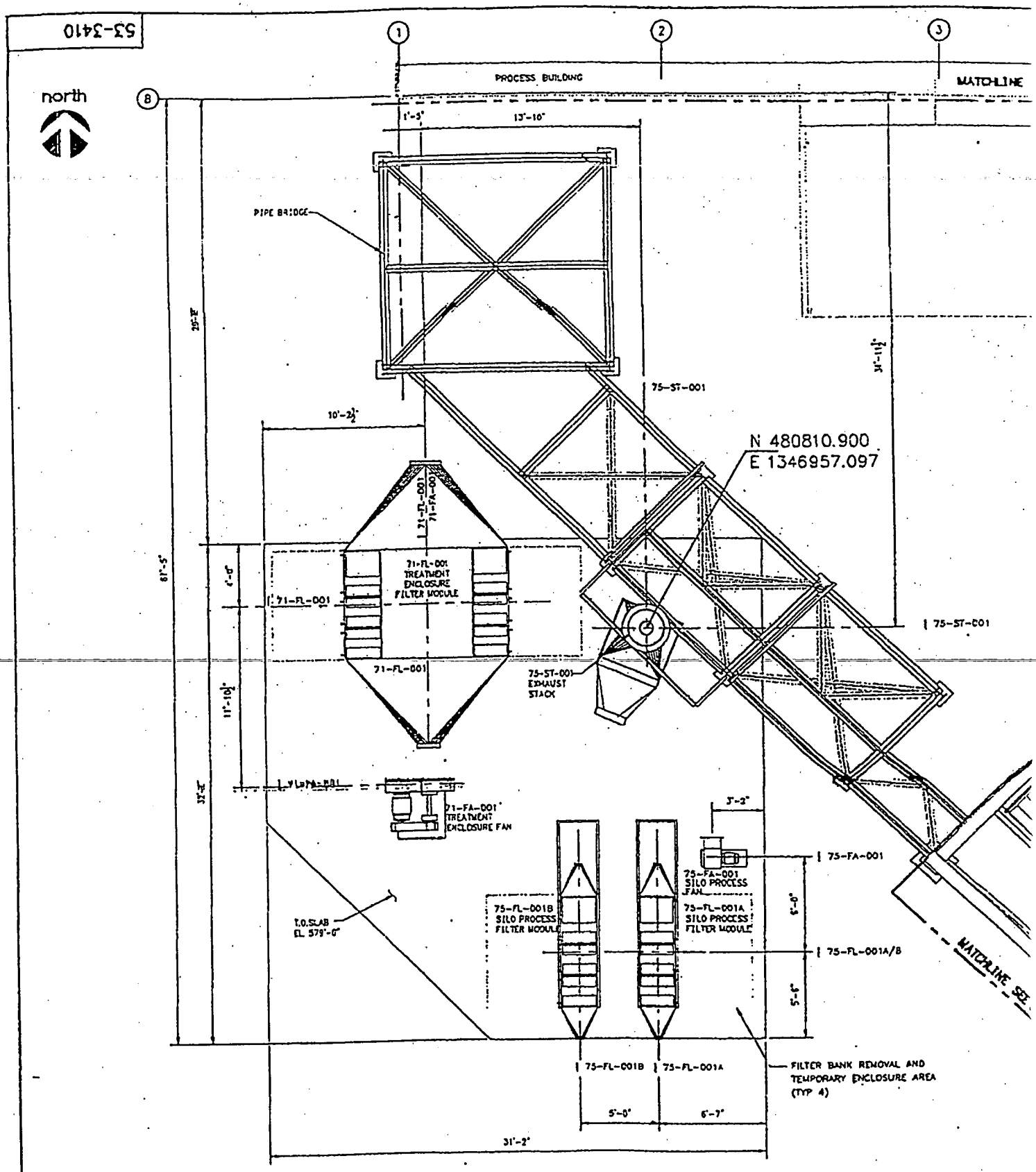
53-3410
north
PROCESS BUILDING
MATCHLINE
PIPE BRIDGE
75-ST-001
N 480810.900
E 1346957.097
71-FL-001
TREATMENT ENCLOSURE FILTER MODULE
71-FA-001
71-FA-001 TREATMENT ENCLOSURE FAN
75-ST-001 EXHAUST STACK
75-FA-001
75-FA-001 SILO PROCESS FAN
75-FL-001B SILO PROCESS FILTER MODULE
75-FL-001A SILO PROCESS FILTER MODULE
75-FL-001A/B
T.O.SLAB EL. 579'-0"
FILTER BANK REMOVAL AND TEMPORARY ENCLOSURE AREA (TYP 4)
13'-10"
10'-2½"
31'-2"
5'-0"
6'-7"
3'-2"
PLAN

Fig. 5

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Rocky Mountain
Remediation Services, L.L.C
. . . protecting the environment

FERNALD SILO 3 PROJECT

ARARs Compliance Strategy
RMR-0445-ENG-024-000

May 12, 2000

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LIST OF ACRONYMS

AAC	Acute Aquatic Criteria
ARAR	Applicable or Relevant and Appropriate Requirement
BAT	Best Available Technology
BMP	Best Management Practice
CAC	Chronic Aquatic Criteria
CEQ	Council on Environmental Quality
CEDE	Committed Effective Dose Equivalent
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	Constituent of Concern
DCG	Derived Concentration Guide
DOE	Department of Energy
EDE	Effective Dose Equivalent
EPA	Environmental Protection Agency
FEMP	Fernald Environmental Management Project
Fluor Fernald	Fluor Fernald, Inc.
HEPA	High Efficiency Particulate Air
H&S	Health and Safety
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NWP	Nationwide Permit Program
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
RCRA	Resource Conservation and Recovery Act
RMRS	Rocky Mountain Remediation Services, L.L.C.
ROD	Record of Decision
SWPPP	Stormwater Pollution Prevention Plan
TBC	To-be-considered
TCLP	Toxicity Characteristic Leaching Procedure
TSD	Treatment Storage and Disposal

1.0 PURPOSE

Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBC) requirements for the Silo 3 Project were identified in the December 7, 1994 Record of Decision (ROD) for Remedial Actions at Operable Unit (OU) 4 at the Fernald Environmental Management Project (FEMP). These previously identified ARARs and TBC requirements were provided to Rocky Mountain Remediation Services, L.L.C. (RMRS) by Fluor Fernald, Inc. (Fluor Fernald). The associated compliance strategy for the project ARARs and TBC requirements has been developed by RMRS and is illustrated in the following Exhibits:

- 1.0-1. Compliance Strategy for Chemical-Specific ARARs and TBCs.
- 1.0-2. Compliance Strategy for Location-Specific ARARs and TBCs.
- 1.0-3. Compliance Strategy for Action-Specific ARARs and TBCs.
- 1.0-4. Compliance Strategy for the Substantive Requirements of Air Contaminant Sources.
- 1.0-5. Compliance Strategy for the Substantive Requirements of Wastewater, Stormwater and Wetlands.
- 1.0-6. Compliance Strategy for the Substantive Requirements under the Resource Conservation and Recovery Act (RCRA).

Exhibit 1.0-1. Compliance Strategy for Chemical-specific ARARs and TBCs.

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radionuclide Emissions (Except Airborne Radon-222)	40 Code of Federal Regulations (CFR) § 61 Subpart H Emissions of radionuclides to the ambient air from Department of Energy (DOE) facilities shall not exceed those amounts that might cause any member of the public to receive in any year an Effective Dose Equivalent (EDE) of 10 mrem per year (mrem/yr). Monitoring is required at release points having potential to discharge radionuclides which could cause an EDE in excess of 1% of the standard (0.1mrem/yr) to any member of the public.	This requirement is applicable to remediation of Silo 3 material. Radioactive materials within Silo 3 might contribute to the dose to members of the public from the air pathway during implementation of remedial actions.	RMRS will use HEPA filtration that will minimize radionuclide particulate emissions. The HVAC system includes a continuous Isokinetic stack sampler	RMR-0445-ENG-010, Point Source Air Emission Data. RMR-0445-ENG-015, Operational Environmental Control Plan
Radon-222 Emissions	40 CFR § 61 Subpart Q No area source at a DOE facility shall emit more than 20 pCi/m^2/s of radon-222 as an average for the entire source during periods of storage and disposal.	This requirement is applicable only to storage and disposal of radium-bearing byproduct material, such as Silo 3 material. Storage facilities for untreated Silo 3 material or stabilized wastes might qualify as sources.	Treated and solidified Silo 3 and Material will be stored in sealed 55-gallon drums, minimizing Radon emission during interim storage.	
Protection of Air from Residual Radioactive Material	DOE Order 5400.5 Chap. IV, 6.b (proposed 10 CFR § 834) Interim Storage: The above-background concentration of radon-222 in air above an interim storage facility must not exceed 100 pCi/L at any point, an annual average of 30 pCi/L over the facility, or an annual average of 3 pCi/L at or above any location outside the site.	DOE Orders are identified as TBCs only when no promulgated ARARs exist, to ensure the adequate protection of human health and the environment. Portions of DOE Order 5400.5 were selected as TBCs to ensure adequate protection of the public during and following remediation. Management of radium and thorium bearing wastes might result in the release of radon gas to the environment.	Breathing air in 11 (e) (2) treatment / processing areas, as well as in container storage locations, will be assessed (by mass balance calculations and/or testing) for radon-222.	RMRS Drawing 53-3230, General Arrangement Plan, Process Building. RMR-0445-ENG-005, Occupational ALARA Plan

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Exhibit 1.0-1. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radiation Protection of the Public and the Environment from Radionuclide Air Emissions	Doe Order 5400.5 Chap. III (proposed 10 CFR § 834) Residual concentrations of radionuclides in air in uncontrolled areas are limited to the following, (for known mixtures of radionuclides, the sum of the ratios of the observed concentrations of each radionuclide to its corresponding limit must not exceed 1.0). Derived Concentration Guide (DCG) (μCi/mL) Isotope / D / W / Y Actinium-227: $2x10^{-15}$ / $7x10^{-15}$ / $1x10^{-15}$ Lead-210: $9x10^{-13}$ / ---[b] / --- Polonium-210: $1x10^{-12}$ / $1x10^{-12}$ / --- Protactinium-231: --- / $9x10^{-15}$ / $1x10^{-14}$ Radium-224: --- / $4x10^{-12}$ / --- Radium-226: --- / $1x10^{-12}$ / --- Radium-228: --- / $3x10^{-12}$ / --- Technetium-99: $1x10^{-8}$ / $2x10^{-9}$ / --- Strontium-90[c]: $5x10^{-11}$ / --- / $9x10^{-12}$ Thorium-228: --- / $5x10^{-14}$ / $4x10^{-14}$ Thorium-230: --- / $4x10^{-14}$ / $5x10^{-14}$ Thorium-232: --- / $7x10^{-15}$ / $1x10^{-14}$ Uranium-234: $4x10^{-12}$ / $2x10^{-12}$ / $9x10^{-14}$ Uranium-235: $5x10^{-12}$ / $2x10^{-12}$ / $1x10^{-13}$ Uranium-236: $5x10^{-12}$ / $2x10^{-12}$ / $1x10^{-13}$ Uranium-238: $5x10^{-12}$ / $2x10^{-12}$ / $1x10^{-14}$ [a] D,W, and Y (days, weeks, and years) represent lung retention classes; removal halftimes assigned to the compounds with classes D, W, and Y are 0.5, 50, and 500 days, respectively. Exposure conditions assume an inhalation rate of 8,400 m^3 of air per year (based on an exposure over 24 hours per day, 365 days per year). [b] A hyphen means no limit has been established. [c] The value shown for daily DCG is for strontium radionuclides with a f_1 value of $3x10^{-1}$. The value shown for yearly DCG is for strontium radionuclides with a f value of $1x10^{-2}$.	DOE Orders are identified as TBCs only when no promulgated ARARs exist, to ensure the adequate protection of human health and the environment. Portions of DOE Order 5400.5 were selected as TBCs to ensure adequate protection of the public during and following remediation. Remediation of Silo 3 material has the potential to release radionuclides that are contained in the waste materials.	Breathing air in 11 (e) (2) treatment / processing areas, as well as in container storage locations, will be assessed (by mass balance calculations and/or testing) for radon-222 and other radionuclides of concern.	RMR-0445-ENG-010, Point Source Air Emission Data. RMR-0445-ENG-015, Operational Environmental Control Plan Drawing 55-2008, Silo 3 Gas Treatment HVAC PFD

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Exhibit 1.0-1. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radiation Protection of the Public and the Environment from Radionuclide Release to Waters	DOE Order 5400.5 Chap. III (proposed 10 CFR § 834) Residual concentrations of radionuclides in water that may be ingested are listed below. These DCGs for the constituents of concern (COCs) are based on a committed effective dose equivalent (CEDE) of 100 mrem/yr, assuming ingestion of 2 liters/day. Note that these DCGs apply only if ingestion is the single pathway of exposure. Isotope — Ingested Water DCGs (µCi/mL) Actinium-227 — $1x10^{-8}$ Lead-210 — $3x10^{-8}$ Polonium-210 — $8x10^{-8}$ Protactinium-231 — $1x10^{-8}$ Radium-224 — $4x10^{-7}$ Radium-226 — $1x10^{-7}$ Radium-228 — $1x10^{-7}$ Technetium-99 — $1x10^{-4}$ Strontium-90 — $1x10^{-6}$ Thorium-228 — $4x10^{-7}$ Thorium-230 — $3x10^{-7}$ Thorium-232 — $5x10^{-8}$ Uranium-234 — $5x10^{-7}$ Uranium-235 — $6x10^{-7}$ Uranium-236 — $5x10^{-7}$ Uranium-238 — $6x10^{-7}$	DOE Orders are identified as TBCs only when no promulgated ARARs exist, to ensure the adequate protection of human health and the environment. Portions of DOE Order 5400.5 were selected as TBCs to ensure adequate protection of the public during and following remediation. Remediation of Silo 3 material has the potential to release radionuclides that are contained in the waste materials to environmental media.	All process waters / decontamination waters are slated for discharge to the on – site wastewater treatment plant, within limits specified in the contract. No point source discharges to surface waters are planned.	RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-1. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Ohio Water Quality Standards Use Designation and Criteria	Ohio Administrative code (OAC) 3745-1-07 All pollutants or combinations of pollutants shall not exceed, outside the mixing zone, the Numerical and Narrative Criteria for Aquatic Life Habitat and Water Supply Use Designation listed in Tables 7-1 through 7-15 of this rule. The following COCs for OU4 have warm water habitat criteria concentrations outside the mixing zone as follows: Constituent — Criteria conc.[a] (µg/L) — 30-day average conc. (µg/L) Antimony — 650 — 190 Arsenic — 360 — 190 Beryllium — Tab. 7-10[b] — Tab. 7-11[c] Cadmium — Tab. 7-10 — Tab. 7-11 Chromium — Tab. 7-10 — Tab. 7-11 Copper — Tab. 7-10 — Tab. 7-11 Cyanide — 46 — 12 Lead — Tab. 7-10 — Tab. 7-11 Mercury — 1.1 — 0.20 Nickel — Tab. 7-10 — Tab. 7-11 Selenium — 20 — 5.0 Silver Tab. — 7-10 — 1.3 Thallium — 71 — 16 Zinc — Tab. 7-10 — Tab. 7-11 2-Butanone — 160,000 — 7,100 4-Nitrophenol — 790 — 35 Acetone — 550,000 — 78,000 Aldrin — — — 0.01 Bis(2-ethylhexyl)phthalate — 1,100 — 8.4 Carbon tetrachloride — 1,800 — 280 DDT — — — 0.001 Dieldrin — — — 0.005 Di-n-butyl phthalate — 350 — 190 Diethylphthalate — 2,600 — 120 Dimethylphthalate — 1,700 — 73 Endosulfan[d] — — — 0.00 Endrin — — — 0.002 Fluoranthrene — 200 — 8.9 Methylene chloride — 9,700 — 430 PCBs — — — 0.001	This requirement is applicable to remediation activities involving Silo 3 material. Paddys Run and the stream segment of the Great Miami River adjacent to the FEMP are designated as warm water aquatic life habitats with use designations of agricultural and industrial water supply, and primary contact recreation. Chemical contaminants within Silo 3 might be released during remediation such that they might contribute to contamination in these aquatic habitats. OAC 3745-1-21 (Water Use Designation for the Great Miami River) establishes the classification of the receiving waters for the FEMP.	All process waters / decontamination waters are slated for discharge to the on – site wastewater treatment plant, within limits specified in the contract. No point source discharges to surface waters are planned. Compliance with Ohio WQS will be achieved by compliance with the FEMP NPDES permit. Design information supplied by RMRS will be used to prepare a request for modification of the NPDES permit addressing management of wastewater from the Silo 3 project. As specified by the current NPDES permit; this request will be submitted to OEPA at least 180 days prior to initiating discharge.	RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-1. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Ohio Water Quality Standards Use Designation and Criteria (continued)	[a] Criteria concentration shall be met outside the mixing zone. [b] Criteria concentration based on hardness of water. See Table 7-10 for calculation to determine maximum concentration outside the mixing zone. [c] 30-day average criteria based on hardness of water. See Table 7-11 for calculation to determine allowable 30-day average concentration outside the mixing zone. [d] No designation was made as to whether endosulfan referred to endosulfan I or endosulfan II or the sum total of each. The remaining COCs for OU4 will have criteria concentration levels based on calculated acute aquatic criteria (AAC), or chronic aquatic criteria (CAC).			
Ohio Water Quality Standards "Six Freedoms" for surface water	OAC 3745-1-04 All surface waters of the state shall be free from: • objectionable suspended solids • floating debris, oil, and scum • materials that create a nuisance • toxic, harmful or lethal substances • nutrients that create nuisance growth • substances that will impair designated instream or downstream water uses.	This requirement is relevant and appropriate to remediation activities involving Silo 3 material. This requirement pertains to both discharges to surface waters as a result of remediation and any on-site surface waters affected by site conditions.	See previous item	RMR-0445-ENG-09, Storm Water Drainage Plan. RMR-0445-ENG-015, Operational Environmental Control Plan RMRS-0445-ENG-0060, Pre-Operational Control Plan

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Exhibit 1.0-2. Compliance Strategy for Location-Specific ARARs and TBCs.

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Endangered Species Protection	50 CFR § 402 ORC 1518, 1513.25 OAC 1501-18-1-01 Federal agencies must not jeopardize the continued existence of any endangered or threatened species, or destroy or adversely modify critical habitat of such species.	FEMP is located within the range of the Indiana bat, a federally listed endangered species, and sighting has occurred on the FEMP in 1999. Therefore, this requirement is relevant and appropriate. Any potential impacts of the remedial actions on this species must be evaluated and appropriate actions taken.	No existing structures (which may be used as Indiana bat roosts) will be demolished. Any evidence of Indiana bats roosting in project specific infrastructure will be reported to Fluor Fernald.	
Compliance with Floodplain/Wetlands Environmental Review Requirements	10 CFR § 1022 Executive Order 11990 DOE actions in a wetland must first evaluate the potential adverse effects those actions might have on the wetland and consider the natural and beneficial values served by the wetlands.	This requirement is applicable because the FEMP is a DOE facility. Several alternatives might result in destruction or modification of wetland areas.	All site activities, to include 11 (e) (2) processing / treatment / storage as well as project support areas will be located outside of floodplain and wetlands areas. No CWA 404 permit is needed.	

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Exhibit 1.0-3. Compliance Strategy for Action-Specific ARARs and TBCs.

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
NEPA Evaluations	10 CFR § 1021.2 DOE actions must be subjected to National Environmental Policy Act (NEPA) evaluation as outlined by Council on Environmental Quality (CEQ) regulations in 40 CFR § 1500-1508.	This requirement is applicable because the FEMP is a DOE facility, and this requirement requires NEPA evaluation for specific actions at DOE facilities.	This Comprehensive Environmental Response Compensation and Liability Act (CERCLA) action is addressed under a NEPA supplemental analysis approved December 1996. Further submittals by RMRS are not necessary.	
Nationwide Permit Program	33 CFR § 330 The U.S. Corps of Engineers can issue a Nationwide Permit (NWP) as a general permit for certain classes of actions that involve dredge or fill activities in wetlands or navigable waters. Discharges of dredged or fill material into wetlands may require a wetland delineation.	This requirement is applicable to remediation activities that may require construction of access roads and utility lines resulting in minor wetland disturbances. All dredge and fill activities related to construction of these access roads and utility lines will be conducted in accordance with the substantive terms and conditions of NWP 14 (Road Crossing) and NWP 12 (Utility Line Backfill and Bedding). OEPA has been granted Section 401 State Water Quality Certification for NWPs 12 and 14.	RMRS does not plan to construct road crossing or utility lines through designated wetlands or navigable waters.	

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Discharge of Storm Water Runoff	40 CFR § 122.26 OAC 3745-38 Storm water runoff from landfills, construction sites, and industrial activities must be monitored and controlled. A Stormwater Pollution Prevention Plan (SWPPP) is required for construction activities which result in a total land disturbance of 5 or more acres.	This requirement is applicable to industrial waste sites and construction sites of greater than 5 acres that discharge storm water runoff to the waters of the United States. Some remedial alternatives evaluated might disturb more than 5 acres of land.	Currently, RMRS plans to affect more than one, but less than five, acres. As discussed in its proposal, RMRS anticipates that stormwater runoff will eventually reach Paddy's Run to the west of Silo #3. All storm water that could run onto RMRS' operation will be diverted before it encounters RMRS' work area by dikes and berms. These flows will be directed to Paddy's Run. RMRS storm water runoff control is provided in Storm Water Drainage Plan (RMR-0445-009) Erosion control measures and inspections in accordance with the SWPPP will be implemented. A map detailing where water is be diverted is provided in the project workplans and Silo 3 Project Site Prep Package, RMR-0445-0059. These plans consider impacts of stormwater; needed erosion controls and location of the storm water pond.	RMR-0445-ENG-09, Storm Water Drainage Plan. RMR-0445-ENG-015, Operational Environmental Control Plan RMRS-0445-ENG-0060, Pre-Operational Control Plan

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Exhibit 1.0-3. (continued).

	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Discharge of Treatment System Effluent	40 CFR § 125.100 & 40 CFR § 125.104 Best Management Practices (BMP) Develop and implement a BMP program to prevent the release of toxic or hazardous pollutants to waters of the U.S. Development and implementation of a sitewide BMP Program is also required as a condition of the FEMP National Pollutant Discharge Elimination System (NPDES) Permit. The BMP program must: • Establish specific objectives for the control of toxic and hazardous pollutants • Include a prediction of direction, rate of flow, and total quantity of toxic and hazardous pollutants where experience indicates a reasonable potential for equipment failure.	All of the proposed actions have the potential for releases and runoff from this operable unit. The requirement is not applicable because BMP under the NPDES permit program applies only to ancillary facilities of manufacturing units that might have releases of toxic or hazardous pollutants. The purpose of the BMP program is relevant and appropriate to prevent releases from spills or runoff during implementation of remedial actions. The current FEMP NPDES permit does not contain a BMP Plan requirement. BMP requirements have been superseded by the SWPPP.	Waste minimization efforts should limit the volumes of 11 (e) (2) impacted wastewaters. Approximately 500 gallons of Silo 3, process, and decon waters are expected to be generated by project completion. Potential inadvertent discharge of these liquids will be mitigated by liquid management within RMRS' containment buildings. Stormwaters will be directed to the non-contaminated storm water basin. Silo 3, process, and decon waters are subject to acceptance criteria found in C.5.1.1.3.2 of the contract. Any use of hazardous substances, such as petroleum fuels, and controls to prevent discharge, will be identified to FEMP for their approval prior to site mobilization and/or on-site use.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-09, Storm Water Drainage Plan. RMRS-0445-ENG-0060, Pre-Operational Control Plan
Ohio Water Well Standards	OAC 3745-9-10 Abandonment of Test Holes and Wells Upon completion of testing, a test hole or well shall be either completely filled with grout or such material as will prevent contaminants from entering groundwater.	This requirement is applicable to any test borings and wells that might be installed and/or closed as part of these remedial alternatives.	No test holes or wells are planned. Construction activities have been and will be reviewed to identify possible intersection with existing monitoring well network. Any wells in need of abandonment will be identified to FEMP.	

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Exhibit 1.0-3. (continued).

	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Implementation of Health and Environmental Protection Standards for Uranium Mill Tailings	40 CFR § 192 Subpart C This subpart contains guidance, criteria, and supplemental standards for compliance with Subparts A and B of 40 CFR 192.	This requirement is relevant and appropriate to remediation activities involving Silo 3 material. Radioactive materials in this operable unit are primarily byproduct residues from uranium processing. Requirements for design of controls should be consistent with design of controls for other residual radioactive materials such as mill tailings.	These requirements are addressed to implementing agencies. RMRS regards these regulations' expectations as fulfilled when RMRS satisfies the obligations of its approved project workplan.	RMR-0445-0064, Preliminary Design Documentation RMR-0445-0081, Remedial Design Documentation RMR-0445-ENG-005, Occupational ALARA Plan

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Hazardous Waste Determinations	40 CFR § 262.11 OAC 3745-52-11 Any generator of waste must determine whether or not the waste is hazardous. The procedures to be followed include: • To identify whether a particular material of concern is a "solid waste" • To identify whether a particular exclusion applies to the material eliminating it from definition as a "solid waste" • To identify whether a particular solid waste might be classified as a hazardous waste • To determine if a material otherwise classified as a "hazardous waste" might be excluded from RCRA regulation	These procedures are established to determine whether wastes are subject to the requirements of RCRA. The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate to determine whether OU4 wastes, whether excluded or not, exhibit the characteristics of hazardous waste. The material stored in the silos are sufficiently similar to hazardous wastes based on the TCLP results. Silo 3 contains material which must be treated, stored, and disposed in accordance with RCRA. Other wastes such as debris generated during decontamination (e.g., concrete scabbling), will also require a hazardous waste determination to be made.	RMRS does not anticipate generating any hazardous wastes from its 11 (e) (2) processing operation. RMRS will follow characterization requirements of 40 CFR 261 and 268 (OHC 3745-51 *et seq.*) for currently unanticipated materials, which may derive from Silo #3.	RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Empty Containers	40 CFR § 261.7 OAC 3745-51-7 Containers that have held hazardous wastes are "empty" and exempt from further RCRA regulations if one or more of the of the following are met: • No more than 2.5 cm (1 inch) of residue remains on bottom of inner liner. • Less than 3% by weight of total capacity remains (less than or equal to 110 gallon container, • Less than 0.3% by weight of total capacity remains (greater than 110 gallon container) Containers that have held acutely hazardous ("P" listed) wastes are "empty" and exempt from further RCRA regulation if: • *They or their inner liners have been triple rinsed with an adequate solvent or the inner liner has been removed from the container.*	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on Toxicity Characteristic Leaching procedure (TCLP) results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Containers used to treat or store the contents of Silo 3 might contain residues which exhibit hazardous waste characteristics which must be removed before the containers might be reused or disposed.	RMRS does not anticipate generating empty containers, which once held hazardous wastes. RMRS will manage any such containers as appropriate if generated.	RMR-0445-ENG-015, Operational Environmental Control Plan
Generators Who Transport Hazardous Waste for Off-site Treatment, Storage, or Disposal	40 CFR § 262.20 - 262.33 and 263.20 - 263.31 OAC 3745-52-20 through 33 and OAC 3745-53-20 through 31 Any generator who transports hazardous waste for off-site treatment, storage or disposal must originate and follow-up the manifest for off-site shipments.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Any wastes determined to be RCRA hazardous waste removed from this operable unit for off-site treatment, storage, or disposal might be subject to the manifest requirement.	RMRS has not contracted to be a generator of hazardous wastes. RMRS does not anticipate generation of hazardous wastes during this project. In the event that the project generates currently unanticipated hazardous wastes, RMRS will perform waste management activities, appropriate for the waste type, after communication and involvement with all project stakeholders.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-0060, Pre-Operational Environmental Control Plan

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Treatment, Storage, or Disposal (TSD) Facility Standards	40 CFR § 264 Subpart B OAC 3745-54-13 through 16 General Standards • *Waste Analysis - OAC 3745-54-13 Operators of a facility must* obtain a detailed chemical and physical analysis of a representative sample of each hazardous waste to be treated, stored, or disposed of at the facility prior to treatment, storage, or disposal. • Security - OAC 3745-54-14 Operators of a facility must prevent the unknowing or unauthorized entry of persons or livestock into the active portions of the facility, maintain a 24-hour surveillance system, or surround the facility with a controlled access barrier and maintain appropriate warning signs at facility approaches. • Inspections - OAC 3745-54-15 Operators of a facility must develop a schedule and regularly inspect monitoring equipment, *safety and emergency equipment, security devices* and operating and structural equipment that are important to preventing, detecting or responding to environmental or human health hazards, promptly or immediately remedy defects, and maintain an inspection log. • Training - OAC 3745-54-16 Operators must train personnel within 6 months of their assumption of duties at a facility in hazardous waste management procedures relevant to their positions including emergency response training.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Wastes, which exhibit a characteristic similar to RCRA hazardous waste, removed from this operable unit might be treated, stored, and disposed in accordance with TSD facility standards.	RMRS does not anticipate generating any hazardous wastes from its 11 (e) (2) processing operation. However, the substantive requirements of these RCRA standards will be met for treatment and/or storage of Silo 3 material and other material containing / contaminated with Silo 3 material. Specifically: • Waste analysis has been provided by FEMP; post – treat analyses will be generated by FEMP. • Security will be provided by FEMP; RMRS will maintain locks, controls, and postings as applicable. • RMRS workplans invoke weekly inspection requirements needed to maintain health, safety, and environmental protection during project execution. *Inspection logs will be* maintained. • RMRS Health and Safety (H&S) workplans and/or procedures will detail the Occupational Safety and Health Administration (OSHA) required training for this project. • Spill response equipment will be located in the waste storage areas. • Drum aisle spaces will be maintained at 22 inches, with a 4 foot general aisle space. • Emergency response procedures will identify responses to emergencies (such as fires) in the storage area. Copies of RMRS'	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-013, Contingency Plan RMR-0445-0021, Project Specific Health and Safety Plan RMRS Drawing 53-3230, General Arrangement Plan Process Building.

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
			procedures will be provided to FEMP for amendment of their RCRA contingency plan, if needed. • Secondary containment will be provided for containers that contain / may contain free liquids. • Drums will be stored and operated in a manner that protects containers from contact with precipitation; controls include indoor storage, palletization and tarping. • Containers will be handled in a way that prevents rupture, leakage, or spillage.	

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Treatment, Storage, or Disposal Facility Preparedness and Prevention	40 CFR § 264 Subpart C OAC 3745-54-31 through 35 and OAC 3745-54-17 OAC 3745-54-31 - TSD operators must design, construct, maintain, and operate facilities to minimize the possibility of a fire, explosion, or any unplanned sudden or nonsudden release of hazardous waste to air, soil, or surface water which might threaten human health or the environment. OAC 3745-54-32 - All facilities must be equipped with an internal communication or alarm system, a telephone, or a two-way radio for calling outside emergency assistance, fire control, spill control, and decontamination equipment and water at an adequate volume and pressure to supply water hose streams, foam producing equipment, automatic sprinklers, or water spray systems. OAC 3745-54-33 - All fire protection and spill control and decontamination equipment and communication and alarm systems must be tested and maintained as necessary to assure proper emergency operation. OAC 3745-54-34 - All personnel must have immediate access to emergency communication or alarm systems whenever hazardous waste is being handled at the facility. OAC 3745-54-35 - Aisle space must be sufficient to allow unobstructed movement of personnel, fire and spill control, and decontamination equipment. OAC 3745-54-37 - Operators must attempt to make arrangements, appropriate to the waste handled, for emergency response by local and state fire, police and medical personnel.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Wastes removed from this operable unit might be treated, stored, or disposed in accordance with TSD facility standards.	RMRS does not anticipate generating any hazardous wastes from its 11 (e) (2) processing operation. However, the substantive requirements of these RCRA standards will be met for treatment and/or storage of Silo3 material and other material containing / contaminated with Silo 3 material. RMRS' workplan will identify the project's operating standards for safety, internal communications, fire protection, spill control, decontamination, storage standards, and emergency response procedures. See above.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-013, Contingency Plan RMR-0445-0021, Project Specific Health and Safety Plan

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Exhibit 1.0-3. (cor inued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Treatment, Storage, or Disposal Facility Contingency Plan and Emergency Procedures	40 CFR § 264 Subpart D OAC 3745-54-51 through 52 and OAC 3745-54-55 through 56 OAC 3745-54-51 - Each facility operator must have a contingency plan designed to minimize hazards to human health or the environment due to fires, explosions, or any unplanned releases of hazardous waste constituents to the air, soil, or surface/groundwater. OAC 3745-54-52 - Contingency plans should address procedures to implement a response to incidents involving hazardous waste, and provide for internal and external communications, arrangements with local emergency authorities, and emergency coordinator list, a facility emergency equipment list indicating equipment descriptions and locations, and a facility personnel evacuation plan. OAC 3745-54-55 through 56 - Each facility must have an emergency coordinator who has responsibility for coordinating all emergency response measures, is on the premises or on call at all times, is thoroughly familiar with all aspects of the contingency plan, facility operations, location and characteristics of waste handled, location of pertinent records, and facility layout, and who has the authority to commit the resources necessary to implement the contingency plan in the event of an emergency.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Wastes removed from this operable unit might be treated, stored, or disposed in accordance with TSD facility standards.	RMRS does not anticipate generating any hazardous wastes from its 11(e)(2) processing operation. However, the substantive requirements of these RCRA standards will be met for treatment and/or storage of Silo 3 material and other material containing / contaminated with Silo 3 material RMRS' workplan will identify the project's operating standards for safety, internal communications, fire protection, spill control, decontamination, and storage standards, and emergency response procedures. See above.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-013, Contingency Plan RMR-0445-0021, Project Specific Health and Safety Plan
Closure	40 CFR § 264 Subpart G OAC 3745-55-11, 3745-55-14, and 3745-55-16 Operators must close the facility in a manner that: • Minimizes the need for further maintenance • Minimizes post-closure escape of hazardous constituents • Complies with specific unit type closure requirements All contaminated equipment, structures and soils must be properly disposed or decontaminated. Following closure, a survey plot showing the location of hazardous waste disposal units with respect to surveyed benchmarks must be filed with the legal total zoning authority.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. The Contractor's facility must be clean closed, else media/material remediation to meet closure performance standard. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.)	RMRS is conducting a CERCLA remedial action as detailed in its contract and project plan submittals. RMRS Silo 3 Design Basis Document places closure requirements for container / tank storage and treatment areas to satisfy appropriate and relevant requirements under RCRA.	RMR-0045-0121, Design Basis Document

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Container Storage	40 CFR § 264 Subpart I OAC 3745-55-71 through 78 Containers of RCRA hazardous waste must be: • Maintained in good condition • Compatible with hazardous waste to be stored • Closed during storage (except to add or remove waste) • Managed in a manner that will not cause the container to rupture or leak Storage areas must be inspected weekly for leaking and deteriorated containers and containment systems. Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide a containment system with a capacity of 10 percent of the volume of the largest container of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system. Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier. At closure, remove all hazardous waste and residue from the containment system, and decontaminate or remove all containers, liners, bases, and soils.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) These requirements are relevant and appropriate for alternatives utilizing containers for temporary storage or storage before disposal.	RMRS does not anticipate generating any hazardous wastes from its 11 (e) (2) processing operation. Containers of Silo 3 materials, secondary waste containing Silo 3 material, or treated Silo 3 material not meeting WAC will be managed in accordance with substantive requirements of the container standards. Generation of hazardous wastes that are non-liquid will not require construction or maintenance of secondary containment systems.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-013, Contingency Plan RMR-0445-0021, Project Specific Health and Safety Plan

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Tank Systems	40 CFR § Subpart J OAC 3745-55-91 through 96 Design, operating standards, and inspection requirements for tank units within which hazardous waste is stored or treated. • Tank design must be compatible with the material being stored. • Tank must be designed and have sufficient strength to store or treat waste to ensure it will not rupture or collapse. • Tank must have secondary containment that is capable of detecting and collecting releases to prevent migration of wastes or accumulated liquids to the environment.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Design criteria, operating standards, and inspections for tank treatment units might be relevant and appropriate for alternatives utilizing treatment or storage in a tank prior to disposal.	RMRS does not plan to generate any hazardous wastes from its 11 (e) (2) processing operation. In the event that liquid hazardous wastes are generated and storage in tanks is appropriate, RMRS will manage tanks per the substantive requirements of RCRA, as specified in Section 3.2 of the Design Basis Document. Alternatively, RMRS may propose establishment of a RCRA Temporary Unit (TU) as allowed in 40 CFR 264.553 (OAC 3745-54) or alternatively arrange to transfer the materials to already permitted storage units on – site at FEMP.	RMR-0445-ENG-015, Operational Environmental Control Plan
Closure Requirements for Tanks	40 CFR § 264.197 OAC 3745-55-97 At closure, the facility owner must do the following: • Remove all waste residues • Remove or decontaminate all tank system components • Remove or decontaminate all contaminated soils and structures • Manage all of the above as hazardous wastes • If all contaminated soils cannot be removed, the landfill requirements of 40 CFR § 264.310 apply.	These standards pertain to closure of any tanks and appurtances used to store or treat Silo 3 material during remediation. These requirements are relevant and appropriate because the circumstances and material subject to potential release are similar to those RCRA is designed to address.	RMRS does not plan to generate any hazardous wastes from its 11 (e) (2) processing operation. In the event that decontamination waters (anticipated 500 gallons) exhibit the characteristics of a hazardous waste for cadmium, chromium, lead, or selenium, the holding tank's contents will be removed as completely as practicable. The tank(s) will then be washed with at least 5 % of each tank(s)'s volume and the rinsates managed in the existing on – site waste water treatment system. Management of the empty tank as Low Level Waste (followed by either landfill disposal or metals reclamation) will constitute RCRA closure for the tank.	RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Miscellaneous Units	40 CFR § 264 Subpart X OAC 3745-57-91 through 92 Environmental performance standard, monitoring, inspection, and post-closure care for treatment in miscellaneous units as defined in 40 CFR § 260.10.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Miscellaneous units might be utilized under various alternatives to remediate waste that is sufficiently similar to hazardous waste.	RMRS does not plan to generate any hazardous wastes from its 11 (e) (2) processing operation. RMRS does not anticipate establishment of any RCRA miscellaneous units.	RMR-0445-ENG-015, Operational Environmental Control Plan
Corrective Action for SWMUs	40 CFR Subpart S 40 CFR § 264.552, . 553 Corrective Action Management Units might be designated at the site as areas where remediation wastes (solid, hazardous, or contaminated media and debris) might be placed during the process of remediation. Temporary units consisting of tanks and container storage units might be used to store and treat hazardous waste during the process of corrective action.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) During the process of remediation, materials might require temporary management for the purpose of staging or treating the material. Some of the material might exhibit a RCRA characteristic, or otherwise be sufficiently similar to hazardous waste to make this requirement relevant and appropriate.	RMRS will submit the treated 11 (e) (2) materials to FEMP for subsequent management. Absent inadvertent discharge of RCRA listed hazardous constituents derived from wastes, corrective action is not anticipated. TUs for remediation waste which are characterized as RCRA hazardous wastes may be established if hazardous wastes are unexpectedly generated during removal of the 11 (e) (2) materials.	RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Containment Buildings	40 CFR § 264 Subpart DD Hazardous waste and debris might be placed in units known as containment buildings for the purpose of interim storage or treatment. Containment buildings must be fully enclosed to prevent exposure to the elements and ensure containment of managed wastes. Floor and containment walls must be designed and constructed of materials of sufficient strength and thickness to support themselves, the waste contents, and any personnel and heavy equipment that operate within the operable unit. All surfaces coming in contact with hazardous waste must be chemically compatible with the waste. Primary barriers must be constructed to prevent migration of hazardous constituents into the barrier. Secondary containment systems including secondary barrier and leak detection systems must also be constructed for containment buildings used to manage wastes containing free liquids. Controls must be implemented to ensure: the primary barrier is free of significant cracks, corrosion, or other deterioration that may allow release of hazardous waste; the level of hazardous waste does not exceed height of containment walls and is otherwise maintained within containment walls; tracking of waste out of unit by personnel or equipment used in handling waste is prevented, and fugitive dust emissions are controlled at level of no visible emissions.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) During the process of remediation, materials might require temporary management for the purpose of staging or treating the material. Some of the material might exhibit a RCRA characteristic, or otherwise be sufficiently similar to hazardous waste to make this requirement relevant and appropriate.	The Silo 3 treatment facility is not being utilized as a containment building. Tanks or containers of liquid wastes exhibiting a hazardous characteristic will be maintained in secondary containment. However, the only liquids being stored are potable water, process, raw, or decontamination water that should not become sufficiently contaminated to exceed characteristic limits.	RMR-0445-ENG-015, Operational Environmental Control Plan RMRS Drawing 53-3233, General Arrangement Process Building RMRS Drawings 53-3230, General Arrangement Plan Process Building

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radiation Dose Limit (All Pathways)	DOE Order 5400.5, Chapter II, Section 1.a (proposed 10 CFR §834) The exposure of members of the public to radiation sources as a consequence of all routine DOE activities shall not cause, in a year, an effective dose equivalent greater than 100 mrem from all exposure pathways.	DOE Orders are identified as TBCs only when no promulgated ARARs exist, to ensure adequate protection of human health and the environment. Portions of DOE Order 5400.5 were selected as TBCs to ensure adequate protection of the public during and following remediation. Radiation sources within this operable unit might contribute to the total dose to members of the public from this DOE facility.	Releases of solid 11 (e) (2) materials are not anticipated during processing in containment buildings as described above. Releases of liquids (such as water) containing 11 (e) (2) materials are not anticipated. BAT control measures (HEPA filtration and continuous monitoring) will be employed to minimize radionuclide air emissions.	RMR-0445-ENG-015, Operational Environmental Control Plan RMRS Drawing 55-2008, Silo 3 Gas Treatment HVAC PFD

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Control of Fugitive Dust	OAC 3745-17-08 Requires the minimization or elimination of visible emissions of fugitive dust generated during grading, loading, or construction operations and other practices which emit fugitive dust.	The implementation of remedial action alternatives may require the movement of dirt and other material likely to result in fugitive dust emissions. This requirement is relevant and appropriate because the FEMP is not located in an area subject to this regulation.	All 11 (e) (2) materials processing will be within negative pressure containment buildings. Although placement of roadbed material is anticipated early in the project, RMRS will implement a pre-operational environmental control plan (RMR-0445-060) that addresses the methods and materials to control fugitive dust emissions during construction activities. The pre-operational and operational environmental control plan (RMR-0445-015) will comply with FEMP Site Specific BAT for the control of fugitive dust as defined in RM-0047, FEMP Fugitive Dust Control Requirements.	RMR-0445-0060, Pre-Operational Environmental Control Plan
Prevention of Air Pollution Nuisance	ORC 3704.01 - .05 OAC 3745-15-07 Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution in order to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state. The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors, and combinations of the above in such a manner or in such amounts as to endanger the health, safety, or welfare of the public or to cause unreasonable injury or damage to property shall be declared a public nuisance and is prohibited.	This requirement is applicable to remediation activities involving Silo 3 material. During the remediation process some potential exists for emissions of radionuclides and toxic chemicals to the air, which might endanger individuals or damage property.	RMRS does not anticipate emission of air pollution nuisances.	RMR-0445-ENG-010, Point Source Air Emission Data. RMR-0445-ENG-015, Operational Environmental Control Plan
Control of Visible Particulate Emissions from Stationary Sources	OAC 3745-17-07 Discharge of particulate emissions into ambient air from any stack of a shade or density greater than 20 percent opacity is prohibited. Transient exceedance limits are included in this regulation.	This requirement is applicable to remediation activities involving Silo 3 material. Treatment operations for various alternatives might result in the release of particulate material.	All stack emissions from RMRS' 11 (e) (2) processing operations will be filtered using High Efficiency Particulate Air (HEPA) technologies. Emissions are not expected to generate any visible opacity impact. Potential emissions from Envirobond's™ amendment storage totes will be eliminated through the use of seal/closed totes to meet the 20 %	See above. RMR-0445-ENG-06. Process Description

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
			opacity and nuisance particulate scenarios.	

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Exhibit 1.0-3. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Permit to Install	OAC 3745-31-05(A)(3) The director shall issue a permit to install if he determines that the installation or modification and operation of the air contaminant source will employ the best available technology.	Since an administrative Permit to Install is not required for alternatives involving onsite treatment of Silo 3 material, this requirement is not applicable. However, the substantive requirements of this section must be met by employing Best Available Technology for treating particulate and off-gas emissions during treatment operations. Therefore, this requirement is relevant and appropriate to remediation activities involving Silo 3 material.	The HVAC system includes HEPA filtration and continuous stack monitoring.	RMR-0445-ENG-010, Point Source Air Emission Data. RMR-0445-ENG-015, Operational Environmental Control Plan RMRS Drawing 55-2008, Silo 3 Gas Treatment HVAC PFD
Restrictions on Particulate Emissions from Industrial Processes	OAC 3745-17-11 This requirement establishes numerical emission release limits for particulate material from industrial sources. Any source (operation, process, or activity) shall be operated so that particulate emissions do not exceed allowable emission rates specified in this regulation (based on processing weights [Table 1] or uncontrolled mass rate of emissions [Figure II]). A source complies with Table 1 requirements if its rate of particulate emission is always equal to or less than the allowable rate of particulate emission based on the maximum capacity of the source: Process Rate at Maximum Capacity (lb/hr) — Allowable Rate of Particulate Emission (lb/hr)[1] 100 — 0.551 200 — 0.877 400 — 1.40 600 — 1.83 800 — 2.22 1000 — 2.58 [1] Excerpted from Table 1 of OAC 3745-17-11	This requirement is applicable to remediation activities involving Silo 3 material. Treatment operations for various alternatives might result in release of particulate material which might exceed these standards.	RMRS HEPA emission control technology is anticipated to minimize particulate emissions to less than OAC 3745-17-11's particulate emission maxima.	See above

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Exhibit 1.0-4. Compliance Strategy for the Substantive Requirements for Air Contaminant Sources.

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radionuclide Emissions (Except Airborne Radon-222) 40 CFR Part 61 Subpart H	Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that might cause any member of the public to receive in any year an EDE of 10 mrem per year.	Monitoring is required at release points having potential to discharge radionuclides which could cause an EDE in excess of 1% of the standard (0.1mrem/yr) to any member of the public. This requirement is applicable to remediation of Silo 3 material. Radioactive materials within Silo 3might contribute to the dose to members of the public from the air pathway during implementation of remedial actions.	See above.	RMR-0445-ENG-010, Point Source Air Emission Data. RMR-0445-ENG-015, Operational Environmental Control Plan
Radon-222 Emissions 40 CFR Part 61 Subpart Q	No source at a DOE facility shall emit more than 20 pCi/m 2 Cs of radon-222 as an average for the entire source during periods of storage and disposal.	This requirement is applicable only to storage and disposal of radium-bearing byproduct material, such as Silo 3 material. Storage facilities for untreated Silo 3 material or stabilized wastes might qualify as sources.	See above.	See above. RMR-0445-ENG-005, Occupational ALARA Plan
Permits to Install (PTI) New Sources of Emissions OAC 3745-31-05(A)(3)	The Director shall issue a Permit to Install if he determines that the installation or modification and operation of an air contaminant will: • Not prevent or interfere with the attainment or maintenance of applicable ambient air quality standards; • Not result in a violation of any applicable air pollution control laws; and • Employ best available technology (BAT) to control emissions.	Point sources must not interfere with the attainment or maintenance of any air quality standards or cause a violation of any air control laws. BAT must be used on all point sources. OEPA may also require stack performance testing to evaluate controls.	See above.	RMR-0445-ENG-010, Point Source Air Emission Data. RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-4 (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Particulate Matter Standards OAC 3745-17-07	Visible particulate emissions from any stack may exceed twenty percent opacity, as a six minute average, for not more than six consecutive minutes in any sixty minutes, but shall not exceed sixty percent opacity, as a six minute average, at any time.	No person shall cause or permit any source of particulate emissions to be operated; or any materials to be handled, transported, or stored; or a building or its appurtenances or a road to be used, without taking or installing reasonably available control measures to prevent particulates from becoming airborne.	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-0060, Pre-Operational Environmental Control Plan

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Exhibit 1.0-4 (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Ohio EPA Air Toxics Policy (PTI) (used in conjunction with OAC 3745-31-05(A) (3))	The current PTI regulations provide the Director of Ohio Environmental Protection Agency (OEPA) with a mechanism to require the evaluation of toxic air contaminants from new sources. The OEPA Air Toxics Policy provides a mechanism for calculating the Maximum Acceptable Ground-Level Concentration for a toxic substance. This value at the site boundary will be modeled to the stack to determine a stack limit. All toxic compounds that will exceed the stack limit shall be controlled administratively or by BAT to lower emissions to below the calculated stack limit.	For toxic compound emissions that are calculated to exceed the established stack limit, administrative controls shall be implemented or emissions shall be controlled by implementing BAT for toxic emissions. Performance of these control measures may be verified through performance testing during operation.	No emission of air toxics are anticipated	
Control of Fugitive Dust OAC 3745-17-08	Requires the minimization or elimination of visible emissions of fugitive dust generated during grading, loading, or construction operations and other practices which emit fugitive dust.	The implementation of remedial action alternatives may require the movement of dirt and other material likely to result in fugitive dust emissions. This requirement is relevant and appropriate because the FEMP is not located in an area identified is Appendix A of OAC 3745-17-08 that is subject to this regulation.	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-0060, Pre-Operational Environmental Control Plan
Prevention of Air Pollution Nuisance ORC 3704.01 - .05 OAC 3745-15-07	Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution in order to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state. The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors, and combinations of the above in such a manner or in such amounts as to endanger the health, safety, or welfare of the public or to cause unreasonable injury or damage to property shall be declared a public nuisance and is prohibited.	This requirement is applicable to remediation activities involving Silo 3 material. During the remediation process some potential exists for emissions of radionuclides and toxic chemicals to the air, which might endanger individuals or damage property.	See above.	See above.

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Exhibit 1.0-4 (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Restrictions on Particulate Emissions from Industrial Processes OAC 3745-17-11	This requirement establishes numerical emission release limits for particulate material from industrial sources. Any source (operation, process, or activity) shall be operated so that particulate emissions do not exceed allowable emission rates specified in this regulation (based on processing weights [Table 1] or uncontrolled mass rate of emissions [Figure II]). A source complies with Table 1 requirements if its rate of particulate emission is always equal to or less than the allowable rate of particulate emission based on the maximum capacity of the source: Process Rate at Maximum Capacity (lb/hr) — Allowable Rate of Particulate Emission (lb/hr)[1] 100 — 0.551 200 — 0.877 400 — 1.40 600 — 1.83 800 — 2.22 1000 — 2.58 [1] Excerpted from Table 1 of OAC 3745-17-11	This requirement is applicable to remediation activities involving Silo 3 material. Treatment operations for various alternatives might result in release of particulate material which might exceed these standards.	See above.	RMR-0445-ENG-010, Point Source Air Emission Data. RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-5. Compliance Strategy for the Substantive Requirements for Wastewater, Stormwater and Wetlands.

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Nationwide Permit Program 33 CFR Part 330	The U.S. Corps of Engineers can issue a NWP as a general permit for certain classes of actions that involve dredge or fill activities in wetlands or navigable waters. Discharges of dredged or fill material into wetlands may require a wetland delineation.	Remediation activities may require construction of access roads and utility lines resulting in minor wetland disturbances. All dredge and fill activities related to construction of these access roads and utility lines must be conducted in accordance with the substantive terms and conditions of NWP 14 (Road Crossing) and NWP 12 (Utility Line Backfill and Bedding). OEPA has been granted Section 401 State Water Quality Certification for NWPs 12 and 14.	See above.	
Discharge of Storm Water Runoff 40 CFR Part 122.65 OAC 3745-38	Storm water runoff from landfills, construction sites, and industrial activities must be monitored and controlled. A Stormwater Pollution Prevention Plan (SWPPP) is required for construction activities which result in a total land disturbance of 5 or more acres.	The FEMP has developed a SWPPP that applies to all activities conducted at the FEMP. The Contractor shall comply with the provisions in the SWPPP.	See above.	RMR-0445-ENG-009, Storm Water Drainage Plan RMR-0445-ENG-0060, Pre Operational Environmental Control Plan RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-5 (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Discharge of Treatment System Effluent 40 CFR Part 125.100 & 40 CFR Part 125.104	Best Management Practices (BMP) Develop and implement a BMP program to prevent the release of toxic or hazardous pollutants to waters of the U.S. Development and implementation of a sitewide BMP Program is also required as a condition of the FEMP NPDES Permit. The BMP program must: • Establish specific objectives for the control of toxic and hazardous pollutants • Include a prediction of direction, rate of flow, and total quantity of toxic and hazardous pollutants where experience indicates a reasonable potential for equipment failure.	Silo 3 activities have the potential for releases of toxic or hazardous pollutants in runoff. The BMP program is relevant and appropriate to prevent releases from spills or runoff during implementation of remedial actions. The current FEMP NPDES permit does not contain a BMP Plan requirement. BMP requirements have been superceded by the SWPPP. The Contractor shall comply with the provisions in the SWPPP.	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-5 (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Radiation Protection of the Public and the Environment from Radionuclide Release to Waters DOE Order 5400.5 Chap. III (proposed 10 CFR Part 834)	Residual concentrations of radionuclides in water that may be ingested are listed below. These derived concentration guides (DCGs) for the constituents of concern (COCs) are based on a CEDE of 100 mrem/yr, assuming ingestion of 2 liters/day. Note that these DCGs apply only if ingestion is the single pathway of exposure. Isotope — Ingested Water DCGs (µCi/mL) Actinium-227 — $1x10^{-8}$ Lead-210 — $3x10^{-8}$ Polonium-210 — $8x10^{-8}$ Protactinium-231 — $1x10^{-8}$ Radium-224 — $4x10^{-7}$ Radium-226 — $1x10^{-7}$ Radium-228 — $1x10^{-7}$ Technetium-99 — $1x10^{-4}$ Strontium-90 — $1x10^{-6}$ Thorium-228 — $4x10^{-7}$ Thorium-230 — $3x10^{-7}$ Thorium-232 — $5x10^{-8}$ Uranium-234 — $5x10^{-7}$ Uranium-235 — $6x10^{-7}$ Uranium-236 — $5x10^{-7}$ Uranium-238 — $6x10^{-7}$	DOE Orders are identified as TBCs only when no promulgated ARARs exist, to ensure the adequate protection of human health and the environment. Portions of DOE Order 5400.5 were selected as TBCs to ensure adequate protection of the public during and following remediation. Remediation of Silo 3 material has the potential to release radionuclides contained in the waste materials to environmental media via wastewater or stormwater.	See above.	RMR-0445-ENG-009, Storm Water Drainage Plan RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-5 (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Ohio Water Quality Standards Use Designation and Criteria	All pollutants or combinations of pollutants shall not exceed, outside the mixing zone, the Numerical and Narrative Criteria for Aquatic Life Habitat and Water Supply Use Designation listed in Tables 7-1 through 7-15 of this rule. The following COCs for OU4 have warm water habitat criteria concentrations outside the mixing zone as follows: Constituent — Criteria conc.[a] (µg/L) — 30-day average conc. (µg/L) Antimony — 650 — 190 Arsenic — 360 — 190 Beryllium — Tab. 7-10 [b] — Tab. 7-11 [c] Cadmium — Tab. 7-10 — Tab. 7-11 Chromium — Tab. 7-10 — Tab. 7-11 Copper — Tab. 7-10 — Tab. 7-11 Cyanide — 46 — 12 Lead — Tab. 7-10 — Tab. 7-11 Mercury — 1.1 — 0.20 Nickel — Tab. 7-10 — Tab. 7-11 Selenium — 20 — 5.0 Silver — Tab. 7-10 — 1.3 Thallium — 71 — 16 Zinc — Tab. 7-10 — Tab. 7-11 2-Butanone — 160,000 — 7,100 4-Nitrophenol — 790 — 35 Acetone — 550,000 — 78,000 Aldrin — ---- — 0.01 bis(2-ethylhexyl)phthalate — 1,100 — 8.4 Carbon tetrachloride — 1,800 — 280 DDT — ---- — 0.001 Dieldrin — ---- — 0.005 di-n-butyl phthalate — 350 — 190 Diethylphthalate — 2,600 — 120 Dimethylphthalate — 1,700 — 73 Endosulfan d — ---- — 0.003 Endrin — ---- — 0.002 Fluoranthrene — 200 — 8.9 Methylene chloride — 9,700 — 430 PCBs — ---- — 0.001	This requirement is applicable to remediation activities involving Silo 3 material. Paddys Run and the stream segment of the Great Miami River adjacent to the FEMP are designated as warm water aquatic life habitats with use designations of agricultural and industrial water supply, and primary contact recreation. Chemical contaminants within Silo 3 might be released during remediation such that they might contribute to contamination in these aquatic habitats. OAC 3745-1-21 Water Use Designation for the Great Miami River) establishes the classification of the receiving waters for the FEMP.	See above.	RMR-0445-ENG-009, Storm Water Drainage Plan RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-5 (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Ohio Water Quality Standards Use Designation and Criteria (continued)	[a] Criteria concentration shall be met outside the mixing zone. [b] Criteria concentration based on hardness of water. See Table 7-10 for calculation to determine maximum concentration outside the mixing zone. [c] 30-day average criteria based on hardness of water. See Table 7-11 for calculation to determine allowable 30-day average concentration outside the mixing zone. [d] No designation was made as to whether endosulfan referred to endosulfan I or endosulfan II or the sum total of each. The remaining COCs for OU4 will have criteria concentration levels based on calculated acute aquatic criteria (AAC), or chronic aquatic criteria (CAC).			
Ohio Water Quality Standards "Six Freedoms" for surface water OAC 3745-1-04	All surface waters of the state shall be free from: • objectionable suspended solids • floating debris, oil, and scum • materials that create a nuisance • toxic, harmful or lethal substances • nutrients that create nuisance growth • substances that will impair designated instream or downstream water uses.	This requirement is relevant and appropriate to remediation activities involving Silo 3 material. This requirement pertains to both discharges to surface waters as a result of remediation and any on-site surface waters affected by site conditions.	See above.	See above
OEPA NPDES Permit No. 1|000004*FD	Wastewater associated with remediation of the Silo 3 wastes must be treated if necessary to ensure compliance with the terms and conditions of the FEMP NPDES permit. DOE is required to notify OEPA of any activities or changes at the site which have the potential to significantly alter the character of the wastewater streams being discharged under its existing NPDES permit. A NPDES permit modification is required if the discharge is deemed significant enough to cause a change in the character of the wastewater stream. The existing NPDES permit must also be modified to reflect the addition of any new point source discharges of process wastewaters and stormwaters.	Wastewater must be eliminated, recycled, or minimized during the remediation of Silo 3 material to the extent practicable. Wastewater discharges associated with remediation of the Silo 3 material must be pretreated, if required, to ensure compliance with NPDES permit requirements. The existing NPDES permit will be modified and/or renewed, as necessary, to reflect process wastewater discharges.	Waste minimization efforts should limit the volumes of 11 (e) (2) impacted wastewaters. Approximately 500 gallons of Silo 3, process, and decon waters are expected to be generated by project completion. Potential inadvertent discharge of these liquids will be mitigated by liquid management within RMRS' containment buildings. Stormwaters will be directed to non-contaminated storm water basin. Silo 3, process, and decon waters are subject to acceptance criteria found in C.5.1.1.3.2 of the contract, consistent with NPDES Permit Number 1|000004*FD.	RMR-0445-ENG-009, Storm Water Drainage Plan RMR-0445-ENG-0060, Pre Operational Environmental Control Plan RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-6. Compliance Strategy for the Substantive Requirements under RCRA

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Hazardous Waste Determinations 40 CFR Part 262.11 OAC 3745-52-11	Any generator of waste must determine whether or not the waste is hazardous. The procedures to be followed include: • To identify whether a particular material of concern is a "solid waste" • To identify whether a particular exclusion applies to the material eliminating it from definition as a "solid waste" • To identify whether a particular solid waste might be classified as a hazardous waste • To determine if a material otherwise classified as a "hazardous waste" might be excluded from RCRA regulation	These procedures are established to determine whether wastes are subject to the requirements of RCRA. These procedures are relevant and appropriate to determine whether OU4 wastes, whether excluded or not, exhibit the characteristics of hazardous waste or otherwise require management under RCRA. The Silo 3 material is sufficiently similar to hazardous wastes based on the TCLP results. Wastes such as debris generated during decontamination will also require a hazardous waste determination to be made.	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-0060, Pre-Operational Environmental Control Plan
Empty Containers 40 CFR Part 261.7 OAC 3745-51-7	Containers that have held hazardous wastes are "empty" and exempt from further RCRA regulations if one or more of the of the following are met: • No more than 2.5 cm (1 inch) of residue remains on bottom of inner liner. • Less than 3% by weight of total capacity remains (less than or equal to 110 gallon container), • Less than 0.3% by weight of total capacity remains (greater than 110 gallon container) Containers that have held acutely hazardous ("P" listed) wastes are "empty" and exempt from further RCRA regulation if: • They or their inner liners have been triple rinsed with an adequate solvent or the inner liner has been removed from the container.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Containers used to treat or store the contents of Silo 3 might contain wastes which exhibit a hazardous waste characteristics which must be removed before the containers can be reused or disposed.	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan

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Exhibit 1.0-6. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Generators Who Transport Hazardous Waste for Off-site Treatment, Storage, or Disposal 40 CFR Part 262.20 - 262.33 and 263.20 - 263.31 OAC 3745-52-20 through 33 and OAC 3745-53-20 through 31	Any generator who transports hazardous waste for off-site treatment, storage or disposal must originate and follow-up the manifest for off-site shipments.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. Treated Silo 3 wastes must be transported in accordance with the communication, emergency response, and training requirements under 49 CFR Part 172 and packaging requirements under 49 CFR 173. In addition, any wastes determined to be RCRA hazardous waste removed from this operable unit for off-site treatment, storage, or disposal will be subject to the manifest requirement	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan
Treatment, Storage, or Disposal Facility Standards 40 CFR Part 264 Subpart B OAC 3745-54-13 through 16	General Standards • Waste Analysis - OAC 3745-54-13 Operators of a facility must obtain a detailed chemical and physical analysis of a representative sample of each hazardous waste to be treated, stored, or disposed of at the facility prior to treatment, storage, or disposal. • Security - OAC 3745-54-14 Operators of a facility must prevent the unknowing or unauthorized entry of persons or livestock into the active portions of the facility, maintain a 24-hour surveillance system, or surround the facility with a controlled access barrier and maintain appropriate warning signs at facility approaches. • Inspections - OAC 3745-54-15 Operators of a facility must develop a schedule and regularly inspect monitoring equipment, safety and emergency equipment, security devices and operating and structural equipment that are important to preventing, detecting or responding to environmental or human health hazards, promptly or immediately remedy defects, and maintain an inspection log. Training - OAC 3745-54-16 Operators must train personnel within 6 months of their assumption of duties at a facility in hazardous waste management procedures relevant to their positions including emergency response training.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Wastes, which exhibit a characteristic similar to RCRA hazardous waste, removed from this operable unit might be treated, stored, and disposed in accordance with TSD facility standards.	See above.	See above

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Exhibit 1.0-6. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Treatment, Storage, or Disposal Facility Preparedness and Prevention 40 CFR Part 264 Subpart C OAC 3745-54-31 through 35 and OAC 3745-54-17	OAC 3745-54-31 - TSD facility operators must design, construct, maintain, and operate facilities to minimize the possibility of a fire, explosion, or any unplanned sudden or nonsudden release of hazardous waste to air, soil, or surface water which might threaten human health or the environment. OAC 3745-54-32 - All facilities must be equipped with an internal communication or alarm system, a telephone, or a two-way radio for calling outside emergency assistance, fire control, spill control, and decontamination equipment and water at an adequate volume and pressure to supply water hose streams, foam producing equipment, automatic sprinklers, or water spray systems. OAC 3745-54-33 - All fire protection and spill control and decontamination equipment and communication and alarm systems must be tested and maintained as necessary to assure proper emergency operation. OAC 3745-54-34 - All personnel must have immediate access to emergency communication or alarm systems whenever hazardous waste is being handled at the facility. OAC 3745-54-35 - Aisle space must be sufficient to allow unobstructed movement of personnel, fire and spill control, and decontamination equipment. OAC 3745-54-37 - Operators must attempt to make arrangements, appropriate to the waste handled, for emergency response by local and state fire, police and medical personnel.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Wastes removed from this operable unit might be treated, stored, or disposed in accordance with TSD facility standards.	See above.	See above
Closure 40 CFR Part 264 Subpart G OAC 3745-55-11, 3745-55-14, and 3745-55-16	Operators must close the facility in a manner that: • Minimizes the need for further maintenance • Minimizes post-closure escape of hazardous constituents • Complies with specific unit type closure requirements All contaminated equipment, structures and soils must be properly disposed or decontaminated. Following closure, a survey plot showing the location of hazardous waste disposal units with respect to surveyed benchmarks must be filed with the legal total zoning authority.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. The facility must be clean closed, else media remediation to meet closure performance standards. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.)	See above.	See above

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Exhibit 1.0-6. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Container Storage 40 CFR Part 264 Subpart I OAC 3745-55-71 through 78	Containers of RCRA hazardous waste must be: • Maintained in good condition • Compatible with hazardous waste to be stored • Closed during storage (except to add or remove waste) • Managed in a manner that will not cause the container to rupture or leak Storage areas must be inspected weekly for leaking and deteriorated containers and containment systems. Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide a containment system with a capacity of 10 percent of the volume of the largest container of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system. Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier. At closure, remove all hazardous waste and residue from the containment system, and decontaminate or remove all containers, liners, bases, and soils.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) These requirements are relevant and appropriate for alternatives utilizing containers for temporary storage or storage before disposal.	See above.	RMRS drawing 53-3230, General Arrangement Plan Process Building RMRS drawing 52-3013, ISA Pavement Plan and Section

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Exhibit 1.0-6. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Tank Systems 40 CFR Part Subpart J OAC 3745-55-91 through 96	Design, operating standards, and inspection requirements for tank units within which hazardous waste is stored or treated. • Tank design must be compatible with the material being stored. • Tank must be designed and have sufficient strength to store or treat waste to ensure it will not rupture or collapse. • Tank must have secondary containment that is capable of detecting and collecting releases to prevent migration of wastes or accumulated liquids to the environment.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Design criteria, operating standards, and inspections for tank treatment units might be relevant and appropriate for alternatives utilizing treatment or storage in a tank prior to disposal.	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-0060, Pre-Operational Environmental Control Plan
Closure Requirements for Tanks	40 CFR § 264.197 OAC 3745-55-97 At closure, the facility owner must do the following: • Remove all waste residues • Remove or decontaminate all tank system components • Remove or decontaminate all contaminated soils and structures • Manage all of the above as hazardous wastes • If all contaminated soils cannot be removed, the landfill requirements of 40 CFR § 264.310 apply.	Silo 3 is a tank, according to the definition of 40 CFR Part 264.10, which contains waste sufficiently similar to hazardous waste. These standards pertain to closure of any tanks and appurtenances used to store or treat Silo 3 material during remediation. These requirements are relevant and appropriate because the circumstances and wastes subject to potential release are similar to those RCRA is designed to address.	See above.	See above. RMR-0445-ENG-03, Retrieval Technology Description RMR-0445-ENG-016, Gross Decontamination Plan

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Exhibit 1.0-6. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Miscellaneous Units 40 CFR Part 264 Subpart X OAC 3745-57-91 through 92	Environmental performance standard, monitoring, inspection, and post-closure care for treatment in miscellaneous units as defined in 40 CFR § 260.10.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) Miscellaneous units might be utilized under various alternatives to remediate waste that is sufficiently similar to hazardous waste.	See above.	See above.
Corrective Action for SWMUs 40 CFR Part 264 Subpart S 40 CFR Part 264.552, 553	Corrective Action Management Units might be designated at the site as areas where remediation wastes (solid, hazardous, or contaminated media and debris) might be placed during the process of remediation. Temporary units consisting of tanks and container storage units might be used to store and treat hazardous waste during the process of corrective action.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) During the process of remediation, materials might require temporary management for the purpose of staging or treating the material. Some of the material might exhibit a RCRA characteristic, or otherwise be sufficiently similar to hazardous waste to make this requirement relevant and appropriate.	See above.	RMRS drawing 53-3230, General Arrangement Plan Process Building RMRS drawing 52-3013, ISA Pavement Plan and Section

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Exhibit 1.0-6. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Containment Buildings 40 CFR Part 264 Subpart DD	Hazardous waste and debris might be placed in units known as containment buildings for the purpose of interim storage or treatment. Containment buildings must be fully enclosed to prevent exposure to the elements and ensure containment of managed wastes. Floor and containment walls must be designed and constructed of materials of sufficient strength and thickness to support themselves, the waste contents, and any personnel and heavy equipment that operate within the operable unit. *All surfaces coming in contact with hazardous waste* must be chemically compatible with the waste. Primary barriers must be constructed to prevent migration of hazardous constituents into the barrier. Secondary containment systems including secondary barrier and leak detection systems must also be constructed for containment buildings used to manage wastes containing free liquids. Controls must be implemented to ensure: the primary barrier is free of significant cracks, corrosion, or other deterioration that may allow release of hazardous waste; the level of hazardous waste does not exceed height of containment walls and is otherwise maintained within containment walls; tracking of waste out of unit by personnel or equipment used in handling waste is prevented, and fugitive dust emissions are controlled at level of no visible emissions.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibit a hazardous characteristic.) During the process of remediation, materials might require temporary management for the purpose of staging or treating the material. Some of the material might exhibit a RCRA characteristic, or otherwise be sufficiently similar to hazardous waste to make this requirement relevant and appropriate.	See above.	RMRS drawing 53-3230, General Arrangement Plan Process Building.

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Exhibit 1.0-6. (continued).

Category	ARAR	Requirement Assessment	Compliance Strategy	Cross Reference Index
Treatment, Storage, or Disposal Facility Contingency Plan and Emergency Procedures 40 CFR Part 264 Subpart D OAC 3745-54-51 through 52 and OAC 3745-54-55 through 56	OAC 3745-54-51 - Each facility operator must have a contingency plan designed to minimize hazards to human health or the environment due to fires, explosions, or any unplanned releases of hazardous waste constituents to the air, soil, or surface/groundwater. OAC 3745-54-52 - Contingency plans should address procedures to implement a response to incidents involving hazardous waste, and provide for internal and external communications, arrangements with local emergency authorities, and emergency coordinator list, a facility emergency equipment list indicating equipment descriptions and locations, and a facility personnel evacuation plan. OAC 3745-54-55 through 56 - Each facility must have an emergency coordinator who has responsibility for coordinating all emergency response measures, is on the premises or on call at all times, is thoroughly familiar with all aspects of the contingency plan, facility operations, location and characteristics of waste handled, location of pertinent records, and facility layout, and who has the authority to commit the resources necessary to implement the contingency plan in the event of an emergency.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. (This requirement will be applicable to non-excluded solid waste that exhibits a hazardous characteristic.) Wastes removed from this operable unit might be treated, stored, or disposed in accordance with TSD facility standards.	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan RMR-0445-ENG-013, Contingency Plan RMR-0445-0021, Project Specific Health and Safety Plan
Closure 40 CFR Part 264 Subpart G OAC 3745-55-11, 3745-55-14, and 3745-55-16	Operators must close the facility in a manner that: • Minimizes the need for further maintenance • Minimizes post-closure escape of hazardous constituents • Complies with specific unit type closure requirements All contaminated equipment, structures and soils must be properly disposed or decontaminated. Following closure, a survey plot showing the location of hazardous waste disposal units with respect to surveyed benchmarks must be filed with the legal total zoning authority.	The material in Silo 3 is specifically exempt from the applicability of RCRA requirements. However, these procedures are relevant and appropriate since the material stored in Silo 3 is sufficiently similar to hazardous wastes based on TCLP results. The Contractor's facility must be clean closed, else media remediation to meet closure performance standards. (This requirement will be applicable to non-excluded solid waste that exhibits a hazardous characteristic.)	See above.	RMR-0445-ENG-015, Operational Environmental Control Plan

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FERNALD SILO 3 PROJECT

Health and Safety Controls RMR-0445-H&S-001-000

May 12, 2000

This document has been reviewed and approved by:

Project Manager: _____ Date: _____

Quality Assurance: _____ Date: _____

Health and Safety: _____ Date: _____

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Acronyms and Abbreviations

ALARA	as low as reasonably achievable
H&SC	health and safety controls
IHA	Integrated Hazard Analysis
PHAR	Preliminary Hazard Analysis Report
PPE	personal protective equipment
PSHASP	Project-Specific Health and Safety Plan
PSHPP	Project-Specific Health Physics Plan
PSHSRM	Project-Specific Health and Safety Requirements Matrix
SBDIP	Safety Basis Documentation Implementation Plan

1.0 PURPOSE

The Health and Safety Controls (H&SC) section, of the Remedial Design Package, describes the overall process for the development of the safety documentation to support the operations phase of the Silo 3 Project. The H&SC is an upper-tier document that identifies specific Silo 3 documents that detail the preventative measures, safety controls, and actions to be taken to mitigate the consequences of occupational, public and environmental hazards associated with the operations phase of the Silo 3 Project. The flow down documents used to develop the H&SC, that are referenced for the Silo 3 Project overall safety process, will be revised as the project moves into phases subsequent to operations.

The Silo 3 Project has five elements that identify the project's preventative measures, safety controls and actions to be taken for occupational hazards. The elements are:

- Overall safety
- Occupational safety
- Radiological safety
- Industrial safety
- Safety implementation

The Safety Basis Documentation Implementation Plan (SBDIP) (RMR-0445-0014) identifies the basis for the establishment of hazard controls necessary for the safe operation of the Silo 3 Project. Hazards for the Silo 3 Project are identified in the Integrated Hazard Analysis (IHA) (RMR-0445-0046). The IHA identifies hazards and accident scenarios, and provides a qualitative evaluation of consequences, probabilities, and the risks from potential accidents from the Silo 3 Project. The IHA is preliminary, and consequences of the potential accidents are qualitatively analyzed in the project Preliminary Hazards Analysis Report (PHAR) (RMR-044-0056). The IHA process will continue through final design and will be presented in the Final Hazards Analysis Report.

Occupational safety, for the Silo 3 Project, is described in the Project-Specific Health and Safety Plan (PSHASP) (RMR-0445-0021). The Project-Specific Health and Safety Requirements Matrix (PSHSRM) is an attachment to the PSHASP, that identifies the activities and tasks, potential hazards, monitoring requirements, personal protective equipment (PPE), training, medical monitoring, administrative and engineering controls, permits, and decontamination and disposal procedures. The PSHASP is for the pre-operational, operational, and shutdown and dismantlement phases of the Silo 3 Project. The PSHASP incorporates the results obtained from the PHAR and

the Integrated Hazard Analysis (RMR-0445-0046). The PSHASP will be revised as the project moves into phases subsequent to operations.

Radiological safety for the Silo 3 Project is analyzed and described in the Occupational As Low As Reasonably Achievable (ALARA) Plan (RMR-0445-ENG-005). Implementation of radiological safety is accomplished through the Project Specific Health Physics Plan (PSHPP) (RMR-0445-0044). The PSHPP will be revised as the project moves into phases subsequent to operations. The Occupational ALARA Plan addresses the radiological controls required for pre-operational, operational, and shutdown and dismantlement of the Silo 3 Project. The Occupational ALARA Plan addresses the protection measures required for equipment, engineering design, construction, and stabilization of Silo 3 Project material. The Occupational ALARA Plan will be revised as the project moves into phases subsequent to operations and will be presented in the Final Hazards Analysis Report.

Industrial safety for the Silo 3 Project is described in two documents. One, the Fire Hazards Analysis (RMR-0445-0118) evaluated the Silo 3 Project, in accordance with the proposed design documents, to determine what, if any, design modifications, or enhancements, would be necessary for the fire safety, and life safety elements of the project. Two, The Integrated Human Factors Evaluation (RMR-0445-0117) assesses a variety of areas important to the safe operation of the Silo 3 Project with the goal of reducing the risk to employees, the public, and the environment due to operator error, by identifying and addressing stress, ergonomic, procedural, design, and training issues.

Safety implementation for the Silo 3 Project will be administratively addressed in Safe Work Plans and permits for construction and decontamination and decommissioning. Operating Procedures, the Task Order System and the required Fluor Fernald, Inc. permits will be used during operations.

2.0 REFERENCES

RMR-0445-0014, Safety Basis Documentation Implementation Plan

RMR-0445-0021, Project-Specific Health and Safety Plan

RMR-0445-0046, Integrated Hazard Analysis

RMR-0445-0056, Preliminary Hazard Analysis Report for Silo 3

RMR-0445-0117, Integrated Human Factors Evaluation

RMR-0445-0118, Fire Hazard Analysis

RMR-0445-0044, Project-Specific Health Physics Plan

8.0 Contingency Plan

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FERNALD SILO 3 PROJECT

Contingency Plan
RMR-0445-ENG-013-000

May 12, 2000

This document has been reviewed and approved by:

Project Manager: _____ Date: _____

Quality Assurance: _____ Date: _____

Health and Safety: _____ Date: _____

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LIST OF ACRONYMS AND ABBREVIATIONS

AEDO	Assistant Emergency Duty Officer
ALARA	As Low As Reasonably Achievable
DOE	Department of Energy
EC	Emergency Coordinator
EDO	Emergency Duty Officer
EMT	Emergency Medical Technician
EOC	Emergency Operations Center
ERP	Emergency Response Plan
ERT	Emergency Response Team
FEMP	Fernald Environmental Management Project
Fluor Fernald	Fluor Fernald, Inc.
IHA	Integrated Hazard Analysis
OAC	Ohio Administrative Code
PCM	Personal Contamination Monitor
PPE	Personal Protective Equipment
PSHSP	Project-Specific Health and Safety Plan
RCT	Radiological Control Technician
RMRS	Rocky Mountain Remediation Services, L.L.C.
TSS	Tension Support Structure
VitPP	Vitrification Pilot Plant

1.0 OVERVIEW

This Contingency Plan provides the instruction for response to emergencies and unusual events for Silo 3 Project personnel. It provides for interface with the Fernald Environmental Management Project (FEMP) emergency organization and their response as detailed in the FEMP Emergency Plan. This contingency plan meets the project-specific needs of the FEMP Emergency Plan, Chapter 10, for implementing initial emergency actions on the Silo 3 Project. This plan also meets the requirements of the Ohio Administrative Code and the substantive requirements of the Resource Conservation and Recovery Act (RCRA) Contingency Plan and Emergency Procedures Requirements.

This Contingency Plan, in conjunction with the FEMP Emergency Plan details the necessary plans and procedures to adequately address emergency situations and is in compliance with the Ohio Administrative Code(s) (OAC) as follows:

- OAC 3745-54-51 - Each facility operator must have a contingency plan designed to minimize hazards to human health or the environment due to fires, explosions, or any unplanned releases of hazardous waste constituents to the air, soil, or surface/groundwater.

- OAC 3745-54-52 - Contingency plans should address procedures to implement a response to incidents involving hazardous waste, and provide for internal and external communications, arrangements with local emergency authorities, emergency coordinator list, a facility emergency equipment list indicating equipment descriptions and locations, and a facility personnel evacuation plan.

- OAC 3745-54-55 through 56 - Each facility must have an emergency coordinator who has responsibility for coordinating all emergency response measures, is on the premises or on call at all times, is thoroughly familiar with all aspects of the contingency plan, facility operations, location and characteristics of waste handled, location of pertinent records, facility layout, and who has the authority to commit the resources necessary to implement the contingency plan in the event of an emergency.

The Silo 3 Project has designed project emergency response to keep radiological and chemical exposure to the immediate worker, collocated worker, and to the off-site public, As Low As Reasonably Achievable (ALARA). This contingency plan also embraces the concepts of Integrated Safety Management, in that this Contingency Plan:

- Defines the scope of work
- Analyzes the hazards
- Develops and implements hazard controls
- Performs work within these controls
- Provides feedback and continuous improvement.

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2.0 PLANNING

The potential for an emergency is minimized by the Silo 3 Project design and operating procedures. This process cannot eliminate that risk, however.

Emergencies addressed in this Contingency Plan were identified through the Integrated Hazards Analysis (IHA) process. The IHA is documented in the Integrated Hazard Analysis (RMR-0445-0046) provided as an appendix to the Preliminary Hazards Analysis Report for Silo 3 (RMR-0445-0056). The Preliminary Hazards Analysis tables for each phase of the project provide a listing of the potential emergencies for which the Silo 3 Project must prepare. Unforeseen emergencies are possible and will be addressed using the emergency infrastructure defined by this Contingency Plan, the FEMP Emergency Plan, and the FEMP Emergency Plan implementing procedures.

2.1 Hazards Analysis

The IHA identifies the following project phase-specific potential emergencies. Potential emergencies are not repeated for each phase. For example, catastrophic silo failure could occur during any of the phases (although the consequence would be reduced once the material had been removed from the silo) but is only addressed in the first phase.

2.1.1 Common to All Project Phases

- Catastrophic silo failure (from various causes)
- Tornado and high winds
- Earthquake
- Industrial health and safety accidents.

2.1.2 Pre-Operational Phase (Mobilization, Construction, and Construction Acceptance Testing)

- Fire/explosion
- Construction accident.

2.1.3 Operational Phase (Systems Operability Testing, Operational Readiness Review, Retrieval and Treatment)

- Fire Caused by Vehicle Accident
- Spill Caused by Vehicle Accident
- Spill of Material from Conveyance Pipe
- Tent Collapse
- Process Vessel Failure
- Electrical Fire
- Damaged Storage Drum
- Fire involving Storage Drums.

2.1.4 Facility Shutdown and Dismantlement Phase (Shutdown, Decontamination, and Disassembly)

- Construction safety type accidents
- Contaminated liquid spills.

2.1.5 Demobilization Phase (Equipment and Personnel Removal)

- Vehicle accidents.

2.2 Emergency Planning

The primary methods to protect Silo 3 Project personnel in emergencies are:

- Notification
- Sheltering
- Evacuation.

When an emergency occurs, project or FEMP management may direct sheltering or evacuation of personnel in the immediate area. The nearest permanent shelter for the Silos area is the Vitrification Pilot Plant (VitPP), which is currently designated as the emergency shelter for the Silos area. Further evacuation and protective actions are governed by implementation of the FEMP Emergency Plan.

The Silo 3 Project Emergency Coordinator (EC) is responsible to:

- Inform the Fluor Fernald, Inc. (Fluor Fernald) Assistant Emergency Duty Officer (AEDO) of the existing conditions (including the extent of any existing contamination), and cooperates with the AEDO to resolve the emergency situation
- Direct the activities of the Silo 3 Project personnel in emergency situations, including assigning employees to safely turn off equipment and utilities, and other related tasks in the event of an emergency shutdown, until the Fluor Fernald AEDO arrives
- Provide for assistance of physically challenged employees during evacuations
- Conducts, or designates an alternate to conduct, a Rally Point headcount following evacuation.

Once the Silo 3 Project Emergency Coordinator notifies the AEDO and the initial incident assessment has been conducted, the AEDO directs onsite protective actions. Once the Fluor Fernald Emergency Duty Officer (EDO) has been briefed or the FEMP Emergency Operations Center (EOC) has been activated, the EDO or AEDO will assume primary responsibility for recommending onsite protective actions and implementing the FEMP Emergency Plan.

2.2.1 Tornado, Severe Weather, or Earthquake

Sheltering is the preferred action for tornadoes, severe weather emergencies, and earthquakes. Sheltering is to move personnel into permanent buildings. The emergency shelter for the Silos area is the VitPP.

Severe Weather When the announcement of approaching severe weather is made, perform the following actions only if they can be safely performed before the severe weather arrives:

WARNING: AVOID HAZARDOUS SITUATIONS SUCH AS HIGH UNPROTECTED AREAS OR AREAS WHERE MATERIALS MAY BE BLOWN BY WIND.

- If in an isolated area, then secure equipment/material and move into a permanent structure such as the VitPP
- If in an external storage area, then secure loose materials (e.g., empty drums and boxes) by tying, weighing down, reducing stacking height, or sheltering; and move into a permanent structure such as the VitPP.
- If outside, then secure equipment/material and move to into the nearest permanent structure
- If in a trailer, smoking shelter, or Tension Support Structure (TSS), then seek shelter in the nearest permanent structure such as the VitPP
- If in a permanent structure, then do the following:
    - Close and secure windows, doors, other openings in which wind or rain could enter
    - Move away from windows
    - Shut down equipment that is unsafe to operate during wind or rainstorm
    - Move valuable equipment and materials to a sheltered location
    - Cover equipment that cannot be moved but may be damaged.

Earthquake In case of an earthquake, project personnel will be evaluated and sheltered. **WARNING: RESPONSE SHALL BE IMMEDIATE. DO NOT WAIT FOR INSTRUCTIONS.**

The following steps shall be taken in case of an earthquake:

- Take shelter under a sturdy desk or table. If a desk or table is not available, then go to a supported doorway
- If possible, kneel down, bend head close to knees, cover sides of head with elbows, and clasp hands firmly behind neck
- Avoid walls, shelves, and glassed areas. If inside then do not evacuate while tremors are occurring
- If outside, then move to an open area away from power lines, piping, buildings, and kneel or lie down

- After the tremors have subsided, then evacuate the facility
- When evacuating, move away from structures, avoid electrical wires, broken/leaking pipes, visible fumes, and other hazards that may be encountered
- Assemble at Rally Point #4 (See Appendix C to this Contingency Plan) or as directed by the Silo 3 Project EC.

Tornado

A tornado alert, based on existing conditions or funnel cloud sightings, will be announced by the FEMP communications systems. Silo 3 Project personnel are responsible to assure that all personnel within the Silo 3 Project area are aware of the alert and take appropriate action. Actions include:

- Immediate sheltering in a permanent building. The closest permanent building is the VitPP.
- If in a permanent structure, then do the following:
    - Close and secure windows, doors, other openings in which wind or rain could enter
    - Move away from windows
    - Shut down equipment that is unsafe to operate during wind or rainstorm
    - Move valuable equipment and materials to a sheltered location
    - Cover equipment that cannot be moved but may be damaged.
- If sufficient time does not exist to go to a permanent building, and you are in a trailer, then get out of the trailer. You are probably safer outside, even if the only alternative is to seek shelter out in the open, lie flat on low ground away from facilities, protecting your head. If possible, use open ground away from trees and cars, that can be blown onto you.
- Vehicles are extremely dangerous in a tornado. Park the vehicle as quickly and safely as possible -- out of the traffic lanes. It is safer to get the car out of mud later if necessary than to cause a crash. Get out and seek shelter in a sturdy building. If in the open country, run to low ground away from any cars (that may roll over on you). Lie flat and facedown, protecting the back of your head with your arms. Avoid seeking shelter under bridges, which offer little protection against flying debris.

2.2.2 Radiological Spills

Silo Dome Collapse In case of a silo failure, EM-0030, Silos Area Emergency Procedure would be implemented to provide protection to the workforce. Initial emergency actions, are:

- Cease Silos area operations
- Notify personnel in the immediate area
- Activate local evacuation alarms from the VitPP control room

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- Evaluate the area **(NOTE: When an emergency occurs and evaluation is ordered, personnel will bypass the personal contamination monitors [PCM])**
- Proceed to Rally Point #4 (See Appendix C to this Contingency Plan)
- Notify the Facility Owner or designee of the event and its estimated magnitude
- Notify the AEDO.

Potential recovery actions are described in Operable Unit 4 (OU4): An Analysis of Emergency Recovery Actions – Phase II and will be managed by Fluor Fernald. Fluor Fernald will manage recovery operations in accordance with EM-0003. RMRS will assist Fluor Fernald as requested in emergency termination and recovery operations.

Spill of Silo 3 Material

If a spill or leak of Silo 3 material occurs, Silo 3 Project personnel will perform the following steps:

- Determine the nature extent of the spill or leak
- Make sure unnecessary persons are removed from the spill area
- Notify the AEDO by calling the FEMP Communication Center
- Don proper personal protective equipment (PPE)
- Remove ignition sources if a flammable liquid, gas, or vapor is involved
- If possible and safe, try to contain the spill material and prevent windborne spread of the material using the spill control materials that are kept on hand for this purpose. If the spill includes liquid, then contain liquid with spill control materials provided. If liquids start to dry out, then use spill control materials to cover dry area.
- Assist the FEMP Emergency Response Team (ERT) as requested.

2.2.3 Nonradiological Spills

The Silo 3 spill response equipment includes at least 500 pounds of granular clay materials for use in the event of a spill or leak of fuel, hydraulic oil, lubricating oil, or nonpetroleum hazardous liquids from Silo 3 Project equipment. The Silo 3 Project is responsible for coordination with the FEMP Waste Management Organization for disposal of any spill cleanup materials generated from such a spill. Liquid storage tanks are equipped with a secondary containment device of compatible material that will have the capacity to collect 100% of contents of the largest tank.

Perform the following actions upon discovery of a liquid spill:

- Determine the nature extent of the spill or leak
- Make sure unnecessary persons are removed from the spill area
- Notify the AEDO by calling the FEMP Communication Center
- Don proper PPE
- Remove ignition sources if a flammable liquid, gas, or vapor is involved

- If possible and safe, contain liquid with spill control materials provided as spill response equipment. If liquids start to dry out, then use spill control materials to cover drying area.
- Assist the FEMP ERT as requested.

2.2.4 Fire

In the event of a fire or explosion, Silo 3 Project personnel are to immediately evaluate the Silo 3 Project site and meet at Rally Point #4 (See Appendix C to this Contingency Plan) for accountability. No personnel are to fight a fire beyond the stage were it can be put out with a portable fire extinguisher.

(NOTE: Only personnel trained in the use of portable fire extinguishers will attempt to fight a fire. Using the wrong type of fire extinguisher can be hazardous. Do not use water to extinguish electrical or liquid fires. Use carbon dioxide, "ABC", or dry chemical for electrical or flammable liquid fires. Use Class "A" (water) extinguisher or "ABC" fire extinguisher for trash, wood, or paper fires.)

Actions for project personnel in case of a fire:

- Pull lever on the nearest fire alarm box. If an alarm box is not nearby, dial 911 (or 648-6511 on a cellular telephone) to connect directly with the FEMP Communications Center, or using Channel 7 on a portable radio call "CONTROL"
- If trained to use fire-fighting equipment (and you can do so without endangering yourself), then combat the fire cautiously until trained assistance arrives
- If possible and safe, shut off gas, electrical power, and operating equipment
- Remove combustible or other hazardous material to a secure location
- If it becomes evident that the fire cannot be controlled by local action, then immediately notify personnel to evacuate the facility and surrounding are by contacting the FEMP Communication Center by telephone or portable radio
- Close Fire and Exit doors after facility has been evacuated. **WARNING: DO NOT LOCK FIRE OR EXIT DOORS.**
- After evacuation, proceed to Rally Point #4 (See Appendix C to this Contingency Plan). **Note: Instruct persons in transit to avoid the facility and surrounding area.**

2.2.5 Vehicle Accident

Restricted roadways and enforcement of low speed limits reduce the potential of a vehicle accident on the Silo 3 Project. Silo 3 Project personnel are to respond as follows to a vehicle accident:

- Provide traffic control through the use of additional personnel or barricades to reduce the danger to rescue personnel at the accident scene
- Evaluate the accident for injury to personnel and spill of hazardous material

- Contact the FEMP Communications Center by telephone or portable radio, informing them of the location and extent of the accident
- If trained, provide first aid to any accident victims. **NOTE: FIRST AID TO INJURIES TAKES PRECEDENCE OVER CONTAMINATION CONTROL. Do however, take contamination control measures, if possible, to limit spread of contamination.**
- Once any injuries have been attended to, provide any spill control measures possible using the spill control equipment available
- Assist the ERT, as requested.

2.2.6 Construction Accident

Any construction accident that occurs on the FEMP will be reported to Silo 3 Project personnel and to Fluor Fernald. Injury response will be coordinated by the FEMP Emergency Medical Technicians (EMT). Silo 3 Project personnel will respond as follows:

- Immediately notify Silo 3 Project supervision, who will in turn notify FEMP by contacting the FEMP Communications Center by telephone or portable radio. **NOTE: IF THE INJURY IS SERIOUS, DIRECTLY CONTACT THE FEMP COMMUNICATION CENTER BY CALLING 911 OR USING A PORTABLE RADIO.**
- If trained, provide first aid until the EMT arrives
- Comfort the accident victim and prevent any additional injury from other sources
- Provide assistance to the EMTs as requested.

2.3 Spill Response Equipment

NOTE: The primary consideration for immediate response to any spill is protection of the responders. No response will occur without the proper protection of these individuals.

PPE (coveralls, gloves, booties, and respiratory protection) will be obtained from existing project resources. If these are unavailable, then alternate site sources will be used. Spill response materials are stored at the Silo 3 Project for immediate use.

2.3.1 Airborne Contamination Release

Spills that do, or could, result in airborne contamination will be covered to prevent additional airborne release. Silo 3 personnel that perform these covering operations will be protected with appropriate PPE and respiratory protection. If airline respiratory protection is required, then the Silo 3 supplied air system will be used, if possible. Airlines (with length restrictions consistent with FEMP site requirements) can be run from the breathing air connections to the spill location. This may be in the opposite direction from normal operations, and will be performed only if adequate contamination control can be maintained.

2.3.2 Liquid

Liquid spills within the treatment facility will be contained by berms and sumps built into this facility. Exhibit 2.3-1 provides the location and coverage for each sump. Sumps and the associated bermed area are sized to contain anticipated liquid volumes during normal operations. Process water is fed to the plant and an undetected leak does provide the potential for overfill of a sump. This sump is outfitted with an automatic pump, which transfers water from the sump to the wastewater holding tank. Both sump pump operation and wastewater holding tank high-level are reported by alarm to the project control room.

The project uses petroleum products (vehicle fuel) and hydraulic oils, which could potentially spill. Spill containment and leak detection are built into the aboveground fuel storage tank, and hydraulic systems are located inside bermed areas, preventing uncontrolled release of these materials.

2.4 Emergency Procedures

This Contingency Plan defines the primary course of action for emergency response. In addition to this plan, Operations procedures include response to emergency conditions, including:

- Safe shutdown
- Emergency shutdown
- Alarm response
- Operations response to spill detection.

2.5 Spill Response Kit

A spill response kit is maintained near the Silo 3 office trailers located to the northwest of Silo 3. This kit contains materials for immediate response to anticipated materials. Appendix B contains a listing of the materials contained in this kit.

3.0 ROLES AND RESPONSIBILITIES

3.1 Silo 3 Project Worker

- Notify nearby personnel to evacuate dangerous areas
- Notify the supervisor or the AEDO of emergency or non-routine events immediately
- Proceed in accordance with this Contingency Plan in emergency situations
- Become familiar with the location and use of emergency equipment
- Become familiar with, and carries out, the response to emergency signals in use on the Silo 3 Project
- Participate in emergency procedure drills.

3.2 Fluor Fernald RCTs

000346

Fluor Fernald Radiological Control Technicians (RCT) are under the direction of Fluor Fernald supervision, with input from the Silo 3 Project Radiation Safety Officer. RCTs will respond according to RCR 5-5, Incident and Event Response/Follow-up. RCT response includes:

- Open area access gates and ensures path of egress for emergency response vehicles
- Determine appropriate respiratory protection and anticontamination clothing for responding to radiological hazards
- Perform required radiological monitoring and measurements
- Report to the Incident Commander for assignments
- Assist the ERT in implementing the appropriate response for personnel potentially contaminated or internally exposed during Silo 3 area emergencies
- Respond to Continuous Radon Working Level Monitor alarms.

3.3 Silo 3 Project Emergency Coordinator (EC)

- Maintain adequate familiarity with consequence analyses in the Hazards Analysis Report to judge similarity with emergency in progress. This allows the EC to provide consequence evaluation to the AEDO upon initial response to an emergency.
- Direct the activities of personnel in emergency situations until the AEDO arrives
- Informs the AEDO of existing conditions and coordinates with the AEDO to resolve the emergency situation
- Provide the AEDO with a consequence evaluation based on emergency conditions and previously performed consequence analyses
- Conduct training of assigned employees in:
    - Location and use of fire and evacuation alarm controls and Silo area exits
    - Provisions of this Contingency Plan
    - Location and basic use of fire extinguishers and safety shower/eye washes in their immediate work area
    - Immediate actions to be taken for all credible types of emergencies that could occur in the Silo area.
- Assign employees/alternate to turn off equipment and utilities in the event of an emergency shutdown
- Assign employees to perform specific tasks relating to an individual building during an emergency situation
- Conduct a Rally Point Accountability for those personnel affected when the area is evacuated
- Following the emergency, manage cleanup activities in conjunction with Fluor Fernald.

3.4 Fluor Fernald AEDO

- Direct emergency actions at the scene as the Incident Commander
- Comply with all site procedures relating to abnormal or emergency situations
- Implements:
  - PL-3020, FEMP Emergency Plan
  - EM-0030 Silos Area Emergency Procedures.

4.0 EMERGENCY RECOGNITION/NOTIFICATION

Emergencies will be recognized through external warning systems (approaching severe weather) or by visual identification. Immediate notification of close-by personnel will be by verbal means. Notification of the Silo 3 Project Emergency Coordinator will be by verbal means, hand-held radio, telephone, or by alarm. Unless the emergency is severe enough that the employee notifies the FEMP Communications Center by hand-held radio or telephone, the Silo 3 Project EC will perform those notification and initiate immediate response actions.

5.0 EVACUATION ROUTES/ASSEMBLY AREAS

Any individual instructed to evacuate is to proceed as follows:

- Immediately proceed to primary Rally Point #4, located in the Building 30/45 parking lot (See Appendix C to this Contingency Plan).

6.0 SITE SECURITY AND CONTROL

Following the emergency, the Silo 3 Project EC is responsible for controlling access to the emergency scene. This provides both safety controls to prevent injury or exposure to personnel, and to preserve the scene for investigative evidence collection. The EC may use any means necessary to achieve this goal, including:

- Access control tape
- Verbal control
- Station other personnel (in a safe location).

In case of a serious accident, injury, or event, the involved area will not be disturbed without Fluor Fernald approval.

7.0 EMERGENCY MEDICAL TREATMENT/FIRST AID

If trained, Silo 3 personnel may provide immediate first aid to any accident victims.

NOTE: FIRST AID TO INJURIES TAKES PRECEDENCE OVER CONTAMINATION CONTROL. Do however, take contamination control measures if possible to limit spread of contamination.

The FEMP Communication Center will dispatch Emergency Medical Technicians (EMT). The FEMP site Medical Section is located in the Safety & Health Building (Building 53). All individuals injured on the Silo 3 Project must report the injury to the Silo 3 EC and report to the FEMP Medical Section for evaluation. During off-hours, the individual is to confer with Silo 3 Project management on arranging medical evaluation.

Emergency transportation of injured personnel to off-site medical facilities can be accomplished by either FEMP ambulance, local (mutual aid) ambulance or AirCare helicopter. This transportation will be arranged by the FEMP.

8.0 REFERENCES

EM-0003, Reentry and Recovery, Revision 3, Fernald Environmental Management Project, Fluor Daniel Fernald, Inc., April 1998.

EM-0030, Silos Area Emergency Procedure, Revision 3, Fernald Environmental Management Project, Fluor Daniel Fernald, Inc., March 1999.

FEMP Emergency Plan, PL-3020, Revision 4, Fernald Environmental Management Project, Fluor Daniel Fernald Emergency Preparedness, June 1999.

Integrated Hazard Analysis, RMR-0445-0046-002, Fernald Silo 3 Project, January 2000.

Ohio Administrative Code, effective date on or before September 5, 1999, Anderson Publishing Company, 2000.

Operable Unit 4 (OU4): An Analysis of Emergency Recovery Actions – Phase II, 40000-RP-0029, Revision 0, Fernald Environmental Management Project, Silos Project Task Group, April 1998.

Preliminary Hazards Analysis Report for Silo 3, RMR-0445-0056-002, Fernald Silo 3 Project, January 2000.

RCR 5-5, Incident and Event Response/Follow-up, Radiological Control Requirements Manual, RM-0020, Revision 9, Fernald Environmental Management Project, Fluor Daniel Fernald, October 1999.

RCRA Contingency Plan and Emergency Procedures Requirements, Title 40, Code of Federal Regulations, Part 264, Subpart D, U.S. Environmental Protection Agency, Ch. 1, July 1999.

53-3230

north

UTILITY SHED
40-ME-001 INSTRUMENT AIR DRYER
50-VA-004 BACKFLOW PREVENTER
50-PM-001 PLANT WATER PRESSURE PUMP
50-TK-001 PLANT WATER FEED TANK
40-CM-001 PROCESS AIR COMPRESSORS
50-PM-001 50-TK-001
44-CY-003 ADDITIVE CONVEYOR
44-CY-002B REDUCER CONVEYOR
44-CY-001B BINDER CONVEYOR
44-CY-002A REDUCER CONVEYOR
44-CY-001A BINDER CONVEYOR
44-CY-005 FLEXIBLE ADDITIVE CONVEYOR
24-ME-008 LOADED DRUM PUSHER
24-CY-012 DRUM STORAGE CONVEYOR
71-AC-001 A/C UNIT
AIRLOCK
SUPPORT (TYP.)
BUILDING SKIN
8" WIDE X 8" CURB
26-CY-005 DRUM UNLOADING CONVEYOR
26-CY-003 REJECT SCREW CONVEYOR
26-ME-001 CRUSHER
26-ME-003 DELIDDING LIDDING STATION
26-CY-002 REJECT DRUM CONVEYOR
26-ME-002 DRUM UNLOADER
26-ME-001
26-CY-003
26-CY-002
26-CY-001
26-CY-001 REJECT STAGING DRUM CONVEYOR
26-CY-004 CRUSHED REJECT CONVEYOR
16-TK-001A
16-TK-001B
44-CY-004 ADDITIVE FEEDER
INLET 44-CY-004
26-CN-001 JIB CRANE 1 TON CAPACITY
16-CY-001 SILO 3 MATERIAL FEED CONV. DRIVE
16-ME-001 SILO 3 MATERIAL FEED SCREEN
11-ME-001 ABOVE
23-ME-002 BRIQUETTE SCREEN
23-CY-001 BRIQUETTE CONVEYOR
16-CY-003 BINDER FEED CONVEYOR
23-BN-002 FINES HOPPER
23-CY-002 FINES CONVEYOR
INLET 23-ME-002
11-PM-002 CHILLED WATER PUMP
11-BL-001 P/D BLOWER
62-TK-001 PROCESS WATER TANK
62-PM-001 PROCESS WATER PUMP
23-CY-003 FINES FEED CONVEYOR
16-CY-003 MIXER FEED CONV. DRIVE
LOW PT. FL. ELEV. 577'-7"
62-PM-002 SUMP PUMP
ENCLOSURE SUMP
HIGH PT. FL. ELEV. 578'-0"
AIRBORNE RADIOACTIVITY AREA
BUILDING STRUCTURE LIMITS
11-RF-001 PACKAGED WATER CHILLER
24-CY-010 SECONDARY DRUM SMEAR STATION
24-CY-011 DRUM WIPE DOWN & INSPECTION STATION
24-CY-009 DRUM HOLDING & WIPE DOWN STATION
24-CY-008 SHIPPING WEIGH STATION
24-CY-007 DRUM BANDING & PRIMARY SMEAR STATION
(6) ALPHA COUNTERS
LOW PT. FL. ELEV. 577'-9"
HIGH PT. FL. ELEV. 578'-0"
CONTAMINATION AREA SUMP & 62-PM-005 LOADOUT SUMP PUMP
CONTAMN. AREA
24-CY-006 DRUM LIDDING STATION
24-ME-006 DRUM LIDDER
24-CY-005 DRUM LOADING & TARE GROSS WEIGH STATION
24-CY-004 BARCODE LABELING STATION
24-CY-003 DRUM DELIDDING STATION
24-CY-002
24-CY-002 DRUM STORAGE GRAVITY CONVEYOR
24-ME-001 PALLETIZER
24-CY-013 LOADED PALLET CONVEYOR
24-CY-001 EMPTY PALLET CONVEYOR
FCV-671
FCV-670
24-CY-005 24-ME-007 EMPTY DRUM PUSHER
MATCHLINE SEE DRAWING NUMBER 53-3410
N 480845.858 E1346941.847
AIR STATION
AIRLOCK
41-HE-001A BREATHABLE AIR SYSTEMS
41-HE-001B
41-HE-001C
CONTROLLED ENTRY BASE FLOOR ELEV. 578'-4
ELECTRICAL ROOM FLOOR ELEV. 578'-4" 9'-6" X 27'-6" INS
CHECK POINT AND CHANGE FACILITY

000351

PLAN VIEW – EL. 578'-0"

REFERENCE DRAWINGS

DRAWING NO.	TITLE
53-3231	GENERAL ARRGMT. PLAN PROCESS BLDG. EL. 586'-10
53-3232	GENERAL ARRANGEMENT PROCESS BLDG. - SECTIONS

NOTES

1. SEE DRAWING NUMBER 53-3231 FOR CONTINUATION ABOVE.

3079

Exhibit 2.3-1

Q-LISTED ITEMS ON THIS DRAWING

ITEM	DESCRIPTION	Q-LEVEL
11-BL-001	P/D BLOWER	3
23-BN-002	FINES HOPPER	3
24-ME-006	DRUM LIDDER	3

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	05/12/00	KDL	DMB	REVISED TECHNICAL BASELINE
1	04/27/00	JS	DMB	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW
0	01/27/00	KDL	CAB	TECHNICAL BASELINE
C	11/15/99	KDL	CAB	FOR REVIEW AND COMMENT
B	09/23/99	KDL	CAB	PHAR DESIGN PACKAGE
A	4/5/00	DB	CB	CONCEPTUAL DESIGN

SILO 3 PROJECT
FEMP

GENERAL ARRANGEMENT PLAN
PROCESS BLDG. – ELEV. 578'-0"

RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

SCALE: 3/16"=1'-0"	
DRAWN: KDL	DATE: 3/5/00
DESIGNED: K. LANDRUM	DATE: 9/2/99
CHECKED: C. BOSSARD	DATE: 9/2/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 533230	
Q-LEVEL (Y/N): YES	
DRAWING NUMBER: 53-3230	REV 2

PLOTTED BY: JSTEWART <CPD: 04/27/00 [TIME: 09:00 AM

APPENDIX A - SILO 3 PROJECT EMERGENCY CALL LIST

Silo 3 Project Emergency Personnel (Call down the list until one individual is contacted)					
Title	Name	Onsite Phone	Home Phone	Onsite Address	Home Address
Emergency Coordinator					
Backup Emergency Coordinator					
FEMP Emergency Organization (To be contacted by Emergency Coordinator unless immediate danger or injury exists)					
FEMP Communications Center		Onsite: dial 911 Cell Phone: 648-6511 Onsite radio: Chan. 7, call "Control"			

Example

This table presented as an example. The actual table will be kept current and posted in Silo 3 Project facilities.

000352

F-3079

APPENDIX B - EMERGENCY EQUIPMENT LIST AND SPILL RESPONSE KIT

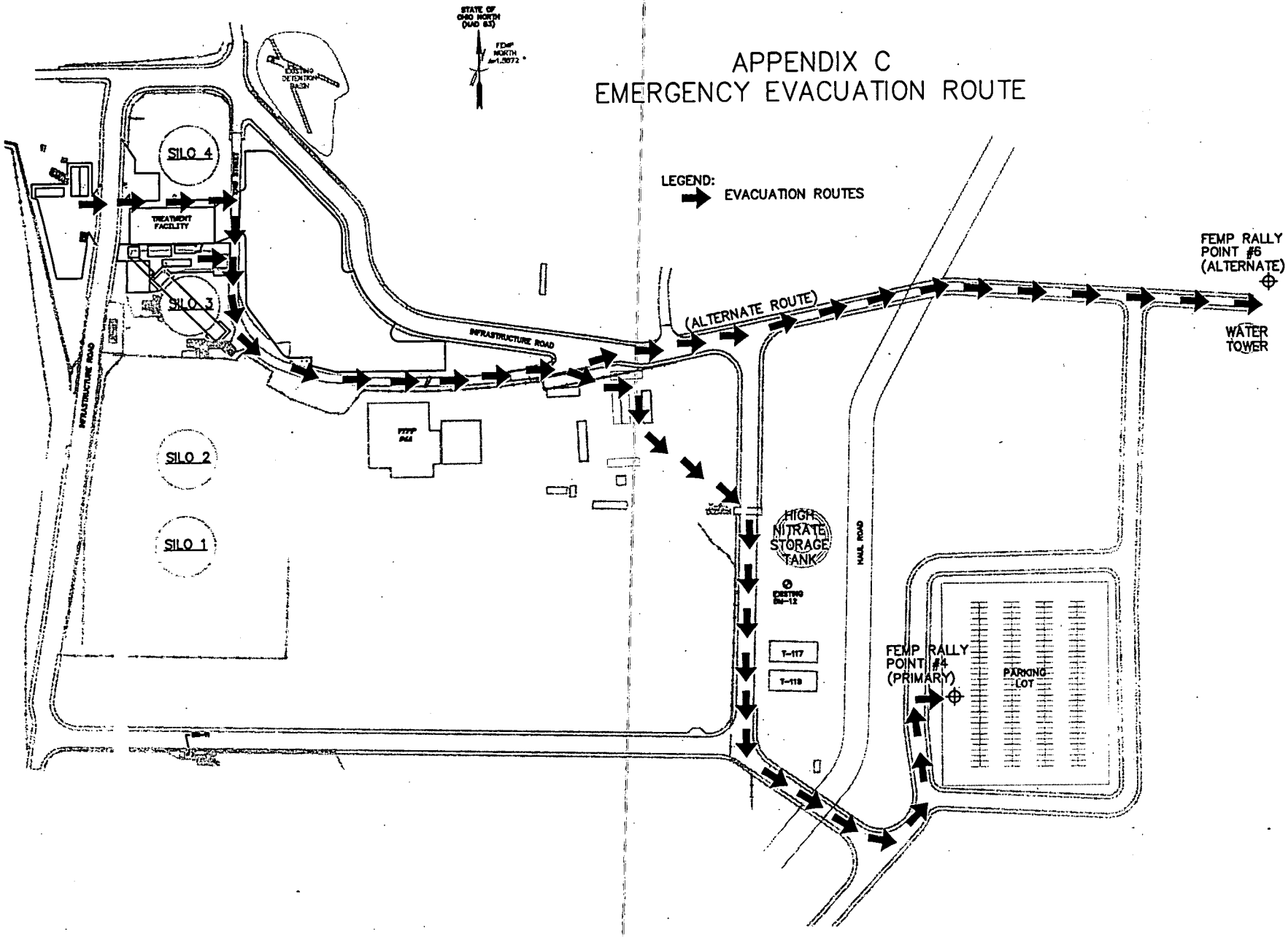
Emergency Equipment List

Portable fire extinguishers
Spill control berms
Sumps
Spill Response kit
Telephone system
Portable radio system
Fire alarm system
Smoke detector system
PPE
Respiratory protection equipment

Spill Response Kit

Shovels – flat blade
Shovels – spade type
Absorbent clay (at least 500 pounds)
Bags – sturdy polyethylene (approximately 50 gallon size)
Buckets – five gallon
Broom (not to be used for airborne hazard materials)
Absorbent dike material
Tarps – impermeable
Sandbags – prefilled
Access control tape

APPENDIX C
EMERGENCY EVACUATION ROUTE



000354

F-3079

Appendix A
Process Flow Diagrams

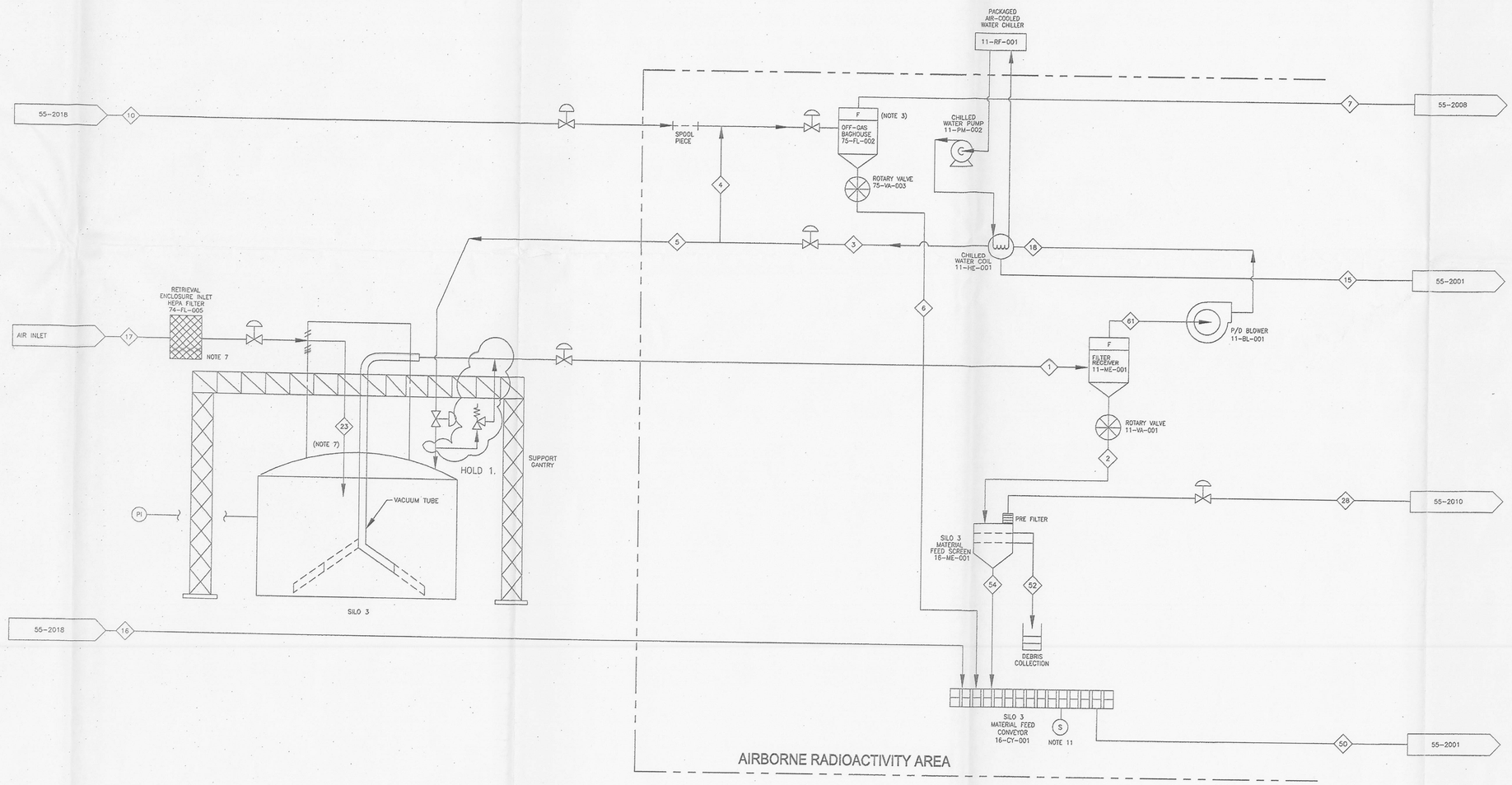
55-2000

FERNALD SILO 3 MASS BALANCE

STREAM NUMBER	1	2	3	4	5	6	7	10	15	16	17	18	23	28	50	52	54	61
DESCRIPTION	RETRIEVED SILO 3 MATERIAL CONVEYANCE NOTE 13	BULK SILO 3 MATERIAL FEED	RETURN SILO 3 MATERIAL/ TEMPERED AIR DISCHARGE	HVAC SILO 3 MATERIAL/ SILO MAKE-UP AIR & OFF GAS	SILO RETURN MATERIAL CONVEYANCE	OFF-GAS BAGHOUSE DISCHARGE	OFF-GAS BAGHOUSE OFF-GAS DISCHARGE	REJECT CRUSHER VENT	CHILLER CONDENSATE	RECYCLED OFF-SPEC PRODUCT CONVEYANCE	RETRIEVAL ENCLOSURE INTAKE	RETURN SILO 3 MATERIAL P/D BLOWER DISCHARGE	RETRIEVAL ENCLOSURE TO SILO CROSS-FLOW	MATERIAL SCREEN VENT	SILO 3 MATERIAL PROCESS FEED	DEBRIS	SILO 3 BULK SCREENED MATERIAL FEED	FILTER RECEIVER OUTLET
AIR MASS FLOW, lb/hr	8,694	N/A	8,694	4,140	4,554	N/A	4,140	5,047	N/A	N/A	4,140	8,694	4,140	1,192	N/A	N/A	N/A	8,694
AIR VOLUMETRIC FLOW, acfm	2,627	N/A	2,006	974	1,056	N/A	981	1,200	N/A	N/A	1,000	2,267	1,013	300	N/A	N/A	N/A	2,750
AIR DENSITY, lb/ft ^{3}	0.0552	N/A	0.0722	0.0708	0.0719	N/A	0.0703	0.0701	N/A	N/A	0.069	0.0639	0.0681	0.0662	N/A	N/A	N/A	0.0527
AIR TEMPERATURE, (DB) °F	94	N/A	85	85	85	N/A	85	85	N/A	N/A	94	165	101	118	N/A	N/A	N/A	100
STATIC PRESSURE, in. W.G. (NOTE 1)	-80	N/A	12	4	10	N/A	1	-3	N/A	N/A	0	18	-0.2	-2	N/A	N/A	N/A	-91

NOTE: ALL DATA IN THE TABLE BELOW HAS BEEN DERIVED FROM RMR-0445-ENG-01 AND ARE USED IN DWG 55-2001.

SOLIDS LB/HR	15,104	15,103	2	1	1	1	0	N/A	0	AS REQUIRED	N/A	2	N/A	N/A	15,099	5	15,098	2
WATER LB/HR	580	580	TRACE	TRACE	TRACE	TRACE	TRACE	N/A	105	AS REQUIRED	N/A	TRACE	N/A	N/A	580	0	580	TRACE
TOTAL LB/HR	15,684	15,683	2	1	1	1	0	N/A	105	AS REQUIRED	N/A	2	N/A	N/A	15,679	5	15,678	2
VOLUME FLOW FT^3 /HR	270	541	0	0	0	0	0	N/A	2	AS REQUIRED	N/A	0	N/A	N/A	541	0	541	0



REFERENCE DRAWINGS

DRAWING NO.	TITLE
55-2001	TREATMENT SYSTEM PFD
55-2008	GAS TREATMENT HVAC PFD
55-2010	PROCESS BUILDING VENTILATION PFD
55-2018	REJECT SYSTEM PFD

NOTES

1. SITE AMBIENT BAROMETRIC PRESSURE AT 614FT. A.S.L. IS 29.2924" Hg. ALL PRESSURES ARE REFERENCED TO THAT ABSOLUTE PRESSURE.
2. TOTAL PRESSURE LOSSES IN PARTICULAR STREAM (OR BRANCH). SUCTION SIDE OF THE P/D BLOWER IS NOT EQUAL TO THE PRESSURE SIDE, HOWEVER, ABSOLUTE PRESSURES AT THE RETRIEVAL ENCLOSURE AND THE END OF THE STACK (EXCEPT FOR VELOCITY PRESSURE COMPONENT) ARE THE SAME.
3. OVERALL MATERIAL ARRESTANCE OF MEMBRANE FILTER OF 99.99% (AT 0.2 MICRON).
4. NOTE REMOVED.
5. ALL MASS BALANCE NUMBERS ARE ROUNDED TO THE NEAREST WHOLE NUMBER, WITH THE EXCEPTION OF AIR DENSITY.
6. NOTE REMOVED.
7. AIRFLOW ENTERS THE RETRIEVAL ENCLOSURE THROUGH THE HEPA FILTER AND PASSES INTO THE SILO THROUGH THE GAP BETWEEN THE SILO ACCESS PORT AND THE RETRIEVAL ARM.
8. NOTE REMOVED.
9. NOTE REMOVED.
10. RETRIEVAL AND CONVEYANCE SYSTEM FLOW RATES BASED UPON 70% SYSTEM AVAILABILITY.
11. PROCESS SAMPLE PORT.
12. AIRFLOWS BASED ON DRY AIR. CONDENSATE FLOW BASED ON MOISTURE REMOVAL AT MAXIMUM SUMMER HUMIDITY AND TEMPERATURE.
13. STATIC PRESSURE AT THE TIP OF THE RETRIEVAL NOZZLE IS -0.5" AND THE FLOW IS 2,100 ACFM.

GENERAL: MASS BALANCE BASED ON CALCULATION RMR-0445-ENG-001.

HOLD 3079

1. VACUUM BREAKER RELIEF SCENERIO BEING EVALUATED.

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	5/12/00	KB	SAS	REVISED TECHNICAL BASELINE
1	4/14/00	KB	SAS	REVISED TECHNICAL BASELINE FOR REVIEW
0	1/27/00			TECHNICAL BASELINE
E	1/06/99			PRELIMINARY DESIGN PACKAGE
D	12/7/99			IDR
C	9/24/99			PHAR DESIGN PACKAGE

SILO 3 PROJECT
FEMP

SILO 3
RETRIEVAL AND CONVEYANCE PFD

RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment 000355

SCALE: NONE	
DRAWN: B. THOMAS	DATE: 1/27/00
DESIGNED: K. BRODSKY	DATE: 1/27/00
CHECKED: S.A. SHARPE	DATE: 4/14/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 55-2000/2	
Q-LEVEL (Y/N): N/A	
DRAWING NUMBER: 55-2000	REV 2

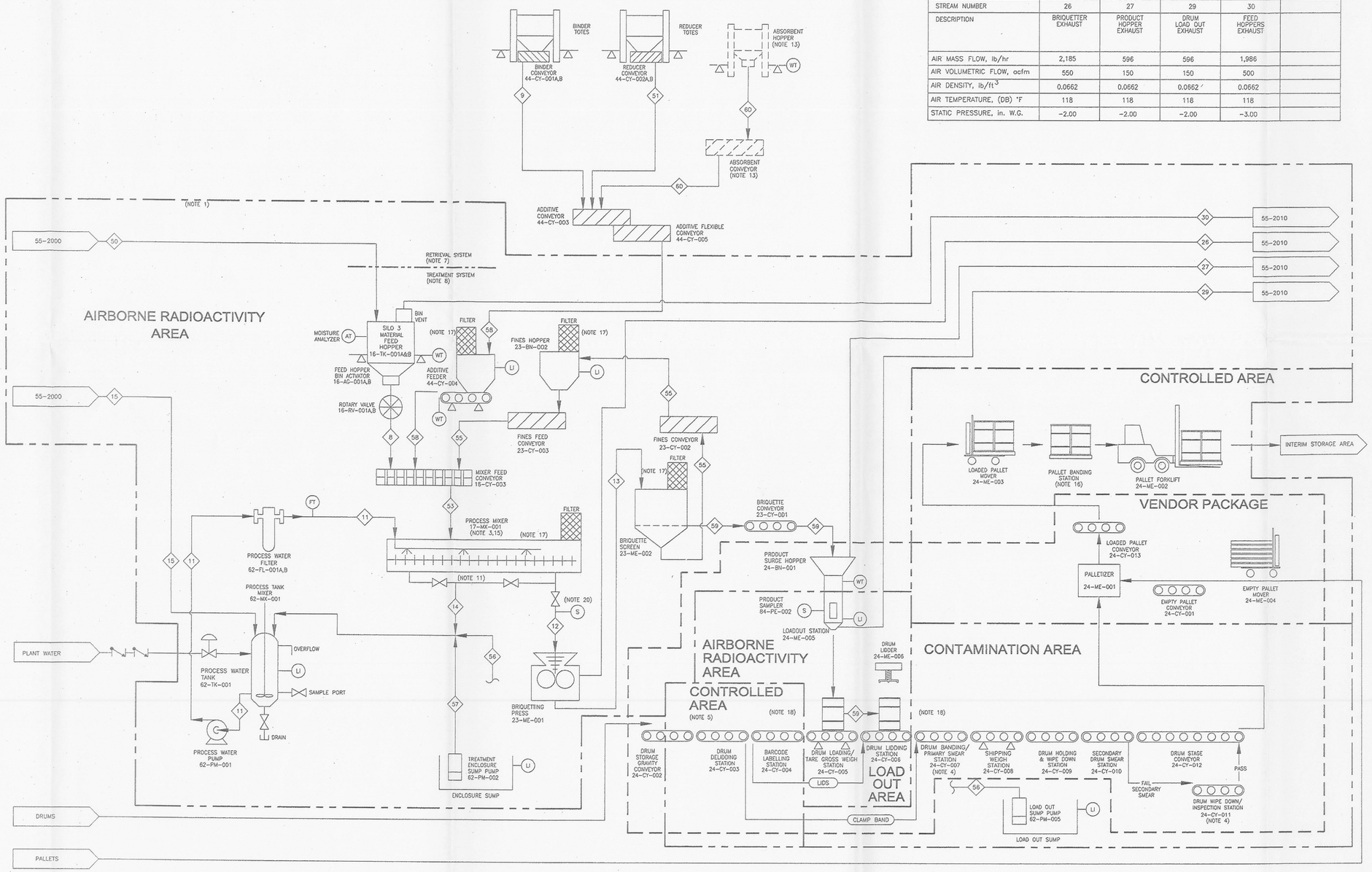
55-2001

FERNALD SILO 3 MASS BALANCE

STREAM NUMBER	8	9	11	12	13	14	15	50	51	53	55	56	57	58	59	60
DESCRIPTION	SILO 3 MATERIAL TO MIXER MAX (NOTE 6,8)	BINDER FEED (NOTE 6,8)	PROCESS WATER FEED (NOTE 6,8)	PRODUCT FROM MIXER (NOTE 6,8,15)	PRODUCT FROM BRIQUETTING MACHINE (NOTE 6,8)	WASH WATER (NOTE 1,3)	CHILLER CONDENSATE (NOTE 7,12)	SILO 3 MATERIAL PROCESS FEED	REDUCING AGENT FEED (NOTE 8)	MIXER FEED (NOTE 8)	BRIQUETTE RECYCLE (NOTE 8)	LOAD OUT SUMP WATER (NOTE 1)	TREATMENT ENCLOSURE SUMP WATER (NOTE 1)	ADDITIVE (NOTE 8)	FINAL PRODUCT (NOTE 8)	ABSORBENT (NOTE 1,2)
SOLIDS LB/HR	11,125	334	0	12,266	12,266	AS REQUIRED	0	15,099	223	12,266	584	AS REQ'D	AS REQ'D	556	11,682	AS REQ'D
WATER LB/HR	428	TRACE	1,464	1,987	1,987	AS REQUIRED	105	580	TRACE	522	95	AS REQ'D	AS REQ'D	TRACE	1,892	AS REQ'D
TOTAL LB/HR	11,553	334	1,464	14,252	14,252	AS REQUIRED	105	15,679	223	12,788	679	AS REQ'D	AS REQ'D	556	13,574	AS REQ'D
VOLUME FLOW FT^3/HR	266	5	23	238	119	AS REQUIRED	2	541	3	263	6	AS REQ'D	AS REQ'D	8	113	AS REQ'D
PROD./DAY (MAX) DRUMS															127	

FERNALD SILO 3 MASS BALANCE cont.

STREAM NUMBER	26	27	29	30	
DESCRIPTION	BRIQUETTER EXHAUST	PRODUCT HOPPER EXHAUST	DRUM LOAD OUT EXHAUST	FEED HOPPERS EXHAUST	
AIR MASS FLOW, lb/hr	2,185	596	596	1,986	
AIR VOLUMETRIC FLOW, acfm	550	150	150	500	
AIR DENSITY, lb/ft^3	0.0662	0.0662	0.0662	0.0662	
AIR TEMPERATURE, (DB) °F	118	118	118	118	
STATIC PRESSURE, in. W.G.	-2.00	-2.00	-2.00	-3.00	



REFERENCE DRAWINGS

DRAWING NO.	TITLE
55-2000	RETRIEVAL AND CONVEYANCE PFD
55-2018	REJECT SYSTEM PFD
55-2008	SILO 3 GAS TREATMENT HVAC PFD

NOTES

1. MASS FLOW NOT INCLUDED IN OVERALL BALANCE.
2. ABSORBENT MAY BE ADDED IF SILO 3 MATERIAL IS TOO WET.
3. MIXER WILL BE WASHED AS A DISCRETE OPERATION AS REQUIRED, AT LEAST ONCE EVERY TWO MONTHS. WASH WATER WILL BE RECYCLED BACK INTO PROCESS AS APPROPRIATE.
4. DRUMS FAILING SMEAR CHECK NOT EXPECTED ROUTINELY.
5. DRUMS REQUIRE TO BE PREPPED WITH ABSORBANT PRIOR TO BEING FILLED WITH BRIQUETTES. DRUM PREPPING WITH ABSORBANT IS DONE MANUALLY.
6. BASED ON FEED MOISTURE CONTENT OF 3.7% TO BOUND PROCESS ON HIGH END.
7. RETRIEVAL SYSTEM FLOW RATES BASED UPON 70% SYSTEM AVAILABILITY.
8. TREATMENT SYSTEM FLOW RATES BASED UPON 95% SYSTEM AVAILABILITY.
9. NOTE NOT USED.
10. NOTE NOT USED.
11. MIXER WASH WATER DRAIN FROM EITHER SIDE OF BAFFLE.
12. BASED ON CONDENSATE FROM THE CONVEYANCE AIR STREAM. 2100 CFM OF 96 DEGREE F 50% RH COOLED TO 45 DEGREES F.
13. EQUIPMENT NOT INSTALLED AS PART OF ORIGINAL CONSTRUCTION.
14. NOTE NOT USED.
15. PROCESS WATER TO BE ADDED TO MIXER BY SPRAY BAR.
16. BANDING IS A MANUAL OPERATION.
17. VENT TO ENCLOSURE. NOMINALLY 0 CFM.
18. DOUBLE ISOLATION DOOR ENTRANCE AND EXIT. LOADING AREA VENTED. (NOT PART OF VENDOR PACKAGE)
19. ALL MASS BALANCE NUMBERS ARE ROUNDED TO THE NEAREST WHOLE NUMBER.
20. PROCESS SAMPLING PORT. 3079

GENERAL: MASS BALANCE BASED ON CALCULATION RMR-0445-ENG-001.

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	5/12/00			REVISED TECHNICAL BASELINE
1	4/14/00	TJS	SAS	REVISED TECHNICAL BASELINE FOR REVIEW
0	1/27/00			TECHNICAL BASELINE
E	1/06/00			PRELIMINARY DESIGN PACKAGE
D	12/7/99			IDR
C	9/24/99			PHAR DESIGN PACKAGE

SILO 3 PROJECT
FEMP

SILO 3
TREATMENT SYSTEM PFD

RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

000356

SCALE: NONE	
DRAWN: B. THOMAS	DATE: 1/27/00
DESIGNED: T. SATKOWSKI	DATE: 1/27/00
CHECKED: S.A. SHARPE	DATE: 4/14/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 55-2001.2	
Q-LEVEL (Y/N): N/A	
DRAWING NUMBER: 55-2001	REV 2

55-2008

FERNALD SILO 3 MASS BALANCE

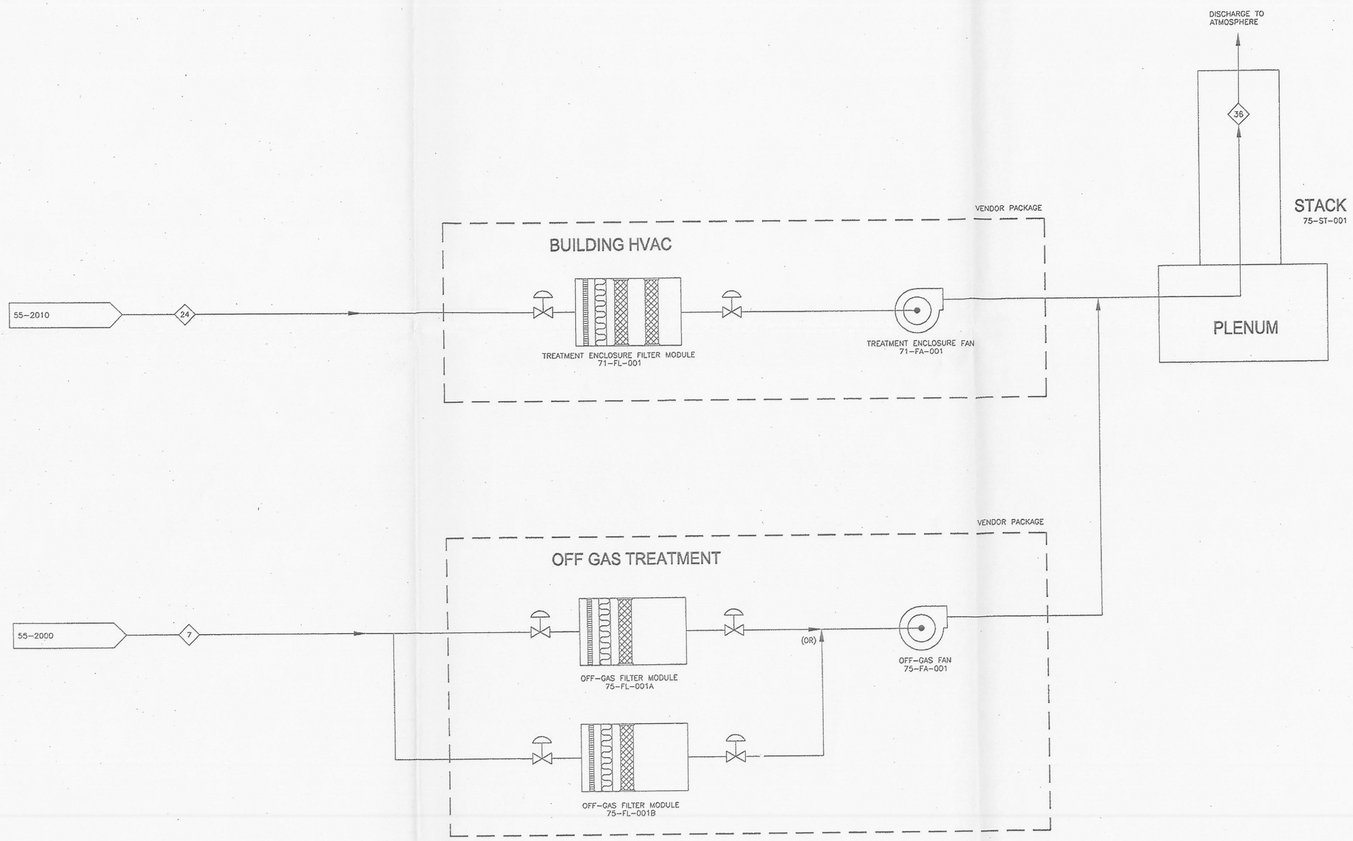
STREAM No	7	24	36
DESCRIPTION	OFF-GAS BAGHOUSE OFF-GAS DISCHARGE	BUILDING EXHAUST	STACK DISCHARGE
AIR MASS FLOW, lb/hr	4,140	59,616	63,756
AIR VOLUMETRIC FLOW, acfm	981	15,000	16,003
AIR DENSITY, lb/ft^3	0.0703	0.0662	0.0664
AIR TEMPERATURE, (DB) °F	85	118	116
STATIC PRESSURE, in. W.G. (NOTES 1 & 2)	1	10	0

NOTE: ALL DATA IN THE TABLE BELOW HAS BEEN DERIVED FROM RMR-0445-ENG-01 AND ARE USED IN DWG 55-2001.

SOLIDS LB/HR	0	N/A	N/A
WATER LB/HR	TRACE	N/A	N/A
TOTAL LB/HR	0	N/A	N/A
VOLUME FLOW FT^3/HR	0	N/A	N/A

EMISSION ESTIMATES (NOTE 3)

POLLUTANT	UNIT	CONCENTRATION
PARTICULATE	$\mu g/m^3$	2.329
RADON	pCi/L	653.7
OTHER RADIONUCLIDES	pCi/L	0.00104



REFERENCE DRAWINGS

DRAWING NO.	TITLE
55-2000	RETRIEVAL AND CONVEYANCE PFD
55-2010	PROCESS BUILDING VENTILATION PFD

NOTES

1. SITE AMBIENT BAROMETRIC PRESSURE AT 614FT. A.S.L. IS 29.2924" Hg (ABSOLUTE).
2. NOTE REMOVED.
3. DETAILS OF EMISSION POINTS AND QUANTITIES ARE SHOWN IN RMR-0445-ENG-010 ("POINT SOURCE AIR EMISSION STUDY")
4. ALL MASS BALANCE NUMBERS ARE ROUNDED TO THE NEAREST WHOLE NUMBER, WITH THE EXCEPTION OF AIR DENSITY.

GENERAL: MASS BALANCE BASED ON CALCULATION RMR-0445-ENG-001.

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	5/12/00	KB	SAS	REVISED TECHNICAL BASELINE
1	4/14/00	KB	SAS	REVISED TECHNICAL BASELINE FOR REVIEW
0	1/27/00			TECHNICAL BASELINE
C	1/6/00			PRELIMINARY DESIGN PACKAGE
B	12/7/99			IDR
A	9/24/99			PHAR DESIGN PACKAGE

SILO 3 PROJECT
FEMP

SILO 3
GAS TREATMENT HVAC PFD

RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

000357

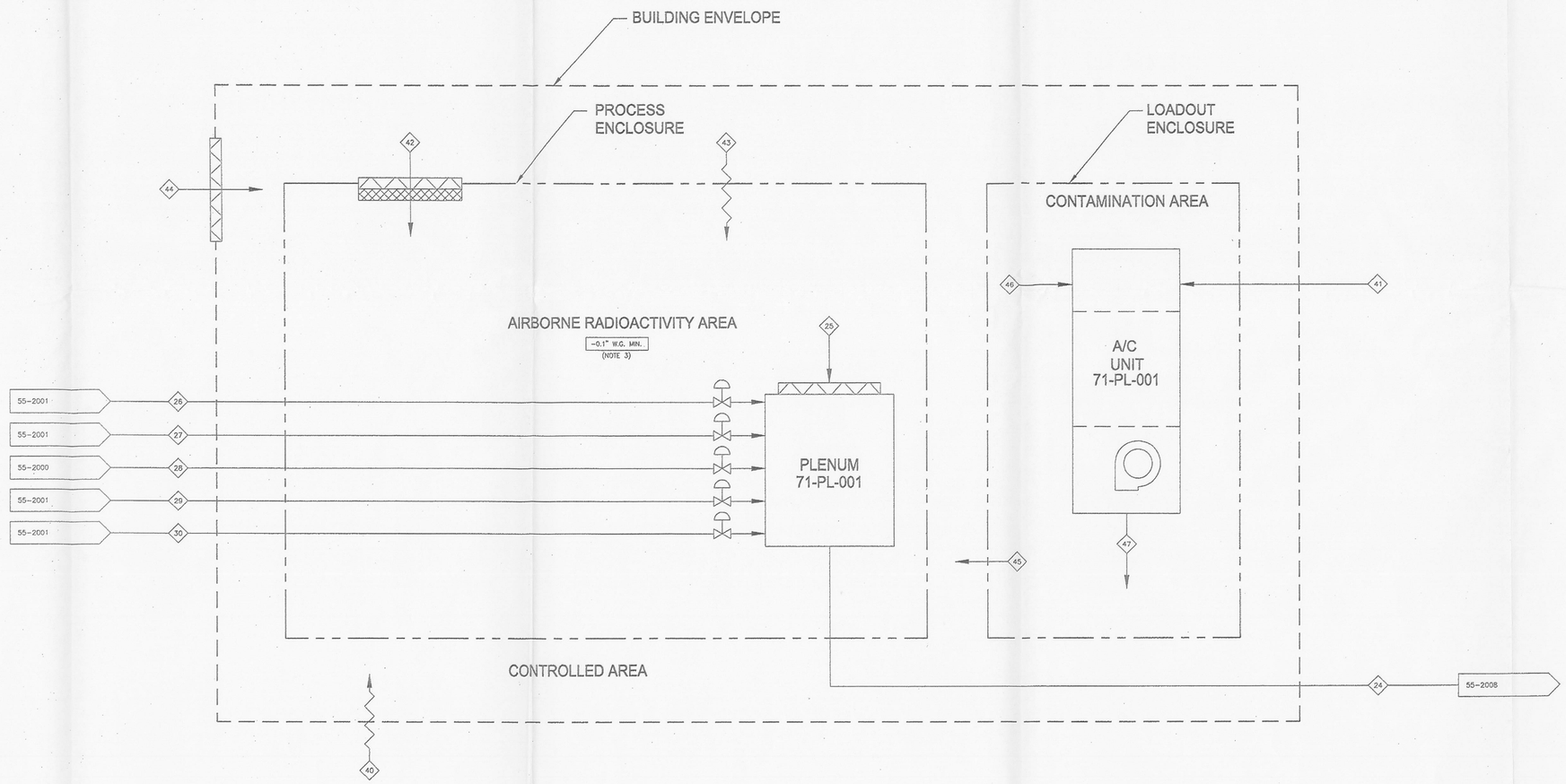
SCALE: NONE	
DRAWN: B. THOMAS	DATE: 1/27/00
DESIGNED: K. BRODSKY	DATE: 4/14/00
CHECKED: S.A. SHARPE	DATE: 4/14/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 55-2008_2	
Q-LEVEL (Y/N): N/A	
DRAWING NUMBER: 55-2008	REV 2

PLOTTED BY: MK
05/11/00 - 1:35pm
P:\7595si_01.hpf\Approved\Process\Flow Diagrams\55-2008_2.dwg

55-2010

PROCESS BUILDING HVAC MASS & ENERGY BALANCE

STREAM NUMBER	24	25	26	27	28	29	30	40	41	42	43	44	45	46	47
DESCRIPTION	BUILDING EXHAUST	PROCESS SPACE DE-PRESSURIZATION	BRIQUETTER EXHAUST	PRODUCT HOPPER EXHAUST	MATERIAL SCREEN EXHAUST	DRUM LOAD OUT EXHAUST	FEED HOPPERS EXHAUST	BUILDING INFILTRATION	LOADOUT MAKE-UP	CONTROLLED CROSS-FLOW	MEMBRANE INFILTRATION	BUILDING MAKE-UP	AREA CROSS-FLOW	LOAD OUT RECIRCULATION	COOL AIR DISCHARGE
AIR MASS FLOW, lb/hr	59,616	53,062	2,185	596	1,192	596	1,986	19,528	3,809	40,709	18,781	36,153	3,809	27,754	31,563
AIR VOLUMETRIC FLOW, acfm	15,000	13,359	550	150	300	150	500	4,717	920	9,993	4,610	8,733	902	6,571	7,087
AIR DENSITY, lb/ft^3	0.0662	0.0662	0.0662	0.0662	0.0662	0.0662	0.0662	0.069	0.069	0.0679	0.0679	0.069	0.0704	0.0704	0.0742
AIR TEMPERATURE, (DB) °F	118	118	118	118	118	118	118	94	94	103	103	94	83	83	55
STATIC PRESSURE, in. W.G. (NOTE 2 & 3)	10	1	-2	-2	-2	-2	-3	1	2	0	0	1	0	0	0



REFERENCE DRAWINGS

DRAWING NO.	TITLE
55-2000	RETRIEVAL AND CONVEYANCE PFD
55-2001	TREATMENT SYSTEM PFD
55-2008	SILO 3 GAS TREATMENT HVAC PFD

NOTES

1. HVAC OF ELECTRICAL AND CONTROL ROOMS BY OTHERS.
2. SITE AMBIENT BAROMETRIC PRESSURE AT 614 FT. A.S.L. IS 29.2924" Hg.
3. VENTILATION ZONE Δ P IS RELATIVE TO THE SURROUNDING AREA.
4. NOTE NOT USED.
5. ALL MASS BALANCE NUMBERS ARE ROUNDED TO THE NEAREST WHOLE NUMBER WITH THE EXCEPTION OF AIR DENSITY.

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	5/12/00	KB	SAS	REVISED TECHNICAL BASELINE
1	4/14/00	KB	SAS	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW
0	1/27/00			TECHNICAL BASELINE
A	01/6/00			PRELIMINARY DESIGN PACKAGE

SILO 3 PROJECT
FEMP

PROCESS BUILDING VENTILATION
PFD

RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

000358

SCALE: NONE	
DRAWN: B. THOMAS	DATE: 1/27/00
DESIGNED: K. BRODSKY	DATE: 1/27/00
CHECKED: S.A. SHARPE	DATE: 4/14/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 55-2010_2	
Q-LEVEL (Y/N): N/A	
DRAWING NUMBER: 55-2010	REV 2

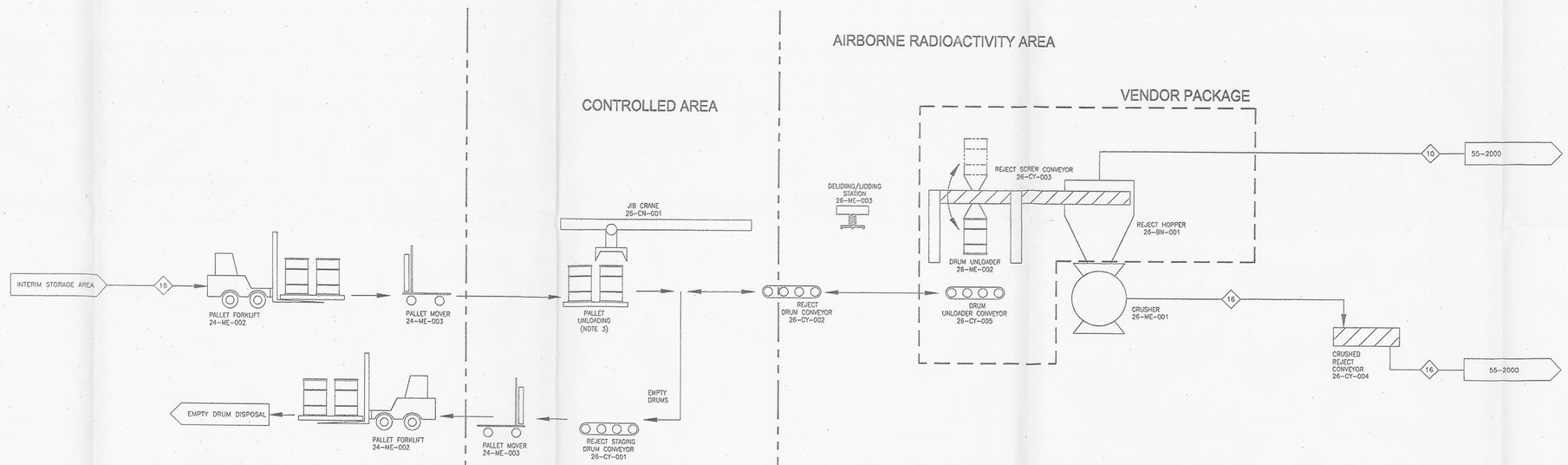
PLOTTED BY: MK

55-2018

FERNALD SILO 3 MASS BALANCE

STREAM NUMBER	10	16
DESCRIPTION (NOTE 5)	REJECT CRUSHER VENT (NOTE 2)	RECYCLED OFF-SPEC PRODUCT CONVEYANCE (NOTE 1)
AIR MASS FLOW, lb/hr	5,047	N/A
AIR VOLUMETRIC FLOW, acfm	1,200	N/A
AIR DENSITY, lb/ft^3	0.0701	N/A
AIR TEMPERATURE, (DB) °F	85	N/A
PRESSURE LOSS, in. W.G.	-3	N/A

SOLIDS LB/HR	N/A	AS REQUIRED
WATER LB/HR	N/A	AS REQUIRED
TOTAL LB/HR	N/A	AS REQUIRED
VOLUME FLOW FT^3/HR	N/A	AS REQUIRED



REFERENCE DRAWINGS

DRAWING NO.	TITLE
55-2000	RETRIEVAL AND CONVEYANCE PFD
55-2010	PROCESS BUILDING VENTILATION PFD

NOTES

1. MASS FLOW NOT INCLUDED IN OVERALL BALANCE.
2. NOT INCLUDED IN OVERALL MASS BALANCE CAMPAIGNED OPERATION.
3. DE-BANDING IS MANUAL OPERATION.
4. THE RECYCLE SYSTEM WAS PREVIOUSLY SHOWN ON 55-2000 'RETRIEVAL AND CONVEYANCE' PFD. THE RECYCLE SYSTEM WAS REMOVED AS THE CONVEYANCE SYSTEM IS NO LONGER BEING USED TO TRANSFER WASTE INTO THE RECYCLE SYSTEM.
5. ALL DATA IN THE TABLE HAS BEEN DERIVED FROM RMR-0445-ENG-01 AND IS USED IN DRAWING 55-2000.
6. ALL MASS BALANCE NUMBERS ARE ROUNDED TO THE NEAREST WHOLE NUMBER, WITH THE EXCEPTION OF AIR DENSITY.

GENERAL: MASS BALANCE BASED ON CALCULATION RMR-0445-ENG-001.

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
1	5/12/00	TJS	SAS	REVISED TECHNICAL BASELINE
0	4/14/00	TJS	SAS	REVISED TECHNICAL BASELINE FOR REVIEW

SILO 3 PROJECT
FEMP

SILO 3
REJECT SYSTEM PFD

RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

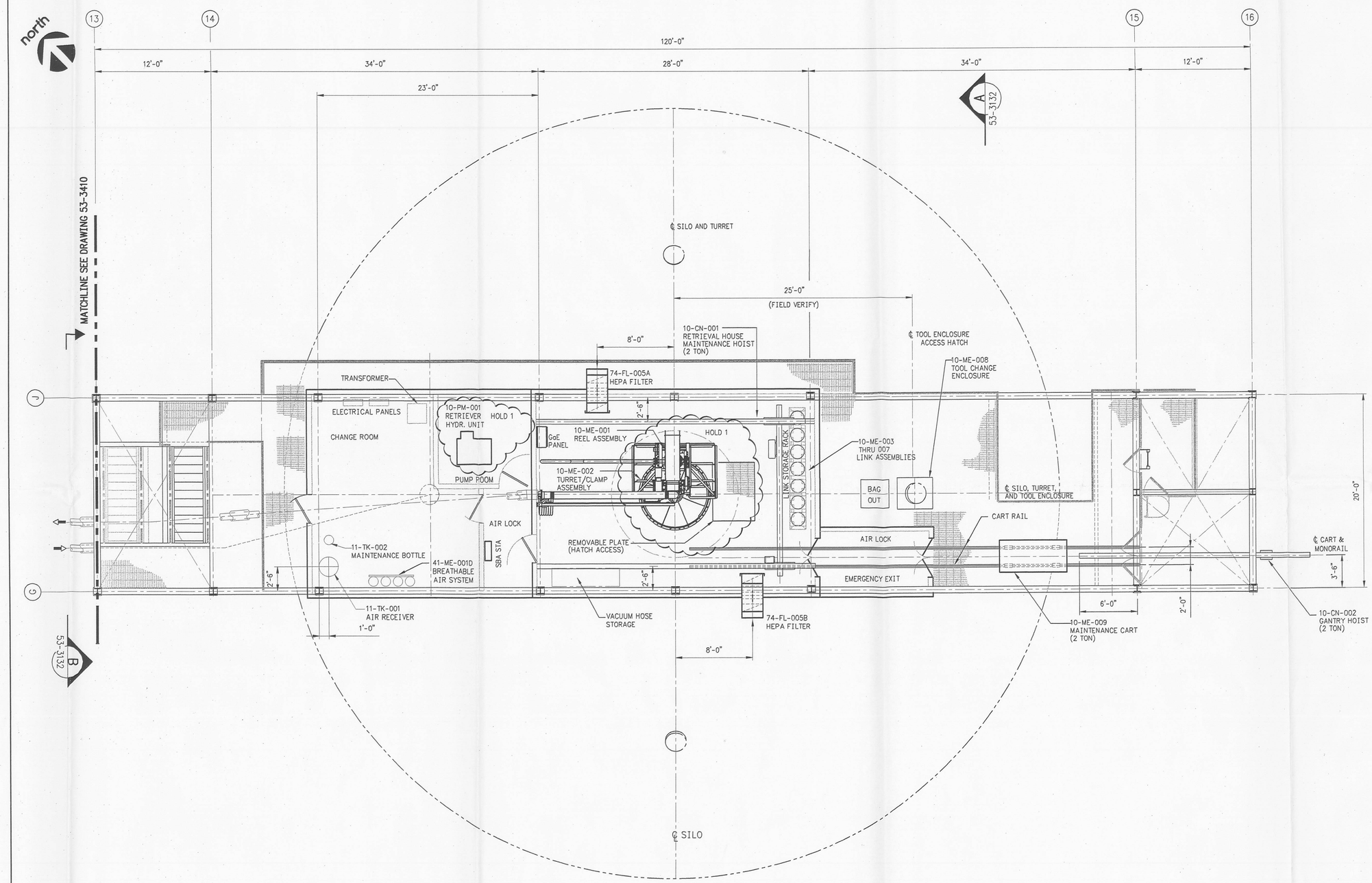
000359

SCALE: NONE	
DRAWN: B. THOMAS	DATE: 4/14/00
DESIGNED: T. SATKOWSKI	DATE: 4/14/00
CHECKED: S.A. SHARPE	DATE: 4/14/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 55-2018	
Q-LEVEL (Y/N): N/A	
DRAWING NUMBER: 55-2018	REV 1

PLOTTED BY:
05/11/00 - 1:52pm

Appendix B
General Arrangements

53-3130



PLAN

AT ELEV. 618'-0"

REFERENCE DRAWINGS

DRAWING NO.	TITLE
53-3132	GANTRY GENERAL ARRANGEMENT - SECTIONS

NOTES

HOLD 1
HOLD RETRIEVAL ARM AND ASSOCIATED EQUIPMENT PENDING VENDOR DATA

Q-LISTED ITEMS ON THIS DRAWING

ITEM	DESCRIPTION	Q-LEVEL
SYSTEM 10	RETRIEVAL SYSTEM-ReTRIEVR + RAPTOR ARM	2*
71-FL-005	RETRIEVAL ENCLOSURE INLET FILTER	3
10-CN-002	GANTRY HOIST	2*
10-CN-001	RETRIEVAL HOUSE MAINTENANCE HOIST	3

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	5/12/00	DHB	DMB	REVISED TECHNICAL BASELINE
1	4/27/00	DHB	KDL	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW
0	1/17/00	KDL	CAB	TECHNICAL BASELINE
A	01/3/00	KDL	CAB	PRELIMINARY DESIGN PACKAGE

SILO 3 PROJECT
FEMP

GANTRY GENERAL ARRANGEMENT
PLAN

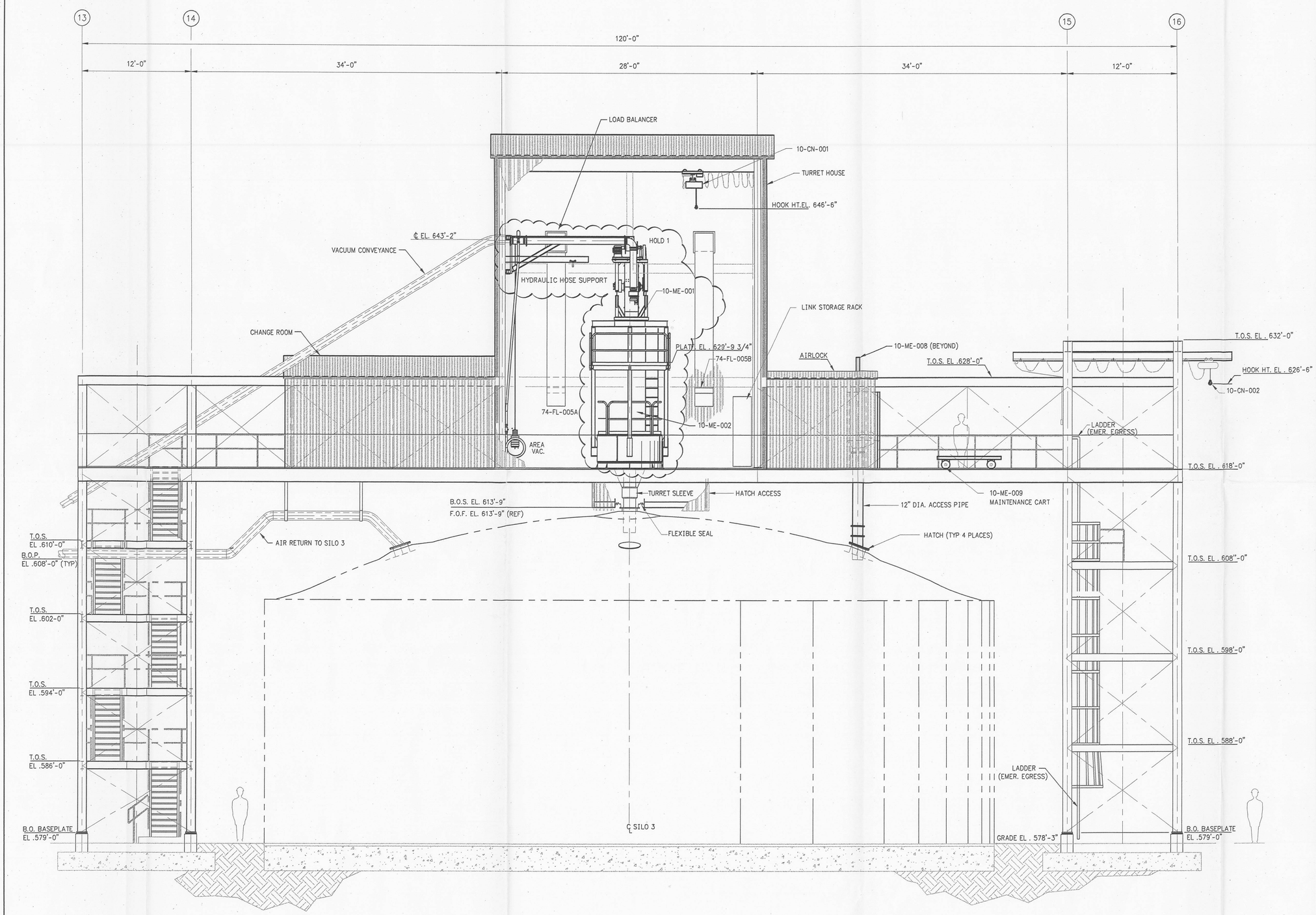
RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

000360

SCALE: 3/16"=1'-0"	
DRAWN: K. LANDRUM	DATE: 9/20/99
DESIGNED: K. LANDRUM	DATE: 1/3/00
CHECKED: C. BOSSARD	DATE: 1/3/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 533130.DWG	
Q-LEVEL (Y/N): Y	
DRAWING NUMBER: 53-3130	REV 2

PLOTTED BY: . <CPD: 05/09/00 [TIME: 08:48 AM]>

53-3131



ELEVATION
(LOOKING NORTH EAST)

REFERENCE DRAWINGS

DRAWING NO.	TITLE
53-3130	GANTRY GENERAL ARRANGEMENT - PLAN

NOTES

1. REFER TO DRAWING 53-3130 FOR Q-LISTED ITEMS SHOWN ON THIS DRAWING.

HOLD 1
HOLD RETRIEVAL ARM AND ASSOCIATED EQUIPMENT PENDING VENDOR DATA

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	5/12/00	DHB	KDL	REVISED TECHNICAL BASELINE
1	4/27/00	DHB	KDL	REVISED TECHNICAL BASELINEISSUFOR REVIEW
0	1/27/00	KDL	CAB	TECHNICAL BASELINE
A	1/7/00	KDL	CAB	PRELIMINARY DESIGN PACKAGE

SILO 3 PROJECT
FEMP

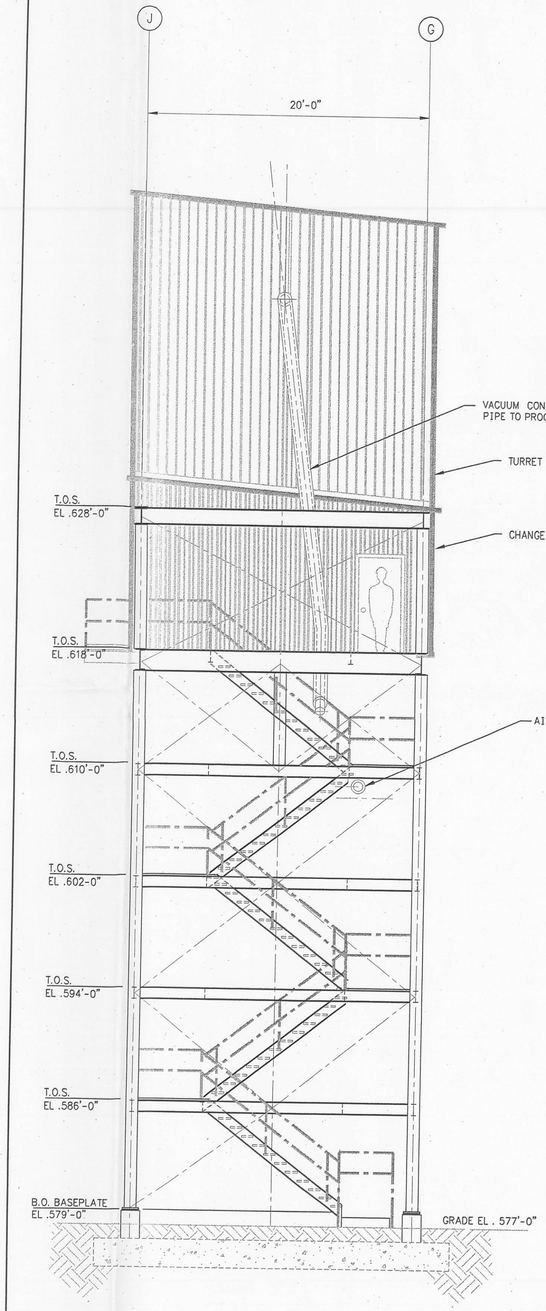
GANTRY GENERAL ARRANGEMENT
ELEVATION

RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment 000361

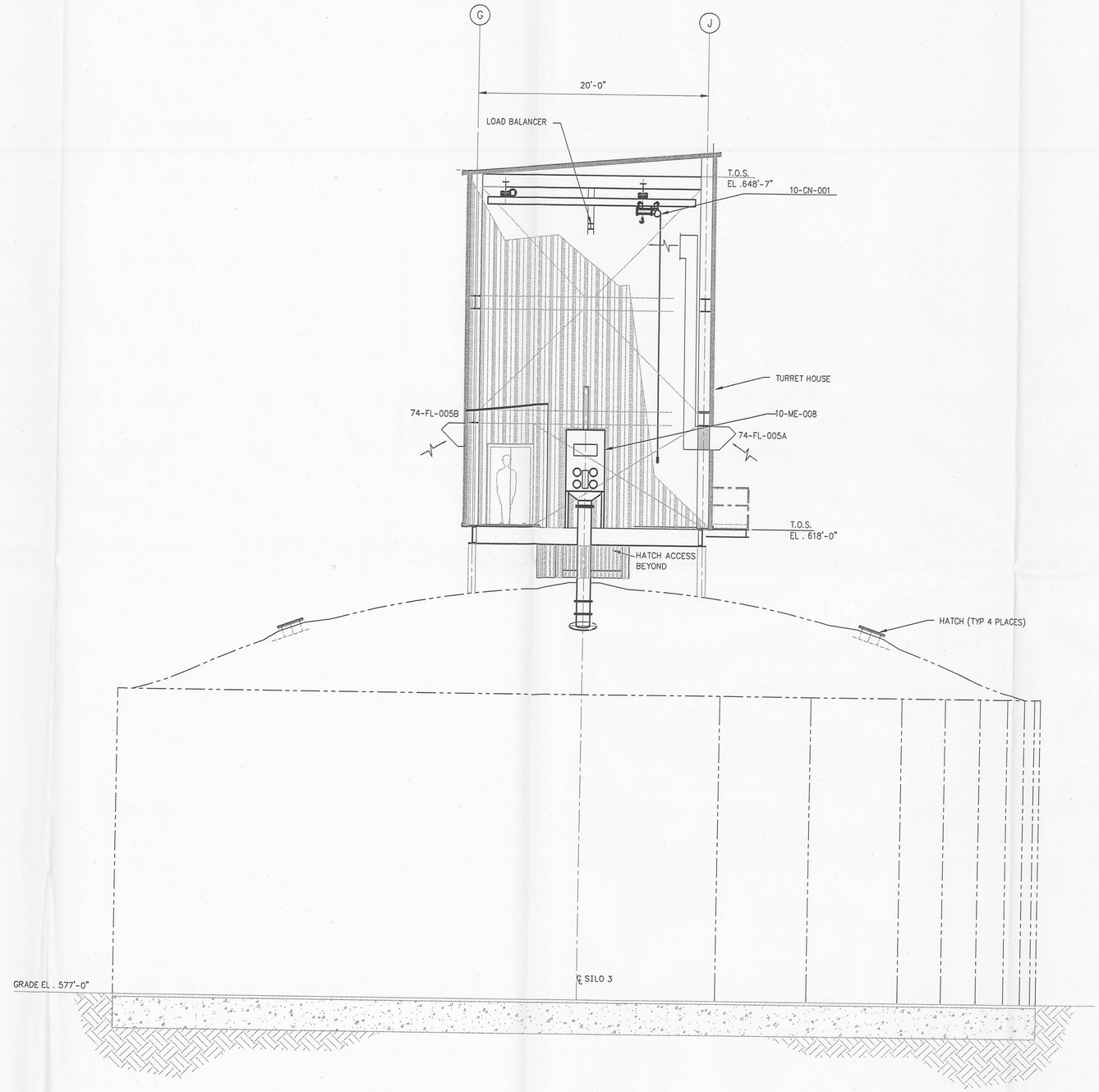
SCALE: 3/16"=1'-0"	
DRAWN: K. LANDRUM	DATE: 1/2/00
DESIGNED: K. LANDRUM	DATE: 1/2/00
CHECKED: C.A. BOSSARD	DATE: 1/3/00
VERIFIED:	DATE:
APPROVED:	DATE:
CADD FILE NAME: 533131_1.DWG	
Q-LEVEL (Y/N): Y	
DRAWING NUMBER: 53-3131	REV 2

PLOTTED BY: . <CPD: 05/11/00 [TIME: 018:57 PM

530-3132



SECTION B (53-3130)
(LOOKING SOUTHEAST)



SECTION A (53-3130)
(LOOKING NORTHWEST)

REFERENCE DRAWINGS

DRAWING NO.	TITLE
53-3130	GANTRY GENERAL ARRANGEMENT - PLAN

NOTES

1. REFER TO DRAWING 53-3130 FOR Q-LISTED ITEMS SHOWN ON THIS DRAWING.

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	5/12/00	DHB	DMG	REVISED TECHNICAL BASELINE
1	4/27/00	DHB	KDL	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW
0	1/27/00	KDL	CAB	TECHNICAL BASELINE
A	01/07/00	KDL	CAB	PRELIMINARY DESIGN

SILO 3 PROJECT
FEMP

GANTRY GENERAL ARRANGEMENT
SECTIONS

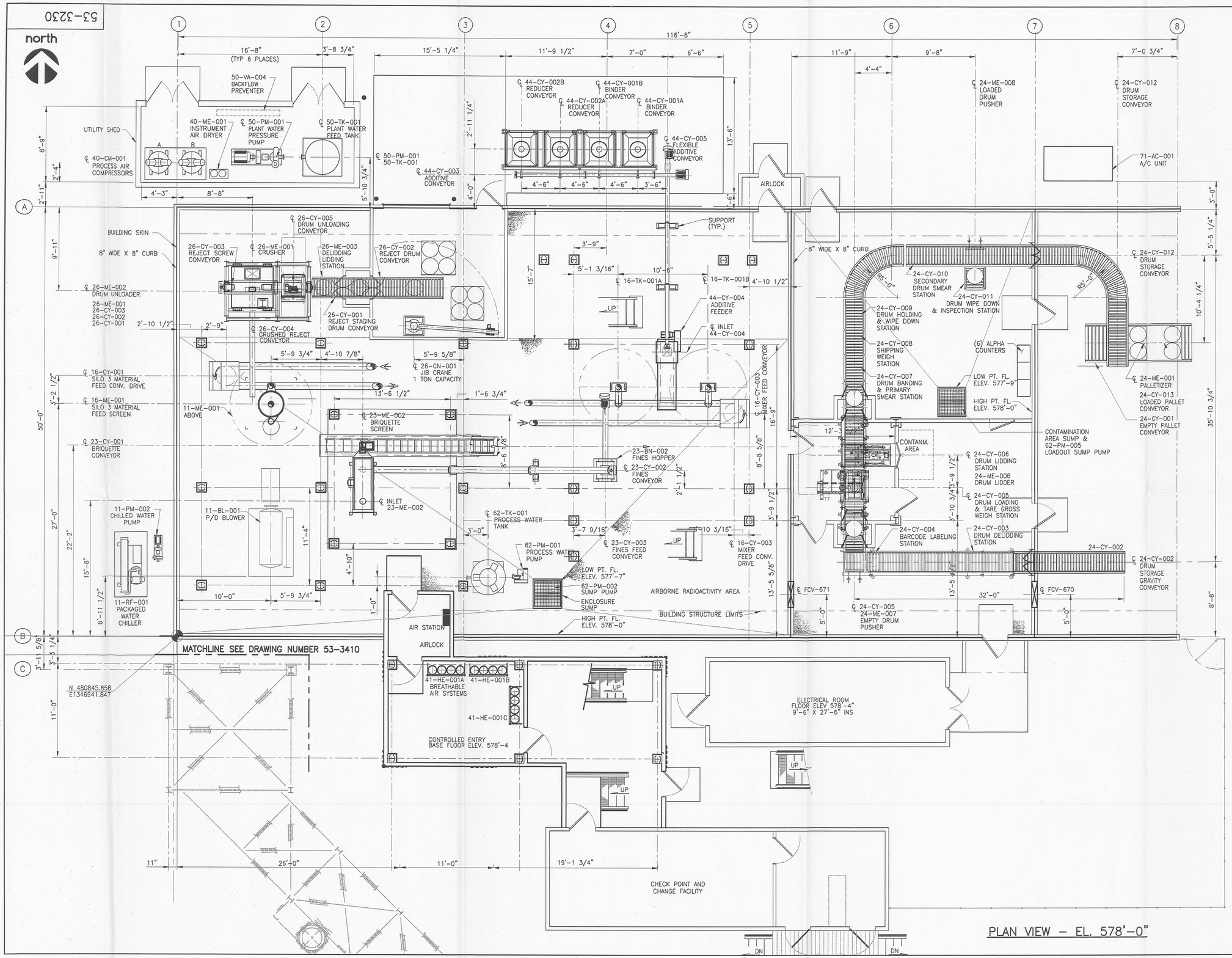
RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

000362

SCALE: 3/16"=1'-0"	
DRAWN: K. LANDRUM	DATE: 9/20/99
DESIGNED: K. LANDRUM	DATE: 1/3/00
CHECKED: C.A. BOSSARD	DATE: 1/3/00
VERIFIED:	DATE:
APPROVED:	DATE:
CADD FILE NAME: 533132.21.DWG	
Q-LEVEL (Y/N): Y	
DRAWING NUMBER: 53-3132	REV 2

PLOTTED BY: . <CPD: 05/11/00 [TIME: 02:05 PM] >

53-3230



PLAN VIEW – EL. 578'-0"

REFERENCE DRAWINGS

DRAWING NO.	TITLE
53-3231	GENERAL ARRGMT. PLAN PROCESS BLDG. EL. 586'-10"
53-3232	GENERAL ARRANGEMENT PROCESS BLDG. – SECTIONS

NOTES

1. SEE DRAWING NUMBER 53-3231 FOR CONTINUATION ABOVE.

Q-LISTED ITEMS ON THIS DRAWING

ITEM	DESCRIPTION	Q-LEVEL
11-BL-001	P/D BLOWER	3
23-BN-002	FINES HOPPER	3
24-ME-006	DRUM LIDDER	3

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	05/12/00	KDL	DMB	REVISED TECHNICAL BASELINE
1	04/27/00	JS	DMB	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW
0	01/27/00	KDL	CAB	TECHNICAL BASELINE
C	11/15/99	KDL	CAB	FOR REVIEW AND COMMENT
B	09/23/99	KDL	CAB	PHAR DESIGN PACKAGE
A	4/5/00	DB	CB	CONCEPTUAL DESIGN

SILO 3 PROJECT FEMP

GENERAL ARRANGEMENT PLAN PROCESS BLDG. – ELEV. 578'-0"

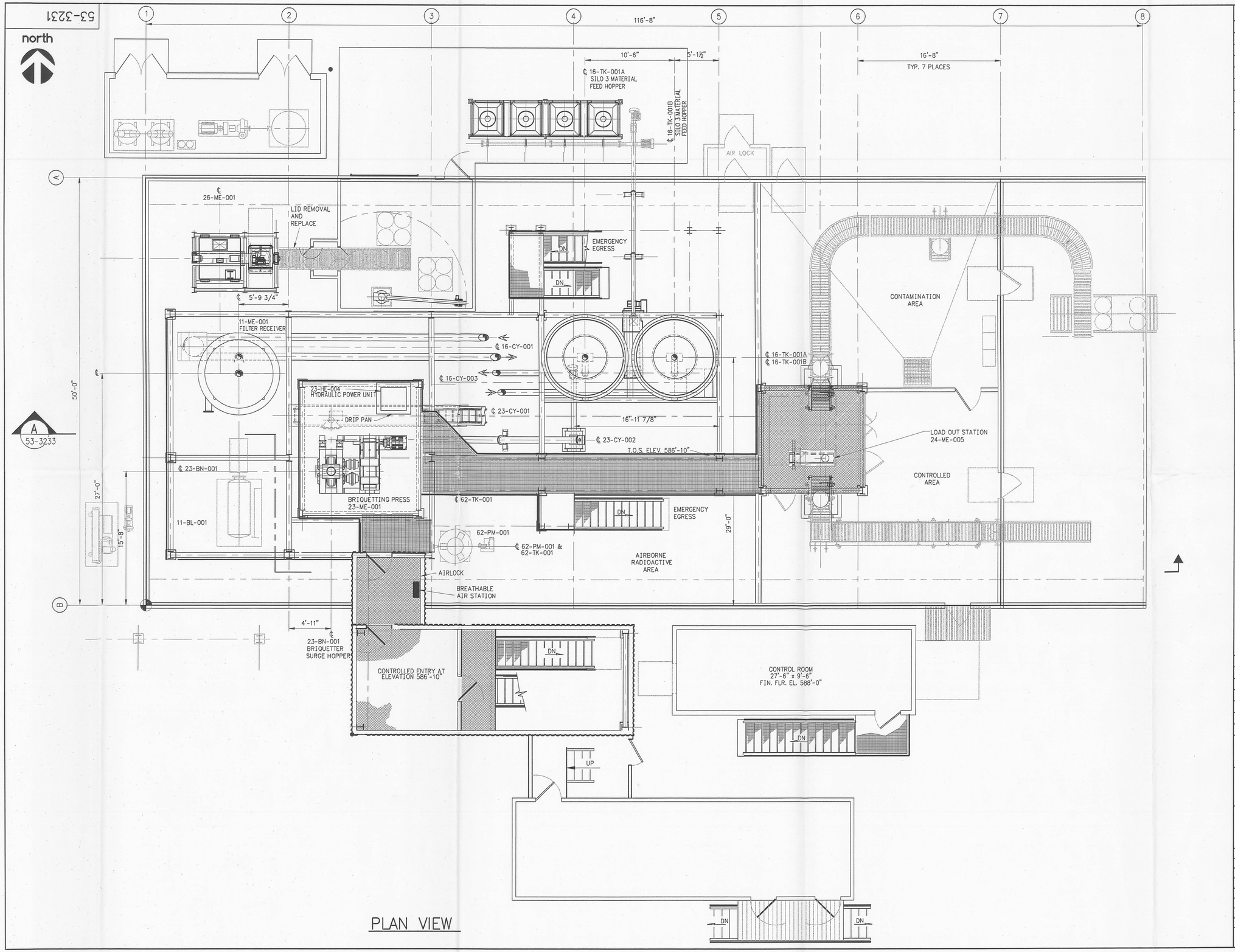
RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

000363

SCALE: 3/16"=1'-0"	
DRAWN: KDL	DATE: 3/5/00
DESIGNED: K. LANDRUM	DATE: 9/2/99
CHECKED: C. BOSSARD	DATE: 9/2/00
VERIFIED:	DATE:
APPROVED:	DATE:
CADD FILE NAME: 53323B	
Q-LEVEL (Y/N): YES	
DRAWING NUMBER: 53-3230	REV 2

PLOTTED BY: JSTEWART <CPD: 04/27/00 [TIME: 09:00 AM]

53-3231



PLAN VIEW

REFERENCE DRAWINGS

DRAWING NO.	TITLE
53-3230	GENERAL ARRGMT. PLAN PROCESS BLDG. EL. 578'-0"
53-3232	GENERAL ARRGMT. PLAN PROCESS BLDG. EL. 601'-7"
53-3233	GENERAL ARRANGEMENT PROCESS BLDG. - SECTIONS

NOTES

1. SEE DRAWING NO. 53-3230 FOR CONTINUATION BELOW.
2. SEE DRAWING NO. 53-3232 FOR CONTINUATION ABOVE.

Q-LISTED ITEMS ON THIS DRAWING

ITEM	DESCRIPTION	Q-LEVEL
23-ME-001	BRIQUETTING PRESS	3
16-TK-001A	SILO 3 MATERIAL FEED HOPPER	3
16-TK-001B	SILO 3 MATERIAL FEED HOPPER	3
23-BN-001	BRIQUETTER SURGE HOPPER	3
24-ME-005	LOADOUT STATION	3

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
1	5/12/00	DHB	DMB	REVISED TECHNICAL BASELINE
0	4/27/00	BP	DMB	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW
A	06/28/99	KDL	CAB	CONCEPTUAL DESIGN

SILO 3 PROJECT
FEMP

GENERAL ARRANGEMENT PLAN
PROCESS BLDG. - ELEV. 586'-10"

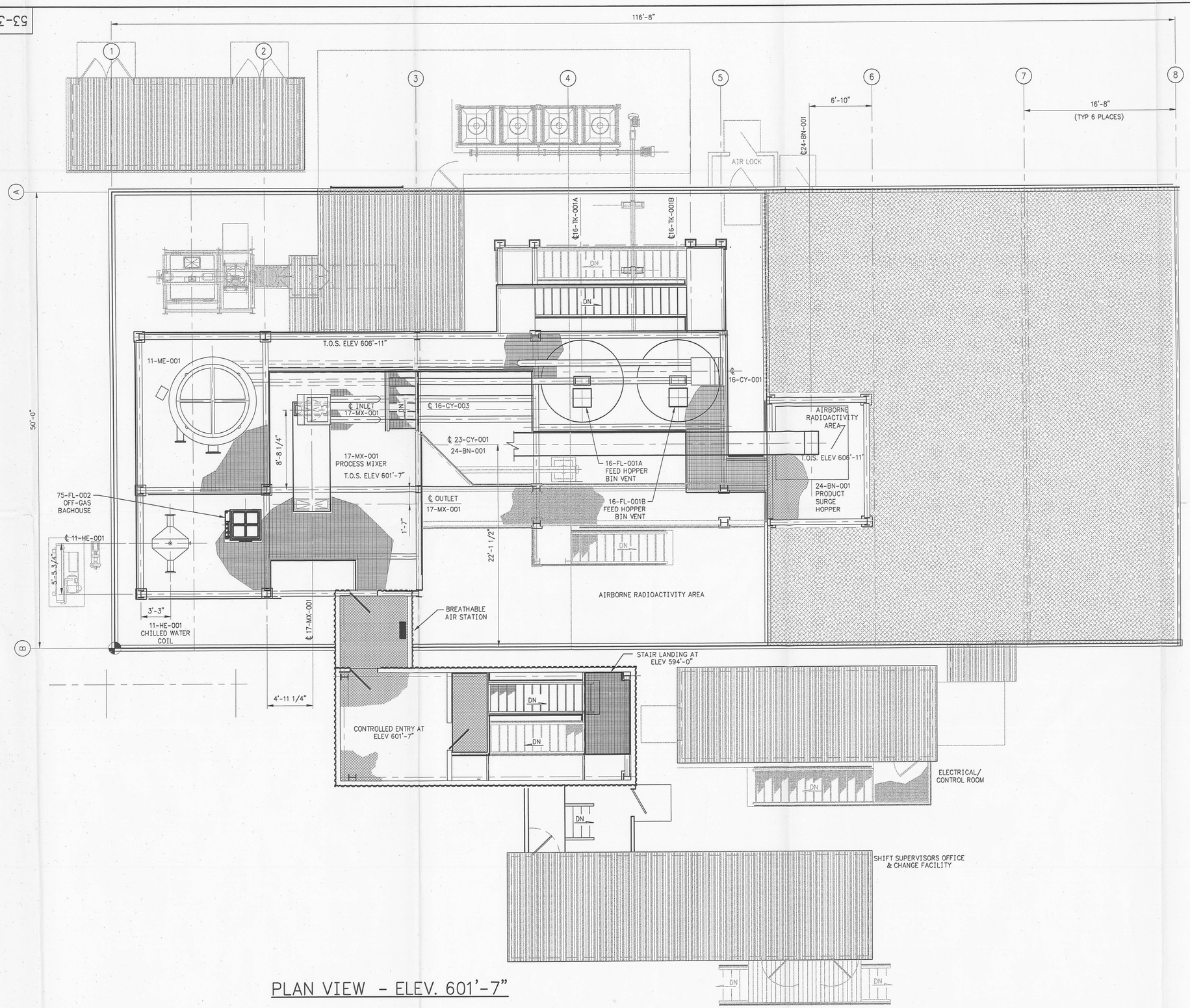
RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment 000364

SCALE: 3/16"=1'-0"	
DRAWN: KDL	DATE: 3/5/00
DESIGNED: K. LANDRUM	DATE: 9/2/99
CHECKED: C. BOSSARD	DATE: 9/2/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 533231_1.DWG	
Q-LEVEL (Y/N): Y	
DRAWING NUMBER: 53-3231	REV 1

PLOTTED BY: . <CPD: 05/10/00 [TIME: 10:50 AM] >

53-3232

north



PLAN VIEW - ELEV. 601'-7"

REFERENCE DRAWINGS

DRAWING NO.	TITLE
53-3231	GENERAL ARRGMT. PLAN PROCESS BLDG. EL. 586'-10"

NOTES

1. SEE DRAWING NO. 53-3231 FOR CONTINUATION BELOW.

Q-LISTED ITEMS ON THIS DRAWING

ITEM	DESCRIPTION	Q-LEVEL
17-MK-001	PROCESS MIXER	3
24-BN-001	PRODUCT SURGE HOPPER	3

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
1	5/12/00	DHB	DMB	REVISED TECHNICAL BASELINE
0	4/27/00	DB	DMB	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW

SILO 3 PROJECT
FEMP

GENERAL ARRANGEMENT PLAN
PROCESS BLDG. - ELEV. 601'-7"

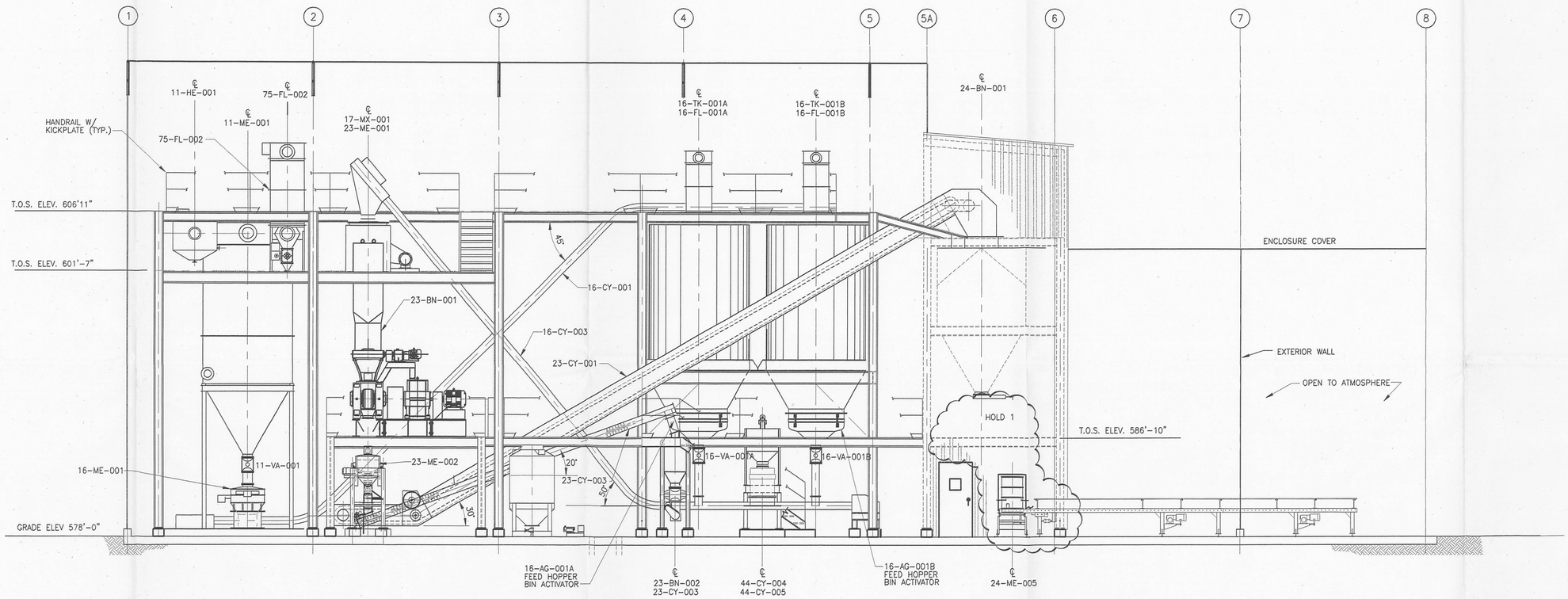
RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

000365

SCALE: 3/16"=1'-0"	
DRAWN: D. BATT	DATE: 4/4/00
DESIGNED: K. LANDRUM	DATE: 3/22/00
CHECKED:	DATE:
VERIFIED:	DATE:
APPROVED:	DATE: 5/14/00
CADD FILE NAME: 533232_0.DWG	
Q-LEVEL (Y/N): Y	
DRAWING NUMBER: 53-3232	REV 1

PLOTTED BY: . <CPD: 05/10/00 [TIME: 11:32 AM] >

53-3233



SECTION A 53-3231
3/16"=1'-0"

REFERENCE DRAWINGS

DRAWING NO.	TITLE
53-3230	GENERAL ARRGMT. PLAN PROCESS BLDG. EL. 528'-0"
53-3231	GENERAL ARRGMT. PLAN PROCESS BLDG. EL. 586'-10"
53-3232	GENERAL ARRGMT. PLAN PROCESS BLDG. EL. 601'-7"

NOTES

1. REFER TO PLAN DRAWINGS FOR Q-LISTED ITEMS SHOWN ON THIS SHEET.

HOLD 1
HOLD DRUM LOADING EQUIPMENT PENDING VENDOR DATA.

3079

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
2	5/12/00	DB	DMB	REVISED TECHNICAL BASELINE
1	4/27/00	DB	DMB	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW
0	1/27/00	KDL	CAB	TECHNICAL BASELINE
B	09/29/99	KDL	CAB	PHAR DESIGN PACKAGE
A	06/28/99	KDL	CAB	CONCEPTUAL DESIGN

SILO 3 PROJECT
FEMP

GENERAL ARRANGEMENT
PROCESS BLDG. – SECTIONS

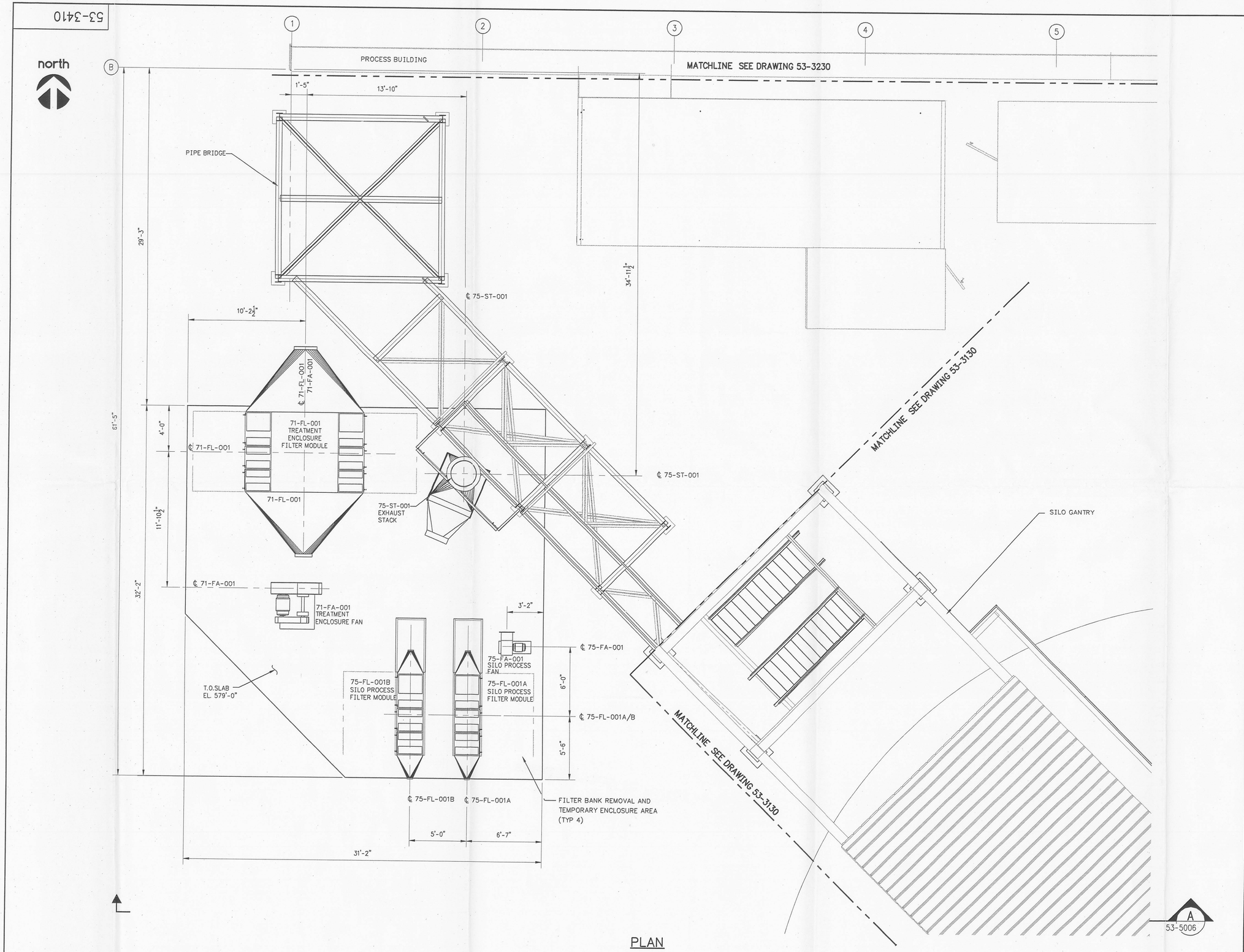
RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

000366

SCALE: 3/16"=1'-0"	
DRAWN: KDL	DATE: 3/5/00
DESIGNED: K. LANDRUM	DATE: 9/2/99
CHECKED: C. BOSSARD	DATE: 9/2/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 533233_1.DWG	
Q-LEVEL (Y/N): Y	
DRAWING NUMBER: 53-3233	REV 2

PLOTTED BY: . <CPD: 05/10/00 [TIME: 08:40 AM]

53-3410



PLAN

REFERENCE DRAWINGS

DRAWING NO.	TITLE

NOTES

3079

Q-LISTED ITEMS ON THIS DRAWING

ITEM	DESCRIPTION	Q-LEVEL
71-FA-001	TREATMENT ENCLOSURE FAN	3
71-FL-001	TREATMENT ENCLOSURE FILTER MODULE	3
75-FA-001	OFF-GAS PROCESS FAN	3
75-FL-001A	OFF-GAS FILTER MODULE	3
75-FL-001B	OFF-GAS FILTER MODULE	3

NOT FOR CONSTRUCTION

REV	DATE	BY	CKD	DESCRIPTION
1	5/12/00	DHB	DMB	REVISED TECHINICAL BASELINE
0	4/27/00	DB	DB	REVISED TECHNICAL BASELINE ISSUE FOR REVIEW

SILO 3 PROJECT
FEMP

GENERAL ARRANGEMENT PLAN
OFF-GAS TREATMENT

RMRS Rocky Mountain Remediation Services, LLC ...protecting the environment

000367

SCALE: 1/4"=1'-0"	
DRAWN: D. BATT	DATE: 2/22/00
DESIGNED: K. LANDRUM	DATE: 2/1/00
CHECKED: D. BURKE	DATE: 4/24/00
VERIFIED:	DATE:
APPROVED:	DATE: 5/11/00
CADD FILE NAME: 533410.DWG	
Q-LEVEL (Y/N): Y	
DRAWING NUMBER: 53-3410	REV 1

PLOTTED BY: . <CPD: 05/11/00 [TIME: 2:15 PM] >

Appendix C
Heat & Mtl. Bal. Calc.

RMRS Rocky Mountain Remediation Services, L.L.C. ...protecting the environment

3079

Calculation Cover Sheet

Calc. Number: RMR-0445-ENG-001

Contract Number:	Discipline: Process	Number of Sheets: 7

Project: Fernald Silo 3

Feature: Heat and Material Balance

Item:

Sources of Data:

References:
"Fernald Silo 3 Project Envirobond and Treatment and Briquetting System Process Criteria"

1. Section 6.0
2. Section 6.1
3. Section 4.0
4. Section 5.0
5. Section 7.1-6
6. Section 6.2
7. Section 7.5.1-5
8. Section 7.9.2-3
9. Section 7.9.2-2
10. Section 7.9.1-1
11. Section 7.9.1-2
12. Section 7.1-7
13. Section 7.7.4-6
14. Section 7.9.1-3
15. Section 7.6.2-2
16. Section 7.3.1-4
17. Section 7.4.1-1
18. Section 7.6.1-1
19. Section 7.6.1-2

Ξ Preliminary Calculation Γ Final Calculation Supersedes Calculation Number _____

Rev. No.	Revision	Calculation By	Date	Checked By	Date	Approved By	Date
1	General	T. Satkowski/ K. Brodsky	4/13/00	A. Spencer	4/14/00	A. Sharpe	4/14/00
2	Revised Technical Baseline	T. Satkowski/ K. Brodsky	5/12/00	S. Pleiman	5/12/00	S. Sharpe	5/12/00

000368

Design Basis

Project Operations Waste Processing

Months	6 (1)
weeks/month	4.33 (2)
Days/week	4 (2)
operating hours/day	7.0 (2)

Waste to be treated

Volume	5100 (3) yd^3 or	137700 ft^3
Max Density	58 (4) lbs/ft^3	
Min. Moisture	3.70% (4)	
Max. Moisture	40% (5)	

Equipment Availability

Retrieval Equipment Availability(2)	70%
Treatment Equipment Availability(6)	95%

Processing Recelpe

Moisture required on dry waste basis (7)	17%
EnviroBond required on dry waste basis (8)	3%
Iron Sulfate required on dry waste basis (9)	2%

Debris

Debris by weight	0.03% (12)
Debris Density	150 (12) lbs/ft^3
Moisture Content	0.0%

Waste Packaging

Volume per 55 gallon drum	7.35 (13) ft^3/drum
packing efficiency	85.0% (13)

Briquetting

Briquetting Webbing Recycle	5% (15)

Absorbent

Absorption Feed Rate	64.0% (14)

Arrestance Efficiency

Filter Receiver	99.990%
Off Gas Baghouse	99.990%

Air Conditions	Tempurature °F	Relative Humidity	Absolute Humidity	Air Density
Inlet	96	50%	0.01857	0.0688
Chiller Coils	45	100%	0.00643	0.0757

Silo 3 Material Bulk Density

In Silo	58.0 (4) lbs/ft^3
Inlet Silo 3 Material Feed Hopper	29.0 (16) lbs/ft^3
Outlet Silo 3 Material Feed Hopper	43.5 (17) lbs/ft^3
Exit Bag house to Process	29.0 (16) lbs/ft^3
Material From Mixer	60.0 (16) lbs/ft^3
Final Product	120.0 (19) lbs/ft^3

Additives	Bulk Density	Moisture Content
EnviroBond	63.0 (10) lb/ft^3	0.0%
Ferrous Sulfate	75.0 (11) lb/ft^3	0.0%
Water	62.4 lb/ft^3	100.0%
Absorbent	60 (14) lbs/ft^3	0.0%

Air Flow

Conveyance Air 96 °F (Stream 1)	2100 cfm	0.0688 lbs/ft^3
By Pass Air 85 °F (stream 4)	974 cfm	0.0701 lbs/ft^3

Mass Flow Based on Maximum Conditions

Overall Processing Time and Quantities of Waste

Operating Hours

Months	6				
weeks/month	4.33				
Days/week	4	Total Available hours	727	Total Available hours	727
hours/day	7.0	Retrieval Equipment Availability	70%	Treatment Equipment Availability	95%
Total Available hours	727	Hours Available Retrieval	509.2	Hours Available Treatment	691.1

Quantity of Waste to be Treated

Volume of material	137700	ft^3
Max Density	58	lbs/ft^3
Maximum Weight of Waste	7986600	lbs.
Min. Percent Moisture	3.70%	
Min. Moisture	295504	lbs. water in waste
Maximum Weight of Dry Waste	7691096	lbs. dry waste

Required Retrieval Flow Rate

Hours		509.2
Stream No.	1	
Stream Name	Retrieved Material Conveyance	
Solid lbs.	7691096	
Moisture Content	3.70%	
Water lbs.	295504	
Total lbs.	7986600	
Bulk Density	58	
Total ft^3	137700	
hours	509.2	
Solid lbs./hour	15104	
Water lbs./hour	580	
Total lbs./hour	15684	
Total ft^3/hour	270	

Treatment System Waste Inputs

Filter Receiver Arrestance	99.990%	Steam 4 ratio	46%
Offgas Baghouse Arrestance	99.990%	Steam 5 ratio	54%

Stream No.	2	18	3	4	5	6	7	61
Stream Name	Bulk Silo 3 Material Feed	Return Material/ P/D Blower Discharge	Return Material/ Tempered Air Discharge	HVAC Material/ Silo Make-up Air & Off Gas	Silo Return Material Conveyance	Exit Bag house to Process	Off Gas Baghouse Discharge	Flow Across P/D Blower
Solid lbs./hour	15103	2	2	1	1	1	0	2
Water in Solidslbs./hour	580	0	0	0	0	0	0	0
Total lbs./hour	15683	2	2	1	1	1	0	2
Total ft^3/hour	541	0	0	0	0	0	0	0

Chiller Condensate	Tempurature oF	Relative Humidity	Absolute Humidity	Air Flow cfm	Lbs Air/minute	Lbs Water in Air/minute
Inlet	96	50%	0.01857	2100	144.48	3
Chiller Coils	45	100%	0.00643	2100	144.48	1

Amount of Water Condensed in Chiller

Inlet	2.7	lbs/min.		
Outlet	0.9	lbs/min.		
Difference	1.8	lbs/min.	105.2	lbs/hour

Stream No.	15
Stream Name	Chiller Condensate
Solid lbs./hour	0
Water in Solidslbs./hour	105
Total lbs./hour	105
Total ft^3/hour	2

Amount of Product Produced

Process Additives

Waste	100%	X	7691096 =	7691096	lbs. dry waste
Water	17%	X	7691096 =	1307486	lbs. water
EnviroBond	3%	X	7691096 =	230733	lbs. EnviroBond
Iron Sulfate	2%	X	7691096 =	153822	lbs. Iron Sulfate
Amount of product produced				9383137	lbs. product

Water Required		Waste Present		Water Addition	
1307486	lbs. -	295504	=	1011982	lbs. water

Flow Rate for Silo 3 Treatment System

Stream No.	8	9	10	11	12	13	14	16
Stream name	Silo 3 Material to Mixer	Binder Feed	Crusher Ventilation	Process Water Feed	Product from Mixer	Product Produced	Wash Water	Reject Material
Solid lbs.	7688281	230733	As Required	0	8476478	8476478	As Required	As Required
Moisture Content	3.7%	0.0%	As Required	100.0%	13.9%	13.9%	As Required	As Required
Water lbs.	295488	0	As Required	1011982	1372844	1372844	As Required	As Required
Total lbs.	7983769	230733	As Required	1011982	9849321	9849321	As Required	As Required
Bulk Density	43.5	63.0	As Required	62.4	60.0	120.0	As Required	As Required
Total ft^3	183535	3662	As Required	16218	164155	82078	As Required	As Required
hours	691.1	691.1	As Required	691.1	691.1	691.1	As Required	As Required
Solid lbs./hour	11125	334	As Required	0	12266	12266	As Required	As Required
Water lbs./hour	428	0	As Required	1464	1987	1987	As Required	As Required
Total lbs./hour	11553	334	As Required	1464	14252	14252	As Required	As Required
Total ft^3/hour	266	5	As Required	23	238	119	As Required	As Required

Stream No.	50	51	52	53	54	55	56	57
Stream name	Silo 3 Material Process Feed	Reducing Agent Feed	Debris	Mixer Feed	Silo 3 Bulk Screen Material Feed	Briquette Recycle	Load Out Sump Water	Treatment Enclosure Sump Water
Solid lbs.	7688281	153822	2396	8476478	7687931	403642	As Required	As Required
Moisture Content	3.7%	0.0%	0.0%	4.1%	0.0%	13.9%	As Required	As Required
Water lbs.	295488	0	0	360862	295475	65374	As Required	As Required
Total lbs.	7983769	153822	2396	8837339	7983406	469015	As Required	As Required
Bulk Density	29.0	75.0	150.0	48.6	29.0	120	As Required	As Required
Total ft^3	275363	2051	16	181822	275356	3908	As Required	As Required
hours	509.2	691.1	509.2	691.1	509.2	691.1	As Required	As Required
Solid lbs./hour	15099	223	5	12266	15098	584	As Required	As Required
Water lbs./hour	580	0	0	522	580	95	As Required	As Required
Total lbs./hour	15679	223	5	12788	15678	679	As Required	As Required
Total ft^3/hour	541	3	0	263	541	6	As Required	As Required

Stream No.	58	59	60
Stream name	Additive	Final Product	Adsorbent
Solid lbs.	384555	8072836	As Required
Moisture Content	0	13.9%	As Required
Water lbs.	0	1307470	As Required
Total lbs.	384555	9380306	As Required
Bulk Density	68	120.0	As Required
Total ft^3	5697	78169	As Required
hours	691.1	691.1	As Required
Solid lbs./hour	556	11682	As Required
Water lbs./hour	0	1892	As Required
Total lbs./hour	556	13574	As Required
Total ft^3/hour	8	113	As Required

Drums of Product

Volume of Product per drum = 7.35 ft^3/drum X 85.0% = 6.25 ft^3/drum

Volume of Product Produced = As Required ft^3/hour

Hour per Day = 7.0 hours/day

113.1 ft^3/hour / 6.25 ft^3/drum X 7.0 hours/day = 127 drums/day or

18.1 drums/hour or 3.31 minutes/drum

Total Number of Drums

18.1 drums/hour X 691.1 hours = 12512 Total Drums

MASS AND ENERGY BALANCE

(As Shown on Dwg's 55-2008 and 55-2010)

STREAM		VOL. FLOW	DB TEMP.	AIR DENSITY	MASS FLOW	PRESSURE	NOTE
No.	Description	(acfm)	(°F)	(lb/ft3)	lb/hr	("W.G. TP)	
17	Retrieval Enclosure ["R/E"] Intake	1,000	94	0.0690	4,140	0.00	4 (Four) Air Changes per Hour
23	R/E to Silo Cross Flow	1,013	101	0.0681	4,140	-0.20	
1	Waste Conveyance	2,627	94	0.0552	8,694	-80.00	Air Only! Includes Cyclone Receiver!
n/a	Flow Across Filter Receiver	2,667	99	0.0543	8,694	-82.00	
n/a	Filter Receiver to P/D Blower	2,692	99	0.0538	8,694	-85.00	
61	Flow Across P/D Blower	2,750	100	0.0527	8,694	-91.00	
18	P/D Blower to Coil	2,267	165	0.0639	8,694	18.00	
3	Tempered Air Discharge	2,006	85	0.0722	8,694	12.00	Colling Capacity of 170,000 Btu
5	Silo Return	1,056	85	0.0719	4,554	10.00	
4	Off-Gas Treatment	974	85	0.0708	4,140	4.00	
7	Off-Gas Discharge	981	85	0.0703	4,140	1.00	
24	Process Building Space	15,000	118	0.0662	59,616	10.00	From Comfort HVAC Study
25	Process Space De-pressurization	13,359	118	0.0662	53,062	1.00	
26	Briquetter Exhaust	550	118	0.0662	2,185	-2.00	
27	Product Hopper Exhaust	150	118	0.0662	596	-2.00	
28	Material Screen Exhaust	300	118	0.0662	1,192	-2.00	
29	Drum Loadout Exhaust	150	118	0.0662	596	-2.00	
30	Feed Hoppers Exhaust	500	118	0.0662	1,986	-3.00	
10	Crusher Ventilation	1,200	85	0.0701	5,047	-3.00	8.0 sq.ft. hood @ 150 fpm!
40	Building Infiltration (55-2010)	4,717	94	0.0690	19,528	1.00	
41	Loadout Area Make Up (55-2010)	920	94	0.0690	3,809	2.00	
42	Controlled Cross-flow (55-2010)	9,993	103	0.0679	40,709	0.10	
43	Membrane Infiltration (55-2010)	4,610	103	0.0679	18,781	0.10	
44	Building Make Up Air (55-2010)	8,733	94	0.0690	36,153	1.00	
45	Area Cross-flow (55-2010)	902	83	0.0704	3,809	0.00	
46	Loadout Recirculation (55-2010)	6,571	83	0.0704	27,754	0.00	
47	Cool Air Discharge (55-2010)	7,087	55	0.0742	31,563	0.00	
36	Stack Discharge (Normal Ops)	16,003	115.85	0.0664	63,756	0.00	

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Stream Number	1	3	4	5	7	10
Description	Waste Conveyance	Tempered Air Discharge	Off-Gas Treatment	Silo Return	Off-Gas Discharge	Crusher Ventilation
Air Mass, lb/hr	8,694	8,694	4,140	4,554	4,140	5,047
Air Volumetric Flow, acfm	2,627	2,006	974	1,056	981	1,200
Air Density, lb/ft^3	0.0552	0.0722	0.0708	0.0719	0.0703	0.0701
Air Temperature, (DB) °F	94	85	85	85	85	85
Static Pressure, in W. G.	-80.00	12.00	4.00	10.00	1.00	-3.00

Stream Number	17	18	23	24	25	26
Description	Retrieval Enclosure ["R/E"] Intake	P/D Blower to Coil	R/E to Silo Cross Flow	Process Building Space	Process Space De-pressurization	Briquetter Exhaust
Air Mass, lb/hr	4,140	8,694	4,140	59,616	53,062	2,185
Air Volumetric Flow, acfm	1,000	2,267	1,013	15,000	13,359	550
Air Density, lb/ft3	0.0690	0.0639	0.0681	0.0662	0.0662	0.0662
Air Temperature, (DB) oF	94	165	101	118	118	118
Static Pressure, in W. G.	0.00	18.00	-0.20	10.00	1.00	-2.00

Stream Number	27	28	29	30	36	40
Description	Product Hopper Exhaust	Material Screen Exhaust	Drum Loadout Exhaust	Feed Hoppers Exhaust	Stack Discharge (Normal Ops)	Building Infiltration (55-2010)
Air Mass, lb/hr	596	1,192	596	1,986	63,756	19,528
Air Volumetric Flow, acfm	150	300	150	500	16,003	4,717
Air Density, lb/ft3	0.0662	0.0662	0.0662	0.0662	0.0664	0.0690
Air Temperature, (DB) oF	118	118	118	118	115.85	94
Static Pressure, in W. G.	-2.00	-2.00	-2.00	-3.00	0.00	1.00

Stream Number	41	42	43	44	45	46
Description	Loadout Area Make Up (55-2010)	Controlled Cross-flow (55-2010)	Membrane Infiltration (55-2010)	Building Make Up Air (55-2010)	Area Cross-flow (55-2010)	Loadout Recirculation (55-2010)
Air Mass, lb/hr	3,809	40,709	18,781	36,153	3,809	27,754
Air Volumetric Flow, acfm	920	9,993	4,610	8,733	902	6,571
Air Density, lb/ft3	0.0690	0.0679	0.0679	0.0690	0.0704	0.0704
Air Temperature, (DB) oF	94	103	103	94	83	83
Static Pressure, in W. G.	2.00	0.10	0.10	1.00	0.00	0.00

Stream Number	47	61
Description	Cool Air Discharge (55-2010)	Flow Across P/D Blower
Air Mass, lb/hr	31,563	8,694
Air Volumetric Flow, acfm	7,087	2,750
Air Density, lb/ft3	0.0742	0.0527
Air Temperature, (DB) oF	55	100
Static Pressure, in W. G.	0.00	-91.00

Stream No.	1	2	3	4	5	6	7
Stream Name	Retrieved Material Conveyance	Bulk Silo 3 Material Feed	Return Material/ Tempered Air Discharge	HVAC Material/ Silo Make-up Air & Off Gas	Silo Return Material Conveyance	Exit Bag house to Process	Off Gas Baghouse Discharge
Solid lbs./hour	15104	15103	2	1	1	1	0
Water lbs./hour	580	580	0	0	0	0	0
Total lbs./hour	15684	15683	2	1	1	1	0
Total ft3/hour	270	541	0	0	0	0	0

Stream No.	8	9	10	11	12	13	14
Stream Name	Silo 3 Material to Mixer	Binder Feed	Crusher Ventilation	Process Water Feed	Product from Mixer	Product Produced	Wash Water
Solid lbs./hour	11125	334	n/a	0	12266	12266	As Required
Water lbs./hour	428	0	n/a	1464	1987	1987	As Required
Total lbs./hour	11553	334	n/a	1464	14252	14252	As Required
Total ft3/hour	266	5	n/a	23	238	119	As Required

Stream No.	15	16	18	50	51	52	53
Stream Name	Chiller Condensate	Reject Material	Return Material/ P/D Blower Discharge	Silo 3 Material Process Feed	Reducing Agent Feed	Debris	Mixer Feed
Solid lbs./hour	0	As Required	2	15099	223	5	12266
Water lbs./hour	105	As Required	0	580	0	0	522
Total lbs./hour	105	As Required	2	15679	223	5	12788
Total ft3/hour	2	As Required	0	541	3	0	263

Stream No.	54	55	56	57	58	59	60
Stream Name	Silo 3 Bulk Screen Material Feed	Briquette Recycle	Load Out Sump Water	Treatment Enclosure Sump Water	Additive	Final Product	Adsorbent
Solid lbs./hour	15098	584	As Required	As Required	556	11682	As Required
Water lbs./hour	580	95	As Required	As Required	0	1892	As Required
Total lbs./hour	15678	679	As Required	As Required	556	13574	As Required
Total ft3/hour	541	6	As Required	As Required	8	113	As Required

Stream No.	61
Stream Name	Flow Across P/D Blower
Solid lbs./hour	2
Water lbs./hour	0
Total lbs./hour	2
Total ft3/hour	0

Appendix D
Silos Env. Mon. Plan

3079

SILOS PROJECTS

ENVIRONMENTAL MONITORING PLAN
40000-PL-0010

Signature Page

Approved by:

K. Wintz, Silo 3 Project Team Coach	5/17/00 Date
P. Pimentel, Silos 1 and 2 AWR Project Team Coach	5/17/00 Date
D. Paine, FDF, Vice President, Silos Project	5/17/00 Date

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RECORD OF ISSUE/REVISIONS

Issue Authorization Date	Effective Date	PCN No.	Rev. No.	Description
	May 17, 2000		0	Initial issue

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SILOS PROJECTS

ENVIRONMENTAL MONITORING PLAN
40000-PL-0010

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2.0 Integrated Environmental Monitoring 1
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3.1.2 The IEMP Air Monitoring Program 2
3.1.3 The IEMP Environmental Radon Monitoring Network 3
3.1.4 Project-Specific Air Particulate Monitoring Program 4
3.2 Direct Radiation Monitoring 5
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3.4 Groundwater Monitoring 6
4.0 Reporting 6
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ACRONYM LIST

ALARA	As Low As Reasonably Achievable
ARAR	Applicable, Relevant, and Appropriate
ASL	Analytical Support Level
AWR	Accelerated Waste Retrieval
AWWT	Advanced Waste Water Treatment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DOE	Department of Energy
FEMP	Fernald Environmental Management Project
HAMDC	Highest allowable minimal detectable concentration
IEMP	Integrated Environmental Management Plan
ISER	Integrated Site Environmental Report
OU4	Operable Unit 4
pCi	pico curie
SCQ	Sitewide CERCLA Quality assurance plan
TLD	Thermoluminescent Dosimeter
WAC	Waste Acceptance Criteria
WPRAP	Waste Pits Remedial Action Plan

000380

SILOS PROJECTS ENVIRONMENTAL MONITORING PLAN

1.0 General

The current focus of environmental monitoring at the Fernald Environmental Management Project (FEMP) is the implementation of site-wide environmental monitoring and project-specific environmental monitoring. Site-wide environmental monitoring is addressed in the Integrated Environmental Monitoring Plan (IEMP) while project-specific requirements are addressed within the environmental control plans, process control plans, and other design documents which constitute the project's remedial design package. For the Silo 3 Stabilization Project and the Silos 1 and 2 Accelerated Waste Retrieval Project (AWR Project), modifications to the site-wide environmental program are necessary to support project activities. Therefore, the focus of this plan is to establish the integrated environmental monitoring requirements for Operable Unit 4 (OU4) during the conduct of both projects.

2.0 Integrated Environmental Monitoring

The IEMP focuses on monitoring air, direct radiation, groundwater, and surface water to ensure protection of human health and the environment during the conduct of site-wide remediation activities. The IEMP incorporates regulatory requirements for site-wide monitoring, trending, reporting, and it serves as the central reporting mechanism to the regulators and stakeholders for the ongoing emission control/ monitoring activities at the FEMP. It is important to note that Site-wide reporting under the IEMP does not preclude project-specific reporting for the Silo 3 Stabilization Project or the AWR Project.

3.0 Project-Specific Environmental Monitoring

Project-specific environmental monitoring requirements are identified in the applicable design documentation for both the Silo 3 Project and the AWR Project (References 1 and 2). Fluor Fernald Inc. has identified additional enhancements to the existing site monitoring program that are integral to both projects. As a result, this project-specific environmental monitoring plan documents the additional requirements addressing air, direct radiation, and project wastewater (i.e., slurry wastewater and decontamination wastewater) monitoring within and surrounding specified project boundaries that will be established by Fluor Fernald, Inc. The need and extent of project-specific monitoring has been evaluated based on the following criteria:

- Project complexity, extent of contamination, and scope;
- Applicable, Relevant, and Appropriate Requirements (ARARs) compliance strategy;
- DOE Orders compliance strategy; and,
- Existing monitoring data, modeling, and monitoring programs.

This project-specific environmental monitoring plan considers the location of the Operable Unit 4 (OU4) projects with respect to other remediation activities [e.g. the Waste Pit Remedial Action Plan (WPRAP) project] and the FEMP boundary. The plan also considers project-specific constraints such as the contaminants of concern; the characteristics of the OU4 wastes; and the material transfer, handling, and storage processes. Project-specific emission modeling of both normal and upset conditions have provided the basis for identifying and instituting process emission controls that are protective to the workers, public, and the environment (References 6 and 7). The effectiveness of the project-specific emission controls will be evaluated through analysis of monitoring results to identify whether increased or altered emission control methods are necessary. Project-specific environmental monitoring summary results will be provided in project completion reports.

3.1 Environmental Radiological Air Emissions Monitoring

Environmental radiological air monitoring during the Silo 3 and AWR Projects will consist of three programs: 1) the Silo 3 and AWR stack monitoring programs; 2) the IEMP Air Monitoring Program including the environmental radon monitoring network; and 3) the project-specific air monitoring program.

3.1.1 The Silo 3 Stabilization Project and AWR Stack Monitoring Program

The Silos 1 and 2 AWR Project stack monitoring requirements are described in the *Silos 1 and 2 Accelerated Waste Retrieval Project Remedial Design Package (Reference 2) and Operational Environmental Control Plan (Reference 3)*. The Silo 3 Stabilization Project stack-monitoring program is described in, RMR-0445-ENG-015-000, *Operational Environmental Control Plan* (Reference 4) and RMR-0445-ENG-024-000, *ARAR Compliance* Strategy (Reference 5). Both projects will deploy isokinetic sampling for particulate radionuclides, monitoring, and recording of stack exhaust that is compliant with Title 40 of the Code of Federal Regulations (CFR), Part 61, Subpart H, and DOE Order 5400.5, Section IV.6.B. Additionally, the stack exhaust from both projects will be continuously monitored for radon to verify that emissions are controlled in a manner that will not cause the point source to result in a contribution to the fence line radon concentration of greater than 0.5 pCi/L, as an annual average above background. Radiological contaminants represent the primary contaminants of concern, therefore the focus of stack air monitoring will be for radionuclides; however, monitoring for other contaminants of concern will be added, as warranted.

3.1.2 The IEMP Air Monitoring Program

The IEMP Air Monitoring Program is an established program that will continue throughout remediation. Within the IEMP Air Monitoring Program, the radiological air particulate monitoring program provides fenceline the monitoring network for assessing the collective site-wide impact of FEMP multiple concurrent remediation activities. This program demonstrates FEMP compliance with all ARARs and provides early warning feedback

regarding the cumulative sitewide effectiveness of project-specific emission controls. The radiological air particulate monitoring program is reviewed annually in order to account for changes in remediation projects at the FEMP.

Additionally, within the IEMP Air Monitoring Program, the radon monitoring network has been designed to focus on monitoring Silos 1 and 2 headspaces, environmental radon levels in the vicinity of the silos, as well as radon levels at the site fenceline. In support of the Silo 3 and AWR projects and in anticipation of treatment of Silo1 and 2 material, the IEMP environmental radon monitoring network is being modified as described below.

3.1.3 The IEMP Environmental Radon Monitoring Network

During the Silo 3 Stabilization Project and the AWR Project, remediation activities directed toward the removal, processing, and storage of radon-generating wastes create the potential for the release of radon to the environment. Modifications and additions to the existing IEMP environmental radon monitoring network are necessary to accommodate construction activities associated with the AWR Project and to better monitor levels around the Silo 1 and 2 area during the OU4 remediation.

Three present radon monitoring stations near the K-65 Silos are to be re-located to accommodate construction activities. The monitoring stations to be re-located are as follows:

- KNW at the K-65 exclusion fence will be moved to the western side of the road, re-designated KNW-A.
- KSW at the K-65 exclusion fence will be moved to the western side of the road, re-designated KSW-A.
- T28 northeast of the K-65 exclusion fence will be moved across the road, in the prevailing wind direction from the K-65 Silos, re-designated LP3.

To better monitor radon levels in the K-65 area, five radon monitoring locations will be added to the existing IEMP radon network. The monitors will provide additional monitoring of radon levels in the vicinity of the silos during the Silo 3 and AWR projects and subsequent treatment operations for the Silos 1, 2, and 3 material. The tentative locations and designations for the monitors are:

- North of Silo 2 near the camera tower at the K-65 exclusion fence, designated KNO.
- South of Silo 1 near the new south camera tower, designated KSO.
- East of Silo 4 and in the prevailing wind direction from Silo 3, designated LP2.
- Southwest of the High Nitrate Storage Tank, near pole #543 at Trailer #117 designated T117.

- An additional station was selected on the FEMP's west fenceline to supplement the established IEMP monitoring network. The monitor (PR-1) will be co-located with the WPTH-2 air particulate monitor, on the western perimeter of the facility.

The detail of the OU4 radon monitoring locations is shown on Dwg. 94X-5500-G-02259 (Attachment A). The map of the entire IEMP radon monitoring network is shown in Dwg. 94X-5500-G-SK-1051 (Attachment B).

Data from selected radon monitors will be accessible via a secure Internet address. The data will include the date and time of the most recent transmission, location, and latest radon concentration. This data will be sent from the monitoring instrumentation without review or validation. Data review and validation will be conducted in a manner consistent with the current methods used under the IEMP Fluor Fernald Inc. radon monitoring program.

3.1.4 Project-Specific Air Particulate Monitoring Program

The IEMP air particulate monitoring program, which is based on air monitors located at the FEMP's perimeter fenceline, provides early warning feedback regarding the cumulative sitewide effectiveness of all remediation project emission controls. The project-specific air particulate monitoring program will provide data that confirms the performance of the emissions controls used for the Silo 3 Stabilization Project and AWR Project. In addition to providing confirmatory data, the monitoring program will also provide data to quantify the nature and extent of releases from both projects in the event of an upset condition. The program will consist of four high-volume particulate air samplers that will be co-located with the radon monitors at the Bio-surge lagoon, LP-2, T117, and LP-15 locations shown in Dwg. 94X-5500-G-SK-1051 (A). These samplers maintain a consistent air sample flow rate between 40 and 50 cubic feet per minute through an 8 by 10-inch filter.

The sampling and analysis program will consist of bi-weekly isotopic thorium, radium-226, and total particulate analyses. Results from the isotopic thorium analysis (thorium-228, thorium-230, and thorium-232) will be used to specifically monitor Th-230, the primary isotope of concern within the Silo 3 residues. The radium-226 analysis will be used to assess the effectiveness of process-control measures during the Silo 3 and AWR projects. Total particulate analysis will be used to determine if the results are indicative of project emissions or reflect the measurement of fugitive emissions from other sources (e.g. dust from construction vehicle traffic).

Samples will be analyzed according to the requirements for Analytical Support Level (ASL) B in the Sitewide CERCLA Quality (SCQ) assurance plan. The highest allowable minimal detectable concentrations (HAMDCs) for ASL B are 9.0 pCi/filter for isotopic thorium analyses and 4.0 pCi/filter for radium-226 analysis.

3.2 Direct Radiation Monitoring

In addition to airborne emissions, exposure to direct radiation is also a radiological hazard at the FEMP, particularly in the vicinity of Silo 1 and Silo 2. Direct, (a.k.a. penetrating) radiation is emitted from the radioactive materials stored onsite. The largest source of penetrating radiation at the FEMP results from the transformation of radium-bearing materials stored in Silos 1 and 2.

The IEMP environmental monitoring network includes thirty-two locations that monitor direct radiation levels associated with the storage of radionuclides at the FEMP. The monitoring is conducted using thermoluminescent dosimeters (TLDs). The monitoring network is well established and the locations were strategically chosen to ensure a monitoring envelope for each radiation source. During the AWR Project, major sources of direct radiation at the FEMP will undergo change. The operation of the Radon Control System (RCS) will result in elevated direct radiation adjacent to the carbon beds. The removal of the berm surrounding Silos 1 and 2 will result is changes to existing radiation shielding. These processes, together with the removal and relocation of the silo wastes to the Transfer Tank Area (TTA) will require an expansion of the IEMP TLD network to ensure adequate coverage of direct radiation sources.

The existing IEMP TLD monitoring network will be modified to take into account the relocation of the wastes stored in the K-65 silos. As necessary, current TLD locations will be adjusted and new TLD locations will be added to adequately characterize and monitor the direct radiation in the vicinity of the AWR project and the site fenceline. The background and technical justification for modifications to the IEMP TLD monitoring network will be provided through the IEMP annual review process.

3.3 Wastewater Monitoring

All wastewater from the Silo 3 Stabilization Project and AWR Project will be discharged to the FEMP Advanced Wastewater Treatment (AWWT) facility, if the wastewater characterization indicates the wastewater stream meets the AWWT WAC. If the WAC is not met, then pretreatment of the wastewater stream will be performed prior to discharge to the AWWT.

3.4 Groundwater Monitoring

Groundwater monitoring is currently managed by the Aquifer Restoration Project (ARP). The ARP provides the monitoring necessary to identify the effect of FEMP remediation activities. This monitoring is adequate for assessing potential impacts on groundwater quality due to the Silo 3 and AWR projects. In the event that collection of groundwater samples is needed to support the projects (or to assess any incidental releases), ARP managers will be notified to coordinate the appropriate groundwater monitoring activity.

4.0 Reporting

All project-specific environmental monitoring will be reported in the Silo 3 Stabilization and AWR Project Completion Reports, which will include a summary of the results generated during the projects. For radon monitoring, the report will identify each of the radon monitoring locations and the minimum, maximum, and average radon levels at each of those locations. For project-specific air monitoring, the report will identify each of the monitoring locations and the minimum, maximum, and average levels of each analyte at each of the locations. For direct radiation monitoring, the report will include TLD locations and a summary of quarterly results.

The project-specific monitoring data will not be included in the IEMP quarterly status or the Integrated Site Environmental Report (ISER) on a routine schedule. However, project-specific data may be reported as necessary in IEMP quarterly status reports and the ISER to explain significant changes in the data from the fenceline IEMP environmental monitoring program.

5.0 References

1) Fernald Silo 3 Project Remedial Design Package, RMR-0445-0081-000, Rocky Mountain Remediation Services, May 2000.

2) Silos 1 and 2 Accelerated Waste Retrieval Project Remedial Design Package, June 2000

3) Operational Environmental Control Plan for the Silos 1 and 2 Accelerated Waste Retrieval Project, June 2000.

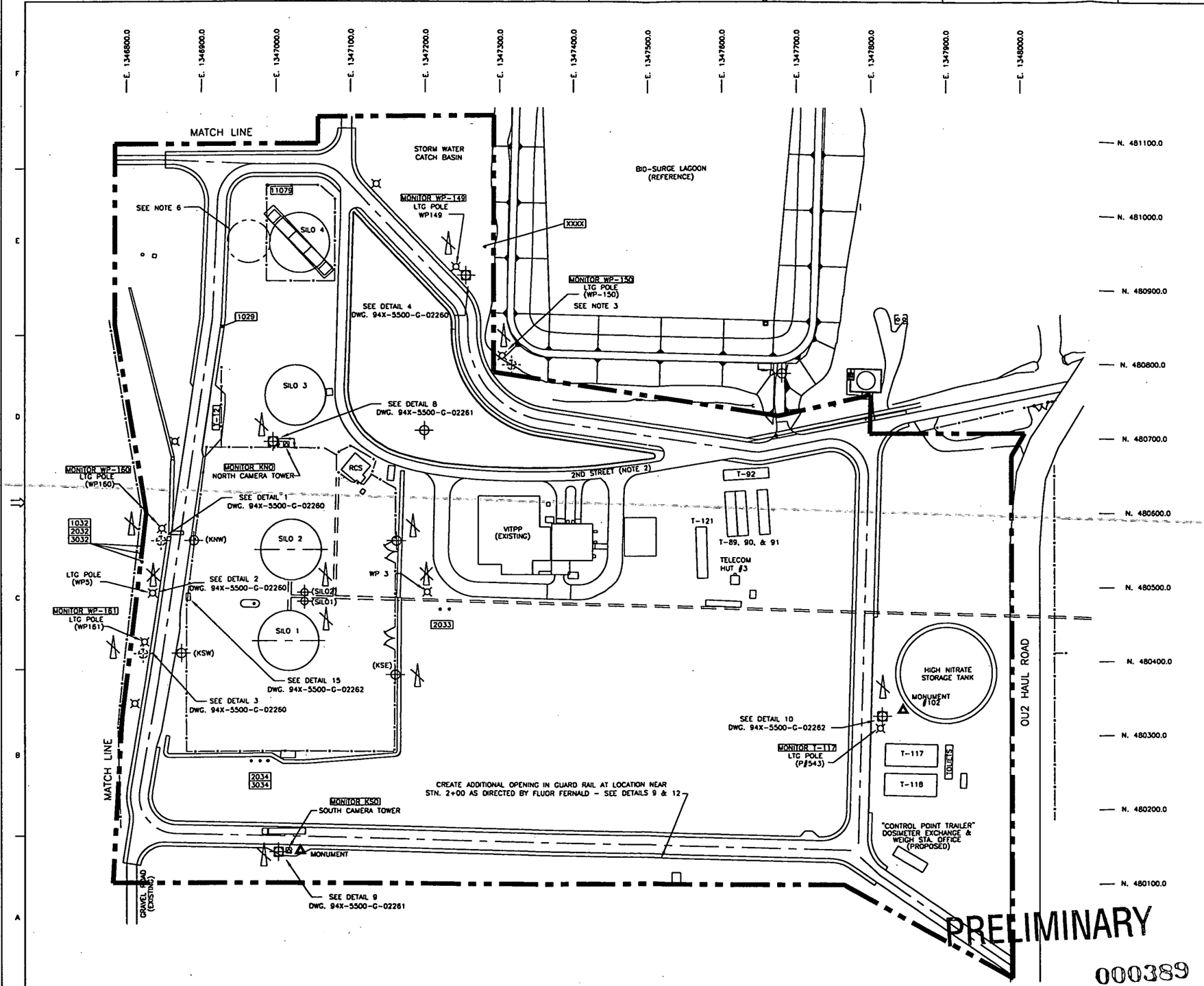
4) Operational Environmental Control Plan, RMR-0445-ENG-015-000, Rocky Mountain Remediation Services, May 2000.

5) Applicable, Relevant, and Appropriate, Requirements Strategy, RMR-0445-ENG-224-000, Rocky Mountain Remediation Services, May 2000.

6) Preliminary Hazards Analysis Report for Silo 3, RMR-0445-0056-002, Rocky Mountain Remediation Services, January 2000.

7) Preliminary Hazards Analysis Report for the Silos 1 and 2 Accelerated Waste Retrieval Project, 624-P622-50, Foster Wheeler Environmental Corporation, January 2000.

Attachment A



NOTES:

1. LOCATION OF FENCES, GATES AND CHECK POINTS TO BE DETERMINED.
2. THIS SECTION OF 2nd STREET TO BE USED BY PEDESTRIAN, LIGHT DUTY, OCCASIONAL DELIVERIES TO OU1, AND EMERGENCY TRAFFIC ONLY.
3. MONITOR, PAD AND POWER OUTLET FOR MONITOR AT WP-150 TO BE INSTALLED BY SILO 3 CONTRACTOR.
4. CONSTRUCTION AND OPERATIONS PERSONNEL WILL USE EXISTING SITE PARKING LOT.
3. PHASE I WORK CONSISTS OF INSTALLATION OF CONCRETE PADS, POWER AND NEW OR RELOCATED RADON MONITORS AND ALL ASSOCIATED SITE WORK AS SHOWN ON DRAWINGS 94X-5500-G-02259, 94X-5500-G-02260, 94X-5500-G-02261 AND 94X-5500-G-02262. PHASE II WORK CONSISTS OF INSTALLATION OF TRANSMITTERS, REPEATERS, HOSTS AND ASSOCIATED EQUIPMENT REQUIRED FOR MONITOR TELEMETRY.
6. EXISTING PRECAST 4'X4' CONCRETE PADS FOR USE AS PADS FOR THE MONITORS ARE LOCATED ON WEST SIDE OF SILO 4.
7. MONITORS AND INSTALLATION COMPONENTS ARE PERFORMANCE GRADE 4.
8. TRANSMITTERS AND REPEATERS ARE NOT PART OF THE PHASE I WORK PACKAGE. THEY ARE TO BE INSTALLED IN PHASE II.
9. CONTRACTOR SHALL EMPLOY EROSION CONTROLS AS REQUIRED TO MINIMIZE SOIL EROSION AND TO PREVENT SEDIMENT FROM LEAVING THE CONSTRUCTION SITE AS A RESULT OF THE CONSTRUCTION ACTIVITIES OF THIS PROJECT. EROSION CONTROL MEASURES SHALL CONFORM TO SECTION 02270 OF THE TECHNICAL SPECIFICATIONS.

LEGEND OF SYMBOLS

- ▲ = MONUMENT
- 1029 = MONITORING WELL NUMBER
- = EXISTING MONITOR LOCATION
- = RELOCATED MONITOR LOCATION
- = NEW MONITOR LOCATION
- = TRANSMITTER (PHASE II)
- = REPEATER (PHASE II)

0 25 50 100 150 200 250
GRAPHIC SCALE
1" = 50'

PRELIMINARY DRAWING

G_02259.DWG

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
FLUOR DANIEL FERNALD
SILOS PROJECT
CINCINNATI, OHIO

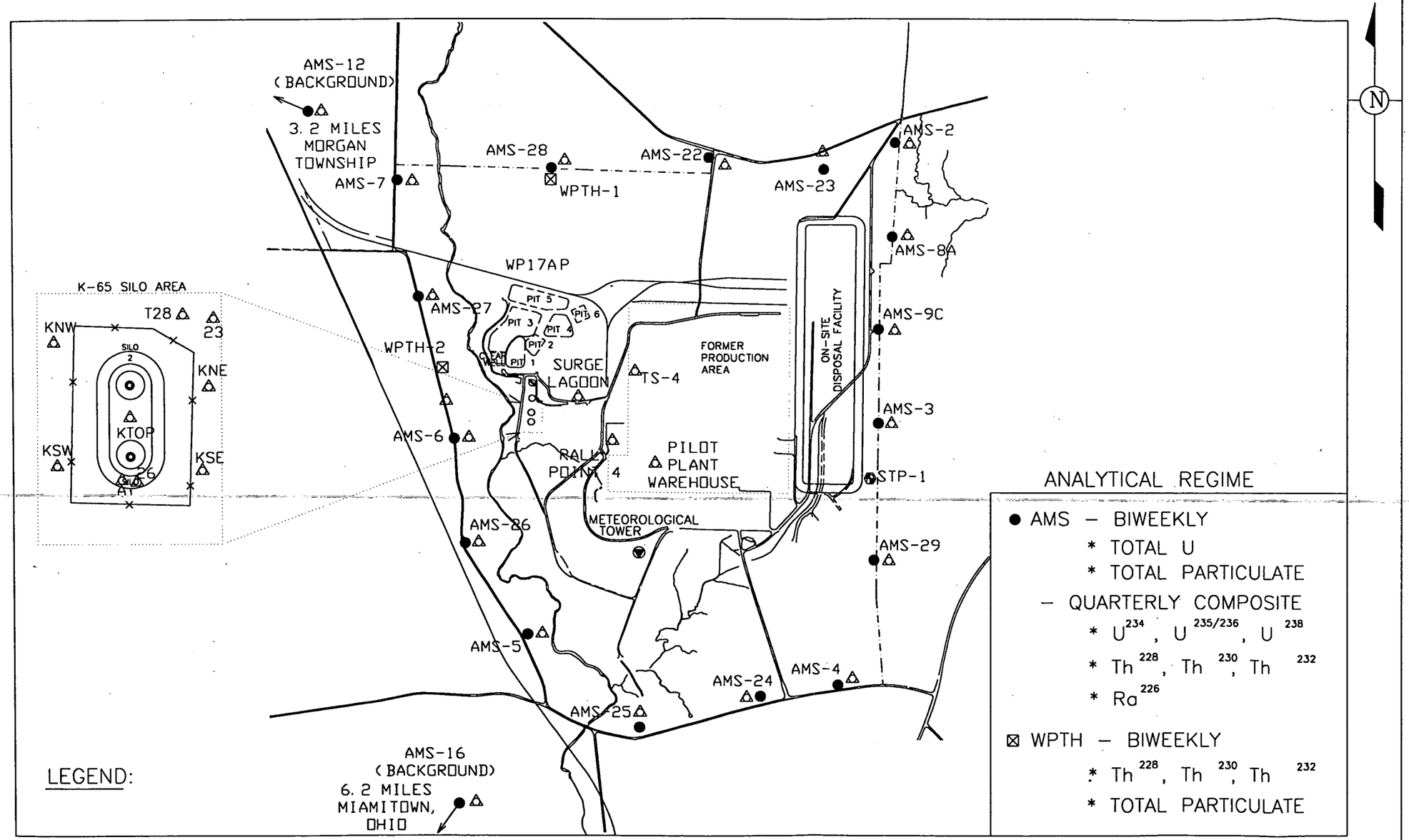
DRAWING TITLE
RADON MONITOR LOCATION
SILOS AREA LOCATION PLAN
OU 4 SILOS PROJECT

DRAWN BY W. OVERHOLT	DATE 1/10/00	DESIGNED, CHECKED BY	CHECKED BY
PURCHASE NO. OU4	PLOT	SCALE 1"=50'	
SUBMITTED FOR APPROVAL	APPROVAL RECOMMENDED		
DATE	ENGINEERING CONSTRUCTION		
REF. PROJECT NO. 40710	SPCL. CONTL. PROJ. NO. —	DRAWING NO. 94X-5500-G-02259	SHEET NO. 1 / REV. NO. B

DISTRIBUTION CODE: XXX 2/8 ACAD INITIALS: WJO DATE: 5/9/00

Attachment B

RADIOLOGICAL AIR MONITORING LOCATIONS



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STATE PLANAR COORDINATE SYSTEM 1927

LOCATION MAP FOR AIR MONITORING LOCATIONS

Mar. 27, 2000