

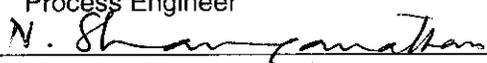
# PLUTONIUM DISPOSITION PROJECT (U)

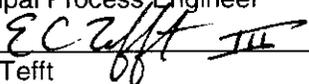
## Project M09A

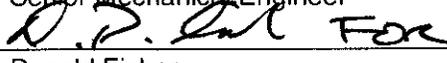
### SCOPE OF WORK

M-SOW-K-00014, Revision 0  
For  
Milling and Mixing System (U)

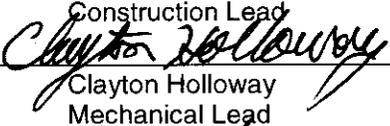
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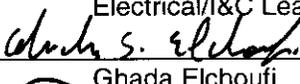
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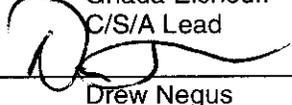
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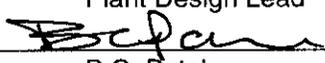
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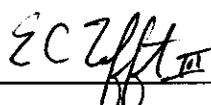
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## 1.0 SCOPE

### 1.1 General Description

This Scope of Work (SOW) covers the Milling and Mixing System (MIX) for the Plutonium Disposition Project (M09A).

Plutonium oxide feed is received in a batch can (~2 kg PuO) into the Milling/Mix glove box from the Feed Preparation glove box. The entire content of the batch can is added into the attritor using an engineered dustless transfer technique.

Based on the net mass of the plutonium oxide added, an appropriate amount (~ 18 kg) of LaBS frit is added to meet the required ratio of Pu oxide to glass frit (approximately 1:9).

The attritor is best described as a stirred ball mill. The stationary tank filled with grinding media and the feed (PuO<sub>2</sub> + frit) to be milled and mixed are agitated at a high speed by a rotating shaft with arms. The rotating shaft stirs the contents at high speed causing impact forces and resulting in size reduction and intimate mixing.

Once the LaBS frit/Pu feed mixture is mixed and milled, the resultant homogeneous powder is discharged by opening a valve at the bottom of the attritor. The powder is discharged into a divider vessel for splitting the content into 2 batches of 10 kg each and dispensed into transport hoppers to be sent for Vitrification.

### 1.2 Background

The Office of Environmental Management has approximately 13 metric tons (MT) of plutonium in approximately 21 MT bulk materials without any defined disposition path. The Plutonium Disposition (PUD) Project is critical to meet the Department of Energy's strategic goal of providing a responsible resolution to the permanent disposal of the nation's excess high-level radioactive materials and waste; and to enable the cleanup of Environmental Management sites.

The Plutonium Disposition Facility (PDF) will be located at the K-Area Complex (KAC) to disposition up to approximately 13 Metric Tons (MT) of Environmental Management (EM) owned surplus plutonium. The facility will utilize a vitrification process to vitrify plutonium into a lanthanide borosilicate (LaBS) glass matrix. This glass will be packaged into bagless transfer cans and placed inside a Defense Waste Processing Facility (DWPF) type canister. The canister will be transported to DWPF and filled with High Level Waste (HLW) glass. The DWPF canisters will be stored in the Glass Waste Storage Buildings and later transported to the geologic repository at Yucca Mountain.

This Scope of Work (SOW) has been developed for the purpose of facilitating **construction** cost and schedule estimates for the Conceptual Design Report (CDR) on the PUD project. The input to this SOW was the approved technical baseline consisting of a Facility Design Description (FDD) and associated System Design Descriptions (SDD). Every intent has been made to assure alignment and consistency between this SOW and the appropriate sections of the technical baseline, in order to provide accurate estimates. This SOW is not a PUD technical baseline document. A more detailed description of the system can be found in the associated SDD listed in the reference section.

A **HOLD** is placed to identify information that is preliminary in nature, results from a design uncertainty, originates from insufficient documentation, needs verification, or identifies a discrepancy. A **TBD** is placed to identify places in the text where numeric values or

descriptive information is not available at the time that the current revision of the SOW is released.

## 2.0 ACRONYMS/ABBREVIATIONS

CDR	Conceptual Design Report
DS	Design Services
DWPF	Defense Waste Processing Facility
FDD	Facility Design Description
HEPA	High-Efficiency Particulate Air (filter)
HLW	High Level Waste
HVAC	Heating, Ventilation and Air Conditioning
KAC	K-Area Complex
LaBS	Lanthanide Borosilicate
LLW	Low Level Waste
MC&A	Material Control and Accountability
MT	Metric Ton
MIX	Milling and Mixing System
NMC	Neutron Multiplicity Counter
MPC&A	Material Protection Control and Accountability
NFPA	National Fire Protection Association
PC	Performance Category
PC&S	Process and Control Services Department
PDF	Plutonium Disposition Facility
PDI	Pressure Differential Indicator
PIDAS	Perimeter Intrusion Detection and Assessment System
PU	Plutonium
PUD	Plutonium Disposition
PuVit	Plutonium Vitrification
SC	Safety Class
SDD	System Design Description
SOW	Scope Of Work
SRS	Savannah River Site
S&S	Safeguards & Security
SS	Safety Significant
TBD	To Be Determined
UCNI	Unclassified Controlled Nuclear Information
UNO	Unless Noted Otherwise
WBS	Work Breakdown Structure
WSRC	Washington Savannah River Company

## 3.0 DESCRIPTION OF PHYSICAL WORK

- 3.1 Performance Category and Functional Classification (SC, SS, PS, GS)
  - 3.1.1 Performance Category
    - 3.1.1.1 The performance category of the Milling and Mixing System is PC-1. (Ref. X-SYD-K-00005)
  - 3.1.2 Functional Classification

3.1.2.1 The systems in this SOW shall be designed in accordance with the requirements of WSRC Manual WSRC-E7, Conduct of Engineering and Technical Support Procedure 2.25 Rev 14, "Functional Classification", (Ref. X-SYD-K-00005) as follows:

- A. HSA-10 attritor with Variable Frequency Drive, 20 HP motor  
Functional Classification – Production Support (PS)
- B. One (1) Dustless frit feed hopper with Frit feed tube w/air lock  
Functional Classification - Production Support (PS)
- C. Scales –Total 4 (1 for frit hopper, 1 for Day hopper, 2 for Divider Vessels)  
Functional Classification - Production Support (PS)
- D. Dustless Day hopper with valves  
Functional Classification - Production Support (PS)
- E. Hoist above rails  
Functional Classification - Production Support (PS)
- F. Divider Vessels with valves  
Functional Classification - Production Support (PS)
- G. Cameras, Barcode reader, Liquid detection, transport system, holdup detector, divider etc.  
Functional Classification - Production Support (PS)
- H. Glovebox with associated HEPA filter housing  
Functional Classification – Safety Significant (SS, PC-3)

### 3.2 **Mechanical/Nuclear/Process**

Refer to M-M8-K-00006 Rev. A for the Milling and Mixing Block Flow Diagram, and M-M8 K-00013 Rev. A for Material Handling Block Flow Diagram.

#### 3.2.1 Milling and Mixing Glovebox Components

3.2.1.1 The following components will be contained within a glovebox. The major components are:

- A. Two (2) Attritors No. MIX-MILL-001 and 002, Model HAS-10, Variable Frequency Drive 20 HP Motor, Refer to Data Sheet No. M-DS-K-00076
- B. Two (2) Divider Vessels No. MIX-VSL-001 and 002, with screw feeder, Each 0.75 Cu. Ft. stainless steel, Refer to Data Sheet No. M-DS-K-00160. (Includes Scales MIX-SCL-004 and MIX-SCL-005)

- C. Two (2) Overhead Hoists No.MIX-CRN-001 and 002, mechanical chain hoist capable of handling 1000 Lbs for vertical 8' lift and Turn-tables No. MIX-TUTB-001 and 002 with tilting mechanism.
- D. Two (2) Dustless Batch Can Dumping Stations No. MIX-STAT-001 and 002.

### 3.2.2 Glovebox

- 3.2.2.1 Refer to M-SPP-K-00059 Rev. B for the general glovebox details. Drawing SK-DE-MIX-0001 Rev. B shows the glovebox and its layout. The present glovebox arrangement allows access to only one side.

The glovebox is ventilated with room air which is drawn through inlet HEPA filters and exhausted through additional HEPA filters to the Glovebox Exhaust System. See drawing M-M6-K-02269 for glovebox ventilation piping and instrumentation diagram. Glovebox ventilation to include the following accessories:

- A. HEPA filter in stainless steel housing. (2 ea.)
- B. Non-testable HEPA filter mounted to skin of glovebox. (1 ea.)
- C. 8" automatic damper, pneumatically operated (1 ea.)
- D. 4" isolation dampers (5 ea.)
- E. 4" balancing damper (2 ea.)
- F. ¼" three-way ball valves, stainless (7 ea.)
- G. 8" Balancing Damper (1 ea.)

### 3.2.3 Frit Hopper

- 3.2.3.1 One (1) 40 Cu. Ft. stainless steel hopper No.MIX-HPR-001 with bottom opening and a variable speed rotary or screw feeder. Refer to Data Sheet No.M-DS-K-00158. (Includes Scale MIX-SCL-001)

### 3.2.4 Day Hopper

- 3.2.4.1 One(1) 4 Cu. Ft. stainless steel hopper No.MIX-HPR-002 with bottom opening with a variable speed rotary or screw feeder. Refer to Data Sheet No.M-DS-K-00159. (Includes Scale MIX-SCL-003)

### 3.2.5 Piping

- 3.2.5.1 Piping material is designated by a "P-Spec" designation from SRS Document WSRC-IM-95-58. The piping material will be welded or utilize flange fittings.

## 3.3 Instrumentation and Controls

The Milling and Mixing System defined in block flow diagrams M-M8-K-00006 and M-M8-K-00013 consists of two attritors and supporting equipment. Controls are defined in the Milling and Mixing Control Block Diagram J-J8-K-00028 and Logic J-J2-K-01554. For Cable and raceway estimated bulk quantities refer to Attachment 3. Instrument Cabinet MIX-INST-100 will be used to house transmitters associated with the following equipment:

- 3.3.1 The following controls equipment is associated with each of the two attritors:
- 3.3.1.1 Attritors MIX-MILL-001 and MIX-MILL-002 as defined in Data Sheet M-DS-K-00076 involve the following control interfaces:
- A. (1) each VFD motor for driving the Attritors
  - B. (1) each Intake Valve with actuator and 2 limit switches
  - C. (1) each Discharge Valve with actuator and 2 limit switches
  - D. (1) each Vibrator
- 3.3.1.2 Divider Vessel as defined in data sheet M-DS-K-00160 involves the following control interfaces:
- A. (1) each Vibrator
  - B. (1) each Screw Feeder Discharge
  - C. (1) Scale (MIX-SCL-004 and MIX-SCL-005)
- 3.3.2 For Milling and Mixing Glovebox Feed Through Penetration Connectors totals see Section 3.4. The Milling and Mixing Glovebox will contain the following:
- 3.3.2.1 Cooling Water System - see Chill Water Scope of Work No. M-SOW-K-00022 and Milling and Mixing and Oxidation Heat Exchanger P&ID M-M6-K-02291. The system and equipment are not part of the Milling and Mixing Scope of Work.
- 3.3.2.2 Glovebox Dry Air as defined in P&ID M-M6-K-02269 includes the following controls:
- A. Total (1) Pressure Differential Indicator (PDI)
  - B. Total (1) Thermocouple
- 3.3.2.3 Glovebox Airlock as defined in P&ID M-M6-K-02269 includes the following controls:
- A. Total (2) Actuators
  - B. Total (4) Limit Switches
- 3.3.2.4 Glovebox Exhaust as defined in P&ID M-M6-K-02269 includes the following controls:
- A. Total (2) PDI across Filter
  - B. Total (1) Flow Element
  - C. Total (1) Pressure Element and Transmitter
- 3.3.2.5 Glovebox Ventilation as defined in P&ID M-M6-K-02269 includes the following controls:
- A. Total (1) Pressure Differential Alarm Switch
- 3.3.2.6 Glovebox Maintenance Exhaust Air Flow Valve as defined in P&ID M-M6-K-02269 includes the following controls:
- A. Total (1) Pressure Element and Transmitter
  - B. (1) Valve
- 3.3.2.7 Frit Hopper MIX-HPR-001 as defined in M-DS-K-00158 includes the following control interfaces:
- A. (1) each Scale MIX-SCL-001 for Loss in weight/Gain in weight

- B. (1) each Screw Feeder
- 3.3.2.8 Day Hopper MIX-HPR-002 as defined in Data Sheet M-DS-K-00159 includes the following control interfaces:
- A. (1) each Screw Feeder
  - B. (1) each Diverter Valve Actuator
  - C. (2) each Diverter Valve Limit Switches
  - D. (1) each Scale Mix-SCL-003 for Loss in weight/Gain in weight
- 3.3.3 Instrument Cabinet MIX-INST-100 will house transmitters required by the above equipment.
- 3.3.4 The installation of the ICS I.O. cabinet ICS-CAB-040 to be located in the -20' Melter I/O Support Room and the OCS workstation ICS-OWS-013 to be located in the Milling and Mixing / Vitrification Control Room are included in the ICS Scope of Work no. J-SOW-K-00002 and defined in the Control Automation Plan J-PMP-K-00001 and the ICS Network Block Diagram J-J8-K-00050. These items are required for system operation, but are not included within the Milling and Mixing Scope of Work.
- 3.3.5 MC&A Equipment (reference Control Block Diagram J-J8-K-00016)
- 3.3.5.1 Scales (1 each)
- 1. The Hopper weigh scale MIX-SCL-002 (Data Sheet J-JD-K-00146) weighs the transport hopper leaving milling and mixing for vitrification and also weigh empty returning transport.
- 3.3.5.2 Barcode readers (4 each)
- 1. Details of the barcode readers are in Data Sheet J-JD-K-00115. The barcode reader tracks Batch Cans from feed prep going to Attritor Mills 1 and 2 and the Vessel 1 and 2 Barcode readers track the batch cans leaving the attritors.
- 3.3.5.3 Gamma Holdup Monitors (8 each)
- 1. Details of the gamma holdup monitors for measuring gamma holdup for MC&A are in Data Sheet J-JD-K-00116. Each attritor has two gamma holdup monitors and the glovebox has four for a total of 8 Gamma monitors.
- 3.3.5.4 Neutron Monitors (2 each)
- 1. Details of the neutron holdup monitors for measuring neutron activity for MC&A are in Data Sheet J-JD-K-00145. The neutron monitor is used to measure neutron activity in the transport hoppers after the Frit is added.
- 3.3.5.5 Gamma Isotopic System (1 each)
- 1. Details of the gamma isotopic system used for plutonium isotopic ratio analysis for MC&A are in Data Sheet J-JD-K-00069. There is one gamma isotopic system in the exit area of the glovebox.
- 3.4 **Electrical**

- 3.4.1 The Milling & Mixing System will contain the following major electrical components and services. The major electrical components will be provided as Engineered Equipment. This Scope of Work includes all raceway, power, control cables/terminations between field equipment and local controls. Provide onsite setup and assembly of the referenced Engineered Equipment. Approximately 48 Glovebox Feed-thru Penetrations Connector Assemblies are required for service to electrical and I&C components/equipment located within glovebox.
- 3.4.1.1 Electrical power distribution will be as shown on single line drawings E-E2-K-02229 and E-E2-K-02230.
- 3.4.1.2 The Milling & Mixing Viewing System, has following electrical equipment, refer to Block Diagram E-EB-K-00705 and Data Sheet # E-DS-K-00021.
- A. 1 each – Inlet View Camera for Attritor # 1, MIX-PCTV-001A
  - B. 1 each – Outlet View Camera for Attritor # 1, MIX-PCTV-001B
  - C. 1 each – Inlet View Camera for Attritor # 2, MIX-PCTV-002A
  - D. 1 each – Outlet View Camera for Attritor # 2, MIX-PCTV-002B
- 3.4.1.3 Work Scope includes installation of new grounding pigtailed (approx. 10 ft. long with bolted connections) between new permanent electrical equipment and/or skids to the existing ground grid system. Small movable equipment will be grounded in accordance with code and or industry practices.
- 3.4.1.4 Provide and install Junction boxes, pull boxes, cables, conduits. Refer to Attachment 3 for Bulk Material Takeoff for cable and conduit descriptions and quantities.
- 3.5 **Plant Design**
- 3.5.1 Piping quantities have been estimated in Attachment 1.
- 3.6 **Civil/Structural/Architectural**
- 3.6.1 Refer to C-SOW-K-00009.
- 3.6.1.1 Milling and Mixing Glovebox. Ref. SK-DE-MIX-0001, 0002
- The Glovebox is 15'x5'x9' high, has WEP and lead shielding, and weighs about 15000 Lbs. which includes Attritors, pumps, Divider vessels, Heat Exchangers, Cooling Jackets, Hoists etc. The bottom frame of the Glovebox will be bolted to 6 each 12" x 12" x 3/4" thick base plates. Each base plate will be anchored with 3/4" diameter A-36 Maxi bolts to the concrete floor -40 Level. Alternatively, Hilti Kwik Bolt-TZ are acceptable for anchoring items.
- 3.6.1.2 Dustless Frit & Day hoppers unit. Ref. SK-DE-MIX-0001, 0002
- The size of the frame will be approximately 4'x 4'x10' high for supporting hoppers which weigh about 7000 lbs. The frame will be made of 4 each of TS 6 x 6 x 0.375 columns, beams on top & bottom and diagonally braced by L 3 X 3 X 3/8 galvanized carbon steel on all four sides. Each column will be supported on and welded to 12" x 12" x 3/4" thick base plates. Each base plate will be anchored with 3/4" diameter A-36 Maxi bolts to the concrete floor -20 Level. Alternatively, Hilti Kwik Bolt-TZ are acceptable for anchoring items.

3.6.1.3 See Attachment 2, for Bulk Material List for C/S/A.

#### **4.0 ASSUMPTIONS**

##### **4.1 General Assumptions**

4.1.1 The Construction Agency will be the SRS Construction Group. Design Services will provide engineering documentation for the installation of this equipment and will rely on the use of SRS Guides and Standards. Glovebox shell will be designed and fabricated by a vendor.

4.1.2 SRS Construction Group will procure all bulk materials.

4.1.3 SRS Construction Group will procure all off-the-shelf components and equipment identified on engineering data sheets that do not require testing or quality documentation.

##### **4.2 Specific Assumptions**

###### **4.2.1 Mechanical**

4.2.1.1 All vessels with an ID 6" or greater shall be per ASME B&PVC Section VIII, Division 1 code stamped or an approved waiver. An appropriate SRS verification record will be completed for each vessel and pressure protection device (disk or valve).

4.2.1.2 All piping will be per ASME B31.3.

###### **4.2.2 Instrumentation and Controls**

4.2.2.1 No specific assumptions have been made in this group.

###### **4.2.3 Electrical**

4.2.3.1 Assume that all permanently installed cabling will be routed in protected conduit/tray.

4.2.3.2 Cables installed within Gloveboxes will be routed within designated tray located within GB and/or supported from structural members within GB utilizing cable tie wraps.

4.2.3.3 Existing grounding grid is intact and adequate for grounding of new equipment.

4.2.3.4 Pull/junction boxes will be required at 100 ft. run minimum intervals. Assume box size to be 18" X18" X 6".

###### **4.2.4 Plant Design**

4.2.4.1 No specific assumptions have been made in this group. Refer to Attachment 1 for the estimated piping quantities within the glovebox.

###### **4.2.5 Civil/Structural/Architectural**

4.2.5.1 The size of the Dustless Frit & Day hoppers unit [Ref. SK-DE-MIX-0001, 0002], is assumed to be maximum 3.5' diameter and 10' high, with the lugs already attached to the hoppers for supporting in the structural frame.

4.2.5.2 Core drills for routing commodities through walls or floors will be covered in C-SOW-K-00009.

4.2.5.3 Functional Classification for drilling holes in concrete surface is SC.

4.2.5.4 The material for all the base plates and structural steel components shall be Galvanized Carbon Steel.

## **5.0 REFERENCES**

### **5.1 Drawing List**

5.1.1 PUD Project Drawings & Sketches

5.1.1.1 SK-DE-MIX-0001, Rev. B, - Glovebox Layout

5.1.1.2 SK-DE-MIX-0002, Rev. B, - Facility Layout

5.1.1.3 SK-DE-MIX-0003, Rev. A, - Partial Floor Plan @ Elev. -40'

5.1.1.4 M-DS-K-00076, Rev. B, - Attritor Datasheet

5.1.1.5 M-DS-K-00150, Rev. B, - Milling and Mixing/Oxidation Cooling Heat Exchanger

5.1.1.6 M-DS-K-00151, Rev. B, - Milling and Mixing/Oxidation Cooling Water Pump

5.1.1.7 M-DS-K-00158, Rev. A, - Frit Hopper Datasheet

5.1.1.8 M-DS-K-00159, Rev. A, - Day Hopper Datasheet

5.1.1.9 M-DS-K-00160, Rev. A, - Divider Vessel Datasheet

5.1.1.10 M-M5-K-01946, Rev. B, - Milling and Mixing system Glovebox Ventilation Diagram

5.1.1.11 M-M5-K-01962, Rev. B, - Cooling Water Pump and Heat Exchanger Flow Diagram

5.1.1.12 M-M6-K-02269, Rev. B, - Milling and Mixing system Glovebox Ventilation P&ID

5.1.1.13 M-M6-K-02291, Rev. A, - Milling and Mixing/Oxidation Heat Exchanger P&ID

5.1.1.14 M-M8-K-00006, Rev. A, - Milling/Mixing

5.1.1.15 M-M8-K-00013, Rev. A, - Milling and System Material Handling Block Flow Diagram

5.1.1.16 M-M8-K-00001, Rev. A, Plutonium Disposition Facility, Level 1

5.1.1.17 M-SPP-K-00059, Rev. B, Plutonium Disposition Gloveboxes

5.1.1.18 P-PG-K-02142, Rev. B, Plutonium Disposition Project General Arrangement Plan at Level -20

5.1.1.19 P-PG-K-02143, Rev. B, Plutonium Disposition Project General Arrangement Plan at Level -40

5.1.1.20 E-DS-K-00021, Rev. A, Milling & Mixing and Vitrification area Viewing Camera System.

5.1.1.21 E-E2-K-02229, Rev. D, Milling/Mixing and Vitrification Motor Control Center - ELNH-MCC-24M Single Line Diagram

- 5.1.1.22 E-E2-K-02230, Rev. D, Milling/Mixing and Vitrification Motor Control Center - ELNH-MCC-31M Single Line Diagram
- 5.1.1.23 E-EB-K-00705, Rev. C, Vitrification Viewing System, Block Flow Diagram
- 5.1.1.24 J-J8-K-00016 Milling/Mixing MC&A Control Block Diagram
- 5.1.1.25 J-J8-K-00028 Milling/Mixing System Control Block Diagram
- 5.1.1.26 J-JD-K-00114 Milling and Mixing Gamma Holdup Monitors
- 5.1.1.27 J-JD-K-00115 Milling and Mixing Barcode Readers
- 5.1.1.28 J-JD-K-00116 Milling and Mixing Gamma Isotopic System (U)
- 5.1.1.29 J-JD-K-00117 Milling and Mixing Batch Can Weigh Scale
- 5.1.1.30 J-JD-K-00146 Milling and Mixing Melter Hopper Weigh Scale

## 5.2 **Design Input Documents**

The following Facility Design Description and System Design Descriptions are the baseline documents used to develop this SOW.

- 5.2.1 Facility Design Description
  - 5.2.1.1 G-FDD-K-00001, Rev B "PUV Facility Design Description"
- 5.2.2 System Design Description
  - 5.2.2.1 X-SYD-K-00005 Rev. C "Milling and Mixing SDD"

## 5.3 **Applicable SRS & Industry Codes, Guides and Standards**

- 5.3.1 Industry Codes and Standards
  - 5.3.1.1 ASME B31.3, 2006 - Chemical Plant and Petroleum Refinery Piping
  - 5.3.1.2 ASME Boiler and Pressure Vessel Code, Sect. VIII, Div. 1, 2006
  - 5.3.1.3 NFPA 70, 2005 – National Electrical Code

See Functional Design Description and System Design Descriptions References 2.2.1.1, 2.2.2.1, 2.2.2.2, and 2.2.2.3 for more codes and standards.
- 5.3.2 SRS Guides & Standards
  - 5.3.2.1 SRSESM 15980-03-R, Mechanical Installation of General and Nuclear Services Instrumentation

- 5.3.2.2 WSRC-TM-95-1, Standard no. 15980, Rev. 6, "Mechanical Installation of Safety Class and Safety Significant Instrumentation"
- 5.3.2.3 WSRC-IM-95-58, Guide no. 15060-G, Rev.5, "Application of ASME B31.3"
- 5.3.2.4 WSRC-IM-95-58, Guide no. 15980-G, Rev.3, "Installation and Calibration of Instruments"
- 5.3.2.5 WSRC-IM-95-58, Guide no. 16051-G, Rev.2, "Installation of Electrical Raceway Systems and Cable Trays"
- 5.3.2.6 WSRC-IM-95-58, Guide no. 16052-G, Rev.3, "Installation of Electrical Wires, Cables and Terminations"
- 5.3.2.7 WSRC-IM-95-58, Guide no. 16053-G, Rev.2, "Installation of Electrical Equipment"
- 5.3.2.8 WSRC-IM-95-58, Guide no. 16056-G, Rev.2, "Installation of Grounding Systems"
- 5.3.2.9 WSRC-TM-95-1, Standard 03010, Rev: 1, Coring, Chipping, and Drilling in Concrete.
- 5.3.2.10 WSRC-TM-95-1, Standard 05057, Rev: 1, Control of Welding.
- 5.3.2.11 WSRC-IM-95-58, Guide 03251-G, Rev: 1, Concrete Anchors.
- 5.3.2.12 WSRC-IM-95-58, Guide 03252-G, Rev: 1, Installation and Testing of Concrete Anchors.

#### 5.4 **Related Scopes of Work (SOW)**

- 5.4.1 C-SOW-K-00009, Rev. 0, Scope of Work for Structural and Architectural Modifications for Process Building.
- 5.4.2 E-SOW-K-00017, Rev. 0, Electrical General Scope of Work
- 5.4.3 J-SOW-K-00002, Rev. 0, Scope of work for ICS & MC&A Network.
- 5.4.4 M-SOW-K-00020, Rev. 0, Scope of Work for HVAC System.
- 5.4.5 M-SOW-K-00021, Rev. 0, Scope of Work for Balance of Plant Air and Gas Systems.
- 5.4.6 M-SOW-K-00022, Rev. 0, Scope of Work for Balance of Plant Water Systems.
- 5.4.7 M-SOW-K-00011, Rev. 0, Scope of Work for Vitrification
- 5.4.8 S-SOW-K-00002, Rev.0, Scope of Work for Safeguards and Security System.

#### 5.5 **Miscellaneous**

- 5.5.1 Inter-Office Memo dated May 23, 2006 from Fisher to Rensch regarding PUDA13000, Detailed Layout Flow Studies, Milling & Mixing.
- 5.5.2 C-CI-G-0039, Rev: 0, Cookbook for Electrical Conduit and Equipment Supports, February 9, 2005.
- 5.5.3 C-CH-G-00004, Rev. 0, Cookbook for Routing & Supports for NPS 2 and Smaller Piping.

**6.0 ATTACHMENTS**

- 6.1 Attachment 1, Bulk Material List for Piping and Valves for Milling and Mixing System
- 6.2 Attachment 2, Bulk Material List for C/S/A for Milling and Mixing System
- 6.3 Attachment 3, Milling and Mixing Bulk Materials, Cable and Conduit

**Attachment 1,  
Bulk Material - Piping and Valves**

<b>System</b>	<b>Process Material</b>	<b>Diameter (inches)</b>	<b>Total Quantity (Feet)</b>
Mixing & Milling	Process Chilled Water	2"	30'
Mixing & Milling	Glovebox Exhaust air	4"	50'

**Attachment 2,  
Bulk Material - C/S/A**

<b>Sr. No.</b>	<b>Description of Item</b>	<b>Size</b>	<b>Quantity</b>	<b>Remarks</b>
1	Base Plates	12" X 12" X 3/4" Thick	10 Nos.	
2	Tube Steel	TS 6 X 6 X 0.375	72 Ft.	Cut to Suit.
3	Anchor Bolts	3/4" Diameter	40 Nos.	
4	Structural Steel L	L 3 X 3 X 3/8	96 Ft.	Cut to Suit.

*Note: Table above includes the bulk material for installing/supporting major equipment.*

**Attachment 3,  
Bulk Material - Electrical Cable and Conduit**

**Description:** Milling and Mixing Bulk Materials, Cable and Conduit  
**Reference:** E-E2-K-02229 (MCC-24M), E-E2-K-02230 (MCC-31M), E-EB-K-00705, J-J8-K-00016, E-EB-K-00028

All Conduits are IMC (Intermediate Metallic Conduit) type.

Item #	From Equipment	To Equipment	XGB Length (A) (ft)	Cable Estimates (Exterior GB)		GB Pentr Conn. (Qty)	(Interior. GB) NGB Length (B) (ft)	Shared Rcw/Tray Length (C) (ft)	Raceway Estimates		Red	Notes/Comments	
				Qty (A)	Cable size/type				Length (D) (ft)	Qty (D)			Size/Desc. (D)
1	ELNH-MCC-24M	Variable Frequency Drive MIX-VFD-001	65	1	3/c# 4 w/1-# 10 gnd			35	10	1	1-1/2" IMC	N	Ref:E-E2-K-02229 (Shared Tray)
2	Variable Frequency Drive MIX-VFD-001	Attritor MIX-MILL-001 (via Disconnect Sw)	210	1	3/c# 4 w/1-# 10 gnd			170	20	1	1-1/2" IMC	N	Ref:E-E2-K-02229 (Shared Tray)
3	ELNH-MCC-31M	Variable Frequency Drive MIX-VFD-002	65	1	3/c# 4 w/1-# 10 gnd			35	10	1	1-1/2" IMC	N	Ref:E-E2-K-02230 (Shared Tray)
4	Variable Frequency Drive MIX-VFD-002	Attritor MIX-MILL-002 (via Disconnect Sw)	210	1	3/c# 4 w/1-# 10 gnd			170	20	1	1-1/2" IMC	N	Ref:E-E2-K-02230 (Shared Tray)
5	120/208 V Power Panel ELLV-PNL-010	Frit Charge Weigh Scale	110	1	3/c# 12				90	1	3/4" IMC	N	Ref:E-E2-K-02230 J-J8-K-00016
6	120/208 V Power Panel ELLV-PNL-010	Gamma Iso electronick Rack #1 MIX-GRIS-001A	120	1	3/c# 12				100	1	3/4" IMC	N	Ref:E-E2-K-02230 J-J8-K-00016
7	120/208 V Power Panel ELLV-PNL-010	Gamma Isotopic System #1 MIX-GRIS-001	205	1	3/c# 12				185	1	3/4" IMC	N	Ref:E-E2-K-02230 J-J8-K-00016
8	120/208 V Power Panel ELLV-PNL-010	Attritor # 1 & 2 (Hold Up) Mon. Mix RE/RT 001A, 001B, 002A, 002B	120	1	3/c# 12				100	1	2" IMC	N	Ref:E-E2-K-02230 J-J8-K-00016
9	120/208 V Power Panel ELLV-PNL-010	Can Turn TableCab Gamma (Hold up) Mon. MIX-RE/RT-003A, 003B, 003C, 003D	120	1	3/c# 12			100				N	Ref:E-E2-K-02230 J-J8-K-00016 (Shared Conduit)
10	120/208 V Power Panel ELLV-PNL-010	Batch CAN/VSL Barcode RDR MIX-RDR-001A, 002A, 001B, 002B	120	1	3/c# 12			100				N	Ref:E-E2-K-02230 J-J8-K-00016 (Shared Conduit)

11	120/208 V Power Panel ELLV-PNL-010	Batch CAN/HOPPER Weigh Scale #1 MIX- SCL-001 & 002	120	1	3/c# 12			100			N	Ref:E-E2-K-02230 J-J8-K-00016 (Shared Conduit)	
12	120/208 V Power Panel ELLV-PNL-010	Hopper # 1 Neutron Mon. MIX-RE/RT-004	120	1	3/c# 12			100			N	Ref:E-E2-K-02230 J-J8-K-00016 (Shared Conduit)	
13	120/208 V Power Panel ELLV-PNL-010	Hopper # 2 Neutron Mon. MIX-RE/RT-005	120	1	3/c# 12			100			N	Ref:E-E2-K-02230 J-J8-K-00016 (Shared Conduit)	
14	120/208 V Power Panel ELLV-PNL-010	Day Hopper feeder Motor MIX-HPR-002	120	1	3/c# 12			100			N	Ref:E-E2-K-02230 J-J8-K-00016 (Shared Conduit)	
15	120/208 V Power Panel ELLV-PNL-010	Divider Vessel 1 Motor MIX-VSL-001	130	1	3/c# 12	1	10		100	1	1" IMC	N	Ref:E-E2-K-02230
16	120/208 V Power Panel ELLV-PNL-010	Divider Vessel 2 Motor MIX-VSL-002	130	1	3/c# 12	1	10	100			N	Ref:E-E2-K-02230 (Shared Conduit)	
17	Video Equip Rack VIT-VER-001	Attritor 1 Inlet View Camera MIX-PCTV-001A	180	1	Vendor Cable RG6 + 6/C # 16 Control Cable	1	10		150	1	2" IMC	N	Ref: E-EB-K-00705 Vendor cable size is assumed.
18	Video Equip Rack VIT-VER-001	Attritor 1 Outlet View Camera MIX-PCTV-001B	180	1	Vendor Cable RG6 + 6/C # 16 Control Cable	1	10	150			N	Ref: E-EB-K-00705 Vendor cable size is assumed (Shared Conduit)	
19	Video Equip Rack VIT-VER-001	Attritor 2 Inlet View Camera MIX-PCTV-002A	180	1	Vendor Cable RG6 + 6/C # 16 Control Cable	1	10	150			N	Ref: E-EB-K-00705 Vendor cable size is assumed (Shared Conduit)	
20	Video Equip Rack VIT-VER-001	Attritor 2 Outlet View Camera MIX-PCTV-002B	180	1	Vendor Cable RG6 + 6/C # 16 Control Cable	1	10	150			N	Ref: E-EB-K-00705 Vendor cable size is assumed (Shared Conduit)	
21	M C & A CABINET MCA-CAB-001	GAMMA ISO Electronic RK # 1 MIX-GRIS-001A	100	1	Cat 5E (4 PR#24)			80		1	3/4" IMC	Y	Ref: J-J8-K-00016

22	M C & A CABINET MCA-CAB-001	Batch Can/Hopper Weigh Scales MIX-SCL-001 & MIX-SCL-002	180	2	Cat 5E (4 PR#24)	2	10	150	1	2" IMC	Y	Ref: J-J8-K-00016	
23	M C & A CABINET MCA-CAB-001	Batch Can Bar Code Readers & Vessel Bar Code Readers MIX-RD-001A, 002A, 001B, 002B	185	4	Cat 5E (4 PR#24)			150	15	1	1" IMC	Y	Ref: J-J8-K-00016 (Shared Conduit)
24	GAMMA ISO Electronic RK # 1 MIX-GRIS-001A	GAMMA Isotopic System # 1 MIX-GRIS-001	140	1	Vendor Cable 12/C Cable w/connectors at both ends			120	1	1-1/2" IMC	Y	Ref: J-J8-K-00016 Vendor cable size is assumed	
25	M C & A CABINET MCA-CAB-001	Neutron & Hold Up Monitors (10)	180	10	Vendor Cable USB Cable			160	1	1" IMC	Y	Ref: J-J8-K-00016	
26	M & M GB INSTRUMNET RACK MIX-INST-100	M & M Attritor 1 MIX-MILL-001 I/O & M & M Attritor 2 MIX-MILL-002 I/O (section 2 GB)	100	50	1PR # 16 SH	10	10	70	1	3" IMC	N	Ref: J-J8-K-00028	
27	M & M GB INSTRUMNET RACK MIX-INST-100	MILLIN & MIXING GB (section 3)	100	50	1PR # 16 SH	10	10	70	1	3" IMC	N	Ref: J-J8-K-00028	
28	M & M Attritor I/O cabinet ICS-CAB-040	M & M Attritor 1 MIX-MILL-001 I/O & M & M Attritor 2 MIX-MILL-002 I/O (section 2 GB)	160	50	1PR # 16 SH	10	10	130	1	3" IMC	N	Ref: J-J8-K-00028	
29	M & M Attritor I/O cabinet ICS-CAB-040	MILLIN & MIXING GB (section 3)	160	50	1PR # 16 SH	10	10	130	1	3" IMC	N	Ref: J-J8-K-00028	
30	M & M Attritor I/O cabinet ICS-CAB-040	M & M GB INSTRUMNET RACK MIX-INST-100	180	2	50 - PR # 16 SH			160	2	3" IMC	N	Ref: J-J8-K-00028	
31	Equipment	Ground Grid	500	1	2/0 Gnd						N	Grounding	

Scope Set: Milling and Mixing System

Date: 3/20/2007

Prepared By: G.S. Rao

Reviewed By: Roderick King

**Exterior Glovebox Cables**

Sum of Qty XGB (ft)	
Ext. Cable Size/Type	Total
Vendor Cable	
RG6 + 6/C # 16 Control Cable	540
50 - PR # 16 SH	360
Vendor Cable	
USB Cable	1,800
3/c# 4 w/1-# 10 gnd	550
2/0 Gnd	500
Cat 5E (4 PR#24)	1,200
1PR # 16 SH	26,000
Vendor Cable	
12/C Cable w/connectors at both ends	140
3/c# 12	1,535
<b>Grand Total</b>	<b>32,625</b>

**Interior Glovebox Cables**

Sum of Qty NGB (ft)	
GB Cable Size/Type	Total
Vendor Cable	
RG6 + 6/C # 16 Control Cable	40
Cat 5E (4 PR#24)	30
1PR # 16 SH	2000
3/c# 12	20
<b>Grand Total</b>	<b>2090</b>

**All Raceway Types**

Sum of Qty Rcw (ft)	
RCWY	Total
1-1/2" IMC	180
3/4" IMC	455
2" IMC	400
1" IMC	275
3" IMC	720
<b>Grand Total</b>	<b>2030</b>

**All Raceway Types Grouped by Red Designation**

Sum of Qty Rcw (ft)		
Red	RCWY	Total
N	1-1/2" IMC	60
	3/4" IMC	375
	2" IMC	250
	1" IMC	100
	3" IMC	720
Y	1-1/2" IMC	120
	3/4" IMC	80
	2" IMC	150
	1" IMC	175
<b>Grand Total</b>		<b>2,030</b>

NOTE: Red designated raceways are associated with (classified) protected transmission system. Installation and (independent) inspection of these components and their associated wiring shall be per Project Security Plan Requirements.