PLUTONIUM DISPOSITION PROJECT (U)

Project M09A

SCOPE OF WORK

M-SOW-K-00013 Revision 0
For
Feed Preparation System (U)

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1.0 SCOPE

1.1 General Description

This Scope of Work (SOW) Covers the Feed Preparation System for the Plutonium Disposition Project.

Feed Preparation receives 3013 containers of oxide from Material Receipt & Storage and transport cans of oxide from Oxidation. The output from Feed Preparation is batch cans with 2 kg of crushed Pu oxide, with a particle diameter less than 1 mm, that are sent to Milling/Mixing.

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

CHA	Consolidated Hazard Analysis
CPD	Can Puncture Device
DMO	Direct Metal Oxidation
DS	Design Services
DWPF	Defense Waste Processing Facility
EM	Environmental Management
GS	General Services

HEPA	High-Efficiency Particulate Air (filter)
HLW	High Level Waste
HVAC	Heating, Ventilation and Air Conditioning
KAC	K-Area Complex
LaBS	Lanthanide Borosilicate
LIBS	Laser Induced Breakdown Spectrometer
MC&A	Material Control and Accountability
MT	Metric Ton
NDA	Non Destructive Assaying
NFPA	National Fire Protection Association
PC	Performance Category
PDI	Pressure Differential Indicator
Pu	Plutonium
PUD	Plutonium Disposition
PDF	Plutonium Disposition Facility
PuVit	Plutonium Vitrification
SC	Safety Class
SDD	System Design Description
SOW	Scope Of Work
SRS	Savannah River Site
SS	Safety Significant
SSC	Structure, System, Component
TBD	To Be Determined
UCNI	Unclassified Controlled Nuclear Information
VFD	Variable Frequency Drive
WSRC	Washington Savannah River Company

3.0 DESCRIPTION OF PHYSICAL WORK

3.1 Performance Category and Functional Classification (SS, PS)

3.1.1 Performance Category

3.1.1.1 The performance category of the Feed Preparation System is PC-1.

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”, as follows:

A. Crusher

1. Functional Classification – Production Support (PS)

B. 3013 Can Puncture Device

1. Functional Classification – Safety Significant (SS)

C. LIBS

1. Functional Classification - Production Support (PS)

3.2 Mechanical/Nuclear/Process

3.2.1 Feed Preparation Glovebox Components

3.2.1.1 The following Feed Preparation components will be contained within the Feed Preparation Glovebox system. Reference sketch SK-DE-FPS-0001 for layout and location of components in the glovebox. The major components are:

A. Lag storage rack (3 each)-one 5 position and two 3 place positions. There is also a 10 position lag storage rack in the Exit Staging glovebox.

B. Crusher (1 each)

1. Refer to M-M8-K-00012 for the block flow diagram. The model of the crusher being considered and to be tested in SRNL is a jaw crusher made by Fritsch, model 1 with the following characteristics:
   - Top opening 65 mm X 65 mm with a maximum feed size of 60 mm.
   - Maximum continuous throughput 140 kg/h
   - Adjustable bottom discharge size 1 – 15 mm
   - Eccentric oscillations 308 / min
   - Motor available in 400 V/3 phase: 230 V / 1 phase: 115 V / 1 phase.

C. Can Puncture Device (1 each)

1. Refer to M-M8-K-00012 for the block flow diagram. The CPD used in the previous projects is being modified to meet the pressure sensing requirement and other safety features to include Safety Significant controls. The development and testing of a CPD to meet the safety significant controls is a planned activity under NMM-TTR-2006-00011.

D. Outer/Inner 3013 Can Cutter/Opener

1. Details of the can cutter are in Data Sheet M-DS-K-00181. The can cutters are to be used to open the Outer 3013 container and also for opening the Inner 3013 container and convenience cans that cannot be opened manually.

E. Gantry Hoist (3 ea)

1. Details of a typical Gantry Hoist are in Data Sheet M-DS-K-00109. The hoists will be used for moving containers inside the gloveboxes.

F. Splitter dumper (1 ea) Equip. No. FPS-STAT-002

G. Dustless Dumper (1 ea) Equip. No. FPS-STAT-001

H. Trolley Cart (2 ea)

I. Telescoping Tray (2ea) for Air Lock use.

3.2.2 Glovebox

3.2.2.1 Drawing SK-DE-FPS-0001 shows the glovebox layout. The present glovebox arrangement allows access to both sides.

3.2.2.2 These gloveboxes are ventilated with room air and dry air which is drawn through an inlet HEPA filter and exhausted through additional HEPA filters to the Glovebox Exhaust System. See drawings M-M5-K-01969 and M-M6-K-02292 for glovebox exhaust flow diagram and piping and instrumentation diagram.

A. HEPA filters in stainless steel housing. (3 ea.)

B. Non-testable HEPA filter mounted to skin of glovebox. (3 ea.).

C. 10” automatic damper, pneumatically operated, stainless (1 ea.)

D. 4” isolation dampers, stainless (13 ea.)

E. 4” balancing damper, stainless (3 ea.)

F. ¼” three-way ball valves, stainless (15 ea.)

G. 10” isolation damper, stainless (3 ea.)

H. 6” balancing damper (1 ea.)

I. 6” isolation damper (2 ea.)

3.2.3 LIBS

3.2.3.1 Refer to J-J8-K-00029 for the LIBS material list.

3.3 Instrumentation and Controls

The Feed Preparation System consists of can cutters, crusher and splitter with supporting equipment, and test equipment as defined in Air Flow P&ID M-M6-K-02292, Material Handling Block Flow Diagram M-M8-K-00012, and Glovebox layouts SK-DE-FPS-0001. Controls are defined in the Feed Preparation Control Block Diagram J-J8-K-00047 and Logic J-J2-K-01582. For Cable and raceway estimated bulk quantities refer to Attachment 2. Instrument Cabinet FPS-INST-100 will be used to house transmitters associated with the equipment described below:

3.3.1 The following controls equipment is associated with the gantries and can cutter:

3.3.1.1 The gantries as defined in Data Sheet M-DS-K-00167 and layouts SK-DE-FPS-0001:

A. Total (3) gantry Hoist motors (FPS-HOI-001, 002, and 003)
B. Total (3) gantry consoles (FPS-CNSL-001, 002, and 003)

3.3.1.2. Can puncture and cutter devices

A. The puncture device (FPS-TOOL-031).
B. Total (2) Can cutters (FPS-CUTR-001 and 002)

The consoles for these three devices are FPS-CNSL-031, 032 & 033)

3.3.2 The following controls equipment is associated with the crusher:

3.3.2.1 The Crusher FPS-CRSH-001 as defined in Data Sheet M-DS-K-00075 and Block Flow Diagram M-M8-K-00012 involves the following control interfaces:

A. Total (1) motor for driving the crusher

B. Total (1) motor for dumping transport can into crusher with run and status controls

3.3.2.2 Crusher Discharge and Intake Dustless Valves - 2 Slide Gates each with the following control interfaces:

A. Total (4) Actuators
B. Total (8) Limit Switches

3.3.2.3 Dustless Dumper Shaker

A. Total (1) motor for dumping with run and status controls

3.3.3 The following controls equipment is associated with the splitter:

3.3.3.1 The Splitter dumper involves the following control interfaces:

A. Total (1) Dumper VFD motor metering device
B. Total (1) Scale cut off signal

3.3.3.2 Splitter Discharge and Intake Dustless Valves - 2 Slide Gates each with the following control interfaces:

A. Total (4) Actuators
B. Total (8) Limit Switches

3.3.4 For Feed Preparation Glovebox Feed through Penetration Connectors totals see Attachment 2. The Feed Prep Glovebox will contain the following:

3.3.4.1 Glovebox Airlocks as defined in SK-DE-FPS-0001 includes the following controls:

A. Total (12) Actuators
B. Total (4) Limit Switches

3.3.4.2 Glovebox Ventilation as defined in P&ID M-M6-K-02292 includes the following controls:

A. Total (6) Filter Pressure Differential Indicators (PDI's)
B. Total (3) Room PDI's
C. Total (1) Flow element and transmitter

3.3.4.3 Glovebox Maintenance Exhaust Air Flow Valve as defined in P&ID M-M6-K-02292 includes the following controls:

A. (1) Modulating Valve with limit switches

3.3.5 Instrument Cabinet FPS-INST-100 will house transmitters required by the above equipment.

3.3.6 The installation of the Feed Prep ICS I.O. cabinet ICS-CAB-030 to be located in the -20' Melter I/O Support Room and the OCS workstation ICS-OWS-015 to be located in the Feed Preparation/Oxidation Control Room are included in the ICS-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 Feed Prep Scope of Work.

3.3.7 MC&A Equipment (reference Control Block Diagram J-J8-K-00025) shows minimum.

3.3.7.1 Scales (Total 2) (there are 3 scales per SK-DE-FPS-0001)

1. The 3013 weigh scale FPS-SCL-001 (Data Sheet J-JD-K-00153) weighs the 3013's coming into Feed Prep from Material Receipt prior to and after opening and removing contents.

2. The Transport Hopper weigh scale FPS-SCL-002 (Data Sheet J-JD-K-00153) weighs the Transport Hopper upon leaving full and returning empty from Milling and Mixing.

3.3.7.2 Barcode readers (Total 2) (there are 4 barcode readers per SK-DE-FPS-0001)

3.3.7.3

1. The 3013 barcode reader FPS-RDR-001 (Data Sheet J-JD-K-00155) scans the 3013's coming into Feed Prep from Material Receipt prior to opening.

2. The Transport Hopper barcode reader FPS-RDR-002 (Data Sheet J-JD-K-00155) scans the Transport Hopper upon leaving and returning from Milling and Mixing...

3.3.7.4 Gamma Holdup Monitors (Total 14)

1. Details of the gamma holdup monitors for measuring gamma holdup for MC&A are in Data Sheet J-JD-K-00152. The crusher has two (2) gamma holdup monitors FPS-RE/RT-001A and B.

2. Remaining twelve (12) Gamma Holdup monitors (FPS-RE/RT-002A through L) are located on top of the glovebox.

3.3.7.5 Gamma Isotopic System (Total 2)

Details of the gamma isotopic system used for plutonium isotopic ratio analysis for MC&A are in Data Sheet J-JD-K-00154. There is one gamma isotopic system in the entry FPS-GRIS-001 and one in the exit FPS-GRIS-002 area of the glovebox.

3.4 Electrical

3.4.1 The Feed Preparation 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 drawing E-E2-K-02225.

3.4.1.2 The following will be the major electrical components:

A. Crusher (1)

B. Gantry Hoist (3)

C. Can cutters, can puncture device and dumpers will have electric motors

3.4.1.3 Work Scope includes installation of new grounding pigtails (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 2 for Bulk Material Takeoff for cable and conduit descriptions and quantities. Unless otherwise stated, it is the responsibility of the installer to provide these commodities.

3.5 Plant Design

3.5.1 There is no piping needed inside the Feed Preparation System glovebox.

3.6 Civil/Structural/Architectural.

3.6.1 The C/S/A scope of work required for installation of supports for the major components of Feed Preparation Systems is as follows.

3.6.2 Glovebox. (Reference 6.1.1.8 SK-DE-FPS-0001, Rev.B)
The size of the Glovebox is approximately 46’x 4’ x10’ high and weighs approximately 120000 lbs. It is supplied with 24 legs with a 6”x6” plate at the bottom. Each leg will be welded to a base plate 12”x12”x ¾” thick and anchored with ¾” diameter bolts to the concrete slab.

4.0 ASSUMPTIONS

4.1 General Assumptions

4.1.1 The Construction Agency will be the SRS Construction Group. DS will provide engineering documentation for the installation of this equipment and will rely on the use of SRS Guides and Standards.

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.

4.1.4 All piping will be per ASME B31.3.

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 competed for each vessel and pressure protection device (disk or valve).

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 Glovebox feed thru connector assemblies are functionally classified as SS and will be purchased as Engineering material.

4.2.4 Plant Design

4.2.4.1 No specific assumptions have been made in this group.

4.2.5 Civil/Structural/Architectural

4.2.5.1 Core drills will be required for routing commodities through existing walls or floors, which will be covered in C-SOW-K-00009.

4.2.5.2. Assume all anchor bolts used for equipment and commodity supports will be A36 Drillco Maxi bolts. Alternately, Hilti Kwik Bolts-TZ are acceptable for anchoring items.

4.2.5.3. Any components inside any equipment like cabinet are the integral of that equipment as one unit.

4.2.5.4. Functional classification for drilling holes in concrete surface is SC.

5.0 TECHNOLOGY DEVELOPMENT ISSUES

The glovebox based LIBS technique is still in the developmental phase. Testing is currently being performed with various surrogate nuclear material with impurities to quantify sample preparation and equipment operational parameters. Additional size reduction of the 1mm maximum particle size, output from the crusher, may be required along with addition of a binder material. Prior to sampling for LIBS analysis, the crusher output will require mandatory mixing to ensure homgeneity. At present, required sample compression, to avoid material dispersion during LIBS analysis, is the only required preparation step. Completed developmental testing output documents will define LIBS final requirements."

6.0 REFERENCES

6.1 References List

6.1.1. PUD project drawings, sketches, and data sheets.

6.1.1.1 M-DS-K-00181, Rev. A - Can Cutter Datasheet
6.1.1.2 M-DS-K-00075, Rev. B-Jaw Crusher Datasheet
6.1.1.3 M-DS-K-00167, Rev. A - FPS Gantry Hoist with Electric Gripper
6.1.1.4 M-M5-K-01969, Rev. B - FPS Glovebox Ventilation Air Flow Diagram
6.1.1.5 M-M6-K-02292, Rev. A - Glovebox - Exhaust System P&ID
6.1.1.6 M-M8-K-00004. Rev. A - Feed Preparation System Block Flow Diagram
6.1.1.7 M-M8-K-00012, Rev. A – Feed Preparation Block Flow Diagram
6.1.1.8 SK-DE-FPS-0001, Rev. B - Glovebox Layout Drawing
6.1.1.9 J-J8-K-00029 – Laser Induced Breakdown Spectrometer Layout, Rev.A
6.1.1.10 J-J8-K-00025, Rev. A - Feed Preparation MC&A Control Block Diagram
6.1.1.11 J-J8-K-00047, Rev. A - Feed Preparation Control Block Diagram
6.1.1.12 J-J8-K-00050, Rev. A – ICS Network Block Diagram
6.1.1.13 J-JD-K-00152, Rev. A – Gamma Holdup Monitor Datasheet
6.1.1.14 J-JD-K-00153, Rev. A – Datasheet Weigh Scale
6.1.1.15 J-JD-K-00154, Rev. A – Datasheet Gamma Isotopic System
6.1.1.16 J-JD-K-00155, Rev. A – Datasheet Bar Code Reader
6.1.1.17 E-E2-K-02225, Rev. C– Feed Prep. And Oxidation Area Single Line Diagram
6.1.1.18 E-E2-K-02229 – Electrical Power Distribution Single Line, Rev.D
6.1.1.19 E-E2-K-02230 – Electrical Power Distribution Single Line, Rev.D

6.2 Design Input Documents

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

6.2.1 Facility Design Description

6.2.1.1 G-FDD-K-00001, Rev B "PUV Facility Design Description"

6.2.2 System Design Description

6..2.2.1 X-SYD-K-00004, Rev. B "Feed Preparation System (FPS) SDD"

6.2.3 Civil/Structural/Architectural

6.2.3.1 For Electrical Conduit and Equipment Supports, Use Cookbook C-CI-G-0039, Rev. 0

6.2.3.2 For Standard HVAC Duct support and details, Use cookbook C-CL-G-0001, Rev. 3

6.2.3.3 For routing and supports for NPS 2" and smaller piping, use cookbook no. C-CH-G-00004, Rev. 0

6.3 Applicable SRS & Industry Codes, Guides and Standards

6.3.1 Industry Codes and Standards

Not Applicable.

6.3.2 SRS Guides & Standards

6.3.2.1 SRSESM 15980-03-R, Mechanical Installation of General and Nuclear Services Instrumentation
6.3.2.1 WSRC-TM-95-1, Standard no. 15980, Rev. 6, "Mechanical Installation of Safety Class and Safety Significant Instrumentation"
6.3.2.3 WSRC-IM-95-58, Guide no. 15060, Rev.5, "Application of ASME B31.3"
6.3.2.4 WSRC-IM-95-58, Guide no. 15980-G, Rev.3, "Installation and Calibration of Instruments"
6.3.2.5 WSRC-IM-95-58, Guide no. 16051-G, Rev.2, "Installation of Electrical Raceway Systems and Cable Trays"
6.3.2.6 WSRC-IM-95-58, Guide no. 16052-G, Rev.2, "Installation of Electrical Wires, Cables and Terminations"
6.3.2.7 WSRC-IM-95-58, Guide no. 16053-G, Rev.2, "Installation of Electrical Equipment"
6.3.2.8 WSRC-IM-95-58, Guide No. 16056-G, Rev.2, "Installation of Grounding Systems."
6.3.2.9 WSRC-TM-95-1, Standard no. 03010, Rev.1, "Coring, Chipping and Drilling in Concrete.

6.4 Related Scopes of Work (SOW)

6.4.1 M-SOW-K-00020, HVAC System- Refer to M-M6-K-02269 Rev. A for Glove Box Ventilation P&ID, and M-M5-K-01946 Rev. A for Glove Box Ventilation Air Flow Diagram.
The furnace extraction module is contained in a region served by the remote handling area HVAC exhaust system and the glovebox is served by air hoods described in this related SOW. The HVAC will remove the furnace heat from the remote handling area.

6.4.2 C-SOW-K-00009, Rev. 0, Scope of Work for Structural and Architectural Modifications for Process Building.

6.4.3 E-SOW-K-00017, Rev. 0, Electrical General Scope of Work

6.4.4 J-SOW-K-00002, Rev. 0, Scope of work for ICS & MC&A Network.

6.4.5 M-SOW-K-00020, Rev. 0, Scope of Work for HVAC System.

6.4.6 M-SOW-K-00021, Rev. 0, Scope of Work for Balance of Plant Air and Gas Systems.

6.4.7 M-SOW-K-00022, Rev. 0, Scope of Work for Balance of Plant Water Systems.

6.4.8 S-SOW-K-00002, Rev.0, Scope of Work for Safeguards and Security System.

6.5 Miscellaneous

6.5.1 M&O-PUD-2006-00045, Plutonium Disposition Project Meeting Minutes – Feed Preparation System.

6.5.2 C-CI-G-0039, Rev: 0, Cookbook for Electrical Conduit and Equipment Supports, February 9,2005.

7.0 ATTACHMENTS

7.1 Attachment 1, Bulk Material List-C/S/A
7.2 Attachment 2, Bulk Material List-Electrical Cable and Conduit

Attachment 1: Bulk Material – C/S/A

Base plates	12” x 12” x ¾” thick	24 Ea.
Anchor Bolts	¾” Diameter	96 Ea.

Attachment 2: Bulk Material – Electrical Cable & Conduit

Exterior Glovebox Cables

Sum of Qty XGB (ft)	
Ext. Cable Size/Type	Total
3/C#12	3,660
1PR #16	21,850
GRIS VENDOR SUPPLIED CABLE	300
GIS VENDOR SUPPLIED CABLE	130
Grand Total	25,940

Interior Glovebox Cables

Sum of Qty NGB (ft)	
GB Cable Size/Type	Total
1PR #16	1,680
3/C#12	400
Grand Total	2,080

All Raceway Types

Sum of Qty Rcwy (ft)	
RCWY	Total
3/4" IMC	670
1"1/2" IMC	160
3" IMC	550
2" IMC	140
1 1/2"IMC	130
Grand Total	1,650

All Raceway Types Grouped by Red Designation

Sum of Qty Rcwy (ft)		
Red	RCWY	Total
N	3/4" IMC	250
	1"1/2" IMC	160
	3" IMC	550
N Total		960
Y	3/4" IMC	420
	2" IMC	140
	1 1/2"IMC	130
Y Total		690
Grand Total		1,650

Attachment 2: Continued

Item #	From Equipment	To Equipment	Cable Estimates (Exterior GB)			GB Pentr	(Interior. GB)	Shared Rcwy/Tray	Raceway Estimates				
			Length (A) (ft)	Qty (A)	Cable size/type	Conn. (Qty)	Length (B) (ft)	Length (C) (ft)	Length (D) (ft)	Qty (D)	Size/Desc. (D)	Red	Notes/Comments
1	MCC-31E	Crusher FPS-CRSH-001A	200	1	3/C#12	1	20	0	160	1	1"1/2" IMC		
2	MCC-31E	Gantry Hoist FPS-CRSH-001	200	1	3/C#12	1	20	160	0	1	1"1/2" IMC		
3	MCC-31E	Gantry Hoist FPS-CRSH-002	200	1	3/C#12	1	20	160	0	1	1"1/2" IMC		
4	1 -20VOLT, 42 CIRCUIT DIST. PANEL	MISC GLOVEBOX EQUIPMENT	180	17	3/C#12	14	20	0	140	1	3" IMC		
	ICS-CAB-030	FPS-INST-100 FEED PREP GLOVEBOX INSTR. RACK	195	35	1PR #16	0	0	0	175	1	3" IMC		
5	ICS-CAB-030	FEED PREP GLOVEBOX	245	35	1PR #16	8	20	0	205	1	3" IMC		
6	FPS-INST-100 FEED PREP GLOVEBOX INSTR. RACK	FEED PREP GLOVEBOX	70	35	1PR #16	8	20	0	30	1	3" IMC		
7	FPS-CNSL-101 ENTRY STAGING GANTRY HOIST CTRL CONSOLE	FPS-HOI-001 FEED PREP GANTRY HOIST #1	90	1	1PR #16	1	20	0	50	1	3/4" IMC		
8	FPS-CNSL-102 CRUSHER PREP GANTRY HOIST CTRL CONSOLE	FPS-HOI-002 FEED PREP GANTRY HOIST #2	90	1	1PR #16	1	20	0	50	1	3/4" IMC		
9	FPS-CNSL-103 EXIT STAGING GANTRY HOIST CTRL CONSOLE	FPS-HOI-003 FEED PREP GANTRY HOIST #3	90	7	1PR #16	1	20	0	50	1	3/4" IMC		
10	CAN PUNCTURE DEVICE SWITCH	FPS-TOOL-001 CAN PUNCTURE DEVICE	90	1	1PR #16	1	20	0	50	1	3/4" IMC		
11	OUTER AND INNER CAN CUTTER HAND SWITCH	FPS-CUTR-001 OUTER AND INNER CAN CUTTER	90	1	1PR #16	1	20	0	50	1	3/4/" IMC		
12	OUTER AND INNER CAN CUTTER HAND SWITCH	FPS-CUTR-002 OUTER AND INNER CAN CUTTER	90	1	1PR #16	1	20	0	50	1	3/4" IMC		

Attachment 2: Continued

Item #	From Equipment	To Equipment	Cable Estimates (Exterior GB)			GB Pentr	(Interior. GB)	Shared Rcwy/Tray	Raceway Estimates				
			Length (A) (ft)	Qty (A)	Cable size/type	Conn. (Qty)	Length (B) (ft)	Length (C) (ft)	Length (D) (ft)	Qty (D)	Size/Desc. (D)	Red	Notes/Comments
14	MCA-CAB-007	FPS-SCL-002	180	1	1PR #16	1	20	140	0	1	3/4" IMC	Y	WEIGH SCALE
15	MCA-CAB-007	FPS-RDR-001	160	1	1PR #16	0	0	0	140	1	3/4" IMC	Y	BAE CODE READER #1
16	MCA-CAB-007	FPS-RDR-002	160	1	1PR #16	0	0	140	0	1	3/4" IMC	Y	BAE CODE READER #2
17	MCA-CAB-007	FPS-RE/RT-001A	160	1	1PR #16	0	0	0	140	1	2" IMC	Y	CRUSHER GAMMA MONIT.
18	MCA-CAB-007	FPS-RE/RT-001B	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	CRUSHER GAMMA MONIT.
19	MCA-CAB-007	FPS-RE/RT-002A	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
20	MCA-CAB-007	FPS-RE/RT-002B	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
21	MCA-CAB-007	FPS-RE/RT-002C	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
22	MCA-CAB-007	FPS-RE/RT-002D	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
23	MCA-CAB-007	FPS-RE/RT-002E	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
24	MCA-CAB-007	FPS-RE/RT-002F	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
25	MCA-CAB-007	FPS-RE/RT-002G	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
26	MCA-CAB-007	FPS-RE/RT-002H	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
27	MCA-CAB-007	FPS-RE/RT-002I	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
28	MCA-CAB-007	FPS-RE/RT-002J	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
29	MCA-CAB-007	FPS-RE/RT-002K	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
30	MCA-CAB-007	FPS-RE/RT-002L	160	1	1PR #16	0	0	140	0	1	2" IMC	Y	GB GAMMA HOLDUP MONIT.
31	FPS-GRIS-001A	FPS-GRIS-001	150	1	GRIS VENDOR SUPPLIED CABLE	0	0	0	130	1	1 1/2"IMC	Y	GAMMA ISOTOPIC SYSTEM
32	FPS-GRIS-002A	FPS-GRIS-002	150	1	GRIS VENDOR SUPPLIED CABLE	0	0	130	0	1	1 1/2"IMC	Y	GAMMA ISOTOPIC SYSTEM
33	FPS-GRIS-001	FPS-CHU-001	65	1	GIS VENDOR SUPPLIED CABLE	0	0	0	45	1	3/4" IMC	Y	GIS MECHANICAL COOLER
34	FPS-GRIS-002	FPS-CHU-002	65	1	GIS VENDOR SUPPLIED CABLE	0	0	0	45	1	3/4" IMC	Y	GIS MECHANICAL COOLER
					Total penetrations	41							