PLUTONIUM DISPOSITION PROJECT (U)

Project M09A

SCOPE OF WORK

M-SOW-K-00020 Revision 0

For

Heating Ventilation and Air Conditioning (HVAC) Systems (U)

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UNCLASSIFIED
DOES NOT CONTAIN UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION
DC/RO: _____ 4-11-07

Revision Page

Revision	Revision Date	Affected Section	Description of Change
0	4-12-07	N/A	Initial Revision

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1.0 SCOPE

1.1 General Description

This Scope of Work (SOW) covers the Heating, Ventilation and Air Conditioning (HVAC) System for the Plutonium Disposition Project. The HVAC System provides confinement ventilation that minimizes the spread of potentially airborne radiological and chemical contaminants within the facility and to the environment and limits personnel exposure within the ALARA guidelines. The HVAC system also provides proper environmental control for the health, safety, and comfort of the operating personnel and for equipment protection.

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 Vitrification Facility (PVF) 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

2.1

Acronyms	Definition
AHU	Air Handling Unit
ANSI	American National Standards Institute
ASHRAE	American Society of Heating Refrigeration and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
C/S/A	Civil/Structural/Architectural
CDR	Conceptual Design Report
DS	Design Services
DWPF	Defense Waste Processing Facility
ECF	Entry Control Facility
EM	Environmental Management
FDD	Facility Design Description
GS	General Services
HLW	High Level Waste
HVAC	Heating, Ventilation and Air Conditioning
HEPA	High-Efficiency Particulate Air (filter)
ICS	Integrated Control System
KAC	K-Area Complex
LaBS	Lanthanide BoroSilicate
lbs	pounds
MT	Metric Ton
NDA	Non-Destructive Assay
NFPA	National Fire Protection Association
P&ID	Piping & Instrumentation Diagram
PC	Performance Category
PS	Production Support
PU	Plutonium
PUD	Plutonium Disposition
PVF	Plutonium Vitrification Facility
SC	Safety Class
SDD	System Design Description
SOW	Scope of Work
SRS	Savannah River Site
SRSESM	Savannah River Site – Engineering Standards Manual
SS	Safety Significant
SSC	Structure, System, Component
TBD	To Be Determined
UL	Underwriters Laboratory
VFD	Variable Frequency Drive
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

The Performance Categories for HVAC Systems are as follows:
(Reference M-SYD-K-00005, Table1-1)

- The Process Area Supply Air System is PC-1,
- Supply Fan Interlock to Exhaust System is PC-3
- Exhaust Duct (inside the process building) PC-2;
- Exhaust Duct (outside process building) PC-3
- Glovebox Exhaust System PC-2;
- Exhaust Fans PC-3;
- Sand Filter PC-3
- Stack PC-3;
- Stack Monitoring PC-3

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 (Reference M-SYD-K-0005):

A. Process Area Supply Air System:
Functional Classification – Production Support (PS)
B. Process Area Exhaust Air System:
Functional Classification – Safety Class (SC)
C. Glovebox Exhaust System:
Functional Classification - Safety Significant (SS)
D. Non- Process Area HVAC System:
Functional Classification - General Support (GS)

3.2 Mechanical/Nuclear/Process

3.2.1 Process Area Supply Air System

Process Area Supply Air System is a once through type system and provides conditioned air to process area to maintain proper environmental control for the health, safety, and comfort of the operating personnel and for equipment protection.

3.2.1.1 Process Area Supply Air System Components - Refer to P&ID # M-M6-K-02310 and Air Flow Diagrams # M-M5-K-01952, 01953 and 01957 for the for the Process Area HVAC Supply Air System. The major components for this system are:

A. Air Handling Units (3 Each)
B. Isolation Dampers (3 Each)
C. Tornado Damper (1 Each)
D. Electric Duct Heaters (30 Each)
E. Fire Dampers (Number of the dampers are to be based on ratio of dampers per linear feet of Supply duct per S-3013 Project))
F. Ductwork and Accessories (See Att. 7.1 for Bulk Material Quantities)

3.2.1.2 Air Handling Units (AHU-001, 002 and 003) - PS

Each of this Process Area Supply AHU shall be designed for 100 percent outside air equipped with Inlet weather hood, with insect screen, weather-stripped inlet damper, filters (pre-filter and medium efficiency filter), Chilled Water Cooling coil, Electric Heating coil, Steam Humidifier and a direct drive centrifugal fan. Fan motor shall include VFDs. Refer to Data Sheet M-DS-K- 00120 for the AHU performance requirements.

3.2.1.3 AHU Isolation Dampers (DMP-028, 029, and 030) - PS

The AHU Isolation Dampers shall be provided with an electric actuator. The dampers shall be galvanized carbon steel. The damper shall be designed and constructed in accordance with ASME AG-1, Section DA. The seat and frame leakage shall meet the requirements of ASME AG-1, Section DA, for Leakage Class II for seat and Class C for frame.

3.2.1.4 Tornado Dampers (DMP-031) - SC

The Tornado Dampers shall be designed for counter balance to actuate and isolate based on tornado pressure to prevent the transmission of tornado pressure surge. The damper shall be stainless steel. The seat and frame leakage shall meet the requirements of ASME AG-1, Section DA, for Leakage Class I for seat and Class B for frame.

3.2.1.5 Electric Duct Heaters (EHTR-001 through 027 and 029 through 031) - PS

The Electric Duct Heaters shall be UL Listed, open coil type and suitable for continuous service. The packaged controls shall be complete with all magnetic contactors, transformers, fused disconnect switch with control panel door interlock. Refer to Data Sheets M-DS-K-00127 through 00132, 00142 and 00149

3.2.1.6 Fire Dampers (DMP-TBD) - PS

The Fire Dampers shall be curtain type dynamic fire dampers. The fire dampers shall be constructed, tested and labeled in accordance with the latest UL 555. The fire dampers shall have a fire rating of 3 hours and shall meet the requirements of the latest edition of NFPA90A. Refer to 3-D model for various damper sizes.

3.2.1.7 Ductwork and Accessories - PS

The Supply air ductwork and accessories shall be galvanized carbon steel. Ductwork shall be constructed and tested in accordance with the requirement in ASME AG-1,Section SA and shall meet Level 3 requirements for the leak tightness.

3.2.2 Process Area Exhaust Air System

Process Area Exhaust Air System provides exhaust ventilation to protect facility personnel from in-process radioactive and hazardous materials. This system also provides confinement ventilation that minimizes the spread of potentially airborne radiological and chemical contaminants within the facility and to the environment and limits personnel exposure within the ALARA guidelines. The process areas will be exhausted through a common Sand Filter and Exhaust Fan-house to a stack.

3.2.2.1 Process Area Exhaust Air System Components - Refer to P&ID # M-M6-K-02311 and Air Flow Diagrams # M-M5-K-01954, 01955, 01956 and 01957 for the for the Process Area Exhaust Air System. The major components for this system are:

A. Exhaust Air Fans (3 Each)
B. Isolation Dampers (3 Each)
C. Tornado Damper (1 Each)
D. Slide Gate Isolation Dampers (6 Each)
E. Fire Wraps for the duct penetrating Fire Barriers (600 Lin. Ft. refer to assumption 4.2.1.1)
F. Sand Filter (1 Each)
G. Ductwork and Accessories (See Att. 7.1 for Bulk Material Quantities)

3.2.2.2 Exhaust Air Fans (FAN-001, 002 and 003) - SC

The Exhaust Air Fans shall be Class 4, SWSI Centrifugal Fans. The fans shall be direct drive and fan housing shall be constructed of minimum 10 gauge Stainless steel. Fans shall be supplied with VFD and TEFC, premium duty motor suitable for VFD drive. Refer to Data Sheet M-DS-K- 00123 for the Fan performance requirements.

3.2.2.3 Fan Isolation Dampers (DMP-021, 022, and 023) - SC

The fan Isolation Dampers shall be provided with an electric actuator. The dampers shall be stainless steel. The damper shall be designed and constructed in accordance with ASME AG-1, Section DA. The seat and frame leakage shall meet the requirements of ASME AG-1, Section DA, for Leakage Class I for seat and Class B for frame.

3.2.2.4 Tornado Dampers (DMP-031) - SC

The Tornado Dampers shall be designed for counter balance to actuate and isolate based on tornado pressure to prevent the transmission of tornado pressure surge. The damper shall be stainless steel. The damper shall be designed and constructed in accordance with ASME AG-1, Section DA. The seat and frame leakage shall meet the requirements of ASME AG-1, Section DA, for Leakage Class I for seat and Class B for frame.

3.2.2.5 Slide Gate Dampers (DMP-015 through 020) - SC

The Slide Gate Dampers shall be provided to manually isolate the fans during maintenance. The dampers shall be stainless steel. The damper shall be designed and constructed and tested in accordance with ASME AG-1, Section DA. The seat and frame leakage shall be zero leakage.

3.2.2.6 Fire Resistance Duct Wraps - SS

The exhaust ducts penetrating through fire barriers shall be provided with the 3 hour rated, Fire Resistance Duct Wraps shall be 3M™ FastMaster® Duct Wrap, 1.5" thick. Fire Resistance Duct wraps shall be installed 10 feet, on each side of the wall, on the duct penetrating the fire barriers. It is assumed that there will be approximately 30 fire barrier penetrations.

3.2.2.7 Ductwork and Accessories - SC

The Exhaust air ductwork and accessories shall be Stainless steel. Ductwork shall be constructed and tested in accordance with the requirement in ASME AG-1, Section SA and shall meet Level 5 requirements for the leak tightness.

3.2.3 Glovebox Exhaust System

The Glovebox Exhaust Air System provides exhaust ventilation to protect facility personnel from in-process radioactive and hazardous materials. This system also provides confinement ventilation that minimizes the spread of potentially airborne radiological and chemical contaminants within the facility and to the environment and limits personnel exposure within the ALARA guidelines. The Glovebox Exhaust will be exhausted through redundant HEPA Filter Housings and then routed to Sand Filter and Exhaust Fan-house to a stack.

3.2.3.1 The Glovebox Exhaust Air System Components - Refer to P&ID # M-M6-K-02293 and Air Flow Diagram # M-M5-K-01970 for The Glovebox Exhaust Air System. The major components for this system are:

A. Glovebox HEPA Filter Housings (2 Each)
B. Glovebox Exhaust Air Fans (2 Each)
C. Isolation Dampers (2 Each)
D. Slide Gate Isolation Dampers (2 Each)
E. Ductwork and Accessories (See Att. 7.1 for Bulk Material Quantities)

3.2.3.2 Glovebox HEPA Filter Housings (FLT-001 and 002) - SS

The HEPA Filter Housing includes inlet Isolation Valve, Fire Screen, pre-filter, HEPA Filter and outlet isolation damper. Refer to Data Sheet M-DS-K- 00126 for the performance requirements.

3.2.3.3 Glovebox HEPA Filter Housings Exhaust Fans (FAN- 004 and 005) - SS

The Glovebox Exhaust Air Fans shall be minimum class III, SWSI Centrifugal Fans. The fans shall be direct drive and fan housing shall be constructed of minimum 10 gauge Stainless steel. Fans shall be supplied with VFD and TEFC, premium duty motor, suitable for VFD drive. Refer to Data Sheet M-DS-K- 00124 for the Fan performance requirements.

3.2.3.4 Slide Gate Dampers (DMP-033 and 034) - SS

The Slide Gate Dampers shall be provided to manually isolate the fans during maintenance. The dampers shall be stainless steel. The damper shall be designed and constructed and tested in accordance with ASME AG-1, Section DA. The seat and frame leakage shall be zero leakage. The Dampers shall be AMCA tested.

3.2.3.5 Fan Isolation Dampers (DMP-028, 029, and 030) - SS

The fan Isolation Dampers shall be provided with an electric actuator. The dampers shall be stainless steel. The damper shall be designed and constructed in accordance with ASME AG-1, Section DA. The seat and frame leakage shall meet the requirements of ASME AG-1, Section DA, for Leakage Class I for seat and Class B for frame. The Dampers shall be AMCA tested.

3.2.3.6 Ductwork and Accessories - SS

The Glovebox Exhaust air ductwork and accessories shall be Stainless steel. Ductwork shall be constructed and tested in accordance with the requirement in ASME AG-1, Section SA and shall meet Level 4 requirements for the leak tightness.

3.2.4 Non-Process Area HVAC System

Non-Process Area HVAC Systems are recirculating type systems which provides conditioned air to non-process areas, such as Can-in-Canister loading, storage and Transportation Area, Entry Control Facility (ECF), NDA Room etc. to maintain proper environmental control for the health, safety, and comfort of the operating personnel and for equipment protection.

3.2.4.1 Non-Process Area HVAC Supply Air System Components - The major components in these systems are:

A. Air Handling Units (3 Each)
B. Isolation Dampers (3 Each)
C. Ductwork and Accessories (See Att. 7.1 for Bulk Material Quantities)

3.2.4.2 Air Handling Unit for Canister Loading, storage and Transfer Area (AHU-006) - PS

Air Handling Unit shall be packaged type complete with combination filter mixing box (include motorized dampers, mixing box and medium efficiency filter), chilled water cooling coil, electric heating coil and BI centrifugal, direct drive, fan. Refer to M-DS-K-00125 for performance requirements.

3.2.4.3 Air Handling Unit for ECF Area (AHU-005) - PS

Air Handling Unit shall be packaged type complete with combination filter mixing box (include motorized dampers, mixing box and medium efficiency filter), chilled water cooling coil, electric heating coil and BI centrifugal, direct drive, fan. Refer to M-DS-K-00122 for performance requirements.

3.2.4.4 Air Handling Unit for NDA Room (AHU-004) - PS

Air Handling Unit shall be packaged type complete with combination filter mixing box (include motorized dampers, mixing box and medium efficiency filter), chilled water cooling coil, electric heating coil and BI centrifugal, direct drive, fan. Refer to M-DS-K-00121 for performance requirements.

3.2.4.5 AHU Isolation Dampers (DMP-TBD) - PS

Each of the AHU Isolation Dampers shall be provided with an electric actuator. The damper shall be galvanized carbon steel. The damper shall be designed and constructed in accordance with ASME AG-1, Section DA. The seat and frame leakage shall meet the requirements of ASME AG-1, Section DA, for Leakage Class III for seat and Class C for frame.

3.2.4.6 Ductwork and Accessories - PS

The ductwork and accessories shall be galvanized carbon steel. Ductwork shall be constructed and tested in accordance with the requirement in ASME AG-1, Section SA and shall meet Level 2 requirements for the leak tightness.

3.3 Instrumentation and Controls

3.3.1 The 3 supply AHUs will be controlled by the ICS (J-SOW-K-00002). For each AHU this will include the supply fan variable speed drive, the chilled water supplied cooling coil, the electric preheat coil and the steam supplied humidifier.

3.3.2 Each AHU will be furnished as a skid containing the following vendor supplied instruments and control panels:

3.3.2.1 VFD control panel (1)

3.3.2.2 Preheater instruments:

A. Control panel (1)
B. Temperature element (2)
C. Temperature transmitter (1)
D. Temperature indicator (1)
E. Low flow switch (1)

3.3.2.3 Humidifier Control Panel

3.3.2.4 Differential pressure instruments:

A. Low efficiency roll filter ΔP indicator (1)
B. Low efficiency roll filter high ΔP switch (1)
C. Moderate efficiency filter ΔP indicator (1)
D. Moderate efficiency filter high ΔP switch (1)

3.3.3 The power feed for each supply fan will have a SC (shutdown) interlock originated by the Main Exhaust System Control Panel.

3.3.4 The cooling coils for each AHU will be supplied chilled water via a common chilled water control valve controlled by the ICS.

3.3.5 Each of the 3 supply air isolation dampers will be controlled by the ICS and will be furnished with the following vendor supplied switches:

A. Damper open limit switch (1)
B. Damper closed limit switch (1)

3.3.6 The common supply air duct will contain the following instruments which interface with the ICS:

3.3.6.1 Temperature instruments:

A. Temperature element (1)
B. Temperature transmitter (1)

3.3.6.2 Humidity instruments:

A. Humidity element (1)
B. Humidity transmitter (1)

3.3.6.3 Pressure instruments:

A. Pressure element (1)
B. Pressure transmitter (1)

3.3.7 Each of the 2 glovebox exhaust fans will be furnished with a vendor supplied VFD control panel.

3.3.8 The glovebox exhaust fans will be controlled by a common Glovebox Exhaust System Control Panel. Major components included within the control panel include independent flow controllers, logic solvers and power supplies.

3.3.9 The power feed for each glove box fan will have a SC (shutdown) interlock originated by the Main Exhaust System Control Panel.

3.3.10 Each of the 2 glovebox exhaust isolation dampers will be controlled by the Glovebox Exhaust System Control Panel and will be furnished with the following vendor supplied switches:

A. Damper open limit switch (2)
B. Damper closed limit switch (2)

3.3.11 Each of the 2 glovebox exhaust filter units will be furnished with the following vendor supplied differential pressure instruments:

A. Low efficiency filter ΔP indicator (1)
B. Low efficiency filter high ΔP switch (1)
C. HEPA filter ΔP indicator (1)
D. HEPA filter high ΔP switch (1)

3.3.12 Each of the 2 glovebox exhaust fan ducts will contain the following differential pressure instruments:

A. Fan suction ΔP indicator (1)
B. Fan discharge ΔP indicator (1)

3.3.13 The common glovebox exhaust air duct will contain the following flow instruments which input to the Glovebox Exhaust System Control Panel:

A. Flow element (2)
B. Flow transmitter (2)

3.3.14 Each of the 3 main exhaust fans will be furnished with a vendor supplied VFD control panel.

3.3.15 The main exhaust fans will be controlled by either of the two (independent) Main Exhaust System Control Panels. These panels will contain the following major components, pressure indicating controllers (2), logic solvers (2) and power supplies (2)

3.3.16 The 105-K building will contain 4 (2 per channel) differential pressure indicating transmitters which input to the Main Exhaust System Control Panel. Each of the two (2) SC differential pressure transmitter channels will contain the following components:

A. Static (outside) atmosphere probe (1ea.)
B. Pressure averaging chamber (1 ea.)
C. Atmospheric sensor expansion tank (1 ea.)
D. Static (inside) pressure probe (4 ea.)
E. Sensing lines, 1/2" PS206B Tubing (1000 ft)

3.3.17 Each of the 3 main exhaust isolation dampers will be controlled by the Main Exhaust System Control Panel and will be furnished with the following vendor supplied switches:

A. Damper open limit switch (2)
B. Damper closed limit switch (2)

3.3.18 Each of the 3 main exhaust fan ducts will contain the following differential pressure instruments:

A. Fan suction ΔP indicator (1)
B. Fan discharge ΔP indicator (1)

3.3.19 Each of the 2 tornado dampers will be furnished with the following vendor supplied switches:

A. Damper open limit switch (2)
B. Damper closed limit switch (2)

3.3.20 The sand filter will contain the following differential pressure instruments:

A. Inlet ΔP indicating transmitter (1)
B. Discharge ΔP indicating transmitter (1)

3.3.21 The status of the SS glovebox exhaust system and the SC main exhaust air system components, tornado damper limit switches and isokinetic particulate sampling system channels will be monitored by the ICS. The following isolators will be used to electrically isolate the SC/SS components from the PS ICS:

A. Digital signal isolators (44)
B. Analog signal isolators (20)

3.3.22 Each of the 2 isokinetic particulate sampling system channels will be furnished as skids containing the following vendor supplied instruments and components:

A. Isokinetic sampling array (1)
B. Vacuum pump (1)
C. Power supply (1)
D. Velocity profiler (1)
E. Stack flow totalizer (1)
F. Linear mass flow meter (1)
G. Sampler flow totalizer (1)
H. Alarm module (2)
I. Flow control valve (1)
J. Particulate CAM (1)

3.3.23 Unless noted otherwise, instruments denoted as vendor supplied are part of Engineered Equipment packages/skids, and thus do not required (separate) installation by Construction.

3.3.24 Provide interface wiring for HVAC instruments & controls detailed within this SOW. Bulk cable and raceway quantities are summarized in Attachment 7.4

3.3.25 All instruments and controls associated with the SC main exhaust system are to be installed in accordance with Channel/Train separation requirements delineated in IEEE 384,

3.4 Electrical

3.4.1 Process Area HVAC Supply Air System Component Electrical Power – Refer S/L Diagrams E-E2-K-02232 and E-E2-K-02233.

3.4.1.1 Provide electrical power feeds to supply fan HVAC-AHU-001 from ELNH-MCC-11M, Cubicle 4D, pre-heater HVAC-HCL-001 from substation breaker #M-11 in Transformer Room #1 at 0' Level and dampers from panel ELLV-PNL-013.

3.4.1.2 Provide electrical power feeds to supply fan HVAC-AHU-002 from ELNH-MCC-11M, Cubicle 5A, pre-heater HVAC-HCL-002 from substation breaker #M-42 in Transformer Room #4 at 0' Level and dampers from panel ELLV-PNL-013.

3.4.1.3 Provide electrical power feeds to supply fan HVAC-AHU-003 from ELNH-MCC-11M, Cubicle 3A, pre-heater HVAC-HCL-003 from substation breaker #M-38 in Transformer Room #3 at 0' Level and dampers from panel ELLV-PNL-013.

3.4.1.4 Provide electrical power feeds to duct heaters HVAC-EHTR-001 through HVAC-EHTR-031 which are located on -20' & -40' Level from motor control center ELNH-MCC-18M located in Electrical Room #2 at -20' Level refer to HVAC Duct Heater Layout M-M5-K-01952 & M-M5-K-01953.

3.4.2 Process Area HVAC Exhaust Air System Component Electrical Power – Refer S/L Diagrams E-E2-K-02236, E-E2-K-02237, E-E2-K-02238 & E-E2-K-02239:
All electrical power covered in this section for the Exhaust Air System is classified as Safety Class (SC) and shall meet all appropriate requirements.

3.4.2.1 Provide electrical power feed to Exhaust Air Fan HVAC-FAN-001 from 480V switchgear bus no. 1, ELNH-SWGR-001 through variable frequency speed drive HVAC-VFD-001.

3.4.2.2 Provide electrical power feed to Exhaust Air Fan HVAC-FAN-002 from 480V switchgear bus no. 2, ELNH-SWGR-002 through variable frequency speed drive HVAC-VFD-002.

3.4.2.3 Provide electrical power feed to Exhaust Air Fan HVAC-FAN-003 from 480V switchgear bus no. 3, ELNH-SWGR-003 through variable frequency speed drive HVAC-VFD-003.

3.4.2.4 Provide electrical power feed to Isolation Damper HVAC-DMP-021 for exhaust fan HVAC-FAN-001 from motor control center ELNH-MCC-001.

3.4.2.5 Provide electrical power feed to Isolation Damper HVAC-DMP-022 for exhaust fan HVAC-FAN-002 from motor control center ELNH-MCC-002.

3.4.2.6 Provide electrical power feed to Isolation Damper HVAC-DMP-023 for exhaust fan HVAC-FAN-003 from motor control center ELNH-MCC-003.

3.4.2.7 Provide electrical power feed to fan room #1 exhaust fan HVAC-FAN-006 from motor control center ELNH-MCC-001.

3.4.2.8 Provide electrical power feed to diesel generator room #1 exhaust fan HVAC-FAN-011 from motor control center ELNH-MCC-001.

3.4.2.9 Provide electrical power feed to room heater in fan room #1 HVAC-HTR-001 from motor control center ELNH-MCC-001.

3.4.2.10 Provide electrical power feed to room heater in diesel generator room #1 HVAC-HTR-004 from motor control center ELNH-MCC-001.

3.4.2.11 Provide electrical power feed to fan room #2 exhaust fan HVAC-FAN-008 from motor control center ELNH-MCC-002.

3.4.2.12 Provide electrical power feed to diesel generator room #2 exhaust fan HVAC-FAN-010 from motor control center ELNH-MCC-002.

3.4.2.13 Provide electrical power feed to room heater in fan room #2 HVAC-HTR-003 from motor control center ELNH-MCC-002.

3.4.2.14 Provide electrical power feed to room heater in diesel generator room #2 HVAC-HTR-005 from motor control center ELNH-MCC-002.

3.4.2.15 Provide electrical power feed to fan room #3 exhaust fan HVAC-FAN-007 from motor control center ELNH-MCC-003.

3.4.2.16 Provide electrical power feed to control room exhaust fan HVAC-FAN-009 from motor control center ELNH-MCC-003.

3.4.2.17 Provide electrical power feed to room heater in fan room #3 HVAC-HTR-002 from motor control center ELNH-MCC-003.

3.4.2.18 Provide electrical power feed to control room heater HVAC-HTR-006 from motor control center ELNH-MCC-003.

3.4.2.19 Provide electrical power feeds to access room heaters HVAC-HTR-007 & HVAC-HTR-008 from motor control center ELNH-MCC-003.

3.4.2.20 Provide 120V electrical branch power circuits to train #1 controls from UPS power ELLV-UPS-001. Consider minimum 5 – 20A, 120V circuits.

3.4.2.21 Provide 120V electrical branch power circuits to train #2 controls from UPS power ELLV-UPS-003. Consider minimum 5 – 20A, 120V circuits.

3.4.2.22 Provide 120V electrical branch power circuits to common fan controls from UPS power ELLV-UPS-003. Consider minimum 5 – 20A, 120V circuits.

3.4.3 Glovebox Exhaust System Electrical Power - Refer to S/L Diagram E-E2-K-02240: Electrical Power required for the Glovebox exhaust system is classified as Safety Significant (SS) and shall meet all appropriate requirements.

3.4.3.1 Provide electrical power feed to Glovebox Exhaust Fan HVAC-FAN-004 from ELNH-MCC-012E, Cubicle 2A through variable frequency speed drive located at the fan motor.

3.4.3.2 Provide 120V, 20A circuit for the Isolation damper for HVAC-FAN-004 from UPS power panel located on -20' Level ELLV-PNL-2.

3.4.3.3 Provide electrical power feed to Glovebox Exhaust Fan HVAC-FAN-005 from ELNH-MCC-012E, Cubicle 2C through variable frequency speed drive located at the fan motor.

3.4.3.4 Provide 120V, 20A circuit for the Isolation damper for HVAC-FAN-005 from UPS power panel located on -20' Level ELLV-PNL-2.

3.5 Plant Design

3.5.1 Ductwork quantities have been estimated in attachment 7.1.

3.6 Civil/Structural/Architectural

3.6.1 The C/S/A scope of work required for installation of supports for the major components and ducts of the Heating Ventilating and Air Conditioning (HVAC) Systems is as follows:

3.6.2 Duct Work.
There are two floors, -20 Level and -40 Level, of KAC building served by the HVAC Duct system. The HVAC Duct supports on -20 Level will be attached to the concrete ceiling above -20 Level floor. The supply ducts size greater than 45" wide and all the exhaust ducts will be supported on the rigid frame made of TS 3 x 3 x 0.25, which will be welded to 9" x 9" x ½" thick base plates. Each base plate will be anchored with ½" diameter bolts to the concrete ceiling.
The remaining supply ducts (smaller than 45" wide) will be supported on the structural steel angles of different sizes which will be hanged with 5/8" diameter threaded rods on the brackets. Each bracket will be welded to 10" x 4" x ½" thick base plate. Each Base plate will be anchored with ½" diameter bolts to the concrete ceiling above -20 Level floor.

3.6.3 Air Handling Units [3]
The size of each Air Handling Unit is approximately 33' X 16' X 10' high and each weighs approximately 60000 lbs. Each AHU is supplied with a structural steel base for mounting which will be anchored with ½ " diameter bolts to the concrete floor at the 0 Level.

3.6.4 Exhaust air Fans (3)
The size of each fan is approximately 7' X 5' X 9'-6" high and each weighs approximately 6400 lbs. Each fan is supplied with a mounting frame at the base with 7- 11/16" diameter mounting holes. It will be anchored with 5/8" diameter bolts on concrete floor of the fan house.

3.6.5 Glovebox HEPA Filter Housing (2)
The size of each Glovebox is approximately 15' X 4'-6" X 7' high and each box weighs approximately 7200 lbs. Each Glovebox is supplied with a mounting frame of structural steel at the base with 28- 9/16" diameter mounting holes. It will be anchored with ½" diameter bolts on concrete floor at the -20 Level.

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 fabricate and install all ductwork, accessories, and supports.

4.2 Specific Assumptions

4.2.1 Mechanical

4.2.1.1 It is assumed that exhaust duct will penetrate approximately 30 fire barriers. The duct penetrating these barriers will be provided with Fire Resistance Duct Wraps. Fire Resistance Duct wraps will be installed 10 feet, on each side of the wall, on the duct penetrating the fire barriers.

4.2.2 Instrumentation

4.2.1.1 It is assumed that the placement of the 105-K building differential pressure indicating transmitters, static (outside) atmosphere probes, pressure averaging chambers and atmospheric sensor expansion tanks, quantity and routing of tubing, will be similar to that for CLWR-TEF.

4.2.1.2 It is assumed the isokinetic particulate sampling system channels will be similar to those for 241-81H.

4.2.3 Electrical

4.2.3.1 Safety Class (SC) power will be used only for the Exhaust Fan System at Sand Filter Fan House Building. Power for the Glovebox exhaust fans will be SS. No SC class power will be provided in KAC process building except for the controls of Safety Class equipment. This power will be provided from the fan house building Electrical Power Distribution System.

4.2.4 Plant Design

4.2.4.1 Since duct layout is not complete, 20% of additional weights are added in the total duct weights.

4.2.5 Civil/Structural/Architectural

4.2.5.1 Core drills will be required for routing electrical conduit through walls or floors.

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

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

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

4.2.5.5 Any components inside any equipment like AHU, Glove Box etc. are the integral parts of this equipment as one unit.

4.2.5.6 The average spacing between the HVAC Duct supports will conservatively be assumed to be 6 feet. All the HVAC Ducts supports outside the KAC building are excluded from this scope.

4.2.5.7 The supports for the Exhaust fans to the floor of the new Exhaust fan-house building is included in the estimate.

4.2.5.8 The material for all the base plates and structural steel components shall be galvanized carbon steel.

5.0 Technology Development Issues

There are currently no technology issues for the HVAC systems.

6.0 REFERENCES

6.1 Drawing List

6.1.1 PUD Project Drawings & Sketches

6.1.1.1 M-M5-K-01952 - HVAC- Supply Air, Elevation -40, Air Flow Diagram
6.1.1.2 M-M5-K-01953 - HVAC- Supply Air, Elevation -20, Air Flow Diagram
6.1.1.3 M-M5-K-01954 - HVAC- Exhaust Air, Elevation -40, Air Flow Diagram
6.1.1.4 M-M5-K-01955 - HVAC- Exhaust Air, Elevation -20, Air Flow Diagram
6.1.1.5 M-M5-K-01956 - HVAC- Exhaust Air, Fan House and Sand Filter, Air Flow Diagram
6.1.1.6 M-M5-K-01957 - HVAC- Exhaust and Supply Air, Air Flow Diagram
6.1.1.7 M-M6-K-02310 - HVAC- Supply Air, Piping and Instrumentation Diagram
6.1.1.8 M-M5-K-02311 - HVAC- Exhaust Air, Piping and Instrumentation Diagram
6.1.1.9 M-M5-K-01970 - Glovebox Exhaust System, Air Flow Diagram
6.1.1.10 M-M6-K-02293 - Glovebox Exhaust System, Piping and Instrumentation Diagram
6.1.1.11 E-E2-K-02232 – Single Line Diagram - Motor Control Center ELNH-MCC-11M
6.1.1.12 E-E2-K-02233 – Single Line Diagram - Motor Control Center ELNH-MCC-18M
6.1.1.13 E-E2-K-02236 – Single Line Diagram - 13.8KV-480V SWITCHGEAR
6.1.1.14 E-E2-K-02237 – Single Line Diagram – MCC - 001
6.1.1.15 E-E2-K-02238 – Single Line Diagram – MCC - 002
6.1.1.16 E-E2-K-02239 – Single Line Diagram – MCC – 003
6.1.1.10 J-J8-K-00032 – HVAC Control Block Diagram
6.1.1.11 J-J8-K-00027 – Stack Radiation Monitoring System Layout

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 M-SYD-K-00005, Rev. C, "HVAC System (HVAC) SDD"

6.3 Applicable SRS & Industry Codes, Guides and Standards

6.3.1 Industry Codes and Standards

6.3.1.1 ASME AG-1, Code for Nuclear Air and Gas Treatment
6.3.1.2 ASHRAE Handbooks - HVAC Fundamentals, Applications, systems
6.3.1.3 NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems
6.3.1.4 IEEE-306 - Standard Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities
6.3.1.5 IEEE-338 - Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems
6.3.1.6 IEEE-379 - Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems
6.3.1.7 IEEE-383 - Type test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations
6.3.1.8 IEEE-384 - Standard Criteria for Independence of Class 1E Equipment and Circuits
6.3.1.8 IEEE-577 - Standard Requirements for Reliability Analysis in the Design and Operation of Safety Systems for Nuclear Facilities
6.3.1.9 IEEE-603 - Standard Criteria for Safety Systems for Nuclear Power Generating Stations
6.3.1.10 ANSI/ISA-S67.04 - Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation
6.3.1.11 ANSI/AMSE AG-1-2003 - Code on Nuclear Air and Gas Treatment

6.3.1.12 NFPA 70 (2005 edition), National Electrical Code

6.3.2 SRS Guides & Standards

6.3.2.1 SRSESM 16051-G Rev. 2, Installation of Electrical Raceway Systems and Cable Trays
6.3.2.2 SRSESM 16052-G Rev. 3, Installation of Electrical Wires, Cables and Termination
6.3.2.3 SRSESM 16053-G, Rev. 2, Installation of Electrical Equipment
6.3.2.4 SRSESM 16056-G Rev 2, Installation of Grounding Systems
6.3.2.5 SRSESM 15980, Rev. 0, "Mechanical Installation of Safety Class and Safety Significant Instrumentation"
6.3.2.6 SRSESM 01703, "Application of ISA S84-01 for SRS Non-Reactor Facilities"
6.3.2.7 SRSESM 01061, "Qualification of Systems, Equipment & Components for Natural Phenomena Hazards"
6.3.2.8 Engineering Guide 01703-G, "Design Guidance for Instrumented Systems That Are Used in Safety Significant and Hazardous Processes"

6.4 Related Scopes of Work (SOW)

6.4.1 M-SOW-K-00022, Balance of Plant - Water System - This related SOW provides the Chilled Water Requirements.

6.4.2 F-SOW-K-00001, Fire Protection System - This related SOW provides the Fire Protection Requirements.

6.4.3 E-SOW-K-00017, Electrical Power Supply System - This related SOW provides the Electrical Power Requirements for all classes of power SC, SS and PS/GS.

6.4.4 J-SOW-K-00002, Integrated Control System/Control Room- Instrumentation and controls for these systems will be connected to the ICS and Control Room as described in this related SOW.

6.4.5 C-SOW-K-00009, Structural and Architectural Modifications for the K-Area Complex

6.4.6 C-SOW-K-00010, Structural and Architectural Modifications Outside the PIDAS

6.5 Miscellaneous

6.5.1 None

7.0 ATTACHMENTS

7.1 Attachment 7.1, Mechanical HVAC Ductwork Bulk Material List (1 Page)
7.2 Attachment 7.2, Electrical and I&C Bulk Material List (2 Pages)
7.3 Attachment 7.3, C/S/A Bulk Material List (1 Page)

ATTACHMENT 7.1

HVAC Duct Material Summary Report

HVAC Ductwork Bulk Material - Summary Table

Supply System Duct - Galvanized Steel

System	Description	Material	Weight - Lbs.	Insul. Matl	Ins Thk - inches
SUPPLY	DUCT - RECTANGULAR	GALVANIZED STEEL	78,135	GLASS WOOL	2
SUPPLY	FITTINGS - RECT.	GALVANIZED STEEL	10,664	GLASS WOOL	2
TOTAL WEIGHT---------->			88,799		
ADD 20% SEE NOTE BELOW---------->			17759.8		
**TOTAL WEIGHT (Galvanized Steel) ---------->			**106,559**		

Exhaust System Duct - Stainless Steel

System	Description	Material	Weight - Lbs.	Insul. Matl	Ins Thk - inches
EXHAUST	DUCT - ROUND	STAINLESS STEEL	27,836	NONE	N/A
EXHAUST	FITTINGS - ROUND	STAINLESS STEEL	4,083	NONE	N/A
TOTAL WEIGHT---------->			31,919		
ADD 20% SEE NOTE BELOW---------->			6383.8		
**TOTAL WEIGHT (Stainless Steel)---------->			**38,303**		

Note: This duct report is based on approximately 80% of the duct Layout. Therefore additional 20% of the weight is added

ATTACHMENT No. 7.2
(Bulk Material Summary)

Scope Set: HVAC

Date: 4/12/07

Prepared By: Suman Shah

Reviewed By: R. King

Cables

Sum of Qty XGB (ft)	
Ext. Cable Size/Type	Total
1/C 500kcmil	5,610
1/C #1/0 GND	1,870
1PR #16 TWSH	13,425
3/C #4/0	360
3/C #12 w/gnd	4,170
5/C #14 w/gnd	8,220
3/C #10 w/gnd	4,390
3/C #2 w/gnd	420
2/C #12 w/gnd	4,400
1/C-500kcmil	1,080
1/C #2/0 GND	360
7/C #16	4,760
2PR #16 TWSH	3,500
Grand Total	52,565

Interior Glovebox Cables

Sum of Qty NGB (ft)	
GB Cable Size/Type	Total
Grand Total	

All Raceway Types

Sum of Qty Rcwy (ft)	
RCWY	Total
1" IMC	3,720
2" IMC	760
3/4" IMC	11,065
3" RGS	1,990
	0
Grand Total	17,535

All Raceway Types Grouped by SC Designation

Sum of Qty Rcwy (ft)		
SC	RCWY	Total
N	1" IMC	3,000
	2" IMC	760
	3/4" IMC	5,750
	3" RGS	1,750
N Total		11,260
Y	1" IMC	720
	3/4" IMC	5,315
	3" RGS	240
Y Total		6,275
Grand Total		17,535

ATTACHMENT No. 7.2

(Bulk Material Backup Data)

Description: HVAC System Bulk Materials, Cable and Conduit
Reference: E-E2-K-02232, E-E2-K-02233, E-E2-K-02236, E-E2-K-02237, E-E2-K-02238, E-E2-K-0039, J-J8-K-00027, J-J8-K-00032

Item #	From Equipment	To Equipment	Cable Estimates (Exterior GB)			Shared Rcwy/Tray	Raceway Estimates				
			XGB Length (A) (ft)	Qty (A)	Cable size/type	Length (C) (ft)	Length (D) (ft)	Qty (D)	Size/Desc. (D)	SC	Notes/Comments
1	ELNH-MCC-11M,4D	HVAC-AHU-001,2&3	120	3	3/C #4/0	0	100	3	2" IMC	N	Production Support
2	ICS - CAB	HVAC-AHU-001,2&3	120	3	7/C #16	0	100	3	3/4" IMC	N	Production Support
3	ICS - CAB	HVAC-AHU-001,2&3	120	15	2PR #16 TWSH	0	100	3	2" IMC	N	Production Support
4	TRANS#1-M14	HVAV-HCL-001	95	6	1/C 500kcmil	0	75	2	3" RGS	N	Production Support
			95	2	1/C #1/0 GND	75	0	0		N	Production Support
5	TRANS#1-M42	HVAV-HCL-002	320	6	1/C 500kcmil	0	300	2	3" RGS	N	Production Support
			320	2	1/C #1/0 GND	300	0	0		N	Production Support
6	TRANS#3-M38	HVAV-HCL-003	520	6	1/C 500kcmil	0	500	2	3" RGS	N	Production Support
			520	2	1/C #1/0 GND	500	0	0		N	Production Support
7	ELNH-MCC-18M	HVAC-EHTR-001X	260	15	3/C #12 w/gnd	140	100	15	1" IMC	N	Production Support
			260	15	5/C #14 w/gnd	240	0	0		N	Production Support
8	ELNH-MCC-18M	HVAC-EHTR-002X	260	15	3/C #10 w/gnd	140	100	15	1" IMC	N	Production Support
	ELNH-MCC-18M	HVAC-EHTR-002X	260	15	5/C #14 w/gnd	240	0	0		N	Production Support
9	ELNH-MCC-18M, 2E	HVAC-EHTR-020	420	1	3/C #2 w/gnd	240	160	1	2" IMC	N	Production Support
	ELNH-MCC-18M, 2E	HVAC-EHTR-020	420	1	5/C #14 w/gnd	400	0	0		N	Production Support
10	ELLV-PNL-XXX	DAMPERS	220	20	2/C #12 w/gnd	100	100	20	3/4" IMC	N	Production Support
11	ICS - CAB	DAMPERS	220	20	7/C #16	100	100	20	3/4" IMC	N	Production Support
12	ELNH-MCC-12E,2A	HVAC-FAN-004	245	1	3/C #10 w/gnd	75	150	1	3/4" IMC	N	Safety Significant
13	ELNH-MCC-12E,2C	HVAC-FAN-005	245	1	3/C #10 w/gnd	75	150	1	3/4" IMC	N	Safety Significant
14	ELNH-SWGR-001	HVAC-FAN-001	60	6	1/C-500kcmil	0	40	2	3" RGS	Y	Safety Class
			60	2	1/C #2/0 GND	40	0	0			
15	ELNH-SWGR-002	HVAC-FAN-002	60	6	1/C-500kcmil	0	40	2	3" RGS	Y	Safety Class
			60	2	1/C #2/0 GND	40	0	0			
16	ELNH-SWGR-003	HVAC-FAN-003	60	6	1/C-500kcmil	0	40	2	3" RGS	Y	Safety Class
			60	2	1/C #2/0 GND	40	0	0			
17	Stack Monitor	Central Contol Rm	1095	2	1PR #16 TWSH	525	550	2	3/4" IMC	Y	Safety Class
18	Fan House CR	105K DP x-mitters	905	4	1PR #16 TWSH	525	360	2	1" IMC	Y	Safety Class
19	Fan House CR	HVAC-AHU-001-003 INTLK	1285	2	1PR #16 TWSH	525	740	2	3/4" IMC	Y	Safety Class
20	Fan House CR	HVAC-DMP-031	1225	2	1PR #16 TWSH	525	680	2	3/4" IMC	Y	Safety Class
21	Fan House CR	GB HEPA FTR RM	1045	1	1PR #16 TWSH	525	500	2	3/4" IMC	Y	Safety Class
22	Fan House CR	HVAC-FAN-001, -002, -003	85	6	1PR #16 TWSH	30	35	3	3/4" IMC	Y	Safety Class
23	Fan House CR	HVAC-DMP-021, -022, -023	85	6	1PR #16 TWSH	30	35	3	3/4" IMC	Y	Safety Class
24	Fan House CR	HVAC-DMP-027	65	2	1PR #16 TWSH	30	15	3	3/4" IMC	Y	Safety Class
25	Fan House CR	FH UPS	50	4	3/C #12 w/gnd	0	30	4	3/4" IMC	Y	Safety Class
26	GB HEPA Filter RM	HVAC-FAN-004, -005	50	4	1PR #16 TWSH	0	30	2	3/4" IMC	N	Safety Significant
27	GB HEPA Filter RM	HVAC-DMP-032, -033	50	4	1PR #16 TWSH	0	30	2	3/4" IMC	N	Safety Significant
28	GB HEPA Filter RM	GB UPS	35	2	3/C #12 w/gnd	0	15	2	3/4" IMC	N	Safety Significant
29	ICS - CAB	MISC. Instr.	170	10	2PR #16 TWSH	50	100	10	3/4" IMC	N	Production Support

ATTACHMENT 7.3
C/S/A Bulk Material List for HVAC System

Item No.	Description of Item	Size of Item	Total Quantity	Remarks
1	Structural Steel L	L 2 x 2 x ¼	1050 Ft.	
2	Structural Steel L	L 3 x 3 x ¼	350 Ft.	
3	Structural Steel L	L 4 x 4 x ¼	2200 Ft.	
4	Tube Steel	TS 3 x 3 x 0.25	1860 Ft.	
5	Threaded Rod	5/8" Diameter	3160 Ft.	
6	Rod Brackets	For 5/8" Diameter	980 Ea.	
7	Base Plates	10" x 4" x ½" Thick	980 Ea.	
8	Base Plates	9" x 9" x ½" Thick	724 Ea.	
9	Bolts	½" Diameter	4730 Ea.	
10	Bolts	5/8" Diameter	12 Ea.	