DOE F 1325.8

United States Government **Department of Energy (DOE)**

memorandum

Savannah River Operations Office (SR)

DATE: FEB 6 2007

REPLY TO ATTN OF: SRPD (Mark A. Smith, 803-952-9613)

SUBJECT: Request for Concurrence with Recommendation of the Defense Nuclear Facilities Safety Board (DNFSB) 2004-2 Plutonium Disposition Project Ventilation System Evaluation Report

TO: Dae Y. Chung, Deputy Assistant Secretary for Safety Management and Operations Environmental Management (EM-60), HQ

The Savannah River Site (SRS) has completed the attached DNFSB 2004-2 Plutonium Disposition Project Ventilation System Evaluation Report. The Plutonium Disposition Project Evaluation Report generated by the Facility Evaluation Team states that the Plutonium Disposition Project will be designed to meet the requirements of the DNFSB 2004-2 performance criteria identified in Table 5-1 of the DNFSB 2004-2 Ventilation System Evaluation Guidance. This memorandum requests that you, as the Office of Environmental Management (EM) technical lead for DNFSB 2004-2, coordinate the review of the Plutonium Disposition Project Evaluation Report with the Independent Review Panel, Program Secretarial Officer, and Central Technical Authority. After coordination of the review with the necessary parties, I request that you provide concurrence with the Plutonium Disposition Project Evaluation Report's path forward by February 28, 2007, to support the critical path schedule for the Plutonium Disposition Project.

If you have any questions, please contact me or have your staff contact Mark A. Smith at 803-952-9613.

Jeffrey M. Allison
Manager

SRPD:MAS:sl

OESH-07-0064

Attachment:
Final DNFSB 2004-2
Evaluation Report

cc w/attachment:
Inés R. Triay (EM-3), HQ
Percy Fountain (EM-3.2), HQ

Attachment: Memo, Allison to Chung,
SUBJECT: Request for Concurrence with Recommendation of the DNFSB 2004-2 Plutonium Disposition Project Ventilation System Evaluation Report, dated:

FEB 6 2007

SRS SITE EVALUATION TEAM CONCURRENCE
Final DNFSB 2004-2 Evaluation Report

Facility: **Pu Disposition Project.** WSRC Letter M&O-NMM-2006-00211, dated December 13, 2006 "DNFSB Recommendation 2004-2 Evaluation of the Pu Disposition Project"

Reference:

1. Commitment 8.6.3 of DNFSB 2004-2 Implementation Plan Revision 1, dated July 12, 2006

2. Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems, dated January 2006, Revision 0.

In accordance with the References above, the SRS Site Evaluation Team has reviewed and concurs with the submittal of the attached Pilot DNFSB 2004-2 Ventilation System Evaluation Report for the Pit Disassembly and Conversion Facility.

Site Evaluation Team (SET) Concurrence:

Signature on File	1/18/07
Mark A. Smith, DOE-SR, Site Lead for SET	Date
Signature on File	1/18/07
Andrew M. Vincent III, WSRC Lead for SET	Date

SRS Site Evaluation Team consists of the following personnel:

DOE Site Lead and SET Chairman (Mark A. Smith, OESH/SRPD)
DOE Alternate Site Lead & Safety Basis SME (Don J. Blake, AMWDP/WDED)
DOE Ventilation System and Natural Phenomena Hazards SME (Brent J. Gutierrez, AMWDP/WDED)
WSRC 2004-2 Site Lead & Safety Basis SME (Andrew M. Vincent III, Technical & Quality Services/Nuclear Safety Department Mgr)
WSRC Ventilation System SME (Scott J. MacMurray, Savannah River National Laboratory/Facility Engineering)
WSMS Safety Basis SME (Robert R. Lowrie)
WSRC SET Administrative Assistant (Barbara A. Pollard, Technical & Quality Services/Nuclear Safety Department)

SAVANNAH RIVER SITE
Aiken, SC 29808 • www.srs.gov

DEC 1 3 2006

M&O-NMM-2006-00211
RSM Track #: 10666

Dr. Karen L. Hooker
Director, Office of Environmental, Safety and Health
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

Dear Dr. Hooker:

DNFSB RECOMMENDATION 2004-2 EVALUATION OF THE Pu DISPOSITION PROJECT

Ref: Letter, R. Pedde to J. M. Allison, WSR-2006-00192, *Letter of Direction for Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2004-2, Active Confinement Systems*, 9/11/06

This letter transmits the final report of the DNFSB Recommendation 2004-2, Active Confinement Systems for the Pu Disposition Project. This report has been completed and approved by the Facility Evaluation Team (FET) for submittal to the Site Evaluation Team (SET). This evaluation was performed in accordance with the DOE guidance provided in "Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems". The evaluation indicated no gaps exist based on the present state of Safety Basis work. As the project matures and analysis indicates opportunities for gap development, the same evaluation techniques will be used to explore those opportunities.

Please contact me or Dave Eisele (2-9245) of my staff for any questions concerning this evaluation.

Sincerely,

E. L. Davis
Area Project Manager
Nuclear Materials Management

/de
Att.

c: P. W. McGuire, DOE-SR, 703-H
H. A. Gunter, 703-H
M. A. Smith, 730-B
R. E. Edwards, 703-H
R. L. Salizzoni, WSRC, 730-4B
C. W. McMullin, 717-K
T. M. Monahon, 705-K
R. M. Sprague, 705-K
D. W. Armstrong, 705-K
T. N. Butler, 705-K
W. F. Bates, 717-K
L. Carey, 730-1B
D. W. McGee, 717-K
Records Administration, 773-52A

Savannah River Site
Pu Disposition
K Area

DNFSB Recommendation 2004-2
Ventilation System Evaluation

Rev 0

December 6, 2006

UNCLASSIFIED

DOES NOT CONTAIN
UNCLASSIFIED CONTROLLED
NUCLEAR INFORMATION

ADC &/or
Reviewing
Official: D. P. [illegible]

Date: 6 DEC 06

Review and Approval

Facility Evaluation Team Concurrence:

D. P. Eisele, Pu Disposition DA Lead	6 DEC 06 Date
W. W. Osborne, WSMS Pu Disposition HA Lead	12/6/2006 Date
A. B. Shah, DA Pu Disposition HVAC SME	12/6/06 Date
A. A. Amin, DE Pu Disposition HVAC SME	12/6/2006 Date
G. L. Cauthen, Pu Disposition DWPF DA Lead	12/6/2006 Date

Table of Contents

Review and Approval 2

Table of Contents 3

List of Tables 4

List of Figures 4

Definitions 4

Abbreviations and Acronyms 5

Executive Summary 6

1. Introduction 7

1.1 Facility Overview 7

1.2 Confinement Ventilation System Strategy 8

1.3 Major Modifications 10

2. Functional Classification Assessment 10

2.1 Existing Classification 10

2.2 Evaluation 11

2.3 Summary 11

3. System Evaluation 11

3.1 Identification of Gaps 11

3.2 Gap Evaluation 12

3.3 Modifications and Upgrades 12

4. Conclusion 12

References 13

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria 14

Attachment 2 – 2004-2 Table 4.3, Bounding Hazards – TABLE 28

Attachment 3 – Figures 30

Attachment 4 – Pu Dispositon Project Evaluation Team, Biographies 32

List of Tables

Table 5.1- Ventilation System Performance Criteria, Attachment 1.

Table 4.3 - Bounding Hazards. Attachment 2.

List of Figures

Figure 1 – Facility Process Flow Diagram, Attachment 3

Figure 2 – Process Building HVAC Flow Concept, Attachment 3

Definitions

3013	A container holding Plutonium and packaged per DOE Standard 3013.
9975	Type B shipping package that may contain a 3013 container.
Confinement	A building, building space, room, cell, glovebox, or other enclosed volume in which air supply and exhaust are controlled and filtered.
Confinement System	The barrier and its associated systems (including ventilation) between areas containing hazardous materials and the environment or other areas in the facility that are normally expected to have levels of hazardous material lower than allowable concentration limits.
Containment	A barrier that precludes release of radionuclides by maintaining a mechanical seal with a quantified leakage requirement.
Hazard Category	Hazard Category is based on hazard effects of unmitigated release consequences to offsite, onsite, and local workers.
Performance Category	A classification based on a graded approach used to establish the NPH design and evaluation requirements for structures, systems and components.
Ventilation System	The ventilation system includes the structures, systems, and components required to supply air to, circulate air within, and remove air from a building/facility space by natural or mechanical means.

Abbreviations and Acronyms

ACVS	Active Confinement Ventilation System
Am	Americium
CD	Critical Decision
CFM	Cubic Feet per Minute
CHAP	Consolidated Hazards Analysis Process
CSSC	Container Surveillance and Storage Capability
CW	Co-located Worker
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DU	Depleted Uranium
DSA	Documented Safety Analysis
DWPF	Defense Waste Processing Facility
EG	Evaluation Guideline
EU	Enriched Uranium
FW	Facility Worker
GS	General Services
HEPA	High Efficiency Particulate Air
KAC	K-Area Complex
LaBS	Lanthinide Borosilicate
MAR	Material At Risk
MT	Metric Ton
Np	Neptunium
NPH	Natural Phenomena Hazard
NU	Natural Uranium
PC	Performance Category
PS	Production Support
Pu	Plutonium
PUV	Plutonium Vitrification
SC	Safety Class
SRS	Savannah River Site
SS	Safety Significant
SSCs	Structures, Systems and Components

Executive Summary

The Plutonium Vitrification (PUV) Facility was identified as a high evaluation priority for the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2004-2 evaluation effort. This confinement ventilation evaluation has been developed in accordance with the Department of Energy (DOE) evaluation guidance for DNFSB Recommendation 2004-2. The Plutonium Disposition Project is in the conceptual design phase and will be constructed at the Savannah River Site (SRS). The safety basis documentation is in the early stages of development but the preliminary Consolidated Hazard Analysis Process (CHAP or CHA) results were adequate to perform this initial review.

The PUV Facility is baselined as a Hazard Category 2 (HC-2) facility. The PUV stores and processes hazardous materials for which confinement ventilation system safety functions will be credited. The PUV facility Active Confinement Ventilation System (ACVS that includes filtration, main exhaust and required support systems) are functionally classified as Safety Class (SC) for protection of the public and are designed to meet Performance Category 3 (PC-3) criteria for NPH events. The Primary Confinement Ventilation System (PCVS that includes the glovebox exhaust) is classified as Safety Significant (SS) for facility worker protection and is designed to meet PC-2 seismic criteria for confinement functions. The glovebox exhaust is filtered through the SC sand filter and main exhaust fans; consequently, the primary exhaust filters are not credited as providing confinement a SC or SS filtration function.

In accordance with the DOE 2004-2 evaluation guidance, the SC and SS CVS subsystems were evaluated using applicable SC and SS criteria defined in Table 5.1. The functional classifications are based on the predicted radiological consequences to receptors from bounding postulated events as derived from initial CHA modules. The potential for gaps between the SC and SS criteria and the facility conceptual design were reviewed and none identified at this time. Should future safety analysis identify additional events requiring different control strategies, 2004-2 criteria will be utilized as input to determine appropriate controls.

The Defense Waste Processing Facility (DWPF) will receive racked Pu laden glass cans in an otherwise typical DWPF canister for final glass pour in the normal DWPF processing mode. The DWPF operation meets the exclusion criteria of glass without energetic release potential (CE-4, *Exclusion Reporting Criteria*), resulting in no DSA changes required for the existing DWPF confinement function.

1. Introduction

1.1 Facility Overview

The PUV Facility will be located in the existing K-Area Complex (KAC) primarily in what was previously the reactor process areas of -20' and -40' levels. The purpose of the PUV project will be to vitrify surplus EM-owned plutonium residues for eventual disposal. The EM feed represents approximately 13 MT of surplus plutonium metal and oxide, along with 8 MT of other impurities (includes actinides such as Am, EU, DU, NU, Np, etc.). The incoming materials are in the form of pure and impure oxide, metal and alloys packaged into 3013 interim storage containers and intact Green Fuel (sintered Pu pellets).

Figure 1 presents the process flow discussed below. The 3013 containers of the process material are first unpackaged from the 9975 shipping packages and placed in a storage vault on 0' level. The 3013 containers of plutonium oxide or metal are drawn from storage and unpackaged and processed in the feed preparation area to an acceptable oxide feed for the vitrification process. The plutonium metal contained in 3013 containers is converted to oxide using a DMO furnace before being transferred to the feed preparation glovebox. Green Fuel assemblies are disassembled and the fuel pellets drawn from the fuel pins for introduction into feed preparation.

The prepared oxide is then blended in an attritor mill with glass frit to form a homogenous mixture. The blended mix is then transferred in a transport hopper and melted to form a lanthanide borosilicate (LaBS) glass that immobilizes the weapons-useable plutonium. The melted glass product is loaded into stainless steel cans and sealed in bagless cans. The bagless cans are loaded into magazines (4 per) and seven magazines are inserted into a framework inside of a DWPF canister to form a can-in-canister assembly. The can-in-canister assemblies are then loaded onto a truck and transported to the DWPF. The can-in-canister is filled with High Level Waste glass and the canister is stored at DWPF prior to eventual disposition at a National Repository.

PUV is designed to process approximately 13 MT of weapons-useable plutonium (~ 21 MT of bulk Pu material) for a planned 6-year operation. PUV operations are compartmentalized into rooms so that batch operations for that module can proceed without impacting adjacent modules. Rooms are arranged to provide for efficient and logical movement of material that is to be unpackaged, processed, vitrified, canned, and loaded into canisters. The PUV process will produce moderate quantities of LLW and TRU waste (material containers and job waste) from the processes, which will be processed for transfer to the onsite Waste facilities where it is either dispositioned on site or shipped to an offsite disposal location.

The project processing area primarily consists of two main areas: the Pu processing area on the -40' level and the support systems on the -20' level. The process area has all the Pu bearing gloveboxes and processing equipment. The support systems on -20 are the

typical air, water, electrical systems plus waste segregation and storage. Material introduction of 3013s will originate on the 0' level.

The 2004-2 guidance discusses safety basis in terms of existing DSA. The PUV is in the CD-1 phase of project evolution and no documented safety basis exists. The CHA process is incomplete and accident selection, with the resultant mitigators identified, has not started. There are several items germane to this report that can be stated. The facility is baselined as HC-2. The MAR in the processing area is multiple kilos of highly respirable Pu oxides. Energetic events are projected to aerosolize considerable quantities of this material. The CHA process has identified several scenarios that produce High qualitative doses to all receptors. This report assumes bounding accidents exist that require active confinement controls. The initial CHA results are bounding to all receptors (offsite individual, co-located and facility workers) thus, future quantitative results will not lead to more restrictive controls.

1.2 Confinement Ventilation System Strategy

The purpose of the PUV Heating, Ventilation, and Air Conditioning (HVAC) System is to provide confinement ventilation that minimizes the spread of potentially airborne radiological contaminants within the facility and to the environment and limits exposure to receptors to within appropriate guidelines. The HVAC system also provides proper environmental control for the health, safety, and comfort of the operating personnel and for equipment protection.

The PUV Facility will be housed within the KAC structure. The principal process areas (Feed Preparation, Oxidation, Milling and Mixing, Vitrification, Bagless Transfer, and Green Fuel Disassembly) will be located on the -40' elevation of the KAC and will be segregated into compartments by separation walls to guard against propagation of an accident event from one process area to another. A common corridor, which will provide personnel access for operation and maintenance to each process area will be designed as a clean area with airlocks provided to control and monitor access into potentially contaminated areas. The -20' elevation of the process building will be the support level, located above the process level, and will also be segregated into compartments by separation walls. The -20' elevation floor houses mainly support systems, such as HVAC, electrical distribution, inert gas systems, etc. that will be required to service the process areas below.

The PUV HVAC System will be designed with confinement zones 1, 2 & 3 (Primary, Secondary, and Tertiary). Zone 1 includes the areas of highest potential for contamination (e.g. gloveboxes & hoods); Zone 2 includes surrounding areas of the Zone 1 in the process rooms; and Zone 3 includes the clean areas (e.g. clean corridors, office spaces, control rooms, etc.). To maintain confinement of hazardous materials, airflow within the building will be from clean areas to areas of successively higher potential for contamination. Air Locks will be provided between clean areas and potentially contaminated areas for contamination control. All material transports between zones 1,2&3 will be by sealed containers (3013s or vit cans) with the following exception –

Green Fuel sintered pellets will be bagged out in a convenience can and transported to Feed Prep through the -40 Zone 3 clean area. The sintered pellet material form (high fired ceramic) makes it very difficult to aerosolize, even in a room fire.

The HVAC system includes:

- Primary Confinement Air Supply (Air Handling Units)
- Primary Confinement Ventilation Glovebox/Hood Exhaust System (Primary Exhaust)
- Secondary and Tertiary Confinement Ventilation Supply (Air Handling Units)
- Secondary and Tertiary Confinement Ventilation Exhaust (Main Exhaust System)

An overall diagram of the confinement ventilation system is presented in Figure 2. It is intended to represent the confinement strategy of PUV only (the processing areas are on the -20 & -40 levels), recognizing that other portions of the building are being used for other purposes that are not part of the strategy described.

The process areas and potentially contaminated areas will be provided with a once through system with no recirculation. The HVAC system for support and non-contaminated/non-process areas will be re-circulating with some make-up air to compensate for the exhaust. The active component HVAC design will incorporate redundancy for Supply Air Handling Units and Primary, Secondary, and Tertiary Exhaust Systems for the reliability, availability and maintainability of the HVAC system. The HVAC system design must select components and materials of construction suitable for the corrosive environment to ensure high levels of system performance and reliability.

The Pu processing area secondary/tertiary confinement ventilation will be provided by three exhaust fans (EF) and three air-handling units (AHU) with two of each normally operating and one each in standby mode. The building static pressure will be controlled automatically by varying one SF's speed thru a variable frequency drive (VFD) and/or the inlet vane damper on one exhaust fan. The exhaust fans are SC and powered by dedicated SC emergency diesel generators.

The primary exhaust system (gloveboxes/hoods) will consist of SS redundant exhaust fans, a dedicated SS standby diesel generator and redundant bag-in/bag-out, two-stage, testable HEPA filter housings. Each inert glovebox has a re-circulating system purification/cooling loop venting to the exhaust system when required to adjust the differential pressure.

The main supply air system for the process areas will utilize AHUs consisting of filters, electric heating coils, chilled water cooling coils, and supply fan. Outside air will be conditioned in the AHUs to meet temperature and humidity requirements. The AHUs will utilize chilled water for cooling and humidity control, electric heat for pre-heating outdoor air and for zone temperature control in the space. Some of the PUV process gloveboxes will be inerted with Argon or Helium. When air is supplied to Zone 1 air gloveboxes from Zone 2 (process module rooms), the inlet will be provided with HEPA

filter to prevent the backflow of potentially contaminated air into the uncontaminated area.

The primary exhaust system for gloveboxes, hoods, and maintenance air flow for inert gloveboxes will consist of pre-filters, two-stage in-place testable HEPA filter housing and a fan. This subsystem will be SS with 100% redundancy. Air from the process gloveboxes (non-inert) and hoods will be exhausted first through gloveboxes and hoods, HEPA filters, and then through the main exhaust system.

The main exhaust system will consist of a sand filter located outside the PIDAS with an inlet/outlet tunnel, exhaust fans, and an exhaust stack. All exhaust streams will be filtered in the sand filter as a final stage and exhausted through the fan house to an elevated exhaust stack. The exhaust air will be sampled and continually monitored within the stack exhaust. The sand filter structure will be of reinforced concrete design that complies with the requirements of Performance Category PC-3 for NPH events. The sand filter, exhaust fans, diesel generators and inlet/outlet exhaust tunnel functional classification will be SC.

1.3 Major Modifications

The PUV project is currently in the "conceptual" phase (CD-1) and therefore design is not complete. The existing KAC main building will be modified to accept the new PUV facility. Extensive D&R of existing reactor components, primarily on the -20' and -40' levels of the reactor building, will occur to make room for the new process. The present DSA classifies the building as SC and it meets NPH PC-3 criteria. All modifications will be analyzed to maintain conformance to this and any other project driven safety basis constraints as they apply to the existing structure.

2. Functional Classification Assessment

2.1 Existing Classification

The system design involved with this project is only at the conceptual level with no accident analysis initiated. Initially, the ACVS (sand filter, main exhaust fans, diesel generators and exhaust ductwork from building to stack) for the PUV is functionally classified as SC and is PC-3 qualified for protection of the public. The ACVS is also initially credited to protect the co-located worker outside the facility. The PCVS (glovebox exhaust fans, diesel generator, HEPA filters and exhaust ductwork from glovebox to main exhaust duct) is functionally classified as SS and is PC-2 qualified to protect the facility worker for the conceptual effort. Process ductwork within the building is functionally classified SS. Tornado dampers are functionally classified SC.

The DWPF will receive PUV canisters for HLW glass pours that will immobilize the Pu laden vitrification cans inside for Repository disposal. Although no CHA work has occurred for DWPF to date, it is assumed that no additional controls will be required. This assumption is based on the inherent stability of the PUV produced glass and the

otherwise normal glass pours planned for the PUV canisters. This operation meets the exclusion criteria of glass without energetic release potential (CE-4, *Exclusion Reporting Criteria*), resulting in no DSA changes required for the existing DWPF confinement function.

2.2 Evaluation

The PUV main exhaust system, including the sand filter, and supporting SSCs are credited as SC to protect the public and control releases that may exceed or challenge the 25-rem EG. These SC SSCs also provide an SS function to protect the co-located worker and control releases that may exceed or challenge the 100-rem evaluation criteria. Bounding accident scenarios for which the SC ACVS is credited to mitigate are postulated within the CHA process. The PUV primary exhaust system for the Pu processing area is credited as SS to protect the facility worker. The PCVS filtration is not credited as an SS confinement function as all exhaust is filtered through the SC main exhaust and filtration system.

2.3 Summary

The SC functional classification of the main exhaust and filtration system for the PUV is appropriately credited to protect the public and co-located worker in accordance with DOE guidance (DOE-STD-3009). Similarly, the SS functional classification of the primary exhaust for the Pu processing area is appropriately credited to protect the facility worker.

No impact is anticipated on the existing DWPF DSA as pertains to the confinement function.

3. System Evaluation

3.1 Identification of Gaps

A hazards data collection table was developed based on the evaluation guidance in response to Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2004-2 to support independent review of accident confinement strategies for the PUV. This information is presented in Attachment 2 as the 2004-2 Table 4.3. Although the accident consequences are qualitatively described, the resulting functional classifications and performance categories assigned produce a conservative posture that future evaluations of a quantitative nature will not affect.

An assessment using the Table 4.3 bounding accidents was performed to evaluate credited SC and SS ACVS subsystems in accordance with the respective evaluation criteria as presented in Table 5-1 of the evaluation guidance. This information is used to identify any gaps between the criteria and the design. Comparison of the SC and SS

ACVS design elements with the criteria is documented in Attachment 1 as the 2004-2 Table 5.1. Table 5.1 has preliminary information on expected approaches to implement the criteria in the project as information only. Final designs will meet the attributes.

3.2 Gap Evaluation

The Pu Disposition Project conceptual design will be consistent with DNFSB Recommendation 2004-2 criteria. No gaps are identified at this time for evaluation.

3.3 Modifications and Upgrades

Because no gaps were identified and the PUV project is ongoing, no modification or upgrades are required. As project design and safety analysis continues, future evaluations will be conducted against DNFSB Recommendation 2004-2 criteria to ensure compliance.

4. Conclusion

The PUV Facility Evaluation Team evaluated the safety-related active confinement ventilation systems in accordance with the referenced guidance, using the safety class and safety significant criteria of Table 5.1 for the main exhaust and primary exhaust systems. The evaluation did not identify any gaps that require resolution at this time. As future safety analysis is developed, any new scenarios resulting in dose concerns will be evaluated using 2004-2 criteria to determine the appropriate controls.

It is anticipated that DWPF will not have any 2004-2 criteria issues related to the vitrification of PUV glass cans.

References

1. Y-ASD-G-00002, Rev. 0, Alternative Study for Locating a Plutonium Vitrification Process in Existing Savannah River Site Process Facilities, 8 June, 2004.
2. Plutonium Vitrification Project, 105-K, Critical Decision Zero (CD-0), 2004.
3. E7 2.25, Rev. 14, Conduct of Engineering and Technical Support Procedure Manual, Functional Classification.
4. DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports.
5. DOE-STD-3013-2004, Stabilization, Packaging, and Storage of Plutonium-Bearing Materials.
6. "Deliverables 8.5.4 and 8.7 of Implementation Plan for DNFSB Recommendation 2004-2, Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems" dated January 2006.
7. "Commitment 8.2 of Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2004-2, *Exclusion Reporting Process*" dated October 2005.
8. DOE-HDBK-1169-2003, DOE Nuclear Air Cleaning Handbook.
9. DOE-STD-1021-93, Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems and Components.
10. DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports.
11. Plutonium Vitrification Facility (PUV) Draft A System Design Description Input, 29 August, 2006.
12. Facility Design Description for Plutonium Vitrification Facility (PUV) - Draft, 23 October, 2006.

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems shall have appropriate filtration to minimize release.	The Glovebox Exhaust Sub-system for air gloveboxes, hoods, and maintenance air flow for inert gloveboxes will consist of pre-filters, two-stage in-place testable HEPA filter housings and a fan. This subsystem will have 100% redundancy. Air from the process gloveboxes (non-inert) and hoods will be exhausted first through gloveboxes and hoods, HEPA filters, and then through the main process exhaust System. The Secondary and Tertiary exhaust system will consist of a Sand Filter located outside the PIDAS with an inlet/outlet tunnel, exhaust fans, and an exhaust stack. All exhaust streams will be filtered in the Sand Filter as a final stage and exhausted through the fan house to an elevated exhaust stack. The stack exhaust will be sampled and continually monitored before being discharged to the atmosphere. The Sand Filter structure will be of reinforced concrete design that complies with the requirements of Performance Category PC-3. The Sand Filter and Exhaust Fans preliminary functional classification will be Safety Class (SC). The glovebox (primary exhaust) HEPA filter/Housing will meet requirements of ASME AG-1, DOE-HDBK-1169, and SRS std. 15888. HEPA filter minimum efficiency will be 99.97% @ 0.3 micron particle size. Airflow resistance across the HEPA filter will conform to DOE std (max. initial resistance 1-1.3 in. w.g). Preliminary sizing for glovebox exhaust HEPA filter will be for 6000 CFM (approximately). All PUV facility process exhaust will be filtered in the Sand Filter as a final stage and exhausted through the fan house to an elevated exhaust stack. Sand Filter will meet the requirement of DOE-HDBK-1169. The Sand filter design will be based on 105,000 CFM (approximately) exhaust, superficial velocity around 5 FPM, Pressure Drop across the sand filter 7-11 in. w.g, and efficiency of 99.51% @ 0.7 micron particle size. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.1 Airborne Particulate and Gases SRS Engineering Standard 15888 ASME AG-1 <u>Reference</u> Draft A –SDD Input for HVAC system <u>Gap Analysis</u> None (Final Filter is Sand Filter which will beSC/PC-3)	ASME AG-1 DOE-HDBK-1169 (2.2.1)

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	2 - Ventilation System – Instrumentation & Control	
Provide system status instrumentation and/or alarms.	The PUV Facility Process Ventilation System instrumentation provides indications of system status both locally, at the individual component and remotely to the Central Control Room. Differential pressure gages provide means of monitoring filters installed in the system to see if they are functioning properly and to ensure process areas are receiving adequate ventilation. Performance status of the ventilation system will be continuously monitored with visual and audible feedback to operators in the Central Control Room. It includes pressure differential in potentially contaminated zones, pressure differential between outside and inside the facility, differential pressure across HEPA filters and Sand Filter, air flow, damper positions, fan operating status, The PUV Facility Process Exhaust System status instrumentation, interlocks with the supply system and/or alarms will be designed for the Performance Category PC-3 and the preliminary functional classification will be Safety Class (SC). The SS portion for the glove box ventilation will be PC-2 with instrumentation appropriate for the HEPA filter flow path and SS functional classification. Exact SS/SC boundary points are under development. Standards DOE Nuclear Air Cleaning Handbook 1169 AHSRAE Design Guide (Section 4) ASME AG-1 Reference Draft A –SDD Input for HVAC system Gap Analysis None (supply interlock, delta P monitoring between outside & Inside, and exhaust fan controls will be SC)	ASME AG-1 DOE-HDBK-1169 ASHRAE Design Guide (Section 4)

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Interlock supply and exhaust fans to prevent positive pressure differential.	The PUV facility process area ventilation will have supply and exhaust fans interlock to prevent pressurization of process areas. Process area exhaust fans and interlock to shutdown supply fans will be SC to prevent pressurization of potentially contaminated zones. The SS portion does not have dedicated supply fans, just filtered air inlets. Standards DOE Nuclear Air Cleaning Handbook 1169, section 4.0 Reference Draft A –SDD Input for HVAC system Gap Analysis None (supply interlock, delta P monitoring between outside & inside, and exhaust fan controls will be SC)	DOE-HDBK-1169 ASHRAE Design Guide (Section 4)
Post accident indication of filter break-through.	Sand Filter and Glovebox HEPA filters build-up will be monitored by pressure differential instruments. A low pressure differential instrument will indicate filter damage and activate an alarm in the Control Room. The stack exhaust will be sampled and continually monitored before being discharged to the atmosphere. Radiation monitoring instrumentation in the exhaust stack will activate an alarm in the Control room if preset limits are reached. The radiation monitoring instrumentations will be SC all the way to the control room. Standards DNFSB Tech 34 Reference Draft A –SDD Input for HVAC system Gap Analysis None ((Final Filter is Sand Filter which will beSC/PC-3)	TECH-34

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	Performance status of the SC and SS ventilation systems will be continuously monitored with visual and audible feedback to operators in the Central Control Room. The ventilation system including air cleaning will remain operational to maintain confinement under normal, abnormal, and accident conditions. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 Reference Draft A –SDD Input for HVAC system Gap Analysis None (supply interlock, delta P monitoring between outside & Inside, and exhaust fans & controls, and Sand Filter will be SC)	DOE-HDBK-1169 (2.4)
Control components should fail safe.	SS and SC Dampers, Fans, and other ventilation system control components will be designed to fail safe to ensure that the confinement is maintained. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 Reference Draft A –SDD Input for HVAC system Gap Analysis None	DOE-HDBK-1169 (2.4)
3 - Resistance to Internal Events – Fire		

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	The preliminary functional classification of the ventilation system is Safety Class which includes PUV facility Exhaust Fans, Sand Filter, main exhaust duct, and interlock w/ Supply Fans. The SC ventilation will perform confinement of materials from the glove boxes during fire scenarios; the SS system is not anticipated to withstand all credible fires in the process rooms. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 10.1 DOE STD 1066 References Draft A –SDD Input for HVAC system Gap Analysis None	DOE-HDBK-1169 (10.1) DOE-STD-1066
Confinement ventilation systems should not propagate spread of fire.	Fire Barriers, Fire Dampers, and Fire Suppression systems will be provided per appropriate Fire Hazards Analysisy (FHA). Design will include Interlock to shutdown Supply Fans. Appropriate functional classifications will be assigned. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 10.1 References Draft A –SDD Input for HVAC system Draft A – FDD Input for FP System Gap Analysis None	DOE-HDBK-1169 (10.1) DOE-STD-1066
4 - Resistance to External Events – Natural Phenomena – Seismic		

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should safely withstand earthquakes.	Process Area Exhaust Ventilation System will be designed to Performance Category PC-3 (Seismic, Tornado, Wind). The SS portions will be PC2. See Note 3 Standards DOE Nuclear Air Cleaning Handbook 1169 Section 9.2 Natural Phenomena References Draft A –SDD Input for HVAC system Gap Analysis None	ASME AG-1 AA DOE 0420.1B DOE-HDBK-1169 (9.2)
5 - Resistance to External Events - Natural Phenomena - Tornado/Wind		
Confinement ventilation system should safety withstand tornado depressurization	Process Area Exhaust Ventilation System will be designed to Performance Category PC-3 (Seismic, Tornado, Wind). Design will include SC Tornado Dampers to withstand tornado depressurization. (see Note 3) Standards DOE Nuclear Air Cleaning Handbook 1169 Section 9.2 Natural Phenomena References Draft A –SDD Input for HVAC system Gap Analysis None	DOE 0420.1B DOE-HDBK-1169 (9.2)

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should withstand design wind effects on system performance.	Process Area Exhaust Ventilation System will be designed to Performance Category PC-3 (Seismic, Tornado, Wind). SS portion to PC-2. (see Note 3). **Standards** DOE Nuclear Air Cleaning Handbook 1169 Section 9.2 Natural Phenomena **References** Draft A –SDD Input for HVAC system **Gap Analysis** None.	DOE 0420.1B DOE-HDBK-1169 (9.2)
6 – Other NP Events (e.g. flooding, precipitation)		

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement Ventilation system should withstand other NP events considered credible in the DSA where the confinement ventilation system is credited.	This criterion will be evaluated in DSA and confinement ventilation design will meet the requirements per DSA. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 9.2 Natural Phenomena References Draft A –SDD Input for HVAC system Gap Analysis None.	DOE 0420.1B DOE-HDBK-1169 (9.2)
7 - Range Fires/Dust Storms		
Administrative controls should be established to protect confinement ventilation systems from barrier threatening events	Administrative controls will be established for Safety Management Programs which will include emergency preparedness and fire protection. It will ensure that pre-fire strategies, plans, procedures, and FHA are performed. Standards DOE 0420.1B References Draft A –FDD Gap Analysis None	DOE 0420.1B
8 - Testability		

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	Air cleaning systems will be designed and tested in accordance with ASME AG-1. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 ASME AG-1 SRS Engineering Standard 15888 References Draft A –SDD Input for HVAC system Gap Analysis None	DOE-HDBK-1169 (2.3.8) ASME AG-1 ASME N510
Instrumentation required to support system operability is calibrated.	The Process Building ventilation system instrumentation is equipped with manifold valves with calibration ports. A PM program and calibration frequencies will be established for the Process Ventilation instrumentation. Non-safety instrumentation is calibrated periodically as driven by the PM program. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 References Draft A –SDD Input for HVAC system Gap Analysis None	DOE-HDBK-1169 (2.3.8)

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Integrated system performance testing is specified and performed.	Integrated system performance testing will be specified and performed for the Process Building Ventilation per ASME AG-1. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 References Draft A –SDD Input for HVAC system Gap Analysis None	DOE-HDBK-1169 (2.3.8)
	9. Maintenance	
Filter service life program should be established.	HEPA Filter service life will be established per engineering standard 15888. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 3.1 and App C SRS Engineering Standard 15888 References Draft A –SDD Input for HVAC system Gap Analysis None	DOE-HDBK-1169 (3.1 & App C)

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	10. Single Failure	
Failure of one component (equipment or control) shall not affect continuous operation	The preliminary functional classification of the exhaust ventilation system is Safety Class which includes PUV facility Exhaust Fans, Sand Filter, main exhaust duct, interlock w/ Supply Fans, and Emergency Diesel Generator. Design will include redundant exhaust fans, Emergency Diesel Generator for SC exhaust fans, back-up power and UPS for controls. This does not apply to the SS portion of the design. Standards DOE 420.1B, Facility Safety, Chapter I, sec. 3.b(8) References Draft A –FDD Gap Analysis None	DOE 420.1B, Facility Safety, Chapter I, sec. 3.b(8)
Automatic backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system. Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system	The preliminary functional classification of the exhaust ventilation system is Safety Class which includes PUV facility Exhaust Fans, Sand Filter, main exhaust duct, interlock w/ Supply Fans, and Emergency Diesel Generator. Design will include redundant exhaust fans, Emergency Diesel Generator for SC exhaust fans, back-up power and UPS for controls. The SS glovebox ventilation will also have backup power to support SS functions. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.7 References Draft A –SDD Input for HVAC system Gap Analysis None	DOE-HDBK-1169 (2.2.7)

Attachment 1 - 2004-2 Table 5.1, Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	11 - Other Credited Functional Requirements	
Address any specific functional requirements fo the confinement ventilatio system (beyond the scope o those above) credited in th DSA.	None identified at this time.	10 CFR 830, Subpart

Notes:

1. Preliminary Functional Classification for the Process Building Ventilation System is given in M&O-PUD-2006-00004, Preliminary PUV Functional Classification.
2. PU-Disposition project is at Conceptual Design stage. DHA will not be prepared in CDR, will have CHAPs.
3. SC/SS Ventilation systems will be assumed to be required for all NPH events until analysis justifies otherwise (e.g tornado scenario may not generate MAR release and thus not require SC diesels to be tornado qualified).

Attachment 2 – 2004-2 Table 4.3, Bounding Hazards – TABLE

Confinement Performance Criteria Analysis Information DNFSB 2004-2 Implementation Plan Table 4.3										
Pu Mitigation Factor			Hazard Category				Performance Criteria			
Bounding Accidents	Type Confinement		Dose Bounding Unmitigated/Mitigated (Not Performance)	Confinement Classification			Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	PBD				
Full Facility Fire	CVS (Note 1)		Unmitigated (Note 2) MOI – High FW, CW - High Mitigated (Note 3)	CVS			Confinement for public and facility workers protection	Note 4	Notes 5, 6 & 7	None
Seismic event collapses building	CVS (Note 1)		Unmitigated (Note 2) MOI – High FW, CW - High Mitigated (Note 3))	CVS			Confinement for public and facility workers protection	Note 4	Notes 5, 6 & 7	None
Tornado upsets building pressure differential	CVS (Note 1)		Unmitigated (Note 2) MOI – High FW, CW - High Mitigated (Note 3))	CVS			Confinement for public and facility workers protection	Note 4	Notes 5, 6 & 7	None
Loss of offsite power followed by process upset	CVS (Note 1)		Unmitigated (Note 2) MOI – High FW, CW - High Mitigated (Note 3)	CVS			Confinement for public and facility workers protection	Note 4	Notes 5, 6 & 7	None

Attachment 2 – 2004-2 Table 4.3, Bounding Hazards - NOTES

2004-2 Table 4.3 NOTES

1. Credit for the confinement ventilation system (CVS) includes credit for the Pu Processing Building safety class confinement structure.

2. Dose categories are:
   Maximum Offsite Individual (MOI) – Negligible (< 0.5 rem), Low (≥ 0.5, <5 rem), Moderate, (≥ 5, <25 rem), High (≥ 25 rem)
   Co-located & Facility Worker – Negligible (< 5 rem), Low (≥ 5, <25 rem), Moderate, (≥ 25, <100 rem), High (≥ 100 rem)

3. Mitigated doses unavailable; CHAP Module still in progress during documentation construction. Formal accident analysis will confirm adequacy of design concept.

4. CVS Functional Requirement: Provide a filtered ventilation pathway to mitigate radioactive material releases from the facility to the environment during and following design-basis events such that the consequence to the public receptor is less than 1 rem TEDE or the consequence to the 100 meter receptor is less than 100 rem CEDE

5. CVS Performance Requirements:

   - Shall remain functional during and following design-basis events with a minimum efficiency of 99.51 percent for radioactive particulates with a mean diameter of 0.7 micron.

   - Shall maintain the Pu Vitrification Facility at a negative pressure during and following design-basis events.

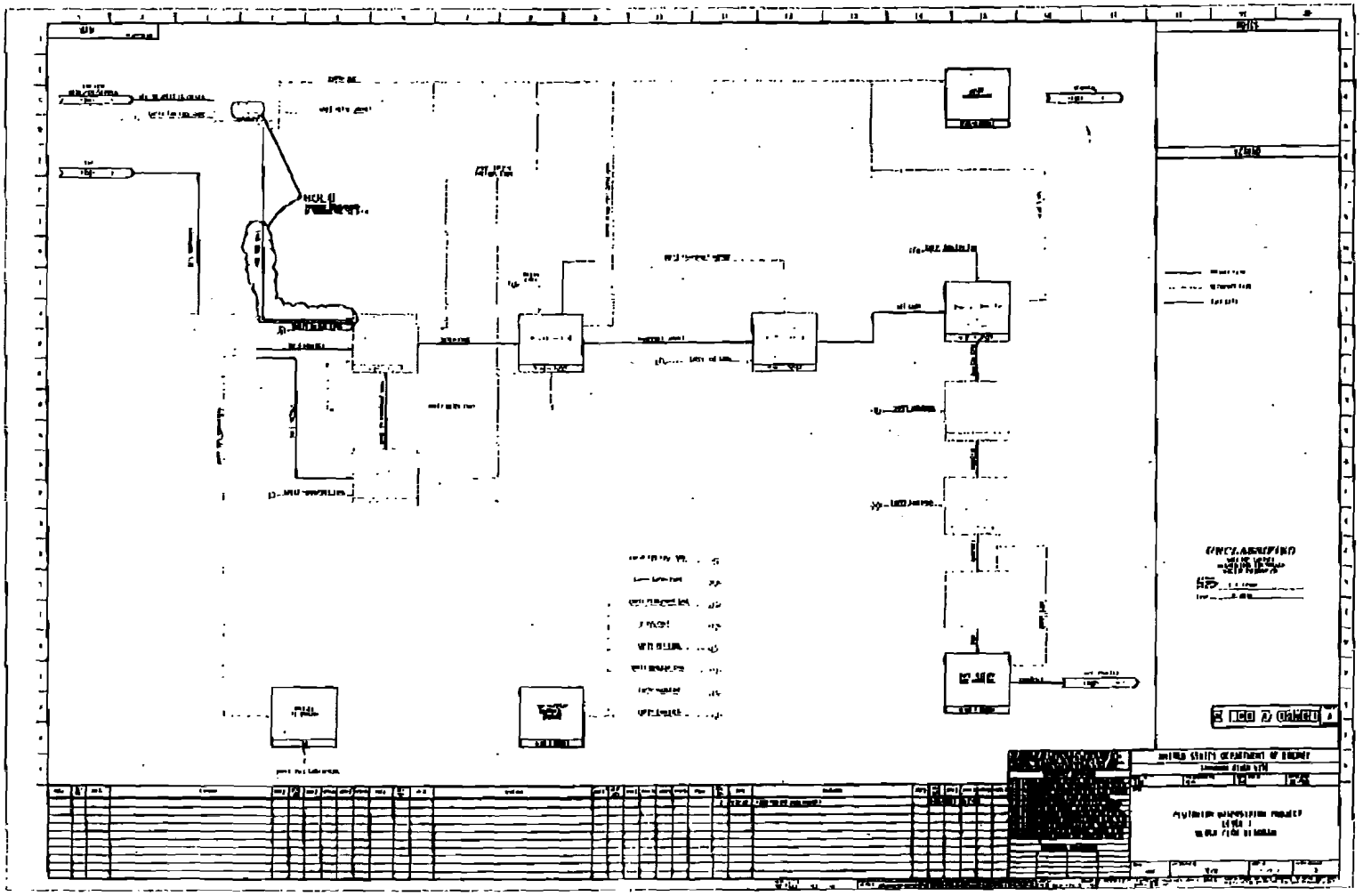
   - The HVAC Confinement System supply air bypass and isolation dampers shall be interlocked and sequenced to prevent potential unfiltered backflow to the environment.

6. CVS Performance Requirement: Safety class emergency diesel generator power and safety class DC power shall be provided for safety class HVAC Confinement System functions.

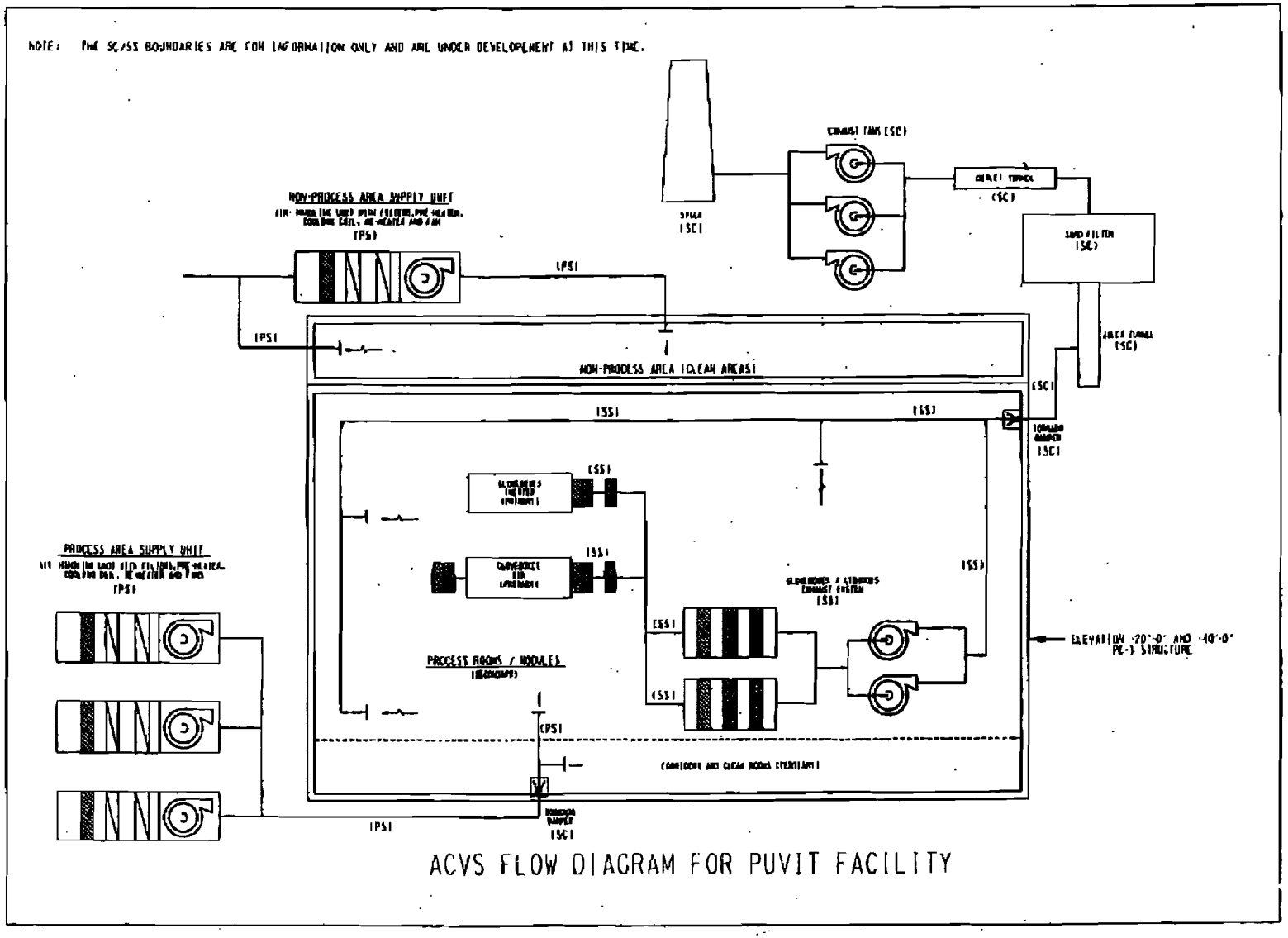
7. CVS Performance Requirement: Shall be designed and constructed to PC-3 natural phenomena design criteria.

Attachment 3 – Figures

Figure –1 Process Flow Diagram



Attachment 3 – Figures



Attachment 4 – Pu Dispositon Project Evaluation Team, Biographies

David P. Eisele – WSRC, Nuclear Materials Management, Pu Disposition DA Lead.

Dave Eisele has a Bachelor of Science Degree in Mechanical Engineering and a Masters in Health Physics. Mr. Eisele has over 25 years construction, operations and engineering experience in safety, regulatory, operations and engineering in the nuclear field. He has been a Design Authority Engineer for Spent fuel Programs and K Area Material Storage to include projects. He was a certified reactor supervisor and Shift Manager in the Reactor Operations Department as SRS. He has provided technical support to Safety Analysis efforts of the HB-Line and H-Canyon 5480.23 SARs and dispersion analysis (AXAIR & MACCS) to numerous facilities. He has also served with HPT doing facility RadCon support and HPT technical initiatives.

Ashok Shah – WSRC, Systems Engineering, Pu-Disposition DA HVAC Engineer

Mr. Shah has M.S and B.S in Mechanical Engineering. He is a Licensed Professional Engineer in the State of Illinois. Mr. Shah is an Associates Member of ASHRAE since 1985. He is also a Working member of ASHRAE Nuclear Sub-Committee since 1996. Mr. Shah has diversified experienced in Mechanical/HVAC Engineering; including commercial, Industrial, Nuclear, and DOE Defense facilities. He has worked in Bechtel Power and BSRI for eight years as a Senior HVAC Engineer. Last fifteen years, he has been working with Washington Savannah River Co. in System Engineering Department. Mr. Shah is currently working as a DA HVAC Engineer on Pu-Disposition Project. He has a total of 33 years experience in Mechanical/HVAC Engineering and specialized in HVAC Design, System Engineering, and HVAC Design Authority. The major projects include the Pu-Vitrification Facility, Modern Pit Facility (MPF), Pit Disassembly & Conversion Facility (PDCF), and Accelerator Production of Tritium (APT).

Arun Amin – BSRI, Design Engineering, Pu-Disposition Lead HVAC Engineer

Mr. Amin has a Bachelor of Science Degree in Mechanical Engineering. He has diversified experienced in Mechanical/HVAC Engineering; Including commercial, Industrial, Nuclear, and DOE Defense facilities. He has worked in Bechtel Power and BSRI for Thirty (30) years in Mechanical/HVAC discipline as an HVAC Engineer and Lead Engineer. Last fifteen years, he has been working with BSRI as a Subject Matter Expert (SME) in HVAC Engineering. Mr. Amin is currently working as a HVAC Lead Engineer for the Pu-Disposition Project. He has a total of 34 years experience in Mechanical/HVAC Engineering and specialized in HVAC/Mechanical Design and SME. The major projects include the Pu-Vitrification Facility, Tritium Extraction Facility (TEF), Modern Pit Facility (MPF), and Accelerator Production of Tritium (APT).

William W. Osborne – WSMS Plutonium Disposition Process CHAP Lead

William Osborne has a Bachelor of Science degree in Chemical Engineering and has over 25 years engineering experience in operations, nuclear safety and chemical process safety. For the past year he has provided safety analysis support to SRS Nuclear Materials Management and Spent Fuel Project facilities. Prior experience includes technical and program management support for nuclear safety and risk analysis of SRS facilities. He also served in various operations assignments in the F-Canyon and Tritium Facilities. Outside of SRS, he was a process safety engineer for chemical and pharmaceutical manufacturing facilities focusing on hazard analysis and risk management.