National Nuclear Security Administration

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

December 19, 2006

The Honorable A. J. Eggenberger
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, D. C. 20004-2901

Dear Mr. Chairman:

On July 12, 2006, Secretary Bodman submitted the Department's revised *Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2004-2, Active Confinement Systems*. Commitment 8.6, *Safety Related Ventilation System Evaluation*, of the Implementation Plan (IP) states that the evaluation process will be piloted at several facilities. For the National Nuclear Security Administration (NNSA), the Pit Disassembly and Conversion Facility (PDCF) has been identified as a pilot facility. The PDCF Ventilation System Evaluation Report is enclosed. The report has been reviewed by the NNSA Central Technical Authority's Chief of Defense Nuclear Safety (CDNS) and the 2004-2 Independent Review Panel (IRP). The CDNS and IRP have concluded that the evaluation and its results are technically sound, consistent with Department of Energy/NNSA safety policy and goals, and consistent with the intent of the IP.

If you have any questions concerning the report, please contact me or have your staff contact Rick Kendall by phone at (301) 903-3102 or by e-mail at Rick.Kendall@nnsa.doe.gov.

Sincerely,

T. P. D'Agostino

Thomas P. D'Agostino
Deputy Administrator
for Defense Programs

Enclosure

cc w/enclosure:
G. Podonsky, HS-1
M. Whitaker, HS-1.1

Printed with soy ink on recycled paper

SRW-253-06-001

Department of Energy - Chicago Operations Office

Pit Disassembly and Conversion Facility

DNFSB Recommendation 2004-2
Ventilation System Evaluation

Washington Group International
Integrated Engineering, Construction, and Management Solutions

7800 East Union Avenue
Suite 100
Denver, CO 80237

Contract No. DE-AC02-99CH10903
Project No. 21124
Rev. 0
September 27, 2006

Unclassified/Not UCNI
C.M. Pascua September 27, 2006

Review and Approval

PDCF Facility Evaluation Team Concurrence:

Jim Clark/_____signature on file____________________ ______9/27/2006____
WGI/Battelle PDCF Safety Basis/Analyst SME — Date

Larry East/_____signature on file____________________ ______9/27/2006____
WSRC Ventilation System SME — Date

Marv Gehret/___signature on file____________________ ______9/27/2006____
WGI PDCF HVAC SME — Date

Sam Glenn/____signature on file____________________ ______9/28/2006____
NNSA Lead — Date

Steve Kline/____signature on file____________________ ______9/27/2006____
WGI/Battelle PDCF Nuclear Safety Lead — Date

John Lux/______signature on file____________________ ______9/27/2006____
Ventilation System SME Consultant — Date

Doug Melton/___signature on file____________________ ______9/27/2006____
WSRC Safety Basis/Analyst SME — Date

Mike Mobley/___signature on file____________________ ______9/27/2006____
WSRC Design Authority Manager — Date

Mahendra Patel/__signature on file____________________ ______9/27/2006____
WGI PDCF HVAC Lead — Date

Table of Contents

Acronyms

AHU	Air Handling Unit
BAS	Building Automation System
CVS	Confinement Ventilation System
CW	Co-located Worker (100 meters)
DCS	Distributed Control System
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
ECF	Portal Entry Control Facility
EF	Exhaust Fan
EG	Evaluation Guideline
HVAC	Heating, Ventilation, and Air Conditioning
HEPA	High Efficiency Particulate Air
MAR	Material At Risk
MOX	Mixed Oxide
MFFF	Mixed Oxide Fuel Fabrication Facility
mREM	Milli-REM
MSEB	Mechanical and Support Equipment Building
NDA	Non-destructive Assay
NNSA	National Nuclear Security Administration
NPH	Natural Phenomena Hazard
PC	Performance Category
PDCF	Pit Disassembly and Conversion Facility
PDSA	Preliminary Documented Safety Analysis
PIDAS	Perimeter Intrusion Detection and Assessment System
PLC	Process Logic Control
PPB	Pu Processing Building
PS	Production Support
REM	Roentgen Equivalent Man
SC	Safety Class
SGT	Safeguards Transporter
SRS	Savannah River Site
SS	Safety Significant
SSC	Structure, System, and Component
SST	Safe Secure Trailer
VFD	Variable Frequency Drive

Definitions

Confinement	A building, building space, room, cell, glovebox, or other enclosed volume in which air supply and exhaust are controlled, and typically filtered. (Ref 12)
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. (Ref. 12)
Hazard Category	Hazard Category is based on hazard effects of unmitigated release consequences to offsite, onsite and local workers. (Ref. 14)
Performance Category	A classification based on a graded approach used to establish the NPH design and evaluation requirements for structures, systems and components. (Ref. 13)
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. (Ref. 12)

Executive Summary

The Pit Disassembly and Conversion Facility (PDCF) was identified as a pilot 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 PDCF project is in the detailed design phase and will be constructed at the Savannah River Site (SRS). The current stage of development for the safety basis provides a relatively mature analysis and safety control strategy. Current and prior issues of the Preliminary Documented Safety Analysis (PDSA) and supporting documentation have undergone various stages of internal Design Agency and external Design Authority review and favorable review by the DNFSB.

The PDCF is a Hazard Category 2 facility. The Pu Processing Building is the only facility structure processing and storing hazardous materials for which confinement ventilation system safety functions are credited. Other facility structures house supporting CVS components and are functionally classified accordingly. The Pu Processing Building active confinement ventilation system (CVS) is functionally classified as Safety Class (SC) and is designed to meet Performance Category 3 (PC-3) criteria for applicable Natural Phenomena Hazard (NPH) events. The Primary Confinement Ventilation Glovebox Exhaust system, with the exception of the glovebox exhaust and plena exhaust filters, is classified as safety significant (SS) confinement function and is designed to meet PC-2 seismic criteria for confinement functions. Primary Confinement Ventilation Glovebox Exhaust is filtered through the SC sand filter; consequently, the primary exhaust filters are not credited as providing confinement filtration functions.

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 postulated events as evaluated in the Rev B Internal Draft Preliminary Documented Safety Analysis (PDSA) and supporting analyses for the facility. The potential for gaps between the SC and SS criteria and the facility design were reviewed. Three gaps, deemed to be discretionary in nature, were identified. The evaluation did not identify any gaps involving a discrepancy between the safety basis requirements and the facility design. A cost/benefit evaluation was performed for the modifications that would be necessary to close the discretionary gaps. These evaluations are summarized in Section 3 of this report. Based on these evaluations, the Facility Evaluation Team recommends that one of the discretionary gaps be carried forward to closure. The identified discretionary gap and recommended closure action are:

Gap Criterion - Post accident indication of filter break-through

Gap Closure - While the sand filter is a safety class structure and is designed to remain functional for all design basis accidents with a minimum removal efficiency of 99.51 %, an upgrade of a sample collection system at the sand filter exhaust to PC-3 NPH criteria and emergency power is warranted to enhance emergency management assessment and monitoring for postulated accidents. This upgrade is estimated to cost $100, 000.

1. Introduction

1.1 Facility Overview

The PDCF project supports the National Nuclear Security Administration (NNSA) strategic goal to protect or eliminate weapon-usable nuclear material. The facility is in the Title II Detail Design phase. The mission of the PDCF is to develop and deploy the capability to disassemble nuclear weapons pits and convert the resulting plutonium (Pu) and other Pu metal to an unclassified plutonium oxide suitable for storage and/or disposition for fabrication into Mixed Oxide (MOX) fuel in the Mixed Oxide Fuel Fabrication Facility (MFFF). The MOX fuel will be used in United States for commercial light water nuclear reactor operation.

The PDCF will be located in the F Area of the Savannah River Site, near Aiken, SC. The PDCF building complex consists of seven individual building systems: Pu Processing Building (PPB), Mechanical and Support Equipment Building (MSEB), Utility Building, Administration Building, Sand Filter Structure, Fan House, and Perimeter Intrusion Detection and Assessment System (PIDAS) Portal Entry Control Facility (ECF) for Pedestrians and Vehicles.

Pu Processing Building (PPB)

The Pu Processing Building houses the systems to receive and process Pu pits and other Pu metal, and ship the resulting products either to the MFFF or to other disposition sites. The safety class structure is of cast-in-place reinforced concrete shear wall construction that complies with the requirements for Performance Category PC-3 structure. The structure has an engineered cover and berm. The Pu Processing Building is the only facility structure processing and storing hazardous materials for which confinement ventilation system safety functions are credited. Other facility structures, as noted below, house supporting CVS components and are functionally classified accordingly.

The building houses the following processes:

Pit and Pu metal receiving, storage and preparation

Pit disassembly

Plutonium separation and conversion

Special Recovery

Oxide blending, milling, and sampling

Product canning

Non-destructive Assay (NDA)

Interim and Product storage

Product shipping

Non-SNM parts sanitization

Highly Enriched Uranium (HEU) decontamination, uranium oxidation, packaging, storage, and shipping

Material Transport Systems

Waste processing and packaging

Sample Management/Analytical Laboratory

Mechanical and Support Equipment Building (MSEB)

The MSEB houses service functions to support the operations that occur in the PPB. Heating, Ventilating and Air Conditioning (HVAC) air supply equipment, mechanical equipment, control and communications equipment, electrical power distribution equipment, uninterruptible power supplies, safety class emergency generators (PPB confinement ventilation system emergency power supply), facility control room, shower and locker areas, and offices are housed in this structure. This structure is a combination of a SC cast-in-place reinforced concrete shear wall construction (west side) that meets Performance Category PC-3 requirements, and structural steel braced frame (east side) that meets Performance Category PC-2 requirements. The security access area portion of the structure includes an engineered cover and berm.

Fan House

The SC PPB confinement ventilation exhaust fans are located in the Fan House structure and are designed to draw air from the Sand Filter Structure and then exhaust through the facility SC exhaust stack. Included in the Fan House also are: the associated ductwork, a control room, an alternate PDCF monitoring station, and a storage room. The SC structure is built of cast-in-place reinforced concrete shear wall construction that meets Performance Category PC-3 requirements.

Sand Filter Structure

The Sand Filter structure is designed to filter potentially contaminated air that is received as exhaust from secondary and tertiary confinement areas of the Pu Processing Building and post HEPA filtration primary confinement systems. The Sand Filter structure has eight levels of gravel and sand, and includes connecting inlet and outlet tunnels. The safety class structure is cast-in-place reinforced concrete shear wall design that complies with the requirements of Performance Category PC-3. All but two feet of the structure is below grade.

Utility Building

The Utility Building houses the main electrical switchgear, safety significant stand-by generators (safety significant backup power for glovebox primary confinement), chillers, HVAC mechanical components, and related areas to provide support services for the complex. The safety significant structure is built of steel framing, metal wall, and roof panels, compliant with the requirements of Performance Category PC-2.

PIDAS Portal ECF

The Pedestrian ECF provides a security checkpoint for pedestrians. The structure is a combination of concrete and steel with metal wall and roof panels that meets the requirements of Performance Category PC-1. There also is a Vehicle ECF that provides a security checkpoint for vehicles.

Administration Building

The Administration Building houses supportive office functions and a large break/lunch room for facility personnel. The single storey structure will be steel with metal wall and roof panels that will meet the requirements of Performance Category PC-1.

1.2 Confinement Ventilation System/Strategy

The Pu Processing Building is designed with three confinement zones – Primary, Secondary, and Tertiary (Zones 1, 2, and 3). Zone 1 consists of the process enclosures, glove boxes and hoods. Zone 2 is the area surrounding the process enclosures and the rooms where the Zone 1 exhaust HEPA filters are located. Zone 3 consists of the work areas not containing process enclosures. As noted in Section 1.1, the Pu Processing Building is the only facility structure processing and storing hazardous materials for which confinement ventilation system safety functions are credited. The HVAC system includes:

- Primary Confinement Dry Air Supply
- Primary Confinement Ventilation Glovebox Exhaust
- Primary Confinement Ventilation Hood Exhaust
- Secondary and Tertiary Confinement Ventilation Supply
- Secondary and Tertiary Confinement Ventilation Exhaust

An overall diagram of the confinement ventilation system is presented in Figure 1-1. Airflow within the building is from uncontaminated areas to areas of successively higher potential for contamination. Room airflow within Zones 2 and 3 is supplied through "laminar" flow diffuser panels projecting downward.

Section 1.1, 1.2, 1.3, and Appendix J of the Pu Building CVS System Design Description (SDD) (Ref. 1) specify general performance, system design, component design, and nuclear safety requirements, respectively for the system. Detailed development of CVS design elements is in various states of maturity. Compliance with design requirements for normal, abnormal, and accident conditions will be performed by interdiscipline reviews, safety class design reviews, SDD compliance matrix activities, and design consistency reviews.

Confinement Ventilation System

The Pu Processing Building secondary/tertiary confinement ventilation is provided by six exhaust fans (EF) and six air-handling units (AHU) with five of each normally operating and one each in standby mode. The AHU supply fans (SF) are interlocked to run only if the corresponding EF is in operation. The building static pressure is controlled automatically by varying one SF's speed thru a variable frequency drive (VFD) and/or the inlet vane damper on one exhaust fan. Four of the exhaust fans are safety class (SC).

The hood exhaust CVS is interlocked to operate only if the secondary/tertiary CVS is operating. This system has redundant exhaust fans. Upstream of the exhaust fans are six bag-in/bag-out, single-stage, testable HEPA filter housings. One of the filter housings is a standby unit,

The glovebox CVS is interlocked to operate only if the secondary/tertiary CVS is running, It consists of safety significant (SS) redundant exhaust fans and redundant bag-in/bag-out, two-stage, testable HEPA filter housings to serve gloveboxes having dry air, (room) air, and inert atmospheres. The redundant dehumdidification units supplying the dry air gloveboxes are interlocked to operate only if a glovebox exhaust fan is running. Each inert glovebox has a recirculating system purification/cooling loop venting to the exhaust system when required to adjust the differential pressure. SS dump valves are provided on gloveboxes to maintain an inward flow in the event of a breach or an internal gas leak causing the glovebox differential pressure to fall below its minimum.

1.3 Major Modifications

This section does not apply to the PDCF project. The PDCF is a new project in support of the Surplus Plutonium Disposition Program and is in the latter stage of Title II detailed design.

2. Functional Classification Assessment

2.1 Existing Classification

Based on the PDSA (Ref. 2), only portions of the active CVS for the Pu Processing Building are functionally classified as SC and are PC-3 qualified for protection of the public. They are also credited to protect the collocated worker outside the facility. Similarly, portions of the Glovebox Primary Confinement Ventilation system are functionally classified as SS and are PC-2 qualified to protect the facility worker. While the current draft issue of the PDSA identifies the Glovebox Primary Confinement Ventilation plena exhaust filters as SS, they are no longer considered SS and the PDSA will be revised. This evolution in the confinement strategy recognizes that the Glovebox Primary exhaust is filtered through the SC sand filter and that the plena exhaust filters only provide a defense-in-depth function.

2.2 Evaluation

The Pu Processing Building Secondary and Tertiary Confinement Ventilation Supply and Exhaust subsystems, 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 collocated worker and control releases that may exceed or challenge the 100-rem evaluation criteria. Unique and bounding accident scenarios for which the SC CVS is credited to mitigate are evaluated in Chapter 3 of the PDSA (Ref. 2). The Primary Confinement Ventilation Glovebox Exhaust subsystem for the Pu Processing Building is credited as SS to protect the facility worker and control releases that may exceed or challenge the 100-rem evaluation criteria based on Chapter 3 of the PDSA (Ref. 2) and supporting hazards analyses (Refs. 3 through 21). Primary Confinement Ventilation Glovebox Exhaust system filtration is not credited as an SS confinement function, as all exhaust is filtered through the sand filter structure. However, glovebox exhaust filtration is credited as an SS double contingency criticality control to prevent long term accumulation of gross amounts of fissile material in the ventilation system.

2.3 Summary

The SC functional classification of Secondary and Tertiary Confinement Ventilation Supply and Exhaust subsystems for the Pu Processing Building is appropriately credited to protect the public in accordance with DOE guidance (DOE-STD-3009). Additionally, the SS functional classification of credited Primary Confinement Ventilation Glovebox Exhaust subsystems for the Pu Processing Building is appropriately assigned to protect the worker.

3. System Evaluation

3.1 Identification of Gaps

A data collection table was developed based on the evaluation guidance in response to Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2004-2 (Ref. 22) to support independent review of accident confinement strategies for the PDCF. This information is presented in Attachment 2.

An assessment was subsequently performed to evaluate credited SC and SS CVS subsystems in accordance with the respective evaluation criteria as presented in Table 5-1 of the evaluation guidance (Ref. 22) and to identify any gaps between the criteria and the design. Comparison of the SC and SS CVS design elements with the criteria is documented in Attachment 1. Three discretionary gaps were identified. They are classified as discretionary since the associated functions are not required by the authorization basis for the facility or commitments to NNSA or the DNFSB.

3.2 Gap Evaluations

As noted in Section 3.1, the SC and SS CVS subsystems were compared to their respective system performance criteria in Attachment 1. Three discretionary gaps were identified as summarized below.

Criteria	Gap Category	Gap Evaluation Summary
Pressure differential should be maintained between zones and atmosphere.	Discretionary	The enclosed SST/SGT truck bay and the outdoor loading dock do not incorporate a differential pressure CVS. Passive confinement of Type B packaging is credited to protect the worker and the public for design basis events that require controls, with no benefit identified to implement differential pressure features. Seismic design features protect the Type B packaging from seismic interaction hazards for a design basis earthquake. The *Recommendation 2004-2 Exclusion Reporting Process* allows categorical exclusion (CE-1/CE-3) of this criterion for the truck bay and the outdoor loading dock.
Post accident indication of filter break-through.	Discretionary	The sand filter is a safety class structure and is designed to remain functional for all design basis accidents with a minimum removal efficiency of 99.51 %. Consequently, the stack air activity monitoring system is not considered critical instrumentation to support post accident planning and response and is not classified as safety class or safety significant. There is no confinement benefit in upgrading the stack air activity on-line monitoring to safety class in reducing off-site consequence in a post accident situation. HVAC detailed design remains in progress to identify sampling points to collect samples to monitor radiological conditions within the HVAC system and the performance of confinement systems as specified by SRS Standard 15889. These sampling points/collection systems have not been credited in the PDSA as safety class or safety significant. There is benefit to design the sample collection system at the sand filter exhaust to survive design basis accidents to allow for assessment, monitoring, and emergency planning to diagnose and control evacuations for accidental releases.
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	Discretionary	The sand filter will be designed to support periodic inspections and testing in accordance with SRS site procedures. However, selected glovebox primary confinement exhaust filters are located inside the glovebox enclosures. The installation configuration of these filters does not allow for periodic testing in accordance with ASME N 510. These filters are not credited as a confinement control. They are credited as a safety significant criticality control to prevent a long-term accumulation of gross amounts of fissile

Criteria	Gap Category	Gap Evaluation Summary
		material in the HVAC exhaust ductwork. Consequently, there is no confinement benefit for the protection of the worker or the public to alter the configuration of these filters.

3.3 Modifications and Upgrades

The discretionary gaps identified in Section 3.2 were reviewed and modifications to close the gaps were developed in Attachment 2. These modifications were developed to a pre-conceptual level of detail and are summarized below.

Discretionary Gap 1: Pressure differential should be maintained between zones and atmosphere (SST/SGT truck bay/normal loading dock)

There are no design basis events involving the SST/SGT truck bay or outdoor loading dock that require CVS safety related controls to protect the public or the worker. The passive design features of the Type B shipping/receiving packaging are credited to protect the public and remain functional for design basis events. Seismic design features of the facility protect the Type B packaging from interaction hazards for a design basis earthquake. In this case, the truck bay is designed as a PC-2 essential structure. As such, its design precludes collapse or significant damage from a design basis PC-3 earthquake.

Modifications to meet this criterion in the SST/SGT truck bay would include upgrading the enclosure structure from PC-2 to PC-3, adding an airlock for truck/trailer entry/exit, and revising the confinement ventilation design. A rough order of magnitude (ROM) estimate to complete the design and construction effort is $11 million.

Based on categorical exclusion guidance provided in the *Recommendation 2004-2 Exclusion Reporting Process*, the subject criterion can be excluded for the SST/SGT truck bay and open loading dock based on Categorical Exclusion (CE) criteria CE-1 and CE-3, respectively. These criteria state:

CE-1 Facilities in which radioactive materials are in containers that have been qualified or certified (e.g., to specific standards) to survive all accident scenarios analyzed in the Documented Safety Analysis.

CE-3 Storage facilities where radiological material is entirely in approved containers (e.g., Type 7A drums, standard waste boxes, IP-2 containers) and the building design, when present, is limited to providing weather protection. This includes outside storage facilities, e.g., storage pads and yards, where no repackaging, or intrusive inspection or characterization is allowed. This does not include facilities in which processing or repackaging operations are authorized.

PDCF radioactive materials are handled in certified and approved containers in the SST/SGT truck bay and on the loading dock in accordance with the above criteria and consequently, as stated in the guidance, there would be no benefit to installing an active confinement ventilation system.

Discretionary Gap 2: Post accident indication of filter break-through (sand filter)

There is no direct dose reduction to the worker or public for implementation of these modification alternatives. The modifications would allow for improved emergency management assessment and monitoring of postulated accident releases and improve diagnosis and control of contamination within the HVAC system

Two modification alternatives were evaluated to meet this criterion: (1) upgrade the existing on-line stack monitoring system to meet safety class requirements or (2) upgrade one of three planned HVAC exhaust sample systems to meet applicable PC-3 criteria. A ROM estimate to complete the design and construction of these modification alternatives is $1.5 million and $100, 000, respectively. The latter estimate is based on in-progress design plans to add three HVAC exhaust sample collection systems with candidate locations at the common hood exhaust ductwork, the common glovebox exhaust ductwork, and the sand filter exhaust. The sand filter exhaust flow sample collection system would be upgraded to PC-3 criteria and emergency power. The sample collection system would include a sampling point prior to the exhaust stack, with sampling components located in the fan house.

Discretionary Gap 3: Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically (glovebox exhaust filters)

There are no design basis events that require crediting the glovebox exhaust filters as a confinement control to protect the facility worker or the public. Ductwork from the glovebox exhaust to the sand filter air supply tunnel is safety significant. Consequently, there are no confinement dose reduction benefits to close this gap.

Modifications to meet this criterion for selected glovebox exhaust HEPA filters that provide a criticality control would require relocation of the filter assemblies outside of the respective gloveboxes and in a configuration that meets ASME N510 testing requirements. A ROM estimate to complete the design and construction effort is $360,000 (further validation of cost and physical room to modify is in progress).

4. Conclusion

The PDCF Facility Evaluation Team evaluated the safety-related active confinement ventilation systems in accordance with Ref. 22, using the safety class and safety significant criteria of Table 5.1 for the Secondary and Tertiary Confinement Ventilation and Primary Confinement Ventilation Glovebox systems, respectively. The evaluation did not identify any gaps that require mandatory resolution; however, three discretionary gaps were determined and the scope of the modifications to close these gaps were developed.

Based on the benefit evaluation presented in Section 3.2 and the modifications/upgrades discussion presented in Section 3.3, the Facility Evaluation Team makes the following recommendations regarding the three discretionary gaps:

<u>Discretionary Gap 1: Pressure differential should be maintained between zones and atmosphere (SST/SGT truck bay and normal loading dock)</u>

No changes to the baseline design are recommended. This criterion provides no confinement benefit for the SST/SGT and loading dock as documented in the facility safety basis, cannot be practically implemented from technical and physical considerations, and qualifies as a categorical exclusion as discussed in Section 3.3.

<u>Discretionary Gap 2: Post accident indication of filter break-through (sand filter)</u>

It is recommended to upgrade the sand filter exhaust sample collection system to PC-3 NPH criteria and emergency power to enhance emergency planning assessment and monitoring in the event of a postulated accident. The modest cost of this upgrade compared to the total facility cost warrants consideration of this modification.

Discretionary Gap 3: Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically (glovebox exhaust filters)

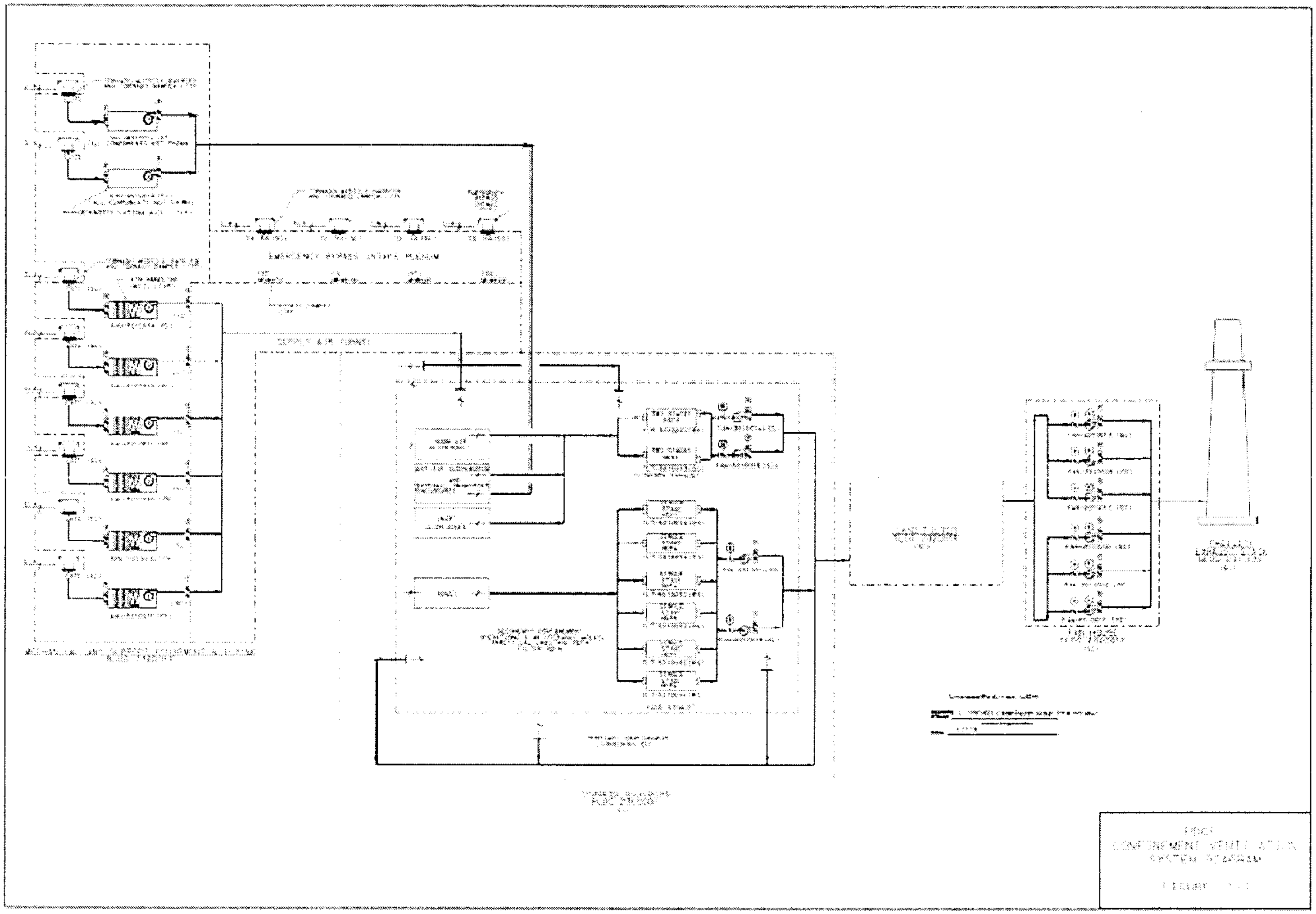
No changes to the baseline design are recommended. This criterion provides no confinement ventilation benefit and consequently does not require closure.

References

General References

1. *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System*, M-SYD-F-00046, Washington Group International, Denver, CO., Rev 0 In-progress.
2. *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis,* S-PSA-F-00001, Washington Group International, Denver, CO, Rev. B Internal Draft, July 25, 2005.
3. Title II Hazards Analysis Update for Receiving and Unpacking Activities/Processes, S-CLC-F-00536, Rev P1, Washington Group International, Denver, CO, December 2, 2004.
4. Title II Hazards Analysis Update for Vaults Activities/Processes, S-CLC-F-00537.
5. Title II Hazards Analysis Update for Pit Disassembly Activities/Processes, S-CLC-F-00538, Rev P1, Washington Group International, Denver, CO, February 25, 2005.
6. Title II Hazards Analysis Update for By-Product Operations, S-CLC-F-00539, Rev P1, Washington Group International, Denver, CO, June 20, 2005.
7. Title II Hazards Analysis Update for SRL Disassembly Activities/Processes, S-CLC-F-00540, Rev P1, Washington Group International, Denver, CO, May 31, 2005.
8. Title II Hazards Analysis Update for Tritium Getter Operations, S-CLC-F-00541, Rev P1, Washington Group International, Denver, CO, May 26, 2005.
9. Title II Hazards Analysis Update for Direct Metal Oxide Activities/Processes, S-CLC-F-00542, Rev P1, Washington Group International, Denver, CO, February 25, 2005.
10. Title II Hazards Analysis Update for Hydride/Dehydride Activities/Processes, S-CLC-F-00543, Rev P1, Washington Group International, Denver, CO, February 25, 2005.
11. Title II Hazards Analysis Update for Product Oxide Handling Activities/Processes, S-CLC-F-00544, Rev P1, Washington Group International, Denver, CO, February 25, 2005.
12. Title II Hazards Analysis Update for Plutonium Canning Activities/Processes, S-CLC-F-00545, Rev P1, Washington Group International, Denver, CO, February 25, 2005.
13. Title II Hazards Analysis Update for Material Movement Activities/Processes, S-CLC-F-00546, Rev P1, Washington Group International, Denver, CO, December 2, 2004.
14. Title II Hazards Analysis Update for Product Non-Destructive Assay Activities/Processes, S-CLC-F-00547, Rev P1, Washington Group International, Denver, CO, February 25, 2005.
15. Title II Hazards Analysis Update for Product Shipping and Packing Activities/Processes, S-CLC-F-00548, Rev P1, Washington Group International, Denver, CO, December 2, 2004.
16. Title II Hazards Analysis Update for Uranium Operations, S-CLC-F-00549, Rev P1, Washington Group International, Denver, CO, April 27, 2005.
17. Title II Hazards Analysis Update for Sanitization Activities/Processes, S-CLC-F-00550, Rev P1, Washington Group International, Denver, CO, April 27, 2005.
18. Title II Hazards Analysis Update for Waste Management Operations, S-CLC-F-00551, Rev P1, Washington Group International, Denver, CO, December 2, 2004.
19. Title II Hazards Analysis Update for Analytical Laboratory Activities/Processes, S-CLC-F-00552, Rev P1, Washington Group International, Denver, CO, February 25, 2005.
20. Title II Hazards Analysis Update for Facility-Wide Activities/Processes, S-CLC-F-00553, Rev P1, Washington Group International, Denver, CO, May 31, 2005.
21. Title II Hazards Analysis Update for Classified Analysis, S-CLC-F-00554, Rev P1, Washington Group International, Denver, CO, June 29, 2005.
22. *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems*, Department of Energy, Washington, D.C., Rev. 0, January 2006.

Figure 1-1 Overall Confinement Ventilation Diagram



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

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

<table>
<tr><th>Evaluation Criteria</th><th>Discussion</th><th>Reference</th></tr>
<tr><td colspan="3">1 - Ventilation System – General Criteria</td></tr>
<tr><td>Pressure differential should be maintained between zones and atmosphere.</td><td>The Pu Processing Building Confinement Ventilation System (CVS) provides a confinement ventilation function that minimizes the spread of potentially radioactive airborne contaminants within the facility, maintains personnel exposure ALARA and prevents the release of radioactive contaminants to the public and environment. The CVS is designed with three confinement zones – Primary, Secondary, and Tertiary (Zones 1, 2, and 3) and employs a once through design that maintains an airflow gradient that moves contaminants to areas of successively higher contamination potential, prior to filtering. The three zones are served by the following subsystems:

• Primary Confinement Dry Air Supply
• Secondary and Tertiary Confinement Ventilation Supply
• Primary Confinement Ventilation Glovebox Exhaust
• Primary Confinement Ventilation Hood Exhaust
• Secondary and Tertiary Confinement Ventilation Exhaust

Selected elements of the Secondary and Tertiary Confinement Ventilation Supply and Exhaust subsystems are credited as safety class for protection of the public. All active safety class components will have 100% redundancy and meet separation requirements for compliance with single failure criteria. Selected elements of the Primary Confinement Ventilation Glovebox Exhaust subsystem are credited as safety significant for worker protection. Airflow from the Primary Confinement Ventilation Glovebox Exhaust vents through the safety class Sand Filter Structure. All other subsystems are functionally classified as Production Support or General Services.

<u>Confinement Zones</u>
• Primary Confinement — gloveboxes, hoods, and the Interim Storage area
• Secondary Confinement — process and primary exhaust HEPA rooms
• Tertiary Confinement — building

Differential pressures between confinement systems are critical to process facilities because they maintain proper airflow direction to prevent the spread of contamination. The PDCF design confinement differential requirements are as follows.
• Primary/Secondary — -0.7 to -1.0 inch w.g (Inert Gloveboxes -0.5 to –1.5 inch w.g.)
• Secondary/Tertiary — -0.1 to -0.15 inch w.g
• Tertiary/Atmosphere — -0.10 to- -0.15 inch w.g.
• Hood Exhaust — 125±25 fpm at opening

Special conditions are considered for tritium areas, Special Recovery Line operations and associated maintenance rooms. They are served by a dedicated exhaust duct in accordance with DOE-HDBK-1129, extending to the exhaust tunnel before combing with other exhaust streams continuing to the sand filter. A dedicated supply duct is similarly isolated. An off-gas treatment system to remove any tritium contamination from the glovebox atmosphere minimizes the risk of discharging tritium via the glovebox CVS.</td><td>DOE-HNBK-1169 (2.2.9) ASHRAE Design Guide</td></tr>
</table>

Evaluation Criteria	Discussion	Reference
	Standards SRS Engineering Standard No. 15889, *Confinement Ventilation Systems Design Criteria*, Section 5.4 ASHRAE Design Guide for Department of Energy Nuclear Facilities, Section 2 ERDA 76-21, Energy Research and Development Administration, *Nuclear Air Cleaning Handbook* DOE-HDBK-1129-99, Tritium Handling and safe Storage References M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* P-M6-F-0011, Rev. P1, *Pit Disassembly and Conversion Facility P&ID HVAC Atmospheric Reference Process Building* P-M6-F-0012, Rev. A, *Pit Disassembly and Conversion Facility P&ID HVAC Atmospheric Reference Process Building* P-MW-F-0001, Rev. A, Pit Disassembly and Conversion Facility P&ID HVAC Airflow and Control Diagram Composite Airflow Diagram Primary Confinement Ventilation P-MW-F-0030, Rev. P5, Pit Disassembly and Conversion Facility P&ID HVAC Airflow and Control Diagram Composite Airflow Diagram Secondary & Tertiary Confinement Gap Analysis The enclosed SST/SGT truck bay and the outdoor loading dock do not incorporate a differential pressure CVS. Passive confinement of Type B packaging is credited to protect the worker and the public for design basis events that require controls. Seismic design features protect the Type B packaging from seismic interaction hazards for a design basis earthquake. In this case, the truck bay is designed as a PC-2 structure. As such, it is designed as an essential structure and precludes collapse or significant damage from a design basis PC-3 earthquake.	
Materials of construction should be appropriate for normal, abnormal and accident conditions.	Materials of construction for the Pu Processing Building CVS safety-class supply duct is galvanized steel varying between 12 and 20 gauge steel depending on duct size, while the material for the safety-class exhaust duct is 12 to 20 gauge stainless steel for zones 2 and 3. Primary Confinement Ventilation Glovebox safety-significant exhaust ductwork is schedule 10 stainless steel pipe for line sizes 8-inch or less and 12 to 16 gauge stainless steel for 10-inch and larger line sizes. Ductwork materials of construction are specified for normal, abnormal, and credited accident conditions of service, regarding humidity, temperature, and chemical (trace amounts from laboratory and electro-decon process) exposure. The sand filter design is fire-resistant and chemically inert. Prefilters and HEPA filters for ductwork and gloveboxes are specified to use filter media and stainless steel frame construction in accordance with the essential requirements of ASME AG-1 and DOE-STD-3020. Primary Confinement Ventilation Glovebox Exhaust fan construction and Secondary and Tertiary Confinement Ventilation Exhaust fan construction will be specified to meet conditions of service for normal, abnormal, and accident conditions. Verification of conditions of service remains in progress as part of detailed design. Standards ERDA 76-21, *Nuclear Air Cleaning Handbook,* Sections 2 through 6 DOE-STD-3020, *Specification for HEPA Filters Used by DOE Contractors*	DOE-HNBK-1169 (2.2.5) ASME AG-1

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

Evaluation Criteria	Discussion	Reference
	DOE-STD-1066-99, *Fire Protection Design Criteria* ASME AG-1, *Code on Nuclear Air and Gas Treatment* References G-SPC-F-00003, *SPECIFICATION FOR SECTION 15816 - METAL DUCTS - SAFETY CLASS (U)* G-SPC-F-00003, *SPECIFICATION FOR SECTION 15861 – AIR FILTERS (U)* Gap Analysis None	
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	Section 1.1, 1.2, 1.3, and Appendix J of the Pu Building CVS System Design Description (SDD) specify general performance, system design, component design, and nuclear safety requirements, respectively for the system. Interdiscipline reviews, safety class design reviews, SDD compliance matrix activities, and design consistency reviews will confirm compliance with design requirements for normal, abnormal, and accident conditions. Credited safety class Secondary and Tertiary Confinement Ventilation Supply and Exhaust SSCs are designed for applicable PC-3 NPHs. Credited safety significant Primary Confinement Ventilation Glovebox Exhaust SSCs are designed for PC-2 seismic hazards. The Pu Processing Building CVS controls the potential release of radioactive material within the building due to an accident. Safety Class Secondary and Tertiary Confinement Ventilation Supply and Exhaust SSCs are designed to maintain the building at a negative pressure with respect to the environment for all design basis accidents. Safety significant Primary Confinement Ventilation Glovebox Exhaust SSCs are designed to protect the facility worker from spill events involving glovebox operations. During normal operation, supply fans are operated to supply air. For abnormal differential pressure conditions, the supply intakes and fans are automatically isolated and the bypass dampers are opened to supply air passively through the air supply tunnels. Both intakes have credited safety class tornado dampers and missile barriers to control flow reversal and the potential release of radioactive material. The air is conditioned via heating or cooling coils to maintain building environment at a comfortable level. Building exhaust flows through a sand filter to the exhaust stack. The Building Automation System (BAS) will control the CVS except during safety class (SC) emergency operation, when redundant stand-alone SC PLCs will control the exhaust fans. During the SC emergency operation, control signals from the BAS will be blocked, but all system monitoring functions will be retained. Standards SRS Engineering Standard 15889, Rev. 0, *Confinement Ventilation Systems Design Criteria* ERDA 76-21, *Nuclear Air Cleaning Handbook,* Section 2 Reference M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-SYD-F-00003, *Pit Disassembly and Conversion Facility System Design Description for Safety and Health Monitoring System*	DOE-HNBK-1169 (2.4) ASHRAE Design Guide

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

Evaluation Criteria	Discussion	Reference
	S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* <u>Gap Analysis</u> None	
Confinement ventilation systems shall have appropriate filtration to minimize release.	<u>Pu Processing Building Secondary and Tertiary Exhaust Filtration</u> A SC sand filter structure is used to remove sub-micron particles in the CVS exhaust air, consisting of a deep bed of segregated sized sand and gravel media of various grades layered to specific depths. The SC below-grade structure incorporates a robust design consisting of approximately 2 ft. thick reinforced concrete walls. Air enters the sand filter from the inlet tunnel through openings into distribution troughs spaced along the length of the sand filter. The air flows through the troughs across the sand filter and upward through a stainless steel grate structure into filter tiles that distribute the air through the graded gravel and sand bed. The filtered air is drawn into an open space on top, just under the roof slab and exits through the exhaust tunnel leading to the fan house. The sand filter exhaust air filtration system will meet the following requirements: • The CVS sand filter structure is designed to remain functional during and following all internal and external (man-made/NPH) design-basis accidents with a minimum efficiency of 99.51 percent. • The CVS sand filter structure is designed and constructed to PC-3 design criteria. • The CVS sand filter structure is designed to filter the total ventilation requirements from the PPB. • The superficial face velocity through the filter media for normal operation will be approximately 5 ft per minute (fpm). **<u>Glovebox Primary Confinement Ventilation</u>** HEPA filters will be installed in the normal Zone 1 exhaust lines for air atmosphere and inert gloveboxes to prevent the accumulation of fissile material in the exhaust path. This function is credited as a SS criticality control to protect the worker. It also supports ALARA goals to control contamination and worker exposure. These glovebox exhaust filters are not credited as a confinement/filtration control. The SS PC-2 seismically qualified exhaust ductwork provides confinement to the sand filter, which is credited to control radioactive releases. Additionally, redundant exhaust systems incorporating two stages of testable HEPA filtration are provided for the glovebox exhaust. HEPA filters will also be installed at the air supply to air atmosphere gloveboxes. These HEPA filters are credited as SS confinement barriers for the gloveboxes to prevent the transport of contamination in the event of a flow reversal. <u>Standards</u> ERDA 76-21, *Nuclear Air Cleaning Handbook,* Section 2 SRS Engineering Standard 15888, *HEPA Filter Requirements* SRS Engineering Standard No. 15889, *Confinement Ventilation Systems Design Criteria*, Sections 5.10, 5.11, and 5.12 ASME AG-1, *Code on Nuclear Air and Gas Treatment,* Table FC-5140 ASME N509-2002, *Nuclear Power Plant Air-Cleaning Units and Components* WSRC-TM-95-1, M-SPP-G000243, HEPA Filter Specification DOE-STD-3020 UL-94	ASME AG-1 DOE-HNBK-1169 (2.2.1)

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

Evaluation Criteria	Discussion	Reference
	Reference SRC-310-00-011, Rev. 0, *Pit Disassembly and Conversion Facility HEPA FILTER/SAND FILTER ALTERNATIVES ANALYSIS* M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* G-SPC-F-00003, *SPECIFICATION FOR SECTION 15861 – AIR FILTERS (U)* Gap Analysis None	
	2 - Ventilation System – Instrumentation & Control	
Provide system status instrumentation and/or alarms.	Pu Processing Building Secondary and Tertiary Ventilation The Pu Processing Building CVS instrumentation provides both local and remote (main control room, MSEB) indications of system status. Differential pressure gages provide means of monitoring secondary confinement areas (Zone 2). The Zone 2 spaces will be manually balanced to achieve a differential pressure of –0.10" TO –0.15" W.G. with respect to Zone 3 areas. Flow elements and local readout gages will be installed in the supply and exhaust duct serving each Zone 2 room. Pressure differential indicating transmitters will be installed in all Zone 2 process areas to provide continuous local and remote monitoring and an alarm if out of range. The building static pressure (BSP) is controlled at–0.125"±0.025" W.G. (adjustable with respect to the outside atmosphere. Four safety class pressure differential indicating transmitters feed two safety class (SC) process logic controllers (PLCs) monitoring each leg of the perimeter providing three averaged signals to the Building Automation System (BAS). The BAS receives one averaged signal from each of the SC PLCs. This BSP signal then modulates the supply fan speed of the trim control unit to compensate for filter loading and/or transient conditions. Deviations of 0.05" W.G. (adjustable) from setpoint shall log an alarm. During normal and abnormal operations (non-accident conditions), the difference between the individual exhaust fans', individual supply fans' and stack total flow (cfm) and the sum of the flows of the operating supply fans required to produce the building negative pressure will be monitored. Out of range flows will cause an alarm to be reported. As noted previously, the CVS will be controlled by the BAS, except during safety class (SC) emergency operation, when the control signals from the BAS will be blocked, but all system monitoring functions will be retained. Instrumentation for safety related components are qualified to the same pedigree as the equipment they control.	ASME AG-1 DOE-HNBK-1169 ASHRAE Design Guide (Section 4)

Evaluation Criteria	Discussion	Reference
	<u>Glovebox Primary Confinement Ventilation</u> Glovebox exhaust fan status, flow (cfm), and inlet and discharge static pressures are monitored by the BAS with local display/indication of all except flow. System static pressure at the HEPA plenum inlet and differential across each stage of two HEPA filters has local indication. System static pressure at the plenum inlet and high differential across the HEPAs are remotely monitored by the BAS and alarmed if out of range. The differential pressure and flow of each glovebox is monitored and alarmed by the Process Control System (PCS) if out of range, both locally and remotely. The differential across each glovebox HEPA filter is monitored locally. The dehumidification units (DHU) status and airflow is monitored remotely by the BAS and alarmed if out of range. The supply duct static pressure is monitored both locally and remotely and alarmed remotely by the BAS if out of range. <u>Hood Primary Confinement</u> Hood exhaust fan status flow, inlet and discharge static pressures, and differential pressure across the single stage of outlet HEPA filters are monitored by the BAS with local display of all except flow. System static pressure at the plenum inlet and high differential across the HEPAs are remotely monitored by the BAS and alarmed if out of range. The face velocity of each hood is monitored and alarmed by the Process Control System (PCS) if out of range, both locally and remotely. <u>Standards</u> ASHRAE *Design Guide for Department of Energy Nuclear Facilities* (Section 4) ASME AG-1, *Code on Nuclear Air and Gas Treatment* SRS Engineering Standard 15889, *Confinement Ventilation Systems Design Criteria*, Section 5.14 <u>Reference</u> M-SYD-F-00046, Rev 0 In-progress, Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System S-PSA-F-00001, Rev. B Internal Draft, Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* *Draft Sequence of Operations*, DD(4/8/05) Initial Startup and Updated Sequence of Operation : Secondary and Tertiary Confinement Ventilation Building Static Pressure (BSP) Control P-MW-F-00031, Rev. P7, Pit Disassembly and Conversion Facility P&ID HVAC Airflow and Control Diagram Air Handling Units Secondary & Tertiary Confinement P-MW-F-0050, Rev. A, Pit Disassembly and Conversion Facility P&ID Exhaust Fans and Sand Filter Secondary & Tertiary Confinement P-MA-F-0001, Rev. P1, Pit Disassembly and Conversion Facility P&ID HVAC Control Building Automation System Control system Architecture P-MA-F-0004, Rev. P1, Pit Disassembly and Conversion Facility HVAC Control Secondary & Tertiary Confinement Ventilation Building Pressure Sequence of Operation P-MA-F-0004A, Rev. P1, Pit Disassembly and Conversion Facility HVAC Control Secondary & Tertiary Confinement Ventilation Building Pressure Sequence of Operation	

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

Evaluation Criteria	Discussion	Reference
	P-MA-F-0004B, Rev. P1, Pit Disassembly and Conversion Facility HVAC Control Secondary & Tertiary Confinement Ventilation Building Pressure Sequence of Operation P-MA-F-0004C, Rev. P1, Pit Disassembly and Conversion Facility HVAC Control Secondary & Tertiary Confinement Ventilation Building Pressure Sequence of Operation <u>Gap Analysis</u> None	
Interlock supply and exhaust fans to prevent positive pressure differential.	<u>Pu Processing Building Glovebox Primary, Secondary and Tertiary Ventilation</u> • Normal and Abnormal Operations The BAS controls operation of the Primary Exhaust plenum fans. Detailed design remains in progress to develop SS controls to maintain credited SS plenum exhaust fan functions. The confinement ventilation systems have appropriate interlocks to prevent the possibility of positive pressure differential. The Building Automation System (BAS) also controls and monitors the operation of the secondary/tertiary exhaust fans, air–handling units containing the supply fans, the glovebox exhaust fans, the dehumidification units (DHU) containing the SF supplying the dry air gloveboxes, hood exhaust fans, and associated dampers. • Accident Conditions During safety class emergency operation of the CVS safety class process logic controllers (PLCs) located in each of the fan rooms take control from the BAS. Two of the four safety class secondary/tertiary exhaust fans are required to run, drawing air into the building through the emergency bypass air intake safety class dampers opened by the safety class PLC. The supply air-handling units are shutdown and SC isolation dampers closed by the SC PLC when this mode of operation is initiated. The Building Automation System will monitor the CVS, if it is operational after a PC-3 event, from the PDCF control room. During safety class operation (accident conditions), the exhaust fans will be controlled by stand-alone safety class PLCs which are to be located in each fan room. Operations personnel will man the Control Room continuously. During safety class operation, control (output) signals from the Building Automation System will be disconnected, but all inputs remain for system monitoring. The exhaust fan control system is designed to operate automatically from the PLCs during safety class mode without operator intervention. All interlocks and controls on the Secondary/Tertiary Exhaust fans will be programmed into the SC PLC logic or hard wired for safety class operations. Currently, no interlocks for accident conditions are incorporated in the Primary Exhaust plenum fan design. <u>Reference</u> M-SYD-F-00046, Rev 0 In-progress, Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System S-PSA-F-00001, Rev. B Internal Draft, Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* *Draft Sequence of Operations, DD(4/8/05)* Initial Startup and Updated Sequence of Operation : Secondary and Tertiary Confinement Ventilation Building Static Pressure (BSP) Control	DOE-HNBK-1169 ASHRAE Design Guide (Section 4)

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

Evaluation Criteria	Discussion	Reference
	<u>Gap Analysis</u>	
Post accident indication of filter break-through.	PDCF sand filter failure including tunneling or "break-through" can be indicated from the stack air activity monitoring system. The PDCF exhaust is monitored and alarmed for elevated levels of alpha, beta, gamma, and tritium radiation. The exhaust sampler and radiation instrumentation is not classified as safety class or safety significant. Post accident indication of sand filter breakthrough is not a credited control in the PDCF PDSA. DNFSB Tech 34 does not specifically address post accident indication of filter break-through. Tech 34 states a concern with having the capability for post accident monitoring and dose assessment for emergency response and planning. The current design for PDCF lacks provision for sampling exhaust system for post accident analysis and assessment. This evaluation criterion is not applicable to the glovebox primary confinement ventilation system. Glovebox primary exhaust is filtered through the sand filter. The glovebox exhaust HEPA filters are not credited by the PDSA accident analyses for release mitigation. They are credited as a long-term control to prevent the accumulation of gross amounts of fissile material in ductwork as a criticality control. <u>Standards</u> SRS Engineering Standard 15889, *Confinement Ventilation Systems Design Criteria*, Section 5.14 DNFSB Tech 34, October 2004 <u>References</u> G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* M-SYD-F-00046, Rev 0 In-progress, Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System S-PSA-F-00001, Rev. B Internal Draft, Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis P-MW-F-0050, Rev A P-MW-F-0093, Rev B <u>Gap Analysis</u> The sand filter is a safety class structure and is designed to remain functional for all design basis accidents with a minimum removal efficiency of 99.51 %. Consequently, the stack air activity monitoring system is not considered critical instrumentation to support post accident planning and response and is not classified as safety class or safety significant. The on-line stack air activity monitoring system is currently not designed to withstand a design basis accident. There is little or no benefit in upgrading the on-line stack air activity monitoring to safety class in reducing off-site consequence in a post accident situation based on the robust design of the confinement/filtration system. HVAC detailed design remains in progress to identify sampling points to collect samples to monitor radiological conditions within the HVAC system and the performance of confinement systems as specified by SRS Standard 15889. These sampling points/collection systems have not been credited in the PDSA as safety class or safety significant. There is benefit in designing the sand filter exhaust sample collection system to survive design basis accidents to allow improved emergency planning and monitoring for postulated accidents.	TECH-34

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

<table>
<tr><th>Evaluation Criteria</th><th>Discussion</th><th>Reference</th></tr>
<tr><td>Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.</td><td><u>Pu Processing Building Secondary and Tertiary Ventilation</u>

• Normal and Abnormal Operations
The CVS will be monitored and controlled by the Building Automation System (BAS) (The BAS is a distributed control system.) except during safety class operation (accident conditions), when the SC exhaust fans will be controlled by stand-alone SC PLCs which are to be located in the fan room. Operations personnel will man the Control Room continuously. During Safety Class operations of the CVS, only the exhaust fans remain operational. During the SC operation, output control signals from the BAS will be disconnected, but all inputs remain for system monitoring. The exhaust fan control system is designed to operate automatically from the PLCs during SC mode without operator intervention. All interlocks and controls on the exhaust fans will be programmed into the PLC logic for SC operations.

• Accident Conditions
The building static pressure (BSP) is controlled at–0.125"±0.025" W.G. (adjustable) in the tertiary confinement (ZONE 3) MAA Perimeter corridor with respect to the outside atmosphere. Four safety-class pressure differential indicating transmitters per each of two (8 total transmitters) SC PLCs sense each leg of the MAA perimeter building corridor static pressure. The signals are transmitted to the SC PLCs where internal programming logic averages the four signals, compares each to the average, eliminate the signal that deviated the most from the average, averages the three remaining signals and transmits the average to the BAS. The BAS receives one averaged signal from each of the SC PLCs. The BAS then chooses the highest (most negative differential) of the two as the controlled variable. This BSP signal will modulate the SF speed of the trim control AHU to compensate for filter loading or during transient conditions. Deviations of 0.05" W.G. (adjustable) from setpoint shall log an alarm.

<u>Glovebox Primary Confinement Ventilation</u>

• Normal and Abnormal Operations
100% redundant safety significant HEPA filter trains are provided.

• Accident Conditions
Safety significant standby power is provided. Glovebox exhaust is not credited for confinement post DBA. or DBE.

<u>Standards</u>
ASME AG-1, Code on Nuclear Air and Gas Treatment

<u>References</u>
M-SYD-F-00046, Rev 0 In-progress, Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System
S-PSA-F-00001, Rev. B Internal Draft, Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis
G-FDD-F-00004, Rev. 7, Facility Design Description for Pit Disassembly and Conversion Facility</td><td>DOE-HNBK-1169 (2.4)</td></tr>
</table>

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

Evaluation Criteria	Discussion	Reference
	Draft Sequence of Operations, DD(4/8/05) *Initial Startup and Updated Sequence of Operation : Secondary and Tertiary Confinement Ventilation Building Static Pressure (BSP) Control* <u>Gap Analysis</u> None	
Control components should fail-safe.	<u>Pu Processing Building Secondary and Tertiary Ventilation</u> The PDCF confinement ventilation system instrumentation provides indications of system status at BAS operator workstations in the Main Control Room, MSEB, Fan House and Utility Building. All instrumentation, control signals and control signal processors will be designed as fail-safe In accordance with ERDA 76-21. A loss of control or motive power event involving the PDCF confinement ventilation system fans will result in securing both intake and exhaust fans and closing supply and exhaust dampers. Following this, a shift to the safety class mode results in restarting by auto sequence the exhaust fans in an induced draft mode. A shift to safety class emergency generator power on loss of normal power is accomplished using a safety class automatic transfer switch. <u>Glovebox Primary Confinement Ventilation</u> A failure of the operating glovebox exhaust train will result in the standby unit starting. This system does not operate in the safety class emergency mode. The isolation dampers at the HEPA plenums and exhaust are designed to fail open to provide a reduced flow and differential pressure in the gloveboxes, as induced by the safety class secondary/tertiary exhaust fans. <u>Standards</u> DOE-STD-1128-98, *Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities* <u>References</u> G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* Draft Sequence of Operations, DD(4/8/05), *Initial Startup and Updated Sequence of Operation : Secondary and Tertiary Confinement Ventilation Building Static Pressure (BSP) Control* <u>Gap Analysis</u> None	DOE-HNBK-1169 (2.4)
	<u>3 - Resistance to Internal Events – Fire</u>	
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain	<u>Pu Processing Building Secondary and Tertiary Ventilation</u> Ventilation supply ductwork is provided with NFPA 90A-compliant fire dampers at Fire Area boundary wall penetrations. Exhaust ductwork is constructed to withstand a 2-hour standard furnace test at Fire Area boundary wall penetrations, in accordance with the methodology documented in "Evaluation of Duct Opening Protection in Two-Hour Fire Walls and	DOE-HNBK-1169 (10.1) DOE-STD-1066

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

Evaluation Criteria	Discussion	Reference
confinement.	Partitions" (See Ref. Below). An equivalency evaluation is in progress. During SC operations of the CVS, only the exhaust fans and the Zone 2 ventilation ducts are required to remain operational. However, in the case of a facility fire, with heat damaging effects, the exhaust fans are located in the fan house and are protected from the effects of fire by physical separation and passive and active fire prevention systems. Exhaust ductwork is heavy gauge stainless steel and is inherently fire resistant. The sand filter media provides a large heat sink mitigating the effect of hot air and gasses on fan performance Redundant SC exhaust fans are located in rooms separated by fire-rated walls. Glovebox Primary Confinement Ventilation The Glovebox Primary Confinement Ventilation system is not designed nor credited to function for fire events. Other controls are credited to protect the facility worker for fire events. Standards DOE-STD-1066-99, *Fire Protection Design Criteria* References F-FHA-F-00026, Rev A Project Fire Hazard Analysis Plutonium Processing and Mechanical & Support Equipment Buildings, Sec. 3.0, Passive Design Features G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* Gewain, R., J. Shanley Jr., P. DiNenno, J. Scheffey, and B. Campbell, "Evaluation of Duct Opening Protection in Two-Hour Fire Walls and Partitions," *Fire Technology,* National Fire Protection Association, Quincy, MA. PDCF Calculation X-CLC-F-00597, Maximum Fan house HVAC Supply Temperature, Rev. 0 Gap Analysis None	
Confinement ventilation systems should not propagate spread of fire.	Pu Processing Building Secondary and Tertiary Ventilation During Safety Class operation of the CVS, only the exhaust fans, the PDCF building structure and the Zone 2 ventilation ducts are required to remain operational/intact. However, in the case of a facility fire, with heat damaging effects, the exhaust fans are located in the fan house and are protected from the effects of fire by physical separation of the passive and active fire prevention systems. Ductwork is heavy gauge metal, is inherently fire resistant, and will be designed to serve as a fire barrier for design basis events. Upon completion of combustible loading analyses, the adequacy of specified ductwork wall thicknesses to serve as a fire barrier will be confirmed. As a result of the use of a sand filter, there is no interlock or need to shutdown exhaust fan operation upon fire detection. For intake fans, however, the Fire Protection System senses an intake duct fire that upon detection of smoke in the supply discharge duct, sends an alarm to the fire alarm control panel and shuts down the intake fan AHU through the variable frequency drive (VFD).	DOE-HNBK-1169 (10.1) DOE-STD-1066

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

Evaluation Criteria	Discussion	Reference
	Ventilation supply ductwork is provided with NFPA 90A-compliant fire dampers at Fire Area boundary wall penetrations. Exhaust ductwork is constructed to withstand a 2-hour standard furnace test at Fire Area boundary wall penetrations, in accordance with the methodology documented in "Evaluation of Duct Opening Protection in Two-Hour Fire Walls and Partitions." An equivalency evaluation has been submitted to NNSA concerning the substitution of robust duct design for fire dampers where exhaust ductwork penetrates Fire Area boundaries. <u>Glovebox Primary Confinement Ventilation</u> The Glovebox Primary Confinement Ventilation system is not designed nor credited to function for fire events. Other controls are credited to protect the facility worker for fire events. <u>Standards</u> DOE-STD-1066-99, Fire Protection Design Criteria F-FHA-F-00026, Rev A Project Fire Hazard Analysis Plutonium Processing and Mechanical & Support Equipment Buildings, Sec. 3.0, Passive Design Features <u>References</u> G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* M-SYD-F-00046, Rev 0 In-progress , *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* <u>Gap Analysis</u> None	
	<u>4 - Resistance to External Events – Natural Phenomena – Seismic</u>	
Confinement ventilation systems should safely withstand earthquakes.	<u>Pu Processing Building Secondary and Tertiary Ventilation</u> The Pu Processing Building and inner structural walls are designed as Performance Category 3 (PC-3) structures and will withstand a DBE. However, several internal walls and process glovebox lines are designed as PC-2 structures and would be expected to experience some damage from a DBE. During certain events such as seismic events greater than PC-2, the Zone 2 PC-3 seismically qualified equipment and the PDCF building structure survive. Therefore, only the exhaust fans and credited ducting portions of the Zone 2, associated equipment, instrumentation and the emergency power system survive the design basis accident. This results in all releases of radioactive and other material being filtered through the sand filter by induced flow prior to reaching the outside environment under seismic design basis scenarios. <u>MSEB and Other Supporting SSCs</u> The MSEB houses service functions to support ventilation operations that occur in the PPB. Heating, Ventilating and Air Conditioning (HVAC) equipment, electrical power distribution equipment, uninterruptible power supplies, emergency generators, and the facility control room are housed in this structure. In addition, safety-class and normal air supply tornado dampers and missile barriers are contained in the MSEB. This structure is a combination of cast-in-place	ASME AG-1 AA DOE 0420.1B DOE-HNBK-1169 (9.2)

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

Evaluation Criteria	Discussion	Reference
	reinforced concrete shear wall construction (west side) that meets Performance Category PC-3 requirements, and structural steel braced frame (east side) that meets Performance Category PC-2 requirements. In addition to the MSEB, the fan house, stack, and diesel generator fuel storage vault are all designed to meet PC-3 NPH events/hazards. All glovebox Zone 1 exhaust ventilation equipment is housed within the PC-3 qualified Pu processing building and is qualified to PC-2 criteria. Finally, the Utility building houses the backup emergency diesel generators that provide power to Zone 1 SS ventilation fans and associated instrumentation. <u>Standards</u> DOE-STD-1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* DOE-STD-1021-93 (Reaffirmed), *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components* <u>Reference</u> G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* <u>Gap Analysis</u> None	
	<u>5 - Resistance to External Events – Natural Phenomena – Tornado/Wind</u>	
Confinement ventilation systems should safely withstand tornado depressurization.	<u>Pu Processing Building Secondary and Tertiary Ventilation</u> The Pu Processing Building is designed to withstand the impact of a DBT corresponding to the PC-3 criteria. Safety class tornado dampers and missile barriers are located at the normal inlet air supply to prevent backflow for a design-basis tornado. Additionally, a safety class bypass air supply system (including bypass and isolation dampers, tornado dampers, and missile barriers) supports operation of the building CVS in a safety class operating mode. In normal operation, supply fans are operated to supply air. In an abnormal condition, the supply intakes and fans are isolated and the bypass damper is open to supply air passively through the tunnels. Both intakes have tornado dampers and missile barriers. The CVS would not be affected by tornado due to the use of louvers/tornado dampers. The criteria for designing PC-3 SSCs specify that the structure must be designed for both atmospheric pressure change (APC) and missiles. The APC criterion is 40 pounds per square foot at 20 pounds per square foot per second. There are two missile criteria. PC-3 structures must be designed to withstand the impact of a 2-inch by 4-inch timber plank weighing 15 pounds and traveling at horizontal speeds of up to 100 mph (wall impact) and vertical speeds of up to 70 mph (roof impact).	DOE 0420.1B DOE-HNBK-1169 (9.2) DOE-STD-1020-2002

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

Evaluation Criteria	Discussion	Reference
	MSEB and Other Supporting SSCs The MSEB houses service functions to support ventilation operations that occur in the PPB. Heating, Ventilating and Air Conditioning (HVAC) equipment, electrical power distribution equipment, uninterruptible power supplies, emergency generators, and the facility control room are housed in this structure. In addition, safety-class and normal air supply tornado dampers and missile barriers are contained in the MSEB. This structure is a combination of cast-in-place reinforced concrete shear wall construction (west side) that meets Performance Category PC-3 requirements, and structural steel braced frame (east side) that meets Performance Category PC-2 requirements. In addition to the MSEB, the fan house, stack, and diesel generator fuel storage vault are all designed to meet PC-3 NPH events/hazards. All glovebox Zone 1 exhaust ventilation equipment is housed within the PC-3 qualified Pu processing building and is qualified to PC-2 criteria. Finally, the Utility building houses the backup emergency diesel generators that provide power to Zone 1 SS ventilation fans and associated instrumentation. Standards DOE-STD-1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* DOE-STD-1021-93 (Reaffirmed), *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components* Reference M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* Gap Analysis None	
Confinement ventilation systems should withstand design wind effects on system performance.	Pu Processing Building Secondary and Tertiary Ventilation The PDCF is designed to withstand the impact of a high winds corresponding to the PC-3 criteria. Safety class tornado dampers and missile barriers are located at the normal inlet air supply to prevent backflow for a design-basis tornado. Additionally, a safety class bypass air supply system (including bypass and isolation dampers, tornado dampers, and missile barriers) supports operation of the building CVS in a safety class operating mode. In normal operation, supply fans are operated to supply air. In an abnormal condition, the supply intakes and fans are isolated and the bypass damper is open to supply air passively through the tunnels. Both intakes have tornado dampers and missile barriers. The CVS would not be affected by high winds due to the use of louvers/tornado dampers. The criteria for designing PC-3 SSCs specify that the structure must be designed for both atmospheric pressure change (APC) and missiles. The APC criterion is 40 pounds per square foot at 20 pounds per square foot per second. There	DOE 0420.1B DOE-HNBK-1169 (9.2)

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

Evaluation Criteria	Discussion	Reference
	are two missile criteria. PC-3 structures must be designed to withstand the impact of a 2-inch by 4-inch timber plank weighing 15 pounds and traveling at horizontal speeds of up to 100 mph (wall impact) and vertical speeds of up to 70 mph (roof impact). High wind could initiate a loss of off\site power only. Confirmation of Pu Processing Building CVS performance remains in progress and additional modeling is planned. Design features to compensate for wind effects from degrading negative differential pressure conditions in the building include incorporation of airlocks, back flow (tornado) dampers, and an atmospheric pressure reference design that provides averaging and dampening from localized wind gusts. For this latter feature, a special outside static air probe is specified that the manufacturer states is "capable of sensing the outside atmospheric air pressure to within 2% of the actual value when subjected to radial wind velocities up to 40 mph, with approach angles up to 30° to horizontal." <u>MSEB and Other Supporting SSCs</u> The MSEB houses service functions to support ventilation operations that occur in the PPB. Heating, Ventilating and Air Conditioning (HVAC) equipment, electrical power distribution equipment, uninterruptible power supplies, emergency generators, and the facility control room are housed in this structure. In addition, safety-class and normal air supply tornado dampers and missile barriers are contained in the MSEB. This structure is a combination of cast-in-place reinforced concrete shear wall construction (west side) that meets Performance Category PC-3 requirements, and structural steel braced frame (east side) that meets Performance Category PC-2 requirements. In addition to the MSEB, the fan house, stack, and diesel generator fuel storage vault are all designed to meet PC-3 NPH events/hazards. All glovebox Zone 1 exhaust ventilation equipment is housed within the PC-3 qualified Pu processing building and is qualified to PC-2 criteria. Finally, the Utility building houses the backup emergency diesel generators that provide power to Zone 1 SS ventilation fans and associated instrumentation. <u>Standards</u> DOE-STD-1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* DOE-STD-1021-93 (Reaffirmed), *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components* <u>Reference</u> G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* <u>Gap Analysis</u> None	

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

Evaluation Criteria	Discussion	Reference
	6 – Other NP Events (e.g., flooding, precipitation)	
Confinement ventilation system should withstand other NP events considered credible in the DSA where the confinement ventilation system is credited.	Other Natural Phenomena considered in the safety basis include wildland fires, intense precipitation/natural deluge events, and lightning. Administrative controls associated with wildland fires are addressed in Section 7 of this table. Design features include building external fire-wall ratings for the design basis wildland fire and fire screens at air intakes. The *Flood Hazard Assessment for the Savannah River Site* (WSRC-MS-99-00499) has established the calculated water flooding elevation for a 100,000-year return flood from the Upper Three Runs at F-Area as 145 ft above sea level. The elevation at F-area is 260 ft above sea level. Localized flooding of the SST/SGT truck bay, as well as seepage and ground water to the facility and confinement ventilation supply and exhaust tunnels, poses a potential hazard. Site grading is designed to convey storm water run-off away from structures in accordance with the Building SDD and structures incorporate water stops at structural joints to control any seepage. In accordance with "Analysis Methods" Section 14, Natural Phenomena Hazards Impacts of WSRC SC D-10, lightning hazards pose a "light" risk value, with protection required for the stack only, due to its height. Similarly, neither the Plutonium Processing Building nor the MSEB has an evaluated risk factor greater than or equal to 4. However, standard Thompson-type lightning protection is installed as a conservative measure. <u>Standards</u> DOE-STD-1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* DOE-STD-1021-93 (Reaffirmed), *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components* <u>Reference</u> M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* G-SYD-F-00019, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for Building Structures System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* F-FHA-F-00027, Revision P2, Fire Hazards Analysis For The Pit Disassembly and Conversion Facility Project Support Structures F-FHA-F-00026, Revision A, Project Fire Hazard Analysis Plutonium Processing and Mechanical & Support Equipment Buildings <u>Gap Analysis</u> None	DOE 0420.1B DOE-HNBK-1169 (9.2)

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

Evaluation Criteria	Discussion	Reference
	7 – Range Fires/Dust Storms	
Administrative controls should be established to protect confinement ventilation systems from barrier threatening events.	In the current design state, all buildings housing SC and SS ventilation system components and associated support systems are built of noncombustible materials. This combined with a PIDAS exclusion area and minimal vegetation presence within the PDCF site prevents wildfire propagation from outside to within the PDCF buildings. This prevents wildfire impacts from impacting ventilation system components. A comprehensive wildland fire protection program is developed and implemented [MCR-01] for SRS facilities. As part of this, wildfire hazard severity analyses are conducted for existing buildings and facilities or planned site improvements. When the hazard analysis identifies a threat from wildfire, approved plans for the establishment and maintenance of defensible space are established. Development of any specific administrative controls designed to address confinement ventilation protection will be developed during Title III design. <u>Standards</u> DOE-STD-1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* DOE-STD-1021-93 (Reaffirmed), *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components* <u>Reference</u> M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* WSRC-SCD-4, Fire Protection Functional Area 12, Rev. 9 WSRC-Manual 2Q2, Section 6, Wildland Fire Procedure, Rev. 7 <u>Gap Analysis</u> None	DOE 0420.1B
	8 - Testability	
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	The sand filter design provides injection and sampling ports in the inlet and outlet tunnels. Injection distribution array and sample collection array design are not completed at this time. All HEPA filter stages in multi-stage installations are individually testable. Inlet and outlet HEPA filters located external to the glovebox are installed in fully testable bag-in/bag-out housings. Inlet and outlet HEPA filters mounted inside of gloveboxes have provisions for aerosol injection and sampling. These filters do not have provision for mixing of the aerosol assuring even distribution over the face of the filter. <u>Standards</u> SRS Engineering Standard 15889, *Confinement Ventilation Systems Design Criteria,* Section 5.15ASME N510,*Testing of Nuclear Air Treatment Systems* ASHRAE *Design Guide for Department of Energy Nuclear Facilities*, Section 8	

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

Evaluation Criteria	Discussion	Reference
	Reference G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* Gap Analysis The sand filter will be designed to support periodic inspections and testing in accordance with SRS site procedures. Primary confinement exhaust filters located inside the glovebox enclosures do not allow for periodic testing in full accordance with ASME N 510. However, these filters are not credited as a confinement control. They are credited as a safety significant criticality control to prevent a long-term accumulation of gross amounts of fissile material in the HVAC exhaust ductwork.	
Instrumentation required to support system operability is calibrated.	Instrumentation required to support system operability and safety functions will be calibrated on a periodic basis in accordance with the commitments identified in the PDSA. Appropriate programs will be established to procure the necessary equipment, train personnel, and calibrate equipment to ensure system functions and accuracy. The majority of instrument calibration requirements will be established and specified during Title III design. Standards NQA-1 Reference S-PSA-F-00001, Rev. B Internal Draft, Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis, Chapter 5 SRS Site Manual 1Q, Procedure 12-2, *Control of Installed Process Instrumentation* Equipment manufacturer data Gap Analysis None anticipated	
Integrated system performance testing is specified and performed.	An Integrated system performance testing will be specified and performed. Chapter 10 of the PDSA makes commitments to test initial equipment installations and any subsequent modifications through a formalized process to ensure that the system will operate within its approved safety basis. A program to execute integrated system performance testing will be established. This program will test and evaluate components and systems against documented criteria. The majority of integrated system performance testing will be established and specified during Title III design. Standards NQA-1 Reference S-PSA-F-00001, Rev. B Internal Draft, Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis, Chapter 5	

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

Evaluation Criteria	Discussion	Reference
	SRS Site Manual 1Q, Procedure 11-1, Test Control Equipment manufacturer data <u>Gap Analysis</u> None anticipated	
	<u>9 - Maintenance</u>	
Filter service life program should be established.	A filter service life program will be established. This program will collect engineering data on each of the filter elements, which includes type, size, flow rate, pressure drop, and anticipated life based on the application. Records will be maintained on the replacement history for each filter and service life modified. The majority filter service life program requirements and associated specifics will be established and specified during Title III design. <u>Standards</u> ERDA 76-21, *Nuclear Air Cleaning Handbook* SRS Engineering Standard 15888, *HEPA Filter Requirements* <u>Reference</u> Equipment manufacturer data <u>Gap Analysis</u> None anticipated	
	<u>10 - Single Failure</u>	
Failure of one component (equipment or control) shall not affect continuous operations.	The design of Safety Class instrumented systems is required to meet national standards for safety. WSRC-TM-95-1, SRS Engineering Standards Manual, Attachment 1, National Codes and Standards for Engineering/Design Task Matrix, and DOE G 420.1-1, Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria Guide for use with DOE O 420.1, Facility Safety, identify the use of these standards for the design of safety class control systems in non-reactor nuclear facilities. SRS Engineering Guide 16600-G, Application of IEEE 384-1992 for SRS Non-Reactor Facilities, provides guidance on applying IEEE 384 requirements to non-reactor facilities such as PDCF. The design is currently in progress with redundancy provided in all safety significant and safety class systems. <u>Standards</u> SRS Engineering Standard 15889, *Confinement Ventilation Systems Design Criteria* <u>Reference</u> G-FDD-F-00004, Rev. 7, *Facility Design Description for Pit Disassembly and Conversion Facility* M-SYD-F-00046, Rev 0 In-progress, *Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System* S-PSA-F-00001, Rev. B Internal Draft, *Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis* <u>Gap Analysis</u> None anticipated	

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

<table>
<tr><th>Evaluation Criteria</th><th>Discussion</th><th>Reference</th></tr>
<tr><td>Automatic backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.</td><td>Safety Class/Emergency loads will be connected to the Emergency Diesel Generators via automatic transfer switches (ATS's). A safety class 125 VDC battery system and the redundant safety class emergency generators are provided to support safety class CVS functions. The emergency generators start automatically and provide power through the ATS's upon loss of normal power.

<u>Standards</u>
SRS Engineering Standard 15889, Confinement Ventilation Systems Design Criteria

<u>Reference</u>
G-FDD-F-00004, Rev. 7, Facility Design Description for Pit Disassembly and Conversion Facility
M-SYD-F-00046, Rev 0 In-progress, Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System
E-SYD-F-00010, Rev 0 In-progress, Pit Disassembly and Conversion Facility System Design Description for Electrical Power Distribution System, Emergency Power
S-PSA-F-00001, Rev. B Internal Draft, Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis

<u>Gap Analysis</u>
None</td><td></td></tr>
<tr><td>Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.</td><td>Two diesel generators, located outside the PIDAS in the Utility Building, will provide Standby Power to Safety Significant loads and selected essential non-Safety-Significant loads. The safety significant UPS and redundant standby generators are provided for safety significant CVS functions. The standby generators start automatically upon loss of normal power.

<u>Standards</u>
SRS Engineering Standard 15889, Confinement Ventilation Systems Design Criteria

<u>Reference</u>
G-FDD-F-00004, Rev. 7, Facility Design Description for Pit Disassembly and Conversion Facility
M-SYD-F-00046, Rev 0 In-progress, Pit Disassembly and Conversion Facility System Design Description for HVAC Confinement Ventilation System
E-SYD-F-00011, Rev 0 In-progress, Pit Disassembly and Conversion Facility System Design Description for Electrical Power Distribution System, Standby Power
S-PSA-F-00001, Rev. B Internal Draft, Pit Disassembly and Conversion Facility, Preliminary Documented Safety Analysis

<u>Gap Analysis</u>
None</td><td>DOE-HNBK-1169 (2.2.7)</td></tr>
<tr><td colspan="3"><u>11 - Other Credited Functional Requirements</u></td></tr>
<tr><td>Address any specific functional requirements</td><td>None identified.</td><td>10 CFR 830,</td></tr>
</table>

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

Evaluation Criteria	Discussion	Reference
for the confinement ventilation system (beyond the scope of those above) credited in the DSA.	Standards Reference Gap Analysis None	Subpart B

Attachment 2 - Gap Modification Cost/Benefit Estimate

Gap Modification Cost/Benefit Estimate

Cost/benefit estimates to close the identified discretionary gaps have been developed to a pre-conceptual level of detail and are presented below:

Discretionary Gap 1: Pressure differential should be maintained between zones and atmosphere (SST/SGT truck bay/normal loading dock)

Gap - The enclosed SST/SGT truck bay and the outdoor loading dock do not incorporate a differential pressure CVS. Passive confinement provided by Type B packaging is credited to protect the worker and the public for design basis events that require controls. The PDSA supporting analyses demonstrate that design basis events do not breach the packaging. There are no safety basis requirements that specify the application of an active or passive confinement system in this situation. Similarly, there will be no realized safety benefits to the public or worker with the installation of a CVS.

Closure Action - The following changes to the SST/SGT truck bay structure would be required to close the discretionary gap: 1) add an airlock for the SST/SGT truck/trailer, 2) modify existing design to close non-confinement ventilation paths and seal off penetrations, 3) extend the Pu Processing Building CVS to the SST/SGT truck bay, with appropriate active components, controls, and ductwork, and 4) upgrade the SST/SGT truck bay structure from PC-2 to PC-3 and perform analyses to support modifications to SSCs.

Cost/Benefit Analysis -

Benefit: None; no dose reduction
Cost: HVAC and supporting design changes - $0.5 million
Structural design changes - $1.0 million
Procurement and construction - $9.5 million
Total Cost - $11 million

Discretionary Gap 2: Post accident indication of filter break-through (sand filter)

Gap - HVAC detailed design remains in progress to identify points to collect samples to monitor radiological conditions within the HVAC system and the performance of confinement systems as specified by SRS Standard 15889. These sampling points/collection systems have not been credited in the PDSA as safety class or safety significant. There is benefit to design the sample collection system at the sand filter exhaust to survive design basis accidents to allow for assessment, monitoring, and emergency planning to diagnose and control evacuations for accidental releases.

Closure Action – Two alternative closure actions were identified: 1) upgrade the on-line stack monitor system from PS to SC (including sample lines, pumps, power supply and analyzer and 2) upgrade the proposed sample collection system at the sand filter discharge to the exhaust stack to PC-3 criteria.

Cost/Benefit Analysis -

	Upgrade On-line Stack Monitoring System	Upgrade Sand Filter Exhaust Sampling
Benefit	None	Support assessment, monitoring, and emergency planning for design basis accidents
Cost	$1.5 million (3 x estimate for PS installation)	$100, 000 (covers analysis, procurement, installation, and QA)

Gap Modification Cost/Benefit Estimate (cont'd)

Discretionary Gap 3: Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically (glovebox exhaust filters)

Gap – HEPA filtration for the glovebox primary confinement exhaust is not credited as an SS confinement control because all ventilation passes through the sand filter. The glovebox primary exhaust plena have provisions for testing in accordance with ASME N510. Glovebox exhaust filters are credited as SS to provide a criticality double contingency control to prevent long-term accumulation of gross amounts of fissile material in the ductwork. Twenty-one of these filters are located within gloveboxes and are not testable in accordance with ASME N510. This condition is identified as a gap to the confinement criterion; however, the criterion does not directly apply to the credited criticality function of the filters. The filter elements will be tested prior to installation and will be equipped with differential pressure indication.

Closure Action – Relocate 21 HEPA filter assemblies outside of primary confinement gloveboxes, reroute ductwork, and install supports and flex connections.

Cost/Benefit Analysis -

Benefit: Compliance with ASME N510 HEPA testing

Cost: $360, 000 (21 filters at $17, 000 per filter of which $12, 000 is design/modeling cost and $5, 000 is for procurement and installation)

Attachment 3 - 2004-2 Data Collection Table 4.3 Submittal

Pit Disassembly and Conversion Facility				Hazard Category 2				Performance Expectations		
Bounding Accidents	Type Confinement (Note 1)		Doses (Note 2)	Confinement Classification			Safety Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	DID				
FIRE EVENTS										
Product NDA Module Room Fire (NA-45)	CVS	3013 Can	Unmitigated MOI - High WG3 - High Mitigated MOI - Negligible WG3 -- Low Note 20	CVS	3013 can		Confinement for public and collocated worker protection	Note 3 Note 7	Note 4 Note 8 Note 9	None
SST/SGT Loading Dock Fire (PS-58)		Type B Package	Unmitigated MOI - High WG3 - High Mitigated MOI - 0 WG3 -- 0	Type B Package			Confinement for public and collocated worker protection	Note 11	Note 12	None
AGV Vault Fire (VM-13)	CVS	3013 can	Unmitigated MOI - High WG3 - High Mitigated MOI - 0 WG3 - 0 Note 21	CVS	3013 can		Confinement for public and collocated worker protection	Note 3 Note 7	Note 4 Note 8 Note 9	None

Pit Disassembly and Conversion Facility				Hazard Category 2				Performance Expectations		
Bounding Accidents	Type Confinement (Note 1)		Doses (Note 2)	Confinement Classification			Safety Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	DID				
Multi-Room Fire (FW-90)	CVS		Unmitigated MOI - High WG3 - High Mitigated MOI - Negligible WG3 - Moderate Note 22	CVS			Confinement for public and collocated worker protection	Note 3	Note 4	None
EXPLOSION EVENTS										
Sanitization furnace Steam Explosion (SF-31)	CVS		Beryllium Release Unmitigated MOI - Moderate WG3 - High Mitigated MOI - Negligible WG3 - Low Note 23		CVS		Confinement for public and collocated worker protection	Note 3	Note 4	None
SRL furnace Steam Explosion (SRL-32)	CVS		Unmitigated MOI - Moderate WG3 - High Mitigated MOI - Negligible WG3 - Low Note 23		CVS		Confinement for public and collocated worker protection	Note 3	Note 4	None

Pit Disassembly and Conversion Facility				Hazard Category 2				Performance Expectations		
Bounding Accidents	Type Confinement (Note 1)		Doses (Note 2)	Confinement Classification			Safety Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	DID				
Product NDA Maintenance Explosion (NA-57)	CVS	3013 can	Unmitigated MOI - Low WG3 - High Mitigated MOI - Negligible WG3 – Low		CVS 3013 can		Confinement for collocated worker protection	Note 3 Note 7	Note 4 Note 8 Note 10	None
LOSS OF CONFINEMENT EVENTS										
Over-pressurization of Interim Storage Can (OH-3)	CVS Note 25	milk bottle	Unmitigated MOI - Low WG3 - High Mitigated MOI - Negligible WG3 – Negligible		milk bottle CVS		Confinement for public and collocated worker protection	Note 3 Note 14	Note 4 Note 15	None
Over-pressurization of Oxide Storage Cans (OH-50)	CVS	3013 can	Unmitigated MOI - High WG3 - High Mitigated MOI - Negligible WG3 – Moderate Note 24	CVS	3013 can		Confinement for public and collocated worker protection	Note 3 Note 7	Note 4 Note 8 Note 9	None
Loss of Ventilation/ Cooling in the Interim Storage Area (VL-16)	CVS	milk bottle	Unmitigated MOI - High WG3 - High Mitigated MOI - Negligible WG3 - Negligible	CVS	milk bottle		Confinement for public and collocated worker protection	Note 3 Note 14	Note 4 Note 5 Note 15	None

Pit Disassembly and Conversion Facility				Hazard Category 2				Performance Expectations		
Bounding Accidents	Type Confinement (Note 1)		Doses (Note 2)	Confinement Classification			Safety Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	DID				
Loss of Ventilation/ Cooling in the Main Vault (Plutonium Operations) (VM-18) Note 31	CVS	3013 can	Unmitigated MOI - High WG3 - High Mitigated MOI – 0 rem WG3 – 0 rem	3013 can	CVS		Confinement for public and collocated worker protection	Note 3 Note 7	Note 4 Note 5 Note 8 Note 9	None
Loss of Ventilation/ Cooling in the Main Vault (Uranium Operations) (VU-3)	CVS	vault structure	Unmitigated MOI - Low WG3 - High Mitigated MOI - Negligible WG3 – Negligible		CVS vault structure Note 30		Confinement for public and collocated worker protection	Note 3 Note 16	Note 4 Note 5 Note 17	None
Misfeed in the Sanitization Furnace (SF-5)	CVS		Unmitigated MOI - Negligible WG3 - High Mitigated MOI - Negligible WG3 – Low		CVS		Confinement for collocated worker protection	Note 3	Note 4	None
AGV Collision Involving 2 Pallets of 3013 Cans (PS-1)	CVS		Unmitigated MOI - Negligible WG3 - High Mitigated MOI - Negligible WG3 – Negligible		CVS		Confinement for collocated worker protection Note 26	Note 3	Note 4	None

Pit Disassembly and Conversion Facility				Hazard Category 2				Performance Expectations		
Bounding Accidents	Type Confinement (Note 1)		Doses (Note 2)	Confinement Classification			Safety Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	DID				
NUCLEAR CRITICALITY EVENTS										
Criticality at the NDA Module	CVS		Unmitigated MOI - High WG3 - High Mitigated MOI - 0 rem WG3 - 0 rem Note 27	CVS			Confinement for public and collocated worker protection	Note 3	Note 4	None
Excess Material in Pit Disassembly Glovebox			Unmitigated MOI - Negligible WG3 - Low Mitigated MOI – 0 rem WG3 -- 0 rem Note 28				Other – Confinement not credited	None	None	None
EXTERNAL HAZARD EVENTS										
Loss of Offsite Power (FW-92)	CVS	3013 can milk bottle	Unmitigated MOI - High WG3 - High Mitigated MOI - Negligible WG3 - Moderate	CVS (Note 29) 3013 can	milk bottle		Confinement for public and collocated worker protection	Note 3 Note 7 Note 14	Note 4 Note 5 Note 8 Note 9 Note 15	None

Pit Disassembly and Conversion Facility				Hazard Category 2				Performance Expectations		
Bounding Accidents	Type Confinement (Note 1)		Doses (Note 2)	Confinement Classification			Safety Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	DID				
SST/SGT Loading Dock Fire (External Event) (FW-105)		Type B Package 3013 can	Unmitigated MOI - High WG3 - High Mitigated MOI – 0 rem WG3 – 0 rem	Type B Package	3013 can		Confinement for public and collocated worker protection	Note 11 Note 7	Note 12 Note 8 Note 9	None
NATURAL PHENOMENA EVENTS										
Earthquake-Induced Collapse of Interior Walls in the PDCF (FW-109)	CVS	Type B Package 3013 can glovebox	Unmitigated MOI - Low WG3 - High Mitigated MOI - Negligible WG3 - Low		CVS Type B Pkg 3013 can glovebox	2/1 Seismic Qual of Walls	Confinement for public and collocated worker protection	Note 3 Note 7 Note 11 Note 18	Note 4 Note 5 Note 6 Note 8 Note 9 Note 13 Note 19	None
Seismic Induced Vault Criticality (FW-110)			Unmitigated MOI - High WG3 - High Mitigated MOI – 0 rem WG3 -- 0 rem				Other – Confinement not credited; seismic qualified SC racks/ pallets credited to prevent event.	None	None	None

Pit Disassembly and Conversion Facility				Hazard Category 2				Performance Expectations		
Bounding Accidents	Type Confinement (Note 1)		Doses (Note 2)	Confinement Classification			Safety Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	DID				
SST/SGT Loading Dock Tornado or Tornado Generated Missile Impact (FW-116)		Type B Package	Unmitigated MOI - negligible WG3 - Moderate Mitigated MOI - negligible WG3 - negligible			Type B Package	Other – DID confinement for collocated worker protection	Note 11	Note 13	None
Seismic-Induced Fire (FW-111a)	CVS		Unmitigated MOI - High WG3 - High Mitigated MOI - Low WG3 - Moderate	CVS			Confinement for public and collocated worker protection	Note 3	Note 4 Note 5 Note 6	None

Notes:

1. Credit of the confinement ventilation system (CVS) includes credit of the SC Pu Processing Building confinement structure and supporting SC SSCs.
2. Dose categories are:

   Maximum Offsite Individual (MOI) – Negligible (< 0.5 rem), Low (≥ 0.5, <5 rem), Moderate, (≥ 5, <25 rem), High (≥ 25 rem)

   – Negligible (< PEL-TWA), Low (≥PEL-TWA, <ERPG-1), Moderate, (≥ERPG-1, < ERPG-2), High (≥ERPG-2)

   Worker Group 3 (WG3) – Negligible (< 5 rem), Low (≥ 5, < 25 rem), Moderate, (≥ 25, < 100 rem), High (≥ 100 rem)

   – Negligible (< ERPG-1), Low (≥ERPG-1, < ERPG-2), Moderate, (≥ERPG-2, < ERPG-3), High (≥ ERPG-3)

   Radiological dose consequences were estimated using Version 1.5.11.1 of the MACCS code for the collocated worker and the maximum offsite individual. Guidance recommendations provided in the Savannah River Site (SRS) *MACCS Input Data Guidance for SRS Applications* were used to supplement accident-specific data to conduct consequence modeling. The collocated worker was evaluated at the 50th quantile dose level without regard to sector, while the MOI was evaluated at the 95th quantile dose level without regard to sector. To determine receptor consequences, flat topography was assumed between the source and the receptor. External dose-rate conversion factors (cloudshine and groundshine) used in the MACCS code were based on Federal Guidance Report 12. Internal dose conversion factors (DCFs) (inhalation) used in the MACCS code were based on Publication 68 and 72 of the International Commission on Radiological Protection (ICRP) to assess the 50-year CEDE. The receptor populations are an adult worker and an adult member of the general public. ICRP Publications 68 and 72 give inhalation DCFs for the worker and general public, respectively. Source term particle sizes of 1.0 μm and 0.1 μm AMAD were used for unmitigated and mitigated (filtered) releases, respectively. Source terms were calculated using DOE-HDBK-3010-94 methodologies. A leak path factor of 1 was used for unmitigated accidents. For mitigated accident conditions, a sand filter removal efficiency of 99.51% was credited. Releases associated with fires were modeled using the CONTAIN code. A maximum leak path factor of 3.6E-3 was predicted.

Radioactive materials in the Pu Processing Building are an intrinsic hazards associated with the surplus weapons material received for processing and, to a lesser extent, the process activities conducted at the facility. They include weapons-grade plutonium (metal and oxide forms), HEU (metal and oxide forms), auxiliary uranium (metal and oxide forms of HEU that have high levels of plutonium contamination), tritium contamination, and sealed sources (plutonium-238, californium-252). Chemicals associated with PDCF operations primarily involve those used for decontamination processes and for Analytical Laboratory activities. Hazardous chemical quantities are below Reportable Quantities, Threshold Quantities, and Threshold Planning Quantities. Beryllium metal will be present in kilogram quantities. Only aerosolized beryllium particulates present a hazard to PDCF workers. These hazards will be managed in accordance with 10 CFR 850.

3. 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.
4. 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 Processing Building 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.
5. CVS Performance Requirement: Safety class emergency diesel generator power and safety class DC power (SC-7A) shall be provided for safety class HVAC Confinement System functions.
6. CVS Performance Requirement: Shall be designed and constructed to PC-3 natural phenomena design criteria.
7. 3013 Can Functional Requirement: Shall safely store radioactive material in accordance with DOE-STD-3013 performance requirements.
8. 3013 Can Performance Requirement: The minimum design pressure of the outer container shall be 699 pounds per square inch gauge (psig) (WSRC report T-ESR-F-00003, Rev 0) provides associated thermal performance behavior).
9. 3013 Can Performance Requirement: The moisture content (weight loss, if using the loss-on-ignition [LOI] method) of oxide to be packaged in any type of sealed container shall be less than 0.5 wt% at the time of packaging.
10. 3013 Can Performance Requirement: The outer container shall remain leak-tight as defined by ANSI N14.5 after a free drop of the package (outer container, inner container, and simulated contents) from a 30-foot height onto a flat, essentially unyielding, horizontal surface.
11. Type B Package Functional Requirement: Provide confinement of radioactive material outside of the Pu Processing Building.
12. Type B Package Performance Requirement: Shall meet the thermal performance requirements of 10 CFR 71.73 for hypothetical accident conditions.
13. Type B Package Performance Requirement: Shall meet the free drop, crush, and puncture performance requirements of 10 CFR 71.73 for hypothetical accident conditions.
14. Milk Bottle Functional Requirement: Milk bottles used for interim storage of plutonium oxide shall be vented and provide filtration.
15. Milk Bottle Performance Requirement: Milk bottle vent filters shall have a minimum retention of 99.97 percent of 0.3-micrometer (μm) test aerosol particles.
16. Vault Structure Functional Requirement: Provide a confinement barrier to minimize the release of radioactive airborne material from the vaults.
17. Vault Structure Performance Requirement: The penetrations into the Main Vault, Product Vault, and Interim Storage Area Structures shall comply with NFPA requirements. No further performance requirements are required for confinement.
18. Glovebox Functional Requirement: Mitigate radiological material releases within the glovebox from entering process areas and the environment.

19. Glovebox Performance Requirements: a) Shall maintain confinement capabilities after a drop or spill event within a glovebox without the use of primary ventilation, b) Shall be designed to PC-2 seismic criteria to maintain confinement functions, c) Shall be designed to PC-3 seismic criteria to maintain criticality spacing and separation.
20. Mitigated doses credit CVS filtration and limited 3013 can thermal performance (can qualifications not complete at this stage of process where fire occurs).
21. Mitigated doses credit CVS filtration and 3013 can thermal performance.
22. Mitigated doses credit CVS filtration and engineering judgment for other controls (e.g., combustible controls, fire barriers, 3013 can thermal performance).
23. Mitigated doses only credit CVS filtration; however, credited safety significant furnace design would prevent explosion.
24. Mitigated doses only credit CVS filtration.
25. Includes glovebox ventilation system.
26. Automated guided vehicle (AGV) collision avoidance system also credited to prevent/control collision.
27. Postulated criticality would fail 3013 cans; CVS credited as SC to mitigate event; however, SS criticality double contingency controls would prevent event.
28. Criticality double contingency controls credited to prevent event.
29. CVS credited as a safety class control to protect the public for postulated releases associated with interim storage; the 30`3 can provides a passive safety class control for main vault release hazards.
30. The vault structures are safety class PC-3 seismically qualified fire barriers, but are credited as a safety significant control for this scenario.
31. For this bounding event, it is postulated that the vault inventory consists of Pu oxide filled containers; for other events the FL CV (SI) is credited as a passive safety significant control to protect the worker.

Attachment 4 - PDCF Facility Evaluation Team

Attachment 4 – PDCF Facility Evaluation Team

Jim Clark - WGI/Battelle PDCF Safety Basis/Analyst SME

Jim Clark is a graduate of University of New Mexico with a Bachelor and Master's Degrees in Nuclear Engineering. He is also a graduate of the US Naval Nuclear power program. Jim has over 25 years experience in operations, supervision of operations, DSA and PRA development and hazards and accident analyses for both reactor and non-reactor nuclear facilities. He previously held an NRC SRO license at the University of New Mexico research reactor. In addition, he has supported development and review of DSAs and PRAs for reactors and non-reactor nuclear facilities at SRS, Hanford, Sandia, WIPP, Pantex and Los Alamos National Labs. He has 20 years experience working with these DOE Sites as an analyst/engineer, Senior Engineer, Instructor, project manager, and consultant. He is also a former Naval Nuclear Power qualified Officer with over 25 years combined active and reserve service.

Larry East - WSRC Ventilation System SME

Larry East has a BS in Mechanical Engineering and a Masters in Business Administration. Larry has over 30 years experience in Project and Engineering Management, Facility Evaluation Board, Engineering Management, Nuclear Safety Analyses, Regulatory Requirements, Operations, Maintenance, Reliability, Confinement Ventilation Systems, Nuclear Facilities Safeguards and Security, and Modification of Nuclear Facilities. He is a certified Project Management Professional, and a member of the Project Management Institute International and American Society of Military Engineers. He is also a Retired Naval Officer where he served in the Naval Civil Engineer Corps (Seabees) where he performed government Contracting Officer responsibilities in the US and abroad.

Marv Gehret - WGI, PDCF HVAC SME

Marv Gehret is a graduate of the University of Dayton with a Bachelor of Technology degree and is a registered professional engineer in the state of Colorado. He has over 35 years of experience as a mechanical engineer primarily involved in the design, construction, and operation of HVAC systems. Prior to the PDCF project Marv had extensive experience in HVAC system design for DOE nuclear facilities at Rocky Flats, Idaho National Engineering Lab, Los Alamos National Lab and Hanford. Additional experience includes new and retrofit design and trouble-shooting for other industrial facilities, engineer for a professional engineering company specializing in testing and balancing and as an applications engineer for a major controls manufacturer.

Sam Glenn, NNSA SRS Office of Nuclear Nonproliferation

Sam Glenn is a senior engineer in the NNSA, Office of Nuclear Nonproliferation at the Savannah River Site. He provides oversight for technical, engineering, and design activities for NNSA nuclear material disposition activities at the site. Specific areas of responsibility and expertise include safety analysis / authorization bases, ventilation systems, and fire protection. Before joining the NNSA nonproliferation programs Mr. Glenn was the technical advisor and special assistant to the Manager, Department of Energy (DOE) Savannah River Operations Office. Prior to his assignment to the SR Manager's staff, Mr. Glenn was the Defense Waste Processing Facility (DWPF) Program Manager. Mr. Glenn has a BS in Mechanical Engineering from Clemson University.

Steve Kline - WGI/Battelle, PDCF Nuclear Safety Lead

Steve Kline is a registered professional engineer in the state of Colorado with a B.S degree in Mechanical Engineering from Loyola University and a Master's degree in Fluid and Solid Mechanics from UCLA. He has over 30 years of experience in the U.S. Department of Energy (DOE) complex and the commercial power (fossil/nuclear) and private industry. He has provided key technical assistance to clients for the development of strategies and analyses for multiple safety analyses, environmental actions and for the preparation of risk assessments (facility/transportation) in compliance with regulatory requirements. He is currently the Nuclear Safety Lead for the Pit Disassembly and Conversion Facility (PDCF) design project.

Attachment 4 – PDCF Facility Evaluation Team

John Lux - Ventilation System SME Consultant

John Lux is a licensed professional engineer with the State of Ohio and a Graduate of the University of Illinois with an MS degree in mechanical engineering and a BS degree from the University of Akron. John has over 25 years experience in research, design, fabrication, prototype development and testing in various mechanical systems disciplines. His experience also includes Providing engineering, design, and technical direction for maintenance and installation activities in DOD, DOE, and industrial applications. Projects included hot water and steam boilers, comfort HVAC, medium and low temperature refrigeration, and commercial kitchen equipment. Conducted continuing education classes to technicians for certification in heating, cooling, and refrigeration system operation and repair. He is currently the president of JLA associates a multi-disciplinary engineering consulting firm providing engineering and design, construction management, and regulatory compliance services to commercial and industrial clients in 28 states.

Doug Melton - WSRC Safety Basis/Analyst SME

Doug Melton is a is a licensed professional engineer with the State of South Carolina and a Graduate of the University of Louisville with BS and M. Eng degrees in Chemical Engineering. He is a principal engineer with the PDCF Design Authority group. Doug has 19 years experience at Savannah River Site with experience providing engineering support to the Plutonium Immobilization Program and the Nuclear Material Management Division. He was the lead engineer for the HB-Line System Engineering Group, where he provided facility engineering support during the Cassini Program (Pu-238 mission). He was involved in the development and implementation of the safety documentation for HB-Line Pu-238 operations.

Mike Mobley - WSRC Design Authority Manager

Mike Mobley is a graduate of Clemson University with an MS degree in chemical engineering and a BS degree from the University of South Carolina. Mike has over 25 years of experience in managing technical organizations over a broad range of disciplines and specialties including applied research and development of actinide separations processing technology, management of technical organizations at Savannah River Site as well as a commercial chemical plant. His Savannah River management experience includes direct engineering support to operating facilities consisting of process computer control and data management system development to quality assurance support of operating nuclear facilities. Mr. Mobley has been the NNP Design Authority Manger since August of 2005, where he provides management of requirements-based design reviews of technical design documents for large scale nuclear facility projects. These review include code and standard compliance, selected SRS engineering guides and standards and hazards, accident, and nuclear criticality safety analyses adequacy.

Mahendra Patel - WGI, PDCF Lead HVAC Engineer

Mahendra Patel is registered professional engineer with a B.S degree in Mechanical Engineering from Gujarat University (India), as well as Master's degree in Mechanical Engineering from University of Missouri. He has over 35 years of experience in the complex HVAC design of industrial facilities. Currently he is a lead HVAC engineer on Pit Disassembly and conversion facility (PDCF) project for the Department of Energy.