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Department of Energy
Washington, DC 20585

SEP 2 2006

The Honorable A.J. Eggenberger
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, DC 20004-2941

Dear Mr. Chairman:

The purpose of this letter is to transmit the two Pilot Facility evaluations conducted by Environmental Management (EM) for Deliverable 8.6.3 of Defense Nuclear Facilities Safety Board Recommendation 2004-2, *Active Confinement Systems.*

Per our commitment, the Pilot Facility evaluations were performed by the individual sites in coordination with the Independent Review Panel (IRP), Central Technical Authority (CTA), and your staff. In-process reviews were conducted with the IRP after each site had collected relevant data from their documented safety analysis and after initial comparisons had been made to the established ventilation system performance criteria. Final review of the complete report is continuing and the IRP review reports are being generated. The IRP review reports along with the lessons learned from the Pilot Facility evaluations will be provided to you upon completion. Final Program Secretarial Officer concurrence and approval of gaps and any upgrades, if necessary, will be in accordance with Deliverable 8.6.5.

EM appreciates the involvement of your technical staff during the Pilot Facility evaluation process and will continue to coordinate with them during completion of the IRP review reports and the final concurrence by EM and the CTA.

If you have any comments or feedback, please call me at (202) 586-0738 or Mr. Dae Y. Chung, Deputy Assistant Secretary for Safety Management and Operations, at (202) 586-5151.

Sincerely,

FOR

Dr. Inés R. Triay
Chief Operating Officer for
Environmental Management

Attachments

cc: Mark Whitaker, DR-1
Russell Shearer, EH-1
Glenn Podonsky, HSS-1

SEPARATION

PAGE

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United States Government Department of Energy (DOE)

memorandum

Savannah River Operations Office (SR)

DATE: SEP 06 2006

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

SUBJECT: Office of Environmental Management (EM) Expectations for Implementation of Commitment 8.6 Under the Department of Energy Implementation Plan Responding to Defense Nuclear Facilities (DNFSB) Recommendation 2004-2 (Memorandum, Triay to Distribution, 06/09/2006)

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

The Savannah River Site (SRS) has completed the attached DNFSB 2004-2 Actinide Removal Process (ARP) Pilot Evaluation Report. SRS recommends that no modification be made to the ARP ventilation systems. This memorandum requests that you, as the EM technical lead for DNFSB 2004-2, coordinate the review of the subject report with the DNFSB 2004-2 Independent Review Panel, Program Secretarial Officer, and Central Technical Authority. After coordination of the review with the necessary parties, I request that you provide concurrence with the report's recommendation by September 15, 2006, to support the critical path schedule for the ARP project.

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

Jeffrey M. Allison
Manager

SRPD:MAS:sl

OESH-06-0165

Attachment:
Pilot DNFSB 2004-2 Ventilation Implementation Final Report for ARP

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

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

Facility: **Actinide Removal Process Pilot for DNFSB 2004-2 Active Confinement Systems.** WSRC Letter LWD-2006-0037, dated July 27, 2006 Pilot DNFSB 2004-2 Ventilation Implementation Final Report for Actinide Removal Process

Reference:

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

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

In accordance with the References above, the SRS Site Evaluation Team has reviewed and concurs with the submittal of the attached Final Report for Actinide Removal Process.

Site Evaluation Team (SET) Concurrence:

MA Smith — 7/31/06
Mark A. Smith, DOE-SR, Site Lead for SET — Date

Tony Hawkins for Richard Salizzoni — 8-29-06
Richard L. Salizzoni, WSRC Lead for SET — Date

SRS Site Evaluation Team consists of the following personnel:

DOE Site Lead and SET Chairman (Mark A. Smith, OESH/SRPD)
DOE Alternate Site Lead & Safety Basis SME (John A. Smartt, OESH/SRPD)
DOE Ventilation System and Natural Phenomena Hazards SME (Brent J. Gutierrez, AMWDP/WDED)
WSRC 2004-2 Site Lead Richard L. Salizzoni (TQS/Engineering Standards Mgr.)
WSRC Alternate Site Lead & Safety Basis SME (Andrew M. Vincent, TQS/Nuclear Safety Department Mgr.)
WSRC Ventilation System SME (Scott J. MacMurray, SRNL Facility Engineering)
WSMS Safety Basis SME (Robert R. Lowrie)
WSRC SET Administrative Assistant (Barbara A. Pollard, Nuclear Safety Dept.)

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

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LWD-2006-0037
RSM Track #: 10067

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orig | SRPD

Dr. Karen L. Hooker, Director
DOE, Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

Dear Dr. Hooker:

Pilot DNFSB 2004-2 Ventilation Implementation Final Report for Actinide Removal Process

Ref: 1. Letter, V.G. Dickert, to Dr. Karen L. Hooker, *Formal Correspondence*, 5/30/06, *LWD-2006-0021, Rev. 0, Pilot DNFSB 2004-2 Ventilation Implementation (Table 4.3)*

This letter transmits the final report of DNFSB Recommendation 2004-2, Active Confinement Systems for the Actinide Removal Process (ARP) involving the 241-96H, 512-S and 512-6S Facilities located at the Savannah River Site (SRS) for Site Evaluation Team review and concurrence. This is in accordance with the DOE guidance provided in "Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems." The ARP facilities have been identified as a pilot project for DNFSB Recommendation 2004-2 evaluations for the DOE complex.

As previously discussed in the transmittal of Table 4.3 to the Site Evaluation Team (Ref: Letter, V.G. Dickert, to Dr. Karen L. Hooker, *Formal Correspondence*, 5/30/06, *LWD-2006-0021, Rev. 0, Pilot DNFSB 2004-2 Ventilation Implementation (Table 4.3)*, the ARP facilities are identified as Hazard Category 2. The 241-96H and 512-S active confinement ventilation systems are functionally classified as Production Support (PS) and were qualitatively assessed to meet Performance Category 2 (PC-2) criteria for the applicable Natural Phenomena Hazard (NPH) events. The functional classification is based upon the low radiological and chemical consequences to both on-site and off-site receptors from postulated events as evaluated in the Consolidated Hazards Analysis (CHA) for each facility.

In accordance with DOE 2004-2 evaluation guidance, SRS evaluated the active confinement ventilation systems at 241-96H and 512-S facilities, the 512-6S facility using the Safety Significant (SS) criteria defined in Table 5.1 due to the Hazard Category 2 inventory levels. To assess functionality for applicable NPH events, PC-2 criteria were used. Gaps were identified between the SS criteria and the facility designs. These gaps were deemed to be discretionary in nature since none of the gaps involved a discrepancy between the Safety Basis requirements and the facility designs. A cost/benefit analysis was performed for the modifications that would be necessary to close the gaps for each facility.

Based upon the results of this evaluation, the Facility Evaluation Team recommends that no modifications be made to the ARP ventilation and supporting systems. Given that there is no dose reduction to the public, minimal dose reduction to the Collocated Worker, high cost of implementation, significant impact to the startup schedule, and the short ARP operating life, the modifications can not be justified.

JUL 27 2006

Facility Evaluation Team Concurrence:

Donald J. Blake, DOE Safety System Oversight — Date 7/27/06

Walter L. Isom, Jr., Integrated Salt Projects Chief Engineer — Date 7/27/06

Marshall S. Miller, DWPF Chief Engineer — Date 7-27-06

David Little, Tank Farm Chief Engineer — Date 7-27-06

Sincerely,

for V.D.

Virginia Dickert, Chief Engineer
Liquid Waste Operations

JUL 2 7 2006

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Savannah River Site
241-96H and 512-S Facilities

DNFSB Recommendation 2004-2
Ventilation System Evaluation
Revision 0
July 26, 2006

Review and Approval

Facility Evaluation Team Concurrence:

Donald J. Blake, DOE Safety System Oversight — Date: 7/27/06

Walter L. Isom, Jr., Integrated Salt Projects Chief Engineer — Date: 7/27/06

David Little, Tank Farm Chief Engineer — Date: 7-27-06

Marshall S. Miller, Waste Solidification Chief Engineer — Date: 7·27·06

for V.G.D

Virginia Dickert, Chief Engineer Liquid Waste Operation — Date: 7-27-06

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Acronyms

ARP	Actinide Removal Process
CHA	Consolidated Hazard Analysis
CW	Co-located Worker (100 meters)
DCS	Distributed Control System
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DSA	Documented Safety Analysis
DWPF	Defense Waste Processing Facility
EG	Evaluation Guideline
HEPA	High Efficiency Particulate Air
LCS	Local Control Station
MAR	Material At Risk
MCU	Modular Caustic Solvent Extraction Unit
MST	Monosodium Titanate
mREM	Milli-REM
NPH	Natural Phenomena Hazard
PC	Performance Category
PS	Production Support
PVV	Process Vessel Vent
REM	Roentgen Equivalent Man
SC	Safety Class
SRS	Savannah River Site
SS	Safety Significant
TPC	Total Project Cost

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

This confinement ventilation evaluation is for the 241-96H, 512-S, and 512-6S facilities associated with the Actinide Removal Process (ARP) at the Savannah River Site (SRS). This evaluation was developed in accordance with the Department of Energy (DOE) evaluation guidance for Defense Nuclear Facility Safety Board (DNFSB) Recommendation 2004-2. The ARP project was identified as a pilot for the DNFSB Recommendation 2004-2 evaluation effort. This evaluation included the active ventilation systems in 241-96H and 512-S. The 512-6S laboratory facility currently has no installed active confinement ventilation system.

The ARP facilities are identified as Hazard Category 2. The 241-96H and 512-S active confinement ventilation systems are functionally classified as Production Support (PS) and meet Performance Category 1 (PC-1) criteria for the applicable Natural Phenomena Hazard (NPH) events. This functional classification is based upon the low radiological and chemical consequences to both 100-m on-site and off-site receptors from postulated events as evaluated in the Consolidated Hazards Analysis (CHA) for each facility.

The CHA Process did not identify any hazard events that needed to have controls included in the Documented Safety Analysis. The events identified in the CHA do not challenge the 25 REM public Evaluation Guideline (EG) from DOE-STD-3009-94 or the 100 REM Co-located Worker (CW) criterion from the WSRC Functional Classification procedure when assessed at 100-m . The bounding event, a design basis seismic event, yielded an unmitigated offsite dose consequence potential of approximately 20 mREM and less than 12 REM for the CW. These unmitigated doses were calculated using a leak path factor of 1.0 (i.e., no credit was taken for any of the active confinement ventilation systems or passive design features).

In accordance with the DOE 2004-2 evaluation guidance, SRS evaluated the active confinement ventilation systems at 241-96H and 512-S facilities, and the 512-6S facility using the Safety Significant (SS) criteria defined in Table 5.1 due to the Hazard Category 2 inventory levels. To assess functionality for applicable NPH events, PC-2 criteria were used. Gaps were identified between the SS criteria and the facility designs. These gaps were deemed to be discretionary in nature since none of the gaps involved a discrepancy between the Safety Basis requirements and the facility designs.

A cost/benefit analysis was performed for the modifications that would be necessary to close the discretionary gaps for each facility. Replacing PC-1 seismic ventilation ductwork, High Efficiency Particulate Air (HEPA) filters, fans, and enclosures with PC-2 rated components would not be effective for post accident mitigation without providing seismically qualified back up power and its associated components and instrumentation. Conversely, building and instrumentation modifications would not be effective without qualifying the ventilation system at PC-2 demand loads and providing PC-2 qualified backup power. Therefore in order to obtain a benefit, all discretionary gaps would have to be closed concurrently.

The active confinement ventilation systems for the ARP facilities are not required to be Safety Class (SC) or SS since unmitigated radiological consequences are very low. It is noted that all events from the Table 4.3 submittal are very unlikely with the exception of spills. Spills are contained within cells and the current HEPA filtered ventilation systems will provide confinement without modifications. The existing ventilation systems would thus, provide the same dose mitigation as modified systems for a non-NPH spill event.

Each process building has qualitatively been shown to be capable of withstanding a PC-2 wind and seismic event, therefore a degree of confinement will be maintained even if no modifications are made. In addition, operator response actions will be established to mitigate a release to both the public and CW during the potential release events.

The estimated total cost of the modifications to address all identified gaps would be approximately $65 to $80 million and would delay ARP radioactive operations startup approximately two years to develop and implement.

Installation of modifications to address the identified gaps would provide limited overall dose reductions, would only add active confinement assurance for NPH events where emergency response actions are adequate, and would require significant overall cost to implement considering the projected three year operating life of the facility. Therefore, the Facility Evaluation Team has determined modifications to the ARP facilities are not recommended.

1. Introduction

1.1 Facility Overview

The ARP mission is to support the removal of radioactive and chemical liquid waste from storage tanks at the SRS Tank Farms and its conversion into a solid form for long term disposal. The ARP will be performed in the 241-96H, 512-S, and 512-6S facilities with a projected operating life of three years. Based upon the radiological inventory that the facilities will process, the Hazard Classification for the ARP facilities is Hazard Category 2. The facilities were modified to support the ARP mission approximately one year ago with plans to put them in radioactive operation in late 2007. The 241-96H and 512-S ventilation systems were designed and installed 10 to 15 years ago.

The process adds Monosodium Titanate (MST) to an aqueous salt waste solution from High Level Waste Storage Tank 49 in order to adsorb strontium and actinides for separation and disposal at the Defense Waste Processing Facility (DWPF). The process flow sheet entails MST addition and mixing in the 241-96H building and then a batch transfer of the mixture to 512-S where a mechanical separation process using cross flow filtration removes strontium and actinide laden MST from the salt solution. Batch processing is repeated until a concentrated MST solution is obtained. The distillate (filtrate) is sent to the Modular Caustic Solvent Extraction Unit (MCU) and the concentrated MST is sent to DWPF for further processing.

1.2 Confinement Ventilation System/Strategy

<u>241-96H Facility</u>

The Process Building ventilation system draws fresh air from outside through two intake supply houses by one of two exhaust fans. Incoming air flows through two supply ducts mounted to the ceiling of the building. Supply air is discharged through four vents from each supply duct over the process cells and flows into the truck well area. Air in the process cells and truck well passes through one of two HEPA filter banks and exhausts through an exhaust fan to the common 241-96H exhaust stack. The Process Building HEPAs and exhaust fans are located outside of the building.

The PVV system supports two MST Strike Tanks, one in each process cell. Air enters from the process cell into each MST Strike tank through an annular space around the agitator shaft. Air is then swept through the vapor space of the tank and exits through a tank PVV nozzle where it passes through one of two HEPA filters and exhausts through the PVV exhaust fan to the common 241-96H exhaust stack. The PVV HEPAs and exhaust fan are located outside of the building.

<u>512-S Facility</u>

The Process Building Ventilation System provides air circulation for the 512-S process and service areas. For the process areas and the parts of the service building that exhaust to the process area, the Process Building Ventilation System removes any radioactive particles from the air before discharging it to the environment through a common 512-S exhaust stack. The Process Building Ventilation System exhausts air from process building and vacuum blower room through HEPA filters. Outside air is continuously drawn into the 512-S process area via louvers located in the walls of the 512-S Building. The air is pulled out of the process area via exhaust ducts and passed through a HEPA filter bank. The HEPA filtered air is exhausted to atmosphere via the common 512-S exhaust stack. The Process Building Ventilation System can also provide a path for air flow through the process cells when one or more of the cell covers are removed for maintenance. The 512-S Process Building Ventilation exhaust fan and ductwork are located outside the building. The Process Building Ventilation HEPA filter unit is located in the 512-1S, HEPA Filter Building.

PVV System flow is provided from the atmosphere and 512-S Building to the process cells via piping (with inlet HEPA filters in parallel in case of flow reversal) and gaps in the cell covers due to the suction from the PVV System blower. The process tanks also have flow pulled through them via in-leakage and overflow lines via the PVV System blower. The PVV System is designed to maintain a differential pressure between the tanks and cells via pressure controllers. Flow is discharged through 4 parallel HEPA filters prior to exiting via the common 512-S exhaust stack.

512-6S Laboratory

The 512-6S Laboratory is a separate facility that may be used to draw low activity filtrate samples into sample vials for analyses offsite. The laboratory was added to the confinement ventilation assessment by virtue of the sample line being connected to one of the process tanks in 512-S. In 2002, a cost/benefit analysis was performed (Ref. 9) and it was determined that the installed confinement ventilation was not necessary for the laboratory because the unmitigated radiological consequences were less than 1.5 mREM to the CW for a sample spill. Based upon this determination, the ventilation system was subsequently removed.

Summary

The applicable DSAs (Ref. 4 and 5) and CHAs (Ref. 1, 2 and 3) for the ARP facilities do not credit any active confinement ventilation system to perform a SC or SS function. The ARP ventilation systems are used for contamination control and to ensure that the vapor spaces in the processing tanks are swept of potentially flammable vapors.

1.3 Major Modifications

There are no Major Modifications currently underway or planned for these facilities. As described above these facilities were recently modified to accomplish the ARP mission.

2. Functional Classification Assessment

2.1 Existing Classification

The active confinement ventilation systems in the ARP facilities are functionally classified as PS and PC-1. The building and process cells were qualitatively evaluated and judged (Ref. 17) to be able to withstand PC-2 NPH events and not fail in a manner that will initiate a spill event.

2.2 Evaluation

There are no SS or SC functions for 241-96H and 512-S associated with the existing active confinement ventilation systems. The CHA did not identify any events that challenge the 25 REM public EG from DOE-STD-3009-94 (Ref. 7) or the 100 REM CW criteria per WSRC procedure E7 2.25, Functional Classification (Ref. 6) as applied at 100-m. The bounding event, a design basis seismic event, yielded an unmitigated offsite dose consequence potential of approximately 20 mREM and less than 12 REM to the 100-m CW. As such, the active confinement ventilation systems in 241-96H and 512-S are appropriately classified as PS.

2.3 Summary

The PS functional classification of the existing active confinement ventilation systems for 241-96H and 512-S is appropriate.

3. System Evaluation

SRS evaluated the active confinement ventilation systems at 241-96H and 512-S Facilities, and the 512-6S Laboratory in accordance with Ref. 8. Table 4.3 (Ref. 10 - included as Attachment 6) was developed from the CHA hazard events since the DSAs do not identify any events that require SS controls. Systems were walked down and documentation was reviewed to confirm system configuration. System configurations were evaluated against the criteria in Table 5.1 and gaps were identified and documented in Attachments 1 through 5. Design Services personnel (construction and estimators) along with the system Design Authority engineers were used to develop scopes of work for the modifications required to close each gap. The estimators then developed cost estimates for the physical modifications. Standard estimating percentages were used for the design and management overhead costs to develop a Total Project Cost (TPC) estimate. The additional costs to further design and build the systems to withstand the effects of a deflagration are estimated to be approximately 50% above the costs used for the cost/benefit analysis. The additional costs were not included in the cost/benefit analysis because the Facility Review Team believes that the prevention of deflagrations would be a more prudent approach as further discussed below.

3.1 Identification of Gaps

This assessment evaluated the ventilation systems and supporting structures, systems and components in 241-96H and 512-S against SS/PC-2 criteria. Although the radiological dose potential is significantly lower than SS classification criteria, events from the CHA were used to determine dose reduction if each facility was modified to close the identified gaps. The methodology and events chosen were previously documented in Table 4.3 and submitted to DOE (Ref. 10).

The SS classification and the associated attributes in Table 5.1 were used as a guide so that the active confinement ventilation systems could be evaluated to a common set of criteria. Since the use of SS criteria was not mandatory per the DSA, modifications to close any identified gap are deemed to be discretionary in nature.

When developing Table 5.1, the following CHA events were considered:

- Process Spill
- Tank Deflagration
- Wind Event
- Seismic Event
- Laboratory Sample Station Spill (512-6S, only)

The Table 4.3 submittal identified tank deflagration as a potential radiological release event. Radiolytic decomposition of water produces combustible gases. It would take a period of several weeks to reach 100% of the Lower Flammability Limit . The buildup of flammable vapors within the vessels is unlikely due to the limited generation rate and facility operating procedures. These procedures will require shiftly surveillance of PVV instrumentation to detect a non-operational ventilation system. Operator action will promptly restore the PVV system or provide alternate ventilation. Therefore, a tank deflagration is considered a highly unlikely event.

Chapter 9 of the DWPF DSA (Ref. 4) includes a discussion of accidents associated with 512-S (Explosions, Earthquakes and High Winds). For explosions, the DSA states that to prevent the vessel vapor space from becoming flammable, nitrogen is added to the vessel vapor space by the nitrogen purge system. No SC or Defense In Depth (including SS) controls are credited, therefore the unmitigated and mitigated scenarios are the same.

3.2 Gap Evaluations

Each of the active confinement ventilation systems was compared with SS system performance criteria in Table 5.1 of Ref. 8. In order to perform this evaluation, ventilation and support systems were walked down and documentation was reviewed to confirm system configuration. Systems were then evaluated against the criteria in Table 5.1, gaps were identified and documented in Attachments 1 through 5. Design Services personnel (construction and estimators) along with the system Design Authority engineers used the gap information to develop scopes of work for the modifications required to close each gap. These scopes of work were reviewed with the Facility Evaluation Team to ensure consistency prior to performing a cost/benefit analysis.

3.3 Modifications and Upgrades

The discretionary gaps identified in Attachments 1 through 5 were reviewed and modifications to close the gaps were developed. These modifications were developed to a pre-conceptual scope level of detail. The modifications are summarized below.

In order for the confinement ventilation system to operate after a PC-2 seismic event, it would be necessary to implement all modifications to ensure that all ventilation and support systems would remain intact; the building and its instrumentation would continue to function (to aid ventilation confinement); backup power would be available to power instrumentation and ventilation fans; and the tanks, cells and ventilation systems would not be affected by seismic interactions. All of the modifications would require a review to determine to what extent the applicable Technical Baseline documentation would need to be revised. Additionally, these modifications would require the development of operating, maintenance and surveillance procedures, seismic interaction analyses, and upgrading the Safety Basis documentation.

There is no dose reduction to the public for modification implementation because systems will not be modified to a SC level. The majority of dose reductions would come from crediting active ventilation system HEPA filters, assuming a minimum filter efficiency of 95%. The estimated cost for modifications is $65 to $80 million. The facility modifications, associated costs to implement those modifications and the resulting CW dose reductions are:

- 241-96H Building, Instrumentation, Facility Stack, Ventilation Ductwork, HEPA Filter/Fan and Enclosure Modifications, and the installation of Backup Power is $25 to $30 million (Reference 11).
    - Reduces CW dose from approximately 3.8 to 0.2 REM for a non-NPH Process Spill

      The ventilation system prevents flammable conditions from developing in the tanks and thus preventing a deflagration. Thus a PC-2 seismic/wind qualified PVV system will prevent a deflagration in an NPH scenario. The combined effect of preventing a deflagration and providing HEPA filtration to address the spill results in a reduction in the CW dose due from 6.1 to 0.2 REM during a seismic/wind event (6.1 to 3.8 reduction due to prevention of deflagration and 3.8 to 0.2 due to active HEPA filtration).

- 512-S Building, Instrumentation, Facility Stack, Ventilation Ductwork, HEPA Filter/Fan and Enclosure Modifications and the installation of Backup Power is $35 to $40 million (Reference 11).
    - Reduces CW dose from approximately 3.8 to 0.2 REM for a non-NPH Process Spill

      The ventilation system prevents flammable conditions from developing in the tanks and thus preventing a deflagration. Thus a PC-2 seismic/wind qualified PVV system will prevent a deflagration in an NPH scenario. The combined effect of preventing a deflagration and providing HEPA filtration to address the spill results in a reduction in the CW dose due from 11.8 to 0.2 REM during a seismic/wind event (11.8 to 3.9 reduction due to prevention of deflagration and 3.9 to 0.2 due to active HEPA filtration)..

- 512-6S Building, Instrumentation, Installation of a Stack, Ventilation Ductwork, HEPA Filter/Fan and Enclosures, and tie-in to the 512-S Backup Power is $5 to $10 million (Reference 11).
  - Reduces CW dose from approximately 1.5 mREM to 0.1 mREM for a sample spill in the laboratory.

241-96H and 512-S Facility Cost/Benefit Analysis Justification

As part of the DNFSB 2004-2 evaluation for the ARP facilities, the system Design Authority engineers identified the modifications needed to close the identified gaps. Detailed results of this analysis are documented in Reference 11. Since the identified modifications in each facility are similar in nature, they have been grouped into five major categories for the purposes of this report:

1. **Building Modifications**
2. **Instrumentation Modifications**
3. **Facility Stack, Ventilation Ductwork, HEPA Filter/Fan and Enclosure Modifications**
4. **Backup Electrical Power Addition**
5. **Tank and Cell Modifications**

All of the modifications listed below would require revising the applicable Technical Baseline documentation. Additionally, these modifications would require the development of operating, maintenance and surveillance procedures, seismic interaction analyses, and revising the Safety Basis documentation.

The information below is presented to identify the benefits and costs associated with undertaking the identified modifications.

1. **Building Modifications**

   In order to close the identified gaps, each building would have to be modified. Airlocks between ventilation zones would have to be installed. Building penetrations would need to be sealed to enhance the ability of the system to maintain a controlled differential pressure.

   The only CHA event for which the modifications would be beneficial is the seismic event. A PC-2 wind event will not affect the buildings per Reference 17. Facility procedures will shut down all processing activities and the ventilation systems if a seismic event occurs, thus ensuring that any releases into the building are not spread by the ventilation system. The MAR is contained in tanks located in concrete cells that have been qualitatively demonstrated to withstand a PC-2 seismic event that would contain the spill and minimize airborne release potential.

   The fire suppression system installed in both facilities meets the approved Facility Fire Hazard Analysis requirements (Ref. 15 and 16). These systems provide coverage for the buildings and would require changes to cover the ventilation systems.

   The cost of modifying the 241-96H building was estimated to be approximately $10 million. The cost of modifying the 512-S building was estimated to be approximately $7 million.

2. **Instrumentation Modifications**

   In order to close the identified gaps, facility instrumentation modifications would have to include installing PC-2 qualified D/P instruments and alarms such as instruments to monitor differential pressures between zones, building/atmosphere DP, HEPA filter DP, Local Control Stations (LCSs) and Control Room alarms. LCSs would have to be installed to provide controls since the Distributed Control System (DCS) is not a safety related system. The LCS would have to have the ability to monitor key system parameters such as flow and filter DP and start and stop fans as required with relays and hardwire interlocks.

Instrument modifications associated with the ventilation systems in each facility will allow for reliable monitoring of various ventilation system parameters, such as flow rates, filter D/P's, etc after a PC-2 seismic or wind event.

Facility procedures will require the shutdown of all processing activities and ventilation systems if a seismic event occurs. After the event, teams would be sent out to survey for facility/system damage, indications of a radiological release, etc. Any problems identified during these surveys would be addressed and corrected prior to ventilation system re-start and a return to processing at the facility. Portable instruments would be used to support post-event surveys.

The cost of modifying the 241-96H and 512-S instrumentation was estimated to be approximately $3 million for each facility.

3. **Facility Stack, Ventilation Ductwork, HEPA Filter/Fan and Enclosure Modifications**

In order to close the identified gaps, the facility exhaust stacks and associated radiation monitors, ventilation ductwork, HEPA filters and their enclosures, fans and their controls and enclosures would require modifications to make these items able to withstand a PC-2 seismic or wind event. Therefore the 241-96H and 512-S ventilation systems would be available following a PC-2 seismic or wind event to prevent a process tank deflagration and to mitigate any spill inside of a process cell.

The 241-96H Process Building Ventilation System ductwork and both facility PVV Systems' ductwork is constructed of stainless steel and does not require modification. The 512-S Process Building Ventilation ductwork is galvanized steel and is thus susceptible to corrosion and identified as a gap in Attachment 3. The scope of the modifications for the 512-S Process Building Ventilation system includes the replacement of this ductwork (and fan) with stainless steel. However given the short operating life of the facility (3 years) and the very small risk of corrosion/contaminating this ventilation system, therefore this specific modification is not warranted.

The cost of modifying the Process Building Ventilation and PVV Systems was estimated to be approximately $8 million in 241-96H and approximately $22 million in 512-S.

4. **Backup Electrical Power Addition**

In order to close the identified gaps, a diesel generator would need to be installed in each facility with sufficient capacity to allow continuous operation of the PVV and Process Building exhaust fans, and continuous operation of instrumentation if a loss of normal electrical power occurs. The Laboratory Facility (512-6S) exhaust fan would be tied to the 512-S backup power system. Facility modifications would require the addition of seismically qualified diesel generators and associated instrumentation, seismically qualified Motor Control Centers, seismically qualified support systems (e.g., fuel oil), connection of fans, LCS and Control Room instrumentation and alarms to backup power in accordance with SS criteria.

Backup power would ensure that the PVV and Process Building Exhaust fans would continue to operate if events occur that result in a loss of normal electrical power. In the event of a loss of normal power, operational procedures require the process to be shut down. The risk from a normal process spill is minimal because all MAR is contained within the tanks and cells within confinement structures.

The cost of this addition was estimated to be approximately $4 million for each facility.

5. **Tank and Cell Modifications (Excluding 512-6S)**

There are no gaps for both facilities tanks and cells. These tanks and cells were qualitatively judged to be able to withstand a PC-2 seismic or wind event per Reference 17. No modifications to tanks and cells are necessary since cells are capable of containing spills during PC-2 events. Process jumpers/piping could fail during a seismic event resulting in a spill within the cells. By virtue of the location of the process jumpers/piping within the cells, a wind event will not result in a spill. Following a seismic event, the cell covers will restrict air exchange between the cell and the building to minimize the spread of airborne contamination from the cells.

512-6S Facility (Laboratory) Cost/Benefit Analysis Justification

The 512-6S facility currently has no installed active confinement ventilation system, System Design Authority engineers identified modifications to provide a new ventilation system to meet the Table 5.1 criteria. The details of these modifications are documented in Reference 17.

A cost benefit analysis was previously performed for the 512-6S Laboratory Facility ventilation system (Ref. 9). The confinement ventilation system was removed since the CW dose consequences were less than 1.5 mREM. Reinstallation of ventilation and support systems to SS criteria would entail the installation of a complete new confinement ventilation system. Installation of a facility stack, HEPA filters, fans, ductwork, backup power, airlocks, instrumentation and controls provides benefit for the CW only during a seismic event. Laboratory modifications are estimated to cost approximately $5.5 million.

Conclusion

The 241-96H and 512-S ARP facilities have active confinement ventilation systems that are functionally classified as PS and meet the PC-1 criteria for applicable NPH events. This functional classification is based upon the low radiological and chemical consequences to both 100-m on-site and off-site receptors from postulated events as evaluated in the CHA for each facility (Ref. 1, 2 and 3). These unmitigated consequences were calculated using a leak path factor of 1.0 (i.e., no credit was taken for any of the active confinement ventilation systems or passive design features).

The Facility Evaluation Team evaluated the active confinement ventilation systems at 241-96H and 512-S Facilities, and the 512-6S Laboratory in accordance with the Ref. 8, using the SS Table 5.1 criteria due to the Hazard Category 2 inventory levels. PC-2 criteria were used to assess functionality for applicable NPH events. The evaluation identified gaps and the scope of the modifications required to close these gaps were developed. Based upon the proposed modifications, scoping estimates were developed.

A cost/benefit analysis was performed for the modifications that would be necessary to close the gaps for each facility. Replacing PC-1 ventilation ductwork, HEPA filters, fans, and enclosures with PC-2 rated components would not be effective for post accident mitigation without providing seismically qualified back up power and its associated components and instrumentation. Conversely, building and instrumentation gap closures would not be effective without changing the ventilation system to PC-2 and providing PC-2 qualified backup power. Therefore in order to obtain a benefit, all discretionary gaps would have to be closed concurrently.

Table 4.3 (Ref. 10) identified the following events: spills, deflagrations, seismic, and wind. It was determined that all events from the Table 4.3 submittal are very unlikely with the exception of spills. Process spills (non-NPH) would be contained within cells and current HEPA filtered ventilation systems will provide confinement without modifications.

The building, process cells and tanks were qualitatively evaluated and judged to be able to withstand PC-2 NPH events (Ref. 17). By virtue of the location of the process jumpers/piping within the cells, a wind event will not result in a spill. In a PC-2 seismic event, spills would still be contained in cells, thus providing spill containment and gross airborne confinement. Facility event response procedures provide adequate protection for an NPH scenario in lieu of making any modifications.

Radiolytic decomposition of water produces combustible gases. It would take a period of several weeks to reach 100% of the Lower Flammability Limit. PVV or nitrogen purge instrumentation and shiftly surveillances will detect a non-operational system which will be promptly restored or response actions will provide alternate ventilation per operating procedures. Therefore tank deflagration is considered a highly unlikely event.

The total cost of modifications is approximately $65 to $80 million and will delay ARP radioactive operations startup by approximately two years to develop and implement the modifications. Facility modifications result in no radiological dose reduction to the public. A modified (PC-2 qualified) ventilation system would prevent flammable conditions from developing in the tanks and prevent a deflagration, thus reducing the consequences to the CW from less than 12% to less than 4% of the CW dose criterion. The CW consequences would be further reduced from less than 4% to less than 1% of the CW dose criterion due to active HEPA filtration following a spill. The actual risk reduction for the CW is not significant based upon the fact that the unmitigated consequences at 100-m do not challenge the 100 rem dose criterion.

Based upon the results of this evaluation the Facility Evaluation Team recommends that no modifications be made to the ARP ventilation systems. Given the lack of dose reduction to the public, insignificant dose reduction to the CW, facility event response procedures, high cost of implementation, significant impact to the startup schedule, and the short ARP operating life, the modifications are not recommended to be implemented.

References

General References

1 WSRC-TR-2002-00223, Rev. 1, Actinide Removal Process & Defense Waste Processing Facility Transfer Lines Consolidated Hazard Analysis

2 S-CLC-S-0104, Rev. 0, Actinide Removal Process Consolidated Hazard Analysis

3 WSRC-TR-2006-00095, Rev. 0, 241-96H Consolidated Hazard Analysis

4 WSRC-SA-6, Rev. 23, Final Safety Analysis Report, Savannah River Site, Defense Waste Processing Facility

5 WSRC-SA-2002-00007, Rev. 3, Concentrated, Storage and Transfer Facilities (includes 241-96H) Documented Safety Analysis

6 E7 2.25, Rev. 14, Conduct of Engineering and Technical Support Procedure Manual, Functional Classification

7 DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports

8 "Deliverables 8.5.4 and 8.7 of Implementation Plan for DNFSB Recommendation 2004-2, Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems" dated January 2006

9 CBU-WSD-2003-00047, WSRC Letter, "Actinide Removal Process Readiness" dated November 21, 2003

10 WSRC Letter LWD-2006-0021, V. G. Dickert to K. L. Hooker, "Pilot DNFSB 2004-2 Ventilation Implementation (Table 4.3)," May 30, 2006

11 PDC-TKN-2006-00006, Confinement Ventilation Scope Cost Estimates

12 DOE-HDBK-1169-2003, DOE Nuclear Air Cleaning Handbook

13 DOE-STD-1021-93, Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems and Components

14 DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports

15 F-FHA-H-00054, Fire Hazard Analysis For Filter/Stripper Building 241-96H (U)

16 F-FHA-S-00012, Fire Hazard Analysis For DWPF Building 512-S (U)

17 PDCS-SEG-2006-00066, Structural Analysis of Buildings 241-96H,512-S and 512-6S

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	1 - Ventilation System – General Criteria	
Pressure differential should be maintained between zones and atmosphere.	The 241-096H building has two ventilation systems. The 241-096H Process Building ventilation system maintains negative pressure relative to the outside and discharges building air to a stack through a HEPA filter bank. The 241-096H Process Vessel Ventilation (PVV) system is a separate ventilation system that maintains process components (tanks) at a negative pressure relative to the building and discharges process ventilation air to a stack through a separate HEPA filter than those used for the building. The 241-096H Process Building ventilation system draws fresh air from outside through two intake supply houses by one of two exhaust fans. Incoming air flows through two supply ducts mounted to the ceiling of the building. Supply air is discharged through four vents from each supply duct over the process cells and flows into the truck well area. Air in the truck well exhausts through one of two flow paths, through one of two HEPA filter banks, depending upon which one of the two exhaust fans is operating. Exhaust air enters the exhaust fan and is exhausted to the 241-096H Process Building exhaust stack. The Process Vessel Ventilation (PVV) system supports two MST Strike Tanks, one in each process cell. Air enters from the process cell into the MST Strike tank through an annular space around the agitator shaft. The MST Strike Tank's overflow line is equipped with a flapper at the end which limits airflow into the tank while providing overflow capability. Air is then swept through the vapor space of the tank and exits through a tank PVV nozzle where it passes through one of two HEPA filters and exhausts through the PVV exhaust fan and is exhausted to the 241-096H Process Building exhaust stack. The PVV system will be controlled by the DeltaV DCS in the 241-2H (3H) Control Room. It will maintain a differential pressure of -1.0 inwc between the MST Strike Tanks and the surrounding cell. Purge flow for each tank will be approximately 100 scfm. <u>Confinement Zones</u> • Primary Confinement — Pump Tank • Secondary Confinement — Cell • Tertiary Confinement — 96H Building Differential pressures between confinement systems are critical to process facilities because they maintain proper airflow direction to prevent the spread of contamination. The recommended confinement differential requirements for existing facilities are as follows. • Primary/Secondary — -0.3 to -1.0 inwc • Secondary/Tertiary — -0.03 to -0.15 inwc • Teriary/Atmosphere — -0.01 to- -0.15 inwc <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169, Section 2.2.9 – Confinement Selection Methodology ASHRAE Design Guide, Section 2 <u>References</u> M-M6-H-8138, Rev 14 M-M6-H-8139, Rev 12 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Components/Instrumentation</u> HI-241096-HVAC-PDIS-2039A — Filter Building HVAC PDI (HEPA dp) HI-241096-HVAC-PDIS-2039B — Filter Building HVAC PDI (HEPA dp) HI-241096-HVAC-PDIS-2040A — Filter Building Cell #1 PDI	DOE-HNBK-1169 (2.2.9) ASHRAE Design Guide

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	HI-241096-HVAC-PDIS-2040B Filter Building Cell #2 PDI HI-241096-PVV-PDIS-100 Strike Tk 1 PVV dp Indicating Transmitter HI-241096-PVV-PDIS-200 Strike Tk 2 PVV dp Indicating Transmitter <u>Gap Analysis</u> Building pressure differential monitoring instruments and associated alarms would need to be installed to measure building differential pressure between confinement systems. Evaluate whether building would survive a PC-2 event.	
Materials of construction should be appropriate for normal, abnormal and accident conditions.	Materials of construction for the 96H Building Ventilation duct are minimum 18 gage 304L stainless steel ASTM A-240 No. 1 or 2B finish. All exhaust ductwork is Level 4 per ERDA '76 Air Cleaning Handbook (earlier version of DOE Nuclear Air Cleaning Handbook). All exhaust ductwork is longitudinally welded, gasketed, bolted and flanged. The flexible connections are Durolon fabric. Gasket material is neoprene. All materials of construction are appropriate for normal, abnormal and accident conditions. Exhaust fans are constructed of galvanize carbon steel. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.5 – Corrosion ASME AG-1 <u>References</u> W747002 Rev 36 W836093 Rev 11 <u>Gap Analysis</u> The building exhaust fans have a corrosion potential due to fans being constructed of carbon steel. This system will need to be reviewed to determine if it needs to be replaced with a new material if ARP will operate longer than 3 years..	DOE-HNBK-1169 (2.2.5) ASME AG-1
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	The 96H Process Building ventilation system consists of intake and exhaust ducting, dampers, two fans, two filters banks, associated controls and instrumentation. The 96H Process Building ventilation system minimizes the potential release of radioactive contamination in the event of a process leak. The 96 H Process Building ventilation system is designed to maintain the building at a slight negative pressure with respect to its surrounding. During normal process operation only one fan and HEPA bank is in operation. Supply air at 9500 cfm enters the building through two intake supply houses. Steam heating coils located in these intake supply houses heat incoming air if the building temperature is less than 55° F. Building incoming air flow is via four air vents in each of the two supply air ducts (eight vents total). The exhaust dampers are adjusted to exhaust 1000 scfm flow through each process cell and 7500 scfm through the rest of the building. Air enters the two process cells through process cell inlet HEPA filters. Building exhaust flows through one HEPA filter bank and to the exhaust stack. Air being discharged is monitored for radioactive contamination by a portable air monitor. The 96H Process Bldg ventilation fans are located in an open area and are exposed to the weather. Ventilation ductwork is exposed to the weather and is also contained in the 96H Process Bldg. Air cleaning and ventilation system must remain intact and serviceable under upset conditions. Ventilation system components must be capable of withstanding differential pressures, heat, moisture, and stress of the most serious accident predicted for the facility, with minimum damage and loss of integrity, and they must remain operable long enough to satisfy system objectives. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 Emergency Considerations	DOE-HNBK-1169 (2.4) ASHRAE Design Guide

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	<u>Reference</u> M-M6-H-8138, Rev 14 M-M6-H-8139, Rev 12 W747002 Rev 36 W836093 Rev 11 <u>Gap Analysis</u> The accidents associated with NPH (loss of confinement and loss of power) and possibly tank deflagration will need to be evaluated. An exhaust fan standby power supply would need to be installed. The building, exhaust stack, ductwork and exhaust fans would not survive a seismic event so it would need to be upgraded to with stand a PC-2 seismic event. Evaluate seismic interaction and correct deficiencies.	
Confinement ventilation systems shall have appropriate filtration to minimize release.	The ARP Process will use the existing Process Building Ventilation system to exchange air in the process cells. Additionally a Process Vessel Vent (PVV) system is installed to remove hydrogen from the Strike Tank vapor spaces and maintain a negative pressure in the Strike Tanks to prevent migration of contamination. <u>Process Building Ventilation</u> The Process Building consists of the Process Cells, truck well, Motor Control Center (MCC) Room, and Crane Control Room areas. Fresh outside air is drawn into the building through two intake supply houses by one of two exhaust fans. Incoming air flows through two supply ducts mounted to the ceiling of the building. The supply air is discharged through four vents from each supply duct over the process cells and flows into the truck well area. Airflow is divided in the truck well. Part of the air supply flows into the process cells through manual dampers and inlet HEPA filter units. The remainder of the supply flow circulates through the truck well area. Air in the truck well exhausts through an exhaust manifold into the exhaust duct and through a pneumatic exhaust damper. The truck well exhaust and process cell exhausts join in the exhaust plenum on the northwest side of the Process Building. The combined air is exhausted from the exhaust plenum through one of two flow paths, depending upon which one of the two exhaust fans is operating. For each exhaust flow path, air passes through a pneumatic exhaust fan inlet isolation damper and a HEPA filter assembly. Exhaust air enters the exhaust fan through a manually operated exhaust fan inlet isolation damper and is exhausted through a manually operated exhaust fan outlet damper on its way to the Process Building Exhaust Stack. Exhaust air flows up the stack and is discharged to the atmosphere. The Process Building Ventilation system will be controlled by the newly installed DELTAV DCS located in 241-2H (3H) Control Room. The HEPA filter house is designed and manufactured to meet ASME N509-2002. The HEPA filter house is a standard Bag-In/Bag-Out Style. HEPA filter house specification consists of 11 and 14 gauge 304 stainless steel. Housing is total weld construction. (Code Welding). Housing conforms to leak tightness per criteria of DOE Nuclear Air Cleaning Handbook. <u>Inlet HEPA Cabinet and Filter</u> Flanders Model (E-5) 1 X 1 GG-F (304)L Type 1 (Cabinet) Flanders Model GG-F (24" x 24" x 11-1/2") (Filter) <u>Exhaust HEPA Cabinet and Filter</u> Flanders Model (E-5) 4 X 2 GG-F (304)R Type 1 (Cabinet) Flanders Model GG-F ((24" x 24" x 11-1/2") (Filter) Pre-Filter size: 23-1/2" x 12-1/2" x 1-7/8") <u>HEPA Filter Specifications</u> Flanders Nuclear Grade HEPA Filter Capacity : 1500 cfm Max Initial Resistance 1.0 inwc	ASME AG-1 DOE-HNBK-1169 (2.2.1)

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	Filter Media : Non-woven glass paper (boron silicate microfiber, 99.97% minimum efficiency Pack Type: 11" deep PUREFORM filter pack (separatorless) Frame Material: ¾" fire-retardant plywood Frame Style : Channel for fluid seal on one face Sealant : Fire-retardant solid urethane Gasket Type/Location: BLU-JEL seal/upstream face Faceguard Type/Location : Galvanize Steel/Both Faces Temperature Max : 250 F Max Differential Pressure : 10 inwc <u>HEPA Filter Performance Testing</u> In-place leak testing of HEPA filter installation is performed in accordance with Manual 2Y1 "*HEPAFilter Testing Procedures*", Procedure 104 "*General Surveillance Testing of HEPA Filters*". In-place leak testing is performed at scheduled intervals for installed testable HEPA filter systems to detect deterioration of filters, gaskets or other causes that could result in leaks. Testing is also done in a manner that will detect airflow that may bypass HEPA filters. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.1 Airborne Particulate and Gases SRS Engineering Standard 15888 ASME AG-1 Table FC-5140 ASME N509-2002 ASME N510 WSRC-TM-95-1, M-SPP-G000243, HEPA Filter Specification <u>Reference</u> M-M6-H-8139 Rev. 12 <u>Components</u> HI-241096-HVAC-FLT-31 FILTER BLDG EXHAUST SYSTEM HEPA FILTER HI-241096-HVAC-FLT-33 FILTER BLDG EXHAUST SYSTEM HEPA FILTER HI-241096-HVAC-FLT-35 FILTER BLDG EXHAUST SYSTEM HEPA FILTER HI-241096-HVAC-FLT-37 FILTER BLDG EXHAUST SYSTEM HEPA FILTER HI-241096-HVAC-FLT-39 FILTER BLDG EXHAUST SYSTEM HEPA FILTER HI-241096-HVAC-FLT-41 FILTER BLDG EXHAUST SYSTEM HEPA FILTER HI-241096-HVAC-FLT-43 FILTER BLDG EXHAUST SYSTEM HEPA FILTER HI-241096-HVAC-FLT-49 FILTER BLDG EXHAUST SYSTEM HEPA FILTER HI-241096-HVAC-FLT-26 FILTER CELL 2 INLET HEPA FILTER HI-241096-HVAC-FLT-27 FILTER CELL 1 INLET HEPA FILTER <u>Gap Analysis</u> Determine HEPA filter performance capability following a seismic event at the applicable PC demand level or close dampers if HEPA filter bypass/leakage occurs. The HEPA filter system meets the filtration requirements however it would need to be upgraded to SS	
2 - Ventilation System – Instrumentation & Control		

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Provide system status instrumentation and/or alarms.	<u>Process Building Ventilation</u> The 96H Process Building Ventilation System instrumentation provides indications of system status both locally, at the individual component and remotely. Differential pressure gages provide means of monitoring filters installed in the system to see if they are functioning properly and to ensure Process Building and filter cell areas are receiving adequate ventilation. The Process Building Ventilation system will be controlled by the DELTAV DCS located in the 241-2H (3H) Control Room. <u>Local Indication</u> HI-241096-HVAC-PDIS-2039A FILTER BLDG HVAC PDI (HEPA dp) HI-241096-HVAC-PDIS-2039B FILTER BLDG HVAC PDI (HEPA dp) HI-241096-HVAC-PDI-2046 PROCESS CELL 1 INLET HEPA dp HI-241096-HVAC-PDI-2045 PROCESS CELL 2 INLET HEPA dp <u>Control Room Indication and Alarm</u> HI-241096-HVAC-PDAH-2039A FILTER BLDG HVAC PDI/HIGH PRESSURE DIFF ALARM HI-241096-HVAC-PDAH-2039B FILTER BLDG HVAC PDI/HIGH PRESSURE DIFF ALARM HI-241096-HVAC-HIS-10A FILTER BLDG FAN 6 – FAN RUNNING HI-241096-HVAC-HIS-11A FILTER BLDG FAN 7 – FAN RUNNING HI-241096-HVAC-PDAL-2040A PROCESS CELL 1 LOW VACUUM ALARM HI-241096-HVAC-PDAL-2040B PROCESS CELL 2 LOW VACUUM ALARM <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 AHSRAE Design Guide (Section 4) ASME AG-1 <u>Reference</u> M-M6-H-8138 Rev. 14 M-M6-H-8139 Rev. 12 <u>Gap Analysis</u> The Building ventilation system instrumentation and associated alarms would have to be upgraded to withstand NPH events The DCS alarms do not meet SS or PC-2 requirements and would have to be upgraded.	ASME AG-1 DOE-HNBK-1169 ASHRAE Design Guide (Section 4)
Interlock supply and exhaust fans to prevent positive pressure differential.	The 96H Process Ventilation building is not equipped with a supply fan. <u>Reference</u> M-M6-H-8138 Rev. 14 M-M6-H-8139 Rev. 12 <u>Gap Analysis</u> None	DOE-HNBK-1169 ASHRAE Design Guide (Section 4)

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Post accident indication of filter break-through.	The current system in place to detect toxic or airborne contamination in the 96H Process Ventilation system is a portable air sampler. A HEPA FILTER dp low alarm is not currently installed. <u>Standards</u> DNFSB Tech 34 <u>References</u> M-M6-H-8138 Rev. 14 M-M6-H-8139 Rev. 12 <u>Gap Analysis</u> An exhaust stack CAM upgrade would be required to meet post accident indication of HEPA filter failure. A HEPA filter low DP alarm upgrade would be required to indicate post accident HEPA filter failure. The HEPA filter DP instrumentation and DCS alarms do not meet SS or PC-2 requirements and would need to be upgraded.	TECH-34
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	The Process Building Ventilation system will be monitored and controlled by the DELTAV DCS located in 241-2H (3H) Control Room. This Control Room is manned by operations personnel continuously. Operation of the 96H Process Ventilation system is controlled by operating procedures. System control is maintained during abnormal and accident conditions using Abnormal Operating Procedures (AOP) and Emergency Operating Procedures (EOP). <u>Local Indication</u> HI-241096-HVAC-PDIS-2039A FILTER BLDG HVAC PDI (HEPA dp) HI-241096-HVAC-PDIS-2039B FILTER BLDG HVAC PDI (HEPA dp) HI-241096-HVAC-PDI-2046 PROCESS CELL 1 INLET HEPA dp HI-241096-HVAC-PDI-2045 PROCESS CELL 2 INLET HEPA dp <u>Control Room Indication and Alarm</u> HI-241096-HVAC-PDAH-2039A FILTER BLDG HVAC PDI/HIGH PRESSURE DIFF ALARM HI-241096-HVAC-PDAH-2039B FILTER BLDG HVAC PDI/HIGH PRESSURE DIFF ALARM HI-241096-HVAC-HIS-10A FILTER BLDG FAN 6 – FAN RUNNING HI-241096-HVAC-HIS-11A FILTER BLDG FAN 7 – FAN RUNNING HI-241096-HVAC-PDAL-2040A PROCESS CELL 1 LOW VACUUM ALARM HI-241096-HVAC-PDAL-2040B PROCESS CELL 2 LOW VACUUM ALARM <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 ASME AG-1 <u>References</u> M-M6-H-8138 Rev. 14 M-M6-H-8139 Rev. 12 <u>Gap Analysis</u> The DCS alarms do not meet SS or PC-2 requirements and would have to be upgraded.	DOE-HNBK-1169 (2.4)

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Control components should fail safe.	<u>Process Building Ventilation System</u> The 96H Process Building Ventilation System instrumentation provides indications of system status both locally, at the individual component and remotely. Differential pressure gauges provide means of monitoring filters installed in the system to see if they are functioning properly and to ensure Process Building and filter cell areas are receiving adequate ventilation. A loss of power event involving the 96H Process Building Ventilation System fans will activate the fan running (off) control room DCS alarm, HI-241096-HVAC-HIS-10A or HI-241096-HVAC-HIS-11A. Dampers fail closed upon loss of power/air. Fan off indication will activate the interlock to shut the inlet HEPA filter damper. High HEPA dp alarm will activate the interlock to shut the inlet HEPA filter damper. <u>Local Indication</u> HI-241096-HVAC-PDIS-2039A FILTER BLDG HVAC PDI (HEPA dp) HI-241096-HVAC-PDIS-2039B FILTER BLDG HVAC PDI (HEPA dp) HI-241096-HVAC-PDI-2046 PROCESS CELL 1 INLET HEPA dp HI-241096-HVAC-PDI-2045 PROCESS CELL 2 INLET HEPA dp <u>Control Room Indication and Alarm</u> HI-241096-HVAC-PDAH-2039A FILTER BLDG HVAC PDI/HIGH PRESSURE DIFF ALARM HI-241096-HVAC-PDAH-2039B FILTER BLDG HVAC PDI/HIGH PRESSURE DIFF ALARM HI-241096-HVAC-HIS-10A FILTER BLDG FAN 6 – FAN RUNNING HI-241096-HVAC-HIS-11A FILTER BLDG FAN 7 – FAN RUNNING HI-241096-HVAC-PDAL-2040A PROCESS CELL 1 LOW VACUUM ALARM HI-241096-HVAC-PDAL-2040B PROCESS CELL 2 LOW VACUUM ALARM <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 <u>References</u> M-M6-H-8138 Rev. 14 M-M6-H-8139 Rev. 12 <u>Gap Analysis</u> The HEPA filter dampers and associated controls would need to be upgraded to withstand a PC-2 seismic event.	DOE-HNBK-1169 (2.4)
	3 - Resistance to Internal Events – Fire	

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	The 96 H Facility fire detection and suppression system meets approved Facility Fire Hazard Analysis requirements. The exhaust fan and the exhaust damper are located on a concrete pad, outside the Process Building, where there is little or no combustible material and the fire danger is minimal. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 10.1 DOE STD 1066 <u>References</u> M-M6-H-8138 Rev. 14 M-M6-H-8139 Rev. 12 F-FHA-H 00054 <u>Gap Analysis</u> None	DOE-HNBK-1169 (10.1) DOE-STD-1066
Confinement ventilation systems should not propagate spread of fire.	During a ventilation system fire event, EOPs will instruct operations to shut down fans. Fan off indication will activate the interlock to shut the inlet HEPA filter dampers which will protect HEPA filter media from fire damage. There is no interlock to shutdown exhaust fan upon fire detection. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 10.1 <u>References</u> F-FHA-H 00054 SW11.4-EOP-001 <u>Gap Analysis</u> Confinement ventilation system automated controls (i.e. interlocks) would need to be installed to prevent propagation of fire.	DOE-HNBK-1169 (10.1) DOE-STD-1066
4 - Resistance to External Events – Natural Phenomena – Seismic		

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should safely withstand earthquakes.	The 96H Process Building and ventilation system in not currently PC-2 qualified. Seismic event could initiate loss of power event and breach of confinement. Active confinement is not credited in a seismic event. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 Emergency Considerations <u>Reference</u> UBC, 1979 SBC, 1979 <u>Gap Analysis</u> The building ventilation system would not survive a seismic event so an upgrade would be required to withstand a PC-2 seismic event. Evaluate seismic interaction and evaluate deficiencies.	ASME AG-1 AA DOE 0420.1B DOE-HNBK-1169 (9.2)
	5 - Resistance to External Events – Natural Phenomena – Tornado/Wind	
Confinement ventilation systems should safely withstand tornado depressurization.	Process Building Ventilation System is not currently qualified PC-2. Process Building Structure and HEPA Filter are not PC-2. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 – Emergency Consideration <u>Reference</u> G-SYD-H-00009, 96H Building Ventilation System <u>Gap Analysis</u> The building ventilation system would need to be upgraded to withstand Tornado depressurization.	DOE 0420.1B DOE-HNBK-1169 (9.2)
Confinement ventilation systems should withstand design wind effects on system performance.	The 96 Process Building and Ventilation system in not currently PC-2 qualified. High wind could initiate a loss of power and breach of confinement. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 Emergency Considerations <u>Reference</u> G-SYD-H-00009, 96H Building Ventilation System <u>Gap Analysis</u> The building ventilation system would not survive a high wind event so it would need to be upgraded to withstand a PC-2 wind event.	DOE 0420.1B DOE-HNBK-1169 (9.2)
	6 - Testability	

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	The HEPA filter housing has been designed and manufactured to meet ASME N509-2002 requirements. HEPA filter housing is the Bag-In/Bag-Out style with the gel-seal technology. Each HEPA filter bank has six ½" quick disconnect type test connections for DOP aerosol testing. Four each at the test section between the pre-filters and HEPA filter and 2 each at the test section downstream of the HEPA filter. In-place leak testing shall be performed at scheduled intervals for installed testable HEPA filter systems to detect deterioration of filters, gaskets or other causes that could result in leaks. The facility has an establish PM program which requires the HEPA filters to undergo in-place leak testing every 18 months. In-place leak testing is performed for this HEPA filter system in accordance with Site Engineering Standards. An additional PM requires that the HEPA filters be replaced every 7 years. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 ASME AG-1 ASME N510 SRS Engineering Standard 15888 Reference M-M6-H-8138 Rev. 14 M-M6-H-8139 Rev. 12 Gap Analysis Revise the 241-96H Facility DSA to include Surveillance Requirements.	DOE-HNBK-1169 (2.3.8) ASME AG-1 ASME N510
Instrumentation required to support system operability is calibrated.	The Process Building ventilation system instrumentation is equipped with manifold valves with calibration ports. A PM program and calibration frequencies have been established for 96H Process Ventilation instrumentation. Non-safety instrumentation is calibrated periodically as driven by the PM program. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 ASME AG-1 Gap Analysis Revise the 241-96H Facility DSA to include Surveillance Requirements.	DOE-HNBK-1169 (2.3.8)
Integrated system performance testing is specified and performed.	No integrated system performance testing is currently performed on the 96H Building Ventilation system. Modifications made to the system are required to be tested as part of Post Modification Testing to ensure compliance with system performance requirements. Currently there are no required response actions for the 96H Building Ventilation system in the DSA. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 ASME AG-1 Gap Analysis Identify Surveillance Requirements and develop associated maintenance and testing procedures. Revise the 241-96H Facility DSA to include system loss of power Surveillance Requirements	DOE-HNBK-1169 (2.3.8)

7 - Maintenance

Attachment 1 - 2004-2 Table 5.1, 241-96H Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Filter service life program should be established.	The facility has established a preventive maintenance program which requires that HEPA filters undergo performance testing every 18 months. An additional PM requires that these filters be replaced every 7 years. In-place leak testing is performed for this HEPA filter system in accordance with Site Engineering Standards. For new HEPA filter systems, under normal operating conditions, where Safety Calculations or calculations used for ALARA based reductions rely on filter tensile strength to perform a safety control then the filter system shall be designed to prevent the filter media from becoming wet. Where accidental wetting can occur, such as from fire protection systems or condensation, then the filter in-service life shall not exceed 5 years. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 3.1 and App C SRS Engineering Standard 15888 Gap Analysis None	DOE-HNBK-1169 (3.1 & App C)
8 - Single Failure		
Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	The 96H Building Ventilation system is not supplied with an alternate power supply (e.g. emergency diesel generator) Gap Analysis The Building Ventilation System would need to be upgraded with a PC-2 qualified backup power system.	DOE-HNBK-1169 (2.2.7)
9 - Other Credited Functional Requirements		
Address any specific functional requirements for the confinement ventilation system (beyond the scope of those above) credited in the DSA.	The 96H Building ventilation system is not credited with any specific safety function in the CSTF DSA or the 241-96H CHA for Actinide Removal. References WSRC-SA-2002-00007, Rev. 3 WSRC-TR-2006-00095, Rev. 0 Gap Analysis None	10 CFR 830, Subpart B

Notes:

1. Radiological consequences of an unmitigated event are well below criteria for classification as Safety Significant (SS), as noted in Table 4.3. However, events are assumed to be SS for Table 5.1 development. All events in the CHA are below 20 mREM to the public and 12 REM to the CW.

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV Ventilation System Performance Criteria

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
	1 - Ventilation System - General Criteria	
Pressure differential should be maintained between zones and atmosphere.	The 241-096H building has two ventilation systems. The 241-096H Process Building ventilation system maintains negative pressure relative to the outside and discharges building air to a stack through a HEPA filter bank. The 241-096H Process Vessel Ventilation (PVV) system is a separate ventilation system that maintains process components (tanks) at a negative pressure relative to the building and discharges process ventilation air to a stack through a separate HEPA filter than those used for the building. The 241-096H Process Building ventilation system draws fresh air from outside through two intake supply houses by one of two exhaust fans. Incoming air flows through two supply ducts mounted to the ceiling of the building. Supply air is discharged through four vents from each supply duct over the process cells and flows into the truck well area. Air in the truck well exhausts through one of two flow paths, through one of two HEPA filter banks, depending upon which one of the two exhaust fans is operating. Exhaust air enters the exhaust fan and is exhausted to the 241-096H Process Building exhaust stack. The Process Vessel Ventilation (PVV) system supports two MST Strike Tanks, one in each process cell. Air enters from the process cell into the MST Strike tank through an annular space around the agitator shaft. The MST Strike Tank's overflow line is equipped with a flapper at the end which limits airflow into the tank while providing overflow capability. Air is then swept through the vapor space of the tank and exits through a tank PVV nozzle where it passes through one of two HEPA filters and exhausts through the PVV exhaust fan and is exhausted to the 241-096H Process Building exhaust stack. The PVV system will be controlled by the DeltaV DCS in the 241-2H (3H) Control Room. It will maintain a differential pressure of -1.0 inwc between the MST Strike Tanks and the surrounding cell. Purge flow for each tank will be approximately 100 scfm. <u>Confinement Zones</u> • Primary Confinement — Pump Tank • Secondary Confinement — Cell • Tertiary Confinement — 96H Building Differential pressures between confinement systems are critical to process facilities because they maintain proper airflow directions to prevent the spread of contamination. The recommended confinement differential requirements for existing facilities are as follows. • Primary/Secondary — -0.3 to -1.0 inwc • Secondary/Tertiary — -0.03 to -0.15 inwc • Teriary/Atmosphere — -0.01 to- -0.15 inwc <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.9 – Confinement Selection Methodology ASHRAE Design Guide Section 2 <u>References</u> M-M6-H-8138, Rev 14 M-M6-H-8139, Rev 12 M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0	DOE-HNBK-1169 (2.2.9) ASHRAE Design Guide

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
	M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Components/Instrumentation</u> HI-241096-HVAC-PDIS-2039A Filter Building HVAC PDI (HEPA dp) HI-241096-HVAC-PDIS-2039B Filter Building HVAC PDI (HEPA dp) HI-241096-HVAC-PDIS-2040A Filter Building Cell #1 PDI HI-241096-HVAC-PDIS-2040B Filter Building Cell #2 PDI HI-241096-PVV-PDIS-100 Strike Tk 1 PVV dp Indicating Transmitter HI-241096-PVV-PDIS-200 Strike Tk 2 PVV dp Indicating Transmitter <u>Gap Analysis</u> Building pressure differential monitoring instruments and associated alarms would need to be installed to measure building differential pressure between confinement systems. Evaluate whether building would survive a PC-2 event and upgrade if required.	
Materials of construction should be appropriate for normal, abnormal and accident conditions.	Materials of construction for the 96H PVV system are stainless steel (304L). Stainless steel is the recommended material for ductwork and housings when corrosion can be expected. The gasket material is a closed cell synthetic rubber compound resistant to the ARP radiochemical process. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.5 – Corrosion HEPA Filter Housing - ASME N509-2002, 304L Piping: ASTM A312, TP304L, Sch 10S Fittings: ASTM A403, WP304L, Sch 10S Fasteners: ASTM A193, B8 Class 2-HH, ¾" Nuts: ASTM A194, 8F-HH, ¾" Flanges: ASTM A182, F304L, Class 150 RF Forged Fittings: ASTM A182, F304L, 3000# Gaskets: ASTM D1056, 2A2, 40 Type A Shore Durometer, 1/8" Tubing: ASTM A249/A269, TP304L Fittings: ASMT A182/A479, 316/316L/304L Electrical: NFPA 70 "National Electric Code (NEC) <u>References</u> SRS Eng. Std : 15060-G Application of ASME B31.3 M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Gap Analysis</u> None	DOE-HNBK-1169 (2.2.5) ASME AG-1

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	The PVV HEPA filter/ fan assembly skid is located in an open area and is exposed to the weather. For earthquake load design for PC-1 structures, the ICC IBC-2000 was used and designated as Seismic Use Group I. For wind load design for PC-1 structures, ASCE 7-2002 was used with a 100-mph wind speed and an Importance Factor of 1.0. The air cleaning and ventilation system must remain intact and serviceable under upset conditions. Ventilation system components must be capable of withstanding differential pressures, heat, moisture, and stress of the most serious accident predicted for the facility, with minimum damage and loss of integrity, and they must remain operable long enough to satisfy system objectives. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 Emergency Considerations ICC IBC-2000 Ip=1 - Seismic ASCE 7-2002 Ip=1 - Wind <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 ICC IBC-2000 <u>Gap Analysis</u> The accidents associated with NPH (loss of confinement and loss of power) and possibly tank deflagration will need to evaluated. A PC-2 qualified backup power system would need to be installed for fan operation. The PVV ductwork, HEPA filter assembly and exhaust fans would not survive a seismic event so it would need to be upgraded to with stand a PC-2 seismic event. Evaluate seismic interaction and evaluate deficiencies.	DOE-HNBK-1169 (2.4) ASHRAE Design Guide
Confinement ventilation systems shall have appropriate filtration to minimize release.	The Process Vessel Vent (PVV) system supports two MST Strike Tanks, one in each process cell. Air enters from the process cell into the MST Strike Tank through an annular space around the agitator shaft. The MST Strike Tank's overflow line is equipped with a flapper at the end which limits airflow into the tank while providing overflow capability. Air is then swept through the vapor space of the tank and exits through a tank PVV nozzle where it passes through one of two HEPA filters into the PVV exhaust fan. PVV fan exhaust combines with the truck well exhaust at a plenum. The combined air is exhausted from the exhaust plenum and is finally exhausted to the Process Building Stack. A vendor fabricated PVV skid consists of two pressure control dampers, an electric heater to prevent moisture from wetting the HEPA filters, and two trains of HEPA filters as well as the complement of various process instrumentation necessary for operation of the skid. The skid has been designed so one HEPA filter train can remain in service while the other filter is being changed out. The PVV system will be controlled from the DELTAV DCS in 241-2H (3H) Control Room and will maintain a differential pressure of -1.0 INWC between the MST Strike Tank interiors and the surrounding cell with a flow of approximately 100 SCFM for each tank. HEPA filter housing is designed and manufactured to meet ASME N509-2002. HEPA filter housing is a standard Bag-In/Bag-Out Style with the Gel Seal sealing technology. The HEPA filter is a Flanders Model G1F-CCF-304L with a differential pressure rating of 20 inwc and rated for 250 cfm. HEPA filter efficiency is 99.97%	ASME AG-1 DOE-HNBK-1169 (2.2.1)

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
	<u>HEPA Filter Performance Testing</u> In-place leak testing of HEPA filter installation is performed in accordance with Manual 2Y1 "*HEPA Filter Testing Procedures*", Procedure 104 "*General Surveillance Testing of HEPA Filters*". In-place leak testing is performed at scheduled intervals for installed testable HEPA filter systems to detect deterioration of filters, gaskets or other causes that could result in leaks. Testing is also done in a manner that will detect airflow that may bypass HEPA filters. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.1 Airbome Particulate and Gases SRS Engineering Standard 15888 ASME AG-1 Table FC-5140 ASME N509-2002 ASME N510 WSRC-TM-95-1, M-SPP-G000243, HEPA Filter Specification <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Components</u> HI-241096-PVV-FLT-1 PVV HEPA FILTER 1 HI-241096-PVV-FLT-2 PVV HEPA FILTER 2 <u>Gap Analysis</u> Determine HEPA filter performance capability following a seismic event at the applicable PC demand level or close dampers if HEPA filter bypass/leakage occurs. The HEPA filter system meets the filtration requirements however it would need to be upgraded to SS	

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
Provide system status instrumentation and/or alarms.	PVV system ventilation instrumentation provides indications of system status both locally and remotely. Two differential pressure gages and pressure indicating transmitters provide means of monitoring filters installed in the system to see if they are functioning properly. Two pressure indicators, one at the fan inlet and one at the fan outlet, are provided to monitor fan performance. Two temperature elements and temperature transmitters are provided upstream and downstream of the HEPA filter to monitor air stream temperature across the HEPA filter. <u>Local Indication</u> HI-241096-PVV-TIT-101 PVV HEATER INLET TEMP IND XMTR HI-241096-PVV-TIT-102 PVV HEPA EXHAUST TEMP IND XMTR HI-241096-PVV-PDIT-105 PVV HEPA FLT-1 DIFF PRESS IND XMTR HI-241096-PVV-PDIT-205 PVV HEPA FLT-2 DIFF PRESS IND XMTR HI-241096-PVV-FIT-108 PVV SYSTEM FLOW TRANSMITTER <u>Control Room Indication and Alarm</u> 96ZI100 MST Strike Tank 1 Vent Position 96ZI200 MST Strike Tank 2 Vent Position 96TI101 Heater Inlet Temperature 96TI102 Exhaust Fan Inlet Temperature 96TDI103 HEPA Filter Differential Alarm 96YI104 Heater 96PDI105 HEPA Filter 1 Pressure Differential 96PDI205 HEPA Filter 2 Pressure Differential 96HIS107 Exhaust Fan 96FI108 PVV System Flow Rate <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 ASME AG-1 <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Gap Analysis</u> The PVV system instrumentation and associated alarms would have to be upgraded to withstand NPH PC-2 events The DCS alarms do not meet SS or PC-2 requirements and would have to be upgraded.	ASME AG-1 DOE-HNBK-1169 ASHRAE Design Guide (Section 4)

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
Interlock supply and exhaust fans to prevent positive pressure differential.	The PVV System is not equipped with a supply fan. Standards DOE Nuclear Air Cleaning Handbook 1169 ASHRAE Design Guide (Section 4) Reference M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 Gap Analysis None	DOE-HNBK-1169 ASHRAE Design Guide (Section 4)
Post accident indication of filter break-through.	The portable air sampler detects toxic or airborne contamination in the PVV system. A HEPA filter dp low alarm is not currently installed. Standards DNFSB Tech 34 References M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 Gap Analysis An exhaust stack CAM upgrade would be required to meet post accident indication of HEPA filter failure. A HEPA filter low DP alarm upgrade would be required to indicate post accident HEPA filter failure. The HEPA filter DP instrumentation and DCS alarms do not meet SS or PC-2 requirements and would need to be upgraded.	TECH-34
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	The PVV system will be monitored and controlled from the DELTAV DCS in 241-2H (3H) Control Room. It will maintain a differential pressure of -1.0 INWC between the MST Strike Tank interiors and the surrounding cell with a flow of approximately 100 SCFM for each tank. MST Strike Tank 1 and 2 ventilation position dampers are hardwire interlocked with the exhaust fan. They close/shut when the exhaust fan is de-energized. The dampers, fan or hardwire interlocks are not seismically qualified. This Control Room is manned by operations personnel continuously. Operation of the PVV system is controlled by operating procedures. System control is maintained during abnormal and accident conditions using Abnormal Operating Procedures (AOP) and Emergency Operating Procedures (EOP). Local Indication HI-241096-PVV-TIT-101 PVV HEATER INLET TEMP IND XMTR HI-241096-PVV-TIT-102 PVV HEPA EXHAUST TEMP IND XMTR HI-241096-PVV-PDIT-105 PVV HEPA FLT-1 DIFF PRESS IND XMTR HI-241096-PVV-PDIT-205 PVV HEPA FLT-2 DIFF PRESS IND XMTR HI-241096-PVV-FIT-108 PVV SYSTEM FLOW TRANSMITTER	DOE-HNBK-1169 (2.4)

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
	<u>Control Room Indication and Alarm</u> 96ZI100 MST Strike Tank 1 Vent Position 96ZI200 MST Strike Tank 2 Vent Position 96TI101 Heater Inlet Temperature 96TI102 Exhaust Fan Inlet Temperature 96TDI103 HEPA Filter Differential Alarm 96YI104 Heater 96PDI105 HEPA Filter 1 Pressure Differential 96PDI205 HEPA Filter 2 Pressure Differential 96HIS107 Exhaust Fan 96FI108 PVV System Flow Rate <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 ASME AG-1 <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Gap Analysis</u> The DCS alarms do not meet SS or PC-2 requirements and would have to be upgraded.	

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
Control components should fail safe.	The MST Strike Tank 1 and 2 ventilation position dampers are hardwired interlocked with the exhaust fan. They close/shut when the exhaust fan is de-energized. The dampers, fan or hardwired interlocks are not seismically qualified. However, the dampers fail closed upon loss of power/air. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Gap Analysis</u> The PVV system HEPA filter dampers and associated controls would need to be upgraded to withstand a PC-2 seismic event.	DOE-HNBK-1169 (2.4)
	[illegible] Resistance to Internal Events – Fire	
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	The 96 H Facility fire detection and suppression system meets approved Facility Fire Hazard Analysis requirements. The exhaust fan and the exhaust damper are located on a concrete pad, outside the Process Building, where there is little or no combustible material and the fire danger is minimal. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 10.1 DOE STD 1066 <u>References</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 F-FHA-H 00054 <u>Gap Analysis</u> None	DOE-HNBK-1169 (10.1) DOE-STD-1066

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should not propagate spread of fire.	During a ventilation system fire event EOPs will instruct operations to shut down fans. Fan off indication will activate the interlock to shut the inlet HEPA filter dampers which will protect the HEPA filter media from fire damage. There is no interlock to shutdown exhaust fan upon fire detection. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 10.1 <u>References</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 F-FHA-H 00054 SW11.4-EOP-001, Fire (U) <u>Gap Analysis</u> PVV system automated controls (i.e. interlocks) would need to be installed to prevent propagation on fire.	DOE-HNBK-1169 (10.1) DOE-STD-1066
	[illegible]	
Confinement ventilation systems should safely withstand earthquakes.	The PVV system is not currently PC-2 qualified. A seismic event could initiate loss of power event and breach of confinement. Active confinement is not credited in a seismic event. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 Emergency Considerations ICC IBC-2000 Ip=1 - Seismic ASCE 7-2002 Ip=1 - Wind <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 ICC IBC-2000 <u>Gap Analysis</u> The PVV system is not PC-2 qualified and would need to be upgraded to withstand a PC-2 seismic event. Evaluate seismic interaction and evaluate deficiencies.	ASME AG-1 AA DOE 0420.1B DOE-HNBK-1169 (9.2)
	5 - Resistance to External Events - Natural Phenomena – Tornado/Wind	

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should safely withstand tornado depressurization.	The 241-96H PVV System is not currently qualified PC-2. Process Building Structure and PVV HEPA Filters are not PC-2. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 – Emergency Consideration <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Gap Analysis</u> The PVV system would need to be upgraded to withstand Tornado depressurization.	DOE 0420.1B DOE-HNBK-1169 (9.2)
Confinement ventilation systems should withstand design wind effects on system performance.	The PVV system in not currently PC-2 qualified. High wind could initiate a loss of power and breach of confinement. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 Emergency Considerations <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Gap Analysis</u> The PVV system would not survive a high wind event so an upgrade would be required to withstand a PC-2 wind event.	DOE 0420.1B DOE-HNBK-1169 (9.2)
	8 - Testability	

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	The HEPA filter housing has been designed and manufactured to meet ASME N509-2002 requirements. HEPA housing is the Bag-In/Bag-Out style with the gel-seal technology. The PVV system HEPA filter assembly skid consists of two HEPA filter housing, Model G1F-CCF-304L with DOP and pressure ports. The HEPA filter housing consists of a ¾" DOP injection port, ½" upstream DOP sample port, ½" downstream DOP sample port, ½" inlet static pressure tap for differential pressure transmitter, and a ½" outlet static pressure tap for differential pressure transmitter. All ports are 3000# 304L half coupling. The ¾" DOP injection port has a Hansen coupling series 6000 (No. 6500) installed. The ½" upstream and downstream DOP sample ports have a Hansen coupling series 6000 (No. 6300) installed. In-place leak testing shall be performed at scheduled intervals for installed testable HEPA filter systems to detect deterioration of filters, gaskets or other causes that could result in leaks. The facility has an establish PM program which requires the HEPA filters to undergo in-place leak testing every 18 months. In-place leak testing is performed for this HEPA filter system in accordance with Site Engineering Standards. An additional PM requires that the HEPA filters be replaced every 7 years. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 ASME N510 SRS Engineering Standard 15888 <u>Reference</u> M-DS-H-00338 MST PVV HEPA Assembly M-M6-H-2398 Rev. 0 M-M6-H-8213 "T" dwg M-M6-H-8214 "T" dwg CBU-LTS-2006-0063, Rev. 0 <u>Gap Analysis</u> Revise the 241-96H Facility DSA to include Surveillance Requirements.	DOE-HNBK-1169 (2.3.8) ASME AG-1 ASME N510
Instrumentation required to support system operability is calibrated.	PVV system instrumentation is equipped with manifold valves with calibration ports. A PM program and calibration frequencies have been established for PVV system instrumentation. Non-safety instrumentation is calibrated periodically as driven by the PM program. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 ASME AG-1 <u>Gap Analysis</u> Revise the 241- 96H Facility DSA to include Surveillance Requirements.	DOE-HNBK-1169 (2.3.8)

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
Integrated system performance testing is specified and performed.	No integrated system performance testing is currently performed on the PVV system. Modifications made to the system are required to be tested as part of Post Modification Testing to ensure compliance with system performance requirements. Currently there are no required response actions for the PVV system in the DSA. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.3.8 ASME AG-1 Gap Analysis Identify Surveillance Requirements and develop associated maintenance and testing procedures. Revise the 241-96H Facility DSA to include system Surveillance Requirements (Loss of Power testing)	DOE-HNBK-1169 (2.3.8)
	[illegible] Maintenance	
Filter service life program should be established.	The facility established a preventive maintenance program which requires HEPA filters undergo performance testing every 18 months. An additional PM requires that these filters be replaced every 7 years. In-place leak testing is performed for this HEPA filter system in accordance with Site Engineering Standards. For new HEPA filter systems, under normal operating conditions where Safety Calculations or calculations used for ALARA based reductions rely on filter tensile strength to perform a safety function; then the filter system shall be designed to prevent the filter media from becoming wet. Where accidental wetting can occur, such as from fire protection systems or condensation, then the filter in-service life shall not exceed 5 years. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 3.1 and App C SRS Engineering Standard 15888 Gap Analysis None	DOE-HNBK-1169 (3.1 & App C)
	[illegible] Single Failure	
Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	The PVV system is not supplied with an alternate power supply (e.g. emergency diesel generator) Gap Analysis The PVV system would need to be upgraded with a PC-2 qualified backup power system.	DOE-HNBK-1169 (2.2.7)

Attachment 2 - 2004-2 Table 5.1, 241-96H PVV System Performance Criteria

Evaluation Criteria	Discussion	Reference
	[illegible] Other Specific Functional Requirements	
Address any specific functional requirements for the confinement ventilation system (beyond the scope of those above) credited in the DSA.	The PVV system is not credited with any specific safety control in the CSTF DSA or the 241-96H CHA for Actinide Removal. <u>References</u> WSRC-SA-2002-00007, Rev. 3 WSRC-TR-2006-00095, Rev. 0 <u>Gap Analysis</u> None	10 CFR 830, Subpart B

Notes:

1 Radiological consequences of an unmitigated event are well below criteria for classification as SS, as noted in Table 4.3. However, events are assumed to be SS for Table 5.1 development. All events in the CHA are below 20 mREM to the public and 12 REM to the CW.

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
[illegible]		
Pressure differential should be maintained between zones and atmosphere.	The 512-S Process Building Ventilation System provides air circulation for the 512-S process and service areas. For process areas and parts of the service building that exhaust to the process area, the Process Building Ventilation System removes any radioactive particles from air before discharging it to the environment. The Process Building Ventilation System exhausts air from process building and vacuum blower room through high efficiency particulate air (HEPA) filters. Outside air is continuously drawn into the 512-S process area via louvers located in the walls of the 512-S Building. The air is pulled out of the process area via exhaust ducts and passed through a set of three HEPA filter banks. The HEPA filtered air is exhausted to atmosphere via the exhaust stack. The Process Building Ventilation System can also provide a path for air flow through the process cells when one or more of the cell covers are removed for maintenance. <u>Confinement Zones</u> Primary Confinement — Pump Tank Secondary Confinement — Cell Tertiary Confinement — Process Area, HEPA Filter Housing Building <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.9 – Confinement Selection Methodology <u>References</u> W776558, Rev. 17 <u>Components/Instrumentation</u> None <u>Gap Analysis</u> • No pressure differential instrumentation is installed to monitor pressure differential between confinement zones. • Existing building porosity (protects secondary and tertiary zones) will not maintain stated negative pressure between zones. Would require sealing building so that ventilation equipment can maintain negative pressure. • Existing building layout does not provide confinement zone separation. Would require modifying Building airlocks to maintain negative pressure between zones. • Existing building is constructed for the PC-1 seismic event. For SS requirement, building would need to be modify/checked for PC-2 seismic event.	DOE-HNBK-1169 (2.2.9) ASHRAE Design Guide

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Materials of construction should be appropriate for normal, abnormal and accident conditions.	The material of construction for the 512-S Process Building Ventilation System filter housing is stainless steel (304L). The exhaust fan is not constructed of stainless steel. Most of the ductwork is galvanized steel. Stainless steel is the recommended material for ductwork and housings when corrosion can be expected. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.5 - Corrosion ASME AG-1 References W776558, Rev. 17 MB20012-1 Sheet 28 Gap Analysis • Existing exterior equipment material will not resist corrosion. Equipment would need to be replaced with corrosion resistance material.	DOE-HNBK-1169 (2.2.5) ASME AG-1
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	The 512-S Process Building Ventilation exhaust fan is located on a concrete pad in an open area south of the Process Building and is exposed to the weather. There is no standby exhaust fan. The majority of the associated exhaust ductwork is located outside the Process Building and is exposed to the weather. The Process Building Ventilation HEPA filter unit is located in the 512-1S, HEPA Filter Building. The HEPA Filter Building roof is removable to facilitate removal/replacement of HEPA filters. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.4 - Emergency Considerations ASME AG-1 Reference W776558, Rev. 17 Gap Analysis • No standby power available for this system. Loss of power will stop exhaust fan. Equipment will not operate in all conditions. Installation of a PC-2 NPH backup power system would be required. • Stack, exhaust ductwork, exhaust fans are not designed to withstand NPH events. This may result in II/I interactions during NPH event and could damage/destroy exhaust system. • Controls for exhaust fan are not designed for NPH events and would need to be upgraded • Existing systems/equipment are designed for the PC-1 criteria and would need to be upgraded to PC-2 for SS criteria, evaluate systems/equipment for the PC-2 criteria and analyze for seismic interactions. • System is not designed to withstand any tank or cell deflagration event and would need to be upgraded.	DOE-HNBK-1169 (2.4) ASHRAE Design Guide

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems shall have appropriate filtration to minimize release.	The 512-S Process Building Ventilation System is equipped with a single Flanders E5 Filter Housing. The housing consists of a 12 filter HEPA filter bank arranged in 3 sections (Upper, Middle and Lower). Each section is 4 filters wide (4 x 3 arrangement). The unit is equipped with pre-filters; inlet and outlet isolation dampers to allow for filter change out and test connections for monitoring filter performance. Individual HEPA filters meet the requirements of SRS Engineering Standards Manual WSRC-TM-95-1, 15888 HEPA filter requirements and M-SPP-G-00243 HEPA Filter Specification. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.1 Airborne Particulates and Gases ASME AG-1 Table FC-5140 SRS Engineering Standard 15888 ASME N509-2002 WSRC-TM-95-1, M-SPP-G-00243, HEPA Filter Specification. <u>References</u> W776558, Rev.17 MB20012-1 <u>Sheet</u> 28 <u>Components</u> S-512000-HVAC-FLT-51154010000 HEPA FILTER HOUSING 18,000 CFM 4 X 3 <u>Gap Analysis</u> • System is not designed to withstand any tank or cell deflagration event and would need to be upgraded to withstand deflagration.	ASME AG-1 DOE-HNBK-1169 (2.2.1)
2 - Ventilation System - Instrumentation & Control		

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Provide system status instrumentation and/or alarms.	The 512-S Process Building Ventilation System instrumentation provides local indication of each section of the HEPA Filter Assembly's Pre-Filter and HEPA Filter Differential Pressure (DP). Local system flow rate indication is also provided. A Common Trouble Alarm on the DCS alerts the 512-S Control Room Operator to a problem with the 512-S Process Building Ventilation System. The Common Trouble Alarm is received when a filter low or high DP alarm is actuated or when a system low flow alarm is actuated. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 ASHRAE Design Guide (Section 4) ASME AG-1 <u>Reference</u> W776558, Rev. 17 <u>Components</u> S-512001-HVAC-PDI-7027A HEPA FILTER DIFF. PRESS. INDICATOR (UPPER SECTION) S-512001-HVAC-PDI-7027B HEPA FILTER DIFF. PRESS. INDICATOR (LOWER SECTION) S-512001-HVAC-PDI-7027E HEPA FILTER DIFF. PRESS. INDICATOR (MIDDLE SECTION) S-512000-HVAC-FIT-7030 VENT SYS. EXHAUST FAN DISCHARGE FLOW INDICATING TRANSMITTER <u>Gap Analysis</u> • Instrumentation listed above will not withstand NPH events • Instrumentation and DCS trouble alarms does not meet the SS requirements, for redundancy. • Would need to be upgraded to SS system. • Existing instrumentation/supports are designed to withstand PC-1 seismic event. Would need to be upgraded to PC-2 criteria.	ASME AG-1 DOE-HNBK-1169 ASHRAE Design Guide (Section 4)
Interlock supply and exhaust fans to prevent positive pressure differential.	The 512-S Process Building Ventilation System is not equipped with supply fans. All air flow through the system is produced by a single exhaust fan. <u>Reference</u> W776558, Rev.17 <u>Gap Analysis</u> Not applicable	DOE-HNBK-1169 ASHRAE Design Guide (Section 4)
Post accident indication of filter break-through.	The 512-S Process Building Ventilation System is equipped with a locally-received low DP alarm for each HEPA filter section (Refer to Instrument & Control Section above). A Common Trouble Alarm on the DCS alerts the 512-S Control Room Operator to a problem with the 512-S Process Building Ventilation System HEPA filters. Manual sampling of the exhaust stream leaving the 512-S ventilation Exhaust Stack can be performed when required. <u>Standards</u> TECH-34 <u>Reference</u> W776558, Rev.17 <u>Gap Analysis</u> • System is not equipped with continuous radiation/contamination monitoring to provide indication of filter breakthrough	TECH-34

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	The 512-S Process Building Ventilation System is controlled locally from a Local Control Station (LCS) located in the 512-S Instrument Shelter (512-2S). This system is not equipped with any remote control capability. The DCS is provided with a system Common Trouble Alarm, which when received requires investigation by a Field Operator. There are no redundant control functions associated with this system. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 ASME AG-1 Reference W776558, Rev 17 Components S-512001-HVAC-FIC-7030VENT. SYSTEM EXHAUST AIR FLOW INDICATING CONTROLLER Gap Analysis • DCS Trouble Alarm does not meet SS requirements and would need to be upgraded to SS. • System controls are not qualified for PC-2 NPH events • Existing instrumentation/supports are designed to withstand PC-12 seismic event. Would need to be upgraded to PC-2 criteria.	DOE-HNBK-1169 (2.4)
Control components should fail safe.	The 512-S Process Building Ventilation System is equipped with a discharge Damper (HCD) located downstream of the exhaust fan. The discharge damper is designed to fail closed on a loss of power, or instrument air and is also interlocked to close when the exhaust fan is shutdown. Standards DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 ASME AG-1 Reference W776558, Rev. 17 Components S-512001-HVAC-FCD-7030 VENT. SYS. EXHAUST AIR FLOW CONTROL DAMPER Gap Analysis • Existing Damper is designed as a PS system. It does not meet the SS criteria for damper control. • Exhaust Fan Discharge Damper and associated controls are not qualified for NPH events to ensure discharge damper fails to safe condition (closed) • Damper control would need to be upgraded to fail safe.	DOE-HNBK-1169 (2.4)
	3 - Resistance to Internal Events – Fire	

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	The 512-S facility is equipped with fire detection and automatic fire suppression equipment in the Low Bay areas of the Process Building, including the Electrical Equipment Rooms. No fire detection or automatic suppression equipment is provided in the High Bay area of the Process Building or the HEPA Filter Building (512-1S), because there is little or no combustible material in either of these areas. A fire in the Electrical Equipment Room resulting in the actuation of the automatic sprinkler system, or a fire in the cable trays along the south wall of the Process Building High Bay area could result in a loss of the Process Building Ventilation System exhaust fan, however, the shutdown of the fan would result in the closing of the exhaust damper, and isolation of the ventilation system. The exhaust fan and the exhaust damper are located on a concrete pad, outside the Process Building, where there is little or no combustible material and the fire danger is minimal. <u>Standards</u> DOE-HNBK-1169 (10.1) DOE-STD-1066 <u>References</u> W776558, Rev. 17 F-FHA-S-00012, Rev. 1 <u>Gap Analysis</u> • During a fire in the Electrical Equipment Room Process building ventilation may be lost. • Ventilation system will be lost due to power loss. Would need to install a PC-2 NPH backup power system.	DOE-HNBK-1169 (10.1) DOE-STD-1066
Confinement ventilation systems should not propagate spread of fire.	There is no fire detection or suppression equipment installed in the High Bay area of the Process Building. There is no interlock to shut down exhaust fan upon fire detection in any portion of the Process Building. <u>Standards</u> DOE-HNBK-1169 (10.1) DOE-STD-1066 <u>References</u> W776558, Rev. 17 F-FHA-S-00012, Rev. 1 <u>Gap Analysis</u> • No controls or provisions available at present time to prevent propagation of fire. • Would need to be install interlocks with the fire system to shutdown fans.	DOE-HNBK-1169 (10.1) DOE-STD-1066
4 - Resistance to External Events - Natural Phenomena - Seismic		

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should safely withstand earthquakes.	Process Building Ventilation System is not currently qualified PC-2. Process Building Structure and HEPA Filter Building are not PC-2. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 – Emergency Consideration UBC, 1979 SBC, 1979 <u>Reference</u> G-FDD-S-00004, *ARP, 512-S Facility, Facility Design Description* G-SYD-S-00001, *DWPF Seismic and Structural Design* <u>Gap Analysis</u> • Existing equipment and ductwork are designed to withstand PC-1 NPH event. Equipment and ductwork are not protected and are not expected to withstand a seismic event • System is not qualified for seismic interactions. Would need to perform II/I analysis and upgrade equipment and ductwork to meet PC-2 NPH seismic event if required.	ASME AG-1 AA DOE 0420.1B DOE-HNBK-1169 (9.2)
	6 - Resistance to External Events - Natural Phenomena - Tornado/Wind	
Confinement ventilation systems should safely withstand tornado depressurization.	Process Building Ventilation System is not currently qualified PC-2. Process Building Structure and HEPA Filter Building are not PC-2. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 – Emergency Consideration <u>Reference</u> G-FDD-S-00004, *ARP, 512-S Facility, Facility Design Description* <u>Gap Analysis</u> • Structure and System are not designed to withstand Tornado or High Wind Events • Would need to upgrade the system to withstand a PC-2 NPH wind event	DOE 0420.1B DOE-HNBK-1169 (9.2)

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should withstand design wind effects on system performance.	Process Building Ventilation System is not currently qualified PC-2. Process Building Structure and HEPA Filter Building are not PC-2. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 2.4 – Emergency Consideration <u>Reference</u> G-FDD-S-00004, *ARP, 512-S Facility, Facility Design Description* <u>Gap Analysis</u> • Process Building Ventilation System is not currently qualified as PC-2. Process Building Structure and HEPA Filter Building are not PC-2 NPH qualified. • The Ventilation System is not designed to withstand Tornado or High Wind Events • Would need to upgrade the process building, HEPA filter Building and Ventilation System to withstand a PC-2 NPH wind event.	DOE 0420.1B DOE-HNBK-1169 (9.2)
[illegible]		
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	The Process Building Ventilation System HEPA filter assembly is equipped with inlet and outlet testing fittings to allow for HEPA filter performance testing. The facility has established a preventative maintenance program which requires that these filters undergo performance testing every 18 months. An additional PM requires that these filters be replaced every 7 years. In-place leak testing is performed for this HEPA filter system in accordance with Site Engineering Standards. <u>Standards</u> DOE-HNBK-1169 (2.3.8) ASME AG-1 ASME N510 SRS Engineering Standard 15888 <u>References</u> MB20012-1 Sheet 28 Work Management System - Passport <u>Gap Analysis</u> None	DOE-HNBK-1169 (2.3.8) ASME AG-1 ASME N510

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Instrumentation required to support system operability is calibrated.	Instrumentation associated with the Process Building Ventilation System is not currently calibrated on a regular basis (not currently designated Installed Process Instrumentation – IPI). These instruments are calibrated upon installation, replacement and when a malfunction is suspected. <u>Standards</u> DOE-HNBK-1169 (2.3.8) <u>References</u> DWPF IPI Database Work Management System - Passport <u>Components</u> S-512001-HVAC-PDI-7027A HEPA FILTER DIFF. PRESS. INDICATOR (UPPER SECTION) S-512001-HVAC-PDI-7027B HEPA FILTER DIFF. PRESS. INDICATOR (LOWER SECTION) S-512001-HVAC-PDI-7027E HEPA FILTER DIFF. PRESS. INDICATOR (MIDDLE SECTION) S-512000-HVAC-FIT-7030 VENT SYS. EXHAUST FAN DISCHARGE FLOW INDICATING TRANSMITTER S-512001-HVAC-FIC-7030 VENT. SYSTEM EXHAUST AIR FLOW INDICATING CONTROLLER <u>Gap Analysis</u> • Components listed above are not maintained as IPI. Add above components to DWPF IPI Database	DOE-HNBK-1169 (2.3.8)
Integrated system performance testing is specified and performed.	No integrated system performance testing is currently performed for the Process Building Ventilation System. Modifications made to the system are required to undergo Post Modification Testing to ensure compliance with system performance requirements. <u>Standard</u> DOE-HNBK-1169 (2.3.8) <u>Gap Analysis</u> • Identify Surveillance Requirements and develop associated maintenance/testing procedures • Revise Facility Safety Basis Documents to include system Surveillance Requirements	DOE-HNBK-1169 (2.3.8)
	[illegible]	
Filter service life program should be established.	The facility has established a preventative maintenance program which requires that these filters undergo performance testing every 18 months. An additional PM requires that these filters be replaced every 7 years. In-place leak testing is performed for this HEPA filter system in accordance with Site Engineering Standards. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 3.1 and Appendix C SRS Engineering Standard 15888 <u>Reference</u> Work Management System - Passport <u>Gap Analysis</u> None	DOE-HNBK-1169 (3.1 & App C)

Attachment 3 - 2004-2 Table 5.1, 512-S Building Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
[illegible]		
Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	The 512-S Facility receives electrical power via a single overhead feeder line and substation. There is no backup electrical power for the facility. <u>Reference</u> E-E2-S-0026, Rev. 5 <u>Gap Analysis</u> • No backup electrical distribution system at the 512-S Facility. Would need to install a PC-2 qualified backup power system.	DOE-HNBK-1169 (2.2.7)
[illegible]		
Address any specific functional requirements for the confinement ventilation system (beyond the scope of those above) credited in the DSA.	The 512-S Process Building Ventilation System is not credited with any specific safety control in the DWPF DSA, or the 512-S CHAP. <u>References</u> WSRC-SA-6, Rev. 23 WSRC-TR-2002-00223, Rev. 1 <u>Gap Analysis</u> None	10 CFR 830, Subpart B

Notes:

1 Radiological consequences of an unmitigated event are well below criteria for classification as SS, as noted in Table 4.3. However, events are assumed to be SS for Table 5.1 development. All events in the CHA are below 20 mREM to the public and 12 REM to the CW.

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	1. Ventilation Systems – General Criteria	
Pressure differential should be maintained between zones and atmosphere.	The Process Vessel Vent System (PVVS) was designed to meet the requirements of DOE Standard 6430.1A Sections 1300-7, 1550-99.0.1, 1550-99.02. Flow is provided from atmosphere and 512-S Building to process cells via piping and gaps in cell covers due to suction from the PVVS blower. Process tanks also have flow pulled through them via inleakage and overflow lines via the PVVS blower. The PVVS is designed to maintain a differential pressure between the tanks and cells via pressure controllers. <u>Parameters of interest:</u> PVV Air Flow (Indications FI7150 and FI7151) 1600 to 1800 cfm Precipitate Tank/Cell Difference (Indication PDI8776B) -8 to -1 inwc Hold Tank/Cell Difference (Indication PDI8776C) -8 to -1 inwc <u>Standard</u> Nuclear Air Cleaning Handbook recommends a vacuum greater than or equal to 1 inwc (Table 2.6). <u>Reference</u>: SW4-15.102 2.1 PVV Fans Normal Operations W750295, Rev. 21 W750495, Rev. 9 <u>Gap Analysis</u> None	DOE-HNBK-1169 (2.2.9) ASHRAE Design Guide
Materials of construction should be appropriate for normal, abnormal and accident conditions.	ASME AG-1 -2003, Code on Nuclear Air and Gas Treatment, was examined in regards to this issue, in particular the various Article XX-3000 Materials. Material of construction of items in contact with air is of stainless steel construction. Stainless steel is listed as an appropriate material. <u>Standard</u> Nuclear Air Cleaning Handbook recommends stainless steel for ductwork and housings. <u>Gap Analysis</u> None	DOE-HNBK-1169 (2.2.5) ASME AG-1
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	System is designed to handle saturated air from the tanks at 55°C. <u>Reference:</u> G-SYS-S-00050, Interarea Transfer Facilities <u>Gap Analysis</u> Accidents associated with NPH (loss of confinement and loss of power) and possibly tank deflagration. A tank or cell deflagration caused by flammable concentration of hydrogen may result in a flame front moving rapidly through the flammable vapor, which in turn, may lead to some overpressure condition or even a detonation. The ventilation system would need to be detonation hardened.	DOE-HNBK-1169 (2.4) ASHRAE Design Guide

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems shall have appropriate filtration to minimize release.	The exhaust HEPA filter system consists of four (4) 24x24x11.5 encapsulated filters installed in parallel. The casings are SST with 5-9/16" diameter inlet and outlet connections. Each filter is approximately 650 CFM. Exhaust HEPA filters have an efficiency of 99.97% for 3 micrometer sized particle. This would correspond to a DF factor of 3333 1/3. This factor is dependent on the PVVS remaining intact. Inlet filters have an efficiency of 99.97 and are installed in case of flow reversal. No credit is currently taken for HEPA filters in accident analysis. Standard Filters and housings are in compliance with the requirements of ASME N509 and AG-1 Section FK References AG-1 Section FK and OPS-DTG-960079, Engineering Path Forward S-PF-96-0121, Low Point Pump PIT Process Vessel Vent HEPA Filter DP Gap Analysis Determine HEPA filter performance capability following a seismic event at the applicable PC demand level or close dampers if HEPA filter bypass/leakage occurs. The HEPA filter system meets the filtration requirements however it would need to be upgraded to SS	ASME AG-1 DOE-HNBK-1169 (2.2.1)
	[illegible] Ventilation System Instrumentation & Control	
Provide system status instrumentation and/or alarms.	Monitored System Parameters: PVV Air Flow (Indications FI7150 and FI7151) 1600 to 1800 cfm Precipitate Tank/Cell Difference (Indication PDI8776B) -8 to -1 inwc Hold Tank/Cell Difference (Indication PDI8776C) -8 to -1 inwc Alarms PVV HEPA Filter Radiation Alarm (indication RI0945) 5.0 mREM/hr (High) PVV HTR Cond Radiation Alarm (indication RI6870) 153 cpm (High) Dilution Air Flow (Indication FIC7150) 1000 cfm (Low) PVV HEPA FLT DIF Press (Indication PDAL6866) low – switch PVV Common Trouble (Indication UA6874B) switch The following other parameters are monitored: Cell Outlet Temp and alarms - TI6865A, TAH/TALL6865A Air Pre-Heater Diff. Temp and alarms - TDIC6865, TDAH/TDAL6865 PVV HEPA Filter Inlet Temperature -TI6865C Vent Heater Condensate HIS6870 Diversion Valve TAH6870 Temp RAH6870 Rad Counts HEPA Filter Diff. Pressure – PHAH/PDAL6866 and HIHI PDAH6866A PVV HEPA Filter Outlet Temp – TI6865B Process Vent System – FI7151 Air Flow, FIC7150/FAL7150 Air Flow and Valve Position, FAL7150 Air Flow, FI7150 Air Flow, HIS7150 Air Flow Selector Inlet Valve Position Open/Closed – ZI7155 Fan 1, ZI7154 Fan 2 Exhaust Fan 2 – UA7460 Trouble, JI7460 Power, HIS7460 Control	ASME AG-1 DOE-HNBK-1169 ASHRAE Design Guide (Section 4)

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	Exhaust Fan 1 – UA7462 Trouble, JI7462 Power, HIS7462 Control Exhaust Fan Lead/Lag Selector – HIS7463 Inlet HEPA Filter Diff. Pressure – PDAL/PDAH7152 Cell Inlet Air Heater – HIS7464 Control Status of Enhanced Manual Operation (EMO) Program – EMOLWFPVV TDIC6865C Steam Valve Heater – HIS7464 Control Tank Diff. Pressure Selector - HIS8776A (Hold Tank or Precipitate Tank) HEPA Rad. - RI0945 Standards In compliance with AG-1 Article IA-C-1000 References: SW4-15.102 2.1 PVV Fans Normal Operations SW4-15.107 512S-PVV, Control Room Operator – 512S Process Vessel Vent Alarm Response Procedure M-M6-S-0254 M-M6-S-0186 W750495 W750295 Gap Analysis • Parameters are monitored either via local control stations (LCS) or the Distributed Control System (DCS) neither of these are credited for NPH events. Controls would have to be provided by a NPH qualified LCS with input from NPH qualified instrumentation. Interlock actions would have to be provided by hardwire interlocks.	
Interlock supply and exhaust fans to prevent positive pressure differential.	There are no supply fans associated with the 512-S PVV System. Reference W750495 W750295 Gap Analysis None	DOE-HNBK-1169 ASHRAE Design Guide (Section 4)

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Post accident indication of filter break-through.	Low Differential Pressure Alarms are provided for the inlet and exhaust HEPA filters associated with the 512-S PVV System. These alarms are received locally and on the DCS. • S-512001-PPV-PDSL-6866 HEPA FILTER DIFFERENTIAL PRESSURE SWITCH LOW • S-512000-PPV-PDSL-7152 PDSL - DIFF PRESSURE SWITCH (LOW) Manual sampling of the exhaust stream leaving the 512-S ventilation Exhaust Stack can be performed when required. Note: SW4-1.9 2.5. Potential Release From 512-S, directs either or both the PVV System and Process Building Ventilation to be shutdown if a release is indicated or suspected. Reference W750495 W750295 Gap Analysis • Parameters are monitored either via local control stations (LCS) or the Distributed Control System (DCS). Neither of these are credited for NPH events. Controls and associated alarms would have to be provided by a qualified LCS with input from qualified instrumentation. Interlock actions would have to be provided by hardwire interlocks. • System is not equipped with continuous radiation/contamination monitoring to provide indication of filter breakthrough. Would need to install permanent radiation monitoring equipment	TECH-34
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	Operation of the 512-S PVV System is controlled via approved operating procedures. Abnormal conditions are indicated by alarms. There is also an EMO J-RS-S-00065, Enhanced Manual Operation LWF Process Vessel Vent System. The EMO provides the following: If the pressure differential rises too high or the flow falls too low, the EMO will reverse the LEAD/LAG designation and start the new LEAD fan (both operating). If the pressure differential and flow is still beyond limits, the EMO will allow both fans to operate. If the pressure differential and flow are within limits, the EMO will stop the LAG fan (set No Lag status) and check the parameters again. If the pressure differential and flow are normal, the EMO will continue normal surveillance with the new LEAD fan operating. If the differential pressure or flow is outside limits, the EMO will generate a message that one fan can not maintain differential pressure and flow. If the LEAD fan stops or faults, the EMO will attempt to restart the LEAD fan. If the LEAD fan will not restart, the EMO will reverse the LEAD/LAG designation and attempt to start the new LEAD fan. AOP-S-8504, Loss of Process Vessel Vent System, requires all transfers to be stopped and if the Service Area/Building Ventilation System is in service to place it in maintenance mode (cross ties it to PVVS). References M-SYD-S-00006, *ARP Process Vessel Vent and Analyzers System Design Description*, Rev. 0 Gap Analysis Parameters are monitored either via local control stations (LCS) or the Distributed Control System (DCS). Neither of these are credited for NPH events. Controls and associated alarms would have to be provided by a qualified LCS with input from qualified instrumentation. Interlock actions would have to be provided by hardwire interlocks.	DOE-HNBK-1169 (2.4)

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Control components should fail safe.	<u>512-S PVV System Components Failure Modes</u> • HCD7039, Cross tie between PVVS and Building/Service Area Ventilation, fails closed. • FCV7150, Dilution Air From Cell Vent, fails open • TCV6865, Steam to Heater, fails closed • HCV7154, Inlet Damper to Blower #1, fails as is. • HCV7155, Inlet Damper to Blower #2, fails as is. • On loss of power or air, there would be a path from the tanks and cells to the stack that passes through the HEPA filters. <u>References</u> W750495 W750295 <u>Gap Analysis</u> None	DOE-HNBK-1169 (2.4)
[illegible]		
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	Existing facility – not required. F-FHA-S-00012 Fire Hazards Analysis for Defense Waste Processing Facility Building 512-S, notes there are no automatic fire suppression systems and no automatic fire detection system for the Ventilation Building 512-1S. It does note that combustible loading is low and would not cause a severe fire. HEPA filters are constructed of low combustible material as required by code. Blowers are located outside of the 512-S Building and have no automatic fire suppression systems and no automatic fire detection system. Combustible loading is low. The MCCs for the blowers (MCC B117 Cubicles 3A and 4A) are located in an electrical room with automatic fire suppression system (sprinklers) and automatic fire detection system.	DOE-HNBK-1169 (10.1) DOE-STD-1066

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should not propagate spread of fire.	There is no fire detection or suppression equipment installed in the High Bay area of the Process Building. There is no interlock to shut down exhaust fan upon fire detection in any portion of the Process Building. Standards DOE-HNBK-1169 (10.1) DOE-STD-1066 References W776558, Rev. 17 F-FHA-S-00012, Rev. 1 Gap Analysis No controls or provisions available at present time to prevent propagation of fire. Would need to install interlocks with the fire system to shut down the ventilation in the even of a fire. Both the PVVS and nitrogen purge system aid in preventing hydrogen related explosions in the tanks. No cell fires are postulated by the CHA (WSRC-TR-2002-00223).	DOE-HNBK-1169 (10.1) DOE-STD-1066
	[illegible]	
Confinement ventilation systems should safely withstand earthquakes.	Seismic event could initiate loss of power event and breach of confinement. Active confinement system is not credited in a seismic accident. Nitrogen purge of vessels is the means for preventing tank explosions during and following a seismic event. During the life of the 512-S facility the functional classification of the PVVS has been changed. At one time it was classified as safety significant with the ability to survive PC-2 loading. This classification applied to mainly passive components with a few valves needing to change state to provide an isolation function. Many components have been evaluated for a seismic event and a seismic fragility study performed for 511-S PVVS, which is similar in construction to the 512-S Facility. Gap Analysis System is not currently qualified for active performance following a PC-2 seismic event. This includes the structure sheltering the components and seismic interactions. The cell structure, building vessels, jumpers and ventilation system would also need to be upgraded for a PC-2 seismic event.	ASME AG-1 AA DOE 0420.1B DOE-HNBK-1169 (9.2)
	5 - Resistance to External Events - Natural Phenomena - Tornado/Wind	
Confinement ventilation systems should safely withstand tornado depressurization.	Active confinement system is not credited in a tornado accident.	DOE 0420.1B DOE-HNBK-1169 (9.2)

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems should withstand design wind effects on system performance.	High wind could initiate loss of power and breach of confinement. 512-S Superstructure would fail with straight winds speeds in excess of 110 mph. <u>Reference</u> S-CLC-S-00027, DWPF High Wind Analysis at LPPP and Cold Feed Makeup Facility. <u>Gap Analysis</u> • Targets would need to be qualified for PC-2 winds. This would include components located outside of structures – blowers, emergency diesel. • The HEPA filters on the exhaust are located in a building which has a removable portion of roof. Table 2 of S-CLC-S-00027 list damage targets for LPPP. This would be similar for 512-S.	DOE 0420.1B DOE-HNBK-1169 (9.2)
	[illegible] Testability	
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	Test connection ports are provided for DOP testing of filters. 2Y1 Procedure 104, General Surveillance Testing of High Efficiency Particulate Air Filters, is perfomed periodically (18 months) as driven by the Work Management System - Passport. Last testing performed on 3/28/06 per WO 630151/2/3/4. <u>Reference</u> Work Management System - Passport <u>Gap Analysis</u> None	DOE-HNBK-1169 (2.3.8) ASME AG-1 ASME N510
Instrumentation required to support system operability is calibrated.	Non-safety instrumentation is calibrated periodically as driven by the Work Management System – Passport. For example, a 36 month PM calibration of FIT/FSLL 7150 (PVV flow) is setup in the Work Management System – Passport. <u>Reference</u> Work Management System - Passport <u>Gap Analysis</u> None	DOE-HNBK-1169 (2.3.8)

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Integrated system performance testing is specified and performed.	No integrated system performance testing is currently performed for the PVV System. Modifications made to the system are required to undergo Post Modification Testing to ensure compliance with system performance requirements. There are currently no required response actions for the PVVS in the DSA. <u>Standard</u> DOE-HNBK-1169 (2.3.8) <u>Gap Analysis</u> • Identify Surveillance Requirements and develop associated maintenance/testing procedures • Revise Facility Safety Basis Documents to include system Surveillance Requirements (Loss of Power Testing)	DOE-HNBK-1169 (2.3.8)
	[illegible] - Maintenance	
Filter service life program should be established.	The facility has established a preventative maintenance program which requires that these filters undergo performance testing every 18 months. An additional PM requires that these filters be replaced every 7 years. In-place leak testing is performed for this HEPA filter system in accordance with Site Engineering Standards. <u>Standards</u> DOE Nuclear Air Cleaning Handbook 1169 Section 3.1 and Appendix C SRS Engineering Standard 15888 <u>Reference</u> Work Management System - Passport <u>Gap Analysis</u> None	DOE-HNBK-1169 (3.1 & App C)
	8 - Single Failure	

Attachment 4 - 2004-2 Table 5.1, 512-S PVV Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	The 512-S Facility receives electrical power via a single overhead feeder line and substation. There is no backup electrical power for the facility. (E-DCP-S-03003, Remove 512-2 Diesel, was implemented and the automatic backup electrical system was removed. UPS remains installed for safe shutdown of facility.) <u>Reference</u> E-E2-S-0026, Rev. 5 <u>Gap Analysis</u> There is no backup electrical distribution system at the 512-S Facility. A PC-2 qualified backup power system would need to be installed.	DOE-HNBK-1169 (2.2.7)
[illegible]		
Address any specific functional requirements for the confinement ventilation system (beyond the scope of those above) credited in the DSA.	512-S Process PVV System is not credited with any specific safety control in the DWPF DSA, or 512-S CHAP. <u>References</u> WSRC-SA-6, Rev. 23 WSRC-TR-2002-00223, Rev. 1 <u>Gap Analysis</u> None	10 CFR 830, Subpart B

Notes:

1 Radiological consequences of an unmitigated event are well below criteria for classification as SS, as noted in Table 4.3. However, events are assumed to be SS for Table 5.1 development. All events in the CHA are below 20 mREM to the public and 12 REM to the CW.

Attachment 5 - 2004-2 Table 5.1, 512-6S Laboratory Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
	1 - Ventilation System - [illegible]	
Pressure differential should be maintained between zones and atmosphere.	The Confinement Ventilation System previously installed at the 512-S Laboratory Building (512-6S) was removed based on a cost benefit analysis performed during 512-S Facility startup in 2003. The reasoning behind the removal of the Lab Exhaust system is documented in Memorandum CBU-WSD-2003-00047, *Actinide Removal Process (ARP) Readiness*, letter from J.W. French to Charles Hansen, dated 21 November, 2003. See Reference 13. <u>Reference</u> CBU-WSD-2003-00047 <u>Gap Analysis</u> • There is no Confinement Ventilation System currently installed at the 512-6S Facility • There is no backup electrical power provided at the 512-S Facility	DOE-HNBK-1169 (2.2.9) ASHRAE Design Guide
Materials of construction should be appropriate for normal, abnormal and accident conditions.	See Block 1 above	DOE-HNBK-1169 (2.2.5) ASME AG-1
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	See Block 1 above	DOE-HNBK-1169 (2.4) ASHRAE Design Guide
Confinement ventilation systems shall have appropriate filtration to minimize release.	See Block 1 above	ASME AG-1 DOE-HNBK-1169 (2.2.1)
	2 - Ventilation System - Instrumentation & Control	
Provide system status instrumentation and/or alarms.	See Block 1 above	ASME AG-1 DOE-HNBK-1169 ASHRAE Design Guide (Section 4)
Interlock supply and exhaust fans to prevent positive pressure differential.	See Block 1 above	DOE-HNBK-1169 ASHRAE Design Guide (Section 4)

Attachment 5 - 2004-2 Table 5.1, 512-6S Laboratory Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
Post accident indication of filter break-through.	See Block 1 above	TECH-34
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	See Block 1 above	DOE-HNBK-1169 (2.4)
Control components should fail safe.	See Block 1 above	DOE-HNBK-1169 (2.4)
3 - Resistance to Internal Events - Fire		
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	See Block 1 above	DOE-HNBK-1169 (10.1) DOE-STD-1066
Confinement ventilation systems should not propagate spread of fire.	See Block 1 above	DOE-HNBK-1169 (10.1) DOE-STD-1066
4 - Resistance to External Events - Natural Phenomena - Seismic		
Confinement ventilation systems should safely withstand earthquakes.	See Block 1 above	ASME AG-1 AA DOE 0420.1B DOE-HNBK-1169 (9.2)
5 - Resistance to External Events/Natural Phenomena - Tornado/Wind		
Confinement ventilation systems should safely withstand tornado depressurization.	See Block 1 above	DOE 0420.1B DOE-HNBK-1169 (9.2)
Confinement ventilation systems should withstand design wind effects on system performance.	See Block 1 above	DOE 0420.1B DOE-HNBK-1169 (9.2)

Attachment 5 - 2004-2 Table 5.1, 512-6S Laboratory Ventilation System Performance Criteria

Evaluation Criteria	Discussion	Reference
[illegible] Testability		
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	See Block 1 above	DOE-HNBK-1169 (2.3.8) ASME AG-1 ASME N510
Instrumentation required to support system operability is calibrated.	See Block 1 above	DOE-HNBK-1169 (2.3.8)
Integrated system performance testing is specified and performed.	See Block 1 above	DOE-HNBK-1169 (2.3.8)
[illegible] Maintenance		
Filter service life program should be established.	See Block 1 above	DOE-HNBK-1169 (3.1 & App C)
[illegible] Single Failure		
Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	See Block 1 above	DOE-HNBK-1169 (2.2.7)
[illegible] Other Credited Functional Requirements		
Address any specific functional requirements for the confinement ventilation system (beyond the scope of those above) credited in the DSA.	See Block 1 above	10 CFR 830, Subpart B

Notes:

1 Radiological consequences of an unmitigated event are well below criteria for classification as SS, as noted in Table 4.3. However, events are assumed to be SS for Table 5.1 development. All events in the CHA are below 20 mREM to the public and 12 REM to the CW.

Attachment 6 - Table 4.3 Submittal

Attachment 6 - Table 4.3 Former Submittal

Table 1 – Ventilation System Evaluation Guidance

Confinement Documented Safety Analysis Information DNFSB 2004-2 Implementation Plan Table 4-3										
Facilities 241-96H and 512-S			Facilities 241-96H and 512-S				Performance Expectations			
Bounding Accidents	Type Confinement		Doses Bounding Unmitigated-Mitigated	Confinement Classification			Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive	(Leak Path Factors [illegible])	SC	SS	DID				
There are no credible events that require accident analysis per the Evaluation Guide (DOE-STD-3009-94), for Facilities 512-S and 241-96H	Ventilation is not credited in the DSA for confinement. Active ventilation is provided in buildings and tanks.	Although not credited in the DSA for confinement, tanks and cells contain and help identify leaks	There are no credible DSA bounding accidents where ventilation is relied upon to mitigate consequences.	NA	NA	NA	There are no credible DSA ventilation functions required.	There are no DSA ventilation functional requirements.	There are no DSA required ventilation performance criteria.	There are no DSA required compensatory measures for the ventilation system.

Table 2 – Facilities 241-96H and 512-S Event Description

Event Category	Facility Applicability	Unmitigated Consequences
Process Spill	Both	CW 3.79 REM Public 6.39 mREM
Laboratory Spill (500 gallons filtrate (from LWHT))	512-S	CW 3.01 mREM Public 0.0048 mREM (Actual numbers are provided. Former report stated "For the CW and the Public, the Lab Event Spill is bounded by a factor of 12 by the Process Spill Event.")
Tank Deflagration	Both	CW 6.10 REM Public 10.4 mREM
Wind & Seismic (Wind assumes same damage as a seismic event. Wind dose consequences were formerly reported as a separate item but the former reported wind information had a typographical error in reported dose consequences.)	Both	CW 11.8 REM Public 20 mREM

Attachment 7 - ARP Facility Evaluation Team

Attachment 7 – ARP Facility Evaluation Team

Don Blake – DOE-SR, AMWDP/WDED, Safety System Oversite

Donald J. Blake is a Nuclear Engineer in the Department of Energy Savannah River Operations Office, Waste Disposition Project, Engineering Division. He has over 20 years of engineering experience in the nuclear field. He holds a Bachelor of Science in Mechanical Engineering from West Virginia University. His primary responsibilities include safety system oversight of the Tank Farm Facilities and review of Tank Farm safety basis documents. In addition, he provides oversight of the engineering activities associated with the Waste Disposition Project. He has participated on several readiness reviews for High Level Waste Facilities, focusing on the safety basis and engineering related activities such as design, testing, and maintenance. Prior to joining DOE in 1994, Mr. Blake held positions in the Nuclear Engineering Department of the Charleston Naval Shipyard, including Shift Refueling Engineer, Assistant Chief Refueling Engineer, Nuclear Reactor Refueling Equipment Branch Chief, and Nuclear Performance Assessment Division Head.

Walter Isom - WSRC, Integrated Salt Projects Chief Engineer

Walter Isom has a Bachelor of Science Degree in Mechanical Engineering. He has 25 years experience at SRS in design engineering, system engineering, operations and maintenance. During his tenure at SRS he has been a system engineer and engineering manager for the ventilation systems of the Canyon and B-line facilities in the Separations Area. He is currently the Salt Deposition Program Chief Engineer.

Andrew Tisler – WSRC. ARP Engineering Manager

Andrew Tisler has a Bachelor of Science Degree in Physics and has over 19 years engineering experience in the safety, regulatory and nuclear field. He has been a system engineer, regulatory engineer, Shift Technical Engineer, the Plant Engineering Manger for one of SRS's Tank Farms and is currently the Design Authority Manager for the Actinide Removal Process – Capacity Enhancement project.

Eric Monaco – WSRC, Tank Farm Ventilation Subject Matter Expert (241-96H)

Eric Monaco holds a Bachelor of Science in Mechanical Engineering from the University of South Carolina and has 7 years experience working with the Tank Farm ventilation systems. Eric is the H-Tank Farm Ventilation Design Authority (DA) responsibly for technical reviews, configuration control, USQs, environmental compliance reviews and protection of the facility design basis. Eric provides day-to-day mechanical engineering field support to the WSRC H-Tank Farm and resolves emergent Operations and Maintenance issues within the facility. He provides engineering support for nitrogen inerting systems, waste tank ventilation systems, pump pit and diversion box ventilation systems. Eric also provides engineering support for maintenance activities including work package and procedure review and approval, design modification review and approval, performance trending and resolution of technical issues.

Anthony Colbert – WSRC, DWPF Ventilation Design Authority (DA) Engineer (512-S)

Anthony Colbert enlisted in the US Navy's Nuclear Power Program, where he served in the Nuclear Submarine Force.

Anthony has worked at the Defense Waste Processing Facility (DWPF) at the Savannah River Site (SRS) for the last 8 years. He has experience in nuclear power plant operation, electrical power generation and distribution, electrical equipment maintenance, technical training, procedure writing and mechanical systems engineering. Anthony currently serves as an HVAC and Chilled Water Systems Design Authority Engineer for both the DWPF and the 512-S Facilities at SRS. He has 20 years total experience in the operation and maintenance of nuclear-process-related equipment.

Michael Potvin – WSRC, DWPF DA Ventilation Engineer (512-S)

Michael Potvin is a 1985 graduate of Virginia Polytechnic Institute and State University with a degree in Mechanical Engineering. Mike has been at the Savannah River Site for 21 years. Mike is currently assigned as a Principle Engineer at the Defense Waste Processing Facility (DWPF) where he is working in the area of safety analysis. While at DWPF, Mike has also served in the role as a plant/system engineer, Shift Technical Engineer, and Control Room Manager. He has also worked in the Reactor Works Engineering Department, where he served as a plant engineer specializing in predictive maintenance and as the manager of the predictive maintenance group.

Nilesh Chokshi – WSRC, DWPF DA Ventilation Engineer (512-S)

Nilesh Chokshi has a Bachelor of Science and Master's Degree in Mechanical Engineering. He worked as an Engineering Specialist with Bechtel Savannah River Inc. for 24 years in Design Engineering. Nilesh is currently working as a Mechanical Engineer in the DWPF Engineering Department. He has a total of 35 years experience in Mechanical Engineering and specialized in Design, Conceptual Design, Energy Conservation, Field Engineering and Procurement in the HVAC field with a wide variety of projects including the Tritium Extraction Facility (TEF) and Savannah River National Laboratory (SRNL) projects. He was Subject Matter Expert (SME) and Energy Conservation expert for the Design Engineering department at SRS.

Latricia Jones – WSRC, DWPF DA Ventilation Engineer (512-S)
Latricia Jones has a Bachelor of Science Degree in Mechanical Engineering from Michigan State University. She has worked at the Savannah River Site for 17 years. Latricia's work experience includes chemical receipt and processing, production computer systems, laboratory remote equipment, compressed gases, procurement, process ventilation, and participation in a facility startup. Latricia is currently working as the Design Authority for the Remote Sampling System, Flush Water System, and the Process Vessel Ventilation Systems for both the DWPF and 512-S Facilities at SRS.
Joseph Randazzo – WSMS Safety Analysis Engineer
Joseph Randazzo is a 1978 Graduate of Lynchburg College in Virginia with a Bachelor's Degree in Physics. Joe performed reactor system design analysis for NSSS vendor Babcock & Wilcox and several nuclear utilities before coming to WSMS. He has performed nuclear licensing at B&W and TMI. In additioon, he has performed problem resolution for SRS's H-Tank Farm and ITP before developing training material and performing as a senior instructor at SRS, Rocky Flats Environmental Technology Site and Los Alamos National Labs. Joe has 12 years experience working with the NRC, commercial nuclear utilities and vendors. Joe has 15 years experience working with four DOE Sites as an Engineer, Quality Engineer, Instructor, Licensing Engineer and procedure writer. Joe is also a consultant for the die cast industry, agricultural industry and an environmental specialist with a bio-remediation background.

SEPARATION

PAGE

06.1191

United States Government **Department of Energy**

memorandum

Idaho Operations Office

Date: September 7, 2006

Subject: Transmittal of Idaho Cleanup Project New Waste Calcining Facility Ventilation System Pilot Evaluation to Deputy Assistant Secretary for Safety Management and Operations (OS-QSD-06-112)

To: Dae Y. Chung
Deputy Assistant Secretary for Management and Operations
EM-60

Reference: (1) Report: Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2004-2 – Active Confinement Systems, Revision 1, dated June 2006
(2) Memo, I. Triay to Distribution, Subject: Office of Environmental Management Expectations for Implementation of Commitment 8.6 under the Department of Energy Implementation Plan Responding to Defense Nuclear Facility Safety Board Recommendation 2004-2, dated June 9, 2006

Attached is the Idaho Cleanup Project Final Evaluation Report for the New Waste Calcining Facility (NWCF) Ventilation System Pilot Evaluation. The NWCF was identified as a pilot evaluation facility as part of the Department's Implementation Plan to DNFSB 2004-2. The attachment is part of the interim milestones identified in reference 2 to show completion of the evaluations required by the implementation plan.

If you have questions or comments regarding this transmittal, please contact Ken Whitham 208-526-4151 or Arnie Preece 208-526- 2911.

Elizabeth D. Sellers
Manager

Attachment

RPT-262
Revision 0

Idaho Cleanup Project

New Waste Calcining Facility Ventilation System Pilot Evaluation

August 2006

REVIEWS AND APPROVALS

Facility Evaluation Team (See Attachment 1 for Bios)

8/30/06

R. G. Peatross, CWI Facility Safety Basis
Subject Matter Expert

(per telecon) RGP 8/30/06

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8/30/06

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for A. B. Preece

A. B. Preece, DOE-ID, Safety Basis Matter Expert

Site Office Manager

9/7/06

E. D. Sellars, DOE-ID

EXECUTIVE SUMMARY

U.S. Department of Energy (DOE), *Ventilation System Evaluation Guidance Document*, provides guidance for performing ventilation system evaluations in accordance with a plan that implements Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2004-2. Recommendation 2004-2 noted concerns with the confinement strategy utilized or planned for in several facilities to confine radioactive materials during or following accidents. The DNFSB prefers active confinement systems that rely on motive force and filters over passive confinement systems that use facility structures and components (e.g., facility enclosure without the motive force).

Per DOE's implementation plan, confinement ventilation system evaluations were performed for a small number of facilities identified as pilot facilities to validate the path forward for the remaining Hazard Category 2 and 3 facilities. The Idaho Nuclear Technology and Engineering Center (INTEC) New Waste Calcining Facility (NWCF) at the Idaho National Laboratory (INL) was designated as one of these pilot facilities.

The pilot evaluation for the NWCF was performed in three phases. Phase I involved data gathering using Table 4.3 of the DOE guidance document and was submitted to the DOE Independent Review Panel (IRP) for concurrence on June 29, 2006. Phase II involved ventilation system evaluations using DOE guidance document Table 5.1 and associated evaluation criteria and was submitted to the IRP for review on July 31, 2006. Phase III involved completion of the final evaluation report and submittal to the IRP. The final pilot evaluation report for the NWCF was transmitted to the DOE Program Secretarial Officer for review.

The NWCF is a Hazard Category 2 facility designed with a combination of passive structures and ventilation systems for contamination control and worker protection. The results of the hazard and accident analysis in the facility documented safety analysis (DSA) relies on the passive confinement features provided by the facility and does not credit safety-significant or safety-class confinement features. Therefore, functional requirements and performance criteria are not identified for any of the NWCF ventilation systems.

Per the evaluation guidance for Hazard Category 2 facilities, the performance criteria for safety-significant ventilation systems is used to evaluate the NWCF ventilation systems. The result of the evaluation is that the NWCF systems meet the nondiscretionary performance criteria for safety-significant ventilation systems, as specified in Table 5.3 of the DOE evaluation guidance document.

The data-gathering phase of the evaluation did result in one finding related to the use of leak path factors (LPFs) in the DSA. The LPFs chosen for two of the design/evaluation accident scenarios were qualitatively derived, based on the torturous path, through multiple barriers that the material would be required to pass before release from its processing location below ground. The technical basis is not well documented or supported by quantitative analysis such as results of engineering calculations or computer code runs, as recommended by the DOE evaluation guidance document. Also, it was found that the material at risk (MAR) assumed in one of these accidents represents an overly conservative assumption for current NWCF conditions. As a result of these findings, the unreviewed safety question process for a potentially inadequate safety analysis has been initiated to evaluate the significance of the application of an LPF less than one to the consequences of this DSA. The DSA will be revised to evaluate the unmitigated events with no credit for LPF. The revision will also update the MAR assumption and doses calculated using the DOE-recommended MELCOR Accident Consequence Code 2 (MACCS2) computer code. It is expected that the MAR and computer code changes will result in a significant reduction in the on-Site and Off-Site consequences. Documentation of the passive design features that provide the basis the LPF will be included as required to support application of the mitigative feature.

CONTENTS

ACRONYMS

ALARA	as low as reasonably achievable
CVS	Confinement Ventilation System
CWI	CH2M–WG Idaho, LLC
DBE	design basis earthquake
DBT	design basis tornado
DCS	Distributed Control System
DF	decontamination factor
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOE-ID	Department of Energy, Idaho Operations Office
DSA	Documented Safety Analysis
ETS	Evaporator Tank System
HV	heating and ventilating
HEPA	high-efficiency particulate air
HVAC	heating, ventilating, and air conditioning
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRP	Independent Review Panel
IWTU	Integrated Waste Treatment Unit
LPF	leak path factor
MACCS	MELCOR Accident Consequence Code System
MAR	material at risk
MSL	mean sea level
MCP	management control procedure

NA	not applicable
NPH	natural phenomena hazard
NSB	nearest site boundary
NWCF	New Waste Calcining Facility
OBE	operational basis earthquake
PBF	Power Burst Facility
PISA	potential inadequacy in the safety analysis
RCRA	Resource Conservation and Recovery Act
RH	remote-handled
RSAC	Radiological Safety Analysis Code
RSS	Rapid Shutdown System
SAR	Safety Analysis Report
SBW	sodium-bearing waste
SDD	system description document
SSC	system, structure, or component
SSE	safe shutdown earthquake
SUPS	Standby Uninterruptible Power System
TAN	Test Area North
TBP	tributyl phosphate
TEDE	total effective dose equivalent
TPR	technical procedure
TRU	transuranic
TSR	technical safety requirement
WC	water column
WIPP	Waste Isolation Pilot Plant

New Waste Calcining Facility Ventilation System Pilot Evaluation

1. INTRODUCTION

The following sections provide a facility overview of the New Waste Calcining Facility (NWCF) and an overview of the confinement ventilation system strategy.

1.1 Facility Overview

The NWCF is categorized as a Hazard Category 2 nuclear facility based on the total quantity of nuclear material that could be available for an unmitigated release. The facility began hot operations in 1982. Until June of 2002, the primary mission of the NWCF was to convert radioactive liquid waste into a granular solid called calcine and to destroy waste process solvents by using them as a combustion fuel in the calcine process. The calcination process is now closed in accordance with Resource Conservation and Recovery Act (RCRA) regulations. There are no plans to restart calcining. Now the primary missions of the NWCF are concentrating waste solutions using the Evaporator Tank System (ETS), filter leaching, and characterizing and processing remote-handled (RH) transuranic (TRU) waste for shipment to the Waste Isolation Pilot Plant (WIPP).

The NWCF building has three main levels—one above grade and two below grade—and two main areas, the decontamination area and the calciner area. Process control takes place above grade, while the evaporation of liquid waste and filter leaching takes place below grade on the second and third levels. Decontamination area activities, which include RCRA-regulated debris treatment and RH TRU characterization and processing, are conducted above grade on the first level and below grade on the second level. The closed calciner process equipment, ETS, associated process vessels, filter leaching cell, and equipment handling radioactive effluent are housed below grade on the second and third levels—in reinforced concrete cells or cubicles—to provide environmental and personnel protection (such as confinement and attenuation of radioactive fields).

1.2 Confinement Ventilation/Strategy

The following is a list of the NWCF ventilation systems:

1. Calciner area
2. Decontamination area
3. Control room
4. Office area
5. Calcium nitrate addition room
6. Switchgear room.

The use of six independent (i.e., no common ducting or components) supply and exhaust systems for general working and limited access areas minimizes the potential for cross-contamination in areas normally occupied by plant personnel (such as the control room, offices, and chemical makeup area).

Of the six separate ventilation systems at the NWCF, only the calciner area and decontamination area systems could warrant consideration as credited equipment to provide a confinement function for releases. The accident analysis for potential events in these areas relied upon passive confinement rather than crediting the active systems. The ventilation systems have been in service for approximately 24 years without undergoing significant modifications. Design information for these systems can be found in the system description document and in detailed system drawings available through the NWCF system engineer.

The heating and ventilating (HV) uses a cascading negative airflow in the NWCF that prevents contamination spread from areas of greater contamination potential to areas of lesser contamination potential. Pressure differentials are maintained in the building between different confinement zones and between the outside atmosphere to ensure that airflow is toward the zones with greater potential for contamination. The HV airflow generally moves in a once-through pattern, from filtered inlets into building areas, then into exhaust ventilation ducting, and finally to exhaust filtration and discharge.

Supply air is distributed throughout the NWCF by means of conventional sheet-steel duct systems. high-efficiency particulate air (HEPA) filters are provided wherever the supply air enters a potentially contaminated area from an operating corridor to prevent the reverse flow of contamination. Each filter has a bagout feature that allows changeout in the contaminated area while protecting the contamination area boundary. HEPA filters are installed on the main building ventilation exit streams and on all process cell and cubicle inlet air streams.

Increased exhaust flow of air occurs when the cell and cubical doors are open and during hatch removal. Devices control and indicate the pressure differentials between confinement zones. Alarms indicate when pressure differentials are outside the prescribed range.

Automatic control and monitoring of the calciner and decontamination area ventilation systems are maintained through a computerized system with operator interfaces, readouts, and alarms located in the control room. Certain aspects of the systems can be controlled manually within the rules of the automatic control system that ensure manual actions do not compromise confinement.

The calciner area and decontamination area ventilation systems operate independently of each other. The airflow from the decontamination area passes through the calciner area system scrubber for removal of corrosive vapors. The calciner area ventilation system was designed for extreme conditions including a design basis tornado, design basis seismic accelerations, temperatures associated with the calciner and ETS, in-cell and out-of-cell fires, and accidental radiological releases from calciner and ETS operations. The decontamination area ventilation system has also been designed for in-cell and out-of-cell fires and earthquakes, but is not hardened for tornados.

1.3 Major Modifications

There are no major modifications to the facility. The facility will undergo minor modifications to support treatment of the sodium-bearing waste (SBW) by the Integrated Waste Treatment Unit (IWTU) and the RH TRU projects. For the IWTU project, SBW waste will be transferred from the Tank Farm to the NWCF blend and hold tanks. The SBW will then be transferred from the blend and hold tanks to the IWTU for treatment using a steam reforming process. The facility will be modified to facilitate these transfers to the IWTU. The RH TRU project will require modifications to the NWCF to facilitate characterization and processing of RH TRU waste for shipment to WIPP. A real-time radiography system will be installed in the decontamination area and a TRU canister lag storage unit and cask stands will be installed in the crane maintenance area.

2. FUNCTIONAL CLASSIFICATION ASSESSMENT

The following sections discuss the appropriateness of the existing functional classification of the ventilation and supporting systems.

2.1 Existing Classification

The functional classifications of the NWCF ventilation systems are documented in the NWCF documented safety analysis (DSA). The current NWCF DSA is Idaho Nuclear Technology and Engineering Center (INTEC) SAR-103, "New Waste Calcining Facility," Revision 3.[1] Revision 4 to Safety Analysis Report (SAR)-103 is expected to be approved in September 2006.

None of the scenarios in the DSA classify ventilation as a safety-significant or safety-class feature required for reducing the consequences of a release. A filter degradation scenario in the NWCF DSA hazard evaluation credits ventilation and process off-gas filtration as a safety requirement for reducing radiological consequences.

2.2 Evaluation

The process used in performing the functional classification evaluation was to review the facility DSA to identify applicable release scenarios and confinement conditions assumed in determining the consequences of mitigated and unmitigated releases, and determine if ventilation is properly credited as a safety-significant or safety-class system. If ventilation is credited, the DSA would also be reviewed to identify credited system functions and required performance criteria.

The hazard analysis in the NWCF DSA evaluates credible scenarios for radiological hazards, nonradiological hazards, explosions, and natural phenomena hazards (NPHs). There are no credible criticality scenarios. The radiological hazard scenarios include HEPA filter failure, fire, explosion, direct radiation exposure, leaks, breaches, drops, and a deflagration. The nonradiological hazard scenarios include nitric acid releases due to corrosion, spills, and leaks; container leaks; and asphyxiation. Credible NPH scenarios are developed for tornado, flood, lightning, and earthquake hazards.

Bounding release scenarios considered for evaluation are listed below:

- ETS nitrated-organic reaction/deflagration
- Ventilation HEPA filter degradation by fire
- Diesel fuel fire involving RH TRU waste
- Container breach involving RH TRU waste
- RH TRU drum repackaging fire
- RH TRU drum deflagration
- Earthquake.

The following provides a basis for excluding scenario categories from consideration in the ventilation system evaluation:

1. **Nuclear Criticality.** There are no credible criticality scenarios. Tank Farm solutions processed in the ETS contain only trace amounts of uranium and are safe to concentrate through the evaporator. With the phaseout of fuel reprocessing, there are no significant sources of uranium at the INTEC that could be transferred to the Tank Farm that would increase the current uranium concentration. There are no credible criticality scenarios for RH TRU or filter leaching operations.

2. **Direct Radiation.** Confinement systems provide no safety function for direct radiation hazards.

3. **Nonradiological Hazardous Materials.** The evaluation criterion in the U.S. Department of Energy (DOE) guidance document, *Ventilation System Evaluation Guidance Document* (January 2006), focuses on the hazards of radiological materials. Similar criteria for nonradiological hazardous materials and asphyxiation hazards are not provided. Toxicity of nonradiological materials was considered within the hazard analysis documented in Chapter 3 of SAR-103. No chemical events present conditions that exceed on-Site exposure guidelines. The facility worker is also subject to high-temperature liquid and shrapnel in a deflagration of the ETS. The ventilation system will not reduce the consequences of the event. The control strategy is focused on preventing the event.

4. **Tornado.** The design and construction of the NWCF included facility and system hardening for a design basis tornado (DBT). For this reason, portions of the calciner area ventilation system are hardened against a tornado hazard and would be expected to meet the required design criteria for tornados. The decontamination area ventilation system design did not include tornado design features. DOE-STD-1020-2002, "Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities,"[2] was issued after the NWCF went into hot operations and does not include tornado design criteria for the Idaho National Laboratory (INL). The annual exceedance probability at the intersection of a site's straight wind and tornado hazard curves is used to determine if tornadoes should be a part of the site design criteria. If the exceedance probability at the intersection of the curves for a DOE site is greater than or equal to 2×10^{-5}, then tornado design criteria are specified in the standard.

5. **Lightning.** The hazard evaluation in the DSA determines that the consequences of a lightning strike on the NWCF are bounded by other fire events. The design and construction of the NWCF includes lightning protection. Lightning protection is a standard feature for nuclear facilities at the INL. While an active ventilation system may reduce the consequences of a fire event, a lightning-initiated fire would not be expected to propagate to material processing and storage areas to involve material at risk (MAR).

6. **Flooding.** The design and construction of the NWCF included facility siting, design, and construction for a design-basis flood. An active ventilation system could not be credited as a mitigative feature for a release caused by flooding.

Attachment B lists the classifications for each of the scenarios considered in the evaluation and the MARs for each of the design/evaluation-basis accidents. The format for the classification table in Attachment B is derived from Table 4.3 of the DOE ventilation system evaluation guidance document.[3]

From Attachment B it can be seen that the nitrated-organic reaction and RH TRU drum handling fire scenarios assumed leak path factors (LPFs) other than one in developing the source terms. These two scenarios and the bases for the LPFs are discussed in more detail in Attachment B.

The information in Attachment B was submitted to the DOE Independent Review Panel (IRP) on June 30, 2006. The IRPs response to the submittal is included as Attachment C.

2.3 Summary

The hazard and accident analysis in the DSA do not specify the ventilation systems as safety-significant or safety-class. Therefore, functional requirements and performance criteria are not identified for any of the NWCF ventilation systems.

The LPFs chosen for the ETS deflagration and TRU drum-handling fire scenarios were qualitatively derived and do not have a strong technical basis that includes identification and quantitative evaluation of the actual leak paths through the facility to the outside environment. Further, in the case of the nitrated-organic reaction scenario, the MAR assumed in the source term calculation is based on first-cycle rafinates from the processing of a conservative fuel type. Fuel processing is no longer performed at INTEC. These rafinates no longer exist at INTEC and represent an overly conservative MAR assumption for NWCF scenarios. Further, the conditions for the nitrated-organic reaction scenario may no longer exist.

The unreviewed safety question (USQ) process for a potential inadequacy in the safety analysis (PISA) has been initiated to evaluate the significance of the application of an LPF less than one to the consequences in the NWCF DSA. The DSA will be revised to evaluate the unmitigated events with no credit for LPF. The revision will also update the MAR assumption and doses calculated using the DOE-recommended MELCOR Accident Consequence Code Version 2 (MACCS2) computer code.[4,5] It is expected that the MAR and computer code changes will result in a significant reduction in the on-Site and off-Site consequences. Documentation of the passive design features that provide the basis the LPF will be included as required to support application of the mitigative feature.

3. SYSTEM EVALUATION

The Site Evaluation Team, the Facility Evaluation Team, and the DOE IRP agreed that the system evaluation should be performed against the attributes of a safety-significant system. These attributes are found in Table 5.1 of the DOE ventilation system evaluation guidance document.[3] All the applicable nondiscretionary attributes of a safety-significant system were considered mandatory by the Site and Facility Evaluation Teams.

As previously discussed (see Section 1.2), only the calciner and decontamination area ventilation systems could warrant consideration as credited equipment to provide a confinement function for releases. The accident analysis for potential events in these areas relied upon passive confinement rather than crediting the active systems. Therefore, the calciner and decontamination area ventilation systems are evaluated against the attributes. The impact of scenarios listed in Appendix B on the ventilation systems were considered as a part of the evaluation.

The system evaluation involved system walk-downs by the Site Evaluation Team and the Facility Evaluation Team. The NWCF ventilation system design description (SDD)[6] and facility fire hazards analysis[7] were reviewed, and the ventilation system engineer was consulted as the evaluation was being performed.

Attachment D shows the results of the calciner and decontamination area ventilation system evaluations against the criteria for safety-significant systems. The system evaluation results demonstrated that these systems meet each nondiscretionary attribute of a safety-significant system. Therefore, there are no gaps between the actual system attributes and the expected attributes of a safety-significant system.

4. CONCLUSION

Based on the results of the hazard and accident analyses, the ventilation systems for the NWCF facility are not required to be designated as safety-significant or safety-class systems. The results for two release scenarios developed in the DSA are based on LPFs other than one. Selection of the LPFs is based on a qualitative assessment of the location of the releases below ground surface rather than on a strong technical basis grounded on quantitative analyses or computer modeling.

The PISA process has been initiated to evaluate the significance of the application of an LPF less than one to the consequences in the NWCF DSA. The DSA will be revised to evaluate the unmitigated events with no credit for LPF. The revision will also update the MAR assumption and doses calculated using the DOE-recommended MACCS2 computer code.[4,5] It is expected that the MAR and computer code changes will result in a significant reduction in the on-Site and off-Site consequences. Documentation of the passive design features that provide the basis for the LPF will be included as required to support application of the mitigative feature.

Two of the six noncredited ventilation systems were evaluated against the attributes expected of safety-significant systems. Both systems meet all the attributes. Therefore, there are no gaps, and modifications to the systems are not required.

5. REFERENCES

1. SAR-103, "New Waste Calcining Facility," Rev. 3, September 6, 2005.

2. DOE-STD-1020-2002, "Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities," U.S. Department of Energy, January 2002.

3. DOE, "Deliverables 8.5.4 and 8.7 of Implementation Plan for Defense Nuclear Safety Board Recommendation 2004-2," Rev. 0, U.S. Department of Energy, January 2006.

4. D. I. Chanin (1998a), M. I. Young, and J. Randall, "Code Manual for MACCS2: Volume 1, User's Guide;" NUREG/CR-6613 (SAND97-0594), Sandia National Laboratories, published by the U.S. Nuclear Regulatory Commission, Washington, DC, 1998.

5. H-N Jow (1990), J. L. Sprung, J. A. Rollstin, L. T. Ritchie, and D. I. Chanin, "MELCOR Accident Consequence Code System (MACCS)," Volume 2 Model Description; Sandia National Laboratories, Albuquerque, NM, NUREG/CR-4691 (SAND86-1562).

6. SDD-143, "System Description, INTEC-659 Heating, Ventilation, and Air Conditioning," Rev. 0, September 2003.

7. HAD-74, "Fire Hazards Analysis for CPP-659, New Waste Calcining Facility (NWCF)," Rev. 5, March 31, 2005.

Attachment 1

Facility Evaluation Team Biographical Sketches

Patrice McEahern
Safety Basis Subject Matter Expert

Ms. McEahern is the Director of Nuclear Safety for CWI. She provides senior-level technical and strategic guidance to the nuclear safety program. Ms. McEahern is participating as a contributing author to the DOE TRU Waste Standard development team. Her experience includes providing support to many DOE sites, such Oak Ridge, Hanford, Rocky Flats, Lawrence Livermore, Los Alamos, Savannah River Site, Mound, Fernald and Brook Haven. Ms. McEahern is also working with a team for the International Atomic Energy Agency to develop an international standard for developing the decommissioning safety case. Ms. McEahern has more than 23 years of experience in the nuclear industry including experience in systems engineering, quality systems engineering and nuclear safety analysis. She has a bachelor's degree in Engineering Science from Colorado State University.

Rod Peatross
Facility Safety Basis Subject Matter Expert

Mr. Peatross is the Nuclear Safety Group Lead for the Liquid Waste Facility Closure Project (LWFCP). He is responsible for leading a group of safety analysts in providing nuclear safety support to the LWFCP facilities, including the NWCF. His group develops and maintains regulation-compliant DSAs, TSRs, and unreviewed safety question assessments, and works with facility management and Department of Energy Idaho Operations Office (DOE-ID) to resolve nuclear safety issues. Mr. Peatross has 17 years of experience in implementing, reviewing, and developing safety-basis documents for new and existing nuclear and nonnuclear facilities and activities at the INL. He has a masters of science degree in occupational safety from the University of Idaho.

Dave Heasley
NWCF Ventilation System Subject Matter Expert

Mr. Heasley is the NWCF System Engineer. He is particularly experienced in the design, history, and operation of the NWCF ventilation systems. He has been involved with the NWCF since it started hot operations in 1982 and has over 30 years experience at the INL.

Attachment 2

System Functional Classifications and Materials at Risk

1. FUNCTIONAL CLASSIFICATIONS

Table 1. Release scenarios and functional classifications from the NWCF DSA.

NWCF Facility			Hazard Category 2				Performance Expectations			
	Confinement Type			Confinement Classification						
Bounding Accidents	Active	Passive	Unmitigated Bounding Doses (rem)	Safety Class Confinement	Safety Significant Confinement	Defense in Depth	Function	Functional Requirements	Performance Criteria	Compensatory Measures
ETS nitrated-organic reaction	None credited	ETS cell and Room 428 LPF = 0.01	100 m = 6 13.9 km = 0.1	None required	None required	None required or credited	NA	NA	NA	NA
HEPA filter degradation	None credited	None credited	100 m = 2E-04 200 m =0.2 13.7 km = 0.04	None required	None required	"Safety requirement" for ventilation and process off-gas filters.	NA	NA	NA	NA
Diesel fuel fire involving RH TRU	None credited	None credited	100 m = 9 13.7 km = < 0.07	None required	None required	None required or credited	NA	NA	NA	NA
Container breach involving RH TRU	None credited	None credited	100 m = 0.6 13.7 km = <5E-03	None required	None required	None required or credited	NA	NA	NA	NA
RH TRU drum repackaging fire	None credited	Spray booth or Cell 308 LPF = 0.1	100 m = 2 13.7 km = 0.02	None required	None required	None required or credited	NA	NA	NA	NA
RH TRU drum deflagration	None credited	None credited	100 m = 1 13.7 km = <0.01	None required	None required	None required or credited	NA	NA	NA	NA
Earthquake event	None credited	None credited	Qualitatively determined to be low consequences at all receptor locations.	None required	None required	None required or credited	NA	NA	NA	NA

2. MATERIALS AT RISK

Table 2. Material at risk (MAR) for nitrated-organic reaction scenario.

Nuclide	Ci
^{3}H	5.00E-01
^{60}Co	3.78E+00
^{63}Ni	6.96E-01
^{90}Sr	3.63E+03
^{90}Y	3.63E+03
^{99}Tc	2.57E-01
^{106}Ru	2.27E-01
^{106}Rh	2.88E+01
^{125}Sb	4.09E+00
^{129}I	4.09E-02
^{134}Cs	3.03E+01
^{137}Cs	3.48E+03
^{137m}Ba	3.29E+03
^{144}Ce	8.33E+01
^{154}Eu	2.12E+01
^{155}Eu	2.57E+01
^{237}Np	5.90E-02
^{238}Pu	9.84E+00
^{239}Pu	1.44E+00
^{241}Am	1.21E+00

Table 3. MAR for exhaust-filter breach.

Nuclide	Feed Activity (mCi/L)
^{60}Co	1.9E-01
^{90}Sr	2.9E+01
^{90}Y	2.9E+01
^{125}Sb	2.7E-01
^{134}Cs	1.1E+00
^{137}Cs	3.0E+01
^{137m}Ba	2.8E+01
^{154}Eu	3.8E-01
^{155}Eu	1.9E-01
^{238}Pu	6.6E-01
^{239}Pu	1.0E-01
^{241}Am	6.0E-02

MAR for Vehicle Fire Involving RH TRU. For multiple drums involved in a diesel pool fire, the MAR was assumed to be 12.4 Pu-239 eq. Ci/drum, or 148.8 Pu-239 eq. Ci in 12 drums.

MAR for Container Breach Involving RH TRU. For drums involved in a container breach accident, the MAR was assumed to be 12.4 Pu-239 eq. Ci/drum.

MAR for RH TRU Drum Repackaging Fire. For material involved in a drum repackaging fire, the MAR was assumed to be 12.4 Pu-239 eq. Ci/drum.

MAR for RH TRU Drum Deflagration. For material involved in a drum deflagration, the MAR is a waste drum with 12.4 Pu-239 eq. Ci/drum.

3. EXPLANATION OF LEAK PATH FACTORS

Two scenarios used LPFs other than one. These are the nitrated-organic reaction and the RH TRU drum loading fire scenarios. The following sections described these scenarios and discuss the derivation of the LPFs.

3.1 ETS Nitrated-Organic Reaction Scenario

In the ETS process, a nitrated-organic reaction could occur from a separate organic phase encountering concentrated nitrates under acidic conditions. A self-accelerating reaction could cause harm to workers and damage to equipment, and require extensive cleanup of the facility.

The frequency of this scenario is estimated to be unlikely. A report by the Defense Nuclear Facility Safety Board (DNFSB), sample analysis results, and operating knowledge provide the bases for the frequency. The DNFSB performed a review of potential for nitrated-organic reactions, and concluded that "The Chemical Processing Plant Facility (CPP) at Idaho National Engineering and Environmental Laboratory (INEEL) is considered capable but extremely unlikely to produce a red oil event." Current sample results show the tributyl phosphate (TBP) concentrations to be in the parts per billion (ppb) range. Fuel reprocessing activities have ceased, and no reprocessing waste exists in the Tank Farm. Most, if not all, organics would have been vaporized in the calcination process (500 to 600°C [932 to 1,112°F]) and would not have been found as residue in the dissolved bed solutions. The presence of concentrated nitrates (7 to 10 *M*) is necessary for a nitrated-organic reaction to occur. Chemicals such as nitric acid and aluminum nitrate were used extensively in fuel processing operations. Thus, Tank Farm solutions contain nitrates. The solutions that are processed through the ETS contain significant quantities of nitrates. The current nitrate molarity for the Tank Farm solutions to be processed range from 2.59 to 5.24.

The source term analysis assumed an LPF of 1% determined qualitatively, based on the location of the event and physical barriers to a release outside the facility. The physical barriers include a concrete-shielded cell below ground surface level with thick concrete and steel-shielded access hatches to the maintenance area. A release from the maintenance area to the outside environment would then be through the maintenance area super structure. The majority of the radionuclides released to the maintenance area would remain in the NWCF due to condensation or contact with walls and equipment. However, some small quantity of radionuclides is assumed to escape through unfiltered exits, such as the roll-up door, during the brief period of pressurization.

The source term analysis also determined a damage ratio of 10% based on analysis results of a red oil explosion in 1993 at the Tomsk-7 plant in Russia. The Tomsk-7 nitrated-organic reaction resulted in less than 10% of the vessel solution being released from the cell.

The source term calculation assumed a compilation of the maximum concentration of each radionuclide in the Tank Farm and an evaporator operating volume of 2,000 gal. The INL-specific RSAC code and 95% weather conditions were used to determine the radiological doses at the nearest site boundary (NSB) and co-located worker location.

Unmitigated consequence analysis results in a total effective dose equivalent (TEDE) of approximately 0.1 rem at the NSB and a TEDE of 6 rem at the co-located worker location. These doses conservatively include ingestion at the NSB which is not required per DOE-STD-3009-94. The doses do not challenge the evaluation guideline doses of 100 rem to the facility workers and 25 rem to the off-Site public. (The evaluation guidelines for the Idaho Cleanup Project [ICP] are from SAR-100, "ICP Standardized Safety Analysis Report [SAR] Chapters," approved by DOE.) If an LPF of 1 is assumed, the resulting doses will be 10 rem at the NSB and 600 rem at the co-located worker location. In this case, the evaluation guideline for the off-Site public is approached and the off-Site evaluation guideline for the co-located worker is exceeded. Deleting ingestion at the NSB would reduce the 10-rem dose to 1 rem. The co-located worker dose of 60 rem would not be affected. The DSA qualitatively determined that the nonradiological consequences would exceed evaluation guidelines for the co-located worker, but not for the off-Site public due to the distance to the NSB. The facility worker would receive a high dose and be subject to high-temperature material, high radiation, and potential pressure or shrapnel hazards.

Technical safety requirement (TSR)-level Specific Administrative Controls for the ETS temperature parameter prevents a worker fatality and prevents the event. Implementation of the temperature limit is through an automatic system that reduces the risk of a reaction by monitoring and controlling the temperature. The ETS temperature instruments required to monitor temperature and the rapid shutdown system (RSS) are safety-significant. The DSA does not identify the need for safety-class structures, systems, or components (SSCs) because the dose at the NSB does not challenge the ICP evaluation guideline.

3.2 RH TRU Drum Repackaging Fire

During drum repackaging activities in the decontamination cell or the steam spray booth, a drum of uncontained RH TRU material could be involved in a fire. Initiators for the fire are equipment failure or electrical failure within the cell or steam spray booth. This is an anticipated event.

The MAR was assumed to be 12.4 Pu-239 equivalent Ci/drum. This MAR is based on the Pu-239 maximum fissile gram equivalent loading in an RH TRU drum retrieved from the ICP Intermediate Level Transuranic Storage Facility at the INL.

The damage ratio for the uncontained material is 1.

The respirable airborne release fraction of 1.0×10^{-2} for uncontained cellulose or largely cellulose mixed waste is assumed. This is the bounding airborne release fraction and respirable fraction values used in accordance with DOE-HDBK-3010-94.

As in the ETS nitrated-organic reaction accident, the LPF for a fire involving a finite quantity of combustible material within a passive confinement barrier is 0.1. RH TRU drum repackaging is conducted within the steam spray booth or Cell 308. A fire involving one drum of combustible material is not postulated to be an intense event that would challenge the confinement barrier provided by the building structure. The Tomsk-7 nitrated-organic reaction resulted in less than 10% of the vessel solution being released from the cell. Thus, it is assumed that 10% of the drum is released to the spray booth or cell.

The resulting doses are approximately 0.02 rem TEDE at the NSB and 2 rem TEDE at the co-located worker location. These doses do not challenge the ICP evaluation guideline of 0.5 rem for anticipated releases to the off-Site public or the co-located worker evaluation guideline of 100 rem at 100 m. Increasing the LPF from 0.1 to 1 would result in a corresponding order of magnitude increase in the doses to 0.2 rem at the NSB and 20 rem at the co-located worker location.

Attachment 3

Independent Review Panel Report

The IRP had not issued the referenced letter of concurrence at the time this evaluation report was due.

Attachment 4

System Evaluation Tables

Table 1. Comparison of the NWCF calcine area ventilation system to performance criteria.

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Ventilation System - General Criteria			
Pressure differential should be maintained between zone and atmosphere.	Number of zones as credited accident analysis to control hazardous material release; demonstrate by use considering in-leakage.	The accident analysis in the DSA does not credit contamination zone pressure differentials to control hazardous material releases. However, a zoned pressure differential approach is applied in the design and operation of the ventilation systems. The criteria would be met if the ventilation system was credited by the safety basis.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Materials of construction should be appropriate for normal, abnormal and accident conditions.	None.	The ventilation system is designed for high-temperature conditions for normal operating conditions in the calcine cell and evaporator cell. The system is also designed for fires in the cells and outside the cells. A vent scrubber/mist eliminator system removes corrosive vapors and mists from the air streams, the decontamination cells and cubicles, and the filter leaching cell before the air reaches the calciner exhaust system.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	As required by the accident analysis to prevent a release.	The exhaust system withstands the anticipated normal and abnormal operations. The ventilation system is identified as a "safety requirement" in the hazard evaluation for exhaust filter failure and a fire that degrades exhaust filters. The exhaust system is not credited for any other scenario in the hazard or accident analysis. The focus is on preventing the deflagration scenario rather than on preventing a release once it has happened. Therefore, the ventilation exhaust system is not credited with reducing doses after the scenario. If the calcine area ventilation exhaust system were credited in the ETS deflagration scenario, the exhaust system would have to withstand the overpressure and heat of the deflagration. There are no studies that demonstrate the system is capable of providing a credited safety function under these conditions. If the exhaust system must be credited, survivability of the system after a deflagration must also be demonstrated. The SDD states that the one of the design objectives of the calcine ventilation system was that it would maintain confinement during in-cell and out-of-cell fires. Manually activated spray nozzles provide emergency cooling and fire	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0

Table 1. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
		protection at the exhaust plenums. Exhaust plenums have moisture separators to protect the filters if the spray system should activate. The accident consequences from this scenario are well below the evaluation guidelines; therefore, filter performance during a fire is not credited by the DSA.	
Confinement ventilation systems (CVS) shall have appropriate filtration to minimize release.	Address: (1) Type of filter (e.g., HEPA, sand, sintered metal); (2) Filter sizing (flow capacity and pressure drop); (3) Decontamination factor vs. accident analysis assumptions.	The HEPA filters on the exhaust system are designed for a decontamination factor (DF) between 4×10^7 and 1×10^7. All inlet plenums are HEPA-filtered to prevent the release of activity caused by pressurization of the system. The inlet HEPA filters to the calcine area are not tested after installation; therefore, a reduced DF is assumed for these filters. The inlet HEPA filters to the calcine cells have test fixtures and are tested after installation. The filters are rated at 1,500 scfm at 1.0 in water column (WC). The accident analysis in the DSA does not make assumptions regarding dose reduction due to filtration. The system design DF is sufficiently large that if crediting a DF would be required by the accident analysis, the required DF would be no larger than the DF already designed into the system. This performance criteria would be met.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Ventilation System – Instrumentation and Control			
Provide system status instrumentation and/or alarms.	Address key information to ensure system operability (e.g., system delta-P, filter pressure drop).	Performance status of the ventilation system is continuously monitored with visual and audible feedback to operators in the NWCF control room. Feedback includes pressure differentials in potentially contaminated zones, differential pressure across the exhaust HEPA filters, air flow, vane trim, hand switch status, and fan operating status. Alarms are categorized as standard and high priority. High-priority alarms include high-high and low-low alarms that initiate the rapid shutdown system. Standard alarms include high and low alarms for flow, level, pressure, pressure differential, acidity content of the scrubber, radiation, and temperature.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Interlock supply and exhaust fans to prevent positive pressure differential.	None.	The supply and exhaust blowers are automatically controlled from the NWCF control room. Blowers can also be manually controlled from the local control panel. When the local hand switch for a given blower is placed in the off position, the blower cannot be started from the control room. Interlocks prevent operation of the supply blowers if the exhaust blowers are not operating. Shutdown of the exhaust blowers will automatically result in a shutdown of the supply blowers.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Post accident indication of filter break-through.	Instrumentation supports post-accident planning and	Filter buildup is monitored by pressure differential instruments. A low-pressure differential instrument indicates filter damage and activates an alarm in the	SDD-143, System Description Document for

Table 1. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
	response: should be considered critical instrumentation for safety class.	control room. Radiation monitoring instrumentation in the NWCF exhaust stack activates an alarm in the NWCF control room if preset limits are reached.	INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	Address for example impact of potential common mode failures from events that would require active confinement function.	The reliability of the control system to maintain confinement is not credited by the facility DSA for accident conditions. Compliance with applicable codes and standards ensures that an acceptable level of system reliability is achieved for normal and abnormal conditions. There are no reliability studies addressing system reliability during accident conditions discussed in the DSA. None of the accident scenarios evaluated in the DSA require active confinement for reducing doses that approach an evaluation guideline. Active confinement would be required as a part of the radiation control program for keeping doses as low as reasonably achievable (ALARA) and for contamination control. A common mode failure may be the deflagration scenario that could result in a failure of the ETS vessel (primary confinement) and a failure of the HEPA filters (secondary confinement). Which could result in an unfiltered leak outside the facility. A PISA assessment is being performed on the appropriateness of the LPF assumed for the deflagration scenario. Beyond design basis events would result in multiple failures and significant releases.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Control components should fail safe.	None.	Dampers, trim vanes, blowers, and other ventilation system components are designed to fail safe to ensure confinement is maintained. Major control system component failures will result in the ventilation system going to fail safe configurations.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Resistance to Internal Events - Fire			
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	Required for new facilities; as required by the accident analysis for existing facilities (discretionary). Must address protection of filter media.	The NWCF is not a new facility. The ventilation system is identified as a "safety requirement" in the hazard evaluation for exhaust filter failure and a fire that degrades exhaust filters. It is not credited for any other scenario in the hazard or accident analysis sections. Manually activated spray nozzles provide emergency cooling and fire protection at the exhaust plenums. Exhaust plenums have moisture separators to protect the filters if the spray system should activate.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0

Table 1. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Confinement ventilation systems should not propagate spread of fire.	Required for new facilities; as required by the accident analysis for existing facilities (discretionary). Address fire barriers, fire dampers arrangement.	The ventilation system is identified as a "safety requirement" in the hazard evaluation for exhaust filter failure and a fire that degrades exhaust filters. The calcine area system is not credited with preventing fire propagation. All NWCF ventilation systems are designed to operate independent of each other. Therefore, a fire in the calcine area could not propagate to the decontamination area through the ventilation system. Manually activated spray nozzles provide emergency cooling and fire protection at the exhaust plenums.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft)
Resistance to Internal Events – Natural Phenomena - Seismic			
Confinement ventilation systems should safely withstand earthquakes	If the active CVS system is not credited in a seismic accident condition there is no need to evaluate that performance and/or design attribute for the confinement ventilation system (discretionary). Also, any seismic impact on the confinement ventilation system performance will be based on the current functional requirement in the DSA. NOTE: Seismic requirements may apply to defense-in-depth items indirectly for the protection of safety SSCs.	The ventilation system is identified as a "safety requirement" in the hazard evaluation for exhaust filter failure and a fire that degrades exhaust filters. It is not credited in a seismic accident. The calcine area ventilation system is seismically designed. For the original NWCF design, the safe shutdown earthquake (SSE) was defined as a maximum credible INTEC earthquake of 7.75 on the Richter scale, with a resultant horizontal bedrock acceleration of 0.33 g (gravitational force) and a resultant vertical bedrock acceleration of 0.22 g. The primary design concern for the SSE was confinement of radioactivity during and following the earthquake. An operational basis earthquake (OBE) equal to one-half of the magnitude of the SSE was selected. The minimum OBE at the INTEC was an earthquake with a resultant horizontal bedrock acceleration of 0.17 g and a resultant vertical bedrock acceleration of 0.11 g. Important systems were designed to "ride through" the OBE without significant problems or unacceptable economic loss. In addition, the OBE would not destroy those features of the plant necessary for continued safe operation. If credited, the ventilation systems would safety withstand the OBE.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 1, Rev. 3, Rev. 4 (draft)
Resistance to External Events – Natural Phenomena – Tornado/Wind			
Confinement ventilation system should safely withstand tornado depressurization.	If the active CVS system is not credited in a tornado condition there is no need to evaluate that performance and/or design attribute for the confinement ventilation system (discretionary). Also,	The calcine area ventilation system is designed to a design basis tornado (DBT). The ventilation system is identified as a "safety requirement" in the hazard evaluation for exhaust filter failure and a fire that degrades exhaust filters. It is not credited in a tornado condition. DOE-STD-1020-2002 does not identify tornado criteria for the INL. However, the NWCF is designed with tornado protection features that would prevent unacceptable radiological consequences	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 1, Rev. 3, Rev. 4 (draft)

Table 1. (continued)

<table>
<tr><th>Evaluation Criteria</th><th>Criteria Explanation</th><th>Comparison to Criteria</th><th>Reference</th></tr>
<tr><td></td><td>any tornado impact on the confinement ventilation system performance will be based on the current functional requirement in the DSA.</td><td>if it were struck by a DBT with the following characteristics:

1. A tornado rotational wind velocity of 150 mph
2. A translational wind velocity of 25 mph
3. A radius of maximum rotational wind of 150 ft
4. A peak pressure differential of 0.75 psi from an ambient atmospheric pressure of 12.25 psi
5. A pressure transient of a decrease of 0.25 psi/s over a period of 3 sec followed by an increase back to ambient in 3 sec
6. The missiles listed below in the following table:

DBT missiles.
<table>
<tr><th>Object</th><th>Dimensions</th><th>Weight (lb)</th><th>Velocity (mph)</th></tr>
<tr><td>Wood plank</td><td>4 in. × 12 in. × 12 ft</td><td>115</td><td>130</td></tr>
<tr><td>6-in. Schedule 40 pipe</td><td>6.6 in. in dia × 15 ft</td><td>289</td><td>22</td></tr>
<tr><td>1-in. steel rod</td><td>1.0 in. in dia × 4 ft</td><td>9</td><td>18</td></tr>
<tr><td>Utility pole</td><td>13.5 in. in dia × 35 ft</td><td>1,120</td><td>58</td></tr>
<tr><td>12-in. Schedule 40 pipe</td><td>12.6 in. in dia × 15 ft</td><td>750</td><td>16</td></tr>
<tr><td>Automobile</td><td>16.4 × 6.6 × 4.3 ft</td><td>4,000</td><td>92</td></tr>
</table>
Abovegrade areas necessary for process control, radiological confinement, and ventilation control have been hardened to DBT limits. These areas include the control room (438), the switchgear room (433), the standby generator room (432), the HV equipment room (434), operations offices (436 and 437), corridors (435 and 409), computer equipment room (439), Stairway No. 1, calciner exhaust air plenum room (423), and calciner supply air plenum room (601).

A tornado backdraft damper is installed at the calciner area system air intake.</td><td></td></tr>
</table>

Table 1. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Confinement ventilation system should withstand design wind effects on system performance.	If the active CVS system is not credited in a wind condition, there is no need to evaluate that performance and/or design attribute for the confinement ventilation system (discretionary). Also, any wind impact on the confinement ventilation system performance will be abased on the current NPH analysis in the DSA.	The ventilation system is identified as a "safety requirement" in the hazard evaluation for exhaust filter failure and a fire that degrades exhaust filters. It is not credited in a wind condition. The design of the facility for tornados bounds the design for high winds.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft)
Other NP Events (e.g., flooding, precipitation)			
Confinement ventilation system should withstand other NPH events considered credible in the DSA where the confinement ventilation system is credited.	If the active CVS system is not credited for this event, there is no need to evaluate that performance and/or design attribute for the confinement ventilation system (discretionary). Also, any impact on the confinement ventilation system performance will be based on the current NPH analysis in the DSA.	The ventilation system is identified as a safety requirement in the hazard evaluation for exhaust filter failure and a fire that degrades exhaust filters. It is not credited in any natural phenomena condition. However, the NWCF is by design protected from flooding. The 10,000-yr flood crest at the NWCF is estimated to be 4,912 ft above mean sea level (MSL). The NWCF abovegrade first level is 4,917 ft above MSL or about 5 ft above the estimated flood stage level. Subsurface hydraulic pressures will be insignificant, because neither the flooding time nor the water volume will be sufficient to saturate the soil to depths of 30 to 40 ft.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) Big Lost River Flood Report, BLM
Range Fires/Dust Storms			
Administrative controls should be established to protect confinement ventilation systems from barrier threatening events.	Ensure a properly thought out response to external threat is defined (e.g., pre-fire plan).	There are no TSR-level administrative controls that directly address protecting confinement barriers from range fires or dust storms. There are TSR-level administrative controls for establishing safety management programs, for emergency preparedness and fire protection that include nuclear safety attributes of provision for controlling combustible material loading; ensuring that prefire strategies, plans, procedures and fire hazards analyses are performed; and for maintaining approved emergency response procedures.	TSR-103, Technical Safety Requirements New Waste Calcining Facility TSR-100, INEEL Standardized Technical Safety Requirements (TSR) Document

Table 1. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Testability			
Design supports the periodic inspection and testing of filters and housing. Tests and inspections are conducted periodically.	Ability to test for leakage per intent of N510.	The design of the facility ventilation systems includes ports for testing the integrity and installation of inlet HEPA filters to cells and HEPA filters in the exhaust plenums. The filters are tested at least annually.	MCP-2746, Purchasing, Maintaining, and Using HEPA Filters TPR-5054, HEPA Filter In-Place Testing TPR-7153, NWCF HEPA Filter In-Place (Aerosol) Testing
Instrumentation required to support system operability is calibrated	Credited instrumentation should have specified calibration/surveillance requirements. Non-safety instrumentation should be calibrated as necessary to support system functionality.	The DSA for the NWCF does not credit ventilation system instrumentation in any accident scenario. Ventilation system instrument calibration is performed in accordance with a management control procedure (MCP).	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) MCP-1155, INTEC/TAN/PBF Calibration Program (Supplement to MCP-6303)
Integrated system performance testing is specified and performed.	Required responses assumed in the accident analysis must be periodically confirmed including any time constraints.	Preoperational tests are specified in Technical Procedure (TPR)-7121. Periodic testing of blowers is also specified in procedures. The accident analysis in the DSA does not identify required responses for the ventilation system.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) TPR-7121, Calciner Area HVAC Startup and Shutdown TPR-7125 NWCF HVAC Normal Operations

Table 1. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Maintenance			
Filter service life program should be established.	Filter life (shelf life, service life, total life) expectancy should be determined. Consider filter environment, maximum delta-P, radiological loading, age, and potential chemical exposure.	Instructions for replacing, operating, and in-place (aerosol testing) NWCF filter components are specified in procedure. Filters are replaced if inplace testing indicates filter damage or leakage.	TPR-7146, Replace Off-Gas Filter Components TPR-5054, HEPA Filter In-Place Testing TPR-7153, NWCF HEPA Filter In-Place (Aerosol) Testing
Single Failure			
Failure of one component (equipment or control) shall not affect continuous operation.	Criteria does not apply to safety-significant systems.	Not applicable.	Not applicable
Automatic backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	Criteria does not apply to safety-significant systems.	Not applicable.	Not applicable
Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	None.	Power to the Distributed Control System that monitors and controls the ventilation system is backed by a standby uninterruptible power supply (SUPS). The SUPS can provide backup power for at least 20 minutes from storage batteries. The SUPS can be powered or recharged from the standby generator. The ventilation system is connected to the INTEC standby diesel generator system. The system is programmed to determine the number of generators that start during a commercial power outage and the associated loads. There is an INTEC-wide computerized hierarchy of loads that will then be added and removed, as necessary, from the standby diesel generators. The NWCF standby power is provided when the second diesel generator starts.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft).
Other Credited Functional Requirements			
Address any specific functional requirements for the confinement ventilation system (beyond the scope of those above) credited in the DSA.	None.	None.	Not applicable

Table 2. Comparison of the NWCF decontamination area ventilation system to performance criteria.

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
General Criteria			
Pressure differential should be maintained between zone and atmosphere.	Number of zones as credited accident analysis to control hazardous material release; demonstrate by use considering in leakage.	The accident analysis in the DSA does not credit contamination zone pressure differentials to control hazardous material releases. However, a zoned pressure differential approach is applied in the design and operation of the ventilation system. The criteria would be met if the ventilation systems were credited by the safety basis.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev .4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Materials of construction should be appropriate for normal, abnormal and accident conditions.	None.	A vent scrubber/mist eliminator system in the calcine area ventilation system removes corrosive vapors and mists from the air streams from the decontamination cells and cubicles and from the filter leaching cell before the air reaches the exhaust system.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	As required by the accident analysis to prevent a release.	The decontamination area exhaust system withstands the anticipated normal and abnormal operations. The exhaust system is not credited for any scenario in the hazard or accident analysis. Manually activated spray nozzles provide emergency cooling and fire protection at the exhaust plenums. Exhaust plenums have moisture separators to protect the filters if the spray system should activate. If the decontamination area system were credited for the vehicle fire involving RH-TRU, RH-TRU drum repackaging fire, and RH-TRU drum deflagration; the exhaust system would have to withstand the overpressure of the deflagration scenario and the heat of the fire scenarios while still providing the credited safety function. The system is designed for in-cell and out of cell fires. However, design of the system did not consider the impacts of drum deflagration on system function. Manually activated spray nozzles provide emergency cooling and fire protection at the exhaust plenums. Exhaust plenums have moisture separators to protect the filters if the spray system should activate.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0

Table 2. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Confinement ventilation systems shall have appropriate filtration to minimize release.	Address: (1) Type of filter (e.g., HEPA, sand, sintered metal); (2) Filter sizing (flow capacity and pressure drop); (3) Decontamination factor vs. accident analysis assumptions.	The HEPA filters on the exhaust system are designed for a decontamination factor (DF) between 4×10^7 and 1×10^7. The inlet plenums to the decontamination area have roughing filters and are not HEPA-filtered. Inlets to the decontamination area cells are HEPA-filtered, and are designed with test fixtures for periodic in-service testing. The accident analysis in the DSA does not make assumptions regarding dose reduction due to filtration. The system design DF is sufficiently large that if crediting a DF would be required by the accident analysis, the required DF would be no larger than the DF already designed into the system. This performance criteria would be met.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Ventilation System – Instrumentation and Control			
Provide system status instrumentation and/or alarms.	Address key information to ensure system operability (e.g., system delta-P, filter pressure drop).	Performance status of the ventilation system is continuously monitored with visual and audible feedback to operators in the NWCF control room. Feedback includes pressure differentials in potentially contaminated zones, differential pressure across the exhaust HEPA filters, air flow, vane trim, hand switch status, and fan operating status. Alarms are categorized as standard and high priority. High priority alarms include high-high and low-low alarms that initiate the rapid shutdown system. Standard alarms include high and low alarms for flow, level, pressure, pressure differential, radiation, and temperature.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Interlock supply and exhaust fans to prevent positive pressure differential.	None.	The supply and exhaust blowers are automatically controlled from the NWCF control room. Blowers can also be manually controlled from the local control panel. When the local hand switch for a given blower is placed in the off position, the blower cannot be started from the control room. Interlocks prevent operation of the supply blowers if the exhaust blowers are not operating. Shutdown of the exhaust blowers will automatically result in a shutdown of the supply blowers.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Post accident indication of filter break-through.	Instrumentation supports post-accident planning and response: should be considered critical instrumentation for safety class.	Filter buildup is monitored by pressure differential instruments. A low-pressure differential instrument indicates filter damage and activates an alarm in the control room. Radiation monitoring instrumentation in the NWCF exhaust stack activates an alarm in the NWCF control room if preset limits are reached.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0

Table 2. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	Address for example impact of potential common mode failures from events that would require active confinement function.	The reliability of the control system to maintain confinement is not credited by the facility DSA. Compliance with applicable codes and standards ensures that an acceptable level of system reliability is achieved for normal and abnormal conditions. There are no reliability studies addressing system reliability during accident conditions discussed in the DSA. None of the accident scenarios evaluated in the DSA require active confinement for reducing doses that approach an evaluation guideline. Active confinement would be required as a part of the radiation control program for keeping doses ALARA and for contamination control. There are no common mode failures other than beyond design basis events that would affect the active ventilation system performance.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Control components should fail safe.	None.	Dampers, trim vanes, blowers, and other ventilation system components are designed to fail safe to ensure confinement is maintained. Major control system component failures will result in the ventilation system going to fail safe configurations.	SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Resistance to Internal Events - Fire			
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	Required for new facilities; as required by the accident analysis for existing facilities (discretionary). Must address protection of filter media.	The NWCF is not a new facility. The ventilation system is not credited for any scenario in the hazard or accident analysis sections. Manually activated spray nozzles provide emergency cooling and fire protection at the exhaust plenums. Exhaust plenums have moisture separators to protect the filters if the spray system should activate.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Confinement ventilation systems should not propagate spread of fire.	Required for new facilities; as required by the accident analysis for existing facilities (discretionary). Address fire barriers, fire dampers arrangement.	The ventilation system is not credited with preventing fire propagation. All NWCF ventilation systems are designed to operate independently. Therefore, a fire in the calcine area could not propagate to the decontamination area through the ventilation system. Manually activated spray nozzles provide emergency cooling and fire protection at the exhaust plenums.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft)

Table 2. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Resistance to Internal Events – Natural Phenomena - Seismic			
Confinement ventilation systems should safely withstand earthquakes.	If the active CVS system is not credited in a seismic accident condition there is no need to evaluate that performance and/or design attribute for the confinement ventilation system (discretionary). Also, any seismic impact on the confinement ventilation system performance will be based on the current functional requirement in the DSA. NOTE: Seismic requirements may apply to defense in-depth items indirectly for the protection of safety SSCs.	The NWCF DSA does not credit the ventilation system with operation during and after a DBE. The decontamination area ventilation system is not designed to the NWCF DBE.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) SDD-143, System Description Document for INTEC-659 Heating, Ventilation, and Air Conditioning, Rev. 0
Resistance to External Events – Natural Phenomena – Tornado/Wind			
Confinement ventilation system should safely withstand tornado depressurization.	If the active CVS system is not credited in a tornado condition there is no need to evaluate that performance and/or design attribute for the confinement ventilation system (discretionary). Also, any tornado impact on the confinement ventilation system performance will be abased on the current functional requirement in the DSA.	It is not credited in a tornado condition. DOE Standard DOE-STD-1020-2002 does not identify tornado criteria for the INL. The decontamination area ventilation system is not designed to a design basis tornado (DBT).	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) DOE-STD-1020-2002

Table 2. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Confinement ventilation system should withstand design wind effects on system performance.	If the active CVS system is not credited in a wind condition there is no need to evaluate that performance and/or design attribute for the confinement ventilation system (discretionary). Also, any wind impact on the confinement ventilation system performance will be abased on the current NPH analysis in the DSA.	The ventilation system is not credited in a wind condition.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft)
Other NP Events (e.g., flooding, precipitation)			
Confinement ventilation system should withstand other NPH events considered credible in the DSA where the confinement ventilation system is credited.	If the active CVS system is not credited for this event there is no need to evaluate that performance and/or design attribute for the confinement ventilation system (discretionary). Also, any impact on the confinement ventilation system performance will be based on the current NPH analysis in the DSA.	The ventilation system is not credited in any natural phenomena condition. However, the NWCF is protected from flooding by design. The 10,000-yr flood crest at the NWCF is estimated to be 4,912 ft above MSL. The NWCF abovegrade first level is 4,917 ft above MSL or about 5 ft above the estimated flood stage level. Subsurface hydraulic pressures will be insignificant, because neither the flooding time nor the water volume will be sufficient to saturate the soil to depths of 30 to 40 ft.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) Big Lost River Flood Report, Bureau of Land Management
Range Fires/Dust Storms			
Administrative controls should be established to protect confinement ventilation systems from barrier threatening events.	Ensure a properly thought out response to external threat is defined (e.g., pre-fire plan).	There are no TSR-level administrative controls that directly address protecting confinement barriers from range fires or dust storms. There are TSR-level administrative controls for establishing safety management programs for emergency preparedness and fire protection that include nuclear safety attributes of provision for controlling combustible material loading; ensuring that prefire strategies, plans, procedures and fire hazards analyses are performed; and for maintaining approved emergency response procedures.	TSR-103, Technical Safety Requirements New Waste Calcining Facility TSR-100, INEEL Standardized Technical Safety Requirements (TSR) Document

Table 2. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Testability			
Design supports the periodic inspection and testing of filters and housing. Tests and inspections are conducted periodically.	Ability to test for leakage per intent of N510.	The design of the facility ventilation systems includes ports for testing the integrity and installation of inlet HEPA filters to cells and HEPA filters in the exhaust plenums. The filters are tested at least annually.	MCP-2746, Purchasing, Maintaining, and Using HEPA Filters TPR-5054, HEPA Filter In-Place Testing TPR-7153, NWCF HEPA Filter In-Place (Aerosol) Testing
Instrumentation required to support system operability is calibrated.	Credited instrumentation should have specified calibration/surveillance requirements. Non-safety instrumentation should be calibrated as necessary to support system functionality.	The DSA for the NWCF does not credit ventilation system instrumentation in any accident scenario. Ventilation system instrument calibration is performed in accordance with MCP-1155, INTEC/TAN/PBF Calibration Program.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft) MCP-1155, INTEC/TAN/PBF Calibration Program (Supplement to MCP-6303)
Integrated system performance testing is specified and performed.	Required responses assumed in the accident analysis must be periodically confirmed, including any time constraints.	Preoperational tests for the ventilation systems are specified in procedure TPR-7122. Periodic testing of blowers is also specified in procedures. The accident analysis in the DSA does not identify required responses for the ventilation system.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev .4 (draft) TPR-7122, Decon Area HVAC Startup and Shutdown TPR-7125 NWCF HVAC Normal Operations

Table 2. (continued)

Evaluation Criteria	Criteria Explanation	Comparison to Criteria	Reference
Maintenance			
Filter service life program should be established.	Filter life (shelf life, service life, total life) expectancy should be determined. Consider filter environment, maximum delta-P, radiological loading, age, and potential chemical exposure.	Instructions for replacing, operating, and in-place (aerosol testing) NWCF Filter components are specified in procedure. Filters are replaced if inplace testing indicates filter damage or leakage.	TPR-7146, Replace Off-Gas Filter Components TPR-5054, HEPA Filter In-Place Testing TPR-7153, NWCF HEPA Filter In-Place (Aerosol) Testing
Single Failure			
Failure of one component (equipment or control) shall not affect continuous operation.	Criteria does not apply to safety-significant systems.	Not applicable.	Not applicable
Automatic backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	Criteria does not apply to safety-significant systems.	Not applicable.	Not applicable
Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	None.	Power to the Distributed Control System that monitors and controls the ventilation system is backed by an SUPS. The SUPS can provide backup power for at least 20 minutes from storage batteries, and can be powered or recharged from the standby generator. The ventilation system is connected to the INTEC standby diesel generator system. The system is programmed to determine the number of generators that start during a commercial power outage and the associated loads. There is an INTEC-wide computerized hierarchy of loads that will then be added and removed, as necessary, from the standby diesel generators. The NWCF standby power is provided when the second diesel generator starts.	SAR-103, INTEC SAR-103 New Waste Calcining Facility, Rev. 3, Rev. 4 (draft)
Other Credited Functional Requirements			
Address any specific functional requirements for the confinement ventilation system (beyond the scope of those above) credited in the DSA.	None.	None.	Not applicable