DOE F 1325.8

United States Government

Department of Energy (DOE)

memorandum

Savannah River Operations Office (SR)

DATE: NOV 2 1 2007

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

SUBJECT: Request for Concurrence with Recommendation of the Defense Nuclear Facilities Safety Board (DNFSB) 2004-2 Final Report for the Savannah River Site (SRS) F & H Area Analytical Laboratory

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

In accordance with the DNFSB 2004-2 Implementation Plan (IP) Deliverable 8.6.5, please find attached to this memorandum the DNFSB 2004-2 Final Report for the SRS F & H Area Analytical Laboratory. After completing the evaluation, eight discretionary gaps were identified. None of the gaps were driven by consequences to the public which were shown to be well below the DOE Evaluation Guidelines. SRS recommends that four of these gaps be closed to increase system reliability and operational benefits. The gaps recommended for closure could be closed at an estimated cost ranging between $3.73M to $7.46M. The gaps are:

- Pressure instrumentation is not available to monitor pressure differential between the building interior and outside environment
- Replace existing relay cabinet with a programmable logic controller (PLC) to increase system reliability
- Ventilation component controls do not fail safe, the controls are not SS and are not credited. Replacement of the existing relay cabinet with a PLC will close this gap
- Backup power cables between the lab and the diesel generator could be more robust

It is recommended that the four remaining gaps not be closed because their closure does not provide incremental benefit or significant risk reduction.

Facility modifications to close the recommended gaps will be included in the H-Area and Support Groups Infrastructure Plan and will be prioritized against other facility and site needs.

In accordance with IP deliverable 8.6.5, please provide Program Secretarial Officer concurrence with this recommendation within 90 days of receipt of this report.

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

Jeffrey M. Allison
Manager

TSD:MAS:dmy

OSQA-08-0013

Attachment:
2004-2 Final Report for F & H Area Analytical Laboratory

cc w/attachment:
Dr. Robert C. Nelson (EM-61), HQ
Percy Fountain (EM-3.2), HQ

NOV 2 1 2007

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

Facility: **F & H Area Analytical Laboratory.** WSRC Letter M&O-FHO-2007-00054, "772-F, F & H Area Laboratories, DNFSB 2004-2 Active Confinement Evaluation (Final Report)", dated 6/20/07

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 July 2006, Revision 1.

In accordance with the references above, the SRS Site Evaluation Team has reviewed and concurs with the submittal of the attached F & H Area Analytical Laboratory final report.

Site Evaluation Team (SET) Concurrence:

Signature on file
Mark A. Smith, DOE-SR, Site Lead for SET — 10/25/07 Date

Signature on file
Ken W. Stephens, WSRC Lead for SET — 10/25/07 Date

SRS Site Evaluation Team consists of the following personnel:

DOE Site Lead and SET Chairman (Mark A. Smith, OSQA/TSD)
DOE Alternate Site Lead & Safety Basis SME (Don J. Blake, AMWDP/WDED)
DOE Ventilation System and Natural Phenomena Hazards SME (Brent J. Gutierrez, AMWDP/WDED)
WSRC 2004-2 Site Lead Ken W. Stephens (TQS/Nuclear Safety, Transportation, and Engineering Standards Dept. Mgr.)
WSRC Alternate Site Lead & Safety Basis SME (Andrew M. Vincent, M&O Chief Engineer Dept.)
WSRC Ventilation System SME (Scott J. MacMurray, SRNL Facility Engineering)
WSMS Safety Basis SME (Jerry L. Hansen)
WSRC SET Assistant Project Manager (Barbara A. Pollard, Nuclear Safety Dept.)

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

JUN 2 0 2007

M&O-FHO-2007-00054
RSM Track # 10067

Carl A. Everatt, Director
Office of Safety and Quality Assurance
DOE, Savannah River Operations Office
P.O. Box A
Aiken, S.C. 29802

Dear Mr. Everatt:

**Subject: 772-F, F & H Area Laboratories,
DNFSB 2004-2 Active Confinement Evaluation (Final Report)**

This letter transmits the final report of DNFSB Recommendation 2004-2, Active Confinement Systems for the 772-F Facility located at the Savannah River Site (SRS) for Site Evaluation Team (SET) and Independent Review Panel (IRP) review and concurrence. The attached report has been generated in accordance with the guidance provided in "Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems." Revision 0, January 2006. The facility Evaluation Team (FET) has concurred with the information contained herein.

The 772-F building is a Hazard Category 2 nuclear facility. The active components of the confinement ventilation systems for 772-F are housed in 772-F and 772-4F, a neighboring building defined as a Radiological Facility. This report provides a discussion of the events within the 772-F facility that have the potential for a radiological release that were used as the foundation for Table 5.1, Ventilation System Performance Criteria reviews. Events which act only upon 772-4F were excluded from discussion due to the limited inventory which will normally be carried in the HEPA filters.

In accordance with the DOE 2004-2 Ventilation System Evaluation Guidance, SRS evaluated the confinement ventilation systems at 772-F and components housed in 772-4F using Safety Significant (SS) criteria for the events listed in Table 4.3 in order to develop DNFSB 2004-2 Ventilation Performance Criteria, Table 5.1. Using the SS criteria for evaluating Table 5.1, Performance Category 2 and 3 design load criteria were used to assess the facility for applicable NPH events. Eight gaps were identified between the SS criteria and the 772-F and 772-4F designs. All eight gaps were found to be discretionary in nature since none of the gaps involved a discrepancy between the Safety Basis requirements and the facility designs. In reviewing the discretionary gaps, a number of approaches were developed and evaluated for potential means of closure. None of the modifications/upgrades listed as gap closures were perceived as resulting in a discernable reduction in material release reducing the overall risk for any of the bounding accidents in the DSA. If some or all of the discretionary gaps are closed there is perceived benefit in increased system reliability. Increased system reliability by its nature translates into a discernable reduction in accident risk. The FET recommends the closure of four of the gaps should the DOE decide to fund efforts related to system enhancements for improving worker protection.

Facility Evaluation Team Concurrence:

Billy Hudson, DOE, Nuclear Materials Engineering Division — 6/20/07 Date

Timothy H. Gabriel, FHLAB 2004-2 Lead — 6/20/07 Date

Sincerely,

Michael L. Willis, F-Area Chief Engineer — 6/20/07

CC:

Mark A. Smith, 730-B
Donald J. Blake, 707-H
Brent J. Gutierrez, 707-H
Andrew M. Vincent, 703-H
J. Scott MacMurray, 773-43A
Robert R. Lowrie, CCC-3
Jerry L. Hansen, 707-F
Barbara A. Vereen, 730-4B
Edward J. Hallinan, 730-4B
Darlene G. Murdoch, 735-B
Keith W. Atkinson, 772-F
Roy R. Beck, 707-F
Michael W. Harmon, 707-F
Michael K. Patterson, 707-F
Jerome B. Roberts, 707-F
Ana M. Yaneza, 707-F
William Leschak, 704-66E
Baidya N. Roy, 992-3W

M&O-FHO-2007-00054
Revision 0

Savannah River Site
772-F, F & H Area Laboratories

DNFSB Recommendation 2004-2
Ventilation System Evaluation

Revision 0
JUNE 2007

SRS
savannah river site

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

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT NO. DE-AC09SR18500

Review and Approval

Facility Evaluation Team Concurrence:

Billy Hudson, DOE, Nuclear Materials Engineering Division — Date: 6/20/07

Timothy H. Gabriel, FHLAB 2004-2 Lead — Date: 6/20/07

Sincerely,

Michael L. Willis, F-Area Chief Engineer — Date: 6/20/07

TABLE OF CONTENTS

Page

Definitions 4
Acronyms 5
Executive Summary 6
1. Introduction 6
  1.1 772-F Ventilation Systems Overview 6
  1.2 772-F Ventilation Systems 7
  1.3 Major Modifications 11
2. Functional Classification Assessment 11
  2.1 Existing Classification 11
  2.2 Evaluation 11
  2.3 Summary 11
3. System Evaluation 12
  3.1 Identification of Gaps 12
  3.2 Gap Evaluations 13
  3.3 Modifications and Upgrades 14
4. Conclusion 16
References 17
Attachment 1 – 772-F and 772-4F Facilities General Arrangement 18
Attachment 2 – 2004-2 Table 4.3 for 772-F Ventilation Systems 20
Attachment 3 – 2004-2 Table 5.1, 772-F Ventilation System Performance Criteria 23
Attachment 4 – F & H Areas Laboratories Facility Evaluation Team 34

Definitions

Active Confinement Ventilation System	A ventilation system that uses mechanical means (e.g., blower) to circulate air within, and remove air from a building or building space through filtration. (DOE-HDBK-1169-2003, DOE Nuclear Air Cleaning Handbook)
Confinement	A building, building space, room, cell, glovebox, or other enclosed volume in which air supply and exhaust are controlled, and typically filtered. (DOE-HDBK-1169-2003, DOE Nuclear Air Cleaning Handbook)
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. (DOE-HDBK-1169-2003, DOE Nuclear Air Cleaning Handbook)
Hazard Category	Hazard Category is based on hazard effects of unmitigated release consequences to offsite, onsite and local workers. (DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports)
Performance Category	A classification based on a graded approach used to establish the NPH design and evaluation requirements for structures, systems and components. (DOE-STD-1021-93, Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems and Components)
Ventilation System	The ventilation system includes the structures, systems, and components required to supply air to, circulate air within, and remove air from a building/facility space by natural or mechanical means. (DOE-HDBK-1169-2003, DOE Nuclear Air Cleaning Handbook)

Acronyms

CA	Contamination Area
CAM	Continuous Air Monitor
CVS	Confinement Ventilation System
CW	Co-located Worker (100 meters)
DBA	Design Basis Accidents
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DSA	Documented Safety Analysis
EBE	Evaluation Basis Earthquake
EC	Evaluation Criteria
EG	Evaluation Guideline
FET	Facility Evaluation Team
HA	Hazard Analysis
HEPA	High Efficiency Particulate Air
MAR	Material at Risk
MCC	Motor Control Center
ME	Main Exhaust System
NPH	Natural Phenomena Hazard
OGE	Off Gas Exhaust System
PC	Performance Category
PGA	Peak Ground Acceleration
REM	Roentgen Equivalent Man
ROM	Rough Order of Magnitude
SAAM	Stack Air Activity Monitoring System
SC	Safety Class
SET	Site Evaluation Team
SFE	Service Floor Exhaust System
SRS	Savannah River Site
SS	Safety Significant
TPC	Total Project Cost
TSR	Technical Safety Requirements
WSRC	Washington Savannah River Company

Executive Summary

This confinement ventilation system evaluation is for the 772-F Analytical Laboratory Facilities 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 772-F facility was identified as a part of the SRS 2004-2 evaluation scope. This evaluation included the active ventilation systems in the 772-F Hazard Category 2 Nuclear Facility and the supporting systems in the adjacent 772-4F Radiological facility.

In reviewing the accidents in the DSA only one event scenario was found to fit the Table 4.3 criteria of the 2004-2 Active Confinement Ventilation Evaluation. This event scenario was a Detonation Event with an unmitigated consequence of 0.5 REM Offsite and 137 REM to the Co-Located Worker. These consequences were not found to challenge the 1 to 25 REM Offsite Evaluation Guideline (EG) for Safety Class criteria; however for the Co-Located worker, the unmitigated dose potential does exceed the threshold for Safety Significant limits. In response to the unmitigated 137 REM dose potential to the Co-Located worker, the SRS FHLAB FET and SRS SET requested concurrence from the DOE IRP that the 772-F Confinement Ventilation System be evaluated against the SS performance criteria outlined in Table 5.1. The IRP concurred with this position for evaluating 772-F CVS in a 5/10/07 D. Chung to J. Allison memorandum.

In accordance with the DOE 2004-2 evaluation guidance, SRS evaluated the 772-F active confinement ventilation systems using the SS criteria defined in Table 5.1. To assess functionality for applicable NPH events, PC-2 and PC-3 criteria were used. PC-3 criterion was only given consideration in the gap analysis as a reflection on the facilities construction/design in the field and the facility as described in the DSA. Eight Table 5.1 performance Gaps were identified between the SS criteria and the facility designs.

After the eight gaps were identified, an evaluation was performed on whether the closure of the gaps is mandatory or discretionary. The evaluation identified that there are no Gaps that require immediate attention based on review of the DSA events and 2004-2 EC Table 5.1 performance criteria. All eight gaps were found to be discretionary in nature since none of the gaps involved a discrepancy between the Safety Basis requirements and the facility designs. In reviewing the discretionary gaps, a number of approaches were developed and evaluated for potential means of closure. None of the modification/upgrades listed as gap closures were perceived as resulting in a discernable reduction in material release reducing the overall risk for any of the bounding accidents in the DSA. If some or all of the discretionary gaps are closed there is perceived benefit in increased system reliability. Increased system reliability by its nature translates into a discernable reduction in accident risk. The FET recommends the closure of Gaps 1,4,6, and 8 should the DOE decide to fund efforts related to system enhancements for improving worker protection.

1. Introduction

1.1 Systems Overview

The primary function of the building and associated system is to support the handling of nuclear materials and chemicals in limited bench-scale quantities for analysis. These operations are performed inside the gloveboxes, radiohoods, radiobenches and shielded cells (containment units) contained within the lab modules.

Building 772-F contains the following process systems and confinement systems used to accomplish the primary mission and functions:

- High-Activity Drain (HAD) and Low-Activity Drain (LAD) systems
- Off Gas Exhaust (OGE) system
- Building and process ventilation systems (Main Exhaust System)
- Containment units (includes: shielded cells, gloveboxes, radiohoods, and radiobenches)
- Building shell

1.2 *Ventilation Systems*

772-F Facility Description

772-F was designed in 1952 as a Class 1, blast-resistant structure that was built and placed into service in the mid-1950s. 772-F is a Hazard Category 2 facility. Building 772-F is a two-level structure with the lower level below grade. A majority of the early design information as well as most modification documentation is available for the building as well as laboratory modules and equipment.

Mission

The primary mission of the F/H Labs over the last 50+ years has been to support the chemical separations processing activities at Buildings 221-F and 221-H. Samples received from the canyons and other site areas are subjected to the required radiological and chemical quality control/analyses. Results from these analyses are used to effectively and safely operate the canyon facilities. The mission of the F/H Lab has changed very little over the last 40 years of operation. The projected future use of the facility is to continue its mission to support the separations processes and to provide support for the increasing waste management, waste characterization, waste stabilization, and environmental remediation activities at SRS. F/H Labs will also support the tank farm operations, reactor area programs, the Liquid Waste Disposition Unit, to a limited extent the Defense Waste Processing Facility, and site waste characterization efforts.

Function

The primary function of the building and associated systems is to support the handling of nuclear materials and chemicals in limited bench-scale quantities for analysis. These operations are performed inside the gloveboxes, radiohoods, radiobenches and shielded cells (containment units) contained within the lab modules.

Building 772-F contains the following process systems and confinement systems used to accomplish the primary mission and functions:

- High-Activity Drain (HAD) and Low-Activity Drain (LAD) systems
- Off Gas Exhaust (OGE) system
- Building and process ventilation systems (Main Exhaust System)
- Containment units (includes: shielded cells, gloveboxes, radiohoods, and radiobenches)
- Building shell

Sample Process/ HAD and LAD

Low radioactive activity, high radioactive activity and chemical solutions generated by sample analysis, safety shower testing, laboratory sinks, etc. are temporarily placed into below grade transfer tanks. The high-activity returns are transferred by pump to an LR-56S, a High Activity Effluent Transport Truck, via a loading station located exterior to the facility. The LR-56S will transport HAD effluent to 221-H Canyon for processing. The low activity returns are transferred to the Effluent Treatment Project (ETP) for processing and disposal.

Off Gas Exhaust (OGE)

The function of the Off Gas Exhaust (OGE) system is to exhaust and filter air from the Gloveboxes. Air from within the laboratory area is drawn through the glovebox containment enclosure and filtered to minimize the potential for release during normal operation and low energy accident conditions. The HEPA filters installed at the inlet and outlet of each glovebox are non-leak testable type filters. In addition, the air from the glovebox is exhausted into the main header which directs the air flow to the central OGE filtration in Shielded Area B (SAB). The 3 central OGE HEPA filter housings in Shielded Area B (SAB) each consists of two in-place testable HEPA filters in series. After the air is filtered in SAB, the air passes through the OGE fans (3) in the fan room and then into the Main Exhaust System concrete trench before entering the ductwork to 772-4F where it passes through another two stages of HEPA filtration.

772-F has 47 gloveboxes that are ventilated by the 772-F OGE System.

Gloveboxes handle samples that are equal to or greater than Hazard Category 3 Threshold Quantities.

The glovebox shell, window, gloves, and inlet/exhaust filters of the glovebox serve as the Safety Significant (SS), passive confinement boundary.

The OGE system is not a Safety Class SSC and is not required to achieve safe shutdown or to mitigate the consequences of an abnormal condition. Because the OGE system is a passive Safety Significant confinement system, abnormal conditions, such as failure of the exhaust fans and loss of normal and standby electrical power, pose negligible hazard to the facility workers. In addition to the OGE system being a passive SS system, abnormal operations would have negligible impact to onsite personnel outside the facility or on environmental safety relative to the release of radioactive materials and hazardous chemicals.

Should a loss of normal power occur, two of the three OGE fans are supported by Standby Electric power. The two OGE fans supported by Standby Electrical power will continue to maintain negative pressure boundary, however no 772-F Glovebox work is permitted in this configuration in accordance with operating procedures and the Radiological Protection Program.

Main Exhaust (ME)

The function of the main exhaust system is to exhaust all building areas to the outside environment while minimizing the potential of radioactive releases and subsequent onsite and offsite exposure during normal operation and abnormal conditions. The main exhaust system filters air from all radiological areas, radiohoods and radiobenches, gloveboxes, waste handling systems, and the retrospective air sampling and stack monitoring systems.

The main exhaust system has additional contributory streams and several auxiliary exhaust systems within 772-F. The main exhaust system draws room exhaust air from the 772-F fan room, transfer tank cells, shielded cells and the shielded areas as well as conditioned air supplied to the facility. Auxiliary exhaust systems that tie into the main exhaust system are the High and Low Level Drain exhaust systems, the air monitoring system and the OGE system.

The Main Exhaust flow path primarily consists of air that is exhausted through radiohoods, radiobenches, and exhaust intakes in the laboratory modules. The flow path then goes into ductwork leading the flow path down to the service floor level of the building. On the service floor level the ductwork follows separate pathways to the HEPA filters in South side of the service floor and in Shielded Areas A and C. The air then flows into a larger rectangular duct section where it then flows into the main exhaust concrete plenum that runs north to south along the center of the building. This plenum connects to an east and west plenum that is connected to the new concrete vault located south of the sample tunnel by the old stack. A stainless steel duct connects the concrete vault with the main exhaust system of building 772-4F.

Work in radiobenches and radiohoods include analyses of samples that are below Hazard Category 3 Threshold quantities.

Should a loss of normal power occur, the following fans are supported by Standby Electric power and will continue to operate serving their General Service functions:

- All three Air Monitoring fans (One fan operating, two fans in standby).
- Both Low Activity Drain Exhaust fans(One fan operating, one fan in standby)
- Both High Activity Drain Exhaust fans (One fan operating, one fan in standby)
- Two OGE fans (Two fans operating)

The following sections of the main exhaust system are part of the credited passive confinement system: ductwork from the shielded cells, including the shielded cells, to the HEPA filters in shielded area A for the shielded cells (3 filters), the concrete plenum from the old fan room, including the concrete vault, the stainless steel duct from the vault to 772-4F HEPA filter housings and HEPA filters.

Structural

The ventilation tunnel and stainless steel duct between buildings 772-F and 772-4F are qualified for a 0.20g Peak Ground Acceleration (PGA) Evaluation Basis Earthquake (EBE). These structures and components were qualified for a 0.20g PGA EBE.

772-4F Facility Description

The Airborne Radiation Removal Facility (Building 772-4F) was a major addition to the main exhaust system of 772-F that was designed and constructed in the early 1990's. The building has been evaluated as Radiological Facility. The main exhaust from 772-F enters 772-4F through a stainless steel duct. In 772-4F, there are 10 , 5x3, HEPA housings with two In-Place Testable stages of HEPA filters (300 HEPA Filters, total), that make up the filtration system and four main exhaust fans that provide the main exhaust for 772-F. The main exhaust system discharges to a 190 foot stack outside of 772-4F.

The service floor in 772-F exhausts through a fan and a single stage HEPA filtration system in 772-4F that also discharges to the 772-4F stack.

Should a loss of normal power occur, two of the four Main Exhaust fans are supported by Standby Electrical power. Loss of normal power will activate the Process Upset Alarm and Relay (General Service) which will display on the 772-4F Alarm Panel in the Control Room. When the Process Upset alarm occurs, the following conditions will exist:

- Two of the ME fans will stop running leaving one of the ME fans on Standby Power running at a preset , minimum flow rate and another fan on Standby Power in Standby mode.
- The Service Floor exhaust fan will stop running.
- All Six 772-F Air Handling Units (AHU's) supplying conditioned air to 772-F, will stop running.
- The Control Room will receive the Process Upset alarm.

The Process Upset Alarm configuration can also initiated by

- Flow in the concrete trench drops below a set minimum flow rate
- A high vacuum is measured on the Service Floor level of Building 772-F
- Smoke is detected in one of the Air Handling Units (AHU)

The alarms, controls, and configurations associated with the Process Upset mode are not credited for safe shut down or operation of the 772-F and/or 772-4F ventilation systems and are considered General Service Functions.

Structural

Building 772-4F was found to satisfy the low-hazard code requirements (equivalent to PC-2 loads). Building 772-4F is structurally adequate to remain standing after a 0.20g PGA EBE.

The 772-4F stack was found to be adequate for high-hazard loads, including a 0.20g PGA design basis earthquake. In addition, the stack was evaluated and found to be adequate for loads induced by a 0.20g PGA EBE on the HVAC duct attached to the stack.

The Building 772-4F air filtration system has a seismic capacity greater than or equal to a 0.20g PGA EBE and will maintain the confinement of the exhaust path

1.3 Major Modifications

There are no Major Modifications currently underway or planned for any of the 772-F confinement ventilation systems.

2. Functional Classification Assessment

2.1 Existing Classification

The main exhaust system is part of the credited passive confinement system for its SS function: ductwork from the shielded cells, including the shielded cells, to the HEPA filters in shielded area A for the shielded cells (3 filters), the concrete plenum from the old fan room, including the concrete vault, the stainless steel duct from the vault to 772-4F HEPA filter housings and HEPA filters.

2.2 Evaluation

The Consolidated Hazard Analysis (CHA) did not identify any design basis accidents to be included in the DSA that challenge the public Evaluation Guideline from DOE-STD-3009-94 (i.e., in the range of 1-25 REM). One accident in the DSA does exceed the 100 REM Co-Located Worker Criteria in SRS procedure E7 2.25, Functional Classification and DOE Ventilation System Evaluation Guidance document. The Detonation Event in the DSA, yields unmitigated offsite dose consequences of approximately 0.5 REM and 137 REM for co-located workers (Leak Path Factor 1.0 was used).

There are no active SS or SC functions for the existing active confinement ventilation systems associated with the 772-F Confinement boundary. The 772-F and 772-4F active confinement ventilation systems are not credited by the FHLAB DSA to operate during or following any DBA or NPH events.

2.3 Summary

The SS functional classification of the existing 772-F Building passive confinement ventilation system and GS functional classification of the 772-F Main Exhaust active confinement ventilation System components is appropriate.

3. System Evaluation

SRS evaluated the active confinement ventilation systems at the 772-F and 772-4F Analytical Facilities in accordance with Reference 6. Table 4.3 (Attachment 2) was developed from the Central Laboratory Facilities DSA events. Systems were evaluated and documentation was reviewed to confirm system configuration by the associated System Cognizant Engineers for the F&H Laboratories. System configurations were evaluated against the criteria in Table 5.1 and gaps were identified and documented in Attachment 3.

3.1 Identification of Gaps

The 772-F confinement ventilation systems, structures, and components were evaluated against SS, PC-2 & PC-3 criteria found in Table 5.1, Ventilation System Performance Criteria of Reference 6. The events and methodology used for this evaluation were documented in Table 4.3 (Reference 7) and submitted to DOE.

In evaluating the 772-F active confinement ventilation systems against the SS Table 5.1 Evaluation Criteria (EC), the events from Table 4.3 and system classification boundaries for each confinement ventilation system played an important role in determining whether any of the identified gaps and related closure recommendations would be considered discretionary in nature.

While the unmitigated consequences for the detonation event was the only accident that drove the 772-F evaluation to SS criteria, a few other credible events for the DSA were considered in the development of Table 5.1: Sample Spill, 772-F Facility Fire, Deflagration, and 772-4F Facility Fire.

The following is a summary of the 772-F, discretionary gaps with Table 5.1 EC:

Gap number 1: Table 5.1 EC - Pressure differential should be maintained between zones and atmosphere.

> Discretionary Gap. The building layout does not provide confinement zone separation. Pressure instrumentation to monitor pressure differential between building interior and outside environment is not available. The 772-F CVS is designed to maintain the required pressure differential during normal operations. It is not credited in the DSA to operate during or following any DBA event, including NPH events.

Gap number 2: Table 5.1 EC - Confinement ventilation systems shall have appropriate filtration to minimize release.

> Discretionary Gap. The majority of the Main Exhaust filter housings in the 772-F are 1950's vintage and are constructed with a tape-in-place seal at the inlet and discharge of the HEPA filter frame. These filters do not have a positive seating mechanism that provides a robust seal that is independent of human performance during filter installation.

Gap number 3: Table 5.1 EC - Provide system status instrumentation and/or alarms.

> Discretionary Gap. Relay cabinet, CRP-1, located in 772-4F is sensitive to vibration, radiofrequency interference, and/or pressure pulses and is not Safety Significant (SS) or credited as functioning in the DSA. The result of a CRP-1 failure would range from the ventilation system going into a process upset condition (safe mode failure) to a complete shutdown of the ventilation system resulting from the loss of system controls.

Gap number 4: Table 5.1 EC - Interlock supply and exhaust fans to prevent positive pressure differential.

> Discretionary Gap: The interlocks are not SS and are not credited as functioning during or after DBA events. See also Discretionary gap in "Provide system status instrumentation and/or alarms" section.

Gap number 5: Table 5.1 EC - Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.

Discretionary Gap: The interlocks are not SS and are not required or credited to function during or after DBA events.

Gap number 6: Table 5.1 EC - Control components should fail safe.

Discretionary Gap: The controls are not SS and are not required or credited to function during or after DBA events

Gap number 7: Table 5.1 EC - Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.

Discretionary Gap, The installed design for most of the Inlet and discharge HEPA filters of the gloveboxes in 772-F does not permit In-Place Leak Testing.

Gap number 8: Table 5.1 EC - Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.

Discretionary Gap – Electrical cables are run in open cable trays from 772-4F over the middle of the 772-F roof to the 254-9F diesel generator located on the west side of 772-F. A detonation event could potentially damage these cables and standby power capability (GS) to the 772-4F ventilation system could be lost.

3.2 Gap Evaluations

The 772-F and 772-4F active confinement ventilation systems were compared with SS system performance criteria in Table 5.1 of Reference 6. In order to perform this evaluation, ventilation and support systems documentation were reviewed to confirm system configuration. Systems were then evaluated against the criteria in Table 5.1; eight gaps that are discretionary in nature were identified and documented in Attachment 3.

3.3 *Modifications and Upgrades*

The discretionary gaps identified in Attachments 3, were reviewed by the Design Authority Engineer and other F&H Laboratory personnel and recommendations for closure of the gaps were developed. The recommendations for closure are summarized below.

Gap number 1

Proposed closure for Gap: Enclose laboratory corridors with doors, install a secondary set of doors at exterior exit on west side of 772-F main floor, and provide zone differential monitoring capabilities. This effort would consist of installing seven corridor doorways at the CA boundaries of the central laboratory spaces, installation of a set of doors to perform an airlock function on main floor west side exit door, installation of magnehelic gauges around Laboratory CA boundary, some minor electrical power runs to magnehelic gauges and doors, and the installation of a pressure gauge and transmitter for monitoring the pressure differential between atmosphere and building interior spaces. Implementation of these proposed modifications will also include training, roundsheet revisions, and revision/generation of procedures. The total ROM cost estimated for this gap closure is $832,000 to $1,664,000.

Recommendation: The modification associated with the closure of this gap moves the facility closer to meeting current code and standard definition of Zone boundaries and aids in adding a minor ability to minimize the spread of contamination between internal zones but does not mitigate the consequences of the Detonation event. There is no discernible benefit or significant risk reduction associated with this gap resolution for any of the bounding accidents in the DSA. The FET does not recommend implementing this gap closure for the mitigation of an event but does recommend implementation of this gap closure for the perceived benefit in increased system reliability.

Gap number 2

Proposed closure for Gap: The closure of this gap would require the replacement of the existing ductwork, clean and dirty plenums, and 26 filter housings (Related to Radiological Laboratory Modules) with a more current design that contains an engineered installation aid, boundary around filter shell, and In-Place Leak Testing of filters. Though the new hardware cost are estimated high, the D&R work associated the the existing ductwork, plenums, and filter housing is expected to be the biggest expense associated with this modification. The total ROM cost estimated for this gap closure is $6.2 to $12.4 Million.

Recommendation: This ventilation upgrade primarily brings the immediate laboratory module filtration units up to more current codes and standards but does not improve facility worker protection. The existing location of these filter units is in a remote location that has historically required Radiological Control Operations monitoring and PPE for access. Should a filter installation leak the consequences to the facility worker are low and would have little effect on the environment in which they are located. There is no discernible benefit or significant risk reduction associated with this gap resolution for any of the bounding accidents in the DSA. The FET does not recommend implementation of this modification for the mitigation of the Detonation event consequences.

Gap number 3,4,5, & 6

Proposed closure for Gap: Replace existing CRP-1 Relay Cabinet with a PLC bus system as well as perform upgrade of existing system controls. The replacement of the relay cabinet can be accomplished by relocating an existing PLC with existing tie-ins from air compressors to 772-4F where the CRP cabinet is currently located. The relocation of this PLC bus will utilize a number of existing instrument line trays but will require replacement of existing/installation new cable and conduit runs. The total ROM cost estimated for this gap closure is $2.5 to $5 Million.

Recommendation: While the implementation of this gap closure, with respect to Gaps 4 and 6, does ensure more rigor is put into maintaining the reliability of the Interlocks between the Supply and Exhaust, it does not provide a means of mitigation for the consequences of the Detonation event. There is no discernible benefit or significant risk reduction associated with this gap resolution for any of the bounding accidents in the DSA. The FET does not recommend implementing this gap closure for the mitigation of an event but does recommend implementation of this gap closure for the perceived benefit in increased system reliability.

Gap number 7

Proposed closure for Gap: Due to the small diameter welded pipe duct design and limited space available with the existing glovebox installations (except Lab 175) in 772-F Laboratory modules, it is not possible to modify the existing gloveboxes to permit an aerosol leak test for both the Inlet and discharge HEPA filtration. Therefore in order to close this gap, all glovebox units that are needed for active Analytical Sample analysis will need to be replaced with new glovebox containment units along with lab utilities renovation work as well. The ROM cost estimated for this gap closure is $200,000 to $1 Million per glovebox. The total modification ROM ($9 to $45 Million) for this gap closure is dependent on the number of gloveboxes needed to support the mission of the lab, the lab currently has and maintains 47 gloveboxes.

Recommendation: This ventilation upgrade primarily brings the gloveboxes and associated filtration units up to more current codes and standards but does not provide an improved means of facility worker protection or any perceived mitigation of the consequences associated with the Detonation event. Should a glovebox filter installation leak, the occurrence does not result in a significant release in inventory. Based on current missions and administrative limits imposed on Lab Module work, credited programs such as Radiological Protection Program and Lab Module Checkout (which includes OGE operability checks and radiological surveys) are sufficient to detect any leakage before it has a significant impact to the FW. These credited programs ensure that routine evaluations are performed on the glovebox (including contamination, conditions, and delta P) to ensure the worker protection design feature. Also an abnormal event would drive the lab workers to evacuate the lab modules. There is no discernible benefit or significant risk reduction associated with this gap resolution for any of the bounding accidents in the DSA. The FET does not recommend implementation of this modification for the mitigation of the Detonation event consequences.

Gap number 8

Proposed closure for Gap: Replace and relocate cables and cable trays for both Normal Electrical Power and Standby Electrical Power with new cables in environmentally shielded, seismically qualified cable trays. The new proposed route is still across the roof of 772-F but is roughly 45 feet south of the existing cable route and lies above the change rooms instead of the lab modules where the postulated events could occur. After the cables leave the roof top of 772-F and are routed to 772-4F, a new route/support structure must be designed and installed. The total ROM cost estimated for this gap closure is $400,000 to $800,000.

Recommendation: Based on review of the bounding accidents in the DSA, there is not a discernible benefit or significant risk reduction associated with the gap resolution. While this gap closure modification will provide a more robust protected Power Cable Run the likelihood that a Detonation event would breach the roof and at the specific location that the current cable run exists, is low. There is no discernible benefit or significant risk reduction associated with this gap resolution for any of the bounding accidents in the DSA. The FET does not recommend implementing this gap closure for the mitigation of an event but does recommend implementation of this gap closure for the perceived benefit in increased system reliability.

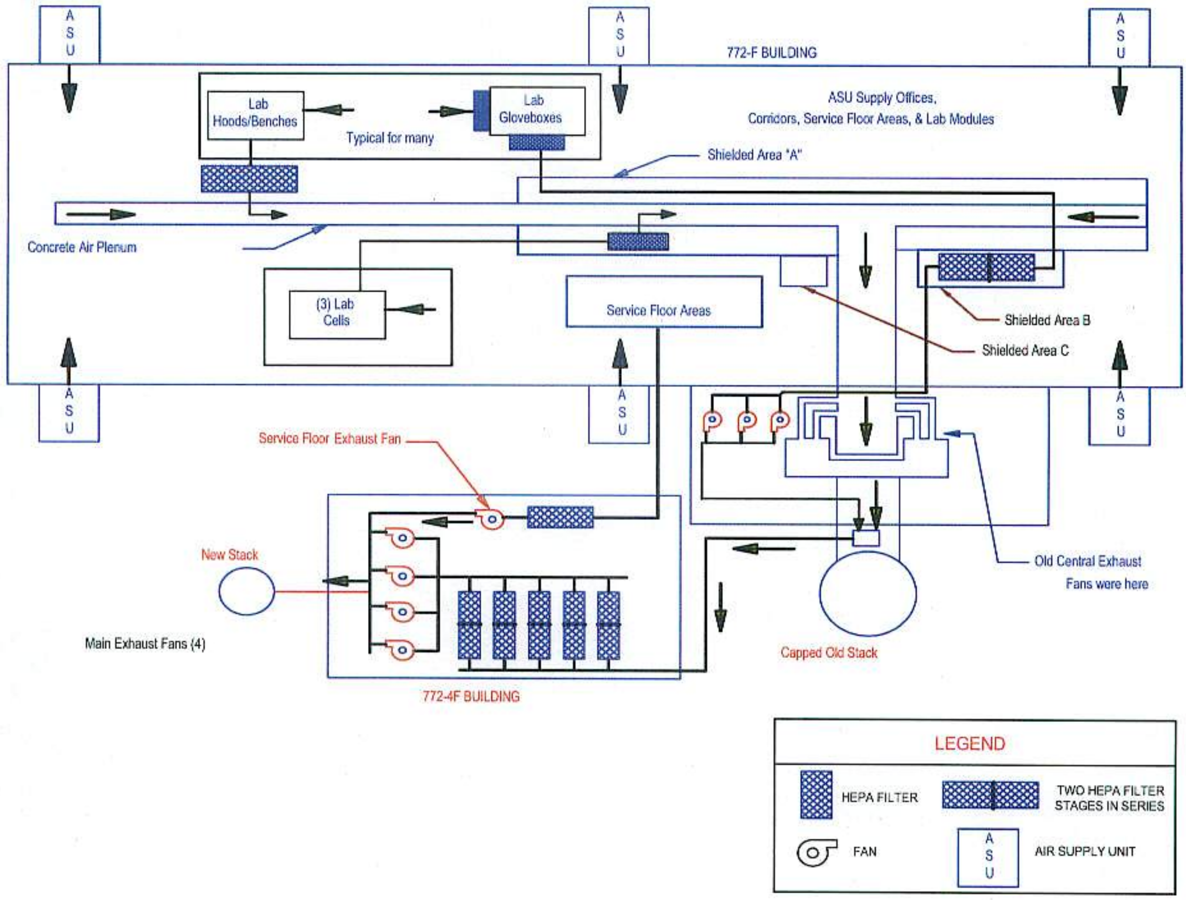
4. Conclusion

The evaluation identified that there are no Gaps that require immediate attention based on review of the DSA events and 2004-2 EC Table 5.1 performance criteria. All eight gaps were found to be discretionary in nature, since none of the gaps involved a discrepancy between the Safety Basis requirements and the facility designs. In reviewing the discretionary gaps, a number of approaches were developed and evaluated for potential means of closure. None of the modification/upgrades listed as gap closures were perceived as resulting in a discernable reduction in material release reducing the overall risk for any of the bounding accidents in the DSA. If some or all of the discretionary gaps are closed, there is perceived benefit in increased system reliability. Increased system reliability, by its nature, translates in to a more effective worker protection program. The FET recommends the closure of Gaps 1, 4, 6, and 8 should the DOE decide to provide funding for efforts related to system enhancements for improving worker protection.

References

1. WSRC-SA-96-26, CENTRAL LABORATORY FACILITY – BUILDINGS 772-F, 772-1F, AND 772-4F SAFETY ANALYSIS REPORT, Rev. 4, Washington Savannah River Company, Aiken, SC, November 2006.
2. WSRC-TR-2006-00099, Consolidated Hazards Analysis for Operations in Building 772-F, 772-1F, 772-4F, and B-25, Rev. 1, Washington Savannah River Company, Aiken, SC, July 2006.
3. S-CLC-F-00595, GLOVEBOX EXPLOSION CONSEQUENCE ANALYSIS FOR THE F/H LABS, Rev. 0, Washington Savannah River Company, Aiken, SC, August 2006
4. Savannah River Laboratory Memorandum DPST-79-359, from M. W. Lee & D. H. Stoddard to J. T. Buckner, STATISTICAL ANALYSIS OF HEPA FILTRATION SYSTEMS, May 1, 1979
5. Conduct of Engineering and Technical Support, WSRC Procedure Manual E7, Procedure 2.25, Functional Classification, Rev. 14, Westinghouse Savannah River Company, Aiken, SC, November 2004.
6. Deliverables 8.5.4 and 8.7 of Implementation Plan for DNFSB Recommendation 2004-2, Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems, U.S. Department of Energy, Washington, DC, January 2006
7. WSRC Memorandum M&O-FHO-2007-00011, from R. W. Cansler to C. A. Everatt, 772-F, DNFSB 2004-2 Active Confinement Evaluation (Table 4.3), March 8, 2007.
8. WSRC Memorandum M&O-FHO-2007-00039, from M. L. Willis to K. W. Stephens, 772-F, DNFSB 2004-2 Active Confinement Evaluation (Table 5.1), May 22, 2007.
9. WSRC-TS-95-18, F-AREA CENTRAL LABORATORY FACILITY, BUILDINGS 772-F,772-1F,772-4F TECHNICAL SAFETY REQUIREMENTS, Rev. 5, Washington Savannah River Company, Aiken, SC, November 2006.

Attachment 1 – 772-F and 772-4F General Arrangement


ASU
772-F BUILDING
Lab Hoods/Benches
Typical for many
Lab Gloveboxes
ASU Supply Offices, Corridors, Service Floor Areas, & Lab Modules
Shielded Area "A"
Concrete Air Plenum
(3) Lab Cells
Service Floor Areas
Shielded Area B
Shielded Area C
Service Floor Exhaust Fan
New Stack
Main Exhaust Fans (4)
772-4F BUILDING
Capped Old Stack
Old Central Exhaust Fans were here
LEGEND
HEPA FILTER
TWO HEPA FILTER STAGES IN SERIES
FAN
AIR SUPPLY UNIT

Attachment 2 - 2004-2 Table 4.3, 772-F Ventilation Systems

Confinement Documented Safety Analysis Information										
Facility 772-F			Hazard Category 2							Performance Expectations
Bounding Accidents	Type Confinement		Doses (rem) Bounding unmitigated/mitigated	Confinement Classification			Function	Functional Requirements	Performance Criteria	Compensatory Measures
	Active	Passive		SC	SS	DID				
Detonation		X(a)	Unmitigated 0.5 for offsite 137 for onsite Mitigated 7.7 E-3 for offsite 0.16 for onsite		X		Confinement for collocated worker	Explosion	Maintain Passive Confinement Boundary (b)	None

Notes

(a) 4.9 E-3 one stage of HEPA filters per Ref. 4 is used as a LPF in DSA (Ref. 1).
(b) This function was evaluated in Ref. 3. Ref. 3 is a qualitative evaluation that was based on the design of the facility and location of the credited components. The evaluation found that the filters and ductwork in 772-F may not survive a detonation but the majority of the 772-F confinement boundary shell, concrete trench, ductwork from the trench to 772-4F, as well as the credited components in 772-4F were found to survive the accident scenario. The facilities ability to perform this function is verified by the inspection and testing conducted for normal operation.

Credible events from the CHA are listed in the Events Table. Events determined to be excluded from consideration and the basis for this decision is also delineated below.

Definitions
CW Co-located Worker (Receptor Consequences were determined using 50% Meteorology)
NC Not Calculated

Table 1
Events

Event Category	Facility Applicability	Unmitigated Consequences
Spill	772-F	CW 1.0E+01 REM Public 1.9E-02 REM
Earthquake/Fire	772-F	CW 1.9E+01 REM Public 2.4E-01 REM
Deflagration	772-F	CW 2.1E+00 REM Public 7.7E-3 REM
Fire	772-4F	CW NC Public 3.58E-06 REM

Events to be excluded

1) Flooding and precipitation events
Based on the SAR section 1.5.1 and 3.3.2.3, flooding is not considered a credible initiator due to the topography of SRS and surrounding area, therefore eliminating the requirement for any further analysis.

2) Extreme temperature and lightning events
Based on the SAR section 3.3.2.3, these events may adversely affect operations but do not result in accident sequences that lead to direct releases of radioactive materials, therefore eliminating the requirement for any further analysis.

3) Adjacent events
Based on the SAR section 3.3.2.3, adjacent fires and explosions are not considered credible accident initiators for the release of radioactive material and are not analyzed further.

4) Aircraft and vehicle impact events
Based on the SAR section 3.3.2.3, these events are bounded by the full facility fire event.

5) Earthquake event
Based on the SAR section 3.4.2.6, the consequences for Building 772-F during a DBE are negligible when compared to the consequences of a full facility fire in Building 772-F. Therefore, only the consequences of a facility fire in Building 772-F have been calculated based on the radiological inventory.

Attachment 3 - 2004-2 Table 5.1, 772-F Ventilation Systems Performance Criteria

Evaluation Criteria	Discussion	Reference
	1 - Ventilation System – General Criteria	
Pressure differential should be maintained between zones and atmosphere.	The 772-F confinement ventilation system (CVS) is designed to maintain the building at a lower pressure relative to the environment for normal operating conditions. Annual flow testing is performed to verify and validate system performance in conjunction with the periodic full facility air balance. Interlocks exist for the supply and exhaust fans to ensure the supply air cannot overcome the exhaust. The building provides a passive confinement barrier. References J-J4-F-2987 Rev. 1, SE5-2-2003023 Rev. 3, SE5-2-2003243 Rev. 9, W845778 Rev. 3, P-PE-F-2634 Rev. 0, W845695 Rev. 3, W845696 Rev. 3, M-M6-F-3010 Rev. 5, M-M6-F-3013 Rev. 4, W2017720 Rev. 4, TP-03-772F-MEXH-01 Gap Analysis Discretionary Gap. The building layout does not provide confinement zone separation. Pressure instrumentation to monitor pressure differential between building interior and outside environment is not available. The 772-F CVS is designed to maintain the required pressure differential during normal operations. It is not credited in the DSA to operate during or following any DBA event, including NPH events.	**DOE-HNBK-1169 (2.2.9) ASHRAE Design Guide, Section 2**
Materials of construction should be appropriate for normal, abnormal and accident conditions.	Materials of construction for the ventilation duct are stainless steel and concrete. The HEPA filter housings are stainless steel. Old HEPA filter housing are constructed per SRS drawings, new HEPA filter housings are constructed by Flanders/CSC. Gasket material is neoprene. Exhaust fans are constructed of galvanized/carbon steel. The portion of ventilation duct that runs under ground is constructed from concrete. The materials of construction were selected to resist chemical attack, steel and concrete were coated to provide additional protection. **Most 772-F containment units (Radiobenches, Radiohoods, and Gloveboxes) are constructed of Stainless Steal shells, glass viewing windows, and neoprene gaskets but some wooden shelled Fume hoods are still in existence in the facility. The few remaining wooden Fumehoods are either out of service or not in a lab module and the introduction of flammables is prohibited, and/or Analytical work is not permitted.** References W813522, W813293, W833519, W2017704, W2017695 W749265, Gap Analysis No Gap. The ventilation system is designed for laboratory process operations. The design and materials of construction will maintain structural integrity to provide passive confinement/containment.	**DOE Nuclear Air Cleaning Handbook 1169 Section 2.2.5 – Corrosion ASME AG-1**

Evaluation Criteria	Discussion	Reference
	1 - Ventilation System – General Criteria	
Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity.	The active CVS was designed for normal operating conditions. However, the Main Exhaust system is not challenged by localized low energy events (drops, spills, and over-pressurization of containers) and is expected to perform under these accident conditions. The Main Exhaust is not credited in the DSA to operate during or following any DBA event, including NPH events. However, the Main Exhaust system inclusive of 772-4F ducts and filter housings has been evaluated to withstand an earthquake and was qualitatively evaluated for an explosion. In both events, earthquake and explosion, the Main Exhaust components which are exterior to 772-F maintain structural integrity to provide for the passive confinement function of contamination control. Also, the buildings 772-F and 772-4F housing the exhaust system components are designed as SS for earthquake. Additionally, building 772-F was evaluated and found to be adequate for PC-3 wind loads (i.e., 137-mph fastest-mile wind speed tornado) and thus would protect the building radiological inventory from the effects of a tornado or high winds. __Reference__ WSRC-SA-96-26, Rev. 4, Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Safety Analysis Report WSRC-TR-2006-00099, Rev. 1, CHA for Operations in Building 772-F, 772-1F, 772-4F, and B-25 __Gap Analysis__ No Gap. The ventilation system is not credited in the DSA to operate during or following any DBA event, including NPH events.	**DOE-HNBK-1169 (2.4) ASHRAE Design Guide**

Evaluation Criteria	Discussion	Reference
Confinement ventilation systems shall have appropriate filtration to minimize release.	All credited exhaust filters in Building 772-4F are contained in filter housings. These housings hold a pre-filter and two stages of HEPA filters. Housing is total welded construction (Code Welding). Housing conforms to leak tightness per criteria of DOE Nuclear Air Cleaning Handbook. The HEPA filter housing is designed and manufactured to meet ASME N509. HEPA filter housing specification consists of 11 and 14 gauge 304 stainless steel. Each 772-4F filter housing has a common differential pressure gauge across each stage of filtration. This differential pressure gauge is used to determine the dust loading of the filters. All credited Main Exhaust filters in Building 772-F are credited for facility worker protection. These filters are contained within tape in place filter housings per 1954 SRS drawings. These housings hold a pre-filter and single stage of HEPA filters. HEPA filter housing specification consists of 16 gauge stainless steel ducting with angle framing. Each 772-F filter bank has a common differential pressure gauge across each stage of filtration. This differential pressure gauge is available to determine the dust loading of the filters. The filter testing program periodically tests HEPA filters in accordance with national standards (American Society of Mechanical Engineers N510, "Testing of Nuclear Air Cleaning Systems") to ensure the required particle-removal efficiency of the filters. The operability of the above exhaust systems is demonstrated by any one HEPA filter stage between the source of the airborne material and the release point to the atmosphere. The HEPA filter testing program ensures the 772-F ME System HEPA filters in Building 772-4F, and the 772-F Shielded Cells HEPA filters perform the required filtration function. Each set of credited HEPA filters in the Main Exhaust is leak-tested annually to verify the filter installation leakage rate. The HEPA filter systems meet the filtration requirements for normal operation. The ventilation systems are not credited in the DSA to operate during or following any DBA event, including NPH events. A review of the systems airflow readings has been performed and no filters were identified as being installed at a location with a flow rate exceeding the manufacturers rated air flow for that filter. **<u>Exhaust HEPA Housing and Filter</u>** <u>772-F</u> Most of the housings were fabricated per SRS drawings with original construction of building 772-F in 1954. Flanders Filter Model Z95296 (24" x 30" x 11-1/2") (HEPA Filter) 99.97% efficient, Fire Retardant Plywood frame, separator less, Neoprene gaskets, SST faceguards both sides. <u>772-4F</u> Flanders Model (E-5) 5 X 6 GG-F2 (304) Type 3 (Cabinet) Flanders Model GG-F (24" x 24" x 11-1/2") (HEPA Filter) 99.97% efficient, Fire Retardant Plywood or SST frame, separator less, with extractor clips, 3/4" deep channel filled with fluid sealant upstream, SST faceguards both sides. <u>Off Gas Exhaust</u> Inlet and exhaust filters of the 772-F gloveboxes are manufactured by Flanders per the site HEPA Filter spec. These HEPA filters vary in size and flow rate based on configuration and flow rate of the glovebox they are to be installed. Most 772-F Glovebox Inlet and discharge HEPA filters are installed in housings that are part of the glovebox shell and/or the filter itself is flanged to the box shell. **<u>Reference</u>** M-M6-F-3013 Rev. 4, W157346 Rev. 50, , TP-03-772F-MEXH-01 **<u>Gap Analysis</u>** Discretionary Gap. The majority of the Main Exhaust filter housings in the 772-F are 1950's vintage and constructed with a tape-in-place seal at the inlet and discharge of the HEPA filter frame. These filters do not have a positive seating mechanism that provides a robust seal that is not dependent on human performance during filter installation.	**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**

Evaluation Criteria	Discussion	Reference
	2 - Ventilation System – Instrumentation & Control	
Provide system status instrumentation and/or alarms.	The CVS(s) are controlled and monitored with installed instrumentation. Alarms are received from these instruments in the Control Room for process upset, loss of normal power, low fan pressures, and low system operating pressures (motor not running). Other system parameters are monitored through the use of round sheets. Local instrumentation is adequate for normal operation. The ventilation systems are not credited in the DSA to operate during or following any DBA event, including NPH events. **<u>Reference</u>** SE5-2-2003023, SE5-2-2003025, SE5-2-2003026, SE5-2-2003243, W2017720, W845697 **<u>Gap Analysis</u>** Discretionary Gap. Relay cabinet, CRP-1, located in 772-4F is sensitive to vibration and/or pressure pulses and is not Safety Significant (SS) or credited as functioning in the DSA. The result of a CRP-1 failure would range from the ventilation system going into a process upset condition (safe mode failure) to a complete shutdown of the ventilation system resulting from the loss of system controls.	**DOE Nuclear Air Cleaning Handbook 1169** **AHSRAE Design Guide (Section 4)** **ASME AG-1**
Interlock supply and exhaust fans to prevent positive pressure differential.	The 772-F and 772-4F CVS(s) are equipped with interlocks for the supply and exhaust fans in effort to ensure the supply air cannot overcome the exhaust. **<u>Reference</u>** J-J4-F-2987 Rev. 1, SE5-2-2003023 Rev. 3, SE5-2-2003243 Rev. 9, W845778 Rev. 3, W845695 Rev. 3, W845696 Rev. 3, M-M6-F-3010 Rev. 5, M-M6-F-3013 Rev. 4, W2017720 Rev. 4, TP-03-772F-MEXH-0 **<u>Gap Analysis</u>** Discretionary Gap: The interlocks are not SS and are not credited as functioning during or after DBA events. See also Discretionary gap in "Provide system status instrumentation and/or alarms" section.	**DOE-HNBK-1169** **ASHRAE Design Guide (Section 4)**
Post accident indication of filter break-through.	During normal operation, the current system to detect airborne contamination for the 772-F Main Exhaust and 772-4F Main Exhaust Ventilation systems is performed by the Stack Air Activity Monitoring System. However, the 772-F and 772-4F Main Exhaust systems are credited in the DSA for passive confinement and not for active confinement during or following any DBA event, including NPH events. Accidents associated with the 772-F Off Gas Exhaust systems are primarily localized and internal to the overall 772-F building CVS. The 772-F Off Gas Exhaust system is also credited for having a passive confinement strategy. The Safety Significant passive confinement boundary for the Off Gas Exhaust system is performed by the Glovebox shell, windows, gloveports, gloves, HEPA filter housings, and HEPA filters. Indication of post accident filter break though of the glovebox inlet filters can be detected by either the credited (FW) laboratory module checkout, differential pressure gauges (not credited), or the local low volume Continuous air samplers (not credited). Indication of post accident filter break though of the glovebox outlet filters can not be detected. **<u>References</u>** M-M6-F-3505 Rev. 0, M-M6-F-3508 Rev. 2, M-M6-F-3989 Rev. 1, M-M6-F-3990 Rev. 0, M-M6-F-3991 Rev. 0, M-M6-F-3992 Rev. 0 WSRC-TS-95-18 Rev. 5, Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Technical Safety Requirements WSRC-SA-96-26, Rev. 4, Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Safety Analysis Report **<u>Gap Analysis</u>** No Gap.	**DNFSB Tech 34**

Evaluation Criteria	Discussion	Reference
Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.	The CVS has no credited automatic control features (except for the interlocks for the supply and exhaust fans). The Main Exhaust system is a constant volume system, an air flow controller adjusts variable inlet vanes to maintain a preset flow rate. The Air Supply system has an interlock connected to the Main Exhaust system so that all air handling units and all but one exhaust fan is shut down due to an abnormal exhaust condition (Process Upset). The ventilation systems and the associated instrumentation and controls in the FH LAB are not considered to be Safety Class items and are not required to achieve safe shutdown. Four one third capacity exhaust fans are provided for redundancy and two of the four fans are serviced by standby electrical power to increase worker safety and contamination control (although not required for safe shutdown). In the unlikely event of an instrument malfunction, the ventilation system enters a Process Upset, and would have no adverse safety impact on facility personnel or the environment (i.e., radiological and hazardous chemical releases). The design of the ventilation systems in Buildings 772-F, and 772-4F has incorporated various personnel protection features that relate to the removal of airborne radioactivity and/or other hazardous material from within these buildings. These ventilation systems ensure that the airborne contamination levels within these buildings are as low as reasonably achievable. __Reference__ M-M6-F-2990, M-M6-F-3010, M-M6-F-3013, W2017693, SE5-2-2000617, SE5-2-2003023, SE5-2-2003243 __Gap Analysis__ Discretionary Gap: The interlocks are not SS and are not expected or credited to function during or after DBA events.	**DOE Nuclear Air Cleaning Handbook 1169** **Section 2.4** **ASME AG-1**
Control components should fail safe.	During design of Building 772-4F and associated equipment, a Design Process Hazard Review was used to determine the "Fail Safe" state for all Main Exhaust components and all air handling units. The results of this review were incorporated in the final design and reviewed during and after start-up testing. The main exhaust system has four one third capacity centrifugal fans with variable inlet vanes, automatic discharge dampers, and manual inlet and discharge isolation dampers. The automatic discharge dampers are interlocked with the fans to open upon operation of the fans and to close when the fans stop to prevent "windmilling" (reverse rotation). The automatic discharge dampers will fail in the open position upon a loss of normal power or instrument air. A velocity probe located in the concrete plenum on the service floor is used to determine the velocity of the air. This probe is attached to a transmitter located in Building 772-4F. The variable inlet guide vanes are used to maintain constant air flow. The flow controller will open the inlet vanes when the flow needs to be increased or will close them when the flow needs to be decreased. This system adjusts the inlet vanes on the main exhaust fan to obtain the desired flow rate. The ventilation systems and the associated instrumentation and controls in the FH LAB are not considered to be Safety Significant items and are not required to achieve safe shutdown. In the event of loss of power involving the Ventilation System, the system has an interlock so that all air handling units and all but one exhaust fan is shut down due to an abnormal exhaust condition (Process Upset). Two Main Exhaust fans and sufficient control to operate one exhaust fan are connected to standby power. If power continued to be supplied to the control room, indication of the fans operating would be available. __Reference__ M-M6-F-2990, M-M6-F-3010, M-M6-F-3013, W2017693, SE5-2-2000617, SE5-2-2003023, SE5-2-2003243 __Gap Analysis__ Discretionary Gap: The controls are not SS and are not expected or credited to function during or after DBA events	**DOE-HNBK-1169 (2.4)**

Evaluation Criteria	Discussion	Reference
	3 - Resistance to Internal Events – Fire	
Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement.	The CVS(s) are not required to remain operational during credible fire or explosion events. In case of a 772-F facility fire, the exhaust fans and filters are located in the 772-4F building and are protected from the heat damaging effects by physical separation and passive and active fire prevention systems. Fire detection results in a reduction in exhaust flow which minimizes blinding and heat effects on the 772-4F Filtration. The design basis fire is a full facility fire which will breach the building shell. Building 772-4F lacks any significant combustible materials. Exhaust ductwork is heavy gauge galvanized/stainless steel and is inherently fire resistant. The sprinkler systems for Building 772-F/4F are hydraulically designed for ordinary Hazard Group 2 occupancy as shown in the Fire Hazards Analysis for the Buildings The fire detection and alarm systems, in addition to being normally powered, can receive standby electrical power from the Building standby diesel generators. The fire alarm system panels also contain a battery backup power supply. The Fire Protection Program ensures that combustible materials are controlled to minimize the potential for fire in such locations. The 772-F Building as well as the Main Exhaust system are designated as SS and are required to provide a passive barrier under explosion conditions. The primary function is to provide confinement of hazardous material, thereby, providing contamination control and worker protection for the CW. This is a passive function provided by the building structural elements and outer structures, ductwork from the 772-F concrete plenum to the 772-4F HEPA filter housings, the 772-4F HEPA filter housings and at least one stage of HEPA filters. **Reference** **F-FHA-F-00003 Rev. 1** **Gap Analysis** No Gap.	**DOE-HNBK-1169 (10.1)** **DOE-STD-1066**
Confinement ventilation systems should not propagate spread of fire.	The basic design of these facilities contributes to fire prevention and lack of propagation through the use of noncombustible construction and compartmentalization of laboratory/process areas. However wood was used in the 772-4F attic construction and if it became involved in a fire, it could lead to a full facility fire. This fire event is bounded in the DSA by a full facility fire as an Anticipated event. Smoke and heat detectors are provided in essential areas of the buildings, including heat detectors in active gloveboxes. The buildings are provided with a partial-coverage wet-pipe sprinkler system suppression system in various locations. Smoke detectors located in the Building 772-F air handling units (AHUs) will disable the AHUs and Building 772-4F main exhaust fans (except one) to protect the Building 772-4F HEPA filters. **Reference** F-FHA-F-00006 Rev. 4 **Gap Analysis** No Gap.	**DOE-HNBK-1169 (10.1)** **DOE-STD-1066**

Evaluation Criteria	Discussion	Reference
	4 - Resistance to External Events – Natural Phenomena – Seismic	
Confinement ventilation systems should safely withstand earthquakes.	Buildings 772-F/772-4F, ME components are required to provide passive confinement protection under earthquake accident conditions. The primary function is to provide confinement of hazardous material, thereby providing contamination control and worker protection for the CW. This is a passive function provided by the ductwork from the 772-F concrete plenum to the 772-4F HEPA filter housings, the 772-4F HEPA filter housings and at least one stage of HEPA filters. Buildings 772-F and 772-4F (including the Building 772-4F stack) are structurally adequate to remain standing for up to a 0.20g Peak Ground Acceleration (PGA) earthquake. In addition, the Building 772-4F air filtration system (HEPA filters and ducts) was judged to be adequate for up to a 0.20g PGA earthquake. The ventilation systems are not credited in Section 3.4.2.18 of the DSA to operate during or following a seismic event. In order to be able to credit (or, if not credited, increase reliability to assume survival in a DBE) an active CVS, if needed for NPH, several major components, including the fans, backup diesel power, relay cabinets, and main power supply path would require major renovation. Reference WSRC-SA-96-26, Rev. 4, Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Safety Analysis Report Gap Analysis No Gap.	**ASME AG-1 AA** **DOE 0420.1B** **DOE-HNBK-1169 (9.2), Section 2.4 – Emergency Consideration UBC, 1979** **SBC, 1979**
	5 - Resistance to External Events – Natural Phenomena – Tornado/Wind	
Confinement ventilation systems should safely withstand tornado depressurization.	The CVS(s) are not credited in Section 3.4.2.7 of the DSA to perform any safety function during or following a tornado event. References WSRC-SA-96-26, Rev. 4, Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Safety Analysis Report Gap Analysis No Gap.	**DOE 0420.1B** **DOE-HNBK-1169 (9.2), Section 2.4 – Emergency Consideration**
Confinement ventilation systems should withstand design wind effects on system performance.	As discussed in the DSA, Building 772-F was designed as a Class I, blast-resistant concrete structure in accordance with Specification 3580 and was determined to be structurally adequate for Performance Category 3 wind loads (i.e., 137-mph fastest-mile wind speed tornado). Because of the structural integrity of Building 772-F, no radiological releases are expected from Design Basis Straight Winds. The ventilation systems are not credited in Section 3.4.2.7 of the DSA to perform any safety function during or following a high winds event. References WSRC-SA-96-26, Rev. 4, Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Safety Analysis Report Gap Analysis No Gap.	**DOE 0420.1B** **DOE-HNBK-1169 (9.2)**

Evaluation Criteria	Discussion	Reference
	6 – Other NP Events	
Confinement ventilation systems should withstand other NP events considered credible in the DSA where the confinement ventilation system is credited.	The CVS(s) are not credited in the DSA to perform any safety function during or following any other NP event. References WSRC-SA-96-26, Rev. 4. Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Safety Analysis Report Gap Analysis No Gap.	**DOE 0420.1B** **DOE-HNBK-1169 (9.2), Section 2.4 – Emergency Consideration**
	7 – Range Fires/Dust Storms	
Administrative Controls should be established to protect confinement ventilation systems from barrier threatening events.	Wild land fire impacts were evaluated for F/H Lab (DSA, Section 3.4.2.3) as another Extremely Unlikely initiator for a full facility fire, which is already the worst case fire possible. The ventilation systems are not credited in the DSA to perform any safety function during or following a full facility fire event. References WSRC-SA-96-26, Rev. 4. Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Safety Analysis Report Gap Analysis No Gap.	**DOE 0420.1B**

Evaluation Criteria	Discussion	Reference
	8 – Testability	
Design supports the periodic inspection & testing of filters and housing, and test & inspections are conducted periodically.	The 772-4F HEPA filter housings were designed and manufactured to meet ASME N509 requirements. Each filter location in the 772-4F HEPA filter banks has a set of ½" quick disconnect type test connections for performance testing (PAO/DOP). The 772-F HEPA filter housings have access ports upstream and downstream of the HEPA filters which provide access to the exhaust stream locations needed for In-Place Leak testing. The 772-F gloveboxes installation and design vary based on time of installation. Most of the gloveboxes in the facility are from the late 1970's and early 1980's. Per the DSA the glovebox shell, Gloveports, Glovebox gloves, HEPA enclosure, and HEPA filters are credited for containment (FW) not filtration. Most 772-F Glovebox Inlet and discharge HEPA filters are installed in housings that are part of the glovebox shell or the filter itself is flanged to the box shell. Due to the design of these filters installations, In-Place Leak testing is not feasible. 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. The facility has an established PM program which requires the Vital Safety Systems HEPA filters to undergo in-place leak testing every 12 months. In-place leak testing is performed for this HEPA filter system in accordance with Site Engineering Standards. **References** Manual 2Y1 "*HEPA Filter Testing Procedures*", Procedure 104 "*General Surveillance Testing of HEPA Filters*". Manual 2Y1 "*HEPA Filter Testing Procedures*", Procedure 505 "*Testing HEPA Filter Systems for (F) Area*". S5-2-7592 Rev. 7, S5-2-9439 Rev. 4, S5-2-5462 Rev. 10, S5-2-6907 Rev. 0, S5-2-7737 Rev. 0 **Gap Analysis** Discretionary Gap. The installed design for most of the Inlet and discharge HEPA filters of the gloveboxes in 772-F does not permit In-Place Leak Testing.	**DOE-HNBK-1169 (2.3.8), ASME AG-1, ASME N510, SRS Engineering Standard 15888**
Instrumentation required to support system operability is calibrated.	The CVS(s) instrumentation are included in the F/H Labs IPI program in accordance with 1Q QAP 12-2. Instruments are calibrated periodically as driven by the IPI database. M&TE is used for all instrument calibrations. **Gap Analysis** No Gap.	**DOE-HNBK-1169 (2.3.8), ASME AG-1, ASME AG-1**
Integrated system performance testing is specified and performed.	The ventilation system performance testing is continuously demonstrated during normal system operation. Integrated system testing is not required for this system by the DSA. However system performance is tested and demonstrated during normal operation. **Gap Analysis** No Gap.	**DOE-HNBK-1169 (2.3.8)**

Evaluation Criteria	Discussion	Reference
	9 – Maintenance	
Filter service life program should be established.	The HEPA filter service life program for the FH Laboratories conforms to the SRS program governed by ENG-STD-15888. For the 772-F ventilation systems, this program is implemented via the Computerized Maintenance Management System (Passport). The filter service life program ensures that filters are tested prior to installation and periodically during service. Additionally this program ensures that the filters with a shelf life equal to or greater than 3 years are not installed and that filters are periodically replaced on a specified schedule. Reference L4.02-00021 Rev. 8, Filter Program, F/H Labs Gap Analysis No Gap.	**DOE-HNBK-1169 (3.1 & App C), SRS Engineering Standard 15888**
	10 - Single Failure	
Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system.	The 772-F CVS(s) are supplied with an alternate power supply (e.g. standby diesel generator). The ventilation systems and standby diesel generators are not credited in the DSA to perform any safety function during a loss of normal power event. Standby power is included in a larger set of worker safety features that provides defense-in-depth. References E-E2-F-2857 Gap Analysis Discretionary Gap – Electrical cables are run in open cable trays from 772-4F over the middle of the 772-F roof to the 254-9F diesel generator located on the west side of 772-F. A detonation event would potentially damage these cables and standby power capability to the 772-4F ventilation system could be lost.	**DOE-HNBK-1169 (2.2.7)**
	11 - 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 772-F Main Exhaust, 772-F Off Gas Exhaust, and 772-4F Main Exhaust systems active CVS functions are not required but passive confinement by these CVS's are credited in the DSA. References WSRC-SA-96-26, Rev. 4. Central Laboratory Facility Buildings 772-F, 772-1F, and 772-4F Safety Analysis Report Gap Analysis No Gap.	**10 CFR 830, Subpart B**

Attachment 4 – F& H Area Laboratories Facility Evaluation Team

Billy Hudson – DOE-SR, AMWDP/WDED, Safety System Oversite

Billy Hudson is a Nuclear Engineer in the Department of Energy – Savannah River Operations Office, Assistant Manager Nuclear Materials Stabilization Project, Nuclear Materials Engineering Division. He has 19 years of engineering experience in the nuclear field. He holds Bachelors of Nuclear and Mechanical Engineering from the Georgia Institute of Technology. His primary responsibilities include engineering and safety basis oversight for the F/H Laboratory (F/H Labs) facility. Additional responsibilities include Safety System Oversight of the safety systems for F/H Labs. Prior to joining DOE in 1992, Mr. Hudson worked as an engineer at Newport News Shipbuilding on the Enterprise Refueling Project.

Timothy Gabriel - WSRC, FET Lead, F/H Laboratories Process Engineering

Timothy Gabriel has a Bachelor of Science in Mechanical Engineering from the University of South Carolina. He has worked at WSRC over 6 years in the areas of Facility Engineering Support for the F & H Area Laboratories. In this position, he is responsible for technical reviews, configuration control, USQs, environmental compliance reviews and protection of the facility design basis. Tim provides day-to-day engineering field support for the 772-F, 772-1F, and 772-4F Confinement Ventilation Systems. While working at SRS, Tim has been recognized in the area of Ventilation and filtration by invitation and participation on the WSRC Site Ventilation & Filtration Committee as a Subject Matter Expert.

Michael Patterson – WSRC, Lead, F/H Laboratories Cognizant Engineer

Michael Patterson has Sixteen years of engineering experience in the nuclear field. He has a Bachelor of Science degree in Mechanical Engineering from Rose-Hulman Institute of Technology. His employment at the Savannah River Site began in 1990 in the Reactor Re-start Division as a Cognizant Engineer with the Airborne Activity Confinement System. In 1992, he moved to FH Laboratories as part of Operations Engineering, then later as a Cognizant Engineer. In this position, he is responsible for technical reviews, configuration control, USQs, environmental compliance reviews and protection of the facility design basis. Mike provides day-to-day engineering field support for the 772-F and 772-1F HVAC Systems.

Michael Harmon – WSRC, F/H Laboratories Cognizant Engineer

Michael Harmon has a Bachelor of Science in Electrical Engineering from the University of South Carolina. He has worked at WSRC since 1989 with past experience including high and low voltage systems, controls, diesel generators, domestic water distribution power and controls, river water pump house power and controls, design and projects technical lead. His present assignments within the Lab include subject matter expert input to the site Senior Electrical Review Board and Electrical Design Authority Engineer for normal and standby power systems.

Jerome Roberts – WSRC, F/H Laboratories Cognizant Engineer

Jerome Roberts has been with the WSRC for over 23 years in various engineering positions. Jerome holds a Bachelor of Science in Mechanical Engineering and an active Professional Engineering License in the State of Georgia. For the last 18 years, he has been the cognizant engineer for the FH Laboratories. In this position, he is responsible for technical reviews, configuration control, USQs,. environmental compliance reviews and protection of the facility design basis. Jerome provides day-to-day engineering field support for the 772-F, 772-1F, and 772-4F Confinement Ventilation Systems..

Ana Yaneza – WSRC, F/H Laboratories Cognizant Engineer

Ana Yaneza has a Bachelor of Science in Electrical Engineering from the Northrop University. She has worked at WSRC for 15 years in F/H Laboratories as a cognizant engineer in the areas of Fire Protection, Electrical Systems, Startup Testing, Instrumentation and Controls, Radiological Monitoring Equipment, and Communications. Prior to WSRC, she worked at Westinghouse Electric Corporation for 3 years as a tactical controls engineer for the Department of Defense Trident I and Trident II Missile Launching Systems.

Roy Beck – WSMS, Safety Analysis Engineer

Roy Beck has a Bachelor of Science degree in Chemistry and began his career at SRS with the DWPF facility as a chemist. Job responsibilities were shifted to Analytical Laboratories in F Area prior to transfer to WSMS as a Regulatory Programs Specialist. Current job responsibilities include Design Authority interface for analytical activities and management of Safety Basis document revisions for the Nuclear facilities and a Low Hazard chemical facility.

Baidya Roy– WSMS, Safety Analysis Engineer

Baidya Roy has a B.S., Mechanical Engineering, M.S., Engineering Mechanics, and a M.S., Environment & Waste Management. He has 35 years of professional and supervisory experience in safety analysis, risk and reliability studies, engineering design, analysis and startup/operational support of DOE and commercial nuclear power facilities.

At present serving as a senior safety professional, performing probabilistic risk analysis for nuclear facilities and deterministic analysis to quantify risks and reliability of systems and components Served as Senior Professional at SRS System Engineering with lead responsibility in several Reactor Restart and Spent Nuclear Fuel Projects. Served as lead engineer at Westinghouse Nuclear Technological Division with responsibility in the areas of seismic/DBA analysis, testing, qualification of electrical/mechanical safety systems for several commercial nuclear power plants. Served as manager in charge of field design and construction support at PNPP-1 (Philippines) and Vogtle Units 1 & 2 (Georgia). Member in ASME and ASTM Technical Committees; Registered Professional Engineer in the State of Massachusetts. Authored several technical publications in the fields of safety, stress, seismic and fluid systems analyses.

William Leschak – WSRC, Solid Waste Operations

William Leschak has a Bachelor of Science degree in Marine Science from the University of South Carolina. He has been employed at SRS since 1993 and currently works for Energy Solutions. Prior to working at SRS, he was employed by SC DHEC for 7 years in the environmental monitoring field. Current duties include serving as NQA-1 Certified Lead Auditor and performing the Cognizant Quality Function for Waste Management Area Projects activities.