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Department of Energy
Washington, DC 20585

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DNF SAFETY BOARD

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW
Suite 700
Washington, DC 20004

Dear Mr. Chairman:

Consistent with the Department of Energy's Implementation Plan for Defense Nuclear Facilities Board Recommendation 2000-2, *Configuration Management, Vital Safety Systems,* I am forwarding an initial Phase II assessment report from the Rocky Flats Field Office. Initial Phase II reports from the remaining Environmental Management Sites will be forwarded as they are completed.

If you have any questions, please contact me at (202) 586-7709 or have your staff contact Mr. William Boyce at (202) 586-8856.

Sincerely,

Jessie Hill Roberson
Assistant Secretary for
Environmental Management

Enclosure

cc w/o Enclosure:
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DEPARTMENT OF ENERGY REPORT ON PHASE II ASSESSMENT OF CONFINEMENT VENTILATION SYSTEM IN BUILDING 371

March 2002

U.S. Department of Energy
Rocky Flats Field Office
Golden, Colorado

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ACRONYMS

AB	Authorization Basis
BIO	Basis for Interim Operation
c v s	Confinement Ventilation System
DACS	Data Acquisition and Control System
D&D	Decontamination and Decommissioning
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOP	Decommissioning Operations Plan
ELPM	Electronic Linking and Procedure Maintenance
EPD	Electrical Power Distribution System
ESWGR	Emergency Switchgear
HEPA	High Efficiency Particulate Air
HVAC	Heating Ventilation and Air Conditioning
ISM	Integrated Safety Management
IWCP	Integrated Work Control Process
KH	Kaiser Hill
LCO	Limiting Condition for Operation
LLW	Low Level Waste
MCC	Motor Control Center
NFPA	National Fire Protection Association
PM	Preventive Maintenance
RFETS	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Filed Office
SNM	Special Nuclear Material
SOE	Stationary Operating Engineer
SWGR	Switchgear
TGEN	Turbine Generator
TRU	Transuranic Wastes
TSR	Technical Safety Requirements
UPS	Uninterruptible Power Supply System
USQ	Unreviewed safety Question Process
v s s	Vital Safety Systems
WIPP	Waste Isolation Pilot Plant

EXECUTIVE SUMMARY

This report documents the results of the Department of Energy, Rocky Flats Field Office Phase II Assessment of the Confinement Ventilation System in Building 37 1. The review was conducted February 1 8th through 22nd, 2002 by a team of specialists representing the Rocky Flats Field Office and Kaiser Hill LLC. The scope, depth and breadth of this review were defined in the Department of Energy Assessment Plan, dated February 2002. The assessment team performed a detailed review of all areas specified in the Confinement Ventilation Criteria and Review Approach Documents specified in the Plan. Review activities included a detailed walkdown and examination of vital Confinement Ventilation system components, conduct of over 20 interviews and review of pertinent facility documentation including Authorization Basis documents, planning documents, engineering-related documents, work packages, maintenance packages and procedures.

Statement of System Operability

In summary, the assessment team determined Building 371 Confinement Ventilation System operability and reliability to be adequate based on the material condition of system components, facility implementation of Technical Safety Requirements and associated Surveillance's, implementation of a graded preventive maintenance program and corresponding corrective maintenance activities. Additionally, each of the objectives specified in the Department of Energy's Criteria and Review Approach Documents are deemed to have been met based on the review activities conducted during this assessment. The review team also concluded that the commitment of Facility management to improve Confinement Ventilation System reliability was readily apparent. In this regard, the HVAC Tiger Team reviews conducted in FY2000 and January 2001 are considered a commendable effort, supported directly by a qualified management, operational, technical and support staff personnel.

During the course of the review the assessment team identified strengths that will support successful operation of the Confinement Ventilation system as well as vulnerabilities that may impact its ability to achieve this success. Principle issues included:

Operability Issues/Concerns:

- Small holes were discovered in the ductwork between the last tested HEPA filters in FP-241 and FP-242 and their corresponding exhaust fans during Phase II assessment walkdowns. This condition represents a potential unfiltered leak path during postulated accident scenarios. *(System Maintenance, Criterion I)*

- The inspection criteria in surveillance procedure 4-PRO-121-VENT-371-SR4.1.8 does not adequately implement the intent of the Limiting Condition for Operation (LCO) 3.1.5 surveillance requirement for identifying potential unfiltered leak paths. For example, the procedure does not explicitly address the need to inspect potential leak paths such as small taped test holes located in the duct before and after the

exhaust fans in System 2 Zone 1 Plenums. This procedure also requires a more general identification of any "damage or degradation in the inspected ductwork"; this element of the procedure does not appear to have been properly conducted during previous performance of this inspection. Taped holes in the Team's opinion are clear evidence of system degradation. *(System Maintenance, Criterion 2, System Surveillance and Testing Criterion 3)*

Opportunities for Improvement:

- The facility should conduct an evaluation to determine why the holes discovered in inlet piping for Exhaust Fans 241A, 241B, 242A, and 242B were allowed to remain at the completion of the work that made them. *(Configuration Management, Criterion 1)*

- During the course of the review, it was noted that discrepancies exist between the BIO LCOs, Surveillance Requirements, System Evaluation Reports, and implementing surveillance procedures. These discrepancies may have contributed to some of the other deficiencies noted elsewhere in this report. The building had previously identified this issue and is working to correct the deficiency under a corrective action plan developed under Price Anderson Amendments Act report NTS-RFO-KHLL- 1999-0003 and a subsequent assessment. *(Safety Function Definition, Criterion 1)*

- Surveillance procedure 4-PRO-121-VENT-371-SR4.1.8 does not perform a visual smoke test of all negative pressure sections of ducting that is being maintained to limit potential unfiltered leak paths from the facility. The procedure currently performs a smoke test of the ducting from the last HEPA filter stage to the exhaust fan shroud and casing. During normal system operation one exhaust fan for each plenum is typically in standby. The zone of negative pressure for the standby fan likely extends into the fan's discharge ducting to the fan's backdraft damper. This section of ducting and the backdraft damper is not currently subject to the visual smoke test per this procedure. *(System Maintenance, Criterion 2)*

Good Practices:

- In response to CVS performance issues early in 2000, the Building 371/374 Closure Project twice convened a HVAC "Tiger Team" to review performance issues affecting the facility's HVAC System and provide recommendations for improvement. The changes endorsed by the Tiger Team have successfully solved the CVS performance issues that have occurred over the last few years. *(System Maintenance, Criterion 1)*

- The Electronic Linking and Procedure Maintenance (ELPM) implementation at Building 371 provides an effective mechanism to readily identify implementing documents for AB and safety basis requirements. The process helps ensure that configuration management of Authorization Basis requirements is maintained through

electronic linking of the Basis for Interim Operation (BIO), System Evaluation Reports, and implementing documents. *(Safety Function Definition, Criteria 1)*

- Facility implementation of PRO-1475-ADM-371, Building 371/374 Implementation Document Change Control Process, provides an effective process for ensuring accurate management of the System Evaluation Report, Authorization Basis, and implementing procedures with respect to changes affecting the safety basis. *(Configuration Management, Criteria 3 & 4)*

- Building management has successfully maintained the operability of the Confinement Ventilation System (CVS) while airflow loads have changed. The use of dummy loads to replace Zone I/IA airflow's as gloveboxes are removed is an excellent idea. Building management should encourage and possibly formalize the use of dummy loads during D&D activities. *(System Maintenance, Criterion 1)*

- The Procurement Engineering group has added an extra step, outside procedure requirements, in the review of HEPA filter requisitions - the HEPA filter SME review assures the specification and the filter application is acceptable. *(System Surveillance and Testing, Criteria 4)*

A more exhaustive discussion of these issues is provided in the report sections that follow this summary. Appendix A provides a detailed discussion of assessment results itemized by Criteria and Review Approach Document.

1.0 INTRODUCTION

On March 8, 2000, the Defense Nuclear Facilities Safety Board (Board) issued Recommendation 2000-2, concerning the degrading conditions of vital safety systems and the capability to apply engineering expertise to maintain the configuration of these systems. Specifically, the Recommendation identified possible degradation in confinement ventilation systems and noted that the Department of Energy (DOE or Department) has not adopted the nuclear business'long-standing practice of designating system engineers for systems and processes that are vital to safety. The Board recommended that the Department take action to assess the condition of its confinement ventilation systems, develop programs for contractor and federal technical personnel that strengthen safety system expertise, and improve the self-assessment processes that evaluate the condition of vital safety systems.

On April 28, 2000, the Department accepted the Board's Recommendation and in October 2000, issued the approved *Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2000-2.* After the initial Phase I review of "facilities of interest" this Implementation Plan calls for Phase II assessments of VSS of facilities as designated by the field office. The Rocky Flats Field Office, in consultation with DOE Headquarters, has selected the ventilation and fire detection and suppression systems in Building 371 for Phase II assessment. This assessment report provides results of the assessment of the confinement ventilation system in Building 371.

2.0 BACKGROUND

RFETS Building 371 Plutonium Facility

The original mission of the Building 371/374 Complex consisted of three elements: 1) to replace the plutonium (Pu) bearing residue recovery and waste operations in Buildings 771 and 774; 2) to recover Pu from weapons returned from the stockpile; and 3) to provide large-scale storage of Pu and Pu-bearing materials. Construction of the Building 371/374 Complex started in the early 1970s and was completed in 1981. Systems operations tests and safety system performance verifications were performed on the Building 37 1/374 Complex before radioactive materials were introduced into the buildings. Waste processing operations in Building 374 functioned acceptably, but problems with the Pu recovery operations in Building 371 were discovered during startup in 1981. Building 371 was unable to achieve designed Pu recovery capabilities due to many deficiencies in the design or construction of its process equipment. Because of these deficiencies, numerous safety-related incidents, and excessive SNM holdup in equipment and piping, DOE directed the Site contractor to curtail Pu recovery operations in 1981. Waste operations in Building 374 continued functioning.

Subsequent to termination of Pu recovery operations in 1981, a Pu Recovery Modification Project (PRMP) was initiated to develop modifications to Building 371. The purpose of the first pilot PRMP project, the Pu Recovery Operability Verification Exercise (PROVE), was to make equipment modifications in order to conduct aqueous

Pu recovery processes. Construction of the PROVE project was approximately 95% complete when the project was terminated in 1989 when all nuclear production operations ceased at the RFETS. Due to incomplete shutdown, many Pu recovery processes require removal of hazardous materials before decontamination or decommissioning (D&D) may begin. These activities are identified as "deactivation" activities in the Decommissioning Operations Plan (DOP).

Since the termination of all nuclear production operations at the Site in 1989, Building 371 has been used primarily for the storage of Pu and uranium (U) metal, oxide, residues, transuranic (TRU) wastes, low-level wastes (LLW), and Resource Conservation and Recovery Act (RCRA) regulated mixed wastes and residues. SNM is stored in the Central Storage Vault (CSV), vault-type rooms, and other designated areas. Building 374 has continued to conduct waste processing operations.

In support of the Site activity of consolidating SNM, all Category I and II quantities of SNM have been moved to Building 371 for interim storage. Materials are to be processed and repackaged. Current plans call for storage of SNM in Building 371 until the SNM is shipped offsite. The storage mission includes storage of up to approximately 13 metric tons (MT) of Pu and 6.3 MT of highly enriched U. In addition, there could be up to 13.0 kg of Americium (Am) present in numerous residue and other forms due to concentration during prior processing or in-growth. Inclusive in this mission is the stabilization and interim storage of packaged Pu residues and TRU wastes until waste can be shipped to disposal facilities, such as the Waste Isolation Pilot Plant (WIPP).

Building 371 is also used to perform related SNM handling activities and other activities to support material stabilization and area decontamination and decommissioning. Building 374 continues to be used to process radioactively contaminated liquid waste streams as required unless and until those functions are assumed by new, more economical facilities. As operations in the Building 371/374 Complex are no longer required, these affected areas are being prepared for D&D.

Confinement Ventilation System

The Building 371 ventilation system provides five (5) Zones of differential pressures. This control scheme provides assurance that contamination will not migrate to less contaminated areas. These zones were established for the original design of the building as a processing facility and area as follows:

Zone I provides the ventilation for primary confinement where highly radioactive material is handled. Zone 1 space includes Gloveboxes, conveyor enclosures, vaults and any other space that may contain high levels of radioactive materials. Zones I/IA are maintained at the lowest pressure in the building. Zone IA provides the ventilation for open enclosures and primary confinement vaults. A Zone IA space is one that provides access to Zone I space, or to any op-en enclosure, which has been used for processing. Plenums, and fans exhausting Zone IA areas are located in Zone II areas. Included in Zone IA are airlocks to canyons or Gloveboxes where a high potential for contamination

exists. Zone II provides the ventilation supply and exhaust for the secondary confinement in the building, maintaining required DP, and filtration. Zone II generally includes any areas containing Zone I/IA spaces, providing operational space with a potential for moderate radioactive contamination. Zone III Provides the ventilation for the tertiary confinement of the building. A Zone III space is not normally subject to contamination, although the facility Authorization Basis permits drum storage in Zone III areas. Generally, Zone III spaces cannot directly contact Zone I or Zone IA spaces. Zone IV provides the ventilation for office areas, and other uncontaminated areas.

System 2 of the Confinement Ventilation System (CVS) has components that supply fresh air make-up, recirculate Zone II/III air, and exhaust Zone I/IA air to the exhaust stack. The assessment focused primarily on the credited components of System 2 as defined in the Building 37 1/374 Complex BIO but also looked at associated equipment that provide defense in depth safety functions. The specifically credited features include:

- Supply air unit housing and a single stage HEPA filter bank. This unit provides tertiary confinement in the event of loss of electrical power.
- Interlock system to shut down supply fans. A low plenum inlet to atmospheric differential pressure interlock will shut the supply fan breakers.
- Valves and interconnecting ductwork for cross-connecting Zone I/IA unfiltered exhaust to alternate plenums. AOV-6740B cross-connects FP-241 with FP-242. AOV-6820B cross-connects FP-243 with FP-142.
- Two stages of Zone I/IA exhaust HEPA filters and fans. The System 2 Zone I/IA exhaust filter plenums include FP-241, FP-242, and FP-243. The System 2 Zone I/IA exhaust fans include EF-241A, EF-241B, EF-242A, EF-242B, EF-243A, and EF-243B.
- Two stages of Zone II/III recirculation HEPA filters. The System 2 Zone II/III exhaust filter plenums include FP-221, FP-222, and FP-223.
- Exhaust and return ductwork from the last HEPA filter stage to the associated fans. This section of the ductwork is under negative pressure and can potentially provide an unfiltered leak path to the environment.
- Exhaust ductwork from the last HEPA filter stage to the building exhaust valve. This section provides tertiary confinement in the event of loss of electrical power.
- Bypass damper (also referred to as the emergency dump valve). When in the OPEN position, AOV-6936A provides the capability to route return air to the exhaust stack. The safety function of AOV-6936A is its fail safe design to ensure valve closure which maintains the tertiary boundary in the event of loss of electrical power.
- DP alarms for Zone IV to Zone III
- Redundant DP alarms for Zone III to atmosphere

Support Systems

Electrical Power Distribution System

The electrical power distribution system (EPD) provides a source of power for the electrical loads in the Building 371/374 complex. Site power originates at the 115kV

alternating current ring bus that receives power from two Public Service of Colorado 115kV alternating current transmission lines.

Two independent 115kV alternating current lines deliver power from the load side of the ring bus to Substation 517/518 via primary switches 9135A or 9135B for 518 and 9136A or 9136B for 517. Public Service of Colorado retain control and maintenance of the two 115kV feeder lines up to the line side of the Automatic Line Switches at the 517/518 Substation. Substation 517/518 is comprised of two transformers which step the 115kV down to 13.8kV for primary distribution to the Building 371/374 transformers. Two independent 13.8kV lines distribute power to the building transformers. Substation 517/518 also has an automatic tie-breaker that allows for transfer of power from the main-breaker of one transformer to the feeder breakers of the other transformer. Substation 5 17/5 18 feeds six transformers that supply power Buildings 37 1/374 and other loads and Buildings. Other onsite substations can also be used to supply power to the Building 371/374 transformers. This can be accomplished via configuration of various line switches; the other on-Site substations operate similar to Substation 517/518. At the building transformers, the 13.8kV alternating current is stepped down to 2400V and 480V alternating current, and distributed via their respective Switchgear/Emergency Switchgear (SWGR/ESWGR) throughout the buildings to electrical loads.

There are two sources for EPD buses:

- Site Power
- Emergency Power

The normal buses distribute power supplied by Building SWGR 731-1/2 and SWGR 371-3/4 to their respective loads. The "E" busses distribute power supplied by Building ESWGR 371-5/6 to their respective loads, which in turn feeds ESWGR 371-7/8. They can also receive backup power from the turbine generator (TGEN) system in the event that Site power is lost.

Uninterruptible Power Supply System (UPS)

The UPS System supplies Alternating Current (AC) to its connected loads from the normal AC-supply, Turbine Generator (TGEN), or batteries. In the event that offsite and TGEN power are interrupted, the UPS System supplies critical electrical equipment with continuous power from battery backup. The UPS system consists of the following major components:

- Dual UPS Units
- Battery Bank
- Distribution Network

Turbine Generator (TGEN) System

The TGEN system supplies power (alternating current) to its connected loads via the Building 371/374 Emergency "E" busses in the event that Site power is lost. The TGEN provides a defense-in-depth function to assist the EPD in supporting designated process and safety equipment including; Heating, Ventilating and Air Conditioning systems, and the Fire Detection and Reporting system, among others.

The TGEN for Building 371 is 2400V, 3-phase, 2500kW turbine-driven generator located in Room 3583 of Building 371. Plant air is used to start a diesel engine, which in turn spins the turbine up to starting speed with the use of a gearbox. The TGEN system is normally inactive and in automatic standby as long as Site power to the building is energized. Upon loss of Site power sources, there is approximately a 5-second delay to permit distinguishing power bumps from an actual outage, after which the generator starts automatically.

Generator protection is provided by the following fault trip relays located in the TGEN control panel:

- Device "5 1G" Over-current Relay, Time Delay, Neutral Ground
- Device "51V" Over-current Relays, Time Delay with Voltage (3 total, 1 for each phase)
- Device "87" Differential Protections Relays (3 total, 1 for each phase)

Compressed Gas System

The Building 371/374 Compressed Gas system is comprised of the following systems:

Instrument Plant Air System – provides is important for facility worker safety and providing defense-in-depth to minimize radiological releases form the facility. BIO credited SC-3 function provided by the Instrument Air System include:

- Providing control air to dampers for Heating, Ventilating, and Air Conditioning (HVAC) Systems 1,2,3,4 and 9.
- Providing air to dry automatic sprinkler lines.

Nitrogen System – provides a backup supply of compressed gas to the Instrument Plant Air System providing nitrogen gas to the Inert Ventilation System, in addition to providing a nitrogen supply to the filter plenum deluge fire water storage tanks. The nitrogen system is important for providing defense-in-depth to minimize radiological releases.

Breathing Air System – provided lean dry air for workers in supplied breathing air garments and supplied air respirators.

Helium Gas and Helium Regeneration Gas Systems – provides compressed gas for pneumatic operation, welding operation. And helium GB atmosphere for PuSPS

3.0 SCOPE OF ASSESSMENT

The assessment focussed on the Building 371 confinement ventilation system as credited in the facility's safety documentation (i.e. Building 371/374 Basis for Interim Operation (BIO) and System Evaluation Report). Representative portions of the systems were selected for detailed assessment and evaluation in accordance pre-determined assessment criteria.

For the ventilation system, the credited components of System 2 were selected as the primary focus of the assessment in accordance with assessment criteria. This system was selected because it is representative of the entire building's ventilation system, was subject to recent upgrades of the interlocks, and has also experienced recent operational problems, notably filter plenum 243.

Assessment of System 2 included representative samples of the credited features of ductwork from the tornado missile barrier through the supply fans, and the pressure control dampers in the various rooms, corridors, and areas, including filters and dampers internal to the ductwork. The boundaries also included ductwork from those rooms, corridors, or areas to the recirculating air and exhaust plenums, including dampers located in the ductwork. The system also includes Zone I/IA exhaust ductwork, inclusive of fans, filters and dampers located in the ductwork. This includes the ductwork connecting the exhaust from return and exhaust plenums to other rooms and the stack. Procurement, qualification, surveillance and testing of HEPA filters were also evaluated.

Associated components included selected motors that drive the system as well as the associated power and control cables back to the line side of the motor control center (MCC) supply breaker, and instrumentation and controls associated with operation and monitoring of the system (this includes instrumentation available for equipment controls, interlocks, indications, and alarms, which may utilize the data acquisition control system (DACS)). The system boundary encompasses selected instruments within a loop and the associated power and control cables from the line side of the supply breaker and control interlocks that exist between some exhaust fans and supply fans. A walkdown of the system was performed to evaluate the system's material condition

Support systems for the ventilation system that perform an active function were also assessed. In general, support system assessment consisted of verification of operability as credited in safety documentation (i.e. Building 371 BIO and System Evaluation Report), review of Phase I assessment results, selected walkdown assessments of material condition, comparison on a sample basis of the actual physical installation with associated safety documents and requirements, and a limited review of operational history information indicative of system reliability, availability, and performance. Specific assessment scope for each system is described below. Active support systems

required to be operable in order for the ventilation system to perform its intended safety function or functional requirements are:

- Electrical Power Distribution System
- Uninterruptible Power Supply System
- Turbine Generator System
- Compressed Gas
- Fire Suppression System

Electrical Power Distribution System – Assessment consisted of walkdown of the material condition of the selected control and power distribution devices, including interconnecting cabling, from system fans, electrical instrumentation, alarm and control devices (including interlock circuitry) from the exhaust fans back to the MCCs that provide electrical power to these fans. Surveillance and preventive maintenance actions performed on the system and Phase I assessment results were also reviewed.

Uninterruptible Power Supply (UPS) System - Assessment consisted of walkdown of the material condition of selected portions of the system from the individual associated ventilation system components back through the UPS distribution panels to the UPS unit, including the associated battery bank. Surveillance and preventive maintenance actions performed on the system and Phase I assessment results were also reviewed.

Turbine Generator System - Assessment consisted of walkdown of the material condition of the turbine generator complex, including starting and fuel systems and the generator output breaker. Surveillance and preventive maintenance actions performed on the system and Phase I assessment results were also reviewed.

Compressed Gas (Instrument air and nitrogen systems) - Assessment consisted of walkdown of the material condition of selected plant air and instrument air systems from the associated ventilation system components back through the service air compressors and inlet filters; to include the compressors, coolers, filters, receivers, and dryers. For the nitrogen system, portions from the connection to the instrument air header back to the isolation valve upstream of the instrument air backup control valve. Surveillance and preventive maintenance actions performed on the system and Phase I assessment results were also reviewed. The Breathing Air system does not directly support the ventilation system and the Helium Gas, and Helium Regeneration Gas Systems were reviewed during the Operational Readiness Review of the Plutonium Stabilization and Packaging System in April 2001 and therefore did not require assessment during Phase II.

The Fire Protection System is being separately evaluated by its own Phase II assessment, and therefore it will not be evaluated as a support system to the ventilation system.

4.0 ASSESSMENT RESULT SUMMARY

Safety Function Definition

The assessment team found that the safety basis-related technical, functional, and performance requirements for the Building 37 1 confinement ventilation system are identified and defined in appropriate safety documents. The Basis for Interim Operation (BIO) Building 37 1/374 Complex, Revision 5 and System Evaluation Report Chapter 2 appropriately describe the confinement ventilation system safety functions including role of the confinement ventilation in detecting, preventing, or mitigating analyzed events in the BIO. The safety function descriptions include associated conditions and assumptions and requirements and performance criteria for the confinement ventilation system. Active components and essential supporting systems are identified for normal, abnormal, and accident conditions. The Building 371 System Evaluation Report Chapter 2 provides information and description of the confinement ventilation system that addresses significant elements of DOE-STD-3009 since much of this information is not included in the present BIO. This information includes: system descriptions, safety function/categorization of safety class/safety significant SSCs, system boundaries, functional requirements, and ability of the safety class SSCs to meet performance criteria. The System Evaluation Report is not a DOE approved authorization-basis (AB) document. However, it serves a key role in addressing the above elements of DOE-STD-3009 as safety basis documentation for the confinement ventilation system in Building 371/374. Building 371 implementing procedures are based on the System Evaluation Report safety bases.

Facility management appears to have taken an aggressive approach to ensuring that safety basis requirements are accurately reflected in implementing documents for the Confinement Ventilation System. The ongoing process of reconciling System Evaluation Report functional requirements, acceptance criteria and reference diagrams with the facility BIO will significantly enhance the then tools utilized to operation and maintain the CVS.

The following Opportunity for Improvement and Good Practice were noted:

Opportunities for Improvement

- During the course of the review, it was noted that discrepancies exist between the BIO LCOs, Surveillance Requirements, System Evaluation Reports, and implementing surveillance procedures. These discrepancies may have contributed to some of the other deficiencies noted elsewhere in this report. The building had previously identified this issue and is working to correct the deficiency under a corrective action plan developed under Price Anderson Amendments Act report NTS-RFO-KHLL-1999-0003 and a subsequent Fast Scan Assessment. (Fast Scan Assessments are essentially surveillance activities conducted in accordance with Kaiser Hill 3-B52-ADM-02.01 *Conduct of Assessment Activities). (Safety Function*

Definition, Criterion 1)

Good Practice

- The Electronic Linking and Procedure Maintenance (ELPM) implementation at Building 371 provides an effective mechanism to readily identify implementing documents for AB and safety basis requirements. The process helps ensure that configuration management of Authorization Basis requirements is maintained through electronic linking of the Basis for Interim Operation (BIO), System Evaluation Reports (System Evaluation Reports), and implementing documents. *(Safety Function Definition, Criteria I)*

Configuration Management

The assessment of the Configuration Management topic area was conducted to determine if changes to safety basis-related requirements, documents, and installed components are adequately controlled. The assessment concluded that changes to the confinement ventilation system's authorization basis requirements, documents and system components have an adequate change control process. Significant progress has been made by the facility since the determination of programmatic deficiency in the area of configuration management within the facility. The process being used to review and update the System Evaluation Reports is comprehensive and should result in accurate documents. Changes to the confinement ventilation system's safety basis requirements, documents, and installed components were reviewed and found to conform to the approved safety/authorization basis (safety envelope) for the facility, and the appropriate change approval authority is determined using the Unreviewed Safety Question (USQ) process. Facility procedures ensure that changes to the confinement ventilation system's safety basis requirements, documents, and installed components are adequately integrated and coordinated with those organizations affected by the change.

One issue noted was the lack of up-to-date drawings for the facilities safety systems. The building (and Rocky Flats Site) has instituted several controls to ensure that when drawings are first field verified to be correct or modified as needed to document the as found condition before they are used. The BIO safety requirements are rooted in functionality of the safety systems and operability is determined through a series of defined functional requirements, and associated compliance requirements and acceptance criteria. The availability of completely accurate drawings, although desirable, is not deemed to be a deficiency that needs to be corrected due to the implemented compensatory measures and the short (2-3 year) remaining life of the facility. A review of the system diagrams in the System Evaluation Report for the ventilation system was performed and no discrepancies were noted. Results of the configuration management of software are discussed separately.

The following Opportunity for Improvement was noted:

Opportunities for Improvement

- The facility should conduct an evaluation to determine why the holes discovered in inlet piping for Exhaust Fans 241A, 241B, 242A, and 242B were allowed to remain at the completion of the work that made them. *(Configuration Management, Criterion I)*

System Maintenance

The assessment of the Confinement Ventilation System (CVS) was conducted to determine if the system and sub-systems are maintained in a condition that ensures their integrity, operability and reliability. The team found that the CVS is a well constructed well designed system with a generally reliable operating history. The individual components are robust and have adequate redundancy in case equipment must be taken out of service for maintenance. Utilities and engineering personnel are knowledgeable and competent in their abilities to maintain the ventilation system. Adequate maintenance processes are in place for prescribed corrective, preventive, and predictive maintenance. The maintenance backlog is managed satisfactorily. Periodic walk downs are performed in accordance with maintenance requirements to assess the material condition of the CVS. Overall, the Confinement Ventilation System (CVS) is maintained and operated in a manner consistent with its credited safety functions as defined in the Building 37 1/374 Complex Basis for Interim Operation (BIO).

During the assessment the review team identified a number of small holes (approximately 1/2" diameter) in the ductwork downstream of the last tested stage of HEPA filtration and upstream of the corresponding exhaust fans that are specifically credited in the Building 371/374 Complex BIO to limit potential unfiltered leak paths. A hole was found at the suction side and the exhaust side of four exhaust fans for a total of eight holes. At the time of discovery, the holes were covered with tape to prevent leakage. Following the discovery on February 20, 2002 the facility suspended operations in the affected area and the holes were repaired on February 21, 2002. Building management and the Rocky Flats Field Office (RFFO) are evaluating the operational impact of the condition that existed while the small holes were covered with tape. The holes are thought to have been created several years ago as part of an attempt to measure or sample bypass leakage through the fan shaft seals. Following the sampling activity the holes were sealed with tape and have existed in this condition until discovery during Phase II assessment activities.

In addition to system operability concerns, the presence of these holes calls into question the adequacy of applicable surveillance procedures and surveillance implementation. Discrepancies identified between approved BIO requirements and associated Surveillance and System Evaluation Report criteria are considered to have directly contributed to this condition.

The following Operability Issues/Concerns, Opportunity for Improvement and Good Practices were noted:

Operability Issues/Concerns

- Small holes were discovered in the ductwork between the last tested HEPA filters in FP-241 and FP-242 and their corresponding exhaust fans during Phase II assessment walkdowns this condition represents a potential unfiltered leak path during postulated accident scenarios. *(System Maintenance, Criterion 1*

- The inspection criteria in surveillance procedure 4-PRO-121-VENT-371-SR4.1.8 does not adequately implement the intent of the Limiting Condition for Operation (LCO) 3.1.5 surveillance requirement for identifying potential unfiltered leak paths. For example, the procedure does not explicitly address the need to inspect potential leak paths such as small taped test holes located in the duct before and after the exhaust fans in System 2 Zone 1 Plenums. This procedure also requires a more general identification of any "damage or degradation in the inspected ductwork"; this element of the procedure does not appear to have been properly conducted during previous performance of this inspection. Taped holes in the Team's opinion are clear evidence of system degradation. *(System Maintenance, Criterion 2, System Surveillance and Testing Criterion 3)*

Opportunities for Improvement

- Surveillance procedure 4-PRO-121-VENT-371-SR4.1.8 does not perform a visual smoke test of all negative pressure sections of ducting that is being maintained to limit potential unfiltered leak paths from the facility. The procedure currently performs a smoke test of the ducting from the last HEPA filter stage to the exhaust fan shroud and casing. During normal system operation one exhaust fan for each plenum is typically in standby. The zone of negative pressure for the standby fan likely extends into the fan's discharge ducting to the fan's backdraft damper. This section of ducting and the backdraft damper is not currently subject to the visual smoke test per this procedure. *(System Maintenance, Criterion 2)*

Good Practices

- In response to CVS performance issues early in 2000, the Building 371/374 Closure Project twice convened a HVAC "Tiger Team" to review performance issues affecting the facility's HVAC System and provide recommendations for improvement. The changes endorsed by the Tiger Team have successfully solved the CVS performance issues that have occurred over the last few years. *(System Maintenance, Criterion 1)*

- Building management has successfully maintained the operability of the Confinement Ventilation System (CVS) while airflow loads have changed. The use of dummy loads to replace Zone I/IA airflow's as glove boxes are removed is an excellent idea. Building management should encourage and possibly formalize the use of dummy loads during D&D activities. *(System Maintenance, Criterion 1)*

System Surveillance and Testing

The team found the surveillance and testing was based on DOE rules and Orders and that the requirements for surveillance and testing demonstrated reliability and operability linked to the safety basis. With the exception of those issues tied to discovery of a potential unfiltered leak path, the review team concluded that surveillance and test procedures effectively confirm that the systems are within operating limits. The facility staff is well trained and demonstrated knowledge of system material condition, and operability through their surveillance and testing programs. HEPA filter qualification, procurement and quality assurance were thorough and addressed DOE directives for HEPA filter design and testing. The Procurement Engineering group has added an extra step, outside procedure requirements, in the review of HEPA filter requisitions - the HEPA filter SME review assures the specification and the filter application is acceptable. Calibration and maintenance of system equipment was confirmed by physical examination of select components. Based on data obtained during the assessment the review team concluded that objectives and criteria specified in the assessment plan have been met. However, with reference to the discovery of a number of small holes in the ductwork downstream of the last tested stage of HEPA filtration, the review team concluded that system surveillance activities were not adequately scoped or performed to ensure that potential unfiltered leak paths would identified and corrected.

Assessment issues identified are included in the System Maintenance Topic Area.

Good Practice

- The Procurement Engineering group has added an extra step, outside procedure requirements, in the review of HEPA filter requisitions - the HEPA filter SME review assures the specification and the filter application is acceptable

Software Quality Assurance

Software used in the confinement ventilation system was assessed to ensure it is subject to a software quality process consistent with 10CFR830.122. Changes and modifications to the Building 371 SC-1/2 and SC-3 Data Acquisition and Control System (DACS) database are controlled through the Site Engineering Design Process, the Site DACS Database Configuration Control procedure for Building 371 and the Site Computer Software Management Manual. If the DACS database change or modification affects an item or system that is credited in the Building 371/374 Complex Basis for Interim Operation (BIO), additional rigor is applied in the engineering design and work control process to ensure the requirements of the BIO is met. The Site Engineering Design Process includes requirements to identify required document changes, perform walk downs and control field changes. The Engineering Design Process also includes a review for designs that involve affected organizations. Engineering design reviews are performed that are formal, thorough, and involve the necessary technical disciplines. The Integrated Work Control Process (IWCP) controls the fieldwork, provides a list of

materials required for the job, and controls post work testing for hardware and software modifications, design changes and repairs.

The Building 37 1 DACS Database Configuration Control procedure defines the process used to maintain the configuration control of the Building 371 DACS Database. The configuration change control process includes an engineering review that develops design bases that effect parameters specified in design documentation (e.g., alarm set point, input range, etc.). The design bases may be in the form of an Engineering Design Package, Calculation, or Engineering Analysis in accordance with the Site engineering process. An independent verification of the DACS Database configuration control change documentation is performed by a DACS qualified individual. Any identified errors are resolved prior to starting work. The last update of the DACS Database was performed in March 2001 and involved changing the SC-3 loops low differential pressure DACS alarm in accordance with the System Evaluation Report, Chapter 2, HVAC System, Section 8.1.2. The final post work testing for this update was successfully completed in March 200 1.

The Team concluded that software used in the confinement ventilation system's instrumentation and control (I&C) components that perform functions important to safety is subject to a software quality process that is consistent with 10 CFR 830.122

Support Systems

1. Electrical Power Distribution System

A walkdown of the material condition of the control and power distribution devices, including interconnecting cabling, from system fans, electrical instrumentation, alarm and control devices from the exhaust fans back to the motor control centers (MCC) that provide electrical power to these fans was performed. Walkdowns were performed for MCCs EMCC1G-9A and EMCC1G-9B that provide power to the exhaust fans for filter plenums 141 and 142, EMCCIT-11 and EMCC1T-2 that provides power to the exhaust fans for filter plenums 241 and 242, and EMCC1T-9 and EMCC1T-10 that provide power to the return fans for filter plenums 221, 222 and 223. Visual inspections of accessible portions of cabling from the fans to the MCCs were also performed. Two deficient conditions were noted during the walkdown. The first is the discovery of tape covering a removed breaker location in panel in room 23 16 that had hand-written note stating exposed 480V located inside. The facility inspected this location and determined that the leads had been properly lifted and air gapped in the panel; a work control form was initiated to install a permanent cover. The second condition noted was a lit "Drive Fault" light for fan EF-141B and EMCC1G-9A. These issues were communicated to the facility for resolution. The overall material condition of the EPD system was determined to be acceptable.

Surveillance and preventive maintenance actions required for the electrical power distribution system were reviewed. Surveillance requirements as well preventive

maintenance required on the system, is identified in System Evaluation Report 11, Section 8.1.1. The surveillance procedure performed on the system was sampled to determine if it is consistent with the System Evaluation Report. A minor discrepancy between one section of the surveillance procedure and the System Evaluation Report was noted and identified to the facility for corrective action. This discrepancy does not impact the actual surveillance performed on the system. The work package for modification of fan interlocks was also reviewed and is discussed in the Configuration Management Section of the report. The results of the Phase I assessment of this system were also reviewed.

2. Uninterruptible Power Supply System

The material condition of the UPS system was determined to be acceptable based physical examination of vital system components during Phase II review activities. UPS system batteries, consisting of a bank of large Lead-Calcium cells provided evidence of thorough and effective system maintenance. Cell casings were clean and free of debris. Associated intercell connectors are maintained in a manner that effectively limits corrosion and contaminants that could adversely increase battery bank resistance. System electrical panels including the Direct Current Rectifier, DC-AC Inverter and associated Automatic Static Transfer Switch are serviced and maintained under contract with a local vendor and exhibit no signs of damage or degradation.

Review of surveillance data sheets for the period covering the past twelve months confirmed that UPS system compliance requirements as specified in System Evaluation Report Chapter 12 have been met. These include:

- UPS output voltage
- UPS output frequency
- Battery bank float voltage
- Charging float voltage of each cell
- Specific gravity and electrolyte temperature of each cell

The System Evaluation Report requirement to perform a 5-year full discharge load test of the UPS batteries was not validated because facility management had chosen to replace the battery bank in March of 1999.

3. Turbine Generator System

The team performed a walk-down of the Turbine Generator system located in room 358lconducted by Utility Technical Support. The turbine generator is load tested periodically to verify operability. The starting system uses compressed air. The air system consists of an air receiver and back up nitrogen tanks. The condition of the equipment and the area appeared in good condition. The utility Technical Support personal was knowledgeable on operation and condition of the equipment.

4. Compressed Gas System

The team performed a walk down of the compressed gas support system to assess the system's material condition, reliability, availability, and performance. The team focused on the SC-3 safety features that are required to be operable in order for the ventilation system to perform its intended safety function. The SC-3 safety features identified in the accident analysis for the Compressed Gas System include the Instrument Air System and the Nitrogen Supply System. The safety function of the Instrument Air System is to control the dampers for HVAC Systems 1, 2, 3, 4, and 9 and to provide air to the dry automatic sprinkler lines. The Nitrogen Supply System provides a backup source of compressed air for the Instrument Air System. The compressed gas system does not perform any SC-1/2 credited safety function as defined in the Building 371/374 Complex BIO.

The Compressed Gas System has four compressors, four after coolers, and four separators that operate in parallel and feed into two air receivers through a common header. The air receivers feed into either of two sets of filters and air dryers. The piping and valve arrangement allows for maintenance of any component without shutting down the Compressed Gas System. Downstream of the air dryers the system splits into Plant Air and Instrument Air.

Three of the four compressors are relatively new and the fourth compressor is part of the original building equipment. A replacement compressor is on hand awaiting installation. The system can meet the building load requirements with two of the four compressors operating.

The compressed gas support systems are maintained and operated in a manner consistent with their credited safety functions. The system has a very reliable operating history. Adequate redundancy and capacity exists in case equipment must be taken out of service for maintenance.

APPENDIX A

DETAILED DISCUSSION OF RESULTS

Assessment Form

DNFSB Recommendation 2000-2 Phase II Assessment

Building 371 Confinement Ventilation System

Topic Area: Safety Function Definition	**Criteria Met?**	
	Yes X	**No**

Objective

Safety basis-related technical, functional, and performance requirements for the confinement ventilation system are identified/defined in appropriate safety documents.

Criteria

1. Safety/Authorization Basis documents identify and describe 1) the confinement ventilation system's safety functions and the safety functions of any essential supporting systems, and 2) the confinement ventilation system's requirements and performance criteria that the system must meet to accomplish its safety functions.

Approach

Record Review:

1-1 Review the appropriate safety/authorization basis documents (Basis for Interim Operation (BIO) Building 371/374 Complex, Revision 5 and System Evaluation Report 2) to determine if the definition/description of the system safety functions includes:

- The specific role of the confinement ventilation system in detecting, preventing, or mitigating analyzed events
- The associated conditions and assumptions concerning the confinement ventilation system's performance
- Requirements and performance criteria for the confinement ventilation system and their active components, including essential supporting systems, for normal, abnormal, and accident conditions relied upon in the hazard or accident analysis.

Interviews: None.

Observations: None

Process:

Records Reviewed:

- Basis for Interim Operations (BIO) for Building 371/374, Revision 5
- System Evaluation Report Chapter 2
- DOE-STD-3009, Preparation Guide for U.S. DOE Nonreactor Nuclear Facility Safety Analysis Reports
- NTS Report NTS-RFO-KHLL-371OPS-1999-0003
- NTS Report NTS-RFO-KHLL-SITEWIDE-2000-0001
- September 27, 2001 Memorandum, "Revision of PAAA Corrective Action Task Associated with NTS-RFO-KHLL-SITEWIDE-2000-0001 – JLH-035-01"
- October 4, 2001 Memorandum, "Closure of PAAA Report NTS-RFO-KHLL-371OPS-1999-0003, Task 30 [29], PATS 99-002098, Plan 03, Task 03 – MWH-016-01"
- PRO-1475-ADM-37 1, "Building 37 1/374 Implementation Document Change Control Process"
- November 16, 2001 Memorandum, "Closure of PAAA Report NTS-RFO-KHLL-371OPS-1999-0003, Task 30, PATS 99-002098, Plan 03, Task 04 – MWH-018-01"
- June 15, 2001 Memorandum, "Closure of PAAA Report NTS-RFO-KHLL-371OPS-1999-0003, Task 31, PATS 99-002098, Plan 03, Task 05 – MWH-010-01"
- AC 5.8 MAP Cards
- August 15, 2001 Memorandum, "Closure for NTS-RFO-KHLL-371-1999-0003 Task 32 and 33 – JWL-024-01"
- June 28, 2001 Memorandum, Building 371/374 Authorization Basis Mapping – JWL-019-01." BUILDING 37 1/374 System Evaluation Report Index with electronic linking of requirements among BIO, System Evaluation Reports and implementing documents.
- June 12, 2000 Letter from Barbara Mazurowski to Robert Card, "Authorization Basis Development"

Personnel Interviewed:

- Nuclear Regulatory Division Director, DOE RFFO
- Nuclear Regulatory Division, DOE RFFO
- Nuclear Safety Manager
- Operations Manager
- Project Chief Engineer
- Electrical Engineer
- Nuclear Safety Manager, K-H
- Nuclear Safety, K-H
- Nuclear Safety, K-H
- Quality Assurance, K-H
- Quality Assurance Manager, K-H

- Price Anderson Program, K-H

Operations Observed:
None

Results:

Record Review/Interviews:
The Basis for Interim Operation (BIO) Building 371/374 Complex, Revision 5 and System Evaluation Report Chapter 2 appropriately describe the confinement ventilation system safety functions including role of the confinement ventilation in detecting, preventing, or mitigating analyzed events in the BIO. The safety function descriptions include associated conditions and assumptions and requirements and performance criteria for the confinement ventilation system. Active components and essential supporting systems are identified for normal, abnormal, and accident conditions.

The Building 37 1 System Evaluation Report Chapter 2 provides information and description of the confinement ventilation system that addresses significant elements of DOE-STD-3009 since much of this information is not included in the present BIO. This information includes:

- System descriptions
- Safety function/categorization of safety class/safety significant SSCs
- System boundaries
- Functional requirements
- Ability of the safety class SSCs to meet performance criteria.

The System Evaluation Report is not a DOE approved authorization basis (AB) document. However, it serves a key role in addressing the above elements of DOE-STD-3009 as safety basis documentation for the confinement ventilation system in Building 37 1/374. Building 371 implementing procedures are based on the System Evaluation Report safety bases.

PAAA NTS reports (NTS-RFO-KHLL-371OPS-1999-0003 and NTS-RFO-KHLL-SITEWIDE-2000-0001) issued in 1999/2000 identified sitewide (including Building 371) violations and deviations with respect to assurance of operability and functionality of safety class and safety significant SSCs. Inconsistencies were found with the System Evaluation Reports and implementing procedures and the facility ABs. Sitewide corrective actions were initiated to break the link between System Evaluation Reports and the ABs and to capture all operability requirements and associated acceptance criteria within the applicable AB, and not in the System Evaluation Reports.

Since Building 371 is still processing nuclear material, adoption of the DBIO format (and breaking the tie to the System Evaluation Report) has been deferred. The

following corrective actions have been implemented as identified in NTS-RFO-KHLL-371OPS-1999-0003 to ensure accurate management of the System Evaluation Report, AB, and implementing procedures:

- Task 29: Procedure PRO-1475-ADM-371 has been issued to manage the Building 371/374 change control process (reference October 4, 2001 Memorandum, "Closure of PAAA Report NTS-RFO-KHLL-3710PS-1999-0003, Task 30 [29], PATS 99-002098, Plan 03, Task 03 – MWH-016-01")
- Task 30: Independent reviews of the 16 System Evaluation Report chapters have been completed and 15 require revision (reference November 16, 2001 Memorandum, "Closure of PAAA Report NTS-RFO-KHLL-3710PS-1999-0003, Task 30, PATS 99-002098, Plan 03, Task 04 – MWH-018-01")
- Task 31: The Building 371 Configuration Control MAP Cards have been revised for improved effectiveness in the internal assessments (reference June 15, 2001 Memorandum, "Closure of PAAA Report NTS-RFO-KHLL-3710PS-1999-0003, Task 31, PATS 99-002098, Plan 03, Task 05 – MWH-010-01")
- Task 32: Electronic linking of System Evaluation Reports and implementing procedures has been completed (reference June 28, 2001 Memorandum, Building 371/374 Authorization Basis Mapping – JWL-019-01").

Two additional corrective actions were identified in response to NTS-RFO-KHLL-

371OPS-1999-0003 to provide additional assurance of closure for this issue:

- Task 34: Perform a fast scan assessment of the effectiveness of completed tasks 28-33 and 35 (scheduled for June 17, 2002 completion)
- Task 35: Revise and implement revisions to System Evaluation Report Chapters 1-4 and 6-16 to address the results of the independent review conducted per task 30 (scheduled for April 15, 2002 completion).

Review of the above corrective actions and closure documentation and completion of Task 35 provides acceptable basis to ensure consistency among the AB, System Evaluation Report and implementing procedures.

Review of the process for implementation of NTS-RFO-KHLL-371OPS-1999-0003 Task 35 revealed a rigorous and thorough approach to review and resolve independent reviewer's comments and to revise the System Evaluation Report, including a "roundtable" review among appropriate entities (nuclear safety, operations, maintenance, engineering, etc.). System Evaluation Report Chapter 2 for the confinement ventilation system has been identified as requiring revisions to ensure consistency with the AB and implementing procedures. This is scheduled for completion by April 15, 2002. This is identified as an opportunity for improvement.

Observations:
N/A

Conclusion:

The Building 371 BIO and System Evaluation Report Chapter 2 appropriately identify and describe 1) the confinement ventilation system's safety functions and the safety functions of essential supporting systems, and 2) the confinement ventilation system's requirements and performance criteria that the system must meet to accomplish its safety functions. The safety function definition criteria for the confinement ventilation system are met.

Operability Issues/Concerns:
None

Opportunities for Improvement:

- During the course of the review, it was noted that discrepancies exist between the BIO LCOs, Surveillance Requirements, System Evaluation Reports, and implementing surveillance procedures. These discrepancies may have contributed to some of the other deficiencies noted elsewhere in this report. The building had previously identified this issue and is working to correct the deficiency under a corrective action plan developed under Price Anderson Amendments Act report NTS-RFO-KHLL-1999-0003 and a subsequent Fast Scan Assessment.

Good Practices:

- The Electronic Linking and Procedure Maintenance (ELPM) implementation at Building 371 provides an effective mechanism to readily identify implementing documents for AB and safety basis requirements. The process helps ensure that configuration management of Authorization Basis requirements is maintained through electronic linking of the Basis for Interim Operation (BIO), System Evaluation Reports, and implementing documents.

Assessment Form

DNFSB Recommendation 2000-2 Phase II Assessment

Building 371 Confinement Ventilation System

Topic Area: Configuration Management	**Criteria Met?**	
	Yes X	**No**

Objective

Changes to safety basis-related requirements, documents, and installed components are controlled.

Criteria

1. Changes to the confinement ventilation system's safety basis requirements, documents, and installed components are designed, reviewed, approved, implemented, tested, and documented in accordance with controlled procedures. Consistency is maintained among the confinement ventilation system system's requirements and performance criteria, installed equipment and components, and associated documents as changes are made.

2. Limited technical walkdown of selected the confinement ventilation system's components verifies that the actual physical configuration of these components conforms to documented design and safety basis documents for the systems.

3. Changes to the confinement ventilation system's safety basis requirements, documents, and installed components conform to the approved safety/authorization basis (safety envelope) for the facility, and the appropriate change approval authority is determined using the Unreviewed Safety Question (USQ) process.

4. Facility procedures ensure that changes to the confinement ventilation system's safety basis requirements, documents, and installed components are adequately integrated and coordinated with those organizations affected by the change.

5. Software used in the confinement ventilation system's instrumentation and control (I&C) components that perform functions important to safety is subject to a software quality process consistent with 10 CFR 830.120.

Approach

Record Review:

1-1 On a sample basis, review and evaluate the change control process and procedures and associated design change packages and work packages to determine whether

the change control process and procedures are adequate and effectively implemented. Determine whether:

- SSCs and documents affected by the change are identified
- Changes are accurately described, reviewed and approved as appropriate
- Installation instructions, post-modification testing instructions and acceptance criteria for turnover to facility operations are specified, and
- Important documents affected by the change (e.g., operating and test procedures, Master Equipment List, etc.) are revised in a timely manner.

3-la Review documentation, such as work packages, for selected changes made to the confinement ventilation system's requirements, installed equipment, and associated documents. Determine whether:

- System changes are reviewed to ensure that system requirements and performance criteria are not affected in a manner that adversely impacts the ability of the system to perform its safety functions
- The USQ process (i.e., USQ screens and USQ safety evaluations/ determinations) is being appropriately used

5-1 For software used by safety system I&C components, request the facility staff to identify:

- The applicable software quality assurance requirements,
- The software quality assurance standards/controls applied to software development, procurement, acceptance, and testing
- The basis for acceptance of these standards/controls as providing adequate assurance that the software is acceptable for performing its associated safety functions

5-2 Review software quality assurance requirements, procedures, and records. Determine whether:

- Software quality assurance documentation exists for software in use
- Configuration management procedures exist for updates, changes, and version control of software and related documentation such as software design documents and a list of software configuration items installed on computer-based components
- An appropriate degree of independence exists between those responsible for software development and quality assurance functions
- A process is in place and used to identify, evaluate, and resolve operational problems that are attributable to-software

Interviews:

1-2 Interview a sample of cognizant confinement ventilation system's line, engineering, and other personnel to verify their understanding of the change control process and commitment to manage changes affecting design and safety basis in a formal, disciplined and auditable manner.

3-1b Interview individuals responsible for processing selected changes made to the confinement ventilation systems requirements, installed equipment, and associated documents. Determine whether:

- System changes are reviewed to ensure that system requirements and performance criteria are not affected in a manner that adversely impacts the ability of the system to perform its safety functions
- The USQ process (i.e., USQ screens and USQ safety evaluations/ determinations) is being appropriately used

4-1 Determine whether engineering (including the design authority and technical disciplines for process control, electrical, mechanical, chemical, HVAC, nuclear, criticality, structural, etc.), operations, and maintenance organizations are made aware of system changes that affect them, and are appropriately involved in the change process. Verify integration and coordination with other organizations that could logically be affected by the change such as facility training, document control, construction, radiological control, OSHA occupational safety, industrial hygiene, occupational medicine, hazard analysis/safety basis, safeguards and security, and fire protection.

5-3 Interview facility engineering and operations staff to determine their awareness of software quality assurance requirements for system software under their cognizance.

Observations:

2-1 Walkdown selected confinement ventilation system components and compare the actual physical configuration of these components to system documents such as design basis and safety/authorization basis documents, system design descriptions, and system drawings such as piping and instrumentation diagrams. Identify any temporary changes, or configuration discrepancies that call into question (1) the operability or reliability of the confinement ventilation systems or (2) the adequacy of the change control or document control processes, including drawing revision, applied to the confinement ventilation systems.

Criterion 1: Changes to the confinement ventilation system's safety basis requirements, documents, and installed components are designed, reviewed, approved, implemented, tested, and documented in accordance with controlled procedures. Consistency is maintained among the confinement ventilation system system's requirements and performance criteria, installed equipment and components, and associated documents as changes are made.

Process

Records Reviewed:

- Integrated Work Control Program (IWCP) packages:
  - T0106534, SF202 Failed to Start
  - T0105700, Replace and Adjust Belts on EF-242B Sheaves and Pillow Block Bearings
  - T0105632, Replace Interlock Relays, Remove High DP Interlocks

- Engineering Design Packages:
  - EO 51151, (T0103488) Install SAAM Rm. 3602, C-Cell
  - EO 52384, (T0107315) Fabricate and Install a Physical Barrier in Glovebox *47*
  - EO 52562, (TO108455) Remove C902Eauto Restart and Sequencer
  - EO 52649, (T0109096) Magnehelic Gauge on GB-70A
  - EO 52644, ((T0109305) Install Point Source Capture for LANL Head Space Gas Sampling Cart in Rm. 2217, Building 371.

- Procedures and Other Documents Reviewed
  - Building 371/374 Basis for Interim Operation
  - Building 371/374 System Evaluation Report
  - MAN- 128-CCCP- 1 .0, *Configuration Change Control Program Manual/Site Configuration Control Description*
  - 1-V5 1 -COEM-DES-2 10, *Site Engineering Process Procedure*
  - MAN-027-SERM, *Site Engineering Requirements Manual*
  - MAN-071-IWCP, *Integrated Work Control Program*
  - 1-PRO-072-001, *Inspection and Acceptance Test Process*
  - PRO-664-NSP-USQP, *Nuclear Safety Program Unreviewed Safety Question Program*
  - PRO-8 15-DM-01, *Developing and Maintaining Documents*
  - MAN- 13 1 -QAPM, *Quality Assurance Program Manual*
  - 1 -W59-COEM-AMN- 16 1, *Preparation, Review, and Approval of System Evaluation Reports*
  - PRO-1475-ADM-371, *Building 371/374 Implementing Document Change Control Process*
  - 3-MAN-033-ACP-AC5.0, *Building 371/374 Administrative Control program Manual*

- Fast Scan Assessment Report, *An Effectiveness Evaluation of the Corrective Actions Implemented for Building 371 Administrative Control (AC) 5.8, Configuration Management*
- Report on Pilot Assessment of Confinement Ventilation System Assessment Criteria and Guidelines at LLNL Building 332
- Report on Pilot Phase II Assessment of Confinement Ventilation System (CVS) of H-Canyon at Savannah River Site
- DNFSB Recommendation 2000-2 Initial Phase I Assessment for RFETS Building 371
- Completed Management Assessment Program assessments for Configuration Management, Surveillance Codes AC5-08A through AC5-08H, and AC5-08Z.

Personnel Interviewed:

- Chemical/Civil Engineer
- Planning and Engineering Manager
- Facilities Engineer
- Mechanical Engineer (HVAC)
- Lead Mechanical Engineer
- Authorization Basis/Administrative Controls Implementation Lead
- Technical Support (HVAC)
- Stationary Operating Engineer (3)
- Facility Manager
- Deputy Project Manager
- Operations Manager

Operations Observed: N/A

Results:

Record Review:

The change control process and procedures that implement this process in Building 371 were reviewed. For safety system components, the change control process is implemented through the Site Engineering Process Procedure (1-V51-COEM-DES-210). The purpose of this procedure is to provide instructions for developing and controlling design documents at the site including engineering design packages, drawings, specifications, calculations and engineering procurements. This procedure ensures that design and design changes are defined, controlled, verified, approved and revised. Chapter 3 provides the criteria for selecting the appropriate engineering approach for the specific task. When a SSC is constructed or modified, a formal Engineering Design Package (EDP) is required. Chapter 4 specifies the requirements and provides the instructions for developing the EDP. Design requirements are established in section 4.3 of the procedure, with specific instructions for the design in section 4.4. These instructions include identification of the interfacing disciplines and use of the planning team from the Integrated Work Control Program (IWCP).

Part of the planning process is the performance of a walkdown to ensure a clear understanding of the technical scope (including drawings) and documentation of the walkdown results. Development of inspection and testing requirements is specified in section 4.4.3 [8] and [9] of the procedure, using the requirements of the Inspection and Acceptance Test Process procedure (l-PRO-072-001). EDP checking, independent verification and review by the planning team organizations are specified in sections 4.4.5 and 4.4.6. EDPs are approved by the designated Responsible Engineering Manager (REM) (section 4.4.7). Instructions are also established for temporary modifications (section 4.4.14).

The revision process for EDPs, Calculations, Specifications, and Drawings is contained within the respective chapters of DES-210, these are:

- Chapter *5, Engineering Change Requests,* for EDPs,
- Chapter *7, Calculations and Other Documents,* section 7.3.4 for Calculations,
- Chapter *8, Specifications,* section 8.7 for Specifications and
- Chapter *9, Drawings,* section 9.6 for Drawings

Consistency among the VSSs performance criteria, installed equipment and associated documents is maintained through several means. For modifications to the system, the Baseline Document Change Form (BDCF), DES-210 Appendix 4.3, is completed. The BDCF is used to identify controlled documents affected by the design activity. These documents include drawings, specifications, preventive maintenance orders, surveillances, and System Evaluation Reports. The responsible facility manager is required to indicate on the BDCF which items require update prior to system return to service, and the Project Chief Engineer determines which documents require update at project closeout. The building implements a procedure (PRO-1475-ADM-371, *Building 371/374 Implementing Document Change Control Process)* that ensures consistency among the various procedures and authorization basis controls. Use of and evaluation of this procedure is described in more detail in Criteria 3 and 4 below.

Nuclear Safety Manual (l-MAN-01 8-NSM) section 6.1.1, Nuclear Safety Authorization Basis (AB) Documentation, specifies the site requirements, guidance, and expectations for the preparation, review, and approval of facility safety analysis and nuclear safety AB documents. This manual has been prepared to be in compliance with DOE Order 5480.23,.which sets forth the definition, basis, and requirements for developing nuclear safety analysis reports. (This order has since been replaced by the Nuclear Safety Rule and Order 5480.23 is slated to be removed from the Kaiser Hill contract). Section 6.1.1.7 of the manual requires that AB changes made to a facility or activity be evaluated and documented in the nuclear safety AB on a real-time basis. Changes may occur from as-discovered conditions or from planned events. DOE, RFFO approval is required for changes to the AB documentation that exceed the approved authorization bases. An annual review of a nuclear safety AB document is also performed. Annual reviews include a review of

the facility System Evaluation Report to ensure compliance with the surveillance requirements identified in the System Evaluation Report.

In November 1999, the project determined that configuration control pursuant to Section 10 of the Building 3711374 Administrative Control (AC) Program Manual was not being adequately followed and a Programmatic Deficiency was declared. Procedures implementing requirements from System Evaluation Reports were found to be inconsistent with the System Evaluation Report requirements and the process for ensuring this was found to be ineffective. Price Anderson Amendments Act report NTS-RFO--KHLL-371OPS-1999-0003 was issued. Twenty-six corrective actions (CAs) were identified, the last of which involved the conduct of a "Fast Scan Assessment" to measure the effectiveness of the actions taken by the building to closeout the CAs. The Fast Scan Assessment, number FY01-092-QA371, was completed in April of 2001. It assessed the effectiveness of the CAs implemented for the Building 371/374 Programmatic Deficiency issued against Administrative Control (AC) 5.8, Configuration Management. The Fast Scan assessment was scheduled following the discovery of additional failures to maintain consistency between the related Authorization Basis (AB) documents, System Evaluation Reports, surveillance procedures, and actual configuration of the building. The Fast Scan Assessment concluded that certain CAs were not effective. Supplemental CAs were developed which added CAs 28 through 35.

As of this assessment, all supplemental CAs are complete except numbers 34 and 35. CA 35 requires the revision of certain System Evaluation Reports. CA 34 requires the performance of another "Fast Scan Assessment" to measure final effectiveness. Completion of the System Evaluation Report revisions is to be completed by April 15, 2002. The Fast Scan is scheduled to be completed by June 15, 2002.

The change control process was evaluated and it was determined that the corrections made to 3-MAN-033-ACP-AC5.0, Rev. 1, Chapter 10 (AC5.8) due to the CAs as outlined in Fast Scan Assessment FY01-092-QA371 are sufficient. These covered changes to System Evaluation Reports, AB documents, designs, or procedures as part of the program summary in Section 10.5 of the Building 371/374 *Administrative Program Manual.*

Additionally, the Document Change Impact Form, found in PRO-1475-ADM-371, *Building 371/374 Implementation Document Change Control Process,* was revised as the result of a CA to ensure that all documents affected by a change would be identified, updated appropriately, and implemented in a coordinated manner ensuring that configuration controls of AB related documents were kept consistent and would be revised in a timely manner. A review of several work control documents and engineering design packages was performed. No issues were noted, compliance with the site and facility procedures was found, and there is a process in place to ensure the document change process.

Interviews:

Interviews were conducted with the Project Chief Engineer, several system engineers and line management personnel. The engineers who perform most of the engineering design work in the facility had excellent knowledge of the implementation of configuration management and the documents that require this (Site Engineering Process Procedure, Integrated Work Control Manual), and the importance of maintaining the safety basis of the facility. However, they did not have an understanding of the *Configurations Change Control Manual/Site Configuration Control Description,* MAN- 128-CCCP-1.1 (the overall site configuration management program). Discussions with the Project Chief Engineer revealed that his emphasis with the staff engineers has been to ensure they understand and comply with the implementing documents rather than the overall site requirements. Additionally, he intends to improve their knowledge through upcoming training as part of the System Engineer qualification process. Interviews conducted with the line management personnel revealed a good understanding of the program and its importance to maintaining the safety basis of the facility.

Observations:
As noted during the walkdowns performed for Criterion 2 below and Criterion 2 of the System Maintenance Topic Area, it was discovered that were four one half-inch (approximate) holes, one each in the inlet piping for Exhaust Fans 241A, 241B, 242A, and 242B. Holes were also discovered on the discharge of the fans. The facility has indicated that the work that made the holes was performed several years ago. Due to time limitations, the assessment team was not able to adequately assess the reason for why the holes were left in these sections of ductwork. Other exhaust fan locations had similar duct penetrations, but these had all been sealed. It is therefore recommended that the facility conduct an evaluation to determine the root causes of why the holes were allowed to remain in the ducting at the completion of the work that made them, and why routine facility inspections did not detect their presence.

Conclusion:
This criteria has been satisfactorily met. The facility is continuing implementation of corrective actions regarding consistency of the System Evaluation Reports to the implementing procedures under a formal corrective action plan. This item is noted as an Opportunity for Improvement in the Safety Function Definition Functional Area.

Operability Issues/Concerns:
None

Opportunities for Improvement:
- The facility should conduct an evaluation to determine why the holes discovered in inlet piping for Exhaust Fans 241A, 241B, 242A, and 242B were allowed to remain at the completion of the work that made them.

Good Practices
N/A

*Criterion 2: Limited technical wulkdown **of** selected the confinement ventilation system's components verifies that the actual physical configuration **of** these components conforms to documented design and safety basis documents **for** the systems.*

Process

Records Reviewed:

- 1-V51-COEM-DES-210, Site Engineering Process Procedure
- Building 371/374 Basis for Interim Operation
- Building 371/374 System Evaluation Report, Chapter 2,
- Work Package T0105632, Replace Interlock Relays, Remove High DP Interlocks
- Work Package T0106422, Replace Sprinkler Heads in Basement
- Work Package T0106534, TS/R Supply Fan 202
- Work Package T0166780, TS/R Return Fan 223A/B Timer
- Drawing 25 155-221, Plutonium Recovery Outside Air Intake System P&I Diagram
- Drawing 25 155-289, Plutonium Recovery Zone 1A Exh. Air FP-242-System 2 P&I Diagram
- Drawing 25155-290, Plutonium Recovery Zone 1A Exh. Air FP-243 System 2 P&I Diagram
- Drawing 25 155-293, Plutonium Recovery Zone III Return Air FP-223 – System 2 P&I Diagram
- Drawing 25001-700, 371 Bldg. Composite HVAC Flow Diagram
- DNFSB Recommendation 2000-2 Initial Phase I Assessment for RFETS Building 371

Personnel Interviewed:

- Mechanical Engineer (HVAC)
- Technical Support (HVAC)

Operations Observed:

Walkdowns were performed of the confinement ventilation system from the inlet air-handling unit to the exhaust plenums. Specific equipment inspected included:

- Outside Air Unit (OAU) 100 including the accessible portions of the missile barrier, roll filters, sock filters, HEPA filters, Air Operated Valves (AOV) 6006 and 6007, and the surrounding enclosure for the OAU.
- Accessible portions of the supply ducting for System 2 including the fire and back draft dampers located in the Building 371 attic area.
- Supply Air Units (SAU) 201, 202, and 203 including the Supply Fans 201,202 and 203, the associated air operated valves, and the inlet filters.
- Exhaust Filter Plenums FP-241, FP-242, and FP-243, and Return Filter Plenums FP-221A and FP-221B including their associated fans, ducting, and valves.
- A walkdown of a typical glovebox including inlet filters, exhaust filters and ducting was performed in room 3335.

Results:

Record Review:
See Observations section below

Interviews:
See Observations section below

Observations:
Walkdowns of the confinement ventilation system revealed that drawings for the ventilation system have not been kept up to date and do not reflect in all cases the as-built configuration of the facility. For example, drawing 25155-221 of the outside air intake system obtained from the site engineering document database (EDOC) does not show the supply HEPA filter system installed several years ago. The walkdown of Drawings 25 155-289 and 25 155-290 for filter plenums 242 and 243 showed only minor discrepancies between the drawing and the as-built condition. Discussions with the system engineer, project chief engineer, and operations management confirmed that drawings for the facility, including those for vital safety systems, had not been kept up-to-date in the past and that there is no effort planned to remedy this. This is due to the large effort and expense that would be required to update drawings for the vital safety systems and the relatively short time the facility is expected to remain in operation.

Investigation of site procedures and requirements revealed a specific acknowledgement that site drawings do not reflect the actual configuration of buildings. To this end, procedures and manuals stipulate that walkdowns must be conducted prior to design or construction activities to document the actual conditions and configuration of the project being worked. Site and Building 371 procedures and manuals listed below confirm the requirement to conduct walkdowns to verify all drawing information prior to use.

1) CCCP – *Configuration Change Control Manual,* Section 5.3 *Document Control* second paragraph states: "Due to the inaccuracy of Site drawings, the Engineering Program SHALL require that prior to any design work proceeding the area under the proposed design work must first be walked down to confirm the existing configuration."

2) MAN-027-SERM, *Site Engineering Requirements Manual,* Section 6.4 states: "Existing Site drawings SHALL not be used as the sole source basis for design. Field verified drawings represent the best and most complete information presently available on Structures, Systems and Components (SSCs) at the Site. However, much of the detailed information expected on a drawing is not shown or is not available. In other instances, the drawing may be incorrect or incomplete."

3) 1-V51-COEM-DES-210 (DES-210), Revision 7, *Site Engineering Process Procedure,* Section 4.4.1, *Design Inputs Identification,* step 11, states: "Perform a walkdown to ensure clear understanding of the technical scope and constructability/destructability issues, utilizing necessary craft, planning, safety, and operations personnel. Participation in the walkdown by HDIT organizations may be limited, but the Designer should contact them for input. The extent of the walkdown will be limited by ALARA considerations. Document the pertinent Walkdown Results/Conclusions in the EDP Template, Section 7. [A] Based on walkdown results, revise outputs from Steps [2{ - [11], as necessary."

4) Basis for Interim Operation Building 371/374 Complex, Volume I, BIO, Appendix A, Section 5, *Configuration Management,* Subsection 5.8.2, *Key program Elements,* item c states: "When facility modifications are to be performed, walkdowns are conducted to confirm configuration; applicable requirements are incorporated; controlled changes are confirmed to be technically correct; and affected controlled documents are consistently modified.

5) 3-MAN-033-ACP-AC5.0, Revision 1, *Administrative Control Program Manual,* Administrative Control (AC) 5.8 - Chapter 10, *Configuration Management,* Section 10.3, *Credited program Elements,* item b, states: "When facility modifications are to be performed, walkdowns are conducted to confirm the current configuration; applicable requirements are incorporated; controlled changes are confirmed to be technically correct; and affected controlled documents are consistently modified."

The simplified flow diagram for HVAC System 2 (System Evaluation Report Chapter 2, Attachment 3, Figure 2) was also compared to the as-built facility configuration. Areas included in the walkdown are noted in the Operations Observed section above. No discrepancies were noted during the walkdown.

During the walkdown it was discovered that were four one half-inch (approximate) holes, one each in the inlet piping for Exhaust Fans 241A, 241B, 242A, and 242B. All of the holes were completely covered (sealed) with vinyl tape. Several holes were also noted in the exhaust side of the ducting for the fans. This condition was immediately reported to the facility and corrective actions were initiated. This item is discussed in detail under Criteria 2 in the System Maintenance Topic Area.

The engineering process also requires that drawings of systems be updated after modifications are performed. Chapter 4 and 9 of the Site Engineering Process Procedure contains the instructions for how and when to update drawings. These instructions require that the responsible engineering manager determine which drawings are to be updated at project closeout and provides the process for doing so. The instructions do not require that all elements of at drawing be updated; it only requires those portions affected by the modification to be updated. An example of this is the Integrated Work Control Package for replacement of ventilation interlock relays and removal of the high differential pressure interlocks. The drawings for the

interlocks were walked down during the work planning process and at project completion, and were confirmed to be updated in the site's Engineering Documentation system.

A review of the Phase I assessment report was also conducted. The report notes that the ventilation system has generally been available to support its safety functions and building operations. In the cases where individual components have experienced unavailability, the system has sufficient redundancy to maintain performance of its safety function. This assessment's conclusions confirm this. No evidence has been seen to indicate that the system will not perform its intended safety function when needed.

In summary, the lack of availability of completely accurate drawings of the confinement ventilation system does not hinder the facility from safely operating over its short remaining life. The building (and Rocky Flats Site) has instituted several controls to ensure that when drawings are utilized, they are first field verified to be correct or modified as needed to document the as-found condition. The assessment team found evidence that these walkdowns are occurring and that the engineers and operations personnel are properly aware of the situation. Additionally, the BIO safety requirements are rooted in functionality of the safety systems. System operability is determined through a series of defined functional requirements, and associated compliance requirements and acceptance criteria. The availability of completely accurate drawings, although desirable, is not deemed to be a deficiency that needs to be corrected due to the tremendous cost in developing "as-built" drawings for even a select few systems, and the short (2-3 year) remaining life of the facility.

Conclusion:
Through field inspection and discussions with project personnel, drawings for the confinement ventilation system were determined to be out of date and not representative of the as-built configuration of the facility in some cases. This is recognized by the facility and procedural requirements are in-place and working that accommodate this. Therefore, no action is recommended to update or change the process for updating and maintaining drawings of the facility. This criterion has been met.

Operability Issues/Concerns:
None

Opportunities for Improvement:
None

Good Practices:
N/A

Criterion 3: Changes to the confinement ventilation system's safety basis requirements, documents, and installed components conform to the approved safety/authorization basis (safety envelope) for the facility, and the appropriate change approval authority is determined using the Unreviewed Safety Question (USQ) process.

Criterion 4: Facility procedures ensure that changes to the confinement ventilation system's safety basis requirements, documents, and installed components are adequately integrated and coordinated with those organizations affected by the change.

Process

Records Reviewed:

- Work Package T0105632, Replace Interlock Relays
- PGC-371-00.1341-MAD
- USQD-371-01.0912-BJS
- Work Package T0108232, TS/R Loop 6092, Room 3563
- Categorical Exclusion (per PRO-664-NSP-USQP) for TO108232
- Work Package T0108242, Temp Mod per COOP to Jumper Supply Fan Isolation Damper Relay
- USQD-371-02.0171-SLA
- Work Package T0107069, TS/R DAC PCM
- Categorical Exclusion (per PRO-664-NSP-USQP) for TO107069
- Nuclear Safety Programmatic Compliance Assessment Report FY01-241-KHE; independent assessment of USQD process
- PRO-1475-ADM-371, "Building 371/374 Implementing Document Change Control Process"
- PRO-664-NSP-USQP, Unreviewed Safety Question Determination Procedure
- MAN-07 l-IWCP, Integrated Work Control Process
- MAN-016-ISM, Integrated Safety Management
- MAN-066-COOP, Conduct of Operations
- MAN-128-CCCP-1.0, Configuration Change Control
- PRO-ZZZ-NSP-IVR, Implementation Verification Review
- USQDs and SESs for B 371 HVAC (completed 2001 and 2002)
- IP-01-048 (PGC-371-01.1916-SJS); *PRO-1475 implementation*
- USQD-371-02.0283-SJS
- IP-01-054 (PGC-371-02.0307-SJS); *PRO-1475 implementation*
- October 4, 2001 Memorandum "Closure of PAAA Report NTS-RFO-KHLL-371OPS-1999-0003, Task 30 [29], PATS 99-002098, Plan 03, Task 03 – MWH-016-01"

Personnel Interviewed:

- Quality and Compliance Program Manager
- PA and EP Manager
- Nuclear Safety Specialist

- Nuclear Safety Manager
- Authorization Basis/Administrative Control Implementation Lead
- Facility Manager
- Project Chief Engineer
- Electrical Engineer
- Nuclear Safety Manager, KH
- Nuclear Safety, KH
- Nuclear Safety, KH
- Quality Assurance, KH
- Quality Assurance Manager, KH

Operations Observed:
N/A

Results

Record Reviews/Interviews:
Selected work packages (T0105632, T0108232, T0108242, & T0107069) and associated USQDs/SESs/Categorical Exclusions for Building 371 confinement ventilation system changes were reviewed. Each of the work packages identified the SC or SS SSCs and applicable safety requirements (LCOs, SRs, etc.) affected by the change. Appropriate USQDs, SESs, AB page changes, or categorical exclusions were conducted for the change. In addition, appropriate independent safety reviews (ISRs), "Return to Service & Operability Checklist," and/or "Post Work Tests" were conducted for the change and for assurance of operability.

The USQD/SES evaluations completed in 2001 and 2002 related to Building 371 confinement ventilation system changes to the system/equipment, AB, System Evaluation Report, and implementing documents were reviewed. The review indicated that appropriate safety reviews are being conducted. In addition, results and conclusions of the Nuclear Safety programmatic compliance assessment (FY01-241-KHE) for Building 371 USQDs and SESs were reviewed. This is an annual independent review, conducted by K-H Nuclear Safety as required by the Nuclear Safety Manual, of the adequacy of USQD and SES evaluations, etc. The K-H NS independent review concluded (for a random sample of 29 evaluations) that all USQD/SES evaluations performed by Building 371/374 exceeded the acceptance criteria for adequate justifications and-conclusions and most provided additional, pertinent information beyond the "adequate" criteria. Note: One evaluation was not reviewed and rated since it was in process and not a final evaluation at the time of the independent review.

The review of Building 37 1 work packages and associated USQD/SES evaluations and interviews of Building 371 personnel concluded that Building 371 is appropriately implementing the USQD process. System changes are reviewed to ensure system requirements and performance criteria are not affected in a manner that

adversely impacts the ability of the system to perform its safety functions. The USQ process (i.e., USQ screens and USQ safety evaluations / determinations) is being appropriately used.

Review of the work packages and interviews of Building 371 personnel concluded that appropriate affected organizations are appropriately involved in the change process. Operations, Maintenance, Nuclear Safety, and Engineering (design authority and appropriate technical disciplines for process control, electrical, mechanical, chemical, HVAC, nuclear, criticality, structural, etc.) are made aware of system changes that affect them. The review found that Building 371 is conducting appropriate integration and coordination with other affected organizations (e.g., facility training, document control, construction, radiological control, OSHA occupational safety, industrial hygiene, occupational medicine, hazard analysis/safety basis, safeguards and security, and fire protection).

Building 371 implemented corrective actions in response to violations and deviations identified in PAAA Report NTS-RFO-KHLL-371OPS-1999-0003 (Task 29) to ensure accurate management of the System Evaluation Report, AB, and implementing procedures. Procedure PRO-1475-ADM-371 has been issued to manage the Building 371/374 change control process (reference October 4, 2001 Memorandum "Closure of PAAA Report NTS-RFO-KHLL-3710PS-1999-0003, Task 30 [29], PATS 99-002098, Plan 03, Task 03 – MWH-016-01"). Review of PRO-1475 and implementation by Building 371 personnel, found a line management process that has objectives to:

- Ensure proposed AB implementing document changes are necessary and sufficient
- Ensure AB/System Evaluation Report/ACPM controls and requirements are incorporated in appropriate documents and work instructions
- Ensure facility personnel are knowledgeable of changes to AB/System Evaluation Report/ACPM controls and requirements
- Ensure AB/System Evaluation Report/ACPM controls and requirements have been implemented through the Implementation Validation Review (IVR) or Operational Readiness Review (ORR/RA) process in accordance with PRO-ZZZ-NSP-IVR.

Samples of PRO-1475 Implementation Plans and associated documentation were reviewed: IP-01-048 (PGC-371-01.1916-SJS & USQD-371-02.0283-SJS) and IP-01-054 (PGC-371-02.0307-SJS). Implementation of PRO-1475 by Building 371 was considered a good practice.

The review of Implementation Plan IP-01-048 for PRO-1475 implementation, "Post Implementation Actions" identified "System Evaluation Report Ch 8 changes IAW System Evaluation Report updates." Inquiry into this revealed that an "additional" change in the Page Change was to remove the 5# propane tank. This was not initially identified as part of the page change and therefore was added as a "Post Implementation Action" during processing of the implementation plan. However, it

does not appear that this change would be verified through the IVR process since it was not included on the IVR Checklist for IP-01-048. It is recommended that facility management review the process to ensure that post actions which impact the AB, System Evaluation Report or implementing documents be included for appropriate IVR to verify implementation of the change in the safety documentation and implementing documents. This minor issue was identified to Building 3711374 for evaluation and action as appropriate.

Observations:
N/A

Conclusion:
Changes to the confinement ventilation system's safety basis requirements, documents, and installed components conform to the approved safety/authorization basis (safety envelope) for the facility, and the appropriate change approval authority is determined using the Unreviewed Safety Question (USQ) process. Criterion 3 is met.

Facility procedures ensure that changes to the confinement ventilation system's safety basis requirements, documents, and installed components are adequately integrated and coordinated with those organizations affected by the change. Criterion 4 is met.

Operability Issues/Concerns:
None

Opportunities for Improvement:
None

Good Practice(s):
- Facility implementation of PRO-1475-ADM-37 1, Building 37 1/374 Implementation Document Change Control Process, provides an effective process for ensuring accurate management of the System Evaluation Report, Authorization Basis, and implementing procedures with respect to changes affecting the safety basis.

Criterion 5: Software used in the confinement ventilation system's instrumentation and control (I&C) components that perform functions important to safety is subject to a software quality process consistent with 10 CFR 830.122.

Process

Records Reviewed:

- MAN- 13 1 -QAPM, Rocky Flats Environmental Technology Site Quality Assurance Program Manual, Revision 1, dated 11/01/01.
- 1-MAN-004-CSMM, Rocky Flats Environmental Technology Site Computer Software Management Manual, Revision 0, dated 2/20/97
- CALC-371-HVAC-000576, Calculation/Tech Basis Cover Sheet & Revision Summary
- MAN-071-IWCP, Site Integrated Work Control Program Manual, Revision 3, dated 1 O/30/2000
- 1-V51-COEM-DES-210, Site Engineering Process Procedure, Revision 7, dated 7/31/01
- 371 System Evaluation Report
- PRO-1449-DACS-CHG, Rocky Flats Environmental Site DACS Database Configuration Control, Building 37 1/374

Personnel Interviewed:

- Building 371 Utilities Manager
- Building 371 Utilities Technology Support
- Building 371 Stationary Operating Engineer
- Compliance Tracking Coordinator
- Building 371 Quality Assurance Lead

Operations Observed:
None

Results:

Record Review:
The Confinement Ventilation System for building 371 utilizes a software system called Data Acquisition Control System (DACS). The DACS software generates system performance logs and is self-monitoring. The system architecture is such that nine electronic loops are established and a series of data points attached. If an alarm situation exists, the data points interrupt the electronic circuit and a combination of audio and electronic alarms are initiated. The DACS software generates system performance logs used for trouble-shooting operational problems and because of this, is self-monitoring. The DACS software has the capability to perform programmable tasks, but that feature is not used - DACS only monitors.

The applicable software quality assurance requirements, the software quality assurance standards/controls, and the basis for acceptance of these standards/controls is well documented through the use of the Integrated Work Control Process, the 1-MAN-004-CSMM Computer Software Management Manual, and Acceptance and Surveillance Testing.

No determination of software development standards/controls was possible because procurement document was unavailable. The procurement documentation would corroborate whether RFETS contributed SQA standards/controls during software development. The DACS software was procured from GSE Systems Inc. in 1986 and development and quality assurance functions were completed before delivery to RFETS. The Surveillance tests that are performed and the historical evidence that the system performs as intended provide the criteria for acceptance of functionality.

The DACS Database Configuration Control procedure PRO-1449-DACS-CHG addresses configuration management issues to include upgrades, changes, stakeholder notification and approvals, and documentation. Version control is performed by an internal system function initiated each time a change is downloaded to the system.

The appropriate degree of independence that exists between those responsible for software development and quality assurance functions does not apply to the DACS system. DACS is a Commercial-off-the-Shelf product that the RFETS Building 371 DACS Support Staff did not develop.

A process is in place and used to identify, evaluate, and resolve operational problems that are attributable to software. Because the DACS Software is proprietary to GSE Systems, Inc., only GSE Systems, Inc can address complete software failure. The Building 371 DACS Support Staff is aware of this fact. DACS has never experienced a complete software failure.

Interviews:
During the interview process, the software quality assurance standards/controls, and the basis for acceptance of these standards/control was discussed. The DACS Support Staff knew that the applicable software quality assurance requirements exist within the 1-MAN-004-CSMM Computer Software Management Manual. Additional QA requirements are applied using the Site Engineering Design Procedure 1-V51-COEM-DES-210 and the Integrated Work Control Program Manual, MAN-017-IWCP. They are aware that the System Evaluation Report contains acceptance criteria. The Surveillance testing process provides assurance that the DACS Software performs its associated safety functions. The facility engineering and operations staff is very aware of software quality assurance requirements for the DACS system software under their cognizance. The DACS Support Staff has been trained and certified by the vender and are very dedicated individuals. They maintain a high degree of professionalism.

Observations:
N/A

Conclusion:
The criteria for the DACS software used in the confinement ventilation system I&C components has been met.

Operability Issues/Concerns:
None

Opportunities for Improvement:
None

Good Practices:
N/A

Assessment Form

DNFSB Recommendation 2000-2 Phase II Assessment

Building 371 Confinement Ventilation System

Topic Area: System Maintenance	**Criteria Met?**	
	Yes	**No**
	X	

Objective

The confinement ventilation systems are maintained in a condition that ensures their integrity, operability and reliability.

Criteria

1. Maintenance processes consistent with the ventilation systems' safety classification are in place for prescribed corrective, preventive, and predictive maintenance, and to manage the maintenance backlog.

2. The confinement ventilation systems are periodically walked down in accordance with maintenance requirements to assess their material condition.

Approach

Record Review:

1-1 Verify that maintenance for the confinement ventilation systems satisfies system requirements and performance criteria in safety basis documents or other local maintenance requirements.

[NOTE] The following approach statements 1-2 and 1-3 need to be reviewed only once for common site or facility-specific implementation of maintenance management processes or programs. Therefore these will be assessed only once during this assessment.

1-2 Evaluate maintenance of aging confinement ventilation system equipment and components.

- Determine whether there are criteria in place to accommodate aging-related system degradation that could affect system reliability or performance
- Review the plans and schedules for monitoring, inspecting, replacing, or upgrading system components needed to maintain system integrity, including the technical basis for such plans and schedules

- Determine whether conditions that require filter replacement (replacement criteria) are specified and how filter aging is accommodated in maintenance processes.

1-3 Determine whether maintenance source documents such as vendor manuals, industry standards, DOE Orders, and other requirements are used as technical bases for development of system maintenance work packages.

2-1 Verify that the confinement ventilation systems are inspected periodically according to maintenance requirements.

2-3 Review confinement ventilation system/component history files for selected system components for the past three years.

- Identify whether excessive component failure rates were identified.
- Determine how failure rates were used in establishing priorities and schedules for maintenance or system improvement proposals.

2-4a Review the procedure and process for performing walkdowns of the confinement ventilation systems.

Interviews:

2-4b Verify through manager and worker interviews that personnel performing walkdowns understand operational features, safety requirements and performance criteria for the system.

Observations:

2-2 On a sample basis, perform a walkdown inspection of the confinement ventilation systems with emphasis on the material condition of installed equipment, components, and operating conditions. Identify and document any observed conditions that could challenge the ability of the system to perform its safety function (e.g., leaks, cracks, deterioration, or other degraded or abnormal conditions). Determine whether observed deficiencies have been identified and addressed in a facility condition assessment or deficiency tracking system.

Criterion 1: Maintenance processes consistent with the ventilation systems' safety classification are in place for prescribed corrective, preventive, and predictive maintenance, and to manage the maintenance backlog.

Process

Records Reviewed:

- Ventilation LCO Compliance Matrix
- Ventilation SC-3 Credited Compliance Matrix
- 4-PRO-121-VENT-371-SR4.1.8, Revision 1, Inspection of Ventilation Ducts in Building 371
- Fan Vibration PM Backlog
- PMWP MM33201D, Recirculation, Exhaust and Supply Fan Diagnostic Testing
- PRO-l 166-ADM-37 1, Revision 0, SSC/SET OOC Disposition Process
- Building 37 1/374 Complex BIO
- Building 371/374 System Evaluation Report
- "Out of Commission" Log Book
- Internal e-mails concerning a proposal to cancel preventive maintenance of CVS fans

Personnel Interviewed:

- Stationary Operating Engineer (SOE)
- Stationary Operating Engineer (SOE)
- HVAC Technical Support
- HVAC Facility Engineer
- HVAC Engineer
- Utilities Manager
- Configuration Control Authority (CCA)
- Stationary Operating Engineer (SOE)
- Nuclear Safety Engineer
- Engineering Manager
- Engineering Lead
- D&D Engineer

Operations Observed:

- Smoke Testing and Walkthrough as described in 4-PRO-121-VENT-371-SR4.1.8

Results:

Record Review:

The Building 371/374 Complex BIO provides Surveillance Requirements and associated frequencies to perform the surveillances on equipment that performs credited safety functions. Building 371 management uses individual procedures to perform each required surveillance and track completion. The following table lists the

safety equipment, safety function, surveillance requirement, and implementing procedures that are used by building management.

SAFETY EQUIPMENT	SAFETY FUNCTION	SURVEILLANCE REQUIREMENT	IMPLEMENTING PROCEDURE
Supply air unit housing and a single stage HEPA filter bank	Provides tertiary confinement	SR 4.3.4 SR 4.5.1 SR 4.5.2 SR 4.5.3	SWP-ssoc-970xx PRO-431-SHEPA-371 PRO-959-HEPA-371-374 Std Work Package
Interlock system to shut down supply fans		SR 4.7.1 SR 4.7.2 SR 4.7.3	PRO-127%HVAC-371 PRO-967-INTL-001 PRO-379-UTIL-002
AOV-6740B & AOV-6820B	Valves for cross-connecting Zone I/IA unfiltered exhaust to alternate plenums	SR 4.1.6	4-PRO-215-AOV-371-SR4.1.6
Two stages of Zone I, IA, II, & III exhaust HEPA filters	Filters air	SR4.1.7 SR4.1.4 SR4.3.5	SWP-ssoc-970xx PRO-959-HEPA-371-374 PRO-959-HEPA-371-374
Exhaust and return ductwork from the last HEPA filter stage to the associated fans	Minimizes unfiltered leak paths	SR4.1.8	4-PRO-121-VENT-371-SR4.1.8
Exhaust ductwork from the last HEPA filter stage to the building exhaust valve	Provides tertiary confinement	SR4.1.8	4-PRO-121-VENT-371-SR4.1.8
Exhaust fans	Limits unfiltered leakage	SR4.1.5	PRO-1283-FAN
Bypass damper, AOV-6936A	Provides tertiary confinement	None	Analyzed as fail-safe by design
DP alarms for Zone IV to Zone III	Verify negative pressures	SR4.1.3	PRO-610-PDIC
Redundant DP alarms for Zone III to atmosphere	Verify negative pressures	SR4.1.1 SR4.1.2	PRO-610-PDIC PRO-610-PDIC

The surveillances listed in the table above represent the majority of the prescribed corrective, preventive, and predictive maintenance that is performed on SC-1/2 equipment. The various procedures and surveillances check for leakage in ductwork and equipment, check HEPA filter efficiencies, monitor differential pressures across HEPA filter stages, check fan bearing temperatures and motor amperage, check differential pressures between HVAC Zones, ensure DP gages are calibrated and

alarms function, check the integrity of HEPA filter plenums, check the supply fan interlock components, and check the supply fan interlock logic. The records review determined that all required surveillances are being performed on a timely basis.

The Assessment Team reviewed the Building 371/374 Complex BIO and compared the Limiting Conditions of Operation (LCOs) against the original design operating basis to determine if the safety credited equipment is operating within its original design parameters. This would help meet the criteria objective to determine if "The confinement ventilation systems are maintained in a condition that ensures their integrity, operability and reliability." The SC1/2 and SC-3 equipment is generally operating within original design parameters with the exceptions discussed in the "Interviews" section below.

Interviews:

The Assessment Team conducted numerous interviews with facility personnel. The lines of inquiry included questions about preventive and predictive maintenance, trending data, system operating parameters, required inspections and calibrations, availability of operating manuals and manufacturer's data, the system modification process.

Interviewees stated that credited safety equipment was being maintained at an adequate level to support safe operations over the short life expectancy of the building. Calibrations, preventative maintenance, and inspections that are required by the BIO were being performed and tracked. Interviewees expressed concerns that generally fell into two areas.

- SOEs and utilities personnel expressed that they would prefer to be more directly involved in the maintenance of their equipment. Preventative maintenance is currently done by a central maintenance group. The utilities personnel believe that, since they work with their equipment on a daily basis, they know their equipment better than the personnel from the centralized maintenance department.
- A second concern addressed the possibility of eliminating preventive maintenance functions on utilities equipment. Several interviewees spoke of an attempt to eliminate preventive maintenance and adopt a "run to failure" mode of operation. The assessment team obtained an e-mail dated 02/05/02 that confirmed that maintenance management was considering the elimination of the yearly preventative maintenance activities on the CVS exhaust fans while maintaining the quarterly preventative maintenance. The e-mail also mentioned adopting a "run to failure" mode on pumps. The team obtained an e-mail from the facilities engineering lead to the engineering manager dated 02/13/02 that disagreed with any cancellation of preventive maintenance for AB credited fans. The e-mail also requested that the consequences of an unplanned failure be determined before a "run to failure" mode is adopted on non-credited equipment. On 02/22/02, an e-mail was generated by engineering management that formally disagreed with the proposal to cancel preventive maintenance activities on AB credited equipment

and requested a failure consequence determination for non-AB credited equipment before canceling any corresponding preventive maintenance.

In response to lines of inquiry involving system operating parameters, the assessment team found that several sub-systems within the CVS are operating at air flows that are lower than the original design basis. Changes to system operating parameters can potentially inhibit the system's ability to perform its safety functions and can adversely affect the performance and life expectancy of individual components within the system.

Engineering and utilities technical support estimate that the Supply Air Unit is providing about half of the fresh air make-up that was specified in the original design. Fresh air make-up is lower because Zone I/IA flows have been reduced from their original design flows due to configuration changes over the last twenty years. A reduction in Zone I/IA air flows means that less air is exhausted from the building. With less air being exhausted, it becomes more difficult to balance the required differential pressures in the various areas in the building. In early 2000, Building 371 experienced problems with oscillating differential pressures within the basement level. These oscillations and balancing problems were addressed by a Building 371 Tiger Team in March and April 2000 and resulted in changes to the way the supply plenums and fans are operated. The team consisted of engineering, utilities, and nuclear safety personnel familiar with the facility HVAC System and its requirements. The HVAC Tiger Team reviewed performance issues affecting the facility's HVAC System and developed a plan to change the supply fan operation and made recommendations to ensure consistent and safe implementation of this operating change. The Team also recommended: an evaluation of HVAC system load to support a decision on returning FP-243 to service; a review of options to provide additional flow in the PuSPS area; new configuration control for HVAC controller programming; and systematic review of supply air flow distribution to identify and correct significant deviations from design flow due to either aging effects or prior uncontrolled adjustments.

The most significant recent change from the original design involves Zone I/IA filter plenum (FP) 243. The Tiger Team reconvened in January of 2001 to review the possible need to restart FP-243. The airflow through FP-243 had been reduced so far below the original design loads that the fans were operating in an unstable part of their fan curves. Utilities routed air through an alternate plenum and did not use FP-243 until additional loads (dummy loads) could be added to the FP-243 supply side. The dummy load consists of a HEPA filter attached to Zone I/IA ductwork that allows room air to be drawn into the Zone I/IA system. The dummy loads are used to replace aifflow from a process room when gloveboxes are removed. In summary, the changes endorsed by the Tiger Team have successfully solved the CVS performance issues that have occurred over the last few years.

Several miscellaneous lines of inquiry led to short, acceptable replies that did not require any follow on investigation. Those items are summarized here. Trending data is not charted but is maintained as part of the required surveillance records.

Operating procedures are available for CVS equipment. Original manufacturer's data is on hand for some of the equipment and unavailable for other equipment. The CVS design basis is generally well understood by utilities and engineering personnel. System modifications follow the site design process. Responses to the lines of inquiry listed in this paragraph were satisfactory.

Observations:

The assessment team walked down System 2 of the CVS from the supply inlet to the exhaust from the building. The team also walked down all credited System 2 pressure differential indicating controllers (PDIC).

Nearly all of the System 2 CVS components are the original building equipment. The equipment is aging but still capable of performing its safety functions. Large equipment such as fans, motors, controllers, dampers, and valves are good quality, strong components with reliable operating histories. The large equipment has adequate redundancy and excess capacity to allow maintenance as required without adversely affecting overall system operations. Small credited equipment such as instruments are well maintained and have redundant components. Calibrations are up to date. The ductwork and plenums were constructed with high quality materials and are still strong and stout.

The assessment team found several individual locations where the material condition of the credited CVS equipment was unsatisfactory.

- Small holes were found in the ductwork between the last tested HEPA filters in FP-241 and FP-242 and their corresponding exhaust fans. A single hole was found in each of four parallel ducts near the fan inlets. The holes were approximately 1/2" in diameter and were covered with tape. This portion of ductwork is specifically credited to minimize potential unfiltered leak paths.
- Small holes were found in the ductwork between the FP-241 and FP-242 exhaust fans and their corresponding back draft dampers. A single hole was found in each of four parallel ducts near the fan outlets. The holes were approximately 1/2" in diameter and were covered with tape.

The assessment team notified building management about the holes. Building management responded by suspending operations in the affected room and verifying combustible materials and ignition source controls in accordance with the required actions defined in the Building 371/374 Complex BIO (LCO 3.1 J.).

According to long time employees, the holes were placed in the ductwork during a work evolution several years ago. The purpose of the holes was to allow sampling from the ductwork in order to test possible leak paths at the fans. Similar test port locations exist at other exhaust fans. In those locations, couplings and pipe plugs are installed at the port locations. There is no clear explanation as to why some of the test ports were permanently repaired and some were temporarily repaired with tape.

The assessment team walked down the compressed gas system and the turbine generator system. Both systems are maintained and operated in a manner consistent

with their credited safety functions. Adequate redundancy and capacity exists in case equipment must be taken out of service for maintenance.

Conclusion:

System 2 of the CVS is a well constructed, well designed system with a reliable operating history. The individual components are robust and have adequate redundancy in case equipment must be taken out of service for maintenance. Utilities and engineering personnel are knowledgeable and competent in their abilities to maintain the ventilation system.

The use of dummy loads has helped to stabilize the differential pressures between Zones. The dummy loads are used to simulate glovebox loads in rooms where gloveboxes have been removed.

The compressed gas and turbine generator support systems are maintained and operated in a manner consistent with their credited safety functions. Adequate redundancy and capacity exists in case equipment must be taken out of service for maintenance.

With the exception of the Operability Issue listed below, the Confinement Ventilation System (CVS) is maintained and operated in a manner consistent with its credited safety functions as defined in the Building 371/374 Complex BIO. Criteria 1 is met based on the good material condition of the primary components, knowledgeable staff, adequate redundancy and extra capacity of equipment, and the proven ability of building management to complete required preventive maintenance and fix ventilation problems as they occur.

Operability Issues/Concerns:

- Small holes were discovered in the ductwork between the last tested HEPA filters in FP-241 and FP-242 and their corresponding exhaust fans during Phase II assessment walkdowns. This condition represents a potential unfiltered leak path during postulated accident scenarios.

Opportunities for Improvement:

None

Good Practices:

- In response to Confinement Ventilation System (CVS) performance issues early in 2000, the Building 371/374 Closure Project twice convened a HVAC Tiger Team to review performance issues affecting the facility's HVAC System and provide recommendations for improvement. The changes endorsed by the Tiger Team have successfully solved the CVS performance issues that have occurred over the last few years.

- Building management has successfully maintained the operability of the CVS while airflow loads have changed. The use of dummy loads to replace Zone I/IA airflow's as gloveboxes are removed is an excellent idea. Building management should encourage and possibly formalize the use of dummy loads during D&D activities.

Criterion 2: The confinement ventilation systems are periodically walked down in accordance with maintenance requirements to assess their material condition.

Process

Records Reviewed:

- Ventilation LCO Compliance Matrix
- Ventilation SC-3 Credited Compliance Matrix
- 4-PRO-121-VENT-371-SR4.1.8, Revision 1, Inspection of Ventilation Ducts in Building 37 1
- Building 371/374 Complex BIO
- Building 371/374 System Evaluation Report

Personnel Interviewed:

- HVAC Technical Support
- HVAC Engineer
- Nuclear Safety Engineer
- Engineering Manager
- Facilities Engineer

Operations Observed:

- Smoke Testing and Walkthrough as described in 4-PRO-121-VENT-371-SR4.1.8, Inspection of Ventilation Ducts in Building 371

Results:

Record Review:

The Building 37 1/374 Complex BIO and System Evaluation Report were reviewed to determine the requirements to walk down the Confinement Ventilation Systems (CVS).

Functional Requirement 1 from the System Evaluation Report states, "The HVAC Systems 1 and 2 shall be maintained to minimize potential unfiltered leak paths providing tertiary confinement for HVAC systems. " The System Evaluation Report defines "two criteria for acceptability: 1) a visual inspection of the exhaust duct from the exhaust side of the fan to the isolation valve; and 2) a smoke tube test after the last tested HEPA filter stage to the fan suction to include the door seals, duct, and fan shaft seals."

LCO 3.1, 5, of the Building 371/374 Complex BIO, states, "The exhaust ducting between the last tested stage of HEPA filtration and the exhaust fans shall be maintained to limit potential unfiltered leak paths."

LCO 3.1, Condition J is defined as, "Visible signs of leakage are detected between the last tested stage of Zone I or IA HEPA filters and the associated filter plenum fans."

SR 4.1.8 addresses LCO 3.1, 5, and states, "Walk down the ventilation system between the last tested HEPA filter stage and the associated fans for visible signs of leakage."

The implementing procedure, Inspection of Ventilation Ducts in Building 371, 4-PRO-121-VENT-371-SR4.1.8, requires a smoke test of the plenum door seals, the duct between the last tested HEPA filter stage and the associated fan, and the fan shaft seal and also visual inspection of all accessible exhaust ductwork.

The assessment team compared the requirements of the safety documents and made the following observations.

- The System Evaluation Report and 4-PRO-121-VENT-371-SR4.1.8, Inspection of Ventilation Ducts in Building 371 are mostly in agreement except that the System Evaluation Report recognizes "**potential** unfiltered leak paths" while 4-PRO-121-VENT-371-SR4.1.8 only inspects and tests for **visible** leak paths.
- LCO 3.1, 5, recognizes "**potential** unfiltered leak paths" but both Condition J of LCO 3.1 and SR 4.1.8 only address " **visible** signs of leakage".
- The System Evaluation Report requires a visual inspection of the all exhaust ductwork (including those sections that are only credited with a tertiary confinement function) whereas the BIO only requires an inspection of the ductwork between the last tested stage of HEPA filtration and the exhaust or return fans.

These inconsistencies between the System Evaluation Report and the BIO should be reconciled. This issue is further discussed in the Configuration Management and Safety Function Definition Topic Areas.

Interviews:
Facilities engineering performed a field walkthrough of the procedure, 4-PRO-121-VENT-371-SR4.1.8, Inspection of Ventilation Ducts in Building 371, for the assessment team.

Observations:
Procedure 4-PRO-121-VENT-371-SR4.1.8, Inspection of Ventilation Ducts in Building 371, is generally clear and easy to follow. It provides well-organized tables to record all testing and inspection results. The completion of 4-PRO-121-VENT-371-SR4.1.8 insures that Criteria 2, " The confinement ventilation systems are periodically walked down in accordance with maintenance requirements to assess their material condition" is met with the following exception. There is no requirement to check for **potential** unfiltered leak paths. The procedure only checks for **visible** leak paths.

One additional problem was observed while performing procedure, 4-PRO-121-VENT-371-SR4.1.8, Inspection of Ventilation Ducts in Building 371. The procedure smoke tests the plenum door seals, the duct between the last tested HEPA filter stage and the associated fan, and the fan shaft seal and also performs a visual inspection of all accessible exhaust ductwork. The implication is that the negative pressure

components of the ductwork are inspected in one way and the sections required for passive tertiary confinement are inspected in another way. This is also confirmed by referencing the BIO, SR 4.1.8, which states, "Walk down the ventilation system between the last tested HEPA filter stage and the associated fans for visible signs of leakage." The differentiation between negative pressure ductwork and passive containment ductwork is understandable. The problem is that, based on the operating fan configurations stated in the BIO, the boundary between negative pressure ductwork and passive containment ductwork is not at the fan seal. It is at least at the back draft damper and could be closer to the main exhaust header depending on the operating fan and the power of the stack effect in the given configuration. Temperature differences between inside air and outside air will influence the power of the stack effect. As an example, if EF-241A was operating and EF-241B was off, the negative pressure at the inlet to EF-241A would exist back into the plenum, though the ductwork to EF-241B, through the vanes in EF-241B, and up to the back draft damper above EF-241B. In addition, the stack effect may cause the exhaust ductwork above EF-241B to have a negative pressure with respect to Room 2213.

Conclusion:

The criteria for this portion of the assessment plan states, "The confinement ventilation systems are periodically walked down in accordance with maintenance requirements to assess their material condition." The Building 371/374 Complex BIO does not required walk downs to inspect for material condition except for the ductwork between the last tested stage of HEPA filtration and the exhaust fans. This specific section of ductwork shall be maintained to limit potential unfiltered leak paths. The assessment team focused its investigations on the credited portion of ductwork but also looked at all System 2 ductwork that is within the scope of 4-PRO-121-VENT-371-SR4.1.8, Inspection of Ventilation Ducts in Building 371.

Procedure 4-PRO-121-VENT-371-SR4.1.8, Inspection of Ventilation Ducts in Building 371, is generally clear and easy to follow. It provides well-organized tables to record all testing and inspection results. The successful completion of 4-PRO-121-VENT-371-SR4.1.8 ensures that Criterion 2, "The confinement ventilation systems are periodically walked down in accordance with maintenance requirements to assess their material condition" is met. Unfortunately, the actual completion of 4-PRO-121-VENT-371-SR4.1.8 did not appear to ensure that LCO 3.1 was met. In this case, small holes covered with tape have existed in the credited portion of the ductwork for years without being reported and repaired.

The documentation path from the safety analysis through the BIO, LCO, SR, and implementing procedure failed to capture at least one credited element from the safety analysis (i.e. the requirement to limit **potential** unfiltered leak paths).

The System Evaluation Report requires an inspection of accessible portions of all exhaust ductwork while the BIO only requires an inspection of the ductwork between the last tested stage of HEPA filtration and the exhaust or return fans. If the intent of the BIO is to inspect those portions of the ductwork that have negative pressures with respect to the

room, then building management should evaluate the pressures in all locations around the fans under all allowable operating conditions.

Operability Issues/Concerns:

- The inspection criteria in surveillance procedure 4-PRO-121-VENT-371-SR4.1.8 does not adequately implement the intent of the Limiting Condition for Operation (LCO) 3.1.5 surveillance requirement for identifying potential unfiltered leak paths. For example, the procedure does not explicitly address the need to inspect potential leak paths such as small taped test holes located in the duct before and after the exhaust fans in System 2 Zone 1 Plenums. This procedure also requires a more general identification of any "damage or degradation in the inspected ductwork"; this element of the procedure does not appear to have been properly conducted during previous performance of this inspection. Taped holes in the Team's opinion are clear evidence of system degradation. *(System Maintenance, Criterion 2, System Surveillance and Testing Criterion 3)*

Opportunities for Improvement:

- Surveillance procedure 4-PRO-121-VENT-371-SR4.1.8 does not perform a visual smoke test of all negative pressure sections of ducting that is being maintained to limit potential unfiltered leak paths from the facility. The procedure currently performs a smoke test of the ducting from the last HEPA filter stage to the exhaust fan shroud and casing. During normal system operation one exhaust fan for each plenum is typically in standby. The zone of negative pressure for the standby fan likely extends into the fan's discharge ducting to the fan's backdraft damper. This section of ducting and the backdraft damper is not currently subject to the visual smoke test per this procedure. *(System Maintenance, Criterion 2)*

Good Practices:

N/A

Assessment Form

DNFSB Recommendation 2000-2 Phase II Assessment

Building 371 Confinement Ventilation System

Topic Area: System Surveillance and Testing	**Criteria Met?**	
	Yes X	**No**

Objective

Surveillance and testing of the confinement ventilation systems demonstrates that they are capable of accomplishing their safety functions and continue to meet applicable system requirements and performance criteria.

Criteria

1. Requirements in applicable DOE Rules and Orders are invoked for the confinement ventilation system.

2. Requirements for surveillance and testing are adequate for demonstrating overall system reliability and operability, and are linked to the technical safety basis.

3. Surveillance and test procedures confirm that key operating parameters for the overall system and its major components are maintained within operating limits.

4. Procurement, qualification, surveillance and testing of HEPA filters (or other filter media) enable monitoring of filter performance and demonstrate filter reliability and operability.

5. Instrumentation and measurement and test equipment for the system are calibrated and maintained.

Approach

Record Review:

1-1 Determine whether DOE Rules and Orders that apply to surveillance and testing of confinement ventilation and essential support systems are incorporated in the appropriate documents.

2-1 Identify the acceptance criteria from the surveillance test procedures used to verify that the confinement ventilation systems are capable of performing their safety functions. Compare the acceptance criteria with the safety functions, functional requirements, performance criteria, assumptions and operating characteristics

discussed in safety documents. Verify that there is a clear linkage between the test acceptance criteria and the safety documentation, and that the acceptance criteria are capable of confirming that safety/operability requirements are satisfied.

3-la Review surveillance and testing procedures for the confinement ventilation systems' major components. Review a sample of the test results and verify:

- Validity of test results
- System performance meets system requirements
- Performance criteria are appropriate for current facility mission life-cycle
- Parameters that demonstrate compliance with the safety requirements can be measured
- Test personnel are knowledgeable and able to satisfactorily perform the test
- The procedure cites applicable Technical Safety Requirements/Limiting Conditions for Operation
- Limits, precautions, system and test prerequisite conditions, data required, and acceptance criteria are included
- Appropriate data recording provisions are included or referenced and are used to record results
- The procedure includes provisions for listing discrepancies
- The procedure requires timely notification of facility management about any failure or discrepancy that could impact operability
- Appropriate personnel reviewed the test results and took appropriate action

4-1 Determine if HEPA filters were qualified to ASME AG-1, Section FC5000

4-2 Determine if procurement specifications reference such standards as DOE-STD-3020-97 and ASME Code AG-1, Section FC

4-3 Determine if an in-place HEPA filter test was performed by the filter housing vendor and that testing met standard requirements in ASME Code AG-1, Section TA

4-4 Where applicable, determine whether visual inspection ports are installed in filter housings to enable *in situ* visual inspection of HEPA filters

4-5 Determine whether the site has a HEPA filter life program

5-1 For the surveillance and test procedures and records reviewed, determine whether the test equipment used for testing was calibrated.

Interviews: Performed during walkthrough

Observations:

2-lb Perform a walkthrough of the surveillance test procedure for one of the confinement ventilation systems' major components with appropriate facility personnel and in conjunction with the record review verify:

- Validity of test results
- System performance meets system requirements
- Performance criteria are appropriate for current facility mission life-cycle
- Parameters that demonstrate compliance with the safety requirements can be measured
- Test personnel are knowledgeable and able to satisfactorily perform the test
- The procedure cites applicable Technical Safety Requirements/Limiting Conditions for Operation
- Limits, precautions, system and test prerequisite conditions, data required, and acceptance criteria are included
- Appropriate data recording provisions are included or referenced and are used to record results
- The procedure includes provisions for listing discrepancies
- The procedure requires timely notification of facility management about any failure or discrepancy that could impact operability
- Appropriate personnel reviewed the test results and took appropriate action

Criterion 1: Requirements in applicable DOE Rules and Orders are invoked for the confinement ventilation system.

Process

Records Reviewed:
- Building 37 1/374 Complex BIO
- Building 37 1/374 System Evaluation Report
- Filter Plenum In-place Testing Work Packages
  - TO107530
  - TO107535
  - TO107536

Personnel Interviewed:
- *Utility Technical Support*
- CVS System Engineer
- HEPA Filter SME
- Filter System Manager

Operations Observed:
None

Results:

Record Review:
The Building 37 1/374 System Evaluation Report refers to ASME N5 10 " Testing of Nuclear Air Treatment Systems" and ASHRAE "HVAC Design Guide for Nuclear Facilities"

Filter Plenum In-place Testing Work Package is based on the ASME N510-1980 " Testing of Nuclear Air Treatment Systems" which defines the requirements for the use of shroud testing in section 10.

The ASME N-5 10 has been incorporated into the ASME AG- 1 "Code on Nuclear Air and Gas Treatment". This document is the accepted National Standard used by DOE.

The ASHRAE "HVAC Design Guide for Nuclear Facilities" has been included in the ASHRAE Applications Handbook as a chapter. This document is the accepted National Standard used by DOE.

Interviews:
Interviews with the filter test personal demonstrated their knowledge of the (DOE Rules and Orders) basis for in-place testing and surveillance requirements.

Interviews with the Technical Support and SME detailed that filters are required to be qualified to DOE-STD-3020-97 and ASME AG-1.

The SITE uses DOE-STD-3020-97 to purchase HEPA filters.

Observations:
N/A

Conclusion:
Requirements in applicable DOE Rules and Orders are invoked for the confinement ventilation system. This criterion is met.

Operability Issues/Concerns:
None

Opportunities for Improvement:
None

Good Practices:
N/A

Criterion 2: Requirements for surveillance and testing are adequate for demonstrating overall system reliability and operability, and are linked to the technical safety basis.

Process

Records Reviewed:

- Building 371/374 System Evaluation Report
- Filter Plenum In-place Testing Work Packages
  - TO107530
  - TO107535
  - TO107536
- Filter Test Data Sheets
  - TO093213
  - TOO86924
  - TO093215
  - TO093209
  - TO086919
  - TO093206
  - TOO86926

Personnel Interviewed:

- Filter System Manager
- Filter Test personnel (2)

Operations Observed:

The Filter System Manager in the filter systems work Lab Building 334 performed walk-through of a filter plenum in-place testing work package. Equipment was set up to demonstrate the method used in Building 371 plenum testing.

Results:

Record Review:

Three completed work packages were reviewed. A review of the work packages showed how the step by step process of testing is performed. The test information is recorded as measurements are made. The Limiting Condition for Operation (LCO) form is filled out based on the test sheet. The data / test results are clear and thorough.

Interviews:

The personnel interviewed were well trained and knowledgeable on the basis for the in-place testing, the use of the test equipment and the procedure used. Based on the interviews and performance noted in the Observations section below, training and qualification of Filter Test Personal to perform equipment operation and surveillance is appears complete and rigorous.

Observations:
The validity of test results was substantiated by a comparison of the data recorded in the current work packages when compared to past data. The repeatability was demonstrated by the data entered on the appendix 10 data sheets.

The system performance at the time of the in-place test is documented on the appendix 9 data sheet, which lists the required filter stage efficiency and the tested stage efficiency.

The performance test criteria are appropriate for current facility mission life cycle. The criteria are based on the material in the area serviced by the plenum. When the material load changes the requirements are reviewed and changed appropriately. The parameters that demonstrate compliance with safety requirements are measured and documented in the in-place test work package

Test personnel were knowledgeable and able to satisfactorily perform the test; qualification on test equipment and test methods is documented.

Technical Safety Requirements/Limiting Conditions for Operation are stated in section 8 of the work package. Reference is made to SR 4.1.7 and SR 4.3.4, LCO's 3.0.7 3.0.8, and System Evaluation Report Chapter 2, 5.1.1 through 5.2.3 and chapter 10, 5.1.2.

The work package includes Limits and precautions (section 7), system and test prerequisite conditions (section 8), data required (appendix 9 & 10), and acceptance criteria (section 8).

Appropriate data recording provisions are included in appendix 9 & 10 of the work package. Section 9 records the filter stage efficiency.

The work package includes provisions for listing discrepancies in appendix 9 under the comment section. Frame, as found and final efficiency is addressed with sat/unsat blocks and a comment section is provided for explanation of the problem.

The work package requires timely notification of facility management about any failure or discrepancy that could impact operability. The work package allows for actions to be taken to replace any failed filters as part of the surveillance. The same crew that is qualified to test filters is qualified to change filters. Appendix 5 of the work package is a checklist, which directs the tester to "notify the Shift Manager immediately" if a "no" is checked.

Appropriate personnel (i.e. Shift Manager and the HVAC Engineer) review the test results and take appropriate action prior to returning the system to service.

A work package is developed for each periodic in-place test this practice allows for any updates to test methods or testing requirements. The ability to tailor the work package to the plenum being tested using a basic site pork package is considered superior to using a site procedure.

Conclusion:

The requirements for the selected surveillance and testing (HEPA In-place Test) demonstrate the overall system reliability and operability. The LCO and System Evaluation Report are the link to the technical safety basis. Training and qualification of Filter Test Personal to perform equipment operation and surveillance is complete and rigorous. This criterion is met.

Operability Issues/Concerns:
None

Opportunities for Improvement:
None

Good Practices:
N/A

Criterion 3: Surveillance and test procedures confirm that key operating parameters for the overall system and its major components are maintained within operating limits.

Process

Records Reviewed:

In-Place Testing

- LCO 3.1 / SR 4.1.7, B-371/374 System Evaluation Report
- CALC-OOO-VEXH-000071, Shroud HEPA Filter In-place Test
- CALC-OOO-VEXH-000275, Challenge Manifold HEPA Filter In-place Test
- Work package replace & test HEPA filters - data sheets
  - TO093213
  - TO086924
  - TO093215
  - TO093209
  - TO086919
  - TO093206
  - TO086926
- Work package - replace & test HEPA Filters
  - TO107530
  - TO107535
  - TO107356

HEPA Filter Pressure Differential

- LCO 3.1 / SR 4.1.4, B-371/374 System Evaluation Report
- PRO-379-UTIL-002, B-371/374 Stationary Operating Engineer Rounds
- 00-371/374-17 attachment 5 "SOE Shift Relief & Turnover Checklist"
- PRO-959-HEPA-371-374 "Surveillance of HEPA Filter Plenum Differential Pressure"

Supply System

- Building 371/374 System Evaluation Report
- 4-PRO-121 LCO 3.1 / SR 4.1.8, By-pass &Duct Inspection
- CALC-OOO-VEXH-000224, Exhaust System By-pass Smoke Test
- PRO-43 1-SHEPA-37 1 "Building 37 1/374 Supply HEPA Filter 18-Month Surveillance"

Personnel Interviewed:

- Filter System Manager
- Utilities Manger
- Technical Support
- Utilities SOE (2)
- Engineer

Operations Observed:

In-Place Testing

A review of the testing procedure was performed. The review included an inspection of the test equipment, requirements for equipment calibration, operation of test equipment, photographs of testing and interviews with test personal. Examples of the test package were reviewed.

HEPA Filter Pressure Differential

A review of the testing procedure was performed. The review included a walk-down of the installations and interview with Utility SOE's. System 2 exhaust filter plenums were checked.

Visual Inspection of the Supply HEPA Filter Stage

A review of the procedure was performed. A step by step description of the surveillance was performed with a Utility SOE.

Results:

Record Review:

In-Place Testing

Technical Safety Requirements/Limiting Conditions for Operation are stated in section 8 of the work package. Referred to are SR 4.1.7 and SR 4.3.4, LCO's 3.0.7 3.0.8, and System Evaluation Report Chapter 2, 5.1.1 through 5.2.3 and chapter 10, 5.1.2.

The work package includes Limits and precautions (section 7), system and test prerequisite conditions (section 8), data required (appendix 9 & 10), and acceptance criteria (section 8).

Appropriate data recording provisions are included in appendix 9 & 10 of the work package. Section 9 records the filter stage efficiency.

The work package includes provisions for listing discrepancies in appendix 9 under the comment section. Frame, as found and final efficiency is addressed with sat/unsat blocks and a comment section is provided for explanation of the problem.

The work package requires timely notification of facility management about any failure or discrepancy that could impact operability. The work package allows for actions to be taken to replace any failed filters as part of the surveillance. The same crew that is qualified to test filters is qualified to change filters. Appendix 5 of the work package is a checklist, which directs the tester to "notify the Shift Manager immediately" if a "no" is checked.

Appropriate personnel (Shift Manager and the HVAC Engineer) review the test results and take appropriate action prior to returning the system to service.

HEPA Filter Pressure Differential

Records Reviewed:

- PRO-959-HEPA-371-374 "Surveillance of HEPA Filter Plenum Differential Pressure"
- LCO 3.1 / SR 4.1.4 B-37 1/374 "System Evaluation Report"
- PRO-379-UTIL-002 B-371/374 'Stationary Operating Engineer Rounds"
- 00-371/374-17 attachment 5 "SOE Shift Relief & Turnover Checklist"

For the above listed records, the results of the assessment are:

- Technical Safety Requirements/Limiting Conditions for Operation are stated in section 1 of the procedure. Referred to are SR 4.1.4 and SR 4.3.5, LCO's 3.1, 3.3 & 3.5.
- The procedure includes Limits and precautions (section 3), system and test prerequisite conditions (section 4), data required (appendix 1), and acceptance criteria (section 6).
- Appropriate data recording provisions are included in appendix 1 of the procedure.
- The procedure includes provisions for listing discrepancies in appendix 1 under the comment section.

Visual Inspection of the Supply HEPA Filter Stage

Records Reviewed:

- PRO-431-SHEPA- "Building 371/374 Supply HEPA Filter 18-Month Surveillance"
- Building 371/374 "System Evaluation Report"
- LCO 3.5 / SR 4.5.1 "Visual Inspection Supply Plenum"
- PRO-379-UTIL-002 B-37 1/374 'Stationary Operating Engineer Rounds"

For the above listed records, the results of the assessment are:

- Technical Safety Requirements/Limiting Conditions for Operation are stated in section 1 of the procedure. Referred to are SR 4.5.1 and LCO 3.5.
- The procedure includes Limits and precautions (section 3), system and test prerequisite conditions (section 4), data required (appendix 1), and acceptance criteria (section 6).
- Appropriate data recording provisions are included in appendix 1 of the procedure.
- The procedure includes provisions for listing discrepancies in appendix 1 under the comment section.
- The procedure requires timely notification of facility management about any failure or discrepancy that could impact operability.

Interviews:

In-Place Testing

Filter Test Personnel were found to be knowledgeable and able to satisfactorily perform the test. The interview demonstrated to the team that the test personnel were able to operate the test equipment (photometer, up-stream test manifold, down-stream test manifold and aerosol generator). A thorough understanding of the test work package and the basis for the test method was demonstrated. A review of the qualification of the filter test technician provided an insight into this understanding. The manager's training included the Harvard In-place Course.

HEPA Filter Pressure Differential

Utility SOEs demonstrated their knowledge of the system and the procedure in the review and walk-down of the procedure. The SOE interviewed provided a copy of the completed procedure demonstrating his ability to satisfactorily perform the test/surveillance.

Visual Inspection of the Supply HEPA Filter Stage

Utility SOEs demonstrated their knowledge of the system and the procedure in the review and walk-down of the procedure. The SOE interviewed provided a copy of the completed procedure demonstrating his ability to satisfactorily perform the test/surveillance.

Observations:

In-Place Testing

A review of the testing procedure was performed. The review included the following: inspection of the test equipment, requirements for equipment calibration, operation of test equipment. Since actually observing an in-place test was not possible photographs of the replacement and in-place testing of the first stage of filters in the Zone II Building 371 plenums were reviewed. The in-place test work package was correlated to the photos. The ASME N-510-1980 "Testing of Nuclear Air Treatment Systems" was explained. This standard is used as a guide for the shroud test method.

HEPA Filter Pressure Differential

The parameters (range of differential pressure) that demonstrate compliance with safety requirements are measured with calibrated gages. The procedure requires that the calibration date of the gage be verified to be current.

The differential pressure data collected is trended. The trending is used to determine one of the parameters used to determine the filter life.

The validity of the results of the data collected is verified by the check made of the gage, which verifies the gage calibration to be current.

The results of the differential pressure data verify that the system is within its operational requirements.

In addition to the procedure PRO-959-HEPA-371-374 "Surveillance of HEPA Filter Plenum Differential Pressure" which is performed monthly the filter plenum differential pressures are observed by the SOE as part of their daily rounds PRO-379-UTIL-002 B-371/374 'Stationary Operating Engineer Rounds".

Visual Inspection of the Supply HEPA Filter Stage

The parameters that demonstrate compliance with safety requirements are measured with a checklist that addresses the visual integrity of the filters and plenum room.

The validity of the results of the data collected is verified by the periodic required supply plenum in-place test – LCO 3.5, SR 4.5.3.

The results of the inspection data verify that the system is within its operational requirements.

In addition to the procedure PRO-43 1-SHEPA-371 "Building 37 1/374 Supply HEPA Filter 18-Month Surveillance" which is performed at 18-month intervals the filter plenum is observed by the SOE as part of their daily rounds PRO-379-UTIL-002 B-37 1/374 'Stationary Operating Engineer Rounds".

Conclusion:

The surveillance and test procedures confirm that key operating parameters for the overall system and its major components are maintained within operating limits. The following specific reviews demonstrated this.

In-Place Testing

A review of the testing procedure was performed. The review included an inspection of the test equipment, requirements for equipment calibration, operation of test equipment, photographs of testing and interviews with test personal. Examples of the test package were reviewed. The procedure addressed SAR requirements, test data, notification requirements, and review requirements.

HEPA Filter Pressure Differential

A review of the testing procedure was performed. A walk-down of the installations was performed. The System 2 exhaust filter plenums were checked. The location and number of pressure gauges along with the testing and surveillance requirements in the procedures was considered adequate for these systems. The differential pressure surveillance is performed monthly; this provides data for future trending.

Visual Inspection of the Supply HEPA Filter Stage

A walk down of the Supply Plenum system was performed. A review of the procedure for visual inspection was performed. A step by step description of the surveillance was performed with a Utility SOE. The checklist used was very complete; the inspection was thorough.

This criterion is met.

Operability Issues/Concerns:
See System Maintenance Topic Area.

Opportunities for Improvement:
None

Good Practices
N/A

Criterion 4: Procurement, qualification, surveillance and testing of HEPA filters (or other filter media) enable monitoring of filter performance and demonstrate filter reliability and operability.

Process

Records Reviewed:

- MAN- 134-PPM, Procurement Program Manual
- PRO-1034-PEQA, Procurement Engineering & Quality Assurance
- MAN-027-SERM, Site Engineering Requirements Manual
- Site Standard SMU-311, HEPA Filters
- DOE-STD-3020-97, Specification for HEPA Filters Used by DOE Contractors
- PR-0003033, HEPA Filter purchase requisition – B-371 PuSPS
- CALC-OOO-NA-000658, Tech. Basis for HEPA Filter
- *SPEC 15860-0806, Specification for HEPA Filters*
- FJL 4-82 "History of Rocky Flats Criteria and Design Requirements for Plutonium Processing Facility Ventilation Systems"
- Evaluation of HEPA Filter Service Life (RFP-5 141)
- WJM-142-93 "Shelf Life of HEPA Filters"
- Engineering Shelf Life Evaluation-HEPA Filters 6-l-93

Personnel Interviewed:

- Procurement Sr. Buyer
- Manager of Procurement Engineering, Quality Assurance and Warehouse Quality
- Procurement Engineering Lead
- Procurement Quality Assurance Lead
- Warehouse Quality Lead
- HEPA filter SME.
- Receiving inspector
- Technical Support
- System Engineer
- Filter System Manager

Operations Observed:

Walk-down of filter plenums to determine the following:

- An in-place HEPA filter test was performed by the filter housing vendor and that testing met standard requirements-m ASME Code AG-1, Section TA
- Where applicable whether visual inspection ports are installed in filter housings to enable *in situ* visual inspection of HEPA filters

Results:

Record Review:
All HEPA filters used in credited and Defense in Depth Systems are required to be qualified to DOE STD-3020-97 which has equivalent qualifications to ASME AG-1, Section FC5000. Four tests are required to be performed on a HEAP filter design every five years or if the design or materials are changed. Two of the four tests are performed by Underwriters Laboratory (TX-586 - Resistance to Heated Air & Spot Flame) and two tests are performed by the Dept. of the Army (Resistance to Over-pressure & Rough Handling). The Procurement specification 15860-0806 "Specification for HEPA Filters" references standard DOE-STD- 3020-97 and ASME Code AG-1, Section FC. This specification is called out on the procurement documents.

The filter plenums in Building 371 were designed to requirements of AEC 6301, ASME N-509, ASME N-5 10 and the Nuclear Air Cleaning Handbook. The Site developed a Plenum Standard that addressed fire concerns and space limitations as well as structural integrity. ASME AG-1 Code on Nuclear Air and Gas Treatment was not published until 1994. Part of the basis for the code was AEC 6301, ASME N-509, ASME N-5 10 and the Nuclear Air Cleaning Handbook. The filter housings were built on site. The filter-housing contractor performed an in-place HEPA filter test. The testing did not meet standard requirements in ASME Code AG-1, Section TA because that section is for a test manifold design. The design used for Building 371 was a "walk-in type" plenums.

A review of the documents relating to an establishment of a HEPA Filter Life Program found two areas: HEPA Filter Service Life and HEPA Filter Shelf Life.

HEPA Filter Service Life:

An evaluation of HEPA filter service life program looked at the document "Evaluation of HEPA Filter Service Life (RFP-5141) which was performed by RFETS. The conclusion reached identified filter exposure to water as being more detrimental than age. The credited HEPA filters in Building 371 plenums where exposure to water had taken place during testing of the manual plenum fire deluge system were replaced in 1999. The manual plenum fire deluge system is no longer flow tested. The additional criteria for HEPA filter change out are based on differential pressure, visual damage, and exposure to water or chemicals.

HEPA Filter Shelf Life:

An evaluation of the HEPA filter shelf life program documents, WJM-142-93 "Shelf Life of HEPA Filters" and "Engineering Shelf Life Evaluation-HEPA Filters 6-1-93", found that a ten year shelf life was put into place in 1993. The program evaluated the manufactures' product information, the quality test requirements and the storage requirements. An extended shelf of ten years was developed. As a conservative

approach a five year test and reevaluation is performed by Filter Systems and Engineering.

Interviews:
The Procurement Sr. Buyer walked down the method and forms used for purchase of HEPA filters. The buyer explained the requirements in MAN-134-PPM "Procurement Program Manual". The buyer interviewed has been assigned the purchase of HEPA filters. The buyer works directly with the Procurement Engineer and the filter SME in the development of the purchase order from the requisition.

The Manager of Procurement Engineering, Quality Assurance and Warehouse Quality performed a review of the organization and its' responsibilities. A Procurement System Flow Chart was used to illustrate the path a filter would follow through the system. This extremely comprehensive chart explained all aspects of the system.

Procurement Engineering Lead reviewed the specification development process and the purchase requisition review. When the requisition is received the procurement engineer has the SME check the filter application and attributes. This extra step of having the HEPA filter SME review the requisition provides added assurance the specification and filter application is acceptable. Once the SME has resolved any questions and approved the filter the procurement engineer then reviews the requisition. The requisition is then sent to the buyer who will prepare the purchase order.

The Procurement Quality Assurance Lead reviewed the supplier qualification process. The filters are purchased as a safety class item therefore the manufacture is required to be approved. The Procurement Quality Assurance group is responsible for audits and evaluations of the manufacture. In addition to the evaluations the group assists Procurement Engineering in specification preparation.

The Warehouse Quality Lead is responsible for the receiving inspection process. HEPA filters are inspected by the DOE Filter Test Facility for quality and conformance to specification. The RFETS Receiving Inspection inspects the container for damage and verifies that all required documentation has been included.

The HEPA filter SME explained the connection between the HEPA Filter design requirements, the DOE standards, the ASME AG-1 Code, the Site Standard HEPA Specification and the procurement documents.

The Filter System Manager explained his procedure for distributing the older filters in stock to the buildings as needed and then replacing the stock through a purchase requisition first issued by the building thereby assuring the filters do not exceed the shelf life requirement. To date approximately 400 filters to date were re tested at five years shelf age by the DOE Filter Test Facility.

Observations:
A tour of the receiving and receiving inspection (B-130) was conducted. The inspectors are located in a separated area where control of received materials can be maintained.

A tour of the HEPA storage facility (B-060) was conducted with specific attention paid to HEPA filter storage. The HEPA filters are stored in a segregated area assigned to the Filter Systems Group. The warehouse meets a Level B storage requirement.

Visual inspection ports are installed in filter housings to enable *in situ* visual inspection of HEPA filters. The filters were observed through ports located in both the sidewalls of the plenums and in the front walls. The lighting provided in the plenums was quite sufficient for inspection of the filters. The inspection ports are used by the SOEs when performing their daily rounds.

A tour of the HEPA storage facility (B-060) was conducted. Specific attention was paid to HEPA filter age dating used to track shelf life. The filters containers were labeled with DOE Oak Ridge Filter Test Facility test labels showing the date of the acceptance testing. Some of the cartons had two labels demonstrating the five-year retest shelf requirement. No filters older than ten years were observed in the storage area.

Conclusion:
Procurement, qualification, testing and inspections of HEPA filters assures that the filter is capable of performing as intended when installed in the Confinement Ventilation System. The inspection of the filter at installation in the system, the initial in-place test and the subsequent in-place tests enable monitoring of filter performance and demonstrate filter reliability and operability. This criterion is met.

Operability Issues/Concerns:
None

Opportunities for Improvement:
None

Good Practices:

The Procurement Engineering group has added an extra step, outside procedure requirements, in the review of HEPA filter requisitions - the HEPA filter SME review assures the specification and the filter application is acceptable

Criterion 5: Instrumentation and measurement and test equipment for the system are calibrated and maintained.

Process

Records Reviewed:

- Operations instructions for the Air Techniques Inc. instrument TDA-2EN
- CALC-OOO-VEXH-00007 1, Shroud HEPA Filter In-place Test
- CALC-OOO-VEXH-000275, Challenge Manifold HEPA Filter In-place Test
- HSB-118-93, In-place DOP Testing of HEPA Filters – Calibration Point Paper
- Filter Plenum In-place Testing Work Packages
  - TO107530
  - TO107535
  - TO107536

Personnel Interviewed:

- *Filter Systems Manager*
- Filter Test Technician

Operations Observed:
A walk-through of a filter plenum in-place testing work package was performed. Equipment was set up to demonstrate the method used in Building 371 plenum testing.

Results:

Record Review:
Three work packages were reviewed. The appendix 12 sheets had been completed and signed off for calibration check.

The team reviewed the point paper on calibration requirements of the test instrument. The basis for the per use field calibration was clearly documented. This is the method used in the work packages reviewed.

The team reviewed the operations instructions for the Air Techniques Inc. instrument TDA-2EN. The calibration requirements of the test instrument are followed in the work packages reviewed and the demonstration performed by the test personal.

The following calculations CALC-OOO-VEXH-000071 "Shroud HEPA Filter In-place Test" and CALC-OOO-VEXH-000275 "Challenge Manifold HEPA Filter In-place Test" were reviewed to verify the calibration method used in assuring the aerosol challenge and detection readings were accurate. The method used to qualify the in-place test manifolds relied on test equipment (Q-107 Laser Penetrometer located in the DOE Filter Test Laboratory in B-442) verified to meet calibration requirement

therefore it can be inferred that calibration can be carried over and applied to the manifolds used in the testing.

Interviews:
Filter System personal demonstrated their knowledge of the test equipment, its operation, the method of calibration check and the basis for the calibration check.

The instruments that fail the calibration check are taken out of service. The disposition of the instrument will be determined by age, condition and potential contamination. If the instrument can be shipped to the manufacture for rebuilding it will be done, if the unit will be disposed of and replaced.

Observations:
The Filter System Manager in the filter systems work Lab Building 334 performed a walk-through of a filter plenum in-place testing work package. The equipment was set up to demonstrate the method used in Building 371 plenum testing. Appendix 12 of the work package is the calibration check instruction for the photometer used to test the leak rate. The manager adequately performed the verification procedure for calibration check.

Conclusion:
Equipment used for in place test meets all requirements of calibration.

The equipment appears to be maintained and stored in protected areas.

The manifolds used in the testing are made of materials which can be easily disposed of if contaminated. They are carefully stored and transported to the area when needed.

This criterion is adequately met.

Operability Issues/Concerns:
None

Opportunities for Improvement:
None

Good Practices:
N/A

APPENDIX B

BIOGRAPHIES OF TEAM MEMBERS

Michael S. Karol
Mike Karol graduated from the University of Arizona after earning a Bachelors and Masters degree in Nuclear Engineering. Mr. Karol served in the Naval Nuclear Propulsion Program as a member of the submarine service. After joining the Department of Energy (DOE) in 1976, Mr. Karol spearheaded the first DOE "Operational Readiness Review Program" at the Hanford Site in Hanford, Washington. He lectured on readiness reviews at the first training course on readiness reviews by EG&G (sponsored by DOE-HQ) for approximately three years. He was also principle author of the first DOE Readiness Review Guidance Document (completed 1982, issued 1987) by DOE HQ ES&H. Mr. Karol joined the Rocky Flats Field Office in 1989 and served in various positions including Assistant Manager for Site Operations, Assistant Manager for Site Operations and Waste Management, and Assistant Manager for Project Management and Engineering until late 1995. Mr. Karol is currently the Division Director for Engineering Support. Mr. Karol's career also includes chairmanship of several Type A and B accident investigations in the DOE complex, lead negotiator for a major lawsuit against DOE in Colorado District Court, and Chairman of a DOE investigation team responding to whistleblower allegations regarding safety, safeguards, design control and quality assurance at Hanford that received scrutiny from Congressman Dingell's congressional investigation sub-committee. More recently, Mr. Karol led the successful Operational Readiness Review of the Plutonium Stabilization and Packaging System in Building 371.

Daniel C. Ford
Daniel Ford is a President of Ford Consulting Group, Inc., and currently serves as Senior Technical Consultant with over twenty-four years of experience in nuclear facilities engineering, safety management and regulatory oversight. Mr. Ford served as senior level consultant to the United States Nuclear Regulatory Commission (NRC) for eleven years and has testified as an expert witness on behalf of the NRC during several Atomic Safety & Licensing Board hearings. His experience includes three years as technical advisor to the Department of Energy's Office of Nuclear Safety in the areas of event analysis, authorization basis, and nuclear safety oversight. At Rocky Flats for six years, he assisted the DOE Field Office in the areas of facility and process authorization basis, engineering, internal assessment, and coordinated Field Office initiatives in response to Defense Nuclear Facility Safety Board recommendations. Mr. Ford holds American National Standards Institute (ANSI) nuclear systems inspection and testing certifications in the areas of electrical power and instrumentation and control systems, and an American Society for Quality Control (ASQC) Quality Engineering certificate.

Mr. Ford's formal assessment experience includes participation in nuclear safety assessment of over forty commercial license holders while serving a consultant to the NRC, and assisting the NRC in development of assessment programs for examination of plant licensing, design, installation, maintenance, inspection and testing programs. While with the Office of Nuclear Safety Mr. Ford participated in several Operational Readiness Reviews including the High Level Tank Draining evolution at RFETS Building 771, resumption activities in RFETS Building 707, and review of nuclear operations at Savannah River, Oak Ridge and Pantex facilities.

Jan K. Fretthold
Mr. Fretthold is a Subject Matter Expert (SME) on HEPA filters and HEPA filter exhaust/supply systems. He was a design engineer at DOE / Rocky Flats Environmental Technology Site for 17 years, Manager of In-place Testing 2 years, and Manger of DOE Central Div. Filter Test Facility RFP for 2-years. He is experienced in mechanical design engineering including machine design, hydraulics, pneumatics, material handling, conveyors, HVAC, and dust collection. Mr. Fretthold has also been an active member of the ASME / **COMMITTEE ON NUCLEAR AIR AND GAS TREATMENT** (CONAGT) In the following groups and subcommittees:

- Task Group on Aging of HEPA Filters
- CBO Task Group on Decommissioning
- Subcommittee on Field Testing Procedure (ASME N-5 10)
- Subcommittee on Ventilation and Air Cleaning Equipment
- Subgroup on HEPA Filters
- Subgroup on Special HEPA Filters – Chair
- Subgroup on Moisture Separators

Mr. Fretthold participated in the development of the "Assessment Criteria and Guidelines To Ascertain the Current Condition of Confinement Ventilation Systems In Defense Nuclear Facilities" document for conducting the Phase II assessments on confinement ventilation systems. He was a team member on the two pilot Phase II assessments at Savannah River Site and the Lawrence Liver-more National Laboratory and was also a team member of a Phase II assessment the confinement ventilation system for the Plutonium Finishing Plant facility at Hanford.

Jeff Fauble
Mr. Fauble is a mechanical engineer at the Rocky Flats Environmental Technology Site (RFETS) and has nearly 20 years of science and engineering experience, 12 of which at Rocky Flats. He has Bachelors of Science degrees in Geology and Geophysics from the University of Utah and a Masters of Science Degree in Mechanical Engineering from the University of Colorado. He attained his Professional Engineer's License in 1998. Mr. Fauble has specialized in design and systems engineering and has extensive experience in chemical process design, environmental design, mechanical equipment design, nuclear ventilation systems, facility design, field engineering, and construction engineering within the DOE nuclear complex. He has held positions of increasing responsibility including design engineer, project engineer, lead engineer, and first and second level management positions.

Robert Williams
Mr. Williams received a BS degree in Fire Protection Engineering from the University of Maryland in 1965. The following two years were spent with the District of Columbia Fire Department with assignments as a firefighter and fire prevention inspector. He was employed as a fire protection engineer with the shore facilities command of the Department of the Navy for five years after which I became the operations fire protection engineer for Pennsylvania Power and Light Company, a position held for seven years.

He returned to the Navy Department in 1979 in the staff position of Assistant Director of Fire Protection for the Navy. He transferred to the Naval Sea Systems Command in 1985 as a supervisory fire protection engineer for navy ships. He accepted the DOE-RFFO fire protection engineer position in October 2000. During the above years, he has completed numerous fire-related courses at training and college levels. He was a state firefighting training instructor in Pennsylvania and Maryland, taught a fire science course at community college, and served on fire-related commissions and advisory boards. He served on two Codes/Standards Committees of the National Fire Protection Association. He has been an auxiliary firefighter in Baltimore City and an active member of three volunteer fire departments, serving as Chief of the College Park Maryland Department. He is a registered Professional Engineer in the States of Maryland and Pennsylvania and a member of the local chapter of The Society of Fire Protection Engineers.

Bruce Campbell
Mr. Campbell is a Senior Fire Protection Engineer with over 24 years of fire protection engineering experience of which 16 years are in the nuclear field. He is the Director of the Denver Office for Hughes Associates, Inc. and is a subcontractor to Kaiser-Hill. His experience also includes over 8 years as a senior loss control engineer for a highly protected risk insurance carrier where he conducted surveys of large industrial facilities. These industrial facilities included fully integrated steel mills, chemical facilities, aircraft hangers, etc.

At the Rocky Flats Environmental Technology Site (REETS), Mr. Campbell has been involved will all aspects of the fire protection program for his entire tenure. He assisted with all operational readiness reviews prior to the D&D mission for the site. Presently he is the contractor Authority Having Jurisdiction in all matters relating to fire protection. Mr. Campbell is a charter member of the DOE Fire Safety Committee and was active in the preparation of several complex-wide fire protection standards including DOE Order 5480.7A, fire protection for gloveboxes and fire protection for filter plenums. He has presented a number of papers on various fire protection subjects at national and international conferences. In addition to his duties as the Fire Protection Programs Manager, Mr. Campbell is the Subject Matter Expert for HSP 31.11, Transfer and Storage of Plutonium for Fire Safety and HSP 3 1.15, Control of Generated Flammable Gas.

Bill Prymak
Mr. Prymak is an engineering expert in the RFFO Engineering Support Division and has nearly 20 years of nuclear and radioactive waste management experience, 12 of which at Rocky Flats. He has a Bachelors of Science degree in Chemical and Petroleum Refining Engineering and a Masters of Science Degree in Ecological Engineering, both from the Colorado School of Mines. He has extensive experience in nuclear operations including being a qualified watch officer a nuclear submarine for 2 years, a Shift Refueling Engineer at the Charleston Naval Shipyard for 2 years and a DOE Facility Representative in Buildings 771 and 707 for 2 years. He has completed the Technical Qualification Program in the functional area of Decommissioning. He has substantial experience in radiological controls from his Navy, shipyard and Rocky Flats experiences. Mr. Prymak

was the DOE Project Manager for development and implementation of the Site Treatment Plan for mixed wastes for 3 years and has been a member of several Headquarters waste steering committees. He has completed numerous assessment courses and is qualified as a lead assessor. He currently holds the following certifications: Certified Hazardous Material Manager; and Registered Environmental Manager. He has been a member of a DOE Type A accident investigation at Rocky Flats and has served on numerous review teams. He has led numerous readiness determination oversight teams for various decommissioning activities at Rocky Flats including the Building 440 Operation Readiness Review, glovebox removal and size reduction in Building 779 and 771, and demolition of Building 779. Most recently, he was the Deputy Team Lead of the Operational Readiness Review of the Plutonium Stabilization Packaging System in Building 37 1.

Howard Saunders
Mr. Saunders is a registered Professional Engineer with over 30 years of engineering experience including 16 years of experience in the nuclear field with in-depth experience in structural design, architectural design, assessments, records documentation and management, project engineering, engineering group management, and engineering procedures, standards and specifications.

While at the Rocky Flats Environmental Technology Site (RFETS), Mr. Saunders has been involved in many aspects of engineering and engineering management including modifications to existing process facilities, development of the site engineering design process, manager of the Site Design Document Control group, and manager of the site structural, civil and architectural engineering groups. Mr. Saunders was also on the team that completed the pre-operational readiness review for the PuSPS project in Building 371 that allowed nuclear material to be placed in sealed containers for storage and shipment. Additionally, Mr. Saunders has lead assessments of several outside Architectural/Engineering Companies that have completed design and construction at RFETS.

Wayne Burch
Mr. Burch is a Quality Assurance Specialist with over twenty years of experience in Quality Assurance at Rocky Flats. He was previously employed by the Site contractor as an inspector and certifier of War Reserve weapons product in Rocky Flats production areas. He has been assigned to RFFO Quality Assurance organizations since December 1990. He has completed the Technical Qualification Program in the General Technical Base, Site Specific and functional areas for Quality Assurance Engineers and Specialists. He has participated in numerous assessments including oversight of the K-H Corporate Operations Readiness Review of Building 371 Tank Draining & Caustic Waste Treatment System Operations and the Building 707 Salt Stabilization Readiness Assessment. He also participated in the recent Engineering Review of the Plutonium Stabilization and Packaging System (PuSPS) in Building 371. He has performed independent Quality Assurance Assessments at the Site for RFFO since 1991 using various Quality Assurance standards. The standards include 10CFR830, Subpart A, Quality Assurance Requirements; DOE Order 414.1A, Quality Assurance; and

ANSI/ASME NQA- 1, Quality Assurance Program Requirements for Nuclear Power Plants. He has reviewed numerous implementation and corrective action plans for RFFO and contractor Quality Programs. He has also performed Safety Management Program (Quality Assurance) reviews for the Site Safety Analysis Report, and Basis for Interim Operations (BIOs) reviews for buildings 707, 771,774,776,777 and 906.

Neil Chismar
Neil has over twenty years experience in data processing. This experience includes computer and peripheral equipment operations, tape library maintenance, and applications support. Neil has held positions in data security, email administration, and configuration management. He has experience as an Instructor in the proper use of computer software packages and has mentored/cross trained coworkers in software Quality Assurance and Quality Control methodologies.

Neil is the Education Coordinator for the Software Quality Association in Denver (SQUAD). SQUAD is a non-profit group of Software Quality professionals in Colorado that gather to network, exchange information, and support one another. SQUAD hosts certification examinations, has monthly meetings where a presentation is given, and holds a yearly vendor showcase to highlight available tools for automation of testing, configuration management, problem management, and source code management. Neil has held past positions on the Board as Vice President and Secretary, and is a founding Board member.

Neil has received the professional designation of Certified Quality Analyst from the Quality Assurance Institute. This certification indicates training in communications, auditing and control, disaster recovery, and quantitative methods. Certification also demonstrates knowledge of software Quality Management, Quality Assurance, and Quality Control methodologies.

Neil is presently the Quality Assurance Manager for DynCorp Systems & Solutions LLC at the Rocky Flats Environmental Technology Site. Responsibilities include, but are not limited to, monthly reports, participation in proposal responses, assistance and contribution to the Project Management Plan, review of documentation and work products, monitoring test activities and test plans, review of project activities for compliance, and recommending corrective actions for any errors, discrepancies, and items of non-conformance or non-compliance. Neil is responsible for audits to include reporting of reviews and results to senior management, conducting reviews and audits of subcontractor activities, auditing internal Configuration Management activities, and tracking non-conformance issues to closure. Neil was instrumental in DynCorp Systems & Solutions attaining a Software Engineering Institute Capability Maturity Model Level 3 rating in February of 200 1.

John Cox
Mr. Cox has 30 years experience in engineering, management, and consulting in commercial nuclear and DOE nuclear programs. Mr. Cox has a BS in mechanical engineering and holds a DOE Q clearance. He is co-founder/owner of Phoenix

Consultants Inc., a small business, consulting firm, providing senior consulting services to DOE and DOE Contractors. Prior to this, Mr. Cox was Vice President with Tenera LP having responsibility for government services support to DOE facilities. Before joining Tenera, he had 19 years experience with Tennessee Valley Authority (TVA) in various management and engineering positions associated with their commercial nuclear power program. As the Licensing Manager, Mr. Cox represented TVA in nuclear plant (Browns Ferry, Sequoyah, Watts Bar, Bellefonte, Hartsville, and Phipps Bend) construction permit and operating license applications with NRC-NRR, Office of Inspection and Enforcement, Advisory Committee on Reactor Safeguards, and Atomic Safety and Licensing Boards. Mr. Cox has been involved in operational readiness reviews, facility/program assessments, and ESH&QA reviews at numerous DOE facilities across the DOE Complex as well as commercial nuclear power plants. Mr. Cox has supported INEEL, Hanford, Oak Ridge, Savannah River, Rocky Flats, Brookhaven National Laboratory, and Argonne East in operational readiness reviews and ESH&QA assessments (as the team lead and in support roles) and in development and implementation of compliance assurance programs for DOE Order compliance and Price-Anderson Amendments Act implementation.