



Department of Energy

Washington, DC 20585

August 27, 2001

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

Dear Mr. Chairman:

Consistent with the Department's implementation plan for the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2000-2, I am forwarding information concerning Deliverable 10, due in June 2001 under the implementation plan.

Commitment 10 calls for the Department to test the effectiveness of confinement ventilation assessment criteria and brief the Board.

The Department briefed the Board on August 16, 2001. Enclosed is a copy of the *Assessment Criteria and Guidelines to Ascertain the Current Condition of Confinement Ventilation Systems in Defense Nuclear Facilities*.

The Department has completed Commitment 10 and proposes closure of this commitment.

Sincerely,

A handwritten signature in black ink that reads "Steven V. Cary".

Steven V. Cary
Acting Assistant Secretary
Office of Environment, Safety and Health

Enclosure

cc:

M. Whitaker, S-3.1



U. S. Department of Energy
Configuration Management - Vital Safety Systems

**Assessment Criteria and Guidelines
To Ascertain the Current Condition of
Confinement Ventilation Systems
In Defense Nuclear Facilities**



August 2001

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ACRONYMS

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
Board	Defense Nuclear Facilities Safety Board
CFR	Code of Federal Regulations
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U. S. Department of Energy
DP	Defense Programs
ERDA	U.S. Energy Research and Development Administration
HEPA	High Efficiency Particulate Air
SER	Safety Evaluation Report
STD	Standard
UCNI	Unclassified Controlled Nuclear Information
UL	Underwriters Laboratory
USQ	Unreviewed Safety Question

Glossary

Operable (operability)– Describes a system, subsystem, train, component, or device that is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, cooling water, lubrication, and other auxiliary equipment required for the system, subsystem, train, component, or device perform its function(s) are also capable of performing their related support functions(s).

Walkdown – A visual inspection of facility structures systems and components to identify the as-found physical configuration and any discrepancies with the currently approved facility documentation. (See DOE STD 1073)

Assessment Criteria and Guidelines To Ascertain the Current Condition of Confinement Ventilation Systems in Defense Nuclear Facilities

INTRODUCTION

This document contains assessment criteria and guidelines for ascertaining the current condition of confinement ventilation systems in Department of Energy (DOE) defense nuclear facilities. The criteria and guidelines fulfill Commitment 9 of the DOE Implementation Plan for Defense Nuclear Facilities Safety Board (DNFSB or Board) Recommendation 2000-2, *Configuration Management, Vital Safety Systems*.

The 2000-2 Implementation Plan specifies two phases of assessments. Phase I assessments call for a review of operational and maintenance records and a qualitative determination of a “readiness state” for each vital safety system within defense nuclear facilities of interest as listed in Appendix E of the 2000-2 Implementation Plan. In the context of the Implementation Plan, vital safety systems are safety class or safety significant, or they perform an important defense in depth function. Phase II assessments call for more detailed assessments of the operational readiness of systems. Section 4.1.1 of the Implementation Plan states, “For the Integrated Safety Management-like [Phase II] assessments, the ventilation system guidance and criteria (discussed in Section 4.1.2) will be tailored for use in specific facilities.” Notwithstanding this additional use, the assessment guidance and criteria in this document focus exclusively on confinement ventilation systems.

This document was developed by a DOE-wide team of experts in the areas of defense nuclear facility and confinement ventilation system design, operation and maintenance. Commitment 10 of the Implementation Plan calls for the criteria and guidelines to be tested at two pilot facilities, and revised as necessary. Commitment 11 tasks field element managers to assemble teams to assess the condition of confinement ventilation systems that are important to safety. Confinement ventilation assessment teams will use existing information and processes (i.e., performance of the assessment should not require development of new or additional information by the facility being assessed).

The remainder of this document is organized as follows:

- The *Background* section describes typical safety functions of a confinement ventilation system and the Board’s concern about aging and degradation of these systems.
- The *Assessment Guidelines* section covers the purpose, scope, and guiding principles for assessments of confinement ventilation systems, and suggests a tailored methodology for those assessments.
- The *Criteria and Approach* section presents an objective, criteria, and approach for each of the following topical areas: (1) safety function definition, (2) configuration management, (3) system maintenance, and (4) system surveillance and testing.
- The *Report Format* section provides a suggested report format.
- The *References* section lists selected references relevant to confinement ventilation systems.

BACKGROUND

Confinement ventilation systems are generally used to prevent the uncontrolled release of radioactive contaminants to the environment, and to minimize worker airborne radiation exposure. To accomplish these functions, fresh air is directed through the facility according to controlled pathways and, finally, through filters, which collect contaminants.

A typical confinement ventilation system induces the flow of air through a facility via an array of components, including ductwork, filters, fans, dampers, associated instrumentation, controls including interlocks, and power sources. Active components are, in turn, supported by other systems or subsystems, which contribute to the operability of various functions of the confinement ventilation system. Some of these support systems may fail during accident conditions, whereas others credited in accident analyses may be needed to continue to perform some or all of their functions.

The confinement ventilation system typically directs fresh air (from outside the facility) to areas inside the facility of least contamination potential, such as offices and hallways. The air flow pathways then proceed through areas of greater contamination potential, such as laboratories, and then to areas with the greatest contamination potential, such as hoods and gloveboxes. Before being discharged from the facility, the air is directed through filters that remove contaminants and is monitored to ensure that contaminants are below specified limits. This directed ventilation flow is designed to entrain potential contaminants and remove them from worker breathing zones.

The confinement ventilation system is also often used to control temperature and humidity conditions in the facility through heating or air conditioning. The confinement ventilation system is often subdivided into zones, interlocked or interfaced with other safety systems (such as the fire protection system), and designed to perform additional safety functions such as isolation, air flow diversion, or shutting down upon detection of excessive contamination (radioactive or toxic materials).

In Recommendation 2000-2, the Board expressed concern that many DOE nuclear facilities were constructed years ago and are approaching the end of their design life. The Board concluded that confinement ventilation systems were degrading and might be approaching unacceptable levels of reliability and operability. The Board advised that as facilities age, a combination of age-related degradation and deficient maintenance may affect the reliability and ability of the system to perform its safety functions as designed.

In accepting Recommendation 2000-2, DOE analyzed oversight findings and information reported in the DOE Occurrence Reporting and Processing System. DOE reached many of the same conclusions as the Board, including the need to pay special attention to the effects of aging on reliability and operability of confinement ventilation systems.

While DOE acknowledged the Board's concern, it also recognizes that the system is not a living organism and does not die at the end of its design life. With proper condition monitoring and assessment, maintenance, modification, repair or replacement of aging components, and analysis of long-term facility missions and system requirements to support these missions, the confinement ventilation or any other safety system can remain operable and reliable into perpetuity.

Assessment Guidelines

Purpose and Scope

These guidelines and criteria provide a consistent overall framework for assessments of confinement ventilation systems important to safety. For completeness, the initial proposed scope of this assessment includes electrical, mechanical, instrumentation and controls, and air cleaning components within the system boundary. The initial proposed scope also includes operability of support systems, such as electrical and pneumatic motive and control power sources, or steam, which are credited in facility safety documentation for the system. The assessment team should tailor this scope to suit the specific system under assessment.

The assessment of a confinement ventilation system will not reanalyze the safety basis, authorization basis, or design of the system or support systems, nor will it second-guess the approval of safety basis, authorization basis, or design documentation. The current approved safety basis, authorization basis, and available design information will be reviewed to identify and understand safety functions (system requirements and performance criteria) of the system.

Finally, the assessment scope should build upon recent assessments, including the 2000-2 Implementation Plan Phase I confinement ventilation system assessment. Useful information in Phase I assessment reports should be used in preparing, tailoring, conducting, and documenting a Phase II assessment. The Phase II assessment team should not critique the conduct of Phase I or validate Phase I results. Review items that were already completed and documented in the Phase I assessment report should not be duplicated as part of Phase II.

Guiding Principles

The following principles should guide conduct of the assessment. The assessment team leader, with assistance from the DOE site manager responsible for 2000-2 Phase II assessments, should ensure that these guiding principles are incorporated in the tailoring process for assessments of confinement ventilation. Therefore, each of these principles is not duplicated in the Objective, Criteria and Approach sections that follow.

- **If the team identifies a condition that poses an imminent threat to personnel or facility safety, line management is notified immediately.** Assessment team personnel should immediately point out the imminent threat condition to their points of contact or appropriate facility manager, and notify the assessment team leader as soon as practical.
- **Previous assessments, such as Phase I assessments, quality assurance reviews and system condition assessments, and the facility-specific design of the system are reviewed but not duplicated in Phase II.** This assessment includes a review of Phase I and other relevant assessments and appropriate portions of the approved authorization basis and related safety documentation for the facility. This review will enable the assessment team to understand previous assessments, specific system safety functions, associated requirements and performance criteria, and assumptions concerning system operation. Although the assessment is not an evaluation of the authorization or

safety basis for the system, any instances in which deficiencies in the authorization or safety basis are identified will be noted by the team and brought to the attention of facility management.

Physical boundaries of systems and subsystems that provide the confinement ventilation safety function are defined for the assessment. A facility may have several systems or subsystems (safety class, safety significant or defense-in-depth) that make up the confinement ventilation safety function credited in safety basis documentation. Some “support systems” may be “vital safety systems” in the context of Recommendation 2000-2, and may be subject to their own Phase II assessment. For this confinement ventilation assessment, the review of support systems will be limited to operability credited in safety documentation for confinement ventilation and operational history of support systems that would indicate their reliability.

- **The assessment includes inspection to determine physical material condition and consistency of system configuration with safety documentation.** Indications of aging-related degradation deserve special attention. Inspection or technical walkdown of selected parts of the system should be performed on a sample basis. The team should not request changes in system or component status that would disrupt the current mode of operation of the system or facility, including access to components that are inaccessible in the current mode of system operation. Where challenges to future operations are identified (e.g., unavailability of repair parts or replacement components), they should be documented so that facility or site staff can ensure that appropriate compensatory measures are put in place before deficiencies occur, and that needed modifications or repairs are timely.
- **Procedures and records for system surveillance testing and maintenance will be evaluated to determine whether they are appropriate and are being used to verify that system requirements and performance criteria described in the safety documentation are satisfied.** Special attention should be devoted to evaluating aging-related degradation of the system and to reviewing site or facility processes or programs for managing degradation as components age (e.g., inspection, condition assessment, refurbishment, maintenance, performance monitoring). The team should assess whether normal operating data, maintenance and test procedures, and records of surveillance tests and maintenance confirm that system requirements and performance criteria (safety functions) are satisfied. The calibration, accuracy, and quality assurance of instrumentation used to measure performance should also be evaluated.
- **Software quality assurance for instrumentation and control (I&C) systems, including embedded microprocessors and related software, should be considered in the scope of the assessment.** The team should request facility staff to identify system components and functions that use microprocessors and related software (e.g., programmable logic controllers, distributed control systems, or process control software) and to identify the safety significance of these components or functions. Request documented evidence that the software quality assurance standards were applied for software development, procurement or use, and request a staff contact for further information. In an appendix to the assessment report, this information should be presented for use in other reviews of software quality assurance. The operational history and failure rates of these components should enable the team to assess the current and long-term reliability of computerized I&C components and the effectiveness of associated quality assurance. The team should not attempt to review lines of code or to conduct its own verification and validation (V&V) of software because these activities are beyond the scope of the confinement ventilation assessment.
- **Reviews of site-wide or facility processes and programs that directly affect continued integrity, reliability and availability of confinement ventilation systems may be combined.** Processes and programs common to more than one confinement ventilation system under Phase II assessment, such as system configuration management, maintenance, and surveillance and testing may be combined in

a single review. These processes and programs are typically required by Technical Safety Requirement administrative controls.

- **Exit meeting and assessment report.** As arranged by the team leader and facility/ site management, appropriate facility and DOE field management should be invited to a briefing on the assessment results. After completion of the review, the assessment team leader will send the final report summarizing the results of the assessment to the field element manager. The report will state whether assessment criteria were satisfied and may contain statements of opportunities for improvement, any observations for consideration by the field office or contractor, and a qualitative conclusion as to the current condition and long-term reliability of the confinement ventilation system. Recommended actions may also be included. Detailed discussions of results may be appended.
- **Continuous improvement.** Items worthy of DOE-wide dissemination should be entered into the DOE Lessons Learned System in accordance with DOE Standard 7501-99. Upon completion of the first two or three confinement ventilation assessments at each site, the team leaders for these assessments should provide feedback to the DOE field office staff manager assigned responsibility for Phase II assessments. After consolidation of site feedback, the field office manager should forward this information to the cognizant/ lead headquarters program office, which, in turn should forward this information to the 2000-2 Implementation Plan Executive Team. To improve confinement ventilation system or any other Phase II assessments, the feedback should contain any recommended changes to assessment process scope, tailoring, criteria, guidelines, or approach.
- **Ground rules for observers and trainees.** Observers and trainees accompanying the assessment team should not interfere with conduct of the assessment. The team leader should define and achieve agreement on observer and trainee limits of participation in advance of the on-site assessment.

Assessment Methodology

The assessment should address the following major activities:

- Review the Phase I assessments of confinement ventilation and supporting systems
- Review safety basis documentation for the system
- Evaluate the material condition of the system
- Review system configuration management, maintenance, and surveillance and testing which affect system integrity, reliability and availability, including high efficiency particulate air (HEPA) filters, if installed in the system, or other types of filters (e.g., sand filters). This review is limited to application of these processes directly to the confinement ventilation system.

A suggested sequence for this assessment, including team selection, site-specific tailoring, preparation, pre-assessment visit, on site assessment, and reporting, follows. The assessment team leader, with assistance from the DOE site manager responsible for Phase II assessments, should ensure that elements of this assessment methodology are incorporated in the tailoring process. Therefore, each of these elements is not duplicated in the Objective, Criteria and Approach sections that follow.

Team Selection.

Team leader appointment and team member selection processes should be consistent with the following guidance.

Team leader:

- Is appointed by the field element manager
- Should be experienced in assessment techniques and leadership of assessment teams
- Should be a Federal employee
- Should be Senior Technical Manager or Technical Qualification Program qualified in accordance with Federal Technical Capability Program guidance
- Should not be in the line organization of the facility at which the confinement ventilation system is assessed
- Should document capabilities to lead the assessment team in a short biographical sketch, which becomes part of the assessment record

Team members:

- Should be technical experts capable of assessing the confinement ventilation system
- Collectively should have knowledge in the following disciplines, as applicable: filter design (HEPA or sand filters, etc.), testing, aging and performance; nuclear/mechanical systems; electrical, instrumentation and controls; safety analysis; and system maintenance, surveillance and testing
- Can be Federal employees, site contractor or subcontractor experts
- Can be from any DOE field site or headquarters office or their contractors or subcontractors
- Should not have contractor line management responsibility for the system under assessment
- Should be selected by the team leader, in consultation with the DOE site manager assigned lead responsibility for Phase II assessments. Although not required, the DOE site lead may consult and request assistance from EM or NNSA headquarters staff for selection of team members.
- Should be provided with personal computers from their home site or the facility under assessment and should be capable of providing daily assessment observations and report inputs in electronic files
- Should document technical capabilities in a short biographical sketch, which becomes part of the assessment record

Site-Specific Tailoring.

- The DOE site office manager assigned responsibility for confinement ventilation assessments should develop a schedule for all of the assessments of confinement ventilation and include DOE and contractor resources in the schedule.
- Any deficiencies identified in the Phase I assessments should be considered in the selection of topical areas and specific criteria in this guide that should be emphasized.
- System drawings should be reviewed. The system should then be walked down during a tour of the facility to inspect material condition and physical layout. System maintenance and configuration management should be reviewed by one or two team members during this walkdown. Using a graded approach, topical areas and criteria from this guide should be used to evaluate any deficiencies identified during this part of the assessment.
- The assessment method and approach should be appropriately graded with greater depth or breadth given to systems relied upon to protect against more significant hazards or having greater system complexity or a longer expected service life.

- Recent assessments, reviews, audits or inspections meeting the objectives or criteria in this guide should be cited and not duplicated to fulfill the appropriate part of this assessment.
- Multiple safety systems subject to confinement ventilation or other Phase II assessments may be under common management, technical and administrative programs or processes for a site or facility. These common programs or processes such as safety basis documentation, configuration management, system maintenance, and system surveillance and testing should be evaluated only once for all confinement ventilation or other Phase II assessments. This one-time review should determine whether facility or site-wide programs are effective in ensuring the current operability and long-term reliability of these systems. The DOE site manager responsible for Phase II assessments should ensure that duplicate reviews of common programs are avoided.
- For multiple systems under common management, technical and administrative programs or processes for a site or facility, specific components or portions instead of multiple complete systems should be assessed. A sample set of individual systems or their components subject to these common programs should be selected for the assessment. For example, specific confinement ventilation systems (e.g., active or passive high-level waste tank exhaust ventilation systems at Hanford, Savannah River, or Idaho) should be bundled to assess material condition of these systems on a sampling basis. The sample size and scope should be based on Phase I results or other indications of operability problems.
- Confinement ventilation systems subject to assessment are systems that are designated “important to safety.” Some vintage authorization basis documents do not use this terminology. Systems with equivalent or similar safety designation, or which perform a confinement ventilation safety function credited in the system or facility safety analyses should be considered for inclusion in this assessment.
- Direct resources and costs of confinement ventilation and all other Phase II assessments, as well as estimated costs of any programmatic delays or impacts should be collected by the responsible site manager.
- Field management should consider incorporating this assessment methodology into other site assessment programs, such as continuing system condition assessments or Facility Evaluation Board (FEB) activities, which will continue after completion of the 2000-2 Implementation Plan.

Preparation. Suggested duration – 2 weeks. Information needed to understand the confinement ventilation system functions, safety basis, design, configuration management, maintenance, and surveillance and testing should be requested from the facility staff. The facility staff should be requested to estimate the remaining lifetime of the system and the facility. This information should be reviewed to identify safety functions, system requirements and performance criteria, and additional details of site or facility processes within the scope of the assessment.

Confinement ventilation system documents such as the following are suggested for review during assessment preparation:

- Phase I assessment report and Secretarial HEPA Filter report, including data and materials assembled for Phase I assessments
- Safety Analysis Report, Basis for Interim Operation, Hazard Analysis Report, Accident Analyses, and other safety basis and authorization basis documentation, including applicable Unreviewed Safety Question Determinations, and Safety Evaluation Reports approved and issued by DOE

- Confinement ventilation system description and system design description (if available)
- Applicable Technical Safety Requirements, Operational Safety Requirements, and surveillance test procedures
- System piping and instrumentation drawings for confinement ventilation and support systems, electrical one-line diagrams, logic diagrams, and other such diagrams
- Design modification packages for any major work, changes, or modifications to the system, including related safety evaluations
- DOE and other industry standards applicable to the confinement ventilation system
- Reports of studies and assessments related to the system
- Maintenance history and occurrence reports for the system
- Surveillance and testing records for the system
- Other records that describe operational history or reliability of the system.

Based on this document review, the team should develop lines of inquiry for interviews and observations during the on site assessment period.

The team leader, with assistance of the DOE field office manager responsible for Phase II assessments, should prepare a detailed list of facility staff, including the DOE Facility Representatives and the contractor Facility Manager, to be interviewed. Lines of inquiry should be matched with the interview list and assigned to specific team members.

Optional Pre-Assessment Visit. Suggested duration – 1-2 days. The team leader may decide to visit the facility in advance of the assessment to gather additional information, to become familiar with the facility staff, and to arrange coordination and information management support and equipment for the team. During the preparation phase or this visit, system or facility-specific training and security needs should be identified and plans or activities to satisfy these needs should be arranged. The team leader may invite other team members to participate in this visit.

The safety functions of each confinement ventilation system are based upon facility-specific safety analyses. The requirements and performance criteria that must be met by the confinement ventilation system design to accomplish these safety functions should appear in system documentation and should be reviewed by the team. For some facilities the facility mission may have sufficiently changed such that confinement ventilation system functions relied upon to protect the public, worker, and environment may be different than those described in historical safety basis documents. In this situation, the team leader should meet with facility engineering or line managers to identify the documented safety functions relied upon for the current facility mission.

On Site Assessment. Suggested duration – 1 week. During a short entrance meeting (2 hours suggested), the facility staff should present information limited to the topics covered in the assessment criteria.

Suggested content of this briefing is as follows:

- System overview and agreed-upon boundaries for the assessment
- Current status and long-term projection of system operability and reliability
- Ability of the system to perform its safety basis functions over its estimated remaining lifetime
- Estimated remaining lifetime of the facility

- Relevant sections and cross reference if necessary of safety basis documents to TSR and surveillance requirements
- Points of contact and escorts
- Administrative support arrangements

The DOE field office staff should present the Safety Evaluation Report, highlighting any commitments to DOE documented in the SER, which should have been incorporated in the authorization basis.

The team leader should introduce the team, discuss the assessment schedule for the week, confirm the list of interviews and modify them according to site preferences and availability of site staff.

Based on the preparatory document review, the team should request and review any additional documents (e.g., system drawings) not received earlier, and then tour the facility to determine overall material condition and physical layout of the system. Material deficiencies noted should be documented and compared to facility processes or systems that capture, track, correct and close material deficiencies.

Once the assessment team has developed an understanding of the facility-specific conditions and layout, the team should review system records and interview personnel to evaluate configuration management, maintenance and surveillance and testing processes applicable to the system. The Facility Manager and DOE Facility Representatives should be interviewed as part of the assessment.

Using an appropriate set of system drawings and procedures, at least one team member should perform a technical walkdown of selected portions of the system to confirm that the as-built configuration conforms to these technical documents. Specific parts of the system to be walked down should be selected based on the results of assessment preparation, the initial tour, and any other information that would suggest problem areas.

From the approved Implementation Plan, “Finally, based upon the assessment results and engineering judgment, the assessment team will estimate the ability of the confinement system to reliably perform its safety function(s) [sic] over the remaining system lifetime.” This conclusion should be based on professional opinions of the team with the condition that current processes in place to control system configuration and operability are maintained, or any changes to these processes or systems are subject to an acceptable Unreviewed Safety Question (USQ) determination process.

Reporting. Suggested duration – 1 week. Guiding Principles described earlier cover site interactions during the assessment visit and report preparation. A guide for suggested format and content of the report appears later.

CRITERIA AND APPROACH

The *Criteria and Approach* section is divided into topical areas: (1) safety function definition, (2) configuration management, (3) system maintenance, and (4) system surveillance and testing. Each of these topical areas includes:

- *Objective* describes the intent that the topical area should contribute to assessment of the confinement ventilation system
- *Criteria* suggest characteristics of a confinement ventilation system that should be verified
- *Approach* suggests collection of information needed to assess the condition of the confinement ventilation system according to the criteria. The items in the *Approach* section are to guide the assessment team; however, the assessment team may choose to select another approach to meet assessment-specific needs.

For each topical area, the criteria and approach items are numbered for easy reference. The items under the *Approach* subsection are numbered such that the items can be readily linked back to the most applicable criterion (e.g., item number 2-1 under the Approach is most directly linked to Criterion 2). However, the evaluation of each criterion should consider relevant information collected during the assessment (not only information related to the linked items).

The 2000-2 Phase I assessment or other reviews of the confinement ventilation system may satisfy some of the objectives and criteria that follow. Previous reviews may also contain information relevant to this assessment, which can be cited and used in this assessment. In such situations, this assessment should be limited to objectives and criteria not covered in previous assessments and should not unnecessarily duplicate previous assessments.

Safety Function Definition

Objective:

Safety basis-related technical, functional, and performance requirements specific to the confinement ventilation system (e.g., as discussed or cited in the facility safety analysis documents), are documented and maintained.

Criteria:

Requirements in applicable DOE rules and orders are invoked for the confinement ventilation systems in the appropriate site documents.

Approach:

Review the appropriate safety/ authorization basis documents, such as safety analysis reports, basis for interim operations, technical safety requirements, safety evaluation reports, and hazards and accident analyses, to determine if the definition/ description of the safety functions of the confinement ventilation system includes:

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

Configuration Management

Objective:

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

Criteria:

1. Changes to confinement ventilation system safety basis requirements, documents, and installed components are designed, reviewed, approved, implemented, tested, and documented in accordance with controlled procedures.
2. Limited technical walkdown of selected system components verifies that the actual physical configuration of these components conforms to documented design and safety basis documents for the system.
3. Changes to the confinement ventilation system safety basis requirements, documents, and installed components conform to the approved safety/authorization basis (safety envelope) for the facility; the appropriate change approval authority is determined using the Unreviewed Safety Question (USQ) process; and consistency is maintained among system requirements and performance criteria, installed system equipment and components, and associated documents.
4. Facility procedures ensure that changes to the confinement ventilation system safety basis requirements, documents, and installed components are adequately integrated and coordinated with those organizations affected by the change.
5. The quality of computer software used in system components or functions is assessed, documented and maintained.

Approach:

1-1 On a limited sample basis, evaluate the change control process and procedures:

- Review procedures governing change control
- Review design change packages and work packages to determine whether change control procedures are implemented
- Interview a sample of cognizant line, engineering, QA managers 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.

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

- 3-1 Review documentation, such as change travelers and changes packages, and interview individuals responsible for processing selected changes made to confinement ventilation system requirements, installed equipment, and associated documents. Determine whether:
- Documents affected by the change are identified
 - Changes are accurately described, reviewed and approved as appropriate
 - Systems, structures, and components affected by the change are identified for facility management, system engineer, users, operators, or others affected by the change
 - Changes to the system 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 used
 - Installation instructions, post-modification testing instructions and acceptance criteria for turnover to facility operations are specified, and
 - Important documents affected by the change are revised timely.
- 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 confinement ventilation 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.
- 5-1 Review software quality assurance controls applied to development or procurement of software for the system. Verify that facility staff has confirmed that software developers have used industry standards and have provided documented evidence of compliance to national or local standards for software quality.
- 5-2 Request facility staff to provide a list of computer programs and software used in instrumentation and controls used in the system. During system walkdown, assess the completeness of the list of computer programs and software used in the system.
- 5-3 Review quality assurance records. Determine whether:
- Software in use has quality assurance documentation, and
 - Procedures exist for software updates, changes, and version control.
- 5-4 Interview facility engineering or operating staff to determine their awareness of software quality assurance requirements for system software programs under their cognizance.

System Maintenance

Objective:

The system is maintained in a condition that ensures its integrity, operability and reliability.

Criteria:

1. For the confinement ventilation system, maintenance processes consistent with safety classification are in place for prescribed corrective, preventive, and predictive maintenance.
2. The system is periodically walked down in accordance with maintenance requirements to assess its material condition.

Approach:

- 1-1 Verify that maintenance for the confinement ventilation 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.
- 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 confinement ventilation system maintenance work packages.
- 2-1 Verify that the system is inspected periodically according to maintenance requirements.
- 2-2 On a sample basis, inspect the material condition of installed components and determine whether any observed deficiencies have been already identified and addressed in a facility condition assessment or deficiency tracking system.
- 2-3 Review system or 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.
- 2-4 Review the procedure and process for performing walk downs of the confinement ventilation system. Verify through manager and worker interviews that personnel performing walk downs understand operational features, safety requirements and performance criteria for the system.

System Surveillance and Testing

Objective:

Surveillance and testing of the confinement ventilation system demonstrates that the system is capable of accomplishing its safety functions and continues to meet applicable system requirements and performance criteria (e.g., safety basis requirements such as Technical Safety Requirements/Limiting Conditions for Operation).

Criteria:

1. Requirements in applicable DOE Rules and Orders are invoked for the confinement ventilation system.
2. Requirements for surveillance and testing necessary to demonstrate overall system reliability and operability are accommodated by the system design 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 confinement ventilation system are calibrated and maintained.

Approach:

- 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 system is capable of performing its 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.
- 3-1 Review surveillance and testing procedures for the confinement ventilation system's major components. Review a sample of the test results. Perform a walkthrough of the surveillance test procedure with appropriate facility personnel 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.

REPORT FORMAT

The report is intended for the cognizant facility managers and DOE line management and should include the following sections. The report must conform to security requirements, be subject to classification review if needed, and should not contain classified information or UCNI.

1. **Title Page (Cover).** The cover and title page state the name of the site, facilities, and dates of assessments of one or more confinement ventilation systems (one report may cover a combination of assessments).
2. **Signature Page.** A signature page should be signed by all team members, signifying their agreement as to the report content and conclusion in the areas to which they were assigned. In the event all team member signatures cannot be obtained due to logistical considerations, the team leader should gain members' concurrence and sign for them.
3. **Table of Contents.** The table of contents should identify, with page numbers, all sections and subsections of the report, illustrations, charts, and appendices.
4. **Acronyms.**
5. **Introduction.** The introduction should provide information and background regarding the site, facility, system, team composition, methodology, and any definitions applicable to the review.
6. **Assessment Results.** State whether the assessment criteria are satisfied and describe any exceptions. Summarize opportunities for improvement, and include a qualitative conclusion regarding the ability of the system to perform its safety functions in its current condition and to remain reliable over the long term. Recommended actions may also be included. Note any topical areas that were not assessed and any limitations on the qualitative conclusion. Detailed discussion of results in each topical area that was assessed should be included as a separate attachment or appendix.
7. **Lessons Learned.** Identify lessons learned that may be applied to future reviews.
8. **Detailed Results.** In each topical area assessed, include enough detail to enable a knowledgeable individual to understand the specific results. As specified in the Implementation Plan, assessment results needing correction will be tracked either locally or in DOE-wide systems. The suggested format for this section is as follows:
 - Is the criterion met [Yes/No]
 - How review was conducted [Include lists of documents reviewed, including any system software documentation and QA, and titles of persons interviewed]
 - System operability issues or concerns
 - Opportunities for improvement
 - Recommended changes to criteria and guidance.
9. **Documents and References.** Title, number, revision and issue date as applicable.
10. **Software Quality Assurance Data (if applicable)**
11. **Biographies of Team Members.**

REFERENCES

1. 10 CFR 830.120, *Nuclear Safety Management (Subpart) Quality Assurance Requirements*
2. 10 CFR 835, *Occupational Radiation Protection*
3. ASME N509 and N510, and ASME AG-1(*Code On Nuclear Air And Gas Treatment*)
4. ASTM F1471-93, *Standard Test Method For Air Cleaning Performance Of High Efficiency Particulate Air Filter System*
5. Brolin Report - *High Efficiency Particulate Air (HEPA) Filter Quality Assurance Program*, 1996
6. Department Response to DNFSB Tech 3, "*Plutonium Ventilation System Study Report*," dated February 1996, and forwarded to the DNFSB by a March 15, 1996, letter from the Secretary of Energy
7. DNFSB Recommendation 2000-2, *Configuration Management, Vital Safety Systems*
8. DNFSB Tech 23, *HEPA Filters Used in the Department of Energy's Hazardous Facilities*
9. DNFSB Tech 26, *Improving Operations and Performance of Confinement Ventilation Systems at Hazardous Facilities of the Department of Energy.*
10. DNFSB Tech 3, *Overview of Ventilation Systems at Selected DOE Plutonium Processing and Handling Facilities*
11. DOE Implementation Plan for DNFSB Recommendation 2000-2, dated October 31, 2000
12. DOE Order 420.1, *Facility Safety*
13. DOE Order 5480.21, *Unreviewed Safety Questions*
14. DOE Order 5480.22, *Technical Safety Requirements*
15. DOE Order 5480.23, *Nuclear Safety Analysis Report*
16. DOE Order 6430.1A, *General Design Criteria*
17. DOE/DP-0125, *Operating Experience Review -Ventilation Systems at Department Of Energy Facilities*
18. DOE-STD- 3022, *HEPA Filter Test Program*
19. DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*
20. DOE-STD-3020-97, *Specification For HEPA Filters Used By DOE Contractors, U.S. Department of Energy*
21. DOE-STD-3025, *Quality Assurance Inspection And Testing Of HEPA Filters*
22. DOE-STD-3026-99, *Filter Test Facility Quality Program Plan*
23. DOE-STD 7501-99, *The DOE Corporate Lessons Learned Program*
24. ERDA-76-21, *Nuclear Air Cleaning Handbook*
25. Regulatory Guide 1.140, *Design Testing And Maintenance Criteria For Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light -Water Cooled Nuclear Power Plants*
26. Regulatory Guide 3.12, *General Design Guide For Ventilation Systems Of Plutonium and Fuel Fabrication Plants*
27. Regulatory Guide 3.32, *General Design Guide For Ventilation Systems For Fuel Processing Plants*
28. UL 586, *High Efficiency Particulate Air Filter Units*
29. UL 900, *Test Performance of Air Filter Units*