



The Secretary of Energy  
Washington, DC 20585

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DNF SAFETY BOARD

The Honorable Peter S. Winokur  
Chairman  
Defense Nuclear Facilities Safety Board  
625 Indiana Avenue, NW, Suite 700  
Washington, DC 20004-2901

Dear Mr. Chairman:

This letter notifies you that all actions called for in the Department of Energy's (DOE) Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2004-2, *Active Confinement Systems*, are completed.

Enclosed is a final report summarizing DOE's actions that complete the Implementation Plan commitments. The final report also provides an overview of (1) improvements to facility confinement ventilation systems, and (2) DOE's confinement ventilation requirements and guidance in fulfillment of the Implementation Plan.

If you have any questions, please contact Dr. James B. O'Brien, Director, Office of Nuclear Safety, at (301) 903-1408.

Sincerely,

A handwritten signature in black ink, appearing to read "Ernest J. Moniz". The signature is fluid and cursive, with a large initial "E" and "M".

Ernest J. Moniz

Enclosure



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# U. S. Department of Energy

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## **Final Report to the Defense Nuclear Facilities Safety Board on the Completion of the Implementation Plan for Recommendation 2004-2**

### *Active Confinement Systems*



**Washington, DC 20585  
June 2014**

# **Final Report to the Defense Nuclear Facilities Safety Board on the Completion of the Implementation Plan for Recommendation 2004-2**

## **1. Purpose**

This Department of Energy (DOE) report:

- Provides background information related to the issuance, acceptance, and implementation plan development of Defense Nuclear Facilities Safety Board (DNFSB or Board) Recommendation 2004-2, *Active Confinement Systems*;
- Formally transmits the final deliverable (Deliverable 10.2, *Final Report*) for Recommendation 2004-2, which summarizes physical modifications and upgrades resulting from the completed system evaluations;
- Provides a summary of the actions taken to complete all Implementation Plan (IP) commitments; and
- Identifies ongoing efforts being taken to continue to improve the Department's confinement ventilation capabilities.

## **2. Background**

On December 7, 2004, the DNFSB issued Recommendation 2004-2, which identified concerns with the safety system (safety-class or safety-significant) designation strategy used in or planned for, ventilations systems used to confine radioactive materials at several DOE defense nuclear facilities. The Board's main issue was that, for the purpose of confining radioactive materials through a facility-level ventilation system, the safety system designation should be based on the active safety function (i.e., forced air through a high efficiency particulate air (HEPA) filter system). The Board was concerned that a passive confinement safety function (i.e., the facility will breathe through the HEPA filter without forced air, and some unfiltered leakage may occur naturally through building leak paths) may not be as effective as the active safety function in a few postulated accident scenarios.

On March 18, 2005, the Secretary accepted DNFSB Recommendation 2004-2 and on August 22, 2005, the Department forwarded its IP to the Board. On July 12, 2006, DOE issued a revision to the IP, which combined the plans for safety and non-safety-related ventilation system evaluations.

The IP identified the following major actions to be taken by the Department to address Recommendation 2004-2:

- **Listing of Facilities Excluded from Further Evaluation (Exclusion Report)** – A listing of facilities that are excluded from further evaluation under the IP based upon meeting Categorical Exclusion criteria or Non-Beneficial criteria.

- **Listing of Hazard Category 3 Defense Nuclear Facilities with an Active Confinement Ventilation System.** Identification of new and existing hazard category 3 facilities with an active confinement ventilation system that were not excluded.
- **Safety-Related Ventilation System Evaluation.** Identification of the safety-related ventilation system safety functions, functional requirements, and performance criteria addressed in the Documented Safety Analyses of Hazard Category 2 and 3 defense nuclear facilities with safety-class or safety-significant confinement systems and evaluation of compliance with ventilation performance criteria. The evaluation will also identify, as appropriate, those value-added physical modifications that may be necessary.
- **Non Safety-Related Ventilation System Evaluation.** This facility-level report is applicable to hazard category 2 facilities that do not have a safety-class or safety-significant confinement ventilation system, as well as hazard category 3 facilities that do not have any confinement ventilation systems. Because these facilities either lack physical ventilation systems, or lack designation of these systems as safety-related, the initial focus of this evaluation will be to determine if safety system designation changes are needed.

As described in Section 3 and 4 below, the Department has completed all of these actions.

### **3. Completion of the IP's Final Action: Summary of Ventilation System Modifications and Revised Directives**

The last action in the Department's IP was to develop a report that summarizes the ventilation system physical modifications and upgrades identified from the completed system evaluations, including funding plans and completion schedules. Lessons learned from the Department's evaluations and other appropriate guidance has been incorporated into related Directives to ensure that facility safety design and operations maintain adequate protection to the workers and the public.

#### **3.1 Facility Evaluations**

The National Nuclear Security Administration (NNSA) completed its facility-specific ventilation system evaluations and transmitted the results to the DNFSB on February 10, 2011. The evaluations concluded that only one facility, the Los Alamos National Laboratory (LANL) Plutonium Facility (PF-4), has performance gaps that are recommended to be addressed via upgrades. Performance upgrades identified include seismically qualifying glove box support stands and upgrading bleed-off system to safety class. However, NNSA is postponing implementation of these upgrades until PF-4 evaluation activities resulting from DNFSB Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety*, and additional analysis concerning the structure vulnerabilities to seismic activity, have been completed. The expectation is that these PF-4 evaluation activities will be completed in calendar year 2014. Initial project evaluation plans incorporating all known facility upgrades at the time

were communicated to the Board on September 29, 2011, and identified fiscal year (FY) 2020 for completion of active confinement ventilation modifications.

The Office of Environmental Management (EM) completed its facility-specific ventilation system evaluations and communicated the results to the DNFSB on June 25, 2010. On November 30, 2012, EM provided the DNFSB a progress update on closure of the ventilation system gaps for the following top priority facilities:

- Priority 1: Savannah River Site (SRS)/Savannah River National Laboratory (SRNL) Gap 21 – Section B/F and Section C Off-Gas Standby Fan Auto-start. This project is to provide an auto standby fan start capability for the 773-A Section B/F and Section C Off-Gas Exhaust (OGE) systems. Prior to this project, the system required the control room operator to manually shut down the online fan and manually start the standby fan. Closure of this gap removed the active steps required by the control room operator.

Status: Completed September 30, 2012.

- Priority 2: SRS F and H Labs. Initially, installation of building confinement zone separation and pressure instrumentation to monitor differential pressure between building interior and outside environments were to be installed. However, the proposed modification was cancelled following analysis that concluded there was minimal benefit of implementing either the original confinement zone separation modifications or alternative seismic qualification modifications.

Status: Cancelled

- Priority 3: SRS/SRNL Gaps 1 through 5 – Sections B and C Central Hood Exhaust HEPA Bank Blanks. This project is to install 10 sets of blanks between 1950s vintage HEPA Filter banks for the 773-A Sections B and C Central Hood Exhaust (laboratory fume hoods). Installation of the blanks will decrease the number of filters that are in-place aerosol leak tested at one time from a maximum of six filters to a maximum of three filters such that the testing meets the intent of American Society of Mechanical Engineers (ASME) Standard N510. This project will provide a more reliable picture of HEPA filter performance.

Status: See the note below.

- Priority 3 and 4: SRS/SRNL Gaps 26, 28 through 31 and 32 – E-Wing Supply and Exhaust Interlocks. This project is to provide supply and exhaust fan interlock capability for the E-Wing confinement ventilation system. Installation of the interlocks will reduce the spread of contamination within the secondary and tertiary confinement zones and prevent a release to the environment from the tertiary confinement zone exhaust fans.

Status: See the note below.

- Priority 4: SRS/SRNL Gaps 8 through 12 – Sections B and C Tertiary Exhaust Interlocks. This project was to provide exhaust fan interlock capability between the primary confinement exhaust (B and C Central Hood Exhaust systems) and the tertiary confinement zone exhaust fans (change rooms). Upon the loss of a primary confinement exhaust system, the associated tertiary confinement zone exhaust fan will shut down and the associated isolation damper will close. Installation of the interlocks will prevent a release to the environment from the tertiary confinement zone exhaust fans if contamination enters the change rooms while the workers relocate from the secondary confinement zone.

Upon further evaluation it was concluded that the best long-term improvement to the SRNL building could be achieved by replacing gaps 8-12 dealing with tertiary confinement changes with gaps 3 and 4. Gaps 3 and 4 scopes included Supply and Exhaust interlocks for the B and C Section fans and replacement of the B and C Central Hood Exhaust Tape-in-Place HEPA filters.

Status: Cancelled modifications for gaps 8 – 12;

**NOTE:** The remaining SRS gaps are all associated with systems at the Savannah River National Laboratory (SRNL). As of March 1, 2014, 13 of the 24 gaps in SRNL have been closed and work on 11 others is in progress. The remaining open gaps are associated primarily with interlocks for the section B and C Exhaust/supply fans, completing the installation of blanks to improve aerosol efficiency testing and replacement of the Tape-in-Place HEPA filters for the Section B and C Central Hood Exhaust.

DOE has targeted approximately \$2M/year in funding to address completion of this work. Budget constraints in FY14 associated with the Continuing Resolution, Sequestration, and Lapse of Funding in FY 13 4, coupled with recovery from those constraints, have driven the application of funding for the Recommendation 2004-2 Gap work below target for FY 14. FY 15 funding is still uncertain. SRS will re-establish and maintain the targeted funding of \$2M/year in FY 15, to close the remaining gaps as expeditiously as possible. DOE will continue to advocate for sufficient funding to address the critical infrastructure work needed to support its mission objectives and commitments to improve safety performance across all EM facilities.

- Priority 5: Hanford Site – Waste Encapsulation and Storage Facility (WESF). There are 1,335 cesium capsules and 601 strontium capsules stored in six pool cells within WESF. The one identified performance gap was that the K-1 ventilation system's HEPA filter testing does not meet ASME Standard N510 requirements. EM also noted that the K-3 HEPA filter system was deteriorating for filters over 22 years old, and which have been previously wetted. Thus, the K-1 filter gap and the K-3 filter replacement were included in the WESF gap closure.

DOE plans to replace the aged and contaminated K-3 filters and stabilize the unneeded hot cells in its revised approach for the WESF ventilation system upgrades. This

approach will result in a more robust confinement ventilation system better suited to address the facility hazards and mission needs. The supporting documentation for this approach was shared with the DNFSB staff.

Status: K-1 ventilation modifications cancelled; K-3 ventilation modifications scheduled for completion by the end of FY 16. The funding has been allocated to support the WESF ventilation system upgrades in FY 14, and scope is included in future budget planning for upgrades to be complete by end of FY 16.

- Priority 6: SRS/SRNL Gaps 35 through 40 and Gap 42 – E-Wing Ventilation Project. This project replaces obsolete, 1950s and 1960s secondary confinement zone exhaust process ventilation systems in 773-A, Section "E" Wing. The existing systems have been replaced with a single exhaust system that meets current national consensus standards.

Status: Completed December 31, 2013.

- Building 325 at Pacific Northwest National Laboratory (PNNL) was originally excluded by the Office of Environmental Management due to its limited life. However, the Office of Science (SC) took over the safety basis authority for the facility in 2007 and made a decision to extend the life of the facility an additional 20 years. SC decided to complete an evaluation of the ventilation system (CRL- ASSESS-ESH-001, Revision 0) which was subsequently reviewed by the Independent Review Panel. The assessment did not identify any gaps involving discrepancies between the safety basis requirements and the facility design. Accordingly, no cost/benefit evaluation was performed for modifications, as none would be necessary to address gaps. Based on this evaluation, the assessment team recommended no further action. The report was provided to the Board's staff on September 14, 2009.

Status: Completed September 2009

### **3.2 Directives Improvement**

DOE revised the following Directives to incorporate improvements relative to confinement ventilation systems based on lessons learned that resulted from its system evaluations and implementation of this Recommendation:

- DOE Order (O) 420.1C, *Facility Safety*, issued in December 2012. In this revision, DOE included the statement that "An active confinement ventilation system is the preferred design approach for nuclear facilities with potential for radiological release."
- DOE Guide (G) 420.1-1A, *Nonreactor Nuclear Safety Design and Guide for Use with DOE O 420.1 Facility Safety*, issued in December 2012. Changes in this revision include Appendix A, *Confinement Ventilation Systems Design and Performance Criteria*, which

presents the design and performance criteria that should be used in the design and construction of new active confinement ventilation systems based on the safety classification of the system.

- DOE Standard (STD) 1189, *Integration of Safety into the Design Process*, issued in March 2008. This DOE Standard includes the following expectations for consideration of active confinement ventilation as part of the design of new nuclear facilities and major modifications to existing nuclear facilities:
  - “DOE expectations for execution of safety activities during design should be clearly communicated commensurate with the hazard and control selection information available at this early stage in the potential project. Safety-in-Design goals should be identified; expectations for adherence to the design requirements of DOE O 420.1B, and any special safety requirements or expectations (e.g., active confinement) for the project should be included. These DOE Expectations for Safety-in-Design efforts should be formally documented.” (*Ref. Section 3.1. Pre-Conceptual Phase. Page 19*)
  - “Confinement strategy – Describe overall approach to facility confinement including use of active confinement system(s); define expected functional classification of any confinement system(s).” (*Ref. Appendix E. Safety Design Strategy, Section 3.3, Key Safety Decisions. Page E-3*)

#### **4. Summary of Actions Taken to Complete Recommendation 2004-2 Implementation Plan Commitments**

Table 1 provides a summary of the actions taken to complete the IP commitments. Table 2 indicates when the site and facility reports were sent to the Board. Table 3 reports on ventilation upgrades.



**Table 1: Actions Taken to Complete Implementation Plan Commitments**

Number	Commitment	Actions Taken
8.1	Listing of New Facilities and Facilities Undergoing Major Modification.	On September 30, 2005, DOE transmitted to the DNFSB, the NNSA and EM listings of new facilities and facilities undergoing major modification.
8.2	Recommendation 2004-2 exclusion reporting process	On October 31, 2005, DOE transmitted to the DNFSB, the Exclusion Reporting Process, which established criteria to be used to exclude certain hazard category 2 and 3 defense nuclear facilities and operations from further review under this Recommendation.
8.3	Complete Recommendation 2004-2 exclusion reports	On December 29, 2005, DOE transmitted to the DNFSB, the NNSA and EM Exclusion Reports, which were developed in accordance with the guidance and criteria contained in the deliverable for Commitment 8.2, Exclusion Reporting Process.
8.4	Listing of hazard category 3 defense nuclear facilities with an active confinement ventilation system	On March 7, 2006, DOE transmitted to the DNFSB, the NNSA and EM Listing of Hazard Category 3 Defense Nuclear Facilities with an Active Confinement Ventilation System.
8.5.1	PF-4 Safety-Related Ventilation System Evaluation Report	On June 16, 2009, DOE transmitted to the DNFSB, the final PF-4 Ventilation System Evaluation report.
8.5.2	Assemble group of subject matter experts to develop appropriate performance and/or design expectations as input to guidance document.	On September 20, 2005, DOE transmitted to the DNFSB, a letter listing a group of subject-matter experts to develop appropriate performance and/or design expectations as input to a guidance document for performing Safety-Related Ventilation System Evaluation.
8.5.3	Hold DOE wide workshop to develop the final methodology and guidance to complete the safety-related ventilation system evaluations.	DOE held two workshops in 2005, with participation by senior Department personnel, representatives from sites throughout the complex, and the Board staff, to develop the methodology and implementation strategy to meet expectations of Board Recommendation 2004-2.
8.5.4	Develop initial Safety-Related Ventilation System Evaluation Guidance document with input from CTAs, PSOs and Board.	On February 2, 2006, DOE transmitted to the DNFSB the guidance document, Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems.
8.5.5	Develop new or revised draft evaluation guidance or guidance for DOE directives or rules and issue for DOE-wide review and comment based on experience and lessons learned from pilot evaluations.	On March 6, 2007, DOE transmitted to the DNFSB, supplementary guidance, <i>2004-2 Ventilation System Evaluation Guidance Addendum</i> , which contains cautions and lessons learned from the pilot evaluations.

8.6.1	Listing of facilities that will complete a Ventilation System Evaluation.	On July 14, 2006, EM transmitted to the DNFSB, the <i>EM Facility Ventilation System Evaluations Priority Listing (Revision 2)</i> ; on August 7, 2006, NNSA transmitted to the DNFSB the <i>NNSA Listing of Facilities that will complete a Ventilation System Evaluation, DNFSB Recommendation 2004-2</i> .
8.6.2	Establish the Independent Review Panel (IRP) (described in the Ventilation System Evaluation Guidance document). The IRP will assist and consult with the site/facility evaluation teams, and review select facility evaluations.	On August 1, 2006, DOE informed the DNFSB of the establishment of the IRP and provided names of panel members.
8.6.3	Site offices complete facility-specific evaluation reports and IRP complete reviews for selected facilities based on any revised Ventilation System Evaluation guidance.	Facility-specific evaluation reports were transmitted to the DNFSB as shown in Table 2
8.6.4	Revise, as necessary, the Ventilation System Evaluation Guidance document based on experience and lessons learned from the pilot facility evaluations.	On March 6, 2007, DOE transmitted to the DNFSB supplementary guidance, <i>2004-2 Ventilation System Evaluation Guidance Addendum</i> , which contains cautions and lessons learned from the pilot evaluations.

8.6.5	PSO concurrence and approval on disposition of gaps and upgrades identified in evaluations after coordination with CTA, if necessary.	<p>On December 31, 2009, EM transmitted to the DNFSB, facility-specific deliverables associated with Commitment 8.6.5 are shown in Table 3.</p> <p>On June 25, 2010, EM transmitted to the DNFSB, the report, <i>Active Confinement System Upgrade Team - Office of Environmental Management - Proposed Upgrades to Confinement Ventilation Systems Review Report and Recommendations</i>.</p> <p>On February 10, 2011, NNSA transmitted to the DNFSB, the report, <i>Review Report and Recommendations for Defense Nuclear Facilities Safety Board Recommendation 2004-2 Confinement Ventilation Systems Evaluations</i>. NNSA site-specific deliverables associated with Commitment 8.6.5 are shown in Table 3.</p> <p>On November 30, 2012, EM transmitted to the DNFSB an update to its progress in achieving closure of ventilation system gaps for EM's top six priority facilities as identified in EM's June 25, 2010, report.</p>
8.7	Non Safety-Related Ventilation System Evaluation Guidance.	On February 2, 2006, DOE transmitted to the DNFSB, the guidance document, <i>Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems</i> .
8.8	Non Safety-Related Ventilation System Evaluation	All Commitment 8.8 deliverables in the revision of this IP are included under Commitment 8.6.
8.9.1	Report of results of reviewing site procedures and safety bases mechanisms for using 25 rem evaluation guideline after completion of the pilots and high priority facility-specific system evaluations under Deliverable 8.6.3.	<p>On November 2, 2007, NNSA transmitted to the DNFSB, the results of the review of NNSA site office and contractor procedures and mechanisms for using the 25 rem evaluation guideline.</p> <p>On March 23, 2007, EM transmitted to the DNFSB, the results of its initial review of site procedures and safety bases mechanisms for using the 25 rem evaluation guideline for the establishment of safety class structures, systems, and components.</p> <p>On June 29, 2007, EM reported to the DNFSB, the conclusion of its review of site procedures and safety basis mechanisms for using the 25 rem evaluation guideline to satisfy Commitment 8.9.1.</p>

8.9.2	Revised DOE Directives/Technical Standards into RevCom.	Both DOE O 420.1C and DOE G 420.1-1A were issued in December 2012, with the involvement of the Board's staff in the review process.
10.1	Periodic briefings to the Board and/or Board staff.	Periodic briefings and discussions with the Board and/or Board staff were held in October 2005, July 2009, and October 2010.
10.2	Recommendation 2004-2 Final Report	Issuance of this report meets this commitment

**Table 2: Facility Evaluation Report (Submitted Per Commitment 8.6.3)**

<b>Site</b>	<b>Facility</b>	<b>Report Issuance Date</b>
SRS	Actinide Removal Process	September 27, 2006
Idaho	New Waste Calcining Facility	September 27, 2006
Idaho	Advanced Mixed Waste Treatment Facility	June 8, 2007
Portsmouth/ Paducah	Depleted UF6 Conversion Buildings	June 8, 2007
SRS	3013 Container Surveillance and Storage Capability (CSSC) Project	June 8, 2007
SRS	CSSC K Area	June 8, 2007
SRS	Plutonium Disposition Project	June 8, 2007
Hanford	Waste Treatment and Immobilization Plant (WTP) Pretreatment (PT) and High-Level Waste (HLW) Facilities	June 8, 2007
Hanford	242-A Evaporator	September 10, 2007
SRS	Tank Farm Waste Tank and Transfer Facility	September 10, 2007
SRS	Defense Waste Processing Facility (DWPF)	September 10, 2007
SRS	Evaporator Facilities	September 10, 2007
SRS	Defense Waste Processing Facility (DWPF) Low Point Pump Pit Facility (LPPP)	September 10, 2007
SRS	H-Canyon and HB-Line Facilities	September 10, 2007
SRS	Evaporator Facilities	September 10, 2007
Idaho	Idaho Nuclear Technology and Engineering Center (INTEC) Fuel Storage Area and Irradiated Fuel Storage Facility	September 10, 2007
Idaho	INTEC Laboratory Facilities	September 10, 2007
Idaho	INTEC Process Equipment Waste Evaporator (PEWE) Facility	September 10, 2007
Oak Ridge	Portable Units, Low-Level Liquid Waste Facilities (LLLW), and TRU Waste Processing Center	September 10, 2007
SRS	Savannah River National Laboratory (SRNL) Building 773-A	December 10, 2007
SRS	F & H Area Analytical Laboratory	December 10, 2007
SRS	Outside Facilities-H (OF-H)	December 10, 2007

SRS	L Area Material Storage Facility Disassembly Basin	December 10, 2007
SRS	Solid Waste Management Facilities	December 10, 2007
WIPP	WIPP Ventilation Systems	December 10, 2007
Oak Ridge	Fission Product Development Laboratory, Building 3517; and Molten Salt Reactor Experiment (MSRE) Facility	December 10, 2007
LLNL	Plutonium Facility (Building 332)	July 8, 2008
SNL	Annular Core Research Reactor	August 31, 2009
SRS	Waste Solidification Building	September 2, 2009
NNSS	Criticality Experimental Facility	September 4, 2009
PNNL	Building 325, Radiochemical Processing Laboratory	September 14, 2009
Y-12	Buildings 9212, 9215, and 9204-2E	January 27, 2010

**Table 3: Reports on Ventilation Upgrades (Submitted Per Commitment 8.6.5)**

Site	Facility	Report Issuance Date
<b>NNSA Sites</b>		
LLNL	Plutonium Facility	July 8, 2008
SNL	Annular Core Research Reactor	August 31, 2009
SRS	Waste Solidification Building	September 2, 2009
NNS	Criticality Experimental Facility	September 4, 2009
Y-12	Buildings 9212, 9215, and 9204-2E	January 27, 2010
<b>EM Sites</b>		
Idaho	INTEC Fuel Storage Area, Irradiated Fuel Storage Facility, Laboratory Facilities, Process Equipment Waste Evaporation, and Advanced Mixed Waste Treatment Plant	December 31, 2009
WIPP	Waste Isolation Pilot Plant	
Oak Ridge	TRU Waste Processing Facility, Portable Units, Molten Salt Reactor Experiment, Fission Product Development Laboratory, Liquid Low-Level Waste System, and Waste Treatment and Immobilization Plant	
Hanford	242-A Evaporator, T-Plant Complex, Waste Receiving and Processing Facility, and Waste Encapsulation and Storage Facility	
SRS	Tank Farm Waste Tank and Transfer Facility, Defense Waste Processing Facility, Evaporator Facilities, Defense Waste Processing Facility Low Point Process Pit, H-Canyon and HB-Line Facilities, SRNL Building, F&H Area Analytical Laboratories, Outside Facilities-H, L-Area Material Storage Facility, and Solid Waste Management Facilities.	

**5. Conclusion**

DOE has taken all actions called for in its IP for Recommendation 2004-2. As a result DOE has reviewed its confinement ventilation systems and made the improvements warranted, to ensure these systems will be readily available to perform their intended safety function, in case of an accident at one of DOE’s nuclear facilities. DOE has also made improvements to its regulatory infrastructure to assure the appropriate design of confinement ventilation systems in any new DOE nuclear facility or nuclear facility undergoing a major modification.