Department of Energy
Washington, DC 20585

January 14, 2011

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 is to notify you that the Department of Energy (DOE) has completed Deliverable 5.4.2 for Defense Nuclear Facilities Safety Board Recommendation 2008-1, *Safety Classification of Fire Protection Systems*. The draft design and operational criteria for fire barriers used in safety class and safety significant applications, along with similar draft guidance developed for wet pipe sprinkler systems and water supply systems, is enclosed. DOE's revision to Standard 1066, *Fire Protection Design Criteria*, to incorporate this guidance and other enhancements is being finalized in preparation for submittal for DOE-wide review via RevCom.

If you have any questions, please contact me at (202) 586-6740 or James O'Brien at (301) 903-1408.

Sincerely,

Andrew C. Lawrence

Andrew C. Lawrence
Director
Office of Nuclear Safety, Quality Assurance and Environment
Office of Health, Safety and Security

Enclosure

cc: Richard Lagdon, US
James Landmesser, EM-61
Mari-Jo Campagnone, HS-1.1
James McConnell, NA- 1
Don Nichols, NA-1
Sharon Steele, NA- 1
Richard Stark, NE-53

Appendix A to Draft Revision of DOE Standard 1066

SAFETY SIGNIFICANT AND SAFETY CLASS FIRE PROTECTION SYSTEM SPECIFICATIONS

This appendix provides design and operational criteria and guidance for fire protection systems used in safety class and safety significant applications.

- Section A.1 provides general design criteria for any type of fire protection system that is used in safety class and safety significant applications. This information is derived from and essentially repeats requirements and guidance contained in DOE Order (O) 420.1B, *Facility Safety,* and DOE Guide (G) 420.1, *Implementation Guide For Use In Developing Documented Safety Analyses To Meet Subpart B of 10 CFR 830.*

- Section A.2 describes current plans for issuing specific design and operation criteria for wet pipe sprinkler systems.

- Section A.3 describes current plans for design and operation criteria for water supply systems.

- Section A.4 provides specific design and operation criteria for fire barriers.

In addition, this Appendix includes two attachments - one that provides details on water supply arrangements, and the second which provides example Technical Safety Requirements.

A.1 General

General design criteria for safety class and safety significant systems specified in Chapter I of DOE O 420.1B are applicable to fire protection systems utilized in safety significant and safety class applications.

A.1.1 System Function and Critical Characteristics

The safety class and safety significant function of the fire protection system is defined in the Documented Safety Analysis (DSA) of the facility (typically in Chapter 4 of the DSA). In accordance with DOE Standard (STD) 3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses,* Chapter 4 of the DSA should specify "the reason for designating the Structures, Systems, and Components (SSC) as a safety-class SSC, followed by specific identification of its preventive or mitigative safety function(s) as determined in the hazard and accident analysis. Safety functions are top-level statements that express the objective of the SSC in a given accident scenario." DOE-STD-3009 also discusses the inclusion of "pertinent aspects" of the safety class and safety significant system in Chapter 4 and states that "pertinent aspects are considered to be those that directly relate to the safety function (e.g., diesel generator load capacity, time to load if critical)."

In addition to having the "pertinent aspects" of the system in the DSA, it is good practice to include more detailed information on design or operational criteria critical to proper operation of the safety system. The combination of the pertinent aspects and this additional detailed information are "critical characteristics" of the system.

A.1.1.1 The critical characteristics shall be documented in a configuration-controlled document system design document. This information can also be included in a system design description document developed in accordance with DOE-STD-3024-98, *Content of System Design Descriptions.*

A.1.2 Support Systems

Per DOE O 420.1B, supporting systems must be identified. It is good practice to include this information in a configuration controlled system design document. This can then also be referenced in a system design description developed in accordance with DOE-STD-3024-98. Refer to DOE Guide 420.1-1 for further information regarding supporting systems.

A.1.3 Design Criteria

General design criteria for safety class and safety significant systems specified in Chapter I of DOE O 420.1 B are applicable to fire protection systems utilized in safety significant and safety class applications.

Additionally, Chapter II of DOE O 420.1B requires that fire protection for DOE facilities, sites, activities, design, and construction must meet or exceed applicable building codes, and codes and standards of the National Fire Protection Association (NFPA).

DOE-STD-1189, *Integrating Safety into the Design Process*, provides criteria for identifying safety class and safety significant systems and criteria for the seismic design of SSCs, including fire protection systems.

A.2 Wet Pipe Automatic Sprinklers

Guidance on wet pipe sprinkler systems is not being provided as part of this deliverable to the Defense Nuclear Facilities Safety Board (DNFSB), but is being updated and will be included in the next revision of DOE Standard 1066 that is scheduled for RevCom review early Calendar Year 2011.

A.3 Water Supply

Guidance on water supply systems is not being provided as part of this deliverable to the DNFSB, but is being updated and will be included in the next revision of DOE Standard 1066 that is scheduled for RevCom review early Calendar Year 2011.

A.4 Fire Barriers

The following provides a summary of the functions, critical characteristics, requirements, criteria, and guidance for new safety significant, and safety class Fire Barrier installations:

A.4.1 System Function and Critical Characteristics

A.4.1.1 System Function

The safety class and safety significant function of the fire barrier system is defined in the DSA of the facility (typically in Chapter 4 of the DSA). This may include information regarding the size and type of fires that the system is designed for, along with any specific considerations that may be required for the system to perform its intended function. For example, the function of the fire barrier is generally to limit the transfer of thermal energy from one side of the barrier to the other to prevent a fire on one side of the barrier from starting a fire on the other side of the barrier for a specified period of time.

A.4.1.2 Critical Characteristics

The critical characteristics of the system should be included in a configuration controlled document (e.g. design document) including, as appropriate:

- The fire barriers hourly fire resistance rating.
- Materials used in the barrier which form the basic composite of the barrier (e.g. gypsum wall board on steel stud with specific screw size and pattern, plus joint protection, or reinforced concrete masonry units of sufficient size and thickness).
- Protection of openings (including dimensions and materials of doors, door frames, dampers and sealing of penetrations).
- Mechanism for and timing of any components that must reposition to perform their safety significant or safety class safety function (e.g., fire damper closure).

A.4.2 System Boundary for the Fire Barrier System

A.4.2.1 The boundary of the safety class or safety significant fire barrier system should be defined such that it is clear which components are to be classified within the system. A boundary for fire barriers may include all walls and devices design to protect openings in the wall between different fire zones.

A.4.3 Support Systems for the Fire Barrier System

Fire barriers are primarily passive or self-actuating devices that do not require motive force outside of the barrier component (e.g., self-actuating dampers). The only support systems are typically structural components; such as, structural bearing or non-bearing fire barriers, floor/ceiling, column/beam assemblies, and trusses/roof framing. The latter are the most important support elements and must be classified as having a fire resistance rating at least equal to or greater than that of the safety class or safety significant barrier, and classified as equal or superior to safety class or safety significant fire barrier system where (1) these elements provide structural support to credited safety class or safety significant fire barriers, or (2) failure of the support system component could fail and damage an adjacent safety class or safety significant fire barrier.

A.4.4 Design Criteria for Fire Barriers

The following provides a summary of the requirements, criteria and guidance for new safety significant, and safety class fire barriers:

A.4.4.1 Safety Significant Design Criteria for Fire Barriers

In addition to the criteria identified in Section 4.2.5 of DOE-STD-1066, the following additional design requirements/guidance are applicable for Fire Barrier installations used in safety significant applications:

A.4.4.1.1 Fire barrier installations should be designed to remain operable for those environmental events they are relied on as specified in the DSA. Examples include:

- Seismic events.
- Other natural phenomena hazards (NPH) such as high wind potential, tornados, flooding, lightning, low temperature and humidity.
- Facility hazards, such as internal flooding, explosions, fire outside the system boundary, missile and vehicle impacts, corrosive environments.
- Wildland fire.
- Physical damage from adjacent equipment and systems; e.g., during a seismic event.
- Facility environmental impacts; e.g., corrosive environments.

A.4.4.1.2 Fire-rated doors, windows, dampers or penetration seals used to protect openings and penetration seals must maintain the fire resistance rating of the overall fire barrier assembly.

A.4.4.1.3 Fire barrier components (e.g., doors, dampers) should be readily accessible for inspection and testing, as well as marked and identifiable in the field as required by the National Recognized Testing Laboratory, and fire barriers should be readily labeled and identifiable in the field.

A.4.4.1.4 To support appropriate implementation of the site or project Quality Assurance (QA) program relative to fire protection systems, the following topics should be addressed (beyond what is specifically identified in DOE O 420.1B and referenced NFPA codes and standards):

- Document control (documents are stored properly to avoid damage; responsibility for completeness, maintenance, and distribution are identified, etc.).
- Records of qualification of fire protection staff and control of qualification records.
- Procurement documentation and control of purchased items or services.

- Identification and control of components (e.g., fire dampers) per requirement 8 of NQA-1-2008, *Quality Assurance Requirements for Nuclear Facility Applications.*
- Handling, shipping and storage requirements for components.
- Control of nonconforming items to prevent inadvertent installation or use.
- Commercial grade dedication of components based upon third-party testing and production monitoring on the contractor's quality assurance program.
- Configuration and design control.
- Results of commissioning testing.

A.4.4.1.5 The QA Program should be audited in different phases (design, construction, and operations) using DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

A.4.4.2 Safety Class Design Criteria for Fire Barriers

In addition to the criteria for Safety Significant applications, the following additional design requirements/guidance is applicable for Fire Barrier installations used in safety significant applications:

A.4.4.2.1 The following components should not be used:[1]

- Fire rated glazing assemblies.
- Curtain style fire dampers in non-confinement ventilation ducts for safety class fire barriers (since their reliability to sufficiently close and latch under dynamic flow has been documented as a concern by the Nuclear Regulatory Commission).

A.4.4.2.2 For safety class fire doors, fire resistive glazing materials shall not be used over an area of more than 100 square inches in a one door leaf for the entire fire barrier.

A.4.4.2.3 Fire doors in safety class fire barriers must be equipped with automatic closures and positive latching devices in accordance with NFPA 80, which can be held open only with magnetic devices designed to close on either activation of any one of four detectors (two detectors on each side of the fire barrier). The detectors must be arranged to be independent of the fire alarm system and designed to release the magnetic hold open device upon primary electrical failure.

A.4.4.2.4 Fusible link devices that are integral to the door closers are not permitted.

A.4.4.2.5 Where non-confinement ventilation ducts must pass through safety class fire barriers, only multiple blade style dynamic fire dampers which will operate and close

[1] If the user chooses to utilize these devices, then their potential impact should be evaluated separately.

under anticipated air flow velocities and anticipated pressures are permitted, or air flow must be shut down by redundant detection so as not to comprise their effectiveness.

A.4.4.3 Codes and Standards

NFPA 80	Standard for Fire Doors and Other Opening Protectives
NFPA 221	Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls
NFPA 251	Standard Methods of Tests of Fire Resistance of Building Construction and Materials
ASTM E 119	Fire Tests of Building Construction and Materials Protection of Electrical Raceways

A.4.4.4 Operability Criteria for Safety Significant and Safety Class Fire Barriers

Technical Safety Requirement Limiting Conditions for Operation should be defined (including appropriate action statements to address situations when the system is inoperable). Attachment A2 provides example Technical Safety Requirements.

Example Technical Safety Requirements for Fire Protection Systems Used in Safety Class or Safety Significant Applications

1. Wet Pipe Automatic Sprinklers

2. Water Supply

3. Fire Barriers

3.1 Example Limiting Condition of Operation

3.1.1 The fire barrier must be un-altered, not breached, penetrated by unstopped or unapproved fire penetration systems, damaged or removed from its original design or approved configuration [consistent with this guide] and all fire barrier Technical Safety Requirements surveillances must be current.

3.2 Example Surveillances

3.2.1 Fire barriers shall be maintained and shall be properly repaired, restored, or replaced where damaged, altered, breached, penetrated, removed, or improperly modified. A program for the inspection and/or testing and maintenance of fire barriers and protected openings (e.g., fire doors and hardware, fire dampers, glazing, and penetration seals) shall be established based on the requirements of NFPA 1 and NFPA 80.

3.2.2 NFPA 1 and 80 should be used to establish the TSR surveillance requirements and limiting conditions of operation and should clearly include requirements for damaged or compromised barriers identified during surveillances or facility operations.

3.2.3 All fire barriers and their components should be visually inspected at least on an annual basis in accordance with the applicable NFPA code (e.g., NFPA 80) to ensure the critical characteristics of the barrier are preserved so its performance will restrict the spread of fire as expected by the safety basis.

3.2.4 Testing shall also be conducted on all active barrier components (e.g., doors closures and dampers) to ensure they will function. For example, the fire damper manufacturer may require that actuators be tested at a certain frequency; thus, this testing frequency shall be incorporated into the Inspection, Testing and Maintenance (ITM) program for fire barriers. If a fire barrier or fire barrier component is damaged, it shall be replaced or returned to the required level of fire resistance using a listed/approved repair system, or by using materials and methods equivalent to the original construction.