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**CONDUCT OF MAINTENANCE (P950)  
OPERATIONS AND MAINTENANCE MANUAL  
OPERATIONS & MAINTENANCE CRITERION**

**TITLE: FIRE PROTECTION SYSTEM  
IMPAIRMENT CONTROL PROGRAM**

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## RECORD OF REVISIONS

Revision No.	Date	Description
0	04/05/02	<p>Initial Issue.</p> <p>This revision reflects the conversion from a WordPerfect document into a Microsoft Word document and additional clarification on how to develop criteria. This revision includes:</p> <ul style="list-style-type: none"> <li>• The addition of a Table of Contents,</li> <li>• The use of basis statements in Sections 6, 7 and 9.</li> <li>• Revision to Section 9, "Required Documents," and further clarification in the use of references.</li> <li>• Changes to Section 4.0 to address O&amp; M Criterion written by groups other than Facility &amp; Waste Operations Systems, Engineering and Maintenance.</li> <li>• Changes to Sections 3 and 6, Appendices A and B per comments of Field Management Council subcommittee.</li> </ul>
Interim	12/17/09	<ul style="list-style-type: none"> <li>• Prepared for Rescinding of Rev.1 to include updating terminology to current organizational structure.</li> </ul>
2	6/17/2010	<p>This revision reflects current organizational structure and responsibilities, corrections, and clarifications of impairment types and examples.</p>



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## CRITERION 733

### FIRE PROTECTION SYSTEM IMPAIRMENT CONTROL PROGRAM

#### 1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for control of fire protection system impairments at Los Alamos National Laboratory (LANL). This Criterion lists expectations that are based on codes, standards, contract commitments and lessons learned associated with LANL implementation of National Fire Protection Association (NFPA) 1, *Uniform Fire Code*, NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*, NFPA 72, *National Fire Alarm and Signaling Code*, and NFPA 101, *Life Safety Code*. The roles and responsibilities described within this Criterion are consistent with LANL P3153, *Roles, Responsibilities, Authorities and Accountability*, and P315, *Conduct of Operations*.

Implementation of this Criterion satisfies LANL PD 1220, *Fire Protection Program*, 10 Code of Federal Regulations (CFR) 851, *Worker Safety and Health Program*, Appendix A.2 "Fire Protection," NFPA 1, 25 and 72, and Department of Energy (DOE) Order 420.1B, *Facility Safety*, Chapter II "Fire Protection" requirements for implementation of a comprehensive fire protection program. Specifically, DOE Order 420.1B Chapter II ¶ 3.b(2)(f) requires that LANL implement fire protection criteria or procedures that address "fire protection system impairments." Compliance with 10 CFR 851, NFPA 1, 25 and 72, and DOE Order 420.1B are required by the LANL Prime Contract (DOE Contract No. DE-AC52-06NA25396).

This document addresses the requirements of P 315, *Conduct of Operations Manual*, and P 950, *Conduct of Maintenance*, by defining the minimum operations and maintenance criteria for structures, systems, and components that it covers. This Criterion lists requirements that are based on codes, standards, contract commitments, lessons learned, or business case. It also lists recommendations based on industry practices, operational experience, or business case. Guidance for implementation of the requirements and recommendations is also provided.

#### 2.0 SCOPE

This Criterion addresses planned impairments to fire protection structures, systems and components (SSCs) resulting from the installation, alteration, repair, relocation, replacement, addition to, and use or maintenance of fire protection systems. This Criterion also addresses unplanned impairments to fire protection SSCs that may arise to system/equipment failure, unsatisfactory performance during a scheduled preventative maintenance evolution or similar unanticipated event. Fire protection SSCs



are defined in Section 3.0. This Criterion does not address specific corrective maintenance actions required to repair or replace impaired equipment.

Fire protection SSCs and related loss control systems shall be taken out of service only when necessary, under carefully controlled conditions, and only in accordance with this Criterion. Fire Protection SSCs shall be restored to service before the end of the same working day that the planned impairment is initiated, unless extenuating circumstances require a longer period. The Facility Operations Direction (FOD), or designee, and the LANL Fire Marshal, or designee, will determine immediate mitigating actions, fire watch requirements, limiting conditions for designated operations up to and including stopping identified hazardous operations and building evacuation until the impairment has been corrected.

FODs are responsible for establishing the appropriate priority for their work tickets to ensure that fire protection system impairments are repaired and returned to service in a timely manner.

### 3.0 ACRONYMS AND DEFINITIONS

#### 3.1 Acronyms

AHJ	Authority Having Jurisdiction
CFR	Code of Federal Regulations
CO <sub>2</sub>	Carbon Dioxide
CSE	Cognizant System Engineer
DACS	Digital Alarm Communicator System
DACT	Digital Alarm Communicator Transmitter
DOE	Department of Energy
DSA	Documented Safety Analysis
FACP	Fire Alarm Control Panels
FOD	Facility Operations Director
FP	Fire Protection
FP-DO	Fire Protection Division Office
HVAC	Heating, Ventilation, and Air Conditioning
IC	Impairment Coordinator
ITM	Inspection, Testing, and Maintenance
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
LCO	Limiting Conditions for Operation
MM	Maintenance Manager
MP	Maintenance Programs
MSS	Maintenance and Site Services
MSS-DL	Maintenance and Site Services Division Leader
MSS-MP	Maintenance and Site Services Maintenance Programs



NFPA	National Fire Protection Association
OM	Operations Manager
ORPS	Occurrence Reporting and Processing System
PM	Preventative Maintenance
POC	Point of Contact
SC	Safety Class
SS	Safety Significant
SSC	Structure, System, and Component
TSR	Technical Safety Requirements

### 3.2 Definitions

**Fire Protections SSCs-** Structures, Systems and Components associated with: Fire Extinguishing/Suppression Systems (sprinklers including anti-freeze subsystems, Halon 1301, gaseous clean agents, carbon dioxide (CO<sub>2</sub>), dry and wet chemical, etc.); Fire Detection Systems (smoke, heat, flame, manual pull stations, etc.); Fire Protection Water Supplies (storage tanks, valves, hydrants, fire pumps, fire mains, etc.); Occupant Notification Appliances (any fire alarm system component such as a bell, horn, speaker, light, or test display providing audible, tactile, or visible outputs); Fire doors and smoke control doors; Fire and smoke dampers; Fire barriers and integral fire barrier through penetration firestop systems; alarm signal transmission to and receiving capability at the; LANL proprietary fire alarm system (Digital Alarm Communicator System, or DACS); facility means of egress and life safety features (exits and exit accesses separated from adjacent areas by fire-rated construction, emergency lighting systems/battery-operated lighting units and supporting diesel generators, EXIT signage, etc.); and spill/fire fighting water collection/retention features (contaminated water run-off collection basins/berms/curbs/dikes, transformer oil collection basins, etc.).

**Impairment-** A scheduled or non-scheduled event that renders a fire protection system incapable of performing its fire protection and/or life safety function. Routine inspection, testing, and maintenance (ITM) activities are not considered impairments if at the conclusion of the ITM evolution the system is fully restored to normal operational status. Impairments can be limited to specific portions of a system (e.g., disconnecting the proprietary fire alarm system reporting, disable of a specific set of initiating devices or the auxiliary response function for a fire alarm system, capping a portion of the piping network of a sprinkler system), or they can involve taking the entire system out of service. Refer to Appendix B for additional guidance.

**Impairment Coordinator-** The Fire Protection Division Office (FP-DO) individual(s) assigned to evaluate and approve outage requests for fire protection system impairments at the request of maintenance organizations, FODs, Maintenance Managers (MMs), or designees. Other functions and duties are as specified in Section 6.0.

**Impairment Tag-** A pre-printed 4-part form that is utilized to document and post the impairment of a fire protection SSC. The form contains sections for describing the



system, component, impairment conditions, time, approvals, notifications, corrections and post maintenance tests that confirm closure. See Appendix A.

**Life Safety-** As defined by NFPA 101, *Life Safety Code*. The scope of NFPA 101 “addresses those construction, protection, and occupancy features necessary to minimize danger to life from fire, including smoke, fumes, or panic.” Also, NFPA 101 “establishes minimum criteria for the design of egress facilities so as to permit prompt escape of occupants from buildings or, where desirable, into safe areas within buildings.”

**Management Level (ML1, ML2, ML3, ML4)-** ML designation is used to grade the structures, systems, equipment, and components and associated activities based on their importance to the protection of the public, environment, and workers, security, and the Laboratory mission. See AP-341-502, *Management Level Determination* for definitions of each ML level.

**Mitigating or Compensatory Action-** Any unusual action taken during the period of fire protection system impairment that provides an additional or compensating level of fire protection and/or life safety during the impairment. Mitigating actions may include a fire watch, establishment of a temporary water supply, establishment of temporary communications, or any other action deemed appropriate by FP-DO to counterbalance the temporary lack of a normally available fire protection SSC.

**Notification Appliance-** Any device approved by FP-DO, designed to provide audible and/or visual warning to building occupants in the event a fire alarm is initiated automatically or manually.

**Planned Utility Outage-** A planned utility outage is a pre-arranged shutdown of a utility or system supplying a building or structure (fire protection, electrical, steam/condensate, water, natural gas, HVAC, etc.) where interruptions of processes or user operations have been addressed and all affected users have been notified. Refer to Criterion 301, *Planned Utility Outages*.

## 4.0 RESPONSIBILITIES

### 4.1 MSS-Division Leader (MSS-DL)

In conjunction with the Authority Having Jurisdiction (AHJ), the Maintenance & Site Services Division Leader (MSS-DL) receives and approves or rejects requests for variances from this Criterion. The MSS-DL maintains the record of decisions for all variance requests.

### 4.2 MSS- Maintenance Programs (MSS-MP)

MSS-MP is responsible for the administrative content, and for monitoring applicability and implementation status of this Criterion. MSS-MP will assist organizations that are not applying or meeting the implementation expectations contained herein or will elevate their concerns to the appropriate level of LANL management.



### **4.3 Fire Protection Division Office (FP-DO)**

Fire Protection Division Office is responsible for the technical content, monitoring the applicability and the implementation status (compliance) of this Criterion.

The FP-DO provides technical assistance and guidance to the FOD on implementation of this Criterion, including the development of compensatory actions.

The FP-DO assigns an Impairment Coordinator (see Section 4.9).

The FP-DO is the system owner and is responsible for the reliable operations of the LANL proprietary fire alarm system (DACs).

The FP-DO notifies the fire department of impairments that may adversely affect or alter emergency response.

The FP-DO requests assistance of the Telecommunication Subcontractor as required to investigate and correct LANL proprietary fire alarm system Communication trouble signals and failures.

FP-DO maintains records generated by the impairment program process.

### **4.4 Facility Operations Director (FOD)**

The FOD is responsible for implementation of this O&M Criterion for identified systems/equipment within their facility boundaries.

The FOD obtains and prioritizes funding, work prioritization, support staffing and other resources to execute the requirements of this Criterion.

The FOD coordinates and communicates with Operations Managers, other affected FODs and building tenants affected by an impairment.

The FOD develops and approves compensatory or mitigating actions when an impairment occurs.

The FOD determines and implements required actions stated within facility Documented Safety Analysis (DSA) and Technical Safety Requirements (TSRs)/Limiting Conditions of Operation (LCOs) when notified of an inoperable or impaired credited fire protection SSC.

The FOD approves system operability determinations prepared by the Cognizant System Engineer (see Section 4.8) as required by the facility DSA and TSRs/LCOs.

### **4.5 Operations Manager (OM)**

The OM is responsible to the FOD for implementing operation portions of this Criterion and for coordinating transfer of systems/equipment to the Maintenance Manager for maintenance activities. The OM with concurrence of the FOD will prioritize implementation within budget allocations.

The OM develops and implements compensatory or mitigating actions when an impairment occurs.



The OM determines and implements required actions stated within facility DSAs and TSRs/LCOs when notified of an inoperable or impaired credited fire protection SSC.

#### **4.6 Maintenance Manager (MM)**

The MM is responsible to the FOD and the MSS-Division Leader for implementing the maintenance portions of this Criterion and for coordinating the transfer of systems/equipment to the Operations Manager at the conclusion of maintenance activities. The MM with concurrence of the FOD will prioritize implementation within budget allocations.

The MM verifies that the training and qualification of workers performing maintenance functions are appropriate for the task(s).

The MM ensures that maintenance activities are performed in a manner that does not violate or alter the design or design basis of fire protection SSCs.

#### **4.7 Authority Having Jurisdiction (AHJ)**

The LANL Fire Marshal is the approval authority for all exceptions and variances to this Criterion. The LANL Fire Marshal cannot approve deviations or exemptions to the CFR, DOE Orders or NFPA Codes and Standards; the fire protection AHJ for these matters is the Los Alamos Site Office (LASO) Manager per DOE O 420.1B (see PD 1220).

The AHJ (LANL Fire Marshal) is responsible for providing a decision on specific technical questions regarding the systems or equipment relevant to this Criterion.

The AHJ has final determination on impairment declarations.

The AHJ approves compensatory or mitigating actions for fire protection SSC impairments when the impairment will or does last longer than 8 hours. The AHJ is the organization, office, or individual responsible for approving equipment, an installation, or a procedure. The AHJ for each chapter of the Engineering Standards Manual is the Point of Contact (POC) for that chapter. See the chapter POC with questions regarding the systems or equipment relevant to this Criterion.

#### **4.8 Cognizant System Engineer (CSE)**

The CSE implements the impairment process as described in Sections 6.1.1 and 6.1.2.

The CSE makes operability determinations in accordance with the Conduct of Engineering program requirements for assigned Safety Class (SC) and Safety Significant (SS) fire protection SSCs.

The CSE assures completion, monitoring and trending ITM for assigned fire protection SSCs.

The CSE implements configuration management for assigned fire protection SSCs.



#### **4.9 Impairment Coordinator (IC)**

The IC follows the impairment program requirements as described in Sections 6.1.1 and 6.1.2.

The IC assures that impairments generated by the planned outage process receive the appropriate level of review. The IC approves the outage request form.

#### **4.10 Emergency Operations Division**

The Emergency Operations Division operates the LANL proprietary fire alarm system, and notifies the fire department (via dispatch center at the TA-69-33 Emergency Operations Center) of fire protection system impairments.

#### **4.11 Telecommunications Subcontractor**

Telecommunications subcontractors are responsible for maintaining leased LANL telecommunications equipment and infrastructure that transfers fire alarm signals from LANL facility fire alarm control panels (FACPs) to the LANL proprietary fire alarm system.

Telecommunications subcontractors are also responsible for assigning and dispatching technicians to troubleshoot leased LANL telecommunications circuits upon notification of a Communication trouble signal or failure.

#### **4.12 LANL Worker**

LANL workers are responsible for notifying the Fire Marshal or designee and the appropriate FOD designee immediately after discovering a previously unidentified impaired fire protection system.

### **5.0 PRECAUTIONS AND LIMITATIONS**

#### **5.1 Precautions**

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. However, all applicable precautions should be contained in the implementing procedure(s) or work control authorization documents. The following precautions are intended only to assist the author of a procedure or work control document in the identification of hazards and precautions that may not be immediately obvious.

There are no unique precautions associated with this Criterion; however, personnel responsible for implementation of this Criterion must be cognizant of the extent of that responsibility and of the consequences of actions taken during an impairment. The ultimate goal of this Criterion is to ensure an acceptable level of life safety and property protection during a scheduled or unplanned impairment of a fire protection SSC at



LANL. Consultation with FP-DO or the LANL Fire Marshal to secure approval of alternate methods of protection is imperative.

## 5.2 Limitations

The intent of this Criterion is to identify the minimum requirements and recommendations for structures, systems, and components (SSCs) operation and maintenance across the Laboratory. Each Criterion user is responsible for the identification and implementation of additional facility specific requirements and recommendations based on their authorization basis and unique equipment and conditions, (e.g., equipment history, manufacturer warranties, operating environment, manufacturer O&M requirements and guidance, etc.)

Nuclear facilities and moderate to high hazard non-nuclear facilities will typically have additional facility-specific requirements beyond those presented in this Criterion. Nuclear facilities should implement the requirements of DOE Order 433.1A, *Maintenance Management Program for DOE Nuclear Facilities* as the minimum programmatic requirements for a maintenance program. Additional requirements and recommendations for SSC operation and maintenance may be necessary to fully comply with the current DOE Order or the CFR as applicable.

Nuclear facilities, certain high hazard facilities and explosives facilities may have additional facility specific requirements beyond those presented in this Criterion which are contained in the DSA, Technical Safety Requirements (TSRs), or facility safety plans, as applicable.

## 6.0 REQUIREMENTS

Minimum requirements for all users are specified in this section. Requested variances to these requirements shall be prepared and submitted to MSS-MP for review and approval. The MSS Division Leader approves or denies variances. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgment, safety matters, and operations and maintenance experience drive the requirements contained in this section.

**Note:** Discovery of SSC with a degraded or non-conforming condition is a triggering input to the Operability Determination and Functional Assessment process defined in AP-341-516, *Operability Determination and Functionality Assessment*. Degraded or non-conforming conditions include, but are not limited to, failed equipment or components, unsatisfactory readings, code or standard violations and fire protection impairments. Personnel performing tests or inspections under this O&M Criterion are not responsible nor authorized to perform the Operability Determination. Any degraded or non-conforming condition discovered under this O&M Criterion shall be communicated to the FOD Representative for input to the AP-341-516 process. While that process may not apply in Low Hazard Non-Nuclear and Office facilities, the same concept



applies. The FOD organization is responsible to determine the response (taking equipment out of service, establishing fire watches, limiting operations, etc.) to SSC degraded and non-conforming conditions.

## 6.1 Operations Requirements

The following actions are required to meet LANL contract commitments as described in PD 1220, *Fire Protection Program*, 10 CFR 851, *Worker Safety and Health Program*, Appendix A.2 "Fire Protection," NFPA 1, 25 and 72, and DOE Order 420.1B. The roles and responsibilities described within this Criterion are consistent with LANL P3153, *Roles, Responsibilities, Authorities and Accountability*, and P315, *Conduct of Operations*.

A generalized process flowchart of the Impairment Process is provided in Appendix D.

### 6.1.1 Planned Impairment

Modifications or corrective maintenance repairs to fire protection SSCs shall follow the LANL utilities outage process described in O&M 301, *Planned Utility Outages*, including the posting of Impairment Tag(s) on the affected system/equipment.

Fire protection SSC impairments shall be authorized by the FOD or designee. The Impairment Coordinator shall review the outage request form and, upon verification of appropriate compensatory actions and notifications, approve and return the outage request form.

Compensatory or mitigating actions for fire protection SSC impairments shall be planned by the requestor and approved by the FOD prior to the impairment. The FOD should consult with the Impairment Coordinator/FP-DO on the scope of compensatory or mitigating actions to be implemented for the impairment.

The LANL Fire Marshal shall be notified of a fire protection SSC impairment lasting in excess of 8 hours.

**Note:** The Fire Marshal has the authority to require that the affected building be evacuated until the impaired fire protection system has been returned to full service.

The fire department shall be notified of fire protection SSC impairments that may adversely affect or alter emergency response regardless of the impairment duration.

Notification shall be made to affected organizations including the FOD, MM, OM, tenants and FODs in adjoining or connected facilities, and the Impairment Coordinator no less than 1 business day prior to the start of work.

Establish appropriate compensatory actions (see guidance in Appendix B) in the affected area **if the impaired fire protection system will remain out-of-service for more than 4 hours.**

Initiate a four-part Impairment Tag (Obtain tag from Impairment Coordinator or MSS-MP; see sample tag in Appendix A).



Part 1 of the Impairment Tag shall be delivered to MSS on the next work day.

Part 2 of the Impairment Tag shall be delivered to the FOD representative upon identification of impairment.

Part 3 of the Impairment Tag shall be delivered to FP-DO on the next work day.

Part 4 of the Impairment Tag shall be posted on the impaired component/system.

Emergency Operations personnel operating and monitoring the DACS track the status of planned impairments to closure. MSS-DO shall retain Part 1 of the Impairment Tag until Part 4 of the Impairment Tag has been received.

Once the fire protection SSC has been restored to service, post-maintenance testing shall be performed prior to returning the impaired system to fully operable status. Testing shall consist of an operational test of the device or component and alarm transmission verification at the fire control panel and the LANL proprietary fire alarm system (DACs). If post-maintenance testing is not successful, the FOD shall be notified of the discrepant condition.

Following successful post-maintenance testing, Part 4 of the Impairment Tag (specifically the "Restored to Service" portion) is completed. Detailed information is required regarding corrective actions taken to return the system to operable status.

Part 4 of the Impairment Tag shall be returned to MSS as soon as possible following the return of the impaired fire protection SSC to service, indicating that the impairment can be closed-out.

Following close-out of the impairment record, MSS shall deliver the completed Part 4 Impairment Tag to FP-DO for final records retention (minimum 1 year retention period prior to archiving following the process described in P 1020, *Document Control and Records Management*).

MSS-MP shall maintain and update daily an electronic log or database listing fire protection system impairments and actions taken. This information shall be provided to the FODs daily. [ORPS Occurrence Report No. ALO-LA-LANL-RADIOCHEM-2001-0002.]

*Basis:* DOE O 420.1B Chapter II ¶ 3.b(2)(f), NFPA 1, NFPA 25, NFPA 72 and NFPA 101.

### **6.1.2 Unplanned Impairment**

The initial impairment determination shall be made by MSS maintenance personnel or the LANL Fire Marshal using the guidance contained in Appendix B.

The responsible FOD or designee is promptly notified of the fire protection SSC impairment following initial declaration. As appropriate, the CSE shall perform required operability determinations to verify impact to the DSA and TSRs in accordance with the Conduct of Engineering program.



The responsible FOD or designee shall make prompt notifications to affected organizations including the MM, OM, tenants and FODs in adjoining or connected facilities, and the Impairment Coordinator.

The FOD and/or OM establishes appropriate compensatory actions (see guidance in Appendix B) in the affected area **if the impaired fire protection system will remain out-of-service for more than 4 hours**. The FOD should consult with the Impairment Coordinator/FP-DO on the scope of compensatory or mitigating actions to be implemented in response to the impairment.

The Impairment Coordinator will evaluate the impairment to determine the cause and impact of the unplanned impairment and will notify the Fire Marshal when systems remain impaired for longer than 8 hours.

**Note:** The Fire Marshal has the authority to require that the affected building be evacuated until the impaired fire protection system has been returned to full service.

The fire department shall be notified of fire protection SSC impairments that may adversely affect or alter emergency response regardless of the impairment duration.

Initiate a four-part Impairment Tag. (Obtain from Impairment Coordinator or MSS-MP. See sample tag in Appendix A).

- Part 1 of the Impairment Tag shall be delivered to MSS on the next work day.
- Part 2 of the Impairment Tag shall be delivered to the FOD representative upon identification of impairment.
- Part 3 of the Impairment Tag shall be delivered to FP-DO on the next work day.
- Part 4 of the Impairment Tag shall be posted on the impaired component/system.

MSS-MP tracks the status of unplanned impairments to closure. MSS-MP shall retain Part 1 of the Impairment Tag until Part 4 of the Impairment Tag has been received.

Once the fire protection SSC has been restored to service, post-maintenance testing shall be performed prior to returning the impaired system to fully operable status. Testing shall consist of an operational test of the device or component and alarm transmission verification at the fire control panel and the LANL proprietary fire alarm system (DACs). If post-maintenance testing is not successful, the FOD shall be notified of the discrepant condition.

Following successful post-maintenance testing, Part 4 of the Impairment Tag (specifically the "Restored to Service" portion) is completed. Detailed information is required regarding corrective actions taken to return the system to operable status.

Part 4 of the Impairment Tag shall be returned to MSS as soon as possible following the return of the impaired fire protection SSC to service, indicating that the impairment can be closed-out.



Following close-out of the impairment record, MSS shall deliver the completed Part 4 Impairment Tag to FP-DO for final records retention (minimum 1 year retention period prior to archiving following the process described in P 1020, *Document Control and Records Management*).

MSS-MP shall maintain and update daily an electronic log or database listing fire protection system impairments and actions taken. This information shall be provided to the FODs daily. [ORPS Occurrence Report No. ALO-LA-LANL-RADIOCHEM-2001-0002.]

*Basis:* DOE O 420.1B Chapter II ¶ 3.b(2)(f), NFPA 1, NFPA 25, NFPA 72 and NFPA 101.

## **6.2 Maintenance Requirements**

No requirements beyond those stated in Section 5.2, Limitations.

## **7.0 RECOMMENDED AND GOOD PRACTICES**

The information provided in this section is recommended based on acceptable industry practices and should be implemented by each user based on the unique application and operating history of the subject systems/equipment.

### **7.1 Operations Recommendations**

No requirements beyond those stated in Section 5.2, Limitations.

### **7.2 Maintenance Recommendations**

No requirements beyond those stated in Section 5.2, Limitations.

## **8.0 GUIDANCE**

### **8.1 Operations Guidance**

None.

### **8.2 Maintenance Guidance**

None.



## 9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained for all fire protection systems to include, as a minimum, the parameters listed in the Table 9-1 below:

<b>Table 9-1: Maintenance History Documentation Parameters</b>				
<b>Parameter</b>	<b>ML 1</b>	<b>ML 2</b>	<b>ML 3</b>	<b>ML 4</b>
<b>Maintenance Activities</b>				
Repair / Adjustments	Required	Required	Required	Required
PM Activities	Required	Required	Required	Required
<b>Equipment Problems</b>				
Failure Dates	Required	Required	Required	Required
Failure Root Cause	Required	Required	Required	Required
<b>Inspection Results</b>				
Inspection Date	Required	Required	Required	Required
SSC Condition	-	-	-	-
<i>'-' indicates documentation is not required.</i>				

*Basis:* Documentation of the parameters listed in Table 9-1 above satisfies the requirements of P 950, Section 3.5.15 which states, "A maintenance history and trending program is maintained to document data, provide historical information for maintenance planning, and support maintenance and performance trending of facility systems and components failure."

## 10.0 REFERENCES

The following references, and associated revisions, were used in the development of this document.

- 10.1 10 CFR 851, *Worker Safety and Health Program*, Appendix A.2 "Fire Protection"
- 10.2 AP-341-502, *Management Level Determination*
- 10.3 AP-341-516, *Operability Determination and Functionality Assessment*
- 10.4 AP-MNT-010, *Maintenance History*
- 10.5 DOE Order 420.1B, *Facility Safety*, Chapter II, "Fire Protection"
- 10.6 DOE Order 430.1B, *Real Property Asset Management*
- 10.7 DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*
- 10.8 P 1020, *Document Control and Records Management*



- 10.9 NFPA 1, *Uniform Fire Code*, 2009 edition
- 10.10 NFPA 101, *Life Safety Code*, 2009 edition
- 10.11 NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems*, 2008 edition
- 10.12 NFPA 72, *National Fire Alarm and Signaling Code*, 2010 edition
- 10.13 *ORPS Occurrence Report No. ALO-LA-LANL-RADIOCHEM-2001-0002*
- 10.14 P 313, *Roles, Responsibilities, Authorities and Accountability*
- 10.15 P 315, *Conduct of Operations Manual*
- 10.16 P 950, *Conduct of Maintenance*
- 10.17 PD 1220, *Fire Protection Program*

## 11.0 APPENDICES

- Appendix A: *Sample Fire Protection System Impairment Tag*
- Appendix B: *Fire Protection Impairment Evaluation and Determination of Compensatory Actions*
- Appendix C: *Fire Watch Requirements*
- Appendix D: *Fire Protection Impairments Process Flow Chart*



APPENDIX A
SAMPLE FIRE PROTECTION SYSTEM IMPAIRMENT TAG

Form with fields for: No. 11500, FIRE PROTECTION SYSTEM OR COMPONENT OUT OF SERVICE, REMOVAL BY AUTHORIZED PERSONNEL ONLY, TECH AREA, BLDG, FLOOR, WING, FIRE PROTECTION WATER CONTROL VALVE NO, HYDRANT NO, SYSTEM NO, ALARM INITIATING DEVICES, DESCRIPTION OF IMPAIRMENT, AUTHORIZED BY, SYSTEM OR COMPONENT OUT OF SERVICE, RESTORED TO SERVICE, WORK PERFORMED, POST OUTAGE TEST & VERIFICATION, OBSERVERS (OR WITNESSES), VERIFIED FOR SSS BY, VERIFIED FOR LANL FIRE PROTECTION.



## APPENDIX B

### FIRE PROTECTION SYSTEM TROUBLE EVALUATION, COMPENSATORY ACTIONS, AND FIRE WATCH REQUIREMENTS

This appendix provides guidance on how to address fire protection SSC impairments. Some fire protection SSC impairments will necessitate compensatory or mitigating actions and immediate repairs. Other system impairments that are of a less critical nature may not necessarily require compensatory actions or immediate repair. The conditions that determine the difference between these types of situations are detailed in this document. It must be stressed that the following information does not address every fire protection system condition that may be encountered.

The following instructions apply to all situations described in this document:

- Contact the LANL Emergency Operations Center (EOC) at 7-6211 if any portion of a fire alarm, fire suppression or gaseous suppression system is impaired or out-of-service. The EOC is located at TA-69, Building 33. Request that this information be immediately relayed to the Los Alamos County dispatchers.
- An Impairment Tag (shown in Appendix A) must be filled out and posted at the impaired system or on the impaired component.
- Compensatory actions such as a fire watch are not required until the SSC has been out of service for more than four hours. The requirements of the fire watch are defined more specifically in Appendix C.
- Personnel in an occupied building can serve as the fire watch if they are notified of this duty, made aware of the extent of the impairment within the facility, and provided with instructions to initiate an evacuation and summon emergency responders if fire or smoke is observed within the facility. Note that unoccupied areas of an otherwise occupied building must be provided with a fire watch, since personnel in the rest of the building will be unable to detect a fire in the unoccupied areas.

- A nuclear facility TSR/LCO takes precedence over the corrective action criteria described in this document.
- Repair priorities as defined in AP-WORK-001:
  - Priority 1 = Begin emergency work immediately,
  - Priority 2 = Schedule repair at earliest opportunity, and
  - Priority 3 = Schedule normal repair.
- When in doubt, be conservative and undertake immediate actions to correct an impairment. Contact the Fire Protection Division Office (FP-DO) or the LANL Fire Marshal for additional guidance.

## A. FIRE DETECTION AND ALARM SYSTEMS

### Required Functionality

A fire alarm system must be capable of all of the following functions, otherwise it is impaired:

- Detect a fire condition, and upon detection:
  - Initiate any required auxiliary or interlocked actions that may be built into the system (like closing fire doors, fire/smoke dampers, turning off ventilation systems, actuating suppression systems, etc.)
  - Relay fire alarm signals back to the Digital Alarm Communicator System (DACS), the LANL proprietary fire alarm system.
  - Activating local fire alarm notification devices (like horns/strobes, speakers or bells/chimes) for local evacuation of building occupants.
- Relay a system actuation signal to the DACS following actuation of an associated fire extinguishing/suppression system.
- Relay trouble/supervisory signals to the DACS for non-normal fire protection system components (like valve supervision, low supervisory air pressure, Knox key box tampering, dirty or out-of-specification sensitivity for smoke detectors, or environmental conditions like low water or room temperature.
- Monitor the condition and integrity of associated system circuits and components (like AC power, low battery charge conditions, ground faults, short circuits, etc.) during normal (non-fire) conditions and indicate problems via a local trouble and/or supervisory signal, and relay those signals to the DACS.

### Abnormal Conditions and Responses



The following incomplete list of abnormal conditions may be encountered in association with a fire detection and alarm system. Compensatory actions and repair priorities vary.

### A.1. FACP Trouble Indication

If a “trouble” alarm is indicated on the fire alarm control panel monitoring faults or circuit problems within the panel and wiring to field devices, the suggested immediate action is to attempt to reset the panel, and determine the cause of the trouble indication.

A.1.a. If it is determined that the trouble condition is the result of a fire control panel fault, establish a fire watch with a 2-hour minimum frequency for the affected area(s) (or at the frequency established in the facility authorization basis document, whichever is more stringent). The affected components should be considered impaired until the trouble indication is corrected.

A.1.b. The repair of the above issue is Priority 1.

**Note:** If the trouble is within the DACS communication circuit or respective integral Digital Alarm Communicator Transmitter (DACT) output zone, subsequent FACP trouble signals may not be reported.

**Note:** On smaller relay panels that report multiple alarm/trouble zones, a trouble alarm may actually be a communication failure with the DACS. This can only be determined by testing of the communication circuits.

### A.2. FACP Supervisory Indication

If a “supervisory” alarm is indicated on the fire alarm control panel monitoring fire suppression systems, equipment or maintenance features of related systems, the suggested immediate action is to determine the cause of the supervisory trouble signal.

A.2.a. If it is determined that the supervisory signal was the result of a PIV or OS&Y valve position monitor switch, then:

- Immediately ensure the PIV and OS&Y’s involved are in the open position and locked or sealed. A fire watch is not required. If the problem cannot be corrected in a timely manner, weekly inspections must be performed in accordance with NFPA 25 to verify correct valve position.



- If there is any indication that a fire protection system control valve has been tampered with, immediately notify LANL Security at x7-5911 and the FOD to report malicious activity.

The repair of the above issue is Priority 2.

A.2.b. If it is determined that the supervisory signal was the result of a dry pipe sprinkler system low supervisory air condition, then:

- Determine what caused the loss of supervisory air or nitrogen and initiate corrective actions. Verify that the loss of supervisory air or nitrogen pressure was not caused by a fire or high temperature condition resulting in sprinkler head activation.
- During freezing weather, close the water control valve to avoid tripping the dry pipe valve and allowing water to enter the system. This course of action should only be taken after determining the loss of air/nitrogen in the system was not caused by a sprinkler head fusing as a result of heat caused by a fire.
- If the dry pipe system control valve is closed, establish an hourly fire watch for the area protected by the dry pipe system (or at the frequency established in the facility authorization basis document, whichever is more stringent).
- If there is no danger of freezing, the dry pipe valve can be left in a tripped position (i.e., with water in the system piping) and no fire watch is required if the building is occupied. However, the sprinkler system flow alarm will not work, and will not activate a local building or remote alarm signal to the DACS in this configuration – so a fire watch must be established on a minimum 2-hour frequency when the protected building is not occupied.

The repair of the above issue is Priority 1.

A.2.c. If it is determined that the supervisory signal was the result of a low air condition in a rate-of-rise deluge system, deluge pilot head operated system, rate-of-rise pre-action system or electrically activated pre-action system, then:

- Verify that the loss of air or nitrogen was not a result of a fire condition.
- If loss of supervisory air or nitrogen is not due to fire condition, then:



1. Close the water control valve. Generate an impairment tag and post on the closed water control valve.
2. Notify the fire department of the impairment to the fire suppression system as it may adversely affect or alter emergency response.
3. Establish a fire watch at 1-hour intervals for the area protected by the fire suppression system (or the frequency established in the facility authorization basis document, whichever is more stringent).
4. Instruct fire watch and other facility personnel to open the fire suppression system control valve in the event of a fire if safe to do so.

The repair of the above issue is Priority 1.

A.2.d. If it is determined a subpanel is the cause of the supervisory signal (for example, a Halon, FM-200, CO<sub>2</sub>, or other subpanel,) then:

- Determine the cause of the supervisory signal and initiate corrective actions.
- If the sub-panel is associated with a gaseous or clean agent fire extinguishing system that protects an area also protected by an automatic sprinkler system that is fully operational, then a fire watch is not required.
  - Otherwise, establish compensatory actions including a fire watch for the affected area at 1-hour surveillance intervals (or at the frequency established in the facility authorization basis document, whichever is more stringent).
- Once a fire watch is established, it may be prudent to disable the gaseous or clean agent fire extinguishing system until the supervisory signal is repaired to prevent inadvertent system actuation and release of the agent.

The repair of the above issue is Priority 1.



A.2.e. If it is determined that the supervisory trouble signal is associated with a Knox key lock box, then:

- Verify that the Knox key box is secure and has not been tampered with. Report any tampering to the FOD and Security (x7-5911) immediately.
- Notify FP-DO to remove facility keys from the Knox key box until monitoring of the key box is restored.

The repair of the above issue is Priority 2.

A.2.f. If it is determined that the supervisory trouble signal is a result of a monitored low temperature condition within a building area (For example, resulting from the loss of heat in sprinkler valve house or the loss of heat tape monitoring), then:

- Determine what area is affected by the loss of heat.
- Initiate corrective actions to repair/restore the heat source.
- Establish compensatory actions to provide an alternate heat source. A fire watch would not be required if temporary heat is provided. The heat source should be routinely checked at intervals that are dictated by the weather and location.
- If temporary heat cannot be provided, the control valve for the fire suppression system should be closed and the system should be drained to prevent freezing and damage to system piping and sprinkler heads. This action will impair the fire suppression system. Establish a fire watch for the affected area at 1-hour surveillance intervals (or at a frequency prescribed by the facility's authorization basis document, whichever is more stringent).

**Note:** Without temporary heat, and in potentially freezing conditions, the fire suppression system is in danger of freezing, which will at least prevent the system from operating as designed, and at worst will break system piping, causing facility damage and requiring system repair.

The repair of the above issue is Priority 1 if temporary heat cannot be provided, and Priority 2 otherwise.

### A.3. FACP Communication Failure

If a “communication fault” related alarm is indicated on the fire alarm control panel monitoring fire suppression systems or equipment or maintenance features of related systems, then alarm, trouble, and supervisory signals cannot be transmitted from fire control panel to the DACS.

- First, verify that the FACP is operating properly.
- If the FACP is operating properly, then call FP-DO (x7-9045) to verify that DACS and FACP equipment are working correctly.
- If FACP and DACS determined to be operating properly, then FP-DO will contact the telecommunication subcontractor to troubleshoot their communications circuits.
- Establish a fire watch at 2-hour surveillance intervals for the area protected by the fire alarm control panel (or at a frequency prescribed by the facility’s authorization basis document, whichever is more stringent). Fire watch duties shall include monitoring the FACP for alarms and notifying the EOC or calling 911 if the FACP indicates a fire alarm.

The repair of the above issue is Priority 1.

**Note:** The communication failure signal will only occur in microprocessor-based FACPs (like Autocall, EST-2, EST QuickStart, Notifier, FCI, Simplex, etc.). The communication failure signal will only be apparent at the EOC, not at the FACP. The FACP might indicate some systems trouble or it might indicate no trouble at all.

**Note:** Suppression and detection and alarm systems may still be operational when this condition exists.

### A.4. Planned Outage

Planned fire detection and alarm system outages are permitted under controlled conditions initiated through the Utility Outage Permit system (as described in Criterion 301, *Planned Utility Outages*.) with compensatory actions as defined by the FP-DO comments on the utility outage permit. Fire detection and alarm system outages are authorized for various reasons; the following are the most common:

- Fire detection and alarm system modification.
- Fire detection and alarm system must be temporarily disabled to allow for a building modification.



- Testing of fire detection and alarm system equipment.
- Replacement of fire protection system components.

## B. FIRE SUPPRESSION SYSTEMS

### B.1. Water-Based Fire Suppression Systems

Water-based fire suppression systems are defined as any automatic or manually actuated system that is designed to apply water or water-foam solution to a fire. This includes all types of wet pipe, dry pipe, pre-action, deluge, standpipe and foam-water fire suppression systems, and can include systems that apply fire fighting foam to a fire.

#### Required Functionality

A water-based fire suppression system must be capable of all of the following functions, otherwise it is impaired:

- Detecting a fire condition such as high ambient temperature.
- Applying water or foam-water solution to the fire.
- Providing an indication of system actuation (normally sent via the FACP to the DACS to initiate dispatch of the fire department).
- Some water-based suppression systems will include a local control/releasing panel to accomplish actions necessary to apply water to the fire. These actions, such as opening a deluge valve, are also required functions of the fire suppression system.
- The fire suppression system must have a reliable water supply, with adequate pressure, flow, and quantity available to supply water to the protected area.

#### B.1.a. System or Component Impairments

##### Impairment Criteria

When unsatisfactory conditions associated with components of a water-based suppression system are discovered, the suppression system is not considered impaired unless the following conditions exist:

- B.1.a.1. 10% or more of the system sprinklers/ nozzles, pilot heads, or detectors (like for deluge or preaction systems) in any given 1,500 square foot area (typical NFPA 13 design area) protected by the

same system are incapable of detecting high ambient temperatures;  
or

- B.1.a.2. 10% or more sprinklers or nozzles in a given 1,500 square foot area protected by the same system are incapable of applying water to a fire; or
- B.1.a.3. System actuation cannot be detected or an actuation signal cannot be transmitted via the fire alarm system to the FACP to the DACS. This condition will require compensatory actions as defined in Section A. Fire Alarm Systems.
- B.1.a.4. The water supply to the system is impaired, such that adequate water pressure/flow is not available to the sprinkler system.
- B.1.a.5. In a building required to be fully protected by a sprinkler system, any of the following might constitute an impairment of the building's sprinkler system under this Criterion.
- a modular office
  - clean room
  - screen room
  - experimental enclosure
  - temporary radiological control containment enclosures/huts/tents

**Note:** See NFPA 13, *Standard for the Installation of Sprinkler Systems*, ¶ 8.5.5.3.1, and NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*, ¶ 5.3.1.1.

#### **B.1.b. Responses**

If conditions exist such that the affected system is impaired, then:

- Establish a fire watch with a 1-hour frequency for the affected area (or at a frequency prescribed by the facility's authorization basis document, whichever is more stringent).
- Prohibit hot work (like cutting, welding, grinding or other spark- or flame-producing operations) or other increased fire hazard activities in the affected area until the fire suppression system can be restored to service (unless such activities are required to repair the system and adequate protective measures are established).

The repair of the above issue is Priority 1.



### B.1.c. Water Supply System

Water supply system impairments prevent the underground water supply from providing the design pressure and flow rate to the base of the fire protection riser.

Suggested compensatory measures to provide an alternate water supply to the water-based fire suppression system affected by an underground water supply outage include, but are not limited to, the following:

- Run 2½ in hose line(s) from an operable fire hydrant to the fire department connection (FDC) or the 2 in sprinkler system main drain for a suppression system. If freezing is a concern, the hose(s) should be connected, but the hydrant may be left in the closed position with operating valve/handle/wrench staged in a strategic location, and the fire watch should be instructed to open the hydrant in the event of a fire. This will provide limited operability of the fire suppression system, but it is still deemed to be impaired.

#### **Water flow alarm considerations:**

The temporary water supply described above will by-pass the pressure switch (normal indicator of riser water flow) on the suppression system riser. Water flow indication is required, and must be considered if this compensatory action is used. Options include the following:

If there are additional flow switches downstream of the temporary water supply connection, they will operate normally to indicate system actuation and produce an alarm signal to the DACS.

If there are no flow switches mounted downstream of the temporary connection, a flow switch mounted in the temporary water supply hose may be used to provide a flow alarm. The flow switch mounted in the hose line(s) should be located near the riser, regardless of where the connection is made (FDC or 2 in main drain). The alarm tie-in for the flow switch alarm is also required in order to alleviate requirements for a fire watch.

Description of the flow switch mounting device: A segment of pipe (2, 2½ or 3 in diameter) approximately 18 in long with appropriate male/female hose



thread on either end for connection to the hose(s), with an appropriate female thread fitting or hole saw opening installed in the middle of the pipe section to receive the flow switch. A flow switch approved for fire service with NO/NC contacts should be used.

Where a temporary water supply cannot be provided, the affected suppression system(s) must be considered impaired, and compensatory actions must be established.

- Establish a fire watch with a 1 hour surveillance interval (or at a frequency prescribed by the facility's authorization basis document, whichever is more stringent).
- Prohibit hot work (like cutting, welding, grinding or other spark- or flame-producing operations) and other increased fire hazard operations in the protected area while the sprinkler system is out of service (unless required to repair the system and adequate protective measures are established).

The repair of the above issue is Priority 1.

#### **B.1.d. Unique Situations**

Other circumstances, such as a major modification to a building that is protected by an automatic sprinkler system, may require innovative thinking to provide sprinkler protection to the facility. For example, it may be necessary to place a portion of the sprinkler system out of service during construction activities. If the section of the sprinkler system to be worked on can be isolated from the rest of the system (ex. by removing a section of piping and capping the remaining system piping), then a portion of the sprinkler system can be placed back into service while the remainder of the system is worked on. This will allow continued protection for the area not under construction. For this sort of planned activity, consult FP-DO for assistance.

#### **B.2. Gaseous/Clean Agent Fire Extinguishing Systems**

##### **Required Functionality**

Gaseous fire suppression systems at LANL include Halon 1301, FM-200, CO<sub>2</sub> and other gaseous clean agent fire extinguishing systems. A gaseous fire suppression system must be capable of all of the following functions, otherwise it is impaired:

- Detect a fire condition (smoke, heat, or flame) via an integral fire detection system.
- Initiate any necessary automatic actions prior to releasing gaseous fire extinguishing agent into the protected enclosure or on the fire hazard (such as isolating ventilation systems, automatically closing doors and dampers to ensure that the protected room is relatively gas-tight, etc.)
- Release the required quantity of fire extinguishing agent into the protected enclosure or on the fire hazard. (The quantity of agent will vary depending on the configuration of the protected enclosure and/or fire hazard.)
- Maintain the required concentration of fire extinguishing agent in the protected enclosure for the required time period. (The concentration and soak time may vary depending on the specific agent used, the hazard protected, and the configuration of the room.)
- Initiating a local alarm within the protected facility and relaying an indication of system actuation through the facility FACP to the DACS.

### **Abnormal Conditions and Responses**

Functional problems involving gaseous fire extinguishing systems must be evaluated immediately. This type of fire extinguishing system is installed in areas or buildings that are of high value, programmatically vital and/or otherwise unique in nature due to hazard. With the exception of agent container weight, trouble analysis should follow the same steps and guidance provided in this document for fire detection and alarm systems described in Section A.1. above.

- A fire watch should be established immediately upon determining that the gaseous fire extinguishing system cannot perform its required functions (as defined above). The fire watch surveillance intervals must meet the minimum 1-hour surveillance requirement or more frequently if required in the facility's authorization basis document.
- Note that the inability of the protected room or space to remain relatively gas-tight (contain the extinguishing agent for the required soak-time) also renders a gaseous fire extinguishing system impaired. Therefore, unsealed penetrations or open doors into a room protected with a gaseous fire



extinguishing system will render the system impaired, and must be sealed/closed before the system can be considered operable.

- Note that some areas protected with gaseous fire suppression systems are also protected with automatic sprinklers. In these cases, if the automatic sprinkler system protects the same space as the gaseous fire extinguishing system, then a fire watch need not be established if the sprinkler system and all associated alarm capabilities are verified to be in working order.

The repair of the above issue is Priority 1 if no other automatic fire suppression system is available. The repair is Priority 2 if automatic sprinkler protection is provided within the protected enclosure.

### **B.3. Other Types of Fire Suppression/Extinguishing Systems**

#### **Required Functionality**

Other types of fire suppression systems employed at LANL include wet and dry chemical extinguishing systems. These systems must be capable of the following functions, otherwise it is impaired:

- Detecting fire conditions (if automatically actuated).
- Initiating special actions prior to releasing fire suppressing agent (ex. ventilation shutdown, power shunt-trip, etc.)
- Releasing fire extinguishing agent within the protected area or on the protected hazard.
- Initiating a local alarm within the protected facility and relaying an indication of system actuation through the facility FACP to the DACS.

B.3.a. If an operable sprinkler system protects the same area as the impaired fire suppression system, then no compensatory actions are required.

The repair of the above issue is Priority 2.

B.3.b. If there is no operable automatic sprinkler system protecting the same area as the impaired fire extinguishing system, then:

- Establish a fire watch with a 1-hour frequency for the affected area (or at a frequency prescribed by the facility's authorization basis document, whichever is more stringent).

- Prohibit hot work (like cutting, welding, grinding or other spark- or flame-producing operations) or other increased fire hazard activities in the affected area until the fire suppression system can be restored to service (unless such activities are required to repair the system and adequate protective measures are established).

**Note:** For chemical extinguishing systems that protect specific hazards, such as kitchen grease hoods and cooking appliances (hot cooking oils), automatic sprinkler protection for the general building and kitchen areas IS NOT an acceptable compensatory action for an impaired chemical extinguishing system. The building automatic sprinkler system does not provide an equivalent level of protection from the fire hazards posed by high-temperature cooking oils. Cessation of cooking activities and isolating power and/or gas to the cooking appliance protected by the chemical extinguishing system is the appropriate compensatory action until the chemical extinguishing system is returned to service.

The repair of the above issue is Priority 1.

#### **B.4. Planned Outage**

Planned fire detection and alarm system outages are permitted under controlled conditions initiated through the Utility Outage Permit system (as described in Criterion 301, *Planned Utility Outages*.) with compensatory actions as defined by the FP-DO on the outage permit. Fire detection and alarm system outages are authorized for various reasons; the following are the most common:

- System modification due to building modification,
- Repair of damaged or leaking piping or sprinklers/nozzles,
- Repair of system components (flow switches, inspector test valves, fire department connection check valves and interior inspection or repair of alarm check valves),
- Testing back flow prevention devices,
- Repairing main drain valve, and
- System alarm testing.

If the system outage is required for a condition that does not render the fire suppression system impaired, as defined above, then no compensatory actions are required during the system outage.

- Outages must be planned to minimize fire suppression system down time.



- Suggested compensatory actions during water-based fire suppression system outages are:
- Establish a fire watch with a 1 hour surveillance interval (or at a frequency prescribed by the facility's authorization basis document, whichever is more stringent);
- Prohibit hot work (like cutting, welding, grinding or other spark- or flame-producing operations) and other increased fire hazard operations in the protected area while the sprinkler system is out of service (unless required to repair the system and adequate protective measures are established).

The repair of the above issue is Priority 2.

### C. HYDRANTS AND STANDPIPES

#### Required Functionality

A fire hydrant or standpipe system must provide a ready source of water at an adequate flow and pressure, and with appropriate hardware (like hose connections) to enable firefighting personnel to manually fight a fire. Otherwise, it is impaired.

If a fire hydrant or standpipe system is impaired, no compensatory actions are required unless required by the facility's authorization basis document.

The water supply associated with a fire hydrant or standpipe system may include a water flow device such that a signal will be relayed to the DACS upon use of the standpipe system or hydrant. Normally, flow switches are located on the building fire suppression system risers. Where a standpipe is supplied off of a building riser equipped with a flow switch, use of the standpipe will actuate the flow switch. Where a facility's water supply system includes one or more diesel or electric fire pumps, use of a fire hydrant will result in actuation of a fire pump and subsequent alarm to the DACS indicating fire pump operation (running).

The repair of the above issue is Priority 2.

If a hydrant or standpipe system must be considered impaired, notify the Los Alamos Fire Department immediately, since LAFD has preplanned to use the impaired equipment to fight a fire at the facility.



If the hydrant or standpipe will be impaired for more than 14 days, contact FP-DO for guidance on appropriate compensatory actions.

**Note:** A fire hydrant is sometimes used for non-fire fighting purposes (like filling a tanker truck used to mitigate dust at a construction site – see PD 1220 Attachment B *Nonemergency Use of Fire Hydrants*). In such cases, it is required to obtain approval from FP-DO and UI-DO prior to nonemergency use of a fire hydrant. No compensatory actions are typically necessary, although UI-DO typically requires the use of a backflow preventer.

## D. FIRE BARRIERS AND SUB-COMPONENTS

This section includes impairments of fire barriers and fire barrier components: fire dampers, smoke dampers, fire barrier penetration seals, and fire doors.

### D.1. Fire Barriers

#### Required Functionality

A fire barrier must be capable of all of the following functions, otherwise it is impaired:

- Prevent or retard the spread of fire beyond the room or area of fire origin. This is both a Loss Prevention function and a Life Safety function. Fire barriers are typically used to separate areas of higher fire hazard from areas of lower fire hazard, or to separate large facilities into sections so that the consequences of a fire will be minimized.
- Provide building occupants with a safe exit path from the building. This is a Life Safety function. Enclosed stairwells and floors/ceilings between building elevations are considered to be fire barriers required for Life Safety.
- Provide building occupants with an area of refuge within the building, such that they need not exit the building but will still be safe from fire in another part of the building. This is a Life Safety function. Enclosed stairwells in some buildings fulfill this function. Other areas of refuge are as defined by the building emergency plan (BEP).
- Provide a containment (gas-tight) boundary around a room protected by a gaseous fire extinguishing system. This is a Loss Prevention function. This function of a fire barrier is required to ensure that the appropriate fire extinguishing agent concentration will be maintained in the protected room for the duration (soak-time) necessary to extinguish the fire.

The repair of the above issue is Priority 1 when life safety issues are involved, and Priority 2 for property protection.

## D.2. Fire Barrier Sub-Components

Sub-components of a fire barrier include fire dampers, smoke dampers, through penetration firestop systems (penetration seals) and fire doors. The fire protection function of these sub-components is primarily to maintain the fire protection function of the fire barrier in which they are installed.

### D.2.a. Fire Dampers

Fire dampers are installed in ventilation ductwork where the ducts penetrate fire rated barriers (with exceptions as per NFPA 90A).

#### Required Functionality

A fire damper must be capable of all of the following functions, otherwise it is impaired:

- Remaining in the open position during normal operation, so as not to adversely affect normal operation of the ventilation systems in which the dampers are installed.
- Automatically closing when exposed to fire effects. (Fire damper actuation is typically by melting of a fusible link resulting in automatic closure of the fire damper. Fire dampers must be able to successfully close under normal airflow.)
- When in the closed position, preventing spread of flames, heat and significant hot gases through the ductwork, across the fire barriers in which the dampers are installed, so that fire spread from one side of a fire barrier to the other through the ductwork is prevented or retarded.

**Note:** Fire dampers do not prevent spread of smoke through ductwork.

The repair of the above issue is Priority 1 when life safety issues are involved, and Priority 2 for property protection.

## D.2.b. Smoke Dampers

### Required Functionality

Smoke dampers are installed in HVAC ductwork to resist spread of smoke through the ducts during a fire in the facility. A smoke damper must be capable of all of the following functions, otherwise it is impaired:

- Remaining in the open position during normal operation, so as not to adversely affect normal operation of the ventilation systems in which the dampers are installed.
- Automatically closing when closure is initiated by a control system.
- Smoke dampers must be able to successfully close under normal airflow, unless the actuating alarm or smoke management system also shuts down the ventilation system.
- When in the closed position, preventing the spread of smoke through the ductwork.

The repair of the above issue is Priority 1 when life safety issues are involved, and Priority 2 for property protection.

**Note:** A smoke damper is closed when a device on the damper is activated by an associated fire alarm system or by an associated smoke management system. (Damper closure devices can be electrothermal, electromagnetic, pneumatic, or hydraulic.)

## D.2.c. Penetration Seals

### Required Functionality

Through penetration firestop systems (or penetration seals) are installed in fire-rated barriers that have been penetrated. A fire barrier penetration might have nothing passing through it, or it may have piping, ductwork, cable trays, conduits, cables, etc., running through it. A penetration seal must be capable of all of the following functions, otherwise it is impaired:

- Remaining in place in the wall or floor during normal conditions and during and following a fire.



- Preventing spread of fire through the fire rated barrier penetration by preventing/retarding passage of flames, heat, hot gases, or smoke through the penetration.

The repair of the above issue is Priority 1 when life safety issues are involved, and Priority 2 for property protection.

#### D.2.d. Fire Doors

##### Required Functionality

Fire doors are installed in fire rated barriers that must be equipped with openings that allow passage of people/equipment. A fire door must be capable of all of the following functions, otherwise it is impaired:

- Returning to the closed and latched position when released from an open position, if the door is in the normally closed position.
- Automatically closing and latching when fire conditions are present on either side of the doorway, if the door is normally in the open position.
- Preventing spread of significant flames, smoke, and hot gases from one side of the door to the other, thereby preventing or retarding spread of fire through the doorway to the non-fire side.
- Remaining in a closed position in the wall where installed during fire conditions on either side of the door.

The repair of the above issue is Priority 1 when life safety issues are involved, and Priority 2 for property protection.

**Note:** The automatic actuation can occur when heat melts a fusible link on the door hardware, or it may occur when smoke actuates a smoke detection system adjacent to the doorway, which electrically releases magnetic switches that hold the door normally open.

**Note:** Approval tests of fire doors per Underwriters Laboratories and NFPA standards allow some minimal flaming through the gap at the bottom of the door. NFPA 80 specifies the maximum allowable gap at the bottom of the door. This allowance for minimal flaming on the non-fire side is based on the expectation that a personnel access doorway



will be clear of combustible materials on either side of the door – minimal flames under the door are therefore not expected to propagate the fire to the non-fire side.

**Note:** NFPA 80 requires that the latch on a standard personnel fire door extend at least ½ in and specified the maximum allowable gap between the edge of the door and the doorframe to ensure that the door will stay in the closed position during a fire.

### **D.3. Abnormal Conditions and Responses**

The following incomplete list of abnormal conditions may be encountered in association with fire barriers and sub-components. Compensatory actions and repair priorities vary.

- D.3.a. If a normally closed or open fire door cannot close on its own, but once in the closed position will remain closed, and is otherwise unimpaired, no compensatory actions are required as long as the door is left in the closed position and some means is enforced to ensure that the door remains in the closed position unless in use (for example, a sign on both sides of the door stating that it must be returned to the fully closed and latched position following use, and a periodic visual check during normal working hours to verify position).
- D.3.b. If a fire door must be propped open for longer than 4 hours, then the restrictions identified in D.3.e. below apply.
- D.3.c. It is acceptable for a fire door to have up to three small electrical cords temporarily running beneath it for up to 8 hours. This does not make the fire door impaired as long as the door is able to close and latch. If the duration must extend beyond 8 hours, then the door should be considered impaired and the restrictions identified in Section e below apply.
- D.3.d. If a fire barrier or sub-component of a fire barrier associated with a gaseous fire suppression system is damaged or impaired such that the required concentration of gaseous fire suppressant cannot or might not be maintained in the protected room for the required duration, then the associated gaseous fire suppression system should be considered impaired. See the section above on gaseous fire suppression systems.
- D.3.e. If fire doors, fire damper, smoke damper, or penetration seal is damaged or impaired such that it represents a breach in the fire barrier, compensatory actions may be required:
- D.3.e.1. If the damaged/impaired component cannot be repaired within 10 working days, then an hourly fire watch is required on both sides of the affected barrier until repair/replacement. If the damaged/impaired component can be repaired/replaced within 10 working days, then no additional actions are required.

The repair of the above issue is Priority 1 if the damaged/impaired component is located in a fire barrier that forms a stairwell, or if it is located in a floor or ceiling between elevations of a multi-story building. The repair is Priority 2 otherwise.



D.3.e.2. If the damaged/impaired component is located in a fire barrier that separates a higher fire hazard from a lesser fire hazard, then the following apply:

- If the area on either side of the affected fire barrier is protected by a sprinkler system, and that sprinkler system is operable, then no additional actions are required.
- If the damaged/impaired component is not repaired within 10 working days, then an hourly fire watch is required on both sides of the barrier during non-normal work hours. Otherwise, no additional actions are required.

The repair of the above issue is Priority 1 if there is no sprinkler system on either side of the affected barrier. The repair is Priority 2 otherwise.

D.3.e.3. If the damaged/impaired component located in a fire barrier is credited by a Fire Hazards Analysis for separation within a building to maintain potential loss due to a fire at less than \$1 million, then the following applies:

D.3.e.3.a If the area on either side of the affected fire barrier is protected by a sprinkler system, and that sprinkler system is operable, then no additional actions are required.

D.3.e.3.b If there is no sprinkler system on either side of the fire barrier, then an hourly fire watch on both sides of the barrier is until the damaged/impaired component is repaired (or at the frequency established by the facility's authorization basis document).

The repair of the above issue is Priority 2.

## E. FIRE PREVENTION MECHANISMS

Many LANL facilities employ fire prevention mechanisms as part of a Defense In Depth program of fire protection. These mechanisms do not constitute fire protection systems, therefore are not directly covered by this Criterion. These mechanisms include such things as:



- Process monitoring and interlocks (like high-temperature monitoring of exothermic processes).
- Diking/drainage providing containment for stored liquids including flammable/combustible liquids.
- Fail-safe design of processes (like fail-safe settings including heat sources off, agitation systems running, cooling water valves open, ventilation operating).
- Combustion safeguards for fuel-fired equipment.
- Programmatic combustible loading control and surveillance programs.

When the above types of mechanisms are temporarily impaired or suspended, consideration should be given to taking compensatory actions until these mechanisms can be returned to operable status. There is no requirement to declare an impairment as described by this Criterion, but compensatory actions are strongly recommended. The FP-DO can provide guidance on this matter.



## Appendix C Fire Watch Requirements

### 1.0 Scope

This procedure contains the requirements for providing a Fire Watch in facilities or for operations where automatic fire detection, suppression and/or alarm systems are provided but are impaired and the affected area is unattended.

### 2.0 Requirements

The FOD shall ensure that the following requirements are accomplished:

1. Fire watch personnel understand the specific nature of the impairment and the specific area affected.
2. Fire watch personnel for fire system impairments shall rove all areas affected by the impairment.
3. Fire watch personnel have been instructed in the appropriate emergency actions, including the best method for sounding an alarm, manually activating a suppression system (if appropriate) and safe to do so, a method for notifying the Fire Department of an emergency (e.g., activating a building fire alarm and/or calling 911), and the proper use of a portable fire extinguisher.
4. Fire watch personnel have been instructed in the proper frequency of tours. The frequency of tours shall be:
  - a. Continuous when required by facility process standards or process controls.
  - b. Hourly when automatic suppression systems are impaired.
  - c. Once every 2 hours if only automatic alarm capability is impaired.
  - d. As amended by FP-DO.
5. Fire watch personnel shall be informed of unusual conditions (e.g., unattended heat producing operations such as ovens, furnaces and similar appliances, presence of flammable and combustible liquids, flammable compressed gases, or appreciable quantities of combustible materials) and any safety-related items that are applicable for accomplishing the fire watch tasks safely.
6. Fire watch personnel have received formal Fire Extinguisher Hands-On Training within the last 12 months.



### 3.0 Records

A record of fire watch tours shall be maintained for two years or longer as directed by the Facility Manager. The record shall note the following, at a minimum:

1. Name and organization of fire watch personnel.
2. Date and time of required fire watch.
3. Any unusual conditions observed.
4. Description of any event requiring emergency response.

### 4.0 References

1. PD 1220, *Fire Protection Program*
2. NFPA 1, *Uniform Fire Code*, 2009 edition
3. NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*, 2008 edition

## APPENDIX D

### FIRE PROTECTION IMPAIRMENTS PROCESS FLOW CHART

