



Document Hierarchy: Functional Series
 Document Number: Criterion 737 R0
 Approval Date: 3/11/2010
 Effective Date: 4/11/2010
 Supersedes: None

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

TITLE: WET CHEMICAL EXTINGUISHING SYSTEMS

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Reviewed Classification			
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RECORD OF REVISIONS

Revision No.	Date	Description
0	03/11/10	Initial Issue

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CRITERION 737

WET CHEMICAL EXTINGUISHING SYSTEMS

1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for operation and maintenance of wet chemical fire extinguishing systems at LANL.

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. The 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.

Implementation of this Criterion satisfies LANL PD 1220, *Fire Protection Program*, 10 CFR 851, *Worker Safety and Health Program*, Appendix A.2 "Fire Protection", and DOE Order 420.1B, *Facility Safety*, Chapter II "Fire Protection" ITM requirements for the subject equipment / system. Compliance with 10 CFR 815 and DOE Order 420.1B are required by the LANL Prime Contract (DOE Contract No. DE-AC52-06NA25396). Issuance of this Criterion is also responsive to corrective actions cited within 10 CFR 851 Noncompliance Report No. NTS--LASO-LANS-LANL-2009-0003, *Programmatic Breakdown in ITM of Kitchen Fire Extinguishing Systems*, February 25, 2009.

2.0 SCOPE

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of wet chemical fire extinguishing systems that discharge wet chemical from fixed nozzles and piping by means of expellant gas. This Criterion does not address corrective maintenance actions required to repair or replace equipment. For dry chemical extinguishing systems, see Criterion 728, *Dry Chemical Extinguishing Systems*.

Wet chemical fire extinguishing systems currently installed at LANL facilities are restricted to systems in kitchen hoods at TA-3-261, TA-16-192, TA-53-1, and TA-55-1. If a different type of wet chemical extinguishing system is installed at a LANL facility (other than a kitchen hood system), this Criterion must be modified to reflect additional ITM requirements.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

AHJ	Authority Having Jurisdiction
CFR	Code of Federal Regulations
DOE	Department of Energy
FOD	Facility Operations Director
FP-DO	Fire Protection Division Office
ITM	Inspections, Testing, and Maintenance
LANL	Los Alamos National Laboratory
ML	Management Level
MM	Maintenance Manager
MSS	Maintenance and Site Services
NFPA	National Fire Protection Agency
OM	Operations Manager
O&M	Operations and Maintenance
PD	Program Description
SCC	Systems, Structures, and Components
TSR	Technical Safety Requirement

3.2 Definitions

Wet Chemical Normally an aqueous solution of organic or inorganic salts or a combination thereof that forms an extinguishing agent.

Expellant Gas The medium used to discharge extinguishing agent from its container.

Hydrostatic Testing. Pressure testing of a pressure boundary (tank, piping, etc.) to verify its strength against unwanted rupture.

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 for definitions of each ML level.

4.0 RESPONSIBILITIES

4.1 MSS-Division Leader (MSS-DL)

Receives and approves or rejects, in conjunction with the AHJ, requests for variances from this criterion. Maintains the record of decision for all variance requests.

4.2 MSS- Maintenance Programs (MP)

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)

FP-DO is responsible for the technical content of this Criterion and assessing the proper implementation across the Laboratory. FP-DO shall provide technical assistance to support implementation of this Criterion.

4.4 Facility Operations Director (FOD)

Responsible for implementation of this O&M Criterion for identified systems/equipment within their facility boundaries.

4.5 Operations Manager (OM)

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.

4.6 Maintenance Manager (MM)

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.

4.7 Authority Having Jurisdiction (AHJ)

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

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.

5.2 Limitations

The intent of this Criterion is to identify the minimum requirements and recommendations for SSC 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 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 Code of Federal Regulations (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 Documented Safety Analysis (DSA), Technical Safety Requirements (TSR), 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 and the LANL Fire Marshal approve or deny 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. 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

6.1.1 Baseline Operations Checklist

Wet chemical fire extinguishing systems shall remain in-service at all times. A wet chemical fire extinguishing system shall be deemed in-service when the following conditions are met:

- The type of wet chemical fire used in the system is listed for the particular system and recommended by the manufacturer of the wet chemical fire extinguishing system [e.g., UL 300 for commercial cooking equipment].
- The wet chemical container and expellant gas assembly are in good condition and mounted properly.
- Discharge nozzles are in good physical condition, unobstructed, and are aligned properly.
- Automatic and manual means of system actuation are in good working order.
- Equipment interlocks for fuel and electric power shutoff are operational.
- The system piping, hoses, fittings, and hangers are in good repair.
- The system is connected to the fire alarm system in accordance with the requirements of NFPA 72, *National Fire Alarm and Signaling Code* .

Basis: NFPA 17A, 2009 Edition, *Standard for Wet Chemical Extinguishing Systems*. Compliance with this *Code* is required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II "Fire Protection," both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program.

6.2 Inspection Requirements

6.2.1 Monthly Inspection

A monthly inspection shall be conducted in accordance with the manufacturer's listed installation and maintenance manual or owner's manual. At a minimum, the visual inspection shall include verification of the following:

- The extinguishing system is in its proper location.
- The manual actuators are accessible and unobstructed.
- The tamper indicators and seals are intact.
- The maintenance tag or certificate is in place.
- The system shows no physical damage or condition that might prevent operation. Visually inspect all detectors, fusible links, expellant gas containers, agent containers, releasing devices, piping, hose assemblies, nozzles, signals and auxiliary

equipment to ensure they are in good working condition and free of apparent defects or damage.

- The pressure gauge(s), if provided, is in the operable range.
- The nozzle blowoff caps, where provided, are intact and undamaged.
- Verify that neither the protected equipment nor the hazard (e.g. type of cooking oil) has been replaced, modified, or relocated.

Basis: NFPA 17A, 2009 Edition, *Standard for Wet Chemical Extinguishing Systems*, Chapter 7.2.2. Compliance with this *Code* is required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II "Fire Protection," both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program.

6.2.2 **Semi-Annual Inspections (twice per year)**

- Verify that neither the protected equipment nor the hazard (e.g., type of cooking oil) has been replaced, modified, or relocated.
- A visual examination of all detectors, the expellant gas container(s), the agent container(s), releasing devices, piping, hose assemblies, nozzles, signals, all auxiliary equipment, and the liquid level of all non-pressurized wet chemical containers.
- A visual examination of kitchen hoods containing mechanical or fire-actuated dampers, internal washing components, or other mechanically-operated devices.
- The entire kitchen hood exhaust system is inspected for grease buildup.

NOTE: If the exhaust system is found to be contaminated with grease deposits, the contaminated portion shall be cleaned by a properly trained, qualified and certified person or firm acceptable to the AHJ.

Basis: NFPA 17A, 2009 Edition, *Standard for Wet Chemical Extinguishing Systems*, Chapter 7.2.2, and NFPA 96, 2008 Edition, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, Chapter 11. Compliance with these *Codes* is required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II "Fire Protection," both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program

6.3 **Maintenance Requirements**

The following are maintenance requirements for all wet chemical fire extinguishing systems protecting LANL facilities.

A service technician who performs maintenance on an extinguishing system shall be trained and shall have passed a written or online test that is acceptable to the AHJ. The service technician shall possess a certification document issued by the manufacturer or testing organization.

6.3.1 Semi-Annual Maintenance (twice per year)

Maintenance shall be conducted in accordance with the manufacturer's listed installation and maintenance manual.

- Verification that the agent distribution piping is not obstructed. The following methods can be used:
 1. Disassembly of all piping
 2. Conducting a full or partial discharge test
 3. Utilizing other methods recommended by the manufacturer
- Fixed temperature-sensing elements of the fusible metal alloy type (i.e. fusible links) for extinguishing system actuation and fire dampers within the exhaust system shall be replaced. They shall be destroyed when removed.
- The year of manufacture and the date of installation of the fixed temperature-sensing element shall be marked on the system inspection tag.
- Where semiannual maintenance of any wet chemical containers or system components reveals conditions such as, but not limited to, corrosion or pitting in excess of the manufacturer's limits, structural damage or fire damage, or repairs by soldering, welding, or brazing, the affected part(s) shall be replaced or hydrostatically tested in accordance with the recommendations of the manufacturer or the listing agency.
- Where the maintenance of the system(s) reveals defective parts that could cause an impairment or failure of proper operation of the system(s), the affected parts shall be replaced or repaired in accordance with the manufacturer's recommendations. Until such repairs are accomplished, the system shall be tagged as impaired.
- Each wet chemical system shall have a tag or label securely attached, indicating the month and year that maintenance was performed and identifying the person performing the work. Only the current tag or label shall remain in place.
- Inspection and testing for restorable-type heat detectors shall include the following:
 1. A visual inspection to determine whether there is damage to the detector or buildup of foreign debris.
 2. An operational/functional test in accordance with the detector manufacturer's testing instructions.
 3. A calibration verification test, if applicable, in accordance with the detector manufacturer's instructions.
- Non-restorable heat detectors shall be functionally tested in accordance with the manufacturer's recommendations.

Basis: NFPA 17A, 2009 Edition, *Standard for Wet Chemical Extinguishing Systems*, Chapter 7.2.2 and NFPA 96, 2008 Edition, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, Chapter 11. Compliance with these Codes is required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II "Fire Protection," both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program.

6.3.2 Annual Maintenance

- Fixed temperature-sensing elements other than the fusible metal alloy type shall be permitted to remain continuously in service, provided they are inspected and cleaned or replaced if necessary in accordance with the manufacturer's instructions, every 12 months or more frequently to ensure proper operation of the system.

Basis: NFPA 17A, 2009 Edition, *Standard for Wet Chemical Extinguishing Systems*, Chapter 7.2.2. Compliance with this Code is required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II "Fire Protection," both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program.

6.4 Testing Requirements

6.4.1 Annually

- All wet chemical fire extinguishing systems shall be tested, including the operation of the detection system signals and releasing devices, including manual stations and other associated equipment. A discharge of the wet chemical normally is not required as part of this test.
- Test actuation of fire dampers within exhaust systems for proper operation in accordance with manufacturer's listed procedures.

Basis: NFPA 17A, 2009 Edition, *Standard for Wet Chemical Extinguishing Systems*, Chapter 7.2.2, and NFPA 96, 2008 Edition, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, Chapter 11. Compliance with these Codes is required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II "Fire Protection," both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program.

6.4.2 Every 12 Years

Conduct a hydrostatic pressure test on the following system equipment, at a test pressure equal to the marked factory test or as specified by the manufacturer:

- Wet chemical containers
- Auxiliary pressure containers
- Hoses assemblies

EXCEPTIONS:

- Auxiliary pressure containers not exceeding 2 in. outside diameter and less than 2 ft in length
- Auxiliary pressure containers bearing the DOT "3E" marking

Basis: NFPA 17A, 2009 Edition, *Standard for Wet Chemical Extinguishing Systems*, Chapter 7.2.2. Compliance with this Code is required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II "Fire Protection," both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program.

6.5 Impairments and Modifications

If one or more of the operations requirements listed in Section 6.1.1 are not satisfied, or defective parts that could cause an impairment or failure of proper operation of the system(s) have been identified, follow the actions outlined in Criterion 733, *Fire Protection System Impairment Control Program*.

6.5.1 Inspection Following an Impairment, System Actuation, or Modification

- A complete visual inspection of the system shall be performed in accordance with Section 6.2.1 before returning it to service.
- All extinguishing systems shall be recharged after use or as indicated by an inspection or maintenance check. After any discharge, the system piping shall be flushed in accordance with the procedures detailed in the manufacturer's listed installation and maintenance manual

6.5.2 Testing Following Impairment or Modification

- An operational test of the system shall be performed before returning the system to service. This involves testing of all system components without discharging the wet chemical agent.
- If system piping has been breached, piping continuity shall be tested before returning the system to service. Use one of the methods listed in Section 6.3.1 of this Criterion.

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

There are no operational recommendations for this Criterion.

7.2 Maintenance Recommendations

In order to maintain system components in good working order, it is recommended that those system components exposed to harsh conditions (cooking grease, heat, etc.) be cleaned at least annually.

8.0 GUIDANCE

8.1 Operations Guidance

No operations guidance available.

8.2 Maintenance Guidance

No maintenance guidance available.

9.0 REQUIRED DOCUMENTATION

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

Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
PARAMETER	ML 1	ML 2	ML 3	ML 4
Maintenance Activities				
Repair / Adjustments	X	X	X	X
PM Activities	X	X	X	X
Equipment Problems				
Failure Dates	X	X	X	X
Failure Root Cause	X	X	X	X
Inspection Results				
Inspection Date	X	X	X	X
SSC Condition	X	X	X	X

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"

10.0 REFERENCES

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

- 10.1 P 315, Conduct of Operations Manual
- 10.2 P 950, Conduct of Maintenance
- 10.3 AP-341-502, Management Level Determination
- 10.4 PD 1220, Fire Protection Program.
- 10.5 10 CFR 851, Worker Safety and Health Program, Appendix A.2 "Fire Protection."
- 10.6 DOE Order 420.1B, Facility Safety, Chapter II "Fire Protection."
- 10.7 10 CFR 851 Noncompliance Report No. NTS--LASO-LANS-LANL-2009-0003, Programmatic Breakdown in ITM of Kitchen Fire Extinguishing Systems, February 25, 2009.
- 10.8 AP-MNT-010, Maintenance History.
- 10.9 NFPA 17A, 2009 Edition, Standard for Wet Chemical Extinguishing Systems.
- 10.10 NFPA 96, 2008 Edition, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- 10.11 UL 300, Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment, May 2005.
- 10.12 NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code.

11.0 APPENDICES

None