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

TITLE: DRY CHEMICAL EXTINGUISHING SYSTEMS

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The information contained in this document conforms to the official definition (including its specific exclusions) of the Construction and Facilities Engineering (CONST) Designated Unclassified Subject Area (DUSA), therefore it is exempt from classification and sensitive information review requirements.

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Conduct of Maintenance (P 950)
Operations and Maintenance Manual
Dry Chemical Extinguishing Systems

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RECORD OF REVISIONS

Revision No.	Date	Description
0	11/21/02	Initial Issue
1	7/9/10	This revision also includes the incorporation of all formatting changes addressed in Revision 3 of the O&M Criterion 101 Writer's Guide. This revision reflects current organizational structure and responsibilities, corrections, clarifications and examples.

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CRITERION 728

DRY 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 dry chemical 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 dry chemical fire extinguishing systems. This Criterion does not address corrective maintenance actions required to repair or replace equipment. For wet chemical extinguishing systems, see Criterion 737, *Wet Chemical Extinguishing Systems*.

Dry chemical extinguishing systems currently installed at LANL facilities are:

- HazMat lockers at TA-48, buildings 168, 180 and 181
- HazMat flammable liquids storage lockers at TA-54, buildings 68, 69 and 70
- Tritium sheds at TA-54, buildings 1027, 1028, 1030 and 1041.

If a different type of dry chemical extinguishing system is installed at a LANL facility (i.e., local application for a specific hazard), 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
DSA	Documented Safety Analysis
FOD	Facility Operations Director
ITM	Inspections, Testing and Maintenance
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
ML	Management Level
MM	Maintenance Manager
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
O&M	Operations & Maintenance
OM	Operations Manager
PM	Preventative Maintenance
SSC	Structures, Systems and Components
TSR	Technical Safety Requirements

3.2 Definitions

Dry Chemical - A powder composed of very small particles, usually sodium bicarbonate-, potassium bicarbonate-, or ammonium phosphate-based with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking), and the proper flow capabilities.

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, *Management Level Determination* 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 (MSS-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 Facility Operations Director (FOD)

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

4.4 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.

4.5 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.

4.6 Authority Having Jurisdiction (AHJ)

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

The LANL Fire Marshal in conjunction with the MSS Division Leader is the approval authority for all exceptions and variances to this Criterion. The LANL Fire Marshal cannot approve deviations or exemptions to the Code of Federal Regulations (CFR), Department of Energy (DOE) Orders or National Fire Protection Association (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).

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 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 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 (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 and 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, *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

6.1.1 Baseline Operations Checklist

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

1. Dry chemical and expellant gas containers are in good condition, mounted properly, and are charged with the required quantity of extinguishing agent and expellant gas.
2. Discharge nozzles are in good physical condition, unobstructed, and are aligned properly.
3. Automatic and manual means of system actuation are in good working order.
4. Equipment interlocks for fuel/electric power shutoff, ventilation shutoff, damper closure, door closure, etc., are operational (if applicable).
5. The system piping, hoses, fittings, and hangers are in good repair.
6. 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 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition. Compliance with this NFPA code is required per 10 CFR 851, Appendix A.2, and DOE Order 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:

1. The extinguishing system is in its proper location.

2. The manual actuators are accessible and unobstructed.
3. The tamper indicators and seals are intact.
4. The maintenance tag or certificate is in place.
5. 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 are in good working condition and free of apparent defects or damage.
6. The pressure gauge(s), if provided, is in operable range.
7. The nozzle blowoff caps, where provided, are intact and undamaged.
8. Verify that neither the protected equipment nor the hazard has been replaced, modified, or relocated.

Basis: NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition. Compliance with this NFPA code is required per 10 CFR 851, Appendix A.2, and DOE Order 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)

1. Verify that neither the protected equipment nor the hazard has been replaced, modified, or relocated.
2. 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 are in good working condition and free of apparent defects or damage.
3. Verify that the agent distribution piping and discharge nozzles are not obstructed.
4. Examine the dry chemical. If there is evidence of caking, the dry chemical shall be discarded and the system recharged in accordance with the manufacturer's instructions.

Exception: Dry chemical in stored pressure systems shall not require semiannual examination but shall be examined at least every six years.
5. If the dry chemical agent is stored in a pressurized container, check the pressure. If the gauge indicates more than a 10% loss in pressure from that required, refill or replace the container.

Basis: NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition. Compliance with this NFPA 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.

6.3 Maintenance Requirements

The following are maintenance requirements for all dry chemical fire extinguishing systems protecting LANL facilities. Maintenance shall be conducted in accordance with manufacturer's listed installation and maintenance manual. 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)

1. Verification that the agent distribution piping is not obstructed. The following methods can be used:
 - a. Disassembly of all piping
 - b. Purging of piping with nitrogen or dry compressed air
 - c. Conducting a full or partial discharge test
 - d. Utilizing other methods recommended by the manufacturer
2. Fixed temperature sensing elements of the fusible metal alloy type (i.e. fusible links) for extinguishing system actuation, and fire/smoke dampers and fire doors, associated with the system shall be replaced at least semiannually from the date of installation. They shall be destroyed when removed.
3. The year of manufacture and the date of installation of the fixed temperature-sensing element shall be marked on the system inspection tag.
4. Where semiannual maintenance of any dry 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.
5. Where the maintenance of 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.
6. Each dry chemical system shall have a tag or label 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.
7. Dry chemical system shall be recharged after use or as indicated by inspection or maintenance check.

Basis: NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition. Compliance with this NFPA 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 *Semi-Annually (twice per year)*

1. Conduct an operating test of each dry chemical extinguishing system. This involves an operational test all system components, including manual release stations and other associated equipment, without discharging the dry chemical agent.
2. Test actuation of fire/smoke dampers, fire doors and other associated equipment for proper operation in accordance with manufacturer's listed procedures.

Basis: NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition. Compliance with this NFPA code is required per 10 CFR 851, Appendix A.2, and DOE Order 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 test on the following system equipment, at a test pressure equal to the marked factory test or as specified by the manufacturer:

1. Dry chemical agent storage containers (test empty)
2. Auxiliary pressure containers
3. Valve assemblies
4. Hose assemblies

Exceptions:

1. Dry chemical containers that are part of extinguishing systems having an agent capacity exceeding 150 lb (68 kg)
2. Auxiliary pressure containers not exceeding 2 in. (0.05 m) outside diameter and less than 2 ft (0.6 m) in length.
3. Auxiliary pressure containers bearing the DOT "3E" marking.

Note: All equipment passing the test must be thoroughly cleaned and dried prior to reinstallation/reuse.

Basis: NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition. Compliance with this NFPA 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 operational 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

1. A complete visual inspection of the system in accordance with Section 6.2.1 shall be performed before returning it to service.
2. All extinguishing systems shall be recharged after use or as indicated by 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

1. 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 dry chemical agent.
2. 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

Not applicable.



8.2 Maintenance Guidance

Not applicable.



9.0 REQUIRED DOCUMENTATION

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

Table 9-1: Maintenance History Documentation Parameters				
Parameter	ML 1	ML 2	ML 3	ML 4
Maintenance Activities				
Repair / Adjustments	Required	Required	Required	Required
PM Activities	Required	Required	Required	Required
Equipment Problems				
Failure Dates	Required	Required	Required	Required
Failure Root Cause	Required	Required	Required	Required
Inspection Results				
Inspection Date	Required	Required	Required	Required
SSC Condition	Required	Required	Required	Required
<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".

10.0 REFERENCES

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

- 10.1 10 CFR 851 Noncompliance Report No. NTS--LASO-LANS-LANL-2009-0003, *Programmatic Breakdown in ITM of Kitchen Fire Extinguishing Systems*, February 25, 2009
- 10.2 10 CFR 851, *Worker Safety and Health Program*, Appendix A.2 "Fire Protection"
- 10.3 AP-341-502, *Management Level Determination*
- 10.4 AP-341-516, *Operability Determination and Functionality Assessment*
- 10.5 AP-MNT-010, *Maintenance History*
- 10.6 DOE Order 430.1B, *Real Property Asset Management*, Attachment 2 "Contractor Requirements Document" (Paragraph 2, Sections A through C)
- 10.7 DOE Order 420.1B, *Facility Safety*, Chapter II "Fire Protection"
- 10.8 DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*
- 10.9 NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition
- 10.10 P 315, *Conduct of Operations Manual*
- 10.11 P 950, *Conduct of Maintenance*
- 10.12 PD 1220, *Fire Protection Program*

11.0 APPENDICES

None.