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

TITLE: PORTABLE FIRE EXTINGUISHERS

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Conduct of Maintenance (P 950)
Operations and Maintenance Manual
Portable Fire Extinguishers

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RECORD OF REVISIONS

Revision No.	Date	Description
0	010/02/02	Initial Issue
1	02/18/10	Revised document to reflect current LANL organizations, update references and align requirements to current expectations contained within NFPA 10, <i>Standard for Portable Fire Extinguishers</i> , 2010 Edition.

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CRITERION 731

PORTABLE FIRE EXTINGUISHERS

1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for maintenance of portable fire extinguishers 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 851 and DOE Order 420.1B are required by the LANL Prime Contract (DOE Contract No. DE-AC52-06NA25396).

2.0 SCOPE

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of portable fire extinguishers. This Criterion applies to all LANL facilities, programmatic activities including Decontamination and Decommissioning (D&D) and units deployed on mobile equipment (e.g., lift trucks, automobiles and trucks, cranes, etc.).

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
HMIS	Hazardous Materials Identification System
ITM	Inspections, Testing, and Maintenance
LANL	Los Alamos National Laboratory
MM	Maintenance Manager
MSS	Maintenance and Site Services

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MSS-MP	Maintenance and Site Services – Maintenance Programs
OM	Operations Manager
O&M	Operations and Maintenance

3.2 Definitions

Portable fire Extinguisher – A portable device, carried or on wheels and operated by hand, containing an extinguishing agent that can be expelled under pressure for the purpose of suppressing or extinguishing fire.

Basis: NFPA 10, Standard for Portable Fire Extinguishers, 2010 Edition, Section 3.4.3.

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 technical content, monitoring the applicability and the implementation status of this Criterion. MSS-MP will assist organizations that are not applying or meeting implementation expectations or will elevate 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

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activities. The MM with concurrence of the FOD will prioritize implementation within budget allocations.

4.6 Authority Having Jurisdiction (AHJ)

4.6.1 The AHJ (Point of Contact for the Fire Protection Chapter of the LANL Engineering Manual) is responsible for providing a decision on specific technical questions regarding the systems or equipment relevant to this Criterion.

4.6.2 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.

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 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, vendor 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 and certain high hazard 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 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 Monthly Inspections

Inspect portable fire extinguishers to ensure the following:

- a. Location in designated place,
- b. No obstruction to access or visibility,
- c. Pressure gauge reading or indicator in the operable range or position
- d. Fullness determined by weighing or hefting for self-expelling-type extinguishers, cartridge-operated extinguishers, and pump tanks
- e. Condition of tires, wheels, carriage, hose, and nozzle for wheeled extinguishers
- f. Indicator for non-rechargeable extinguishers using push-to-test pressure indicators.

In addition, portable fire extinguishers located in areas of high frequency of fires in the past, severe hazards, susceptible to mechanical or physical damage, or exposure to abnormal temperatures or corrosive atmospheres are subject to following additional visual inspections:

- g. Verifying that operating instructions on nameplates are legible and face outward
- h. Checking for broken or missing safety seals and tamper indicators

- i. examination for obvious physical damage, corrosion, leakage, or clogged nozzle

Basis: NFPA 10, 2010 Edition, Chapter 7, Sections 7.2.2, 7.2.2.1, and 7.2.2.2.

- 6.1.1.1** When an inspection of any fire extinguisher reveals a deficiency in any of the conditions listed above, immediate corrective action shall be taken.

Basis: NFPA 10, 2010 Edition, Chapter 7, Section 7.2.3.

- 6.1.1.2** When an inspection of any rechargeable fire extinguisher reveals a deficiency in conditions (c), and (d) in Section 6.1.1 above, the extinguisher is subjected to applicable maintenance procedures as described in Section 6.2 of this Criterion.

Basis: NFPA 10, 2010 Edition, Chapter 7, Section 7.2.3.1.

- 6.1.1.3** When an inspection of any non-rechargeable dry chemical fire extinguisher reveals a deficiency in any of the conditions listed in (c), (d) and (f) in Section 6.1.1 above, the extinguisher is removed from further use, discharged and destroyed at the direction of the owner or returned to the manufacturer.

Basis: NFPA 10, 2010 Edition, Chapter 7, Section 7.2.3.2.

6.2 Maintenance Requirements

Fire extinguishers removed from service for maintenance or recharge shall be replaced by a fire extinguisher suitable for the type of hazard being protected and shall be of at least equal rating.

6.2.1 Annual Maintenance

- 6.2.1.1** Fire extinguishers are subjected to maintenance at intervals of not more than 1 year, and at the time of hydrostatic test, and when specifically indicated by an inspection or electronic notification.

- 6.2.1.2** Fire Extinguisher are internally examined for the following extinguisher types:

- A. Stored-pressure loaded stream and antifreeze
- B. Pump tank water and pump tank calcium chloride-based
- C. Dry chemical, cartridge-and cylinder-operated with mild steel shells
- D. Dry powder, cartridge-and cylinder-operated, with mild steel shells
- E. Wetting agent

Basis: NFPA 10, 2010 Edition Inspection, Maintenance and Recharging of Portable Fire Extinguishers, Chapter 7, Section 7.3.1.1.1, and 7.3.1.1.2, and Table 7.3.1.1.2.

6.2.2 Six Year Maintenance

6.2.2.1 Every 6 years, stored-pressure fire extinguishers that require a 12-year hydrostatic test shall be emptied and subjected to applicable internal examination procedures as detailed in the manufacturer's service manual and the NFPA 10 Inspection, Maintenance and Recharging of Portable Fire Extinguisher standard.

6.2.2.2 When the applicable maintenance procedures are performed during periodic recharging or hydrostatic testing, the 6-year requirement shall begin from that date.

6.2.2.3 Extinguishers that pass the applicable six-year requirement above, shall have the maintenance information recorded on a durable weatherproof label that is a minimum size of 2in. x 3½ in maintenance shall be marked as follows:

- The new label shall be affixed to the shell by a heat-less process, and any old maintenance labels shall be removed.
- These labels shall be of the self-destructive type when their removal from a fire extinguisher is attempted.
- The label shall include the following information -
 - Month and year the maintenance was performed, indicated by a perforation such is done by a hand punch
 - Name or initials of the person performing the maintenance and name of the agency performing the test

Basis: NFPA 10, 2010 Edition, Chapter 7, Section 7.3.1.2.1-7.3.1.1.2, and 7.3.3.1-7.3.3.1.3

6.2.2.4 Maintenance Procedures shall include following the procedures detailed in the manufacturer's service manual and a thorough examination of the basic elements of the fire extinguisher and components of the electronic monitoring system, including the following:

- Mechanical parts of all fire extinguishers.
- Extinguishing agent of cartridge-or-cylinder-operated dry chemical, stored- pressure loaded stream, and pump tank fire extinguisher
- Expelling means of all fire extinguishers
- Physical appearance

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- Components of electronically monitored system
- Hoses on wheeled-type fire extinguishers completely uncoiled and examined for damage.

Basis: NFPA 10, 2010 Edition, Chapter 7, Section 7.3.2.

6.2.3 Recharging

6.2.3.1 All rechargeable-type fire extinguishers are recharged after any use or as indicated by an inspection or when performing maintenance. Minimum intervals for recharging are as described in Appendix B to this Criterion.

6.2.3.2 When performing the recharging, follow NFPA 10 guidance and the manufacturer recommendations.

6.2.3.3 The amount of recharge agent is verified by weighing.

6.2.3.4 The recharged gross weight is the same as the gross weight that is marked on the label.

6.2.3.5 After recharging, a leak test is performed on stored-pressure and self-expelling types of fire extinguishers.

Basis: NFPA 10, 2010 Edition, Chapter 7, Section 7.4.

6.2.4 Maintenance Records

6.2.4.1 Each fire extinguisher has a tag or label securely attached that indicates the month and year the maintenance was performed, identifies the person performing the work, and identifies the name of the agency performing the work.

Basis: NFPA 10, 2010 Edition, Chapter 7, Section 7.3.3.

6.2.4.2 Each extinguisher that has undergone maintenance that includes internal examination or that has been recharged has a "Verification of Service" collar located around the neck of the container.

6.2.4.3 The collar contains a single circular piece of uninterrupted material forming a hole of a size that will not permit the collar assembly to move over the neck of the container unless the valve is completely removed.

6.2.4.4 The collar does not interfere with the operation of the fire extinguisher.

6.2.4.5 The collar includes the following information:

- Month and year the maintenance was performed, indicated by the perforation such as is done by a hand punch.
- Name of agency performing the maintenance or recharge.

EXCEPTION: Cartridge/cylinder-operated fire extinguishers do not require a "Verification of Service" collar.

Basis: NFPA 10, 2010 Edition, Chapter 7, Sections 7.3.3, and 7.3.3.2.

6.3 Testing Requirements

6.3.1 Conductivity Test

1. A conductivity test is conducted annually on all carbon dioxide hose assemblies as described within NFPA 10.
2. Hose assemblies found to be nonconductive are replaced.
3. Carbon dioxide hose assemblies that pass a conductivity test have the test information recorded on a durable weatherproof label that has a minimum size of ½ in. × 3 in.
4. The label is affixed to the hose by means of a heatless process.
5. The label includes the following information:
 - (a) Month and year the test was performed, indicated by perforation, such as is done by a hand punch.
 - (b) Name or initials of person performing the test, and the name of the agency performing the test.

Basis: NFPA 10, 2010 Edition, Chapter 7, Section 7.3.1.3-7.3.1.3.2.2.

6.3.2 Hydrostatic Testing

- 6.3.2.1** Hydrostatic testing is performed by persons who are trained in pressure testing procedures and safeguards who testing equipment, facilities, and appropriate manufacturer's service manual(s) available.
- 6.3.2.2** Personnel performing hydrostatic testing are certified by an organization with a certification program acceptable to the AHJ.
- 6.3.2.3** A hydrostatic test always includes both an internal and an external visual examination of the cylinder.
- 6.3.2.4** Hydrostatic testing are conducted using water or another compatible non-compressible fluid as the test medium.
- 6.3.2.5** Air or other gases are not be used as the sole medium for pressure testing.

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6.3.2.6 All air is vented prior to hydrostatic testing to prevent violent and dangerous failure of the cylinder.

Basis: NFPA 10, 2010, Chapter 8, Section 8.1.2-8.1.4.2.

6.3.2.7 Where a fire extinguisher cylinder or shell has one or more of the following conditions, it shall not be hydrostatically tested, but shall be condemned or destroyed by the owner or at the owner's direction:

- where repairs by soldering, welding, brazing, or use of patching compounds exist,
- where the cylinder threads are worn, corroded, broken, cracked, or nicked.
- where corrosion has caused pitting, including pitting under a removable nameplate or name band assembly,
- where the fire extinguisher has been exposed to excessive heat, flame, or fire,
- where a calcium chloride type of extinguishing agent was used in a stainless steel fire extinguisher,
- where the shell is of copper or brass construction joined by soft solder or rivets,
- where the depth of a dent exceeds 1/10 of the greatest dimension of the dent if not in a weld, or exceeds 1/4 in. (0.6 cm) if the dent includes a weld,
- where any local or general corrosion, cuts, gouges, or dings have removed more than 10 percent of the minimum cylinder wall thickness.
- where a fire extinguisher has been used for any purpose other than that of a fire extinguisher.

Basis: NFPA 10, 2010 Edition, Chapter 8, Section 8.4.2.

6.3.2.8 When a fire extinguisher cylinder, shell, or cartridge fails a hydrostatic pressure test, or fails to pass a visual examination, it shall be condemned or destroyed by the owner or the owner's agent.

6.3.2.9 When a cylinder is required to be condemned, the re-tester shall notify the owner in writing that the cylinder is condemned and that it cannot be re-used.

Basis: NFPA 10, 2010 Edition, Chapter 8, Section 8.8.

6.3.2.10 Condemned cylinders shall be stamped "CONDEMNED" on the top, head, shoulder, or neck with a steel stamp.

6.3.2.11 Minimum letter height shall be 1/8in. (0.3 cm). A condemned cylinder shall not be repaired.

6.3.2.12 No person shall remove or obliterate the "CONDEMNED" marking.

Basis: NFPA 10, 2010 Edition, Chapter 8, Section 8.8.2.

6.3.2.13 Fire extinguishers shall be hydrostatically tested per guidance in NFPA 10, Chapter 8, and at the intervals indicated in Table 8.3.1 in NFPA 10 (See Appendix A of this Criterion).

6.3.2.14 A hydrostatic test shall also be performed on fire extinguisher hose assemblies equipped with a shutoff nozzle at the end of the hose. The test interval shall be the same as specified for the fire extinguisher on which the hose is installed.

6.3.2.15 A permanent record shall be maintained for each cylinder tested.

Basis: NFPA 10, 2010 Edition, Chapter 8.

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

7.1.1 Employee Training

Group leaders should ensure employees receive fire extinguisher familiarization training upon initial employment.

Basis: FP-DO recommendation.

7.1.2 Procurement

FP-DO should pre-approve all purchases of portable fire extinguishers to ensure proper size and type for in the intended application. Portable fire extinguishers are to be approved and listed by a national testing laboratory for their intended use.

7.1.3 Personnel

Persons other than MSS Fire Protection Maintenance personnel may conduct inspection requirements identified in this document.

7.2 Maintenance Recommendations

None



8.0 GUIDANCE

8.1 Operations Guidance

None

8.2 Maintenance Guidance

8.2.1 PMI 40-35-018, Portable Fire Extinguisher Inspection, Testing and Maintenance.

This document may be used to implement the requirements of this Criterion.

9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained for portable fire extinguishers 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
Fire Extinguisher Maintenance Activities				
Repair / Adjustments	X	X	X	X
PM Activities	X	X	X	X
Fire Extinguisher Equipment Problems				
Failure Dates	X	X	X	X
Failure Root Cause	X	X	X	X
Fire Extinguisher 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 NFPA 10, 2010 Edition, *Standard for Portable Fire Extinguishers*.

11.0 APPENDICES

Appendix A: Hydrostatic Test Interval for Fire Extinguishers

Appendix B: Recharging Interval for Fire Extinguishers

APPENDIX A

**Hydrostatic Test Interval for Extinguishers
(NFPA 10, Table 8.3.1)**

Extinguisher Type	Test Interval (Years)
Stored-pressure water, loaded stream, and/or antifreeze	5
Wetting agent	5
AFFF (aqueous film-forming foam)	5
FFFP (film-forming fluoroprotein foam)	5
Dry chemical with stainless steel shells	5
Carbon dioxide	5
Wet chemical	5
Dry chemical, store-pressure, with mild steel shells, brazed brass shells, or aluminum shells	12
Dry chemical, cartridge or cylinder-operated, with mild steel shells	12
Halogenated agents	12
Dry powder, stored-pressure, cartridge or cylinder- operated, with mild steel shells	12

NOTE: Stored-pressure water extinguishers with fiberglass shells (pre-1976) are prohibited from hydrostatic testing due to manufacturer's recall.

Basis: NFPA 10, 2010 Edition, Chapters 8-9.

APPENDIX B

Recharging Interval for Fire Extinguishers

Extinguisher Type	Recharging Interval
Pump tank water extinguishers	Annually (new chemicals or water, as applicable)
Pump tank calcium chloride-based antifreeze extinguishers	Annually (new chemicals or water, as applicable)
Stored-pressure wetting agent extinguishers	Replace agent annually
Liquid charge-type AFFF extinguishers	Replace pre-mixed agent at least every three years
Liquid charge-type FFFP extinguishers	Replace pre-mixed agent at least every three years
Solid charge-type AFFF extinguishers	Replace agent once every five years
Non-pressurized AFFF and FFFP fire extinguishers	Agent is subjected to agent analysis per manufacturer's recommendations

Basis: NFPA 10, 2010 Edition, Chapter 7