CRITERION 727

GASEOUS AGENT FIRE EXTINGUISHING SYSTEMS

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RECORD OF REVISIONS

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1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for operation and maintenance of total flooding gaseous agent fire extinguishing systems at LANL.

This document addresses the requirements of LIR 230-05-01(Ref 10.1), "Operations and Maintenance Manual."

Implementation of this Criterion satisfies DOE Order 430.1A (Ref 10.2) for the subject equipment/system. DOE Order 430.1A (Ref 10.2) "Life Cycle Asset Management," Attachment 2 "Contractor Requirements Document," Paragraph 2, Sections A through C, which in part requires UC to "…maintain physical assets in a condition suitable for their intended purpose," and employ "preventive, predictive, and corrective maintenance to ensure physical asset availability for planned use and/or proper disposition." Compliance with DOE Order 430.1A is required by Appendix G of the UC Contract.

2.0 SCOPE

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of total flooding gaseous agent fire extinguishing systems. The gaseous agents include Halon 1301, which is permitted to be maintained in existing systems; and clean agents, which are used in new systems. This Criterion addresses corrective maintenance actions in Section 7.2.

Refer to O & M Criterion 731, *Portable Fire Extinguishers*, for information regarding Halon 1211 portable fire extinguishers.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

AHJ	Authority Having Jurisdiction
CFR	Code of Federal Regulations
DOE	Department of Energy
FWO	Facility and Waste Operations
ITM	Inspection, Testing and Maintenance
LIG	Laboratory Implementation Guidance
LIR	Laboratory Implementation Requirement
LPR	Laboratory Performance Requirement
MSE	Maintenance and Systems Engineering
O&M	Operations and Maintenance
PPE	Personal Protective Equipment
PP&PE	Personal Property and Programmatic Equipment
RP&IE	Real Property and Installed Equipment
SSC	Structures, Systems, and Components
SSS	Support Services Subcontractor
UC	University of California

3.2 Definitions

Clean Agent. A gaseous fire extinguishing agent that is electrically nonconductive and leaves no residue upon evaporation. FM-200 is an example of this type of agent that is currently in use at LANL.

Halon. A halogenated hydrocarbon (halocarbon) gaseous fire extinguishing agent. Halons include Bromochlorodifluoromethane (Halon 1211), bromotrifluoromethane (Halon 1301), and mixtures of Halon 1211 and Halon 1301 (Halon 1211/1301). The only halon this Criterion covers is Halon 1301.

Gaseous Agent. A gaseous fire extinguishing agent. The primary types of gaseous agents are carbon dioxide, Halons and clean agents. This Criterion addresses Halon 1301 and clean agents. There are no carbon dioxide systems at LANL.

Hydrostatic Testing. Pressure testing of the gaseous agent storage container to verify its strength against unwanted rupture.

Management Level Determination (ML1, ML2, ML3, ML4). A classification system for determining the degree of management control applied to facility work. See LIR 230-01-02 for definitions of each ML level.

Total Flooding. The act and manner of discharging a fire extinguishing agent into a protected space for the purpose of achieving a specified minimum agent concentration throughout the protected space.

4.0 RESPONSIBILITIES

4.1 FWO-Maintenance and System Engineering (MSE)

4.1.1 FWO-MSE is responsible for the administrative content of this Criterion and monitoring the applicability and the implementation status of this Criteria and either assisting the organizations that are not applying or meeting the implementation expectations contained herein or elevating their concerns to the director(s).

Basis: LIR 301-00-01.11; Issuing and Managing Laboratory Operations Implementation Requirements and Guidance, Section 5.4, OIC Implementation Requirements.

4.1.2 FWO-MSE shall provide technical assistance to support implementation of this Criterion.

4.2 FWO-Fire Protection (FWO-FIRE)

4.2.1 FWO-FIRE is responsible for the technical content of this Criterion and assessing the proper implementation across the Laboratory.

4.2.2 FWO-FIRE shall provide technical assistance to support implementation of this Criterion.

4.3 Facility Manager

4.3.1 Responsible for operations and maintenance of institutional, or Real Property and Installed Equipment (RP&IE) under their jurisdiction, in accordance with the requirements of this document.

4.3.2 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document that may be assigned to the FM in accordance with the FMU-specific Facility/Tenant Agreement.

4.4 Group Leader

4.4.1 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document, which are under their jurisdiction.

4.4.2 Responsible for system performance analysis and subsequent replacement or refurbishment of assigned PP&PE.

4.5 Authority Having Jurisdiction (AHJ) – Fire Marshal

4.5.1 The AHJ is responsible for providing a decision on a specific technical question regarding this criterion.

4.5.2 The LANL Fire Marshal is the approval authority for any exceptions and variances to this Criterion.

4.6 Support Services Subcontractor (SSS)

4.6.1 Responsible for providing ITM of the fire protection systems addressed in this Criterion at the request of the responsible Facility Manager.

4.6.2 Responsible for coordinating work with the operating group and Facility Manager to conduct ITM in the affected area.

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Precautions

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. A compilation of all applicable precautions shall 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/precautions that may not be immediately obvious.

5.2 Limitations

The intent of this Criterion is to identify the minimum generic 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 shall implement the requirements of DOE Order 433.1 (Ref. 10.3) 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 CFR identified above.

6.0 REQUIREMENTS

Minimum requirements that Criterion users shall follow are specified in this section. Requested variances to these requirements shall be prepared and submitted to FWO-MSE in accordance with LIR 301-00-02 (Ref. 10.4), "Variances and Exceptions to Laboratory Operations Requirements," for review and approval. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgement, safety matters, and operations and maintenance experience drive the requirements contained in this section.

6.1 Operations Requirements

Refer to Criterion 720, *Fire Alarm Systems*, and to NFPA 72, *National Fire Alarm Code*® for operations requirements related to the detection system that discharges the extinguishing agent.

6.1.1 Operability Checklist

Gaseous agent fire extinguishing systems must be operable at all times. A system shall be deemed operable when the following conditions are met:

- An adequate number of containers filled with fire extinguishing agent is available and in functioning condition as part of the extinguishing system.
- Discharge nozzles are in place, aligned properly, and unobstructed.
- Ceiling tiles and other movable items near discharge nozzles are well secured.
- Activation devices are in place and are in good repair.
- The fire detection system for the protected space is in service (devices are functioning, device circuits are monitored by system control panel).
- The system control panel is fully functional, monitoring and controlling all appropriate devices, with the ability to relay alarm, supervisory and trouble signals to the LANL Central Alarm Station.
- All penetrations in the perimeter (walls, floor/ceiling) of the protected area are sealed, closed, or connected to an automatic closing system (electromagnetic doors, dampers, etc.) that is activated by operation of the extinguishing system.
- All equipment interlocks are in operating condition (e.g., automatic closure of doors/dampers, automatic shutdown of ventilation systems, etc.)
- Extinguishing agent container brackets are in good repair.

- The system piping, fittings, and hangers are in good repair.
- An adequate reserve supply of extinguishing agent is available (if a connected reserve is not already provided) in containers that can be immediately connected to the extinguishing system.

6.1.2 Semi-Annually

Check the container pressure gauges for proper operating pressures. If the loss in pressure exceeds 10%, replace or refill the containers.

Basis: NFPA 12A-1997, *Standard on Halon 1301 Fire Extinguishing Systems* and NFPA 2001-2000, *Standard on Clean Agent Fire Extinguishing Systems*. Compliance with these NFPA codes is required per Appendix G of the UC contract.

6.1.3 Annually

- Check that containers are properly mounted and undamaged.
- Thoroughly inspect and test the entire extinguishing system, except that discharge testing is not required. See Section 6.3 for testing requirements.
- Inspect the enclosure. Check all openings (doors, dampers, etc.) around the protected space to verify they are closed or connected to an automatic closure system. Check that all penetrations are properly sealed.

Basis: NFPA 12A-1997, *Standard on Halon 1301 Fire Extinguishing Systems* and NFPA 2001-2000, *Standard on Clean Agent Fire Extinguishing Systems*. Compliance with these NFPA codes is required per Appendix G of the UC contract.

6.2 Maintenance Requirements

Refer to Criterion 720, *Fire Alarm Systems*, and to NFPA 72, *National Fire Alarm Code*® for maintenance requirements related to the detection system that discharges the extinguishing agent.

6.2.1 Gaseous agent fire extinguishing systems shall be maintained in full operating condition at all times. Any impairment and restoration of a gaseous agent system shall be reported promptly to the AHJ.

Basis: NFPA 12A-1997, *Standard on Halon 1301 Fire Extinguishing Systems* and NFPA 2001-2000, *Standard on Clean Agent Fire Extinguishing Systems*. Compliance with these NFPA codes is required per Appendix G of the UC contract.

6.3 Testing Requirements

Refer to Criterion 720, *Fire Alarm Systems*, and to NFPA 72, *National Fire Alarm Code*® for testing requirements related to the detection system that discharges the extinguishing agent.

6.3.1 Semi-Annually

- Weigh each Halon container. If a container shows a loss in net weight of more than 10%, replace or refill the containers. Record the weight and pressure on the attached tag.
- Operate control activation devices (ensure that explosive squibs are inactive).
- Conduct an operational test of the system. Test auxiliary functions, such as damper and door release controls, without dumping the system.

Basis: NFPA 12A-1997, *Standard on Halon 1301 Fire Extinguishing Systems* and NFPA 2001-2000, *Standard on Clean Agent Fire Extinguishing Systems*. Compliance with these NFPA codes is required per Appendix G of the UC contract.

6.3.2 Five (5) Years

When a system has been discharged and a minimum of 5 years has passed since the last hydrostatic test, another test is required prior to refilling the cylinders.

Basis: NFPA 12A-1997, *Standard on Halon 1301 Fire Extinguishing Systems* and NFPA 2001-2000, *Standard on Clean Agent Fire Extinguishing Systems*. Compliance with these NFPA codes is required per Appendix G of the UC contract.

6.3.3 Twelve (12) Years

Perform a hydrostatic test on all cylinders.

NOTE: Conduct tests with trained personnel according to the procedures in the applicable NFPA code.

Basis: Frequency: NFPA 12-2000, *Standard on Carbon Dioxide Extinguishing Systems*; GE Global Asset Protection Services Guideline GAP.13.4.1.1, *Halon 1301 Systems*; and GE Global Asset Protection Services Guideline GAP.13.6.1, *Clean Agent Systems*. Compliance with NFPA codes is required per Appendix G of the UC contract.

Procedure: NFPA 12A-1997, *Standard on Halon 1301 Fire Extinguishing Systems* and NFPA 2001-2000, *Standard on Clean Agent Fire Extinguishing Systems*. Compliance with these NFPA codes is required per Appendix G of the UC contract.

7.0 RECOMMENDATIONS 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 his/her unique application and operating history of the subject systems/equipment.

7.1 Operations Recommendations

7.1.1 Persons other than SSS Fire Protection Maintenance personnel may conduct the visual inspection identified in this document.

7.2 Maintenance Recommendations

7.2.1 Purchase an annual service contract with a company experienced in installing and servicing gaseous agent extinguishing systems. The service contract should include the annual ITM requirements as well as emergency response for replacing extinguishing agent containers within 24 hours after a system discharge.

Basis: The complexity of gaseous extinguishing systems warrants having servicing agencies experienced in installing them perform the ITM. In addition, the inability to operate with gaseous fire extinguishing systems out of service may warrant assurance of prompt replacement of agent after a system discharge.

7.3 Testing Recommendations

7.3.1 To minimize the duration of impairment, replace the agent containers that are out for hydrostatic testing. Send containers out for hydrostatic testing to a company trained and equipped to perform this testing safely.

8.0 GUIDANCE

8.1 Operations Guidance

8.1.1 Not applicable.

8.2 Maintenance Guidance

8.2.1 Not applicable.

8.3 Testing Guidance

8.3.1 Not applicable.

9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained for (electric motors) 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 LPR 230-07-00, Criteria 2, (Ref. 10.5) which states; “Maintenance activities, equipment problems, and inspection and test results are documented.”

10.0 REFERENCES

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

10.1 LIR 230-05-01.0, Operations and Maintenance Manual.

10.2 DOE O 430.1A, Attachment 2 “Contractor Requirements Document” (Paragraph 2, Sections A through C), a requirement of Appendix G of the UC Contract.

10.3 DOE Order 433.1, Maintenance Management Program for DOE Nuclear Facilities.

10.4 LIR 301-00-02.0, Variances and Exceptions to Laboratory Operation Requirements.

10.5 LPR 230-07-00, Maintenance History.
10.6 NFPA 12-2000, Standard on Carbon Dioxide Extinguishing Systems.
10.7 NFPA 12A-1997, Standard on Halon 1301 Fire Extinguishing Systems.
10.8 NFPA 2001-2000, Standard on Clean Agent Fire Extinguishing Systems.
10.9 GE GAPS.13.4.1.1, Halon 1301 Systems.
10.10 GE GAPS.13.6.1, Clean Agent Systems.

11.0 APPENDICES

None