Document Hierarchy:	Functional Series
Document Number:	**Criterion 726 R1**
Approval Date:	05/28/2010
Effective Date:	06/28/2010
Supersedes:	Criterion 726 R0

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

TITLE: DRY PIPE SPRINKLER SYSTEMS

Name	Organization	Date	Signature
Criterion Author:			
Joseph White Fire Protection Engineer	FP-DO	05/ 26/ 2010	Signature on File (mm)
Approved by:			
James Streit Fire Protection Division Leader	FP-DO	05/ 27/ 2010	Signature on File (mm)
Charles Anderson NHHO Deputy Associate Director	ADNNHO	05/ 27/ 2010	Signature on File (mm)
Issuing Authority:			
Susanne Waylett MSS Division Leader	MSS-DO	05/ 28/ 2010	Signature on File (mm)

DUSA CLASSIFICATION STATEMENT

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.

Documents intended for public release must still be processed through the publication release section of the Classification Group

RECORD OF REVISIONS

Revision No.	Date	Description
0	08/04/03	Initial Issue
1	05/26/10	Complete revision, including the following – • Changes reflect current LANL organizations • Change reference to reflect P950, *Conduct of Maintenance* • Remove DOE O 430.1B references from Section 1 • Incorporate 2008 edition of NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems* • Incorporate 2010 edition of NFPA 72, *National Fire Alarm and Signaling Code* • Incorporate LASO action on cancellation and modification of 1999-era equivalencies to portions of NFPA 25 and 72 (LASO Memorandum No. SO:21WF-203741, *National Fire Protection Association 25 and National Fire Protection Association 72 Equivalency Cancellation/Modification*, January 19, 2010)

TABLE OF CONTENTS

CRITERION 726
DRY PIPE SPRINKLER SYSTEMS

1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for operation and maintenance of dry pipe sprinkler 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 primary codes concerning the installation and inspection, testing, and maintenance requirements for dry pipe sprinkler systems are NFPA 13, *Standard for Installation of Sprinkler Systems*; and NFPA 25, *Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*. The Criterion lists requirements that are based on codes, standards, contract commitments, lessons learned and LASO direction on previous equivalencies to some NFPA 25 and 72 inspection, testing and maintenance (ITM) requirements.. 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 dry pipe sprinkler systems. This Criterion does not address corrective maintenance actions required to repair or replace equipment.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

AHJ	Authority Having Jurisdiction
DOE	Department of Energy
FACP	Fire Alarm Control Panel
FDC	Fire Department Connection
FOD	Facility Operations Director
FP-DO	Fire Protection Division Office
ITM	Inspection, 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
OM	Operations Manager
OS&Y	Outside Screw and Yoke (valve)
PM	Preventative Maintenance
SC	Safety Class
SS	Safety Significant
SSC	Structures, Systems and Components
TSR	Technical Safety Requirement

3.2 Definitions

Dry Pipe Sprinkler System- A dry pipe sprinkler system, shown in figure 1, is typically used to provide sprinkler protection to buildings or portions of buildings that are subject to freezing. The system piping (fig 2) located above the dry pipe valve in unheated areas contains pressurized air or nitrogen gas. The air pressure, or in some cases nitrogen pressure, on the system side of the dry pipe valve keeps the dry pipe valve closed, which keeps water below the dry pipe valve and out of the system piping under normal conditions. When sprinklers open, air or nitrogen escapes through the open sprinklers allowing pressure to drop in the system piping. The drop in gas pressure allows the water pressure below the dry pipe valve to open the dry pipe valve. This allows water to flow through the piping system and discharge through the open sprinklers.

Although a dry pipe sprinkler system has many of the same components, a dry pipe system will require more intensive inspection and testing due to the additional components and increased complexity. Additionally, the interior of the dry pipe is more susceptible to corrosion that could lead to obstructions in the system.

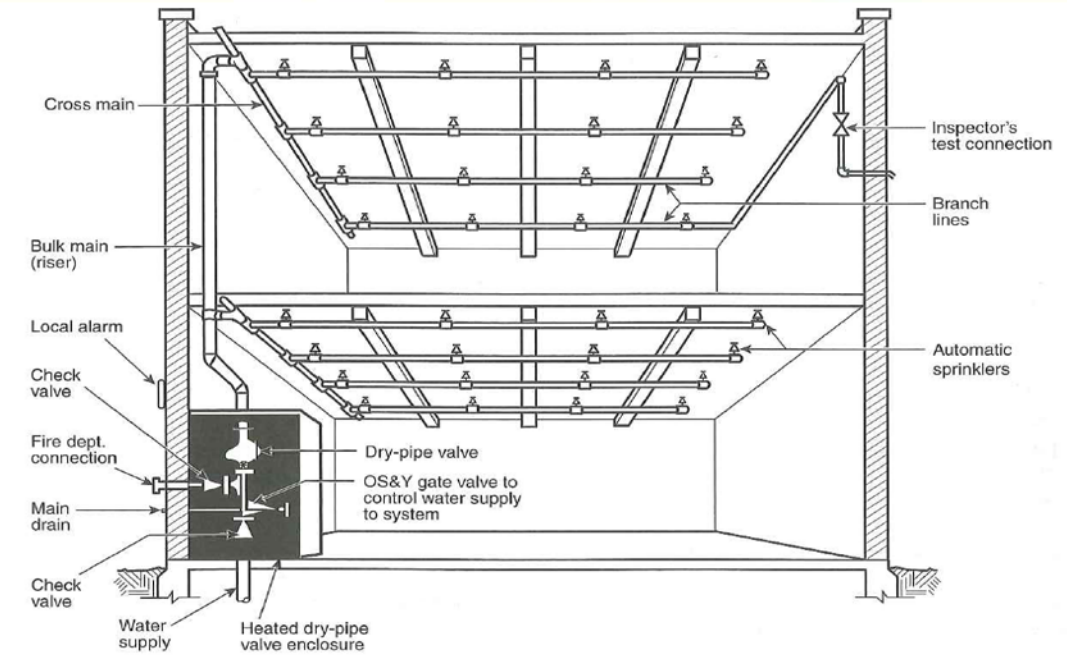

Figure 1, Dry Pipe Sprinkler System

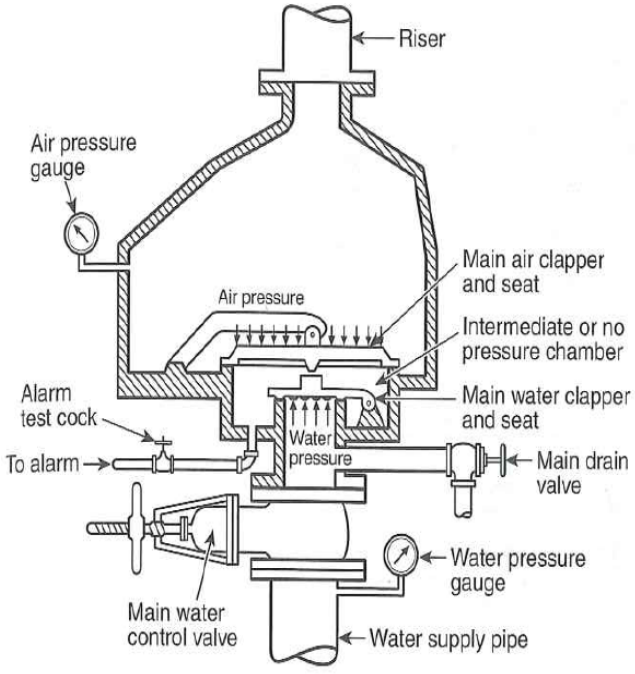

Figure 2, Dry Pipe Valve

Impairment - A condition where a fire protection system or portion thereof is out of order, and the condition can result in the fire protection system not functioning in a fire event.

1. **Emergency Impairment** - A condition where a water-based fire protection system or portion thereof is out of order due to an unexpected occurrence, such as a ruptured pipe, an operated sprinkler, or an interruption of the water supply to the system.
2. **Preplanned Impairment** - A condition where a water-based fire protection system or portion thereof is out of service due to work that has been planned in advance, such as revisions to the water supply or sprinkler system sprinklers and/ or piping.

Inspection - A visual examination of a system or portion thereof to verify it appears to be in operating condition and is free of physical damage.

Maintenance - In water-based fire protection systems, work performed to keep equipment operable or to make repairs.

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.

Testing - A procedure used to determine the status of a system as intended by conducting periodic physical checks on water-based fire protection systems. These tests follow up on original acceptance test at specified intervals.

4.0 RESPONSIBILITIES

4.1 MSS-Division Leader (MSS-DL)

In conjunction with the AHJ, the 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 of this Criterion and monitoring the proper implementation across the Laboratory. FP-DO shall provide technical assistance to support implementation of this Criterion and will assist

organizations that are not applying or meeting implementation expectations of this Criterion or will elevate concerns to the appropriate level of LANL management.

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.

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.

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.

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 CFR, DOE Orders or NFPA Codes and Standards - the fire protection AHJfor these matters is the LASO Manager per DOE O 420.1B (see PD 1220).

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

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.

The discharge of large quantities of water (>5,000 gal) from a fire protection system may require the issuance of a Notice of Intent (NOI) to discharge this and greater quantities of water up to 3 weeks prior to the evolution to meet LANL commitments with the New Mexico Environment Department (NMED). NOIs must be coordinated with the LANL Environmental Protection Division.

Measures outlined in O & M Criterion 733, *Fire Protection Systems Impairment Control,* shall be initiated during inspection, testing, and maintenance activities that impair the operation of dry pipe sprinkler system.

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) identified above.

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, in conjunction with the LANL Fire Marshal approves or denies variances. 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.

The requirements specified in this section are presented in a graded approach based on codes and standards (primarily NFPA 25), contract commitments, lessons learned and LASO direction on previous equivalencies to some NFPA 25 and 72 ITM requirements. In negotiation with LASO, FP-DO maintains the list of facilities designated as "high value" facilities for the purposes of this Criterion.

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

The automatic dry pipe sprinkler system shall remain operational at all times. The automatic dry pipe sprinkler system shall be deemed operational when the following conditions are met:

1. All water supply control valves are in the open position
2. The water supply gauge pressure reads normal
3. The air supply gauge pressure reads normal
4. The pressure gauge for any quick opening device reads normal
5. All control valves are properly supervised
6. All control valves are unobstructed and accessible
7. Control valve identification signs are in place
8. The system is free from leaks
9. The fire department connection (FDC) is unobstructed and is easily visible from the fire department approach and is readily accessible
10. The FDC caps are in place
11. The water flow alarm is operational
12. All sprinkler heads are unobstructed (ref. NFPA 13, Chapter 8)
13. Continuous or non-continuous obstructions such as storage and partial-height partitions are at least 18” below sprinkler deflectors
14. Where fixed continuous or non-continuous obstructions beneath sprinklers are more than 48” wide [ex., scaffold, platforms, ductwork, cable trays, cutting tables, experimental apparatus tables, laser tables, glove boxes, containment enclosures, screen rooms], sprinklers must be provided underneath
15. Where intermediate sprinklers might be cooled by sprinklers located above, the intermediate level sprinklers are equipped with spray shields

16. Sprinklers are a sufficient horizontal distance from ceiling-height obstructions (beams, walls, partitions, ducts, soffits, etc.) so that sprinkler spray pattern is not significantly obstructed (refer to NFPA 13 Chapter 8 for restrictions)
17. Pendent and upright sprinklers are at least 4" from wall
18. Piping, fittings, hangers, bracing, valves, sprinklers, and other components are in their proper locations and in good repair
19. Adequate water supply is available (with appropriate water pressure and quantity – compare to previous satisfactory test results)
20. System side air or N_2 pressure is being maintained in accordance with manufacturer's recommendations

Basis: NFPA 13, 2010 edition, and NFPA 25, 2008 edition. Compliance with these NFPA Codes are 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.

6.1.2 Nuclear Facilities, High-Hazard Non-nuclear Facilities and "High Value" Facilities

The following are operations/ visual inspection requirements for automatic dry pipe fire sprinkler systems protecting LANL nuclear facilities (be they SC, SS or defense in-depth), high-hazard non-nuclear, and other "high value" facilities.

6.1.2.1 Daily Inspections

Dry pipe valve enclosure heating equipment, without remotely-monitored low temperature alarms, are inspected daily during cold weather for its ability to maintain a minimum temperature of at least 40ºF.

6.1.2.2 Weekly Inspections

1. Dry pipe valve enclosures equipped with remotely-monitored low temperature alarms shall be inspected weekly during cold weather for its ability to maintain a minimum temperature of at least 40ºF.
2. For dry pipe systems where the air or N_2 pressure is not remotely supervised and monitored by the fire alarm system, gauges are inspected to ensure that normal air or N_2 and water pressures are being maintained. The gauge on the system side of the dry pipe valve shall indicate that the proper ratio of air or N_2 pressure is being maintained in accordance with the manufacturer's instructions. The gauge on the quick opening device, if provided, shall indicate the same pressure as the gauge on the system side of the dry pipe valve.
3. For dry pipe systems that protect freezers, the air or N_2 pressure gauge near the compressor shall be compared weekly to the pressure gauge above the dry pipe valve. When the gauge near the compressor is reading higher than the gauge near

the dry pipe valve, the air or N_2 line in service shall be taken out of service, and the alternate air or N_2 line opened to equalize pressure. The air or N_2 line taken out of service shall be internally inspected, shall have all ice blockage removed, and shall be reassembled for use as a future alternate air line.

4. Where provided, reduced pressure backflow prevention assemblies are inspected to ensure the differential-sensing valve relief port is not continuously discharging.

6.1.2.3 Monthly Inspections

1. Gauges for dry pipe systems where the air or N_2 pressure is remotely-monitored and supervised by the facility FACP are inspected to ensure they are in good condition and that the normal water supply pressure is being maintained.
2. Control valves, including dry pipe valve alarm line trim control valves (controlling water to a pressure switch and/ or water motor gong) that are locked and/ or electrically supervised by the facility FACP are inspected to ensure they are in the following condition:
   A. In the normal open or closed position
   B. Properly supervised
   C. Unobstructed and readily accessible
   D. Provided with appropriate wrenches
   E. Free from external leaks
   F. Provided with appropriate identification as to what the valve controls
3. Dry pipe valves and system riser check valves are externally inspected to verify:
   A. The gauges indicate normal water supply pressure is being maintained
   B. The valves are free of physical damage
   C. The intermediate chamber is not leaking
   D. All (trim) valves are in the appropriate open or closed position
   E. The retard chamber or alarm drains are not leaking

6.1.2.4 Quarterly Inspections

1. Alarm devices (pressure and flow switches, valve supervision switches, etc.) are inspected to ensure they are free of physical damage.
2. Where applicable, the hydraulic nameplate/ placard is inspected to verify that it is securely attached to the sprinkler riser (or other approved location) and is legible.
3. Where provided, pressure reducing valves are inspected to verify the valves are in the open position, not leaking, in good condition (hand wheels installed and not broken), and that downstream pressures are being maintained as designed.
4. Fire department connection (FDC) is inspected to verify:
   A. The FDC is visible and accessible
   B. Couplings and swivels are not damaged and rotate smoothly
   C. Plugs or caps are in-place and in good condition
   D. Identification signs are in-place

E. The check valve is not leaking
F. The automatic drain valve is in-place and operating properly
G. The FDC internal clapper(s) is in-place an operating properly
H. If FDC plugs or caps are not in-place, the interior of the connection shall be inspected for obstructions, and it shall be verified that the FDC clapper(s) is functional over its full range

5. Where sprinkler heads are protected against overspray residue (e.g., paint spray booths, resin application rooms, mixing rooms) by cellophane or paper bags, these bags are inspected to verify the lack of accumulation of heavy residue deposits.

6.1.2.5 Annual Inspections

1. Inspect the interior of the dry pipe valve when the trip test is conducted. Clean, repair, or replace parts as necessary in accordance with the manufacturer's instructions.
2. Low temperature alarms if installed in valve enclosures are inspected at the beginning of the heating season.
3. Prior to the onset of freezing weather conditions in the Fall, buildings are inspected to verify that windows, skylights, doors, ventilators, and other openings and closures, blind spaces, unused attics, stair towers, roof penthouses, and low (crawl) spaces under buildings do not expose water-filled piping to freezing and verify that adequate heat [minimum 40°F] is available. Operability of heat tape and other freeze prevention systems is also verified where installed.
4. From floor level, sprinkler piping and fittings are inspected to verify that these are in good condition and free of mechanical damage, leakage, corrosion, or subject to external loads by materials either resting on the pipe or supported by the pipe or pipe supports (e.g., cabling strapped to piping).

   Note: Pipe and fittings installed within concealed spaces not visible from floor level need not be inspected. Pipe and fittings installed within areas that are inaccessible for safety considerations due to process operations are inspected during each scheduled shutdown or outage.

5. From floor level, sprinkler pipe hangers and seismic bracing are inspected to verify that these are in good condition and free of mechanical damage, leakage, corrosion, or subject to external loads by materials either resting on the pipe or supported by the pipe or pipe supports (e.g., cabling strapped to hangers or bracing).

   Note: Hangers and seismic bracing installed within concealed spaces not visible from floor level need not be inspected. Hangers and seismic bracing installed within areas that are inaccessible for safety considerations due to process operations are inspected during each scheduled shutdown or outage.

6. From floor level, sprinkler heads are inspected to verify that these are in good condition and free of mechanical damage, foreign material (e.g., loading of lint, dust, oil residue and similar debris), paint (overspray), leakage, corrosion, and

installed in the proper orientation (e.g., upright, pendant or sidewall). Glass bulb sprinklers are inspected to verify that the colored liquid is present.

Note: Sprinklers heads installed within concealed spaces not visible from floor level need not be inspected. Sprinkler heads installed within areas that are inaccessible for safety considerations due to process operations are inspected during <u>each</u> scheduled shutdown or outage.

7. The supply of spare sprinkler heads is inspected to verify that the proper number and type of sprinkler heads is available, and a sprinkler head wrench is available for each type of sprinkler head. The stock of spare sprinkler heads must include all types and ratings installed within the protected facility as follows:
   A. For facilities having no more than 300 sprinkler heads, no fewer than 6 sprinklers
   B. For facilities having 300 to 1,000 sprinkler heads, no fewer than 12 sprinklers
   C. For facilities having over 1,000 sprinkler heads, no fewer than 24 sprinklers

   Basis: NFPA 13, 2010 edition, and NFPA 25, 2008 edition. Compliance with these Codes are 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. See also LASO Memorandum No. SO:21WF-203741, *National Fire Protection Association 25 and National Fire Protection Association 72 Equivalency Cancellation/Modification*, January 19, 2010 .

6.1.3 Balance of LANL Facilities

The following are operations/ visual inspection requirements for automatic dry pipe fire sprinkler systems protecting LANL facilities that are not nuclear facilities, high-hazard non-nuclear facilities, or designated as a "high value" facilities.

6.1.3.1 <u>Daily Inspections</u>

Dry pipe valve enclosure heating equipment, without remotely-monitored low temperature alarms, are inspected daily during cold weather for its ability to maintain a minimum temperature of at least 40ºF.

6.1.3.2 <u>Weekly Inspections</u>

1. Where provided, reduced pressure backflow prevention assemblies are inspected to ensure the differential-sensing valve relief port is not continuously discharging.
2. For dry pipe systems that protect freezers, the air or N_2 pressure gauge near the compressor shall be compared weekly to the pressure gauge above the dry pipe valve. When the gauge near the compressor is reading higher than the gauge near the dry pipe valve, the air or N_2 line in service shall be taken out of service, and the alternate air or N_2 line opened to equalize pressure. The air or N_2 line taken out of service shall be internally inspected, shall have all ice blockage removed, and shall be reassembled for use as a future alternate air line.

6.1.3.3 Semi-Annual Inspections

1. Dry pipe valve enclosures equipped with remotely-monitored low temperature alarms shall be inspected weekly during cold weather for its ability to maintain a minimum temperature of at least 40ºF.
2. For dry pipe systems where the air or N_2 pressure is not remotely supervised and monitored by the fire alarm system, gauges shall are inspected to ensure that normal air or N_2 and water pressures are being maintained. The gauge on the system side of the dry pipe valve shall indicate that the proper ratio of air or N_2 pressure is being maintained in accordance with the manufacturer's instructions. The gauge on the quick opening device, if provided, shall indicate the same pressure as the gauge on the system side of the dry pipe valve.
3. Gauges for dry pipe systems where the air or N_2 pressure is remotely-monitored and supervised by the facility FACP are inspected to ensure they are in good condition and that the normal water supply pressure is being maintained.
4. Control valves, including dry pipe valve alarm line trim control valves (controlling water to a pressure switch and/ or water motor gong) that are locked and/ or electrically supervised by the facility FACP are inspected to ensure they are in the following condition:
   A. In the normal open or closed position
   B. Properly supervised
   C. Unobstructed and readily accessible
   D. Provided with appropriate wrenches
   E. Free from external leaks
   F. Provided with appropriate identification as to what the valve controls
5. Dry pipe valves and system riser check valves are externally inspected to verify:
   A. The gauges indicate normal water supply pressure is being maintained
   B. The valves are free of physical damage
   C. The intermediate chamber is not leaking
   D. All (trim) valves are in the appropriate open or closed position
   E. The retard chamber or alarm drains are not leaking
6. Alarm devices (pressure and flow switches, valve supervision switches, etc.) are inspected to ensure they are free of physical damage.
7. Where applicable, the hydraulic nameplate/ placard is inspected to verify that it is securely attached to the sprinkler riser (or other approved location) and is legible.
8. Where provided, pressure reducing valves are inspected to verify the valves are in the open position, not leaking, in good condition (hand wheels installed and not broken), and that downstream pressures are being maintained as designed.

9. FDC is inspected to verify:
   A. The FDC is visible and accessible
   B. Couplings and swivels are not damaged and rotate smoothly
   C. Plugs or caps are in-place and in good condition
   D. Identification signs are in-place
   E. The check valve is not leaking
   F. The automatic drain valve is in-place and operating properly
   G. The FDC internal clapper(s) is in-place an operating properly
   H. If FDC plugs or caps are not in-place, the interior of the connection shall be inspected for obstructions, and it shall be verified that the FDC clapper(s) is functional over its full range
10. Where sprinkler heads are protected against overspray residue (e.g., paint spray booths, resin application rooms, mixing rooms) by cellophane or paper bags, these bags are inspected to verify the lack of accumulation of heavy residue deposits.

6.1.3.4 Annual Inspections

1. Inspect the interior of the dry pipe valve when the trip test is conducted. Clean, repair, or replace parts as necessary in accordance with the manufacturer's instructions.
2. Low temperature alarms, if installed in valve enclosures, are inspected at the beginning of the heating season.
3. Prior to the onset of freezing weather conditions in the Fall, buildings are inspected to verify that windows, skylights, doors, ventilators, and other openings and closures, blind spaces, unused attics, stair towers, roof penthouses, and low (crawl) spaces under buildings do not expose water-filled piping to freezing and verify that adequate heat [minimum 40°F] is available. Operability of heat tape and other freeze prevention systems is also verified where installed.
4. From floor level, sprinkler piping and fittings are inspected to verify that these are in good condition and free of mechanical damage, leakage, corrosion, or subject to external loads by materials either resting on the pipe or supported by the pipe or pipe supports (e.g., cabling strapped to piping).

   Note: Pipe and fittings installed within concealed spaces not visible from floor level need not be inspected. Pipe and fittings installed within areas that are inaccessible for safety considerations due to process operations are inspected during each scheduled shutdown or outage.
5. From floor level, sprinkler pipe hangers and seismic bracing are inspected to verify that these are in good condition and free of mechanical damage, leakage, corrosion, or subject to external loads by materials either resting on the pipe or supported by the pipe or pipe supports (e.g., cabling strapped to hangers or bracing).

Note: Hangers and seismic bracing installed within concealed spaces not visible from floor level need not be inspected. Hangers and seismic bracing installed within areas that are inaccessible for safety considerations due to process operations are inspected during each scheduled shutdown or outage.

6. From floor level, sprinkler heads are inspected to verify that these are in good condition and free of mechanical damage, foreign material (e.g., loading of lint, dust, oil residue and similar debris), paint (overspray), leakage, corrosion, and installed in the proper orientation (e.g., upright, pendant or sidewall). Glass bulb sprinklers are inspected to verify that the colored liquid is present.

   Note: Sprinklers heads installed within concealed spaces not visible from floor level need not be inspected. Sprinkler heads installed within areas that are inaccessible for safety considerations due to process operations are inspected during each scheduled shutdown or outage.

7. The supply of spare sprinkler heads is inspected to verify that the proper number and type of sprinkler heads is available, and a sprinkler head wrench is available for each type of sprinkler head. The stock of spare sprinkler heads must include all types and ratings installed within the protected facility as follows:

   A. For facilities having no more than 300 sprinkler heads, no fewer than 6 sprinklers

   B. For facilities having 300 to 1,000 sprinkler heads, no fewer than 12 sprinklers

   C. For facilities having over 1,000 sprinkler heads, no fewer than 24 sprinklers

   Basis: NFPA 13, 2010 edition, NFPA 25, 2008 edition, and DOE-approved Equivalency to NFPA 25. Compliance with these NFPA Codes are 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 Maintenance Requirements

The following are maintenance requirements for all automatic dry pipe fire sprinkler systems protecting LANL facilities; no distinction is made for facility hazard categorization or "high value." Ensure all system components are working. Repair or replace any components that fail a test or inspection in accordance with the manufacturer's instructions.

Note: Maintenance requirements for reduced pressure backflow prevention devices are outside the scope of this Criterion. See Criterion 406 for maintenance requirements for reduced pressure backflow prevention devices.

6.2.1 Annual Maintenance

1. Lubricate the operating stems of sprinkler system outside screw and yoke (OS&Y) valves. Then fully close and reopen the valve completely to test its operation and to distribute the lubricant. Graphite lubricant is recommended.

   Note: Do not apply grease or other sealing materials to the seating surfaces of valves.

2. Replace cellophane or paper bags used to protect sprinkler heads from overspray residue. Only cellophane bags having a thickness no greater than 0.003 in (0.076 mm) or thin paper bags may be used for this application.

   Note: While NFPA 13 is specific about the thickness of cellophane bags used for this purpose, it is non-specific on what constitutes a "thin" paper bag. It is acceptable to use a typical lunch sack paper bag for this purpose. Relatively thick plastic bags have the potential to melt and adhere to the sprinkler head prior to sprinkler head activation, which could adversely affect the performance of the protected sprinkler head.

3. Complete a partial flow test of sprinkler system pressure reducing valves sufficient to move the valve from its seat.

6.2.2 5-Year Maintenance

1. Gauges are replaced or tested by comparison with a calibrated gauge. Gauges not accurate to within 3% of the full scale are replaced or recalibrated.
2. Dry pipe valves and associated strainers, filters and restriction orifices are internally inspected and cleaned/ repaired in accordance with manufacturer's instructions.
3. Check valves are internally inspected and cleaned/ repaired in accordance with manufacturer's instructions
4. Complete an inspection of piping and branch line conditions by opening a flushing connection at the end of one main and by removing a sprinkler head toward the end of one branch line to inspect for the presence of foreign organic and inorganic material.
5. Solder-type sprinkler heads with a temperature classification of extra high (325°F or greater) that have been exposed to semi-continuous to continuous maximum allowable ambient temperature conditions are tested as per Appendix A or replaced.
6. Sprinkler heads subject to harsh environments, including corrosive atmospheres and corrosive water supplies, are tested as per Appendix A or replaced.
7. Complete a full-flow test of sprinkler system pressure reducing valves and compare the results to previous test results and original design requirements. Adjustments made to the pressure reducing valves are made in accordance with manufacturer's instructions.

6.2.3 10-year Maintenance

Dry type sprinkler heads (upright, pendant and sidewall) are tested as per Appendix A or replaced.

6.2.4 20-year Maintenance

Quick- and/ or Fast-Response type sprinkler heads are tested as per Appendix A or replaced.

6.2.5 50-year Maintenance

Standard Response type sprinkler heads are tested as per Appendix A or replaced.

Basis: NFPA 13, 2010 edition, and NFPA 25, 2008 edition. Compliance with these NFPA Codes are 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. See also LASO Memorandum No. SO:21WF-203741, *National Fire Protection Association 25 and National Fire Protection Association 72 Equivalency Cancellation/Modification*, January 19, 2010.

6.3 Testing

6.3.1 Nuclear Facilities, High-Hazard Non-nuclear Facilities and "High Value" Facilities

The following are testing requirements for automatic dry pipe fire sprinkler systems protecting LANL nuclear facilities (be they SC, SS or defense in-depth), high-hazard non-nuclear facilities, and other "high value" facilities.

6.3.1.1 Quarterly Testing

1. Mechanical waterflow devices, including water motor gongs, are tested by flow through the inspector's test connection.
2. The dry pipe valve priming water level is tested.
3. Test quick opening devices, if provided.
4. Sprinkler systems where the sole water supply is through a back flow preventer and/ or pressure reducing valves, a main drain test is conducted.

   Note: When there is a 10% reduction in the full flow residual pressure observed when compared to the original acceptance test or previous tests, the cause for the reduction will be identified and corrected.

6.3.1.2 Semi-Annual Testing

1. The dry pipe valve priming water level is tested.
2. Quick opening devices, if provided, is tested.

3. Pressure switch-type waterflow devices are tested by flow through the inspector's test connection.
4. Valve supervisory switches are tested by operating the monitored valve. A supervisory alarm signal must be generated and transmitted to the alarm monitoring station either during the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position.
5. Low and high air or N_2 pressure alarms are testing in accordance with NFPA 72. An off normal/ supervisory signal should be initiated and transmitted to the FACP and the LANL proprietary fire alarm system when the air or N_2 pressure increases or decreases by 10 psi from the normal set point

6.3.1.3 Annual Testing

1. Conduct a trip test of the dry pipe valve during warm weather. Trip test each dry pipe valve with the control valve partially open. Dry pipe valves protecting freezers are trip tested in a manner that does not introduce moisture into the piping in the freezers.
2. Automatic air pressure maintenance devices, if provided, are tested during the dry pipe valve trip test in accordance with the manufacturer's instructions.
3. Test dry pipe valve automatic air pressure maintenance devices during the valve trip test.
4. Low temperature alarms, if provided in valve enclosures, are tested at the beginning of the heating season.
5. Perform main drain test by fully opening and closing the main drain valve.

   Note: When there is a 10% reduction in the full flow residual pressure observed when compared to the original acceptance test or previous tests, the cause for the reduction will be identified and corrected.
6. Fully close and reopen the system control valve(s).
7. Where provided, pressure reducing or relief valves are subject to a partial flow test adequate to move the valve from its seat.
8. Backflow prevention assemblies are tested as follows:

   A. A forward flow test is conducted at the designed flow rate of the sprinkler system (may include hose stream demands where fire hydrants and/ or standpipe systems are located downstream of the backflow prevention assembly) to verify pressure loss through assembly is consistent with design assumptions.

   B. A backflow performance test is conducted upon completion of the forward flow test.

Note: Where connections do not allow a full flow forward flow test, tests are conducted at the maximum flow rate possible.

6.3.1.4 3-year Testing

1. Conduct a full-flow trip test of the dry pipe valve with the control valve fully open and the quick opening device in service during warm weather.
2. Automatic air pressure maintenance devices, if provided, are tested during the dry pipe valve trip test in accordance with the manufacturer's instructions.

6.3.1.5 5-year Testing

1. Solder-type sprinkler heads with a temperature classification of extra high (325°F or greater) that have been exposed to semi-continuous to continuous maximum allowable ambient temperature conditions are tested as per Appendix A or replaced.
2. Sprinkler heads subject to harsh environments, including corrosive atmospheres and corrosive water supplies, are tested as per Appendix A or replaced.
3. Complete a full-flow test of sprinkler system pressure reducing valves and compare the results to previous test results and original design requirements. Adjustments made to the pressure reducing valves are made in accordance with manufacturer's instructions.

6.3.1.6 10-year Testing

Dry type sprinkler heads (upright, pendant and sidewall) are tested as per Appendix A or replaced.

6.3.1.7 20-year Testing

Quick- and/ or Fast-Response type sprinkler heads are tested as per Appendix A or replaced.

6.3.1.8 50-year Testing

Standard Response type sprinkler heads are tested as per Appendix A or replaced.

Basis: NFPA 13, 2007 edition, and NFPA 25, 2008 edition. Compliance with these NFPA Codes are 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. See also LASO Memorandum No. SO:21WF-203741, *National Fire Protection Association 25 and National Fire Protection Association 72 Equivalency Cancellation/Modification*, January 19, 2010.

6.3.2 Balance of LANL Facilities

The following are operations/ visual inspection requirements for automatic dry pipe fire sprinkler systems protecting LANL facilities that are not nuclear facilities, high-hazard non-nuclear facilities, or designated as "high value" facilities

6.3.2.1 Semi-Annual Testing

1. Mechanical waterflow devices, including water motor gongs, are tested by flow through the inspector's test connection.
2. Pressure switch-type waterflow devices are tested by flow through the inspector's test connection.
3. The dry pipe valve priming water level is tested.
4. Test quick opening devices, if provided.
5. Valve supervisory switches are tested by operating the monitored valve. A supervisory alarm signal must be generated and transmitted to the alarm monitoring station either during the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position.
6. Low and high air or N_2 pressure alarms are testing in accordance with NFPA 72. An off normal/ supervisory signal should be initiated and transmitted to the FACP and the LANL proprietary fire alarm system when the air or N_2 pressure increases or decreases by 10 psi from the normal set point
7. Sprinkler systems where the sole water supply is through a back flow preventer and/ or pressure reducing valves, a main drain test is conducted.

   Note: When there is a 10% reduction in the full flow residual pressure observed when compared to the original acceptance test or previous tests, the cause for the reduction will be identified and corrected.

6.3.2.2 Annual Testing

1. Conduct a trip test of the dry pipe valve during warm weather. Trip test each dry pipe valve with the control valve partially open. Dry pipe valves protecting freezers are trip tested in a manner that does not introduce moisture into the piping in the freezers.
2. Automatic air pressure maintenance devices, if provided, are tested during the dry pipe valve trip test in accordance with the manufacturer's instructions.
3. Test dry pipe valve automatic air pressure maintenance devices during the valve trip test.
4. Low temperature alarms, if provided in valve enclosures, are tested at the beginning of the heating season.

5. Perform main drain test by fully opening and closing the main drain valve.

   Note: When there is a 10% reduction in the full flow residual pressure observed when compared to the original acceptance test or previous tests, the cause for the reduction will be identified and corrected.

6. Fully close and reopen the system control valve(s).
7. Where provided, pressure reducing or relief valves are subject to a partial flow test adequate to move the valve from its seat.
8. Backflow prevention assemblies are tested as follows:

   A. A forward flow test is conducted at the designed flow rate of the sprinkler system (may include hose stream demands where fire hydrants and/ or standpipe systems are located downstream of the backflow prevention assembly) to verify pressure loss through assembly is consistent with design assumptions.

   B. A backflow performance test is conducted upon completion of the forward flow test.

   Note: Where connections do not allow a full flow forward flow test, tests are conducted at the maximum flow rate possible.

6.3.2.3 3-year Testing

1. Conduct a full-flow trip test of the dry pipe valve with the control valve fully open and the quick opening device in service during warm weather.
2. Automatic air pressure maintenance devices, if provided, are tested during the dry pipe valve trip test in accordance with the manufacturer's instructions.

6.3.2.4 5-year Testing

1. Solder-type sprinkler heads with a temperature classification of extra high (325°F or greater) that have been exposed to semi-continuous to continuous maximum allowable ambient temperature conditions are tested as per Appendix A or replaced.
2. Sprinkler heads subject to harsh environments, including corrosive atmospheres and corrosive water supplies, are tested as per Appendix A or replaced.
3. Complete a full-flow test of sprinkler system pressure reducing valves and compare the results to previous test results and original design requirements. Adjustments made to the pressure reducing valves are made in accordance with manufacturer's instructions.

6.3.2.5 10-year Testing

Dry type sprinkler heads (upright, pendant and sidewall) are tested as per Appendix A or replaced.

6.3.2.6 20-year Testing

Quick- and/ or Fast-Response type sprinkler heads are tested as per Appendix A or replaced.

6.3.2.7 50-year Testing

Standard Response type sprinkler heads are tested as per Appendix A or replaced.

Basis: NFPA 13, 2010 edition, NFPA 25, 2008 edition, and DOE-approved Equivalency to NFPA 25 (Ref. 10.8). Compliance with these NFPA Codes are 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 Other ITM Requirements

Ensure all system components are working. Repair or replace any components that fail a test or inspection in accordance with manufacturer's instructions.

6.4.1 Sprinklers

1. Replacement sprinkler heads shall have the appropriate characteristics for the application intended. These characteristics shall include proper:
   A. style
   B. orifice size and K factor
   C. temperature rating
   D. coating (if any)
   E. deflector type (e.g., upright, pendant, sidewall)
   F. design requirements
   G. Use only new, listed sprinklers as replacements.
2. Protect sprinklers covering spray-coating areas against overspray residue. Only cellophane bags having a thickness no greater than 0.003 in (0.076 mm) or thin paper bags may be used for this application.

Note: While NFPA 13 is specific about the thickness of cellophane bags used for this purpose, it is non-specific on what constitutes a "thin" paper bag. It is acceptable to use a typical lunch sack paper bag for this purpose. Relatively thick plastic bags have the potential to melt and adhere to the sprinkler head prior to sprinkler head activation, which could adversely affect the performance of the protected sprinkler head.

3. Conduct an obstruction investigation for sprinkler systems and yard main piping whenever any of the following conditions exist:
   A. Discharge of obstructive materials is found during routine water flow tests
   B. Foreign materials are discovered in fire pumps or check valves
   C. Foreign material in water during drain tests or plugging of inspector's test connection(s)
   D. plugged sprinkler heads
   E. plugged piping in sprinkler systems dismantled during building alterations are discovered
   F. failure to flush yard piping or surrounding public mains following new installations or repairs
   G. record of broken public mains in the vicinity exists
   H. a system that is returned to service after an extended shutdown (> 1 year)
   I. there is reason to believe that the sprinkler system contains sodium silicate or highly corrosive fluxes in copper systems
   J. a system has been supplied with raw water via the fire department connection
   K. pinhole leaks are found

   Basis: NFPA 13, 2010 Edition, and NFPA 25, 2008 Edition. Compliance with NFPA Codes are 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 Dry Pipe Valves

1. Locate and repair leaks resulting in pressure losses greater than 10 psi/ week.
2. During the annual trip test, thoroughly clean the interior of the dry pipe valve and repair or replace any parts as necessary. Grease or other sealing material shall not be applied to the seating surfaces of dry pipe valves.
3. Drain the low points in the dry pipe system after each operation and before the onset of freezing weather.

   Basis: NFPA 25, 2008 Edition. Compliance with NFPA Codes are 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 operability requirements listed in Section 6.1.1 above are not maintained, follow the actions outlined in Criterion 733, *Fire Protection System Impairment Control Program*.

6.5.1 Inspection and Testing (After an Impairment or Modification)

1. Whenever a component in a sprinkler system is adjusted, repaired, reconditioned, or replaced the applicable actions noted in Appendix B, *Component and System Action Requirements*, shall be performed.
2. A main drain test shall be required if the system control valve or other upstream valve was operated. The main drain test results shall compare with the results of previous main drain tests and the dry sprinkler system flow and pressure demand to verify an adequate pressure and volume of water is available to supply the sprinkler system.
3. A LANL Fire Protection Division Representative shall be contacted when the scope of work includes adding, relocating, and/ or removing sprinklers to verify the work performed conforms to the approved plans.

   Basis: NFPA 25, 2008 Edition. Compliance with NFPA Codes are 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.

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

None

7.2 Maintenance Recommendations

None

8.0 GUIDANCE

8.1 Operations Guidance

None

8.2 Maintenance Guidance

None.

9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained for dry pipe sprinkler systems and must 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**

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." Documentation of the parameters listed in Table 9-1 above satisfies the requirements of AP-MNT-010, *Maintenance History*, and NFPA 25.

10.0 REFERENCES

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

10.1 P 313, *Conduct of Operations Manual*

10.2 P 950, *Conduct of Maintenance*

10.3 PD 1220, *Fire Protection Program*

10.4 AP-341-502, *Management Level Determination*

10.5 AP-341-516, *Operability Determination and Functionality Assessment*

10.6 10 CFR 851, *Worker Safety and Health Program*, Appendix A.2 "Fire Protection"

10.7 DOE Order 420.1B, *Facility Safety*, Chapter II "Fire Protection"

10.8 NFPA 25, 2008 Edition, *Standard for the Inspection, Testing and Maintenance of Water-based*

Fire Protection Systems

10.9 NFPA 13, 2010 Edition, *Standard for the Installation of Sprinkler Systems*

10.10 NFPA 72, 2010 Edition, *National Fire Alarm and Signaling Code*

10.11 LANL Equivalency to NFPA 25, consisting of: (a) LANL Memorandum No. FE-21-98-005, *Proposed Equivalency to NFPA Standard 25*, dated June 9, 1998; (b) DOE AOO/ LAOO Memorandum No. LAAMFO:3TR-021, *Fire Protection Inspection, Test, and Maintenance Requirements*, dated 6/ 9/ 1998; and (c) DOE AOO Memorandum No. TASD:98-068:pc, *Disposition of LANL Equivalency Requests to NFPA 25 – Inspection, Testing, and Maintenance (ITM) Frequencies for Water-Based Fire Protection Systems*, dated July 24, 1998

10.12 LASO Memorandum No. SO:21WF-203741, National Fire Protection Association 25 and National Fire Protection Association 72 *Equivalency Cancellation/Modification*, January 29, 2010

11.0 APPENDICES

Appendix A: *Sprinkler Testing Requirements*

Appendix B: *Component and System Action Requirements*

Appendix A

Sprinkler Testing Requirements

(Basis: NFPA 25, 2008 Edition, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*, Chapter 5)

1. Where required below, sample sprinklers shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing.

   - Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be tested. Test procedures shall be repeated at 10-year intervals.
   - Sprinklers manufactured using fast-response elements that have been in service for 20 years shall be tested. They shall be retested at 10-year intervals.
   - Representative samples of solder-type sprinklers with a temperature classification of extra high (325°F or greater) exposed to semi-continuous to continuous maximum allowable ambient temperature conditions shall be tested at 5-year intervals.
   - Where sprinklers have been in service for 75 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing. Test procedures shall be repeated at 5-year intervals.
   - Dry sprinklers that have been in service for 10 years shall be tested or replaced. If maintained and serviced, they shall be retested at 10-year intervals.
   - Where sprinklers are subjected to harsh environments, including corrosive atmospheres and corrosive water supplies, on a 5-year basis, sprinklers shall either be replaced or representative sprinkler samples shall be tested.
   - Where historical data indicates, longer intervals between testing shall be permitted.

2. A representative sample of sprinklers for testing per 1 above shall consist of a minimum of not less than 4 sprinklers or 1 percent of the number of sprinklers per individual sprinkler sample, whichever is greater.

3. Where one sprinkler within a representative sample fails to meet the test requirement, all sprinklers represented by that sample shall be replaced.

Appendix B

Component and System Action Requirements

(*Basis:* NFPA 25, 2008 Edition, Table 5.5.1)

Component	Adjust/ Modify	Repair/ Reconditio n	Replac e	Required ITM Action
Pipe and fittings affecting < 20 sprinklers	X	X	X	Check for leaks at system working pressure
Pipe and fittings affecting ≥ 20 sprinklers	X	X	X	Hydrostatic test per NFPA 13 (e.g., 200 psig for 2 hours)
Sprinklers < 20	X	-	X	Check for leaks at system working pressure
Sprinklers ≥ 20	X	-	X	Hydrostatic test per NFPA 13 (e.g., 200 psig for 2 hours)
FDC	X	X	X	Inspect per Section 6.1.2.3
Control Valves	X	X	X	Fully close and reopen the valve Lock in open position
Vane-type waterflow	X	X	X	Operational test using inspector's test connection
Pressure switch-type waterflow	X	X	X	Operational test using inspector's test connection
Pressure switch-type supervisory air or N_2	X	X	X	Operational test per dry pipe valve or air maintenance device manufacturer's instructions
Water motor gong	X	X	X	Operational test using inspector's test connection
Valve supervision switch	X	X	X	Operational test per NFPA 13/72 (i.e., signal shall be produced during either of the first two revolutions of a hand wheel or when stem has moved one-fifth of the distance from normal position)
Gauges	X	X	X	Verify at 0 psi and at system working pressure
Main Drain	X	X	X	Perform main drain test per Section 6.3.2.2
Auxiliary Drain(s)	X	X	X	Check for leaks at system working pressure Perform main drain test per Section 6.3.2.2
Inspector's test connection	X	X	X	Check for leaks at system working pressure Perform main drain test per Section 6.3.2.2