

Maintenance tasks and task frequencies may be subject to additional requirements (code) as adopted by local government entities (Authority Having Jurisdiction - AHJ) including but not limited to National Fire Protection Association (NFPA) standards. Where requirements conflict between this standard any other local code, the more stringent requirement shall be used. Applicable allowances set forth by adopted local code requirements or AHJ agreements therein can be utilized by the OpCo.

FIRE PROTECTION - BUILDINGS / YARDS								
Component Classification Categories								
Criticality	I	X					Nuclear Switchyards ≥ 220kV as defined in the respective Nuclear Plant Interface Requirements (NPIRS). Note: Fire Protection maintenance is performed by the Nuclear Station personnel in accordance with the Station's program	
	II		X				DC, SS, TDC, TSS locations that serve O'Hare & Midway Airports,	
	III			X			Locations exclusive of Criticality I & II, DC and ≤ 34kV ESS locations	
	IV				X		DC locations	
	V					X	≤34 kV ESS locations	
Duty Cycle	Heavy Load	N/A	N/A	N/A	N/A	N/A		
	Normal Load	N/A	N/A	N/A	N/A	N/A		
Service Condition	In Service	X	X	X	X	X		
	Spare	N/A	N/A	N/A	N/A	N/A		
<b>Condition Monitoring Tasks</b>								
		Task Frequencies				Failure Codes		Comments
CO <sub>2</sub> System Visual Inspection		5W	5W	10W	3M	6M	1a, 2b-d, 4b	
Clean Agent System Visual Inspection		5W	5W	10W	3M	6M	1a, 2b-d	
Sprinkler System Visual Inspection		N/A	5W	10W	3M	6M	1a, 2b, 2d	
Water Mist System Visual Inspection		N/A	5W	10W	3M	6M	1a, 2b, 2d	
Fire Extinguisher Inspection		5W	5W	10W	3M	6M	2b	
Visual Inspection of Fire Protection System		5W	5W	10W	3M	6M	1a, 2a, 3a, 4a-b	
Fire Pump Inspection and Churn		N/A	1M	1M	1M	1M	2b, 4a, 5c-d, 6a	
<b>Time Directed Tasks</b>								
		Task Frequencies				Failure Codes		Comments
Inspection and Maintenance of Automatic Water Sprinkler System		N/A	3M	3M	3M	3M	2b, 2d	
CO <sub>2</sub> System Functional Test and Maintenance		1Y	1Y	1Y	1Y	1Y	2c	
Clean Agent System Functional Test and Maintenance		1Y	1Y	1Y	1Y	1Y	2b, 2c, 3a, 5a, 6a	
Sprinkler System Functional Test and Maintenance		N/A	1Y	1Y	1Y	1Y	2b, 2c, 3a, 5a, 6a	
Water Mist System Functional Test and Maintenance		N/A	1Y	1Y	1Y	1Y	2b, 2c, 3a, 5a, 6a	
Fire Detection System Maintenance		1Y	1Y	1Y	1Y	1Y	1a, 2b, 3a, 6a	
Fire Extinguisher Maintenance		1Y	1Y	1Y	1Y	1Y	2c	
Fire Hydrant Maintenance		1Y	1Y	1Y	1Y	1Y	5a	
Inspection of Fire Louvers		1Y	1Y	1Y	1Y	1Y	2b	
							Locations with CO <sub>2</sub> and Clean Agent systems.	
Inspection of Manual Water Deluge System		1Y	1Y	1Y	1Y	1Y	2b, 4b	
Inspection and Test of Backflow Devices		1Y	1Y	1Y	1Y	1Y	2b,5a	
Inspection and Test of Fire Pumps		1Y	1Y	1Y	1Y	1Y	2b,5a, 5c-d, 6a	
Drain/Refill of Water Storage Tanks		N/A	1Y	1Y	1Y	1Y	2b-d, 5b	
Water Mist System Discharge Test		N/A	3Y	3Y	3Y	3Y	2b, 5a-b	
Sprinkler System Bypass Valve Flow Test		N/A	3Y	3Y	3Y	3Y	2b, 5a-b	
Suppression System Internal Inspection		N/A	5Y	5Y	5Y	5Y	2b, 5b	
							Limited to water based system pipping	
Fire Extinguisher Hydrostatic Testing		5Y	5Y	5Y	5Y	5Y	2d	
<b>Failure Finding Tasks</b>								
		Task Frequencies				Failure Codes		Comments
None		N/A	N/A	N/A	N/A	N/A		
<b>Condition Directed Tasks</b>								
		Task Frequencies				Failure Codes		Comments
None		N/A	N/A	N/A	N/A	N/A		

**FIRE PROTECTION FAILURE MODES**

<b>FAILURE MODES</b>	<b>FAILURE CAUSES</b>	<b>MAINTENANCE TASKS</b>
1. Fails to Alarm	1a. Control Panel Failure	Visual Inspection of Fire Protection System
1. Fails to Alarm	1a. Control Panel Failure	CO <sub>2</sub> System Visual Inspection
1. Fails to Alarm	1a. Control Panel Failure	Clean Agent System Visual Inspection
1. Fails to Alarm	1a. Control Panel Failure	Fire Detection System Maintenance
1. Fails to Alarm	1a. Control Panel Failure	Visual Inspection of Sprinkler System
1. Fails to Alarm	1a. Control Panel Failure	Visual Inspection of Clean Agent System
1. Fails to Alarm	1a. Control Panel Failure	Visual Inspection of Water Mist System
2. Fails to Operate	2a. Control Panel Failure	Visual Inspection of Fire Protection System
2. Fails to Operate	2b. Component Failure	Fire Extinguisher Inspection
2. Fails to Operate	2b. Component Failure	CO <sub>2</sub> System Visual Inspection
2. Fails to Alarm	2b. Control Panel Failure	Clean Agent System Visual Inspection
2. Fails to Operate	2b. Component Failure	Fire Detection System Maintenance
2. Fails to Operate	2b. Component Failure	Inspection of Fire Louvers
2. Fails to Operate	2b. Component Failure	Inspection of Manual Water Deluge System
2. Fails to Operate	2b. Component Failure	Inspection and Test of Backflow Devices
2. Fails to Operate	2b. Component Failure	Inspection and Test of Fire Pumps
2. Fails to Operate	2b. Component Failure	Visual Inspection of Sprinkler System
2. Fails to Operate	2b. Component Failure	Visual Inspection of Clean Agent System
2. Fails to Operate	2b. Component Failure	Visual Inspection of Water Mist System
2. Fails to Operate	2b. Component Failure	Sprinkler System Functional Test and Maintenance
2. Fails to Operate	2b. Component Failure	Clean Agent System Functional Test and Maintenance
2. Fails to Operate	2b. Component Failure	Water Mist System Functional Test and Maintenance
2. Fails to Operate	2b. Component Failure	Fire Pump Inspection and Churn
2. Fails to Operate	2b. Component Failure	Inspection and Maintenance of Automatic Water Sprinkler System
2. Fails to Operate	2b. Component Failure	Water Mist System Discharge Test
2. Fails to Operate	2b. Component Failure	Sprinkler System Bypass Valve Flow Test
2. Fails to Operate	2b. Component Failure	Suppression System Internal Inspection
2. Fails to Operate	2b. Component Failure	Drain/Refill of Water Storage Tanks
2. Fails to Operate	2c. Empty / Low Pressure	CO <sub>2</sub> System Visual Inspection
2. Fails to Alarm	2c. Control Panel Failure	Clean Agent System Visual Inspection
2. Fails to Operate	2c. Empty / Low Pressure	CO <sub>2</sub> System Functional Test and Maintenance
2. Fails to Operate	2c. Empty / Low Pressure	Drain/Refill of Water Storage Tanks
2. Fails to Operate	2c. Empty / Low Pressure	Sprinkler System Functional Test and Maintenance
2. Fails to Operate	2c. Empty / Low Pressure	Clean Agent System Functional Test and Maintenance
2. Fails to Operate	2c. Empty / Low Pressure	Water Mist System Functional Test and Maintenance
2. Fails to Operate	2d. Leaks	Fire Extinguisher Hydrostatic Testing
2. Fails to Operate	2d. Leaks	CO <sub>2</sub> System Visual Inspection
2. Fails to Operate	2d. Leaks	Visual Inspection of Sprinkler System
2. Fails to Operate	2d. Leaks	Visual Inspection of Clean Agent System
2. Fails to Operate	2d. Leaks	Visual Inspection of Water Mist System
2. Fails to Operate	2d. Leaks	Drain/Refill of Water Storage Tanks
2. Fails to Operate	2d. Leaks	Inspection and Maintenance of Automatic Water Sprinkler System
2. Fails to Alarm	2d. Control Panel Failure	Clean Agent System Visual Inspection
3. Fails to Detect	3a. Damaged, Broken or Missing Detector	Visual Inspection of Fire Protection System
3. Fails to Detect	3a. Damaged, Broken or Missing Detector	Fire Detection System Maintenance
3. Fails to Detect	3a. Damaged, Broken or Missing Detector	Sprinkler System Functional Test and Maintenance
3. Fails to Detect	3a. Damaged, Broken or Missing Detector	Clean Agent System Functional Test and Maintenance
3. Fails to Detect	3a. Damaged, Broken or Missing Detector	Water Mist System Functional Test and Maintenance
4. Fails to Meet Local Code or Ordinance	4a. Burned Out Bulb(s)	Visual Inspection of Fire Protection System
4. Fails to Meet Local Code or Ordinance	4a. Burned Out Bulb(s)	Fire Pump Inspection and Churn
4. Fails to Meet Local Code or Ordinance	4b. Missing or Incorrect Signage	Visual Inspection of Fire Protection System
4. Fails to Meet Local Code or Ordinance	4b. Missing or Incorrect Signage	CO <sub>2</sub> System Visual Inspection
4. Fails to Meet Local Code or Ordinance	4b. Missing or Incorrect Signage	Inspection of Manual Water Deluge System
5. Fails to Deliver Adequate Water Flow	5a. Malfunction of the Valves or Back-flow Valve	Fire Hydrant Maintenance
5. Fails to Deliver Adequate Water Flow	5a. Malfunction of the Valves or Back-flow Valve	Inspection and Test of Backflow Devices
5. Fails to Deliver Adequate Water Flow	5a. Malfunction of the Valves or Back-flow Valve	Inspection and Test of Fire Pumps
5. Fails to Deliver Adequate Water Flow	5a. Malfunction of the Valves or Back-flow Valve	Water Mist System Discharge Test
5. Fails to Deliver Adequate Water Flow	5a. Malfunction of the Valves or Back-flow Valve	Sprinkler System Bypass Valve Flow Test
5. Fails to Deliver Adequate Water Flow	5a. Malfunction of the Valves or Back-flow Valve	Sprinkler System Functional Test and Maintenance
5. Fails to Deliver Adequate Water Flow	5a. Malfunction of the Valves or Back-flow Valve	Clean Agent System Functional Test and Maintenance
5. Fails to Deliver Adequate Water Flow	5a. Malfunction of the Valves or Back-flow Valve	Water Mist System Functional Test and Maintenance
5. Fails to Deliver Adequate Water Flow	5b. Piping Blockage or Obstruction	Suppression System Internal Inspection
5. Fails to Deliver Adequate Water Flow	5b. Piping Blockage or Obstruction	Water Mist System Discharge Test
5. Fails to Deliver Adequate Water Flow	5b. Piping Blockage or Obstruction	Sprinkler System Bypass Valve Flow Test
5. Fails to Deliver Adequate Water Flow	5b. Piping Blockage or Obstruction	Drain/Refill of Water Storage Tanks
5. Fails to Deliver Adequate Water Flow	5c. Pump failure	Fire Pump Inspection and Churn
5. Fails to Deliver Adequate Water Flow	5c. Pump failure	Inspection and Test of Fire Pumps
5. Fails to Deliver Adequate Water Flow	5d. Engine / Motor failure	Fire Pump Inspection and Churn
5. Fails to Deliver Adequate Water Flow	5d. Engine / Motor failure	Inspection and Test of Fire Pumps
6. Unintended System Initiation	6a. Defective Fire Detection or Initiation System	Fire Detection System Maintenance
6. Unintended System Initiation	6a. Defective Fire Detection or Initiation System	Sprinkler System Functional Test and Maintenance
6. Unintended System Initiation	6a. Defective Fire Detection or Initiation System	Clean Agent System Functional Test and Maintenance
6. Unintended System Initiation	6a. Defective Fire Detection or Initiation System	Water Mist System Functional Test and Maintenance
6. Unintended System Initiation	6a. Defective Fire Detection or Initiation System	Fire Pump Inspection and Churn
6. Unintended System Initiation	6a. Defective Fire Detection or Initiation System	Inspection and Test of Fire Pumps

## FIRE PROTECTION MAINTENANCE TASK DEFINITIONS

TASK	DEFINITION
Clean Agent System Functional Test and Maintenance	Functional test and maintenance of the Clean Agent suppression system shall be conducted per NFPA -2001. Note date of last hydrostatic test of hoses (if applicable) and gas cylinders. The enclosure protected by the clean agent shall be thoroughly inspected to determine if penetrations have occurred that could lead to agent leakage, if other changes have occurred that could change volume of hazard, or both. Report any defects by exception.
Clean Agent System Visual Inspection	Visually inspect Clean Agent system for signs of damage to nozzles, associated piping and Clean Agent gas cylinders. Check Clean Agent gas cylinders restraints are properly secured. Inspect for proper liquid levels and pressures for systems without supervisories / communication to SCADA.
CO <sub>2</sub> System Functional Test and Maintenance	Functionally test CO <sub>2</sub> system, including check for proper alarm activation. Weigh high pressure (above 850psi) cylinders, note date of last hydrostatic test and operate control heads.
CO <sub>2</sub> System Visual Inspection	Visually inspect carbon dioxide extinguishing system to confirm proper liquid levels and pressures. The inspection should assure the system is free of damage and is in ready condition.
Drain/Refill of Water Storage Tanks	Drain/refill of water tanks per current contract. Fulfill weekly, monthly, quarterly, and semi-annual requirements as stipulated in NFPA 25
Fire Detection System Maintenance	Inspect, test and maintain in accordance with equipment manufacturer's instructions.
Fire Extinguisher Hydrostatic Testing	Hydrostatically test or replace with pre-tested fire extinguisher.
Fire Extinguisher Inspection	Inspect visually for correct placement, unobstructed access and physical condition. Verify inspection tag is up to date.
Fire Extinguisher Maintenance	Thoroughly examine all mechanical parts, the extinguishing agent, and the expelling means.
Fire Hydrant Maintenance	Test to determine adequate water flow and pressure at the hydrant.
Fire Pump Inspection and Churn	Inspection, testing, and maintenance with a churn test per current contract in accordance with NFPA 25. Fulfill weekly, monthly, quarterly, and semi-annual requirements as stipulated in NFPA 25.
Inspection and Test of Backflow Devices	Backflow prevention device assemblies shall be tested in accordance with local municipality requirements.

## FIRE PROTECTION MAINTENANCE TASK DEFINITIONS

Inspection and Test of Fire Pumps	Inspection of the Fire Pump shall be conducted per NFPA -25.
Inspection of Fire Louvers	Visual assessment of the condition of fire louvers and associated mechanism. Items to check include: -- Verify thermal links installed (if appropriate) and intact
Inspection and Maintenance of Automatic Water Sprinkler System	Main drain test and inspection, functional testing, and maintenance of switches (i.e. low temp, tamper, waterflow, etc.), alarms, and supervisory functions per current contract. Fulfill weekly, monthly, and quarterly requirements as stipulated in NFPA 25.
Inspection of Manual Water Deluge System	Visual assessment of the condition of the deluge system. Items to check include: -- Verify that signs and placards are in place at the fire department connection -- Verify that signs and placard labels match the intended equipment -- Verify that caps are hand tight on the fire department connections -- Verify that the deluge sprinklers heads are unobstructed -- Verify that pipes and hangers are in general good repair (no obvious damage, pipes hanging, heads missing, or other potential problems)
Sprinkler System Bypass Valve Flow Test	Flow test to check operability and flow through the critical dry, deluge, and preaction valve per current contract in accordance with NFPA 25. System Bypass valve (bypassing critical substation electrical equipment from being impacted by water) is used during test.
Sprinkler System Functional Test and Maintenance	Functionally test Sprinkler System, including check for proper alarm / supervisory activation and valve operation.
Sprinkler System Visual Inspection	Visually inspect Sprinkler System for signs of damage to nozzles and associated piping: signs of leakage (wet system); free of corrosion, foreign materials, paint, and physical damage. Gauges shall be inspected to ensure that normal air and water pressures are being maintained for systems without supervisor / communication to SCADA. Sprinkler System valve enclosure heating equipment shall be inspected for proper operation.
Suppression System Internal Inspection	Internal inspection of all piping system and equipment such as, but not limited to: all valves, piping, strainers, filters, orifices, feed mains that make up the deluge, preaction, dry valve, and wet systems per current contract in accordance with NFPA 25

## FIRE PROTECTION MAINTENANCE TASK DEFINITIONS

Visual Inspection of Fire Protection System	Visual inspection of fire protection system to assure readiness for operation, ordinance requirements met and all components in service.
Water Mist System Discharge Test	Discharge test (use bypass flow vave if present) for Vortex water mist systems to check the operability and flow through the critical deluge valve per current contract in accordance with NFPA 25
Water Mist System Functional Test and Maintenance	Water Mist System components and systems shall be inspected and tested to verify that they function as intended, including check for proper alarm / supervisory activation and valve operation. Note date of last hydrostatic test of hoses (if applicable) and gas cylinders (if applicable). The enclosure protected by the system shall be thoroughly inspected to determine if penetrations have occurred that could lead to Water Mist leakage, if other changes have occurred that could change volume of hazard, or both. Report any defects by exception.
Water Mist System Visual Inspection	Visually inspect Water Mist System for signs of damage to nozzles and associated piping: signs of water tank leakage; free of corrosion, foreign materials, paint, and physical damage. Check gas cylinders (if applicable) are properly secured. Inspect for proper tank water levels and pressures, where applicable, for systems without supervisories / communication to SCADA. Valve / tank enclosure heating equipment shall be inspected for proper operation.

# FIRE PROTECTION MAINTENANCE BASIS

## Fire Protection - Buildings / Yards - Template Summary

The Preventive Maintenance program is documented via maintenance templates. Templates have been developed that address transmission, substation, and distribution equipment that is owned and maintained by Exelon Utilities. Each template documents the program tasks, frequencies, failure modes, and maintenance basis for the associated equipment. Tasks and associated frequencies are designed to address known failure modes of the equipment covered by the template. In general, the tasks included in the maintenance templates are the result of good industry practices, industry experience, and manufacturer recommendations.

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### References:

Internal reports and operating experience

NFPA 10: Standard for Portable Fire Extinguishers

NFPA 12: Standard on Carbon Dioxide Extinguishing Systems

NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems

NFPA 25: Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

NFPA 72: National Fire Alarm Code

NFPA 750: Standard on Water Mist Fire Protection Systems

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### Boundary Definition

The boundary of fire protection systems for the purpose of this document is defined to

- Central control / alarm panel

- Smoke and fire sensors with associated wiring

- Portable extinguishers

- Fixed fire suppression systems (including piping, tanks and controls)

Excluded from this treatment are: SCADA and other alarm / communication systems.

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### Failure Experiences

In general equipment failures are subject to ACE/RCI investigation. Findings/recommended corrective actions are incorporated into the template as required.

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### Vendor Recommendations

N/A

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# FIRE PROTECTION MAINTENANCE BASIS

## Disposition of Vendor Recommendations

N/A

## Basis For Template Tasks

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**Clean Agent Functional Test and Maintenance:** This inspection approximates real-time condition monitoring that can detect developing problems and degradation, and provides condition data used to initiate corrective actions.

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**CO<sub>2</sub> System Visual Inspection:** Verifies that the system components are in proper configuration for potential operation and are free of physical damage. Approximates real-time condition monitoring that can detect developing problems and degradation, and provides condition data used to initiate corrective actions.

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**Drain/Refill of Water Storage Tanks:** Draining and refilling of Water Storage Tanks used for Sprinkle Systems or Water Mist Systems ensures there is no water flow obstruction, no interior degradation of the tank, proper water level and quality.

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**Fire Detection System Maintenance:** Ensures that installed detection system components operate when called upon to do so.

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**Fire Extinguisher Hydrostatic Testing:** Ensures that fire extinguishers can remain pressurized safely, especially when there is evidence of corrosion or mechanical injury to the

## FIRE PROTECTION TEMPLATE DEVELOPMENT HISTORY

<b>Revision 0</b>		<b>Date 10/30/2015</b>
Writer	Hugo Castaneda (Material Condition)	
Reviewer(s)	Ken Wendt, Ron Diotallevi, Vincen Smith	
Approver(s)	Michael Moy (UFAM ComEd)	
Reason Written	Created to document the ComEd maintenance program tasks, frequencies, failure modes, and maintenance basis.	

<b>Revision 1</b>		<b>Date 10/27/2017</b>
Writer	Hugo Castaneda (ComEd Material Condition)	
Reviewer(s)	Dale Player (ComEd), Nitin Patel (ComEd), Vincen Smith (ComEd), Ron Diotallevi (ComEd), John Lithio (ComEd), Ismael Rivera Jr (Dresden Nuclear Station Systems Engineer), Travis Greene (Byron Nuclear Station Systems Engineer), Sachin Shukla (Braidwood Nuclear Station Systems Engineer), Aaron Kulow (Quad Cities Nuclear Station Systems Engineer), Kent Nelson (LaSalle Nuclear Station Systems Engineer)	
Approver(s)	Michael Moy (UFAM ComEd)	
Reason Written	Revised to reflect additional of Clean Agent suppression at $\geq 220\text{kV}$ Nuclear Switchyards. In addition, Sprinkler system quarterly inspection, Fire Pump inspection/churn, water based discharge tests and water storage tank drain tasks were added to reflect ComEd best practices.	