

SUBSTATION BUILDING - Control							
Component Classification Categories							
Criticality	I	X					Nuclear Switchyards ≥ 220kV as defined in the respective Nuclear Plant Interface Requirements (NPIRs)* DC, SS, TDC, TSS locations that serve O'Hare & Midway Airports, Locations exclusive of Criticalities I & II, DC locations and ≤34kV ESS locations DC locations ≤34kV ESS locations
	II		X				
	III			X			
	IV				X		
	V					X	
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	N/A	N/A	N/A	N/A	N/A	
	Spare	N/A	N/A	N/A	N/A	N/A	
Condition Monitoring Tasks		Task Frequencies			Failure Codes		Comments
None		N/A	N/A	N/A	N/A	N/A	
Time Directed Tasks		Task Frequencies			Failure Codes		Comments
HVAC Maintenance		6M	6M	6M	6M	6M	1a Applies only to buildings that have heat pumps, central air conditioning units and/or central heating systems.
Ventilation System Maintenance		3Y	3Y	3Y	3Y	3Y	1c Applies only to buildings that have large, serviceable air handling systems (≥250k CFM or ≥ 5 HP Motors)
Failure Finding Tasks		Task Frequencies			Failure Codes		Comments
Emergency Lights Functional Check		5W	5W	10W	3M	6M	3a
Intrusion Alarm Functional Check		5W	5W	10W	3M	6M	3b
Ventilation System Functional Check		5W	5W	10W	3M	6M	1c
Visual Inspection		5W	5W	10W	3M	6M	1a, 1b
Check Roof Drains		3M	3M	3M	3M	3M	2a Parapet roofs only.
Detailed Roof Drain Inspection		N/A	6M	6M	6M	6M	2a Parapet roofs only, limited to areas with high debris / vegetation or Cap Banks on roof.
Cable Space/Basement Inspection		1Y	1Y	1Y	1Y	1Y	1d, 2b, 3c
Thermography of Cable Space/Basement		1Y	1Y	1Y	1Y	1Y	4a Where solid dielectric cable joints present; excludes joints covered with fire-wrap material
Roof Inspection - All Other Roofs		3Y	3Y	3Y	3Y	3Y	2a Where the condition of the roof is degraded, 1Y inspections are acceptable (Previous inspection results will determine if required)
Roof Inspection - PitchedShingle / Metal Roof		3Y	6Y	6Y	6Y	6Y	2a Where the condition of the roof is degraded, 1Y inspections are acceptable (Previous inspection results will determine if required)
Roof Inspection - Multiple Membrane Roof		3Y	6Y	6Y	6Y	6Y	2a Where the condition of the roof is degraded, 1Y inspections are acceptable (Previous inspection results will determine if required)
Condition Directed Tasks		Task Frequencies			Failure Codes		Comments
None		N/A	N/A	N/A	N/A	N/A	

*Refer to NPIRs and Interface Procedure for division of labor responsibility

SUBSTATION BUILDING - Other								
Component Classification Categories								
Criticality	I	X						
	II		X					
	III			X				
	IV				X			
	V					X		
	VI						X	
Duty Cycle	Heavy Load	N/A	N/A	N/A	N/A	N/A	N/A	
	Normal Load	N/A	N/A	N/A	N/A	N/A	N/A	
Service Condition	In Service	N/A	N/A	N/A	N/A	N/A	N/A	
	Spare	N/A	N/A	N/A	N/A	N/A	N/A	
Condition Monitoring Tasks		Task Frequencies					Failure Codes	
None		N/A	N/A	N/A	N/A	N/A	N/A	
Time Directed Tasks		Task Frequencies					Failure Codes	
HVAC Maintenance		6M	6M	6M	6M	6M	6M	
Ventilation System Maintenance		3Y	3Y	3Y	3Y	3Y	N/A	
Failure Finding Tasks		Task Frequencies					Failure Codes	
Emergency Lights Functional Check		5W	5W	10W	3M	6M	10W	
Intrusion Alarm Functional Check		5W	5W	10W	3M	6M	10W	
Ventilation System Functional Check		5W	5W	10W	3M	6M	10W	
Visual Inspection		5W	5W	10W	3M	6M	10W	
Check Roof Drains		3M	3M	3M	3M	3M	3M	
Detailed Roof Drain Inspection		N/A	6M	6M	6M	6M	6M	
Cable Space/Basement Inspection		AR	AR	AR	AR	AR	AR	
Roof Inspection - All Other Roofs		3Y	3Y	3Y	3Y	3Y	3Y	
Roof Inspection - Pitched Shingle / Metal Roof		3Y	6Y	6Y	6Y	6Y	6Y	
Roof Inspection - Multiple Membrane Roof		3Y	6Y	6Y	6Y	6Y	6Y	
Condition Directed Tasks		Task Frequencies					Failure Codes	
None		N/A	N/A	N/A	N/A	N/A	N/A	

*Refer to NPIRs and Interface Procedure for division of labor responsibility

BUILDING FAILURE MODES

FAILURE MODES	FAILURE CAUSES	MAINTENANCE TASKS
1. Fails to Provide Stable Interior Environment	1a. HVAC Failure	HVAC Maintenance
1. Fails to Provide Stable Interior Environment	1a. HVAC Failure	Visual Inspection
1. Fails to Provide Stable Interior Environment	1b. Open / Closed Ventilation Openings	Visual Inspection
1. Fails to Provide Stable Interior Environment	1c. Ventilation / Fan Failure	Ventilation System Maintenance
1. Fails to Provide Stable Interior Environment	1c. Ventilation / Fan Failure	Ventilation System Functional Check
1. Fails to Provide Stable Interior Environment	1d. Corrosion	Cable Space/Basement Inspection
2. Fails to Keep Out the Elements	2a. Leaks	Roof Inspection
2. Fails to Keep Out the Elements	2a. Leaks	Check Roof Drains
2. Fails to Keep Out the Elements	2a. Leaks	Detailed Roof Drain Inspection
2. Fails to Keep Out the Elements	2a. Leaks	Cable Space/Basement Inspection
2. Fails to Keep Out the Elements	2b. Wildlife	Cable Space/Basement Inspection
3. Fails to Provide Safe / Secure Environment	3a. Emergency Lights Failure	Emergency Lights Functional Check
3. Fails to Provide Safe / Secure Environment	3b. Unauthorized Entry	Intrusion Alarm Functional Check
3. Fails to Provide Safe / Secure Environment	3c. Bulged / collapsed cable joints	Cable Space/Basement Inspection
4. Fails to Provide Conduction Path	4a. Cable Joint Heating	Thermography of Cable Space/Basement

BUILDING MAINTENANCE TASK DEFINITIONS

TASK
Cable Space/Basement Inspection
Check Roof Drains
Detailed Roof Drain Inspection
Emergency Lights Functional Check
HVAC Maintenance
Intrusion Alarm Functional Check
Roof Inspection
Thermography of Cable Space/Basement
Ventilation System Functional Check
Ventilation System Maintenance
Visual Inspection

BUILDING MAINTENANCE TASK DEFINITIONS

DEFINITION
Visual assessment of the condition of the cable space / basement. Inspection should include a check and record of the following: safety items (bulged or collapsed cable joints), functional access doors with appropriate guards, evidence of rodent and insect intrusion, housekeeping issues, excessive flooding, visual assessment of cable support structures and other metal structures, cable trays, and control cable.
Inspection of roof drains for signs of clogging.
Perform a thorough visual inspection of the roof surface and drains. Check roof for signs of leaks, cracks, large debris, punctures, or deterioration. Inspect roof drains for signs of clogging and remove as necessary. This task is intended to be performed by accessing the top of the roof.
Check of emergency lights for proper operation. Includes check that emergency light bulbs are appropriate wattage.
Periodic maintenance of the heating and cooling system in buildings with central air conditioners and/ or central heating systems. Need to ensure that installed climate control units are operating properly.
Check door entry sensors are functional and initiate remote alarm. Verify none of the sensors are disabled or disconnected.
Perform a thorough visual inspection of the roof surface. Check roof for signs of leaks, cracks, punctures, or deterioration.
Infrared inspection of electric equipment and power path components to identify hot spots that may exist in concentric neutral joints for solid dielectric cable located in the basement of substation control building.
Inspection and functional check of the ventilation system.
Inspection, lubrication and maintenance of the ventilation system, including thermostats and roof mounted fans.
Visual assessment of the condition of the substation buildings. Inspection includes, but is not limited to, a check and record of the following: safety items (fire extinguishers and exit lighting, eye wash station, covered floor openings, etc.), rodent and insect intrusion, housekeeping issues, doors / locks / security, interior and exterior lighting, lighted exit signs (where installed), visual assessment of structure, cable trays, control panels, alarms and relay targets.

BUILDING MAINTENANCE BASIS

Substation Building 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.

References:

Internal reports and operating experience
EPRI 10011779 Guidelines for the Life Extension of Substations

Applicability

Substation Building - Control: Buildings that house control, Outdoor Switchgear roofs and protection devices for equipment within the substation.

Substation Building - Other: Buildings whose purpose is to house equipment / facilities other than control and protection devices for equipment within the substation. For example, oil pumping plants (normally located at Transmission Terminals), storage buildings, communication buildings, etc.

Boundary Definition

The boundary of a substation building for the purpose of this document is defined to include the structure as well as any heating, cooling or ventilation systems, cable space / basement components.

Excluded from this treatment are: Sump systems are addressed in a separate template.

Transmission Terminals: Are sites (69kV & up and not applicable at Nuclear Switchyards) where transmission lines transition from an overhead construction to underground construction. Transmission Terminals may be within a fenced in area or may consist of special terminal structures only. A Transmission Terminal site may contain more than one transmission circuit.

Failure Experiences

Added task associated with thermography of solid dielectric cable concentric neutral joints when located in the basement of substation control building. RCI associated with Downers Grove fire indicated that root cause of failure was attributed to cable joint failure. Failure mode has been determined to be detectable using thermography. AR 22369 was assigned for update of this template to reflect recommended test methods based on Distribution Standards technical recommendation.

Vendor Recommendations

N/A

Disposition of Vendor Recommendations

N/A

Basis For Template Tasks

Cable Space/Basement Inspection: This inspection approximates real-time condition monitoring that can detect developing problems and degradation, and provides condition data used to initiate corrective actions.

Check Roof Drains: Blocked drains increase chances of leaks and water damage to building structures.

Detailed Roof Drain Inspection: Blocked drains increase chances of leaks and water damage to building structures. Roof degradation can increase chances of leaks and water damage to building structures. Detailed inspection intended for known roofs with heavy debris areas. Inspection maybe increased based on previous inspection results.

Emergency Lights Functional Check: Emergency lighting is often fed from the station battery and provides illumination in case of loss of station aux power.

BUILDING MAINTENANCE BASIS

HVAC Maintenance: Periodic maintenance of the heating and cooling system in buildings with heat pumps, central air conditioners and/or central heating systems is required to maintain stable temperatures within the building.

Intrusion Alarm Functional Check: Substation buildings are equipped with door entry alarms. Alarms should be verified operational, not disabled and able to alarm remotely when activated.

Roof Inspection: Roof degradation can increase chances of leaks and water damage to building structures.

Operating experience suggests that roofs greater than 20 years old, have led to two or more equipment failures in a year timeframe and/or a roof population exhibits a 20% or greater annual issue find rate, 1Y inspections may be appropriate.

Thermography of Cable Space / Basement: IEEE Standard 62 identifies thermography as a primary tool for detection of hot spots. The scope of the thermographic inspection is solid dielectric cable concentric neutral joints when located in the basement of substation control building.

Ventilation System Functional Check: Ensure that ventilation system is operational and thermostats are functional.

Ventilation System Maintenance: Ensure proper operation of the ventilation system.

BUILDING TEMPLATE DEVELOPMENT HISTORY

Revision CE 0		Date 12/04/2015
Writer	Hugo Castaneda	
Reviewer(s)	Ken Wendt, Eric Jensen, David Williams, Nitin Patel	
Approver(s)	Michael Moy (UFAM ComEd)	
Reason Written	Revised criticality definitions and modified former PECO/ComEd document to serve as the ComEd maintenance standard.	

Revision CE 1		Date 12/14/2018
Writer	Hugo Castaneda (ComEd Material Condition)	
Reviewer(s)	Dale Player (Mgr Material Condition), Tony O'Connor (Sr Engineer, T&S Engineering Standards & Applications) Betsy Spolarich (Prin Work Plan Coordinator, ComEd T&S Equipment Stds), Terrence Myelle (Byron Strategic Elec Eng Branch Manager), Jeff Snyder (LaSalle BOP Eng Manager), Joe Haluska (Quad Cities Eng Manager), Adam Kambic (Braidwood Strategic Engineering Branch Manager), Ismael Rivera Jr (Dresden Sr Staff Engineer), Rizwan Ahmed (Exelon Corporate Switchyard Engineer), Aaron Kulow (Exelon Corporate Switchyard Engineer)	
Approver(s)	Michael Moy (UFAM ComEd)	
Reason Written	Revised document as part of the 3yr cycle review. Incorporated Transmission Terminals criticality with associated maintenance basis updated. Updated standard Nuclear Criticality verbiage and added a note to referene NPIRs and Interface Procedure for division of labor.	