

STRUCTURES - OHT			
Component Classification Categories			
Criticality	I	X	69 kV and above line structures
	II		
Duty Cycle	Heavy Load	N/A	
	Normal Load	N/A	
Service Condition	In Service	X	
	Spare	N/A	
Condition Monitoring Tasks			
None		N/A	
Time Directed Tasks			
Relamp Aerial and Navigation Obstruction Light - Non-LED		6M	3a-d
Relamp Aerial and Navigation Obstruction Light - Non-LED		1 Y	3a-d
Relamp Aerial and Navigational Obstruction Light - LED		8Y	3a-d
Functional Assessment for Aerial and Navigation Obstruction Lighting - LED		2Y	3a-d
Failure Finding Tasks			
Visual Inspection - Comprehensive Aerial		4Y	1a-d, 1f-i, 2a-b, 3a-d
Visual Inspection - Standard Aerial		1Y	1a-d, 1h, 3a-d
Visual Inspection - Ground Patrol		1Y	1a-d, 1f-i, 2a-c
			Lines/structures not accessible for <i>Visual Inspection - Standard Aerial</i> . 4 year as needed inspection of lines and structures as needed for ground line and low height defects which engineering has determined to be difficult to identify during the comprehensive aerial visual inspection. Ground patrol inspections shall be on a staggered cycle with respect to the comprehensive aerial inspection. The cycle should be aligned with the vegetation management cycle as much as possible.
Wood Pole Ground Line Inspection		10Y	1a-e, 1h, 2a-c
Condition Directed Tasks			
Climbing Inspection		AR	1f-i, 3a-d
			As Needed

This document is intended to depict maintenance activities for ComEd and are consistent with the North Star maintenance guidelines for Exelon Utilities. It is not intended to be used as "Evidence of Compliance" for regulatory audits or in support of regulatory Readiness Evaluations. Evidence of Compliance documents shall be owned and maintained at the individual OpCo level.

OHT STRUCTURES - FAILURE MODES

FAILURE MODE	FAILURE CAUSES	MAINTENANCE TASKS
1. Fails to Provide Support	1a. Damaged Due to Contact	Wood Pole Ground Line Inspection
1. Fails to Provide Support	1a. Damaged Due to Contact	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1a. Damaged Due to Contact	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1a. Damaged Due to Contact	Visual Inspection - Standard Aerial (with and without thermography)
1. Fails to Provide Support	1b. Wood Arm/Brace Broken/Deterioration/Cracks/Strength Loss	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1b. Wood Arm/Brace Broken/Deterioration/Cracks/Strength Loss	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1b. Wood Arm/Brace Broken/Deterioration/Cracks/Strength Loss	Visual Inspection - Standard Aerial (with and without thermography)
1. Fails to Provide Support	1b. Wood Arm/Brace Broken/Deterioration/Cracks/Strength Loss	Wood Pole Ground Line Inspection
1. Fails to Provide Support	1c. Wildlife Damage (woodpecker holes, eagle nest)	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1c. Wildlife Damage (woodpecker holes, eagle nest)	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1c. Wildlife Damage (woodpecker holes, eagle nest)	Wood Pole Ground Line Inspection
1. Fails to Provide Support	1c. Wildlife Damage (woodpecker holes, eagle nest)	Visual Inspection - Standard Aerial (with and without thermography)
1. Fails to Provide Support	1d. Fire Damage	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1d. Fire Damage	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1d. Fire Damage	Wood Pole Ground Line Inspection
1. Fails to Provide Support	1d. Fire Damage	Visual Inspection - Standard Aerial (with and without thermography)
1. Fails to Provide Support	1e. Wood Pole Decay at Ground line	Wood Pole Ground Line Inspection
1. Fails to Provide Support	1f. Abrasion/Wear of hardware attachment point	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1f. Abrasion/Wear of hardware attachment point	Climbing Inspection
1. Fails to Provide Support	1f. Abrasion/Wear of hardware attachment point	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1g. Missing Bolts at Member Connection	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1g. Missing Bolts at Member Connection	Climbing Inspection
1. Fails to Provide Support	1g. Missing Bolts at Member Connection	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1g. Missing Bolts at Member Connection	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1h. Broken/Slack Guy Wire(s)	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1h. Broken/Slack Guy Wire(s)	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1h. Broken/Slack Guy Wire(s)	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1h. Broken/Slack Guy Wire(s)	Wood Pole Ground Line Inspection
1. Fails to Provide Support	1h. Broken/Slack Guy Wire(s)	Climbing Inspection
1. Fails to Provide Support	1h. Broken/Slack Guy Wire(s)	Visual Inspection - Standard Aerial (with and without thermography)
1. Fails to Provide Support	1i. Steel Deterioration Due to Rust	Visual Inspection - Comprehensive Aerial
1. Fails to Provide Support	1i. Steel Deterioration Due to Rust	Visual Inspection - Ground Patrol (1yr, 5yr)
1. Fails to Provide Support	1i. Steel Deterioration Due to Rust	Climbing Inspection
2. Fails to Provide Adequate Path to Ground for Shield Wire	2a. Interrupted Current Path/Broken Bond Wire	Visual Inspection - Comprehensive Aerial
2. Fails to Provide Adequate Path to Ground for Shield Wire	2a. Interrupted Current Path/Broken Bond Wire	Visual Inspection - Ground Patrol (1yr, 5yr)
2. Fails to Provide Adequate Path to Ground for Shield Wire	2a. Interrupted Current Path/Broken Bond Wire	Wood Pole Ground Line Inspection
2. Fails to Provide Adequate Path to Ground for Shield Wire	2b. Interrupted Current Path/Broken Connection	Visual Inspection - Comprehensive Aerial
2. Fails to Provide Adequate Path to Ground for Shield Wire	2b. Interrupted Current Path/Broken Connection	Visual Inspection - Ground Patrol (1yr, 5yr)
2. Fails to Provide Adequate Path to Ground for Shield Wire	2b. Interrupted Current Path/Broken Connection	Wood Pole Ground Line Inspection
2. Fails to Provide Adequate Path to Ground for Shield Wire	2c. Inadequate Grounds at Pole Base	Visual Inspection - Ground Patrol (1yr, 5yr)
2. Fails to Provide Adequate Path to Ground for Shield Wire	2c. Inadequate Grounds at Pole Base	Visual Inspection - Comprehensive Aerial
2. Fails to Provide Adequate Path to Ground for Shield Wire	2c. Inadequate Grounds at Pole Base	Wood Pole Ground Line Inspection
3. Aerial Obstruction Light Fails to Operate	3a. Lamp Burnt Out	Relamp Aerial and Navigation Obstruction Light - Non-LED
3. Aerial Obstruction Light Fails to Operate	3a. Lamp Burnt Out	Relamp Aerial and Navigational Obstruction Light - LED
3. Aerial Obstruction Light Fails to Operate	3a. Lamp Burnt Out	Visual Inspection - Comprehensive Aerial
3. Aerial Obstruction Light Fails to Operate	3a. Lamp Burnt Out	Visual Inspection - Standard Aerial (with and without thermography)
3. Aerial Obstruction Light Fails to Operate	3a. Lamp Burnt Out	Functional Assessment for Aerial and Navigation Obstruction Lighting - LED
3. Aerial Obstruction Light Fails to Operate	3b. Damaged Base Fixture	Relamp Aerial and Navigation Obstruction Light - Non-LED
3. Aerial Obstruction Light Fails to Operate	3b. Damaged Base Fixture	Relamp Aerial and Navigational Obstruction Light - LED
3. Aerial Obstruction Light Fails to Operate	3b. Damaged Base Fixture	Visual Inspection - Comprehensive Aerial
3. Aerial Obstruction Light Fails to Operate	3b. Damaged Base Fixture	Visual Inspection - Standard Aerial (with and without thermography)
3. Aerial Obstruction Light Fails to Operate	3b. Damaged Base Fixture	Functional Assessment for Aerial and Navigation Obstruction Lighting - LED
3. Aerial Obstruction Light Fails to Operate	3c. Blown Arrestor	Relamp Aerial and Navigation Obstruction Light - Non-LED
3. Aerial Obstruction Light Fails to Operate	3c. Blown Arrestor	Relamp Aerial and Navigational Obstruction Light - LED
3. Aerial Obstruction Light Fails to Operate	3c. Blown Arrestor	Visual Inspection - Comprehensive Aerial
3. Aerial Obstruction Light Fails to Operate	3c. Blown Arrestor	Visual Inspection - Standard Aerial (with and without thermography)
3. Aerial Obstruction Light Fails to Operate	3c. Blown Arrestor	Functional Assessment for Aerial and Navigation Obstruction Lighting - LED
3. Aerial Obstruction Light Fails to Operate	3d. Failed Power Source	Relamp Aerial and Navigation Obstruction Light - Non-LED
3. Aerial Obstruction Light Fails to Operate	3d. Failed Power Source	Relamp Aerial and Navigational Obstruction Light - LED
3. Aerial Obstruction Light Fails to Operate	3d. Failed Power Source	Visual Inspection - Comprehensive Aerial

OHT STRUCTURES - FAILURE MODES

FAILURE MODE
3. Aerial Obstruction Light Fails to Operate
3. Aerial Obstruction Light Fails to Operate

FAILURE CAUSES
3d. Failed Power Source
3d. Failed Power Source

MAINTENANCE TASKS
Visual Inspection - Standard Aerial (with and without thermography)
Functional Assesment for Aerial and Navigation Obstruction Lighting - LED

OHT STRUCTURES - MAINTENANCE TASK DEFINITION

TASK	DEFINITION
Climbing Inspection	Performed on as needed basis, when additional inspection is warranted.
Wood Pole Ground Line Inspection	Inspection includes partial excavation of wood pole at ground line and boring to perform internal inspection. Perform selective treatment of wood poles, those showing signs of decay. Those reject poles which are candidates for replacement.
Relamp Aerial and Navigation Obstruction Light - Non-LED	Replace aerial obstruction lamp and inspect for worn/ damaged components.
Relamp Aerial and Navigational Obstruction Light - LED	Replace aerial obstruction lamp and inspect for worn/ damaged components.
Functional Assesment for Aerial and Navigation Obstruction Lighting - LED	Routine inspection of lighting system to verify correct operation
Visual Inspection - Comprehensive Aerial	Inspection performed aerially where accessible by helicopter. Inspection includes; all structure components, detailed inspection of hardware assemblies, detailed inspection of structural connections, detailed spacer analysis and detailed review of conductor/shield wire spans between structures. The speed of inspection averages 1.5 mph.
Visual Inspection - Ground Patrol (1yr)	Inspection performed from ground level due to inaccessibility by helicopter. --Inspection includes visual inspection of all major structural and electrical components as well as identification of significant damage to both shield wire and phase conductor.
Visual Inspection - Ground Patrol (5yr)	Inspection performed from ground level. --Inspection includes visual inspection of all major structural and electrical components as well as identification of significant damage to both shield wire and phase conductor.
Visual Inspection- Standard Aerial	Inspection performed aerially where accessible by helicopter. Inspection include: -major structure components -conductor/shield wire spans between structures.

OHT STRUCTURES - MAINTENANCE BASIS

OHT STRUCTURES 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
Interviews with OHT personnel

Boundary Definition

The boundary of a structure is defined to include all components of the structures which support phase conductors and shield wire. This includes the shaft or pole, arms, braces and connection points "pinning eyes". Switch structures are also included. The establishment of the boundary for the structure was based on the functional relationship between the components that comprise the equipment.

For the purpose of this template steel structures include lattice tower type, steel pole type and steel shaft with lattice arms.

For the purpose of this template wood structure types include H-frame, single pole and multi-pole.

Failure Experience

Failures are subject to ACE/RCI investigation. Findings/recommended corrective actions are incorporated into the template as required.

Vendor Recommendations

N/A

Disposition of Vendor Recommendations

N/A

Basis For Template Tasks

OHT STRUCTURES - MAINTENANCE BASIS

Climbing Inspection: Performed on as needed basis, when additional inspection is warranted.

Ground Line Inspection: The frequency for this task is based on industry experience. Effective treatment will extend the life of the existing wood structure. This inspection also is used to identify degradation and the need to initiate corrective actions such as structure replacement or reinforcement.

Relamp Aerial and Navigation Obstruction Light -LED: Task frequency is based on life of lamp.

Aerial Obstruction light are installed on structures in direct flight paths of airports and are required per FAA guidelines. Several structures outside airport flight paths are illuminated with beacon type lights. These structures are greater than 200 ft in height.

Relamp Aerial and Navigation Obstruction Light -Non-LED: Task frequency is based on life of lamp.

Aerial Obstruction light are installed on structures in direct flight paths of airports and are required per FAA guidelines. Several structures outside airport flight paths are illuminated with beacon type lights. These structures are greater than 200 ft in height.

Visual Inspection - Comprehensive Aerial: This inspection approximates real-time condition monitoring that can detect developing problems and degradation, and provides condition data used to initiate corrective actions. The comprehensive inspection is performed at a slower fly speed to allow for more detailed visual inspection of the structure.

Visual Inspection - Ground Patrol: This inspection approximates real-time condition monitoring that can detect developing problems and degradation, and provides condition data used to initiate corrective actions. More frequent inspections are used due to lack of visibility from aerial inspections from the obstructive terrain and urban congestion along the line.

Visual Inspection - Standard Aerial: This inspection approximates real-time condition monitoring that can detect developing problems and degradation, and provides condition data used to initiate corrective actions. When inspection is for the basis of thermography as a higher speed inspection speed is used

OHT STRUCTURES TEMPLATE DEVELOPMENT HISTORY

Revision 0		Date 06/17/2005
Writer	Howard Murray (Transmission Line Engineering)	
Reviewer(s)	3/4/05 Template Challenge Session Attendees	
Approver(s)	Kathy McHugh (FAM Maintenance Planning)	
Reason Written	To document the maintenance program tasks, frequencies, failure modes, and maintenance basis	
Revision 1		Date 12/01/2006
Writer	Howard Murray (Transmission Line Engineering)	
Reviewer(s)		
Approver(s)	Kathy McHugh (FAM Maintenance Planning)	
Reason Written	General scrub, task and periodicity review/update.	
Revision 2		Date 11/30/2010
Writer	Chuck Priebe	
Reviewer(s)	Ken Wendt (Mgr. Material Condition), Drew Reindel (Mgr. T&S Engineering)	
Approver(s)	Bill Fluhler , Bill Gannon, Nitin Patel, Jim Crane, Bill Sullivan	
Reason Written	Added note to ensure template changes are communicated to affected work groups.	
Revision 3		Date 02/17/2012
Writer	Antoine Morgan	
Reviewer(s)	Drew Reindel	
Approver(s)	Drew Davis	
Reason Written	Updated frequency ground patrol to once every five years for PECO system. Created ComEd and PECO sub sections for Ground Patrol task definitions and maintenance basis.	
Revision 4		Date 11/18/2014
Writer	Robert Munley, Stephen Dasovich, Howard Murray	
Reviewer(s)	George Leinhauser, Ken Wendt, Ken Braerman	
Approver(s)	J. Coffman, Cory Sommerson, Mike Moy	
Reason Written	Updated to align across BGE, ComEd, and PECO with incorporation of best practices.	
Revision 5		Date 2/2/2018
Writer	Howard Murray	
Reviewer(s)	Angelo DeAngelis (Material Condition)	
Approver(s)	Mike Moy (UFAM ComEd)	
Reason Written	3 year review, no content change.	