The National Electric Safety Code (NESC) discusses installation and maintenance of electric supply lines and equipment. Safeguarding personnel during installation, construction, and maintenance is the primary concern.

The 2002 Edition of the National Electrical Safety Code (NESC) provides basic safety requirements for the installation, operation or maintenance of outdoor communication and electric power facilities. It therefore complements the National Electrical Code (NEC) which provides requirements for indoor facilities. The NESC is intended to primarily focus on helping ensure the safety of employees and the public, and is not intended to be a design specification or instruction manual.

The NESC addresses maintenance of overhead lines:

- Section 214 - Inspection And Tests Of Lines And Equipment (overhead lines)
- Section 218 - Tree Trimming

Section 214 - Inspection And Tests Of Lines And Equipment

The rules for inspection and testing on lines and equipment are broken down into two parts, when in-service and when out-of-service. The open or closed status of a switch, fused cutout, recloser, etc., will determine if a line is in- or out-of-service. A line that is permanently abandoned must be removed or maintained in a safe condition. Opening the cutouts on the line and grounding the line may make it electrically safe but not structurally safe. If the permanently abandoned line is leaning or falling over, it must be removed or maintained in a safe condition.

Rule 214 applies to overhead supply and communications lines. Similar inspection rules are outlined in Rule 121 for electric supply stations and Rule 313 for underground lines.

Rule 214 does not provide a specific requirement as to how often to inspect overhead lines. The inspection frequency must be determined by the utility “at such intervals as experience has shown to be necessary.” This statement should consider what the local conditions are, for example, do poles rot faster in some areas due to acidic soil conditions, do insulators fail more in some areas due to salt fog, pollution from a nearby factory, lightning, etc. A utility must have an inspection program that has proper record keeping and inspection frequency; however, the frequency of the inspection must be determined by the utility. Finding out what other utilities use for an inspection frequency and making proper adjustments may be a starting point for a utility without an inspection program.

The Code recognizes that inspections may be performed as a separate duty or performed while performing other duties. This statement does not eliminate the need for an inspection program or permit an “inspect it only if I see it” program. If an employee notices a defect while performing another task, the defect must be corrected, not ignored.

Cutouts, switches, reclosers, circuit breakers, etc., are used to switch overhead lines and determine if a line is in or out of service. Rule 214, does not specify the inspection or testing intervals.

Section 218 - Tree Trimming

The NESC does not provide a specific clearance from a conductor (of any voltage) to a tree.

The Code recognizes that at times tree trimming or removal may not be practical.

If tree trimming or removal is not practical, the Code requires using methods to separate the conductor from the tree to avoid damage by abrasion and grounding. This requirement is very general. No specifics are provided as to how to accomplish the separation.

ComEd has three systematic programs related to its overhead distribution system:

1. An overhead circuit inspection program that visually inspects all feeder poles at least every four years:
    a. 2-year 34kV program
    b. 4-year 4-12kV program
2. An overhead circuit thermography inspection that visually inspects all main-line feeder poles at least every four years.
    a. 2-year 34kV program
    b. 4-year 4-12kV program
3. A wood pole inspection and treatment program that identifies poles 12 years old and older which have begun to deteriorate and provide supplemental treatment to prevent and halt further deterioration. ComEd crews are also required to perform a safety inspection on a pole before performing work on the pole.
    a. Variable
4. A vegetation management/line clearance program designed to minimize power interruptions and hazards caused by tree branches and other types of vegetation that come in contact with power lines.
    a. 4-year cycle

The following procedures provide additional details on Inspection And Tests Of Lines and Equipment or Tree Trimming:

AM-ED-P034 - Preventive and Predictive Maintenance Program
To provide guidelines for the development, documentation, implementation, and oversight of an effective preventive (PM) and predictive (PdM) maintenance program for the electric transmission, substation, and distribution assets. A successful maintenance program will ensure the reliability of the system.

AM-ED-P034-R0001 - EED PCM Template Index

Distribution Related PCM Templates
AM-ED-P034-R3002 Distribution Aerial Conductor
AM-ED-P034-R3007 Distribution Wood Poles

CM-ED-021001 - Overhead Distribution Circuit Inspection And Maintenance Procedure
ComEd uses in house Maintenance Inspectors to inspect its overhead circuit population (4kV, 12kV, 13kV, and 34kV overhead circuits).

ComEd Maintenance Inspectors perform a visual inspection of overhead primary conductors in order to identify repairs which may lead to an outage. The inspection identifies broken or damaged: arms, arresters, fault indicators, fused cutouts, grounds, insulators/deadends, poles, primary conductors, & tie wires.

The visual inspection identifies broken equipment such as crossarms, poles, insulators, cutouts, blown lightning arresters, and clearance issues.

ComEd performs regular maintenance and repairs on its equipment throughout the year.

ComEd has a prioritization system for all repairs.

Maintenance and repairs are prioritized in accordance to Work Management procedure WM-ED-P014 (Work Screening And Prioritization).

In general, repairs may be prioritized into four categories:

- Priority 10 repairs require an immediate response and will be worked 24/7 until they are complete. These are repairs that have an immediate impact on the number or length of customer power outages.
- Priority 20 repairs are required to begin within 24 hours, depending on system conditions (ie weather). The work is targeted for completion within 14 days.
- Priority 30 repairs must be completed within eight weeks
- Priority 40 repairs are longer-term items. They do not pose an impact on the number or length of power outages.

ComEd also has special “Fix it Now” teams that focus on making high-priority repairs to ensure they get done quickly and to avoid taking away resources from the more routine maintenance that we need to do.

ComEd spends between $40-$50 million per year on corrective maintenance on our overhead distribution system.

In non-storm situations, it is not unusual to have about 20 percent of our 1,000 overhead employees handling regular maintenance and repair work. This is in addition to underground workers handling similar assignment for the underground system.

On a typical day, we have about 200 field construction employee (75 crews) working on corrective maintenance.

Overhead Circuit Thermography Inspection

ComEd uses a contractor (United Pole Technologies) to inspect its overhead circuit population.

The overhead circuit thermography inspection is a reliability program. It has been in existence since 1999. It involves infrared inspection of electrical equipment along the overhead distribution feeders and visual inspection of poles and other equipment along the feeders. This program does not cover the lateral taps.

Overhead circuit thermography is a non-intrusive technique is used to monitor the operating condition of equipment and components. Thermography is a Preventive Maintenance (PM) tool that allows for the identification of anomalies prior to failure, and allows for the scheduling of corrective maintenance. It is a diagnostic inspection technology that is used to help determine maintenance requirements of the Distribution system.

An infrared camera is used to determine “hot-spots” (temperature variations) at equipment and electrical connections.

The thermography camera is detecting the energy levels from one surface and comparing that level with another surface. These energy levels show themselves as invisible light waves that are part of the electromagnetic spectrum known as infrared. Excessive temperature differences are a clue that something may not be operating properly.

The thermography inspection identifies thermal anomalies at bolted connections, splices, and disconnects.

Wood Pole Inspection
ComEd uses a contractor (Osmose Utilities Services, Inc) to inspect and treat its wood pole population.

During the inspection, the pole is checked for signs of decay. If decay is found, the pole is treated to stop the decay. The pole's remaining strength is evaluated based on the remaining healthy wood. If the remaining strength has dropped below 66% of the original strength, it is categorized as a "reject" pole. A pole is categorized as a "priority reject" if there is a hollow center and less than one inch of shell at any point around the circumference or with a completely decayed butt.

Rejected poles are then checked to determine if they can be restored via c-truss installation. This determination is largely based on factors above and beyond the natural decay of the pole. Some pole locations do not have available space to accommodate a c-truss installation. Those poles would be categorized as "non-restorable".

ComEd utilizes a method for pole reinforcement known as "c-trussing". With this method, a steel brace is driven into the ground alongside the pole. The c-truss is attached to the pole with steel banding. This is a cost effective measure to restore the pole to its original strength. This is considered a permanent repair.

ComEd has approximately 1.4 million utility poles

ComEd initiated an aggressive two-year program in 2005 and 2006 to address priority reject poles. Over the two-year period, a total of 6647 poles were addressed. A total of 2223 poles were replaced and 4424 poles were restored via c-truss installation.

The cost of our 2005-2006 program was $17 million.

This year we are spending about $1 million.

In 2007, we resumed a regular pole replacement program. This year, we have already replaced 122 poles, and we plan to replace another 85 before the end of the year.

We also replace poles on an emergency basis when they are damaged due to storms, vehicle accidents, etc. Since 2005, we have replaced about 3,800 poles on an emergent basis, or about 750 poles per year. We spend between $2 million and $6 million on emergent pole replacements each year.

ComEd distribution pole performance during non-storm conditions is good. Non-storm pole failures have virtually no contribution to customer interruptions.

As part of its routine engineering jobs to serve customers, ComEd also has many opportunities to inspect distribution poles. Such jobs include connecting and disconnecting overhead services, repair and/or replacement of devices on poles (crossarms, insulators, connectors, lightning arrestors, etc), streetlight repairs, and responses to trouble calls. Each of these jobs affords the opportunity to inspect the poles. Should there be any safety concerns or poor pole conditions, the crews or engineers would so note the condition and pass that information on to the FIN supervisor.

Vegetation Management/Line Clearance Program
ComEd uses a contractor (Asplundh Tree Expert Co) to perform line clearance activities.

4-year cycle (8,625miles/year)

The vegetation management/line clearance program is designed to minimize power interruptions and hazards caused by tree branches and other types of vegetation that come in contact with power lines. We clear limbs, trees, vines, and other plants away from power lines before they have a chance to damage facilities or equipment.

Our vegetation management contractors are specially trained and qualified to trim and remove trees in close proximity to electrical conductors. They are also trained in the proper arboricultural techniques. The pruning techniques utilized meet the standards set by the National Arborists Association and the International Society of Arboriculture.

CM-CE-9004 EED West Construction And Maintenance Walkdown And Job Closing
A field confirmation is conducted by a Construction Supervisor after the work has been completed in the field. This confirmation ensures the work has been performed per the design or “AS BUILT” design changes are identified on the construction drawings prior to returning to the designer.

AD-ED-105 Procedure Use And Adherence
ComEd provides direction to company or contractor personnel on the required reference to the procedure during performance of any work based on the relative probability of making an error and the impact of an error.

Expectations on the required reference to the procedures are categorized as Level 1, Level 2, and Level 3.

- Level 1 Procedure is a Continuous Use Procedure: Reading each step of the procedure prior to performing that step. A Level I Procedure SHALL be in the possession of the primary individual responsible for the proper performance of the task.
- Level 2 Procedure is a Reference Use Procedure: Referring to a procedure that is reasonably available at the work location for reference either prior to or periodically during the performance of an activity.
- Level 3 Procedure is an Information Use procedure: An activity that is typically performed from memory. The procedure is available, but not necessarily at the work location.

ComEd construction standards are considered a Level 2 Procedure and are available to construction workers at work locations for reference.

Training
TQ-ED-10 Training And Qualification Program
TQ-ED-104 On-The-Job Training And Evaluation Activities
TQ-ED-111 Overhead Electrician/Aerial Line Mechanic Training Program
The safe operation and maintenance of the electric distribution system is addressed in Occupational Safety and Health Administration (OSHA) 1910.269.

ComEd employees are trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their respective job assignments.

ComEd maintains Training And Qualification Program of its overhead construction workforce

Initial training provides personnel with requisite knowledge and skills to independently perform their job function.

Continuing training refreshes and improves the application of knowledge and job related skills for improved job performance.

ComEd trains and qualifies personnel in the knowledge and skills to perform their jobs in accordance with its construction standards. Training personnel are supported/augmented by construction line personnel in all progression training topics.

Overhead Electrician Training:
- Climbing School: A school that provides instruction in basic pole climbing techniques.
- Basic Line School: Entry-level training that provides the knowledge and skills required for personnel to safely and effectively perform the elementary tasks associated with their job.
- Single Phase School: Training that provides the technical knowledge skills and abilities required working single phase or multi-phase tasks where it is not necessary to reach over energized conductors to perform a given task.
- Three Phase School: Training that provides the technical knowledge, skills and abilities required for personnel to safely and effectively perform the higher level tasks associated with the job. Completion of these schools qualifies the worker to perform work on all types of construction with the exception of those skill considered specialty tasks.
- On-The-Job Training (OJT): Structured training activities conducted in the job environment, through which trainees achieve defined learning objectives.

Equipment Failure Investigation
AM-ED-1017 Equipment Failure Investigation Forensic Evidence Handling
AM-ED-129-8001 Electric Equipment And Component Failure Process
Electric Distribution Equipment (devices, equipment, hardware, cable, and wire) whose failure or suspected non-conformance to the product specification are subject to analysis in order to determine the cause of the failure.

Product experts/Subject Matter Experts analyze defective equipment or components to identify trends. These trends may lead to changes in materials or construction standards.

When necessary, technical bulletins are issued to engineering and construction personnel to discuss lessons learned or changes in materials or construction standards.