



COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA PUBLIC UTILITY COMMISSION
P.O. BOX 3265, HARRISBURG, PA 17105-3265

IN REPLY PLEASE
REFER TO OUR FILE

December 28, 2012

Mr. Paul E. Russell, Esquire
Associate General Counsel
PPL Electric Utilities Corporation
Two North Ninth Street
Allentown, PA 18101-1179

**Re: Biennial Inspection, Maintenance, Repair and Replacement Plan
Docket No. M-2009-2094773**

Dear Mr. Russell:

On October 2, 2012, PPL Electric Utilities Corporation (PPL) filed its Biennial Inspection, Maintenance, Repair and Replacement Plan (Plan), pursuant to 52 Pa. Code § 57.198(a), to become effective on January 1, 2014.

The Commission's regulations require EDCs to file, every two years by October 1, a biennial plan for the periodic inspection, maintenance, repair and replacement of facilities that is designed to meet reliability performance benchmarks and standards set forth in 52 Pa. Code §§ 57.191-57.197. The Commission's Implementation Order, entered August 13, 2009, identified PPL as one of six EDCs in Compliance Group 2 which must file their plans on October 1, 2010 and every 2 years thereafter. The plans must cover the two calendar years beginning 15 months after filing and remain in effect for two calendar years thereafter.

Plan Consistency

The Commission's regulations require that the Plan "must be consistent with the National Electrical Safety Code, Codes and Practices of the Institute of Electrical and Electronic Engineers, Federal Energy Regulatory Commission Regulations and the provisions of the American National Standards Institute, Inc." 52 Pa. Code § 57.198(b).

The Plan states that PPL's programs are consistent with the National Electrical Safety Code (NESC), Codes and Practices of the Institute of Electrical and Electronic Engineers, Federal Energy Regulatory Commission Regulations and the provisions of the American National Standards Institute, Inc. (ANSI).

Time Frames

The Commission's regulations provide the following relating to inspection and maintenance time frames:

(c) *Time frames.* The plan must comply with the inspection and maintenance standards in subsection (n). A justification for the inspection and maintenance time frames selected shall be provided, even if the time frame falls within the intervals prescribed in subsection (n). However, an EDC may propose a plan that, for a given standard, uses intervals outside the Commission standard, provided that the deviation can be justified by the EDC's unique circumstances or a cost/benefit analysis to support an alternative approach that will still support the level of reliability required by law.

52. Pa. Code § 57.198(c).

PPL has proposed modifications of the standards, discussed *infra*, for the following programs, or parts of programs:

- Pole loading calculations,
- Distribution overhead line inspection interval, and
- Distribution transformer inspection interval.

Record Keeping

The Commission's regulations require that EDCs "maintain records of inspection and maintenance activities sufficient to demonstrate compliance with its distribution facilities inspection, maintenance, repair and replacement programs." 52 Pa. Code § 57.198(m).

The Plan states that inspection and maintenance activities performed by PPL employees are tracked by electronic work requests in the company's Work Management System software application which date-stamps transactions and captures an electronic signature of the employee certifying completion. Inspection and maintenance activities performed by PPL contractors are documented with itemized records, which identify when and what type of work was performed, before invoices for the work are paid.

Vegetation Management

Section 57.198(n)(1). Vegetation management. The Statewide minimum inspection and treatment cycle for vegetation management is between 4-8 years for distribution facilities. An EDC shall submit a condition-based plan for vegetation management for its distribution system facilities explaining its treatment cycle.

The Plan states that PPL employs a 5-year tree trimming cycle for all distribution lines in the northern areas of its service territory and a 4-year cycle for the southern areas. The demarcation line for the northern and southern areas is the Blue Mountains, which does not follow the borders of PPL's regions. Vegetation growth rates are higher south of the Blue Mountains than north of them and a 2009 study recommended realigning intervals on a geographic, rather than urban and rural basis. PPL employs a \$2.00 per Customer Minutes Interrupted (CMI) saved cost threshold as a principal criteria for evaluating new projects; costs

below that threshold are considered to be prudent investments. The change to North/South trim cycles was made because the estimated cost is well below the threshold.

PPL uses directional pruning, which removes only the branches growing toward power lines, allowing trees to retain more of their natural space and shaping and reducing stress. The National Arbor Day Foundation and other tree care groups endorse directional pruning as better for tree health.

The Plan generally complies with this inspection and maintenance interval.

Pole Inspections

Section 57.198(n)(2). Pole inspections. Distribution poles shall be inspected at least as often as every 10-12 years except for the new southern yellow pine creosoted utility poles which shall be initially inspected within 25 years, then within 12 years annually after the initial inspection. Pole inspections must include:

- (i) Drill tests at and below ground level.*
- (ii) A shell test.*
- (iii) Visual inspection for holes or evidence of insect infestation.*
- (iv) Visual inspection for evidence of unauthorized backfilling or excavation near the pole.*
- (v) Visual inspection for signs of lightning strikes.*
- (vi) A load calculation.*

PPL will inspect distribution poles every 10 years. Each pole is partially excavated, inspected visually, sounded and bored above ground. If decay is present, a full excavation, 360 degrees around the pole is done. All measurable decay is entered into the contractor's engineering-based software program to determine the percentage of remaining strength, taking into consideration ANSI and NESC standards. If the percentage of remaining strength is below established parameters, a load calculation is performed to determine the pole's capacity to support the load. Based on the inspection and testing results, the pole is either treated with a preservative, reinforced or replaced.

The Plan generally complies with this inspection and maintenance interval. However, PPL has requested an exemption from performing the pole loading calculations as part of the pole inspections and has provided the following justification.

The design of PPL's lines is based on its Distribution Engineering Instructions which are based on NESC Heavy Loading conditions. PPL requires entities attaching facilities to its poles to perform their own load calculations before making the attachment. Load calculations are performed on poles when the estimated percentage of remaining strength falls below established parameters. Most of the limited numbers of pole failures are aggravated by weather conditions such as trees being blown into lines, so the potential risk reduction through a load calculation is insignificant.

For the reasons stated above, we do not believe that additional periodic load calculations will significantly enhance the reliability of PPL's distribution system. Appropriate line design and subsequent assessments of pole strength conducted prior to the attachment of non-company facilities should be sufficient to ensure the integrity of the poles. Therefore, we will exempt PPL from performing load calculations as part of its pole inspection program.

Pole Inspection Failure

Section 57.198(n)(3). Pole inspection failure. If a pole fails the groundline inspection and shows dangerous conditions that are an immediate risk to public or employee safety or conditions affecting the integrity of the circuit, the pole shall be replaced within 30 days of the date of inspection.

The Plan states that critical poles that pose an immediate safety concern are reinforced or replaced as soon as possible, but no later than 30 days after notification. Other non-restorable rejected poles are generally replaced within one year of identification. Pole strength and loading calculations are provided for each rejected pole to assist in reinforce vs. replace decisions and schedule prioritization. Reinforcement by C-Truss is completed within 90 days of identification.

The Plan generally complies with this requirement.

Distribution Overhead Line Inspections

Section 57.198(n)(4). Distribution overhead line inspections. Distribution lines shall be inspected by ground patrol a minimum of once every 1-2 years. A visual inspection must include checking for:

- (i) Broken insulators.*
- (ii) Conditions that may adversely affect operation of the overhead transformer.*
- (iii) Other conditions that may adversely affect operation of the overhead distribution line.*

PPL's Plan includes an infrared inspection of 3-phase and 2-phase overhead lines adjacent to roadways every two years. Lines are scanned from vehicles with a roof-mounted infrared camera to capture a thermal image of components carrying electrical current. Heat emission measurements are compared to reference temperatures and the probability of failure is estimated based on the magnitude of temperature difference from reference. The method detects problems in current carrying components such as transformers, connections, splices, hot line clamps, disconnects, switches, lightning arrestors, Bridges disconnects, terminators, etc., whether or not there are visible defects. At-risk items are prioritized and mitigated by repair or replacement.

Visual inspections are condition-based for selected circuits (e.g., poor performing circuits, circuits with excessive customers experiencing multiple service interruptions, and circuits undergoing Expanded Operational Reviews (EOR). Inspections are scheduled when indicated by circuit performance, as measured by PPL's Circuit Performance Index (CPI) and confirmed by an analysis of actual service interruptions that identifies failures addressable by

visual inspection. In addition to looking for visible defects in current-carrying components, visual inspection looks for mechanical defects in anchors, guys, crossarms, insulators, offset brackets, grounding systems and poles.

As an integral part of the 10-year pole inspection process, the inspector observes, notes and reports at-risk conditions of all pole attachments, specifically crossarms, braces, conductors, transformers, fuse cutouts, lightning arrestors, reclosers, regulators, capacitors, switches, wildlife protection, vegetation encroachment, guys, anchors, ground wires and rods.

PPL has requested an exemption from the 1-2 year inspection and maintenance interval for overhead lines, and has provided the following justification.

PPL conducted a trial of infrared inspections of multi-phase lines in 2006. The inspections saved an estimated 1,460,000-2,600,000 CMI at a cost of \$0.15 to \$0.09 per CMI saved, compared to a \$2.00 per CMI saved cost threshold which is used as a principal criteria for evaluating new projects for inclusion in the portfolio of reliability programs. Costs below that threshold are considered prudent investments. Since infrared costs per CMI saved are well below the threshold, PPL instituted a two-year infrared cycle.

PPL also conducted an overhead line visual inspection cost benefit study in 2010 which calculated a reliability benefit as a probability that inspections and the associated repairs will reduce equipment failure service interruptions. The study also estimated avoided CMI/mile for visual inspections that follow infrared inspections because there is a significant overlap between the two methods. Given PPL's reliability parameters, there is no interval for visual overhead inspections that meets the established cost threshold, particularly when performed in conjunction with infrared inspections. Visual inspections alone at two-year intervals are 50 percent above the threshold; two-year visuals done in conjunction with infrared are 100 percent above the threshold.

PPL asserts that targeted visual inspections have more value than universal inspections. In a typical year, less than 15 percent of the circuits are responsible for 80 percent of equipment failure CMI. For the period 2002 to 2009, 30 percent of the circuits were responsible for 80 percent of equipment failure CMI.

Thus, PPL employs a conditional-based visual inspection approach, combined with EOR field checks and overhead inspections in conjunction with pole inspections. PPL believes that the efficacy of this approach is confirmed by the flattening of the growth curve of equipment failures, which shows that the number of equipment failure service interruption cases has been stable for the last four years. PPL states that its goal is focused on results (i.e., the reliability experienced by customers), "not the rote execution of particular tasks."

Given the justification provided by PPL and the fact that the company's reliability performance indices have been near the benchmarks during the past two years, we find PPL's approach to providing acceptable levels of reliability performance within reasonable cost of service principles to be acceptable. Therefore, the request of PPL for an exemption from the distribution overhead line inspection interval is approved.

Inspection Failure

Section 57.198(n)(5). Inspection failure. If critical maintenance problems are found that affect the integrity of the circuits, they shall be repaired or replaced no later than 30 days from discovery.

The Plan states that priorities for corrective maintenance associated with infrared inspections are determined by the magnitude of the variance from normal operating temperature. In all cases, the maximum days allowed after receiving a report for service before corrective maintenance is performed is 30 days.

For visual inspections, the inspector determines the urgency for repairs and assigns an appropriate order of priority from three categories: 1) For emergency defects which threaten the safety of the public or employees or will cause a service interruption at any moment, corrective action must be taken immediately; 2) For priority defects with a high probability of causing a service interruption if not corrected promptly, corrective action must be taken within 30 days; and 3) For unsatisfactory defects with a lower probability of causing a service interruption if not corrected promptly, corrective action must be taken within three months.

The Plan generally complies with this requirement.

Distribution Transformer Inspections

Section 57.198(n)(6). Distribution transformer inspection. Overhead distribution transformers shall be visually inspected as part of the distribution line inspection every 1-2 years. Above-ground pad-mounted transformers shall be inspected at least as often as every 5 years and below-ground transformers shall be inspected at least as often as every 8 years. An inspection must include checking for:

- (i) Rust, dents or other evidence of contact.*
- (ii) Leaking oil.*
- (iii) Installation of fences or shrubbery that could adversely affect access to and operation of the transformer.*
- (iv) Unauthorized excavation or changes in grade near the transformer.*

The Plan states that overhead transformers are inspected as part of overhead visual line inspections, infrared inspections, and pole inspections. Inspections of pad-mounted and below-ground transformers are scheduled when indicated by circuit performance, as measured by PPL's CPI and confirmed by an analysis of actual service interruptions that identifies underground failures addressable by visual inspection. Pad-mounted and below-ground transformers are also inspected as part of the underground residential development cable testing, replacement and curing program.

Transformers are visually inspected for damage (rust, dents, cracks, locking devices, broken bushings, etc.), integrity of connections and leaks. Pad-mounted and below-ground transformers have cables and elbows inspected for deterioration, foundations and covers inspected and animals, nests, cobwebs and vegetation removed.

PPL has requested an exemption from the fixed inspection cycle for transformers in favor of a condition-based inspection program, and has provided the following justification.

PPL's overhead line inspection cost benefit study estimated that about 20,000 CMI annually could be saved via visual overhead transformer inspections. The estimated cost to inspect those transformers every two years would be \$1.3 million or \$65 per CMI avoided, compared to the threshold of \$2.00 per CMI saved for identifying prudent reliability investments. Similarly, pad-mounted transformer inspections are estimated to save no more than 2,692 CMI at a cost of \$333,000 annually for a five-year cycle, or \$124 per CMI saved. Below-ground transformer inspections are estimated to save no more than 271 CMI at a cost of \$25,000 annually for an eight-year cycle, or \$92 per CMI saved.

Resources that would be applied to shorter cycles would reduce the resources applied to other more cost-effective reliability programs set forth in PPL's Plan.

In view of the foregoing justification, we find that PPL's condition-based inspection program is a reasonable and cost-effective alternative to the fixed inspection intervals. Therefore, we will exempt PPL from the inspection intervals for overhead, pad-mounted and below-ground transformers.

Recloser Inspections

Section 57.198(n)(7). Recloser inspections. Three-phase reclosers shall be inspected on a cycle of 8 years or less. Single-phase reclosers shall be inspected as part of the EDC's individual distribution line inspection plan.

The Plan states that three-phase reclosers are included in the two-year infrared line inspection program. Single-phase reclosers are inspected as part of PPL's distribution line inspection program. Reclosers are replaced every eight years.

As replacement cycles are extended, planned replacement costs decline, while failures with their forced replacement costs and SAIFI increase. A 2003 PPL cost/benefit analysis showed that total costs declined until a 12-year replacement cycle is reached, with total costs increasing for replacement cycles longer than twelve. Given PPL's current reliability performance, an eight-year cycle provides an appropriate balance of cost and SAIFI.

The Plan generally complies with this requirement.

Substation Inspections

Section 57.198(n)(8). Substation inspections. Substation equipment, structures and hardware shall be inspected on a cycle of 5 weeks or less.

The Plan states that PPL performs a visual inspection of all substations on a monthly basis. Infrared inspections are performed annually.

Inspection and recording of abnormal conditions include the following:

- Power transformers,
- Circuit breakers,
- Auxiliary equipment,
- Batteries and chargers,
- Control house, and
- Yard and perimeter.

The Plan generally complies with this requirement.

Conclusion

Upon review of PPL's Biennial Inspection, Maintenance, Repair and Replacement Plan, it appears that the filing meets the requirements of 52 Pa. Code § 57.198 and is, therefore, accepted. Furthermore, as discussed *supra*, the exemptions requested by PPL are approved. This approval is contingent upon the possibility that subsequent audits, reviews and inquiries, in any Commission proceeding, may be conducted, pursuant to 52 Pa. Code § 57.197(a).

This plan must remain in effect for two calendar years, beginning January 1, 2014. PPL may, however, request Commission approval of subsequent revisions to its approved Plan, in accordance with 52 Pa. Code § 57.198(l). Revisions must be submitted to the Commission as an addendum to PPL's quarterly reliability report filed pursuant to § 57.195, including prospective and past revisions to its Plan and a justification for the revisions.

If you are dissatisfied with the resolution of this matter, you may, as set forth in 52 Pa. Code § 5.44, file a petition with the Commission within twenty (20) days after the date of this letter. Please direct any questions regarding this filing to Darren Gill, Deputy Director, Bureau of Technical Utility Services, (717) 783-5244, or dgill@pa.gov.

Very truly yours,



Paul T. Diskin
Director
Technical Utility Services

cc: Robert Young, Law Bureau
Darren Gill, TUS
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