

Kimberly A. Klock
Senior Counsel

PPL
Two North Ninth Street
Allentown, PA 18101-1179
Tel. 610.774.5696 Fax 610.774.6726
KKlock@pplweb.com



FEDERAL EXPRESS

April 30, 2018

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street
Harrisburg, Pennsylvania 17120

RECEIVED

APR 30 2018

PA PUBLIC UTILITY COMMISSION
SECRETARY'S BUREAU

**Re: PPL Electric Utilities Corporation
2017 Annual Reliability Report
Docket No. E-00030161**

Dear Ms. Chiavetta:

M-2016-2522508

Enclosed for filing on behalf of PPL Electric Utilities Corporation ("PPL Electric") is an original of PPL Electric's 2017 Annual Reliability Report to the Pennsylvania Public Utility Commission. This report is being filed pursuant to the Commission's regulations at 52 Pa. Code § 57.195(a).

As required by the Commission's regulations, copies of the enclosed report have been served upon the Office of Consumer Advocate ("OCA") and the Office of Small Business Advocate ("OSBA").

Pursuant to 52 Pa. Code § 1.11, the enclosed document is to be deemed filed on April 30, 2018, which is the date it was deposited with an overnight express delivery service as shown on the delivery receipt attached to the mailing envelope.

In addition, please date and time-stamp the enclosed extra copy of this letter and return it to me in the envelope provided.

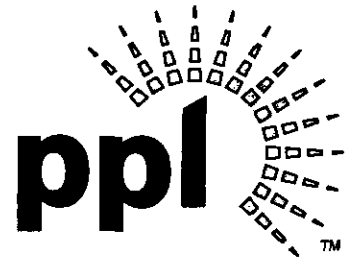
If you have any questions regarding the enclosed report, please call me or B. Kathryn Frazier, PPL Electric's Regulatory Affairs Manager at (610) 774-3372.

Very truly yours,

Kimberly A. Klock

Enclosures

cc: Tanya J. McCloskey, Esquire
Mr. John R. Evans
Mr. Daniel Searfoorce



PPL Electric Utilities

**PPL Electric Utilities Corporation
2017 Annual Reliability Report
to the
Pennsylvania Public Utility Commission**

RECEIVED

APR 30 2018

**PA PUBLIC UTILITY COMMISSION
SECRETARY'S BUREAU**

May 1, 2018

1) *An overall current assessment of the state of the system reliability in the EDC's service territory including a discussion of the EDC's current programs and procedures for providing reliable electric service.*

In 2017, PPL Electric customers experienced an exceptional year for reliability, even with ten reportable storms. In 2017, SAIFI was 27% below the established benchmark level, SAIDI 27% below the benchmark, and CAIDI less than 1% above the benchmark. All metrics were well within the 12 and 36 month standards.

Since 2013, with the exception of the 2014 due to winter storm Nika, PPL Electric customers have generally enjoyed their best reliability ever. The company attributes this improved level of performance to:

- A robust vegetation management program.
- Significant investment in distribution automation technology such as:
 - Continued investment in the Smart Grid Initiative.
 - Increased leverage of our Distribution Management System (DMS).
 - Full implementation of Fault Isolation and System Restoration (FISR) technology.
- Well-targeted reliability investments including fusing and storm hardening.
- An increased focus on remediating momentary outages before they become permanent outages.
- An emphasis on making optimal, data-driven asset investment decisions.

It is PPL Electric's mission to achieve and maintain best in class levels of electric delivery service to its customers in a cost effective manner. Maintenance programs are one of the key elements that focus on maintaining system and circuit reliability, equipment performance, and interruption prevention. The scope of these maintenance programs, procedures, and activities covers all areas of the electrical infrastructure.

These programs include:

Transmission

Transmission inspection programs include aerial patrols conducted via helicopter or UAV (Unmanned Aerial Vehicle). These patrols focus on comprehensive inspections and routine "stop and go" inspections for identification of maintenance work. Inspections focus on all Transmission line equipment, including poles, arms, line switches, interrupters, arresters, grounding, guying, anchors, and other key components. Proactive replacement programs are in place to target specific risk areas (e.g. cellon treated wood poles, upswept wood arms, etc.) and to apply data-driven approaches to mitigate known reliability risks (e.g. avian interference, lightning performance, etc.).

Substation

Substation maintenance programs include inspections and overhauls of equipment, such as breakers, disconnects, power cables, and security equipment. Some equipment is maintained on a time basis; other equipment is condition-monitored. These two methods help ensure that maintenance work is performed in a cost-effective manner. Besides time and condition-based maintenance, thermo-graphic inspections help ensure that substation equipment does not operate at elevated temperature levels for an extended period of time, which could lead to equipment failure

Distribution

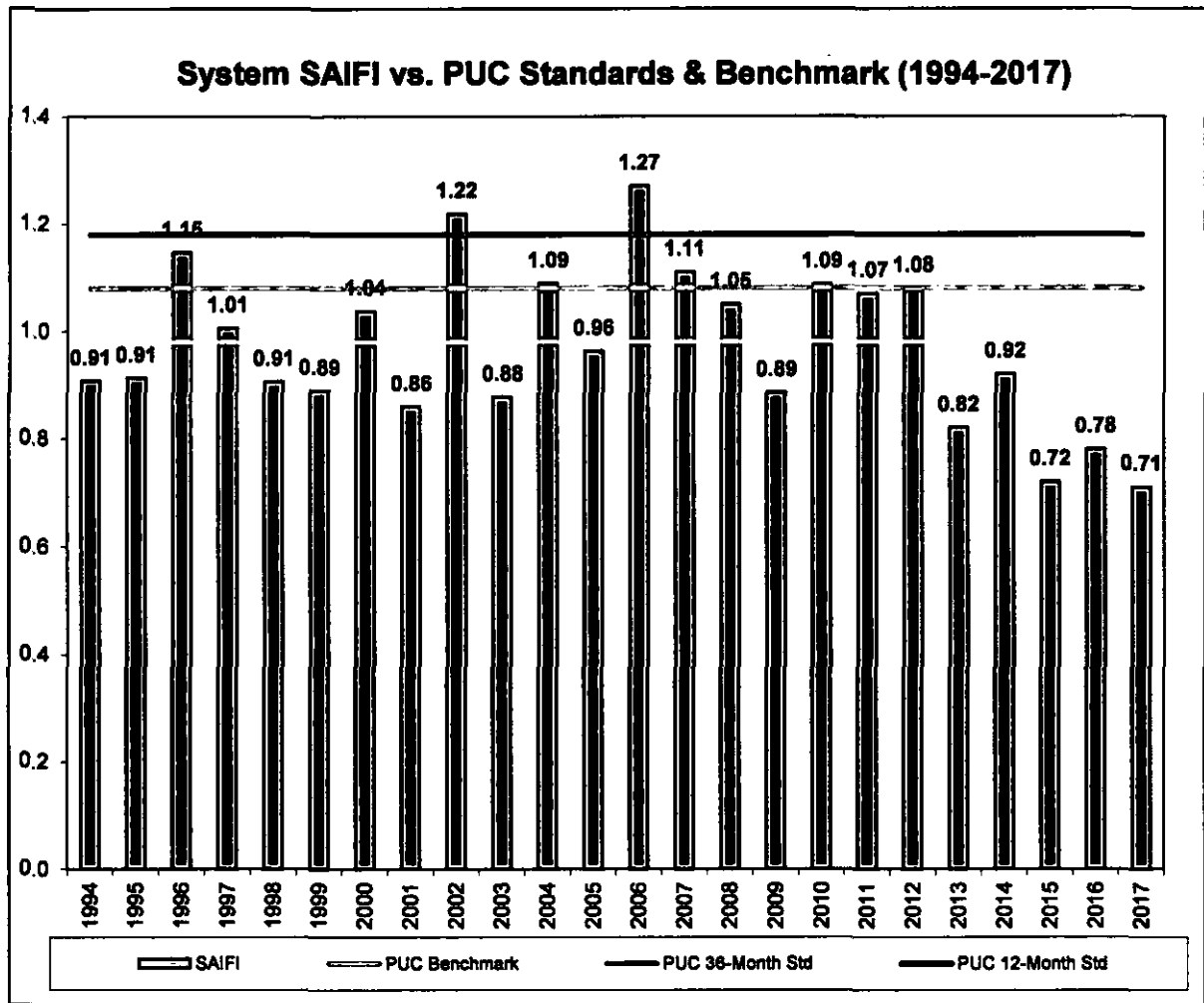
Distribution programs encompass many maintenance aspects similar to transmission and substations, and also include load surveys that help engineers determine peak load requirements, circuit analyses for the identification of lines requiring maintenance work, voltage relief, or other capital improvements. Overhead line inspections can identify damaged or deteriorated equipment that can be repaired or replaced. In addition, distribution maintenance includes inspections of poles, voltage regulators, line switches, capacitors, and other key distribution equipment. PPL Electric also tests underground cable to determine if the cable needs to be replaced, repaired or cured to prevent future failures.

Vegetation

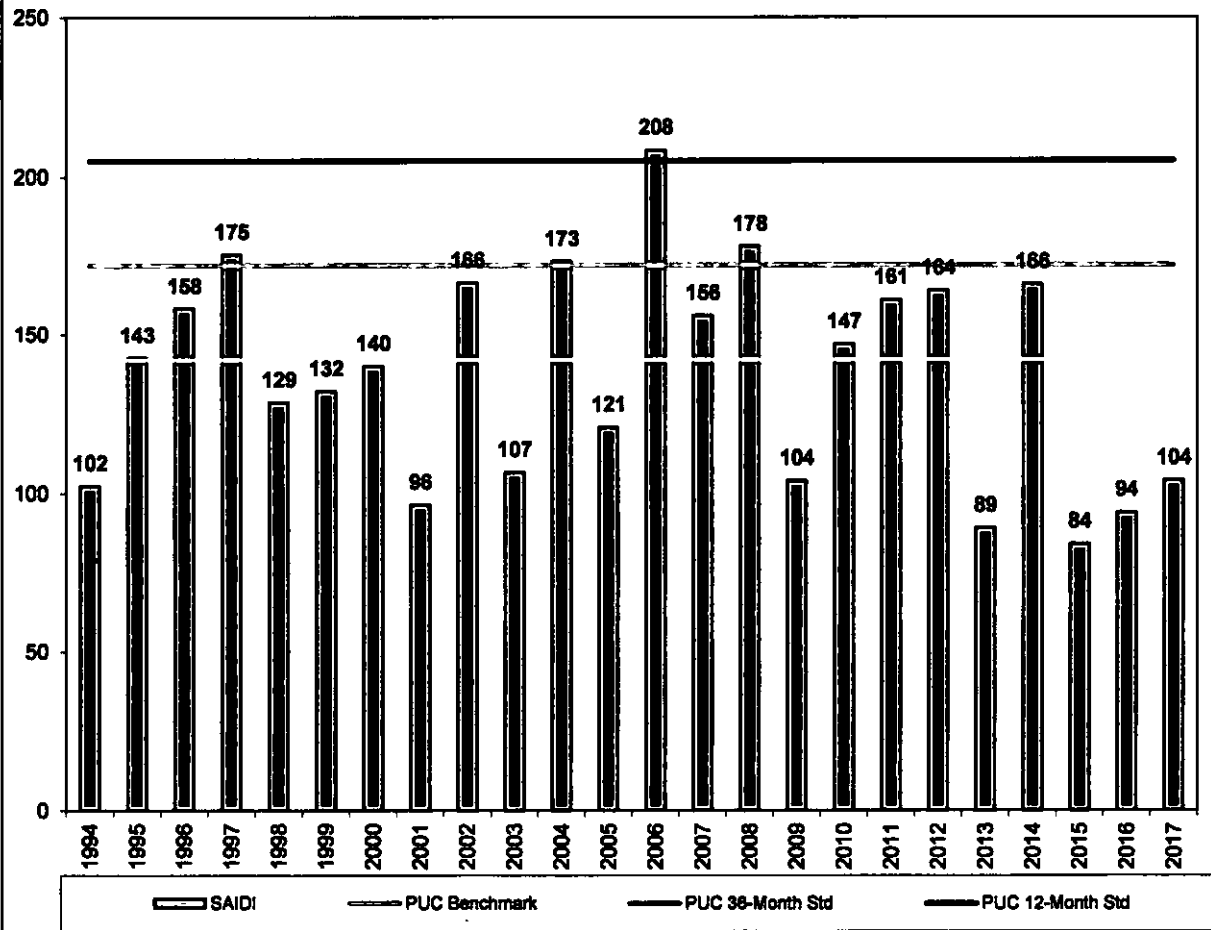
The vegetation on PPL Electric's transmission and distribution rights-of-way (ROW) is maintained utilizing a combination of several management techniques. These include tree pruning, tree removal, re-clearing and herbicide application. Lines are field-surveyed on a regular basis. The work is scheduled and budgeted based on the conditions observed and past performance. Outside of the ROW, danger trees with the potential to fall into the ROW are removed when possible.

Each of these programs is more fully described in Appendices A through D.

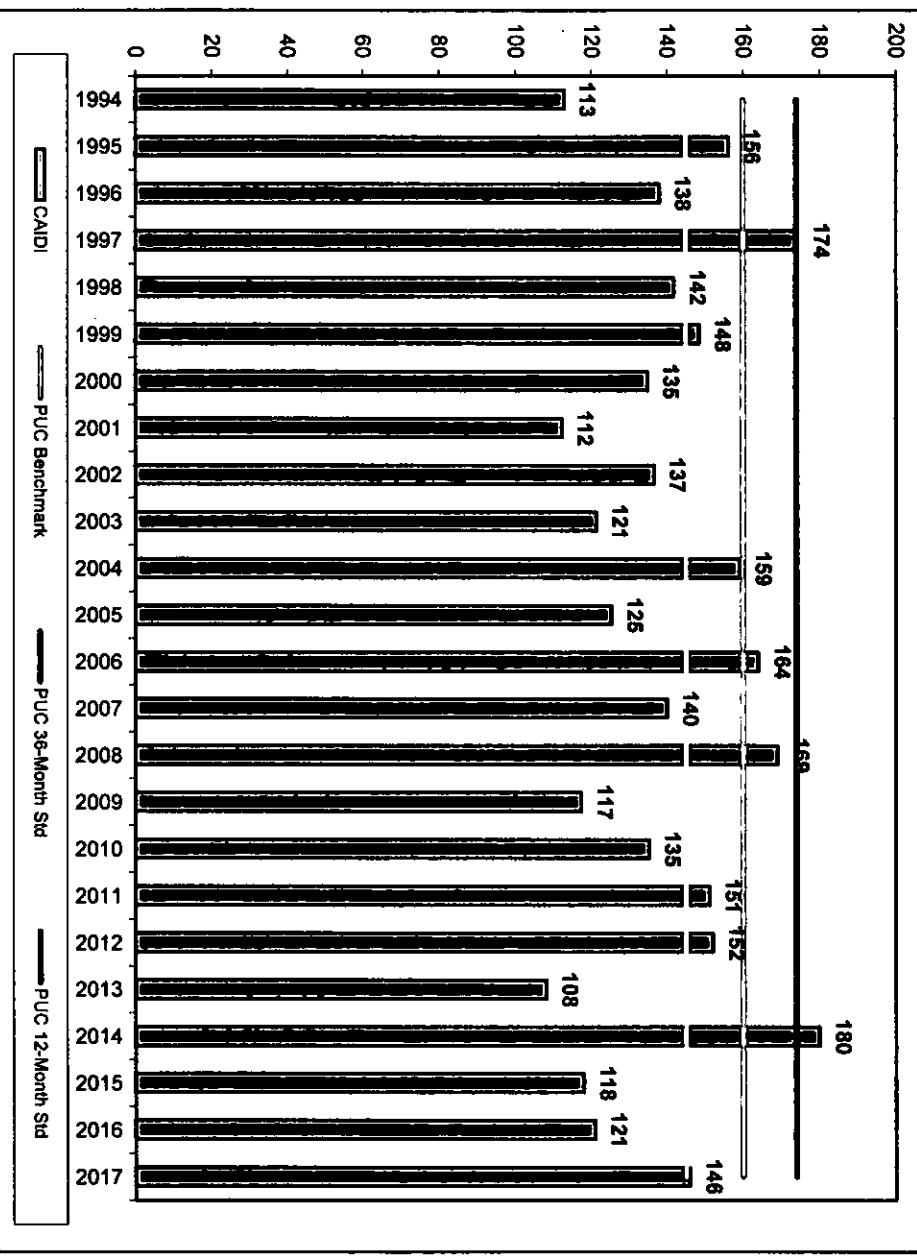
From 1999 through 2012, SAIFI, CAIDI and SAIDI generally have been maintained near benchmark levels and below the 36-month standard levels since the benchmark years of 1994 through 1998, as evidenced by the following three charts. Since 2013, marked improvement can be seen across all reliability measures, with 2014 somewhat distorted because of ice storm Nika, which inflicted heavy damage but was not classified as a major event.



System SAIDI vs. PUC Standards & Benchmark (1994-2017)



System CAIDI vs. PUC Standards & Benchmark (1994-2017)



- 2) ***A description of each major event that occurred during the year being reported on, including the time and duration of the event, the number of customers affected, the cause of the event and any modified procedures adopted in order to avoid or minimize the impact of similar events in the future.***

No major events occurred in 2017.

- 3) *A table showing the actual values of each of the reliability indices (SAIFI, CAIDI, SAIDI, and if available, MAIFI) for the EDC's service territory for each of the preceding 3 calendar years. The report shall include the data used in calculating the indices, namely the average number of customers served, the number of sustained customer interruptions, the number of customers affected, and the customer minutes of interruption. If MAIFI values are provided, the number of customer momentary interruptions shall also be reported.*

<i>Year</i>	2015	2016	2017¹	3 Yr. Avg.
SAIFI (Benchmark = 0.98; Rolling 12-month Std. = 1.18; Rolling 3-yr. Std. = 1.08)	0.718	0.777	0.712	0.736
CAIDI (Benchmark = 145; Rolling 12-month Std. = 174; Rolling 3-yr. Std. = 160)	116.5	121.1	145.6	127.8
SAIDI (Benchmark = 142; Rolling 12-month Std. = 205; Rolling 3-yr. Std. = 172)	83.7	94.1	103.7	93.8
MAIFI	4.2	7.3	6.4	6.0
Customers Served²	1,405,213	1,411,897	1,417,978	1,411,859
Number of Sustained Customer Interruptions (Trouble Cases)	14,971	17,473	17,387	16,610
Number of Customers Affected³	1,009,517	1,097,145	1,009,767	1,038,810
Customer Minutes of Interruptions (CMI)	117,668,548	132,840,591	147,064,995	132,840,590
Number of Customer Momentary Interruptions	5,886,336	10,246,275	9,178,624	8,437,078

¹ Any slight variations from data provided previously are the result of error corrections.

² PPL Electric calculates the annual indices using customers served at the end of the period. This is consistent with the method used to calculate PPL Electric's benchmarks.

³ The data reflects the number of customers interrupted for each interruption event summed for all events, also known as customer interruptions. If a customer is affected by three separate cases of trouble, that customer represents three customer interruptions, but only one customer interrupted.

- 4) *A breakdown and analysis of outage causes during the year being reported on, including the number and percentage of service outages, the number of customers interrupted, and customer interruption minutes categorized by outage cause such as equipment failure, animal contact, tree related, and so forth. Proposed solutions to identified service problems shall be reported.*

The table shows a breakdown of service outage causes for 2017.⁴ The top three causes (equipment failure, tree related, and animals), based on the percentage of cases, are highlighted in the table. Service interruption definitions are provided in Appendix E. PPL Electric has maintenance programs to address controllable service outages. Those programs are detailed in Appendices A through D.

Cause Description	Trouble Cases ⁵	Percent of Trouble Cases	Customer Interruptions ⁶	Percent of Customer Interruptions	Customer Minutes	Percent of Customer Minutes
Animals	3,333	19.2%	44,790	4.4%	2,254,780	1.5%
Contact/Dig-In	158	0.9%	14,259	1.4%	964,873	0.7%
Directed by Non-PPL Authority	85	0.5%	30,430	3.0%	1,635,311	1.1%
Equipment Failures	4,888	28.1%	291,207	28.8%	32,209,465	21.9%
Improper Design	2	0.0%	136	0.0%	2,040	0.0%
Improper Installation	7	0.0%	2,816	0.3%	222,979	0.2%
Improper Operation	6	0.0%	1,229	0.1%	37,778	0.0%
Nothing Found	918	5.3%	50,519	5.0%	3,920,955	2.7%
Other-Controllable	87	0.5%	13,430	1.3%	442,876	0.3%
Other-Non Control	253	1.5%	30,208	3.0%	2,145,000	1.5%
Other-Public	39	0.2%	8,271	0.8%	490,775	0.3%
Tree Related	6,913	39.8%	407,804	40.4%	91,896,726	62.5%
Unknown	0	0.0%	0	0.0%	0	0.0%
Vehicles	698	4.0%	114,668	11.4%	10,841,436	7.4%
Total	17,387	100.0%	1,009,767	100.0%	147,064,995	100.0%

⁴ Any slight variations from data provided previously are the result of error corrections.

⁵ Cases of trouble are the number of sustained customer service interruptions (i.e., service outages).

⁶ The data reflects the number of customers interrupted for each interruption event summed for all events, also known as customer interruptions. If a customer is affected by three separate cases of trouble, that customer represents three customer interruptions, but only one customer interrupted.

Analysis of causes contributing to the majority of service interruptions:

Weather Conditions: PPL Electric records weather conditions, such as wind or lightning, as contributing factors to service interruptions, but does not code them as direct interruption causes. Therefore, some fluctuations in cause categories, especially tree- and equipment-related causes, are attributable to weather variations. For this annual reporting period, weather was considered a significant contributing cause in 50% of cases, 57% of customer interruptions, and 75% of CMI.

Tree Related: PPL Electric has recently increased funding to more aggressively address outside the right-of-way danger trees. For trees within the right-of-way, PPL Electric has implemented a more robust trimming strategy.

Animals: Animals accounted for approximately 19% of PPL Electric's cases of trouble. Although this represents a significant number of cases, the effect on SAIFI and CAIDI is small because approximately 79% of the number of cases of trouble was associated with individual distribution transformers. However, when animals contact substation equipment, the effect may be widespread and potentially can interrupt thousands of customers on multiple circuits. In addition to guarding new distribution transformers and substations, PPL Electric has distribution and substation animal guarding programs to systematically focus on protecting existing facilities most at risk of incurring animal-caused interruptions.

Vehicles: Although vehicles cause a small percentage of the number of cases of trouble, they accounted for a large percentage of customer interruptions and customer minutes, because main distribution lines generally are located along major thoroughfares with higher traffic densities. In addition, vehicle-related cases often result in extended repair times to replace broken poles. Service interruptions due to vehicles are on the rise as a result of an increasing number of drivers and vehicles on the road. PPL Electric has a program to identify and relocate poles that are subject to multiple vehicle hits.

Equipment Failure: Equipment failure is one of the largest single contributors to the number of cases of trouble, customer interruptions and customer minutes. However, approximately 41% of the cases of trouble, 51% of the customer interruptions and 60% of the customer minutes attributed to equipment failure were weather-related and, as such, are not considered to be strong indicators of equipment condition or performance.

5) Specific remedial efforts taken to date and planned for circuits that have been on worst performing 5% of circuits list for a year or more.

Eighteen PPL Electric circuits have been on the worst performing circuit list for a year or more.

Circuit 26604 -- BROOKSIDE 66-04

Remedial Actions

- In 2017, an existing three-phase recloser was reprogrammed to single-phase operation.
- In 2018, a motor operated air break was replaced with a recloser as part of the Smart Grid Program.
- In 2018, hazard tree removal will be performed.
- In 2018, two fuses will be installed.
- In 2018, several porcelain cutouts will be replaced with polymer cutouts.
- In 2018, a set of smart fault indicators will be installed.
- In 2018, a project to build a new reliability substation will be evaluated.
- In 2018, thirty-eight additional locations will receive animal guarding, and additional locations are being evaluated.
- In 2018, one hundred and five poles will be replaced.
- In 2018, a new line and terminal will be evaluated for this circuit.

Circuit 42201 -- SHENANDOAH 22-01

Remedial Actions

- In 2017, a hydraulic circuit recloser was replaced.
- In 2017, a targeted circuit line patrol was performed. As a result, several actions were completed, including additional hot spot tree trimming.
- In 2017, full circuit tree trimming was performed.
- In 2017, an existing hydraulic recloser was upgraded to a Smart Grid device, and a new hydraulic recloser was installed.
- In 2017, three off-cycle pole reviews were completed and replacements identified.
- In 2017, tap fuses were installed at three locations.
- In 2018, two non-communicating devices were replaced with Smart Grid devices.
- In 2018, two additional locations will receive fusing.
- In 2018, a section of difficult to access conductor will be relocated.
- In 2018, distribution under-build on the transmission line will be evaluated.
- In 2019, a new Smart Grid device will be installed.
- In 2019, a section of difficult-to-access conductor will be relocated to a more accessible location.

Circuit 54101 -- S SHERMANSDALE 41-01

Remedial Actions

- In 2017, two single-phase reclosers were replaced.
- In 2017, one three-phase recloser was upgraded to a Smart Grid device.
- In 2017, an Expanded Operational Review was performed.
- In 2017, full circuit tree trimming was performed.
- In 2017, a new single-phase recloser was installed.
- In 2018, additional series fusing will be evaluated.
- In 2018, a tie point will be evaluated for automation.
- In 2018, a new line and terminal will be evaluated for construction at the substation.
- In 2019, a tie point will be automated.
- In 2019, a recloser will be upgraded to a Smart Grid device.

Circuit 43108 -- SOUTH MILTON 31-08

Remedial Actions

- In 2017, a targeted circuit patrol was performed, resulting in several lightning arrestors being replaced.
- In 2017, several protective settings at the circuit breaker and several downstream reclosers were changed.
- In 2017, a recloser was upgraded to a Smart Grid device.
- In 2017, a new single-phase recloser was installed.
- In 2017, an Expanded Operational Review was performed.
- In 2018, full circuit tree trimming will be performed.
- In 2019, a new tie line will be constructed.
- In 2019, two sections of difficult-to-access conductor will be relocated to more accessible locations.

Circuit 26602 -- BROOKSIDE 66-02

Remedial Actions

- In 2017, a tie line to the BROOKSIDE 66-03 was constructed.
- In 2017, additional porcelain cutouts were replaced with polymer cutouts.
- In 2018, an additional Smart Grid device was installed.
- In 2018, 65 poles will be replaced.
- In 2018, several porcelain cutouts will be replaced with polymer cutouts.
- In 2019, section of conductor will be refed to an alternate source.
- In 2019, full circuit tree trimming will be performed.

Circuit 46504 -- LOCK HAVEN 65-04

Remedial Actions

- In 2017, an Expanded Operational Review was performed; as a result, three additional fusing locations and two animal guarding locations were identified and remediated.
- In 2017, additional single-phase load break disconnects were installed.
- In 2017, an additional Smart Grid device was installed.
- In 2017, full circuit tree trimming was performed.
- In 2018, nine minor equipment deficiencies were identified and remediated.
- In 2018, a section of overhead through a heavily wooded area will be converted to underground.
- In 2018, thirty additional animal guards will be installed.

Circuit 64304 -- LINCOLN 43-04

Remedial Actions

- In 2017, a post-storm patrol was performed on this circuit. Several minor items were identified and corrected.
- In 2017, an Expanded Operational Review was performed. As a result, additional fusing was installed at six locations.
- In 2017, a new telemetered recloser was installed as part as the Smart Grid Initiative.
- In 2017, two underground residential developments received cable curing.
- In 2017, a dead-end insulator was replaced.
- In 2018, additional fusing will be installed at two locations.
- In 2018, a new single phase recloser with additional downstream fusing will be installed.
- In 2018, a three phase infrared scan will be performed.
- In 2018, reconfiguring a difficult-to-access section of single phase will be evaluated.
- In 2019, a section of difficult-to-access single-phase will be transferred to an alternate source.

Circuit 67605 -- WARWICK 76-05

Remedial Actions

- In 2017, a post-storm patrol was performed on this circuit. Several minor items were identified and have been corrected in 2017.
- In 2017, two solid blade disconnect switches were replaced with fuses.
- In 2017, two additional locations received fusing.
- In 2017, a new load break disconnect switch was installed.
- In 2017, a failing load break disconnect switch was replaced.
- In 2017, hot spot tree trimming was performed.
- In 2018, a new telemetered recloser will be installed as part as the Smart Grid Initiative.
- In 2018, a three-phase infrared scan will be performed.

Circuit 46702 -- RENOVO 67-02

Remedial Actions

- In 2017, an existing recloser was upgraded to a Smart Grid device.
- In 2017, a solid blade disconnect was installed.
- In 2017, additional fusing was installed.
- In 2017, a line patrol was performed with several minor remediations identified to be performed in 2018.
- In 2018, a section of three-phase conductor that is susceptible to tree outages will be relocated.
- In 2018, two Smart Grid devices will be installed.
- In 2018, full circuit tree trimming will be performed.
- In 2018, three additional fuses will be installed.
- In 2018, hazard tree trimming will be evaluated for this circuit.

Circuit 26703 -- HEMLOCK FARMS 67-03

Remedial Actions

- In 2017, an additional recloser was installed as part of the Smart Grid Initiative.
- In 2017, fuses were added at multiple locations.
- In 2017, two additional load break disconnect switches were installed.
- In 2017, additional animal guarding was installed at multiple locations.
- In 2018, multiple locations will be fused.
- In 2018, additional animal guarding will be installed.
- In 2018, additional hazard tree removal will be evaluated.
- In 2019, an additional Smart Grid device will be installed.
- In 2019, an Expanded Operation Review will be performed.

Circuit 52403 -- GREEN PARK 24-03

Remedial Actions

- In 2017, additional fusing was installed at multiple locations.
- In 2017, circuit breaker relays were upgraded.
- In 2018, full circuit tree trimming will be performed.
- In 2018, four single-phase fuses will be installed.
- In 2018, one additional single-phase fuse location will be evaluated.
- In 2019, the circuit breaker and getaway cable will be replaced.
- In 2019, a second transmission source into the distribution substation will be constructed.

Circuit 28602 -- BLYTHEBURN 86-02

Remedial Actions

- In 2017, five additional taps were fused.
- In 2017, a new load break switch was installed.
- In 2017, an existing three-phase recloser was upgraded to a telemetric recloser.
- In 2018, a three-phase automatic recloser was installed as part of the Smart Grid program.
- In 2018, multiple porcelain cutout fuses were replaced with polymer cutouts.
- In 2018, three additional switches will be installed.
- In 2018, a tie line to the BLYTHEBURN 86-04 will be evaluated.
- In 2018, a single-phase tap fuse will be installed.
- In 2019, an additional Smart Grid device will be installed.

Circuit 52402 -- GREEN PARK 24-02

Remedial Actions

- In 2017, a Smart Grid device was converted to triple-single operation.
- In 2017, circuit breaker relays were upgraded.
- In 2018, two single-phase fuse locations will be evaluated.
- In 2018, enabling triple-single operation at three automated reclosers is being evaluated.
- In 2018, a targeted conductor conversion is being evaluated.
- In 2018, infrared scanning will be performed.
- In 2019, a second transmission source into the distribution substation will be constructed.

Circuit 29701 -- ANGELS 91-01

Remedial Actions

- In 2017, additional animal guarding was installed.
- In 2018, an additional switch will be installed.
- In 2018, an Expanded Operational Review will be performed.
- In 2018, additional animal guarding will be installed.

Circuit 25501 -- MADISONVILLE 55-01

Remedial Actions

- In 2017, multiple locations were animal guarded.
- In 2017, a section of difficult-to-access single-phase was relocated.
- In 2017, upgraded relays were installed at the substation for enhanced fault indication.
- In 2018, additional locations will be animal guarded.
- In 2018, a single phase recloser will be replaced.
- In 2018, additional fusing will be installed.
- In 2018, full circuit tree trimming will be performed.
- In 2018, multiple lightning arrestors will be replaced as the result of an Expanded Operational Review performed in 2017.

Circuit 59002 -- MIFFLINTOWN 90-02

Remedial Actions

- In 2017, a recloser was upgraded to a Smart Grid device.
- In 2018, a fuse was replaced with a recloser, and additional downstream fusing was installed.
- In 2018, a recloser will be replaced.
- In 2018, a motor operated air break switch will received Smart fault indication.
- In 2018, a new tie line will be evaluated.
- In 2018, eighteen single-phase fuses will be installed.
- In 2018, one fuse will be replaced with a solid blade disconnect.
- In 2018, an Expanded Operational Review will be performed.
- In 2018, infrared scanning will be performed.
- In 2019, an additional Smart Grid device will be evaluated.

Circuit 26401 -- INDIAN ORCHARD 64-01

Remedial Actions

- In 2017, animal guarding was installed at multiple locations.
- In 2017, danger tree removal was performed on this circuit.
- In 2018, additional animal guarding will be installed.
- In 2018, a difficult-to-access section of three-phase conductor will be relocated.
- In 2019, full circuit tree trimming will be performed.
- In 2019, an Expanded Operational Review will be performed.

Circuit 52401 -- GREEN PARK 24-01

Remedial Actions

- In 2017, full circuit tree trimming was performed.
- In 2017, two fuses were installed on this circuit.
- In 2017, circuit breaker relays were upgraded.
- In 2018, additional reclosers and fusing will be installed.
- In 2018, an additional new protective device will be evaluated.
- In 2018, additional animal guarding will be installed at two locations.

- 6) *A comparison of established transmission and distribution inspection and maintenance goals/objectives versus actual results achieved during the year being reported on. Explanations of any variances shall be included.*

Inspection & Maintenance Goals/Objectives	2017 Budget	2017 Actual	Variance (%)
Transmission			
Transmission C-tag poles (# of poles)	422	328	-22.3%
Transmission arm replacements (# of sets)	191	202	5.8%
Transmission air break switch inspections (# of switches)	-	4	N/A
Transmission lightning arrester installations (# of sets)	-	-	N/A
Transmission structure inspections (# of structures)	33,291	33,291	0.0%
Transmission tree side trim-Bulk Power (linear feet)	-	-	N/A
Transmission herbicide-Bulk Power (# of acres)	-	-	N/A
Transmission reclearing (# of miles) BES Only	596	596	0.0%
Transmission reclearing (# of miles) 69 kV	1,389	1,389	0.0%
Transmission reclearing (# of miles) 138 kV	185	185	0.0%
Transmission danger tree removals-Bulk Power (# of trees)	-	-	N/A
Substation			
Substation batteries (# of activities)	660	673	2.0%
Circuit breakers (# of activities)	980	901	-8.1%
Substation inspections (# of activities)	3,953	4,213	6.6%
Transformer maintenance (# of activities)	169	106	-37.3%
Distribution			
Distribution C-tag poles replaced (# of poles)	2,654	1,864	-29.8%
C-truss distribution poles (# of poles)	3,696	3,577	-3.2%
Capacitor (MVAR added)	909	610	-32.9%
OCR Replacements (# of)	121	100	-17.4%
Distribution pole inspections (# of poles)	96,822	97,522	0.7%
Distribution line inspections (hours)	8,436	7,604	-9.9%
Group re-lamping (# of lamps)	13,994	12,617	-9.8%
Test sections of underground distribution cable	1,312	1,312	0.0%
Distribution tree trimming (# of miles)	3,985	3,985	0.0%
Distribution herbicide (# of acres)	-	-	N/A
Distribution >18" removals within R/W (# of trees)	-	-	N/A
Distribution hazard tree removals outside R/W (# of trees)	-	-	N/A
LTN manhole inspections (# of)	426	394	-7.5%
LTN vault inspections (# of)	767	646	-15.8%
LTN network protector overhauls (# of)	50	44	-12.0%
LTN reverse power trip testing (# of)	35	29	-17.1%

Explanation of variances greater than 10%:

Transmission C-tag poles: Outage cancelations and equipment failures deferred projects from late 2017 to 2018. This resulted in less poles and structures being replaced than originally budgeted and planned for.

[Substation] Transformer maintenance (# of activities): Resources were focused on the failure and corrective work during the fourth quarter. All inspection work was reevaluated based on inspection cycles.

Distribution C-tag poles replaced (# of poles): Additional funding was approved in the fourth quarter, but not enough resources were available to complete if all.

Capacitor (MVAR added): Actual costs came in higher than estimated, so this work was able to be scheduled for completion in 2018.

OCR Replacements (# of): Scope was completed, the remaining were reevaluated for reprioritization of reliability projects.

LTN vault inspections (# of): Resources were focused on the failure and corrective work during the fourth quarter. All inspection work was reevaluated based on inspection cycles.

LTN network protector overhauls (# of): Resources were focused on the failure and corrective work during the fourth quarter. All inspection work was reevaluated based on inspection cycles.

LTN reverse power trip testing (# of): Resources were focused on the failure and corrective work during the fourth quarter. All inspection work was reevaluated based on inspection cycles.

- 7) *A comparison of budgeted versus actual transmission and distribution operation and maintenance expenses for the year being reported on in total and detailed by the EDC's own functional account code or FERC account code as available. Explanations of any variances 10% or greater shall be included.*

The following table provides operation and maintenance expenses for PPL Electric, as a whole, and includes the work identified in the response to Item (6).

Activity	2017 Budget (\$000)	2017 Actual (\$000)	Variance (%)
Provide Electric Service	5,218	7,017	34.5%
Vegetation Management	53,672	45,105	-16.0%
Customer Response	59,332	55,522	-6.4%
Reliability Maintenance	35,386	36,607	3.5%
System Upgrade	-1,026	10,849	-1157.4%
Customer Service/Accounts	128,214	111,110	-13.3%
Others	36,844	40,166	9.0%
Total O&M Expenses	317,638	306,376	-3.5%

Explanation of variances of 10% or greater:

Provide Electric Service: Costs exceeded the budget due to a high volume of new and adjusted services.

Vegetation Management: Actuals under budget as a result of decreased work scope. Reliability-based trimming was implemented after the reduction in scope.

System Upgrade: Lower budget number reflects expense reduction initiatives achieved in other categories.

Customer Service/Accounts: This variance occurred because of a reduction in uncollectable accounts.

- 8) *A comparison of budgeted versus actual transmission and distribution capital expenditures for the year being reported on in total and detailed by the EDC's own functional account code or FERC account code as available. Explanations of any variances 10% or greater shall be included.*

The following table provides capital expenditures for PPL Electric, as a whole, which includes transmission and distribution activities.

	2017 Budget (S000)	2017 Actual (S000)	Variance (%)
New Service/Revenue	74,357	93,556	25.8%
System Upgrade	637,015	641,119	0.6%
Reliability & Maintenance	408,571	451,688	10.6%
Customer Response	11,854	21,082	77.8%
Other	16,292	19,315	18.6%
Total	1,148,089	1,226,760	6.9%

Explanation of variances of 10% or greater:

New Service/Revenue: Costs exceeded budgeted amount because the number of new customer connects was larger than anticipated.

Reliability & Maintenance: Costs exceeded the budgeted amount as a result of an increased focus on maintaining equipment reliability.

Customer Response: Costs exceeded the budgeted amount as a result of high storm activity.

Other: Costs exceeded the budgeted amount for reasons such as the higher than anticipated number of new customer connects, and a shift to more reliability projects.

Quantified transmission and distribution inspection and maintenance goals/objectives for the current year detailed by system area (that is, transmission, substation and distribution).

Inspection & Maintenance Goals/Objectives	2018 Budget
Transmission	
Transmission C-tag poles (# of poles)	456
Transmission arm replacements (# of sets)	103
Transmission air break switch inspections (# of switches)	0
Transmission lightning arrester installations (# of sets)	0
Transmission structure inspections (# of structures)	33,291
Transmission tree side trim-Bulk Power (linear feet)	N/A
Transmission herbicide-Bulk Power (# of acres)	N/A
Transmission reclearing (# of miles) BES Only	548.87
Transmission reclearing (# of miles) 69 kV	860.62
Transmission reclearing (# of miles) 138 kV	60.12
Transmission danger tree removals-Bulk Power (# of trees)	N/A
Substation	
Substation batteries (# of activities)	673
Circuit breakers (# of activities)	639
Substation inspections (# of activities)	1,797
Transformer maintenance (# of activities)	175
Distribution	
Distribution C-tag poles replaced (# of poles)	3,490
C-truss distribution poles (# of poles)	3,442
Capacitor (MVAR added)	0
OCR Replacements (# of)	40
Distribution pole inspections (# of poles)	60,021
Distribution line inspections (hours)	9,742
Group re-lamping (# of lamps)	13,152
Test sections of underground distribution cable	N/A
Distribution tree trimming (# of miles)	4,420
Distribution herbicide (# of acres)	N/A
Distribution >18" removals within R/W (# of trees)	N/A
Distribution hazard tree removals outside R/W (# of trees)	N/A
LTN manhole inspections (# of)	300
LTN vault inspections (# of)	637
LTN network protector overhauls (# of)	65
LTN reverse power trip testing (# of)	23

10) Budgeted transmission and distribution operation and maintenance expenses for the current year in total and detailed by the EDC's own functional account code or FERC account code as available.

The following table provides budgeted operation and maintenance expenses for PPL Electric, in total, and includes the work identified in the response to Item (9).

Activity	2018 Budget (\$1,000s)
Provide Electric Service	7,475
Vegetation Management	46,843
Customer Response	51,177
Reliability & Maintenance	36,629
System Upgrade	10,350
Customer Services/Accounts	124,863
Other	31,376
Total O&M Expenses	308,713

11) Budgeted transmission and distribution capital expenditures for the current year in total and detailed by the EDC's own functional account code or FERC account code as available.

The following table provides budgeted capital expenditures for PPL Electric, in total, and includes transmission and distribution activities.

Activity	2018 Budget (\$1,000s)
Customer Response	88,127
New Service / Revenue	582,816
Reliability & Maintenance	474,068
System Upgrade	15,710
Other	24,056
Total	1,184,778

12) Significant changes, if any, to the transmission and distribution inspection and maintenance programs previously submitted to the Commission.

In PPL Electric's Inspection, Maintenance, Repair and Replacement Plan for 2018-2019 submitted to the Commission, a proposal was approved to deviate from the five-week substation inspection cycle to a quarterly program. This change is projected to save over \$1M in inspection costs with no adverse impact on reliability.

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PPL Electric Utilities Corporation
Transmission Programs & Procedures

PA PUBLIC UTILITY COMMISSION
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Program	Activity
Helicopter Inspections – Routine	Aerial linemen perform annual routine transmission line patrols from a helicopter. They identify damaged or deteriorated equipment. Engineers review the findings and develop plans for repair or replacement.
Helicopter Inspections – Comprehensive	Aerial linemen perform an overhead comprehensive inspection of transmission line facilities on a risk-based time cycle. Detailed condition reports with close up digital photos are prepared for each specific component problem found along the transmission line and right of way. Engineers review the findings and schedule corrective maintenance as needed.
Helicopter Inspections – Emergency	Aerial linemen perform patrols of transmission lines that operate abnormally. This inspection focuses on identifying damage that may have been caused by lightning, inclement weather, equipment failure or vandalism. Because of the nature of this work, corrective actions are usually expedited.
Field Inspections – Emergency	Line personnel perform emergency foot patrols to inspect transmission lines that operated abnormally. This inspection focuses on identifying damage that may have been caused by lightning, inclement weather, equipment failure or vandalism. Due to the nature of this damage, corrective actions are generally expedited.
Wood Pole – Inspection, Treatment, Replacement, Trussing (reinforcement)	Line personnel examine wood poles for deterioration and measure the degree of rot. Based on the results, the pole is either scheduled for a future inspection, reinforcement for extended life, or replacement.
Equipment Maintenance	During helicopter and foot patrols, equipment and facilities are identified that require repairs. Based on need and criticality, repairs are either scheduled or completed as soon as possible.
Planned Replacement Programs	Lightning arresters and avian guards are installed on targeted 69kV and 138kV facilities based on a data-driven risk analysis to improve reliability of worst performing circuits.
Line Switches – Maintenance & Inspection	Line personnel inspect, maintain, and perform operational tests on 138kV and 69kV transmission line switches to assure proper operation.

Appendix A

Program	Activity
Line Switch Upgrades	Transmission line switches are being programmatically upgraded to include motor operators to allow for remote sectionalizing that substantially improves switching times during outages.
Circuit Analysis	Engineers analyze circuit loading and performance to identify areas needing increased line capacity or improved line reliability.

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PPL Electric Utilities Corporation
Substation Programs & Procedures

PA PUBLIC UTILITY COMMISSION
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Program	Activity
Load Survey	Automatic monitoring devices such as Supervisory Control and Data Acquisition (SCADA) provide continuous, real-time loading information. Engineers review equipment loading and identify facilities and transfer capabilities approaching capacity limits. A portion of the load may be supplied from a different source, the existing facilities may be upgraded, new lines and equipment may be added, or a new substation may be built to address capacity deficiencies.
Substation Inspection/Repair	Electricians inspect substations for security and equipment reliability on a time based maintenance cycle. They attempt to identify and correct potential equipment problems before a failure or interruption of service occurs.
Equipment Service	Electricians perform operational tests on power transformers, load tap changers (LTC), voltage regulators, circuit breakers, circuit switchers, vacuum switches, air break switches and transformer protective switches on a time based maintenance cycle to assure that equipment is operating within established parameters. Equipment serviced includes batteries, battery chargers, protective relays, HV fuses and high-speed automatic grounding switches. Depending on the type of equipment, "service" can include actions other than operational testing.
Inspection & Overhaul	Electricians inspect and overhaul circuit breakers, wave traps, ground switches, stick-operated disconnects, gang-operated disconnects and motor-operated disconnects on a time based maintenance cycle to assure proper operation.
Insulation Testing	Electricians perform power factor testing on power transformer, potential transformers, lightning arresters, current transformers, circuit breakers and power cables on a time based maintenance cycle. Testing also includes other instrument transformers (CCVTs, coupling capacitors, potential devices, etc.). They also perform high-potential testing on air and vacuum circuit breakers to assure proper operation.
Condition Monitoring of Station Equipment	Technicians perform dissolved gas-in-oil, dielectric, oxygen, and oil acidity tests for oil in power transformers and impedance and capacity tests on station batteries to assure equipment is within normal parameters. Periodically, AC power factor tests, hi-potential tests, contact resistance tests and motion tests are performed on circuit breakers. Oil dielectric testing is conducted for oil circuit breakers.

Appendix B

Program	Activity
Thermographic Inspections	Technicians perform thermography surveys of substation facilities to identify components operating at elevated temperature. Based on the findings, engineers develop plans to repair or replace the component(s) prior to failure.
Minor Improvements	Maintenance activities may identify conditions where additions or upgrades are needed to assure reliability. Engineers evaluate the need and develop action plans and schedules to complete the work.
DC Station Service Improvements	Repairmen identify deteriorated station batteries, battery chargers and battery components. Engineers schedule repair or replacement as necessary.
Capacitor Bank Protection	Engineers monitor the need for synchronous closing schemes on vacuum switches on 69kv capacitor banks. They plan and schedule installations as needed.
Area/Regional Supply	Engineers develop specific projects aimed at improving capacity shortfalls or replacing deteriorated or substandard station equipment.
SCADA Replacement	Engineers identify deteriorating substation SCADA equipment and develop plans to repair or replace it.

***PPL Electric Utilities Corporation
Distribution Programs & Procedures***

Program	Activity
Load Survey – of equipment that is not continuously monitored	Line personnel measure the loading of facilities during peak periods. Engineers use this data for system studies.
Load Survey – by automatic monitoring devices	Automatic monitoring devices such as SCADA provide continuous, real-time loading information. Operators use this data to assure that loads do not exceed design limits. Engineers use this data for system studies.
Circuit Analysis	Engineers analyze circuit voltage profiles to balance loads and to identify areas requiring voltage support to maintain required voltage at the customer facility.
Voltage Regulator – Inspection & Maintenance	Line personnel inspect existing equipment for potential failure, and inspect and maintain controls and tap changers to assure proper operation. Line personnel repair or replace any defective equipment.
Overhead Line Switch – Inspection & Maintenance	Line personnel inspect switch installations to identify cracked or broken insulators / bushings, stuck or misaligned blades, insulation or gasket deterioration or other operational problems. Line personnel repair or replace any defective equipment.
Transformer Maintenance	Engineers analyze customer usage data to identify overloaded transformers. Transformers that are heavily loaded are replaced with higher capacity units or part of the load is transferred to other nearby transformers.
Wood Pole – Inspection, Maintenance, Replacement, Trussing, Fiber Wrap (reinforcement)	Inspectors examine wood poles for deterioration and measure the degree of rot. Based on the results, the pole is either scheduled for a future inspection, reinforcement for extended life or replacement.
Overhead Line Inspection	Line inspectors examine overhead facilities to identify damaged, deteriorated or substandard equipment. Line personnel repair or replace any defective equipment. Includes visual and thermo-graphic inspections.
Circuit Performance Review	Engineers use the PPL Electric's Circuit Performance Index to ascertain the need for additional circuit reviews / inspections.

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Appendix C

Program	Activity
Underground Primary Cable – Testing, Maintenance, Replacement, Curing	Line personnel perform insulation and neutral tests on cable in residential developments with potential problems to identify deteriorated cable. Based on the results, the cable is placed back in service, repaired or replaced.
LTN Maintenance	Electricians will inspect, service, maintain and overhaul LTN vaults, manholes, cables, transformers, low voltage network protectors and primary transformer disconnect switches. Based on results, defective equipment is either repaired or replaced.
Public Damaged Facilities Review	A program aimed at identifying the locations of facilities that have been damaged by public contact more than once. Technicians evaluate those installations and, if relocation is possible, schedule work to move the facilities.
Underground Service Cable	Engineers resolve customer service problems that are due to deteriorated service conductors.
Oil Circuit Reclosers	Line personnel replace in-service oil circuit reclosers on a time based maintenance cycle. Removed units are overhauled, tested and returned to service.
Line Protection Equipment	Engineers perform load calculations to identify line protection devices that are approaching their capacity limits. Devices are replaced or upgraded to assure that they function properly.
Capacitor Installation	Engineers perform voltage profiles to determine the need, location and size of any new voltage support equipment required to maintain adequate service voltage levels at customer facilities and provide needed reactive support for system stability. Line personnel install the required equipment.
Upgrade System Facilities	Engineers determine the need for additional capacity and design new and upgraded facilities to assure system reinforcements are constructed by the time they are needed.

***PPL Electric Utilities Corporation
Vegetation Programs & Procedures***

Program	Activity
Tree Pruning	Tree pruning is scheduled based on field conditions observed and/or a system prioritization process. All pruning is done in accordance with <u>American National Standard for Tree Care Operations-Tree, Shrub and Other Woody Plant Maintenance – Standard Practices (ANSI A300)</u> . All circuits are fully trimmed on a 4 year cycle (south) or a 5 year cycle (north), with intermediate work performed on an as-needed basis.
Danger Tree Removal	Trees located both within the right-of-way corridor and outside the right-of-way that may be a threat to line performance/ safety are removed when it is feasible to do so.
Herbicide Application	Tall-growing, undesirable vegetation growing within the rights-of-way corridors is selectively treated with herbicides. Low-growing vegetation that does not represent a hazard to the safe, reliable operation of PPL Electric's facilities is preserved wherever possible.
Reclearing	Tall-growing, undesirable vegetation growing within the rights-of-way corridors is selectively removed in those situations where herbicides can't be utilized. Low-growing vegetation that does not represent a hazard to the safe, reliable operation of PPL Electric's facilities is preserved wherever possible.

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PPL Electric Utilities Corporation
Service Interruption Definitions

Trouble Definitions: After field investigations and repairs are complete, PPL Electric linemen report the cause of each case of trouble. The definitions of the cause codes appear below. Note that while internal codes allow vegetation caused outages to be separated into trimming related and not trimming related, these categories are generally merged for internal reporting purposes, and consistent with the response to question 4.

Improper Design	Controllable	When an employee or agent of PPL Electric is responsible for an error of commission or omission in the engineering or design of the distribution system.
Improper Installation	Controllable	When an employee or agent of PPL Electric is responsible for an error of commission or omission in the construction or installation of the distribution system.
Improper Operation	Controllable	When an employee or agent of PPL Electric is responsible for an error of commission or omission in the operation or maintenance of the distribution system.
Trees –Trimming Related	Controllable	Outages resulting from conductors contacted by tree growth within the clearance zone defined by the current trimming specification (within the Right-of-Way).
Trees – Not Trimming Related	Non-Controllable	Outages due to trees, but not related to lack of proper tree trimming maintenance. This includes danger timber blown into PPL Electric facilities, and trees or limbs felled by the public.
Animals	Controllable	Any outage caused by an animal directly or indirectly coming in contact with PPL Electric facilities. This includes birds, squirrels, raccoons, snakes, cows, etc.
Vehicles	Public	When cars, trucks or other types of vehicles or their cargoes strike facilities causing a problem.
Contact/Dig-in	Public	- When work in the vicinity of energized overhead facilities results in interruptions due to accidental contact by cranes, shovels, TV antennas, construction equipment (lumber, siding, ladders, scaffolding, roofing, etc.). - When contact is made by a non-employee with an underground facility causing interruption.

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Appendix E

Equipment Failure	Controllable	• Outages resulting from equipment failures caused by corrosion or contamination from build-up of materials, such as cement dust or other pollutants. • Outages resulting from a component wearing out due to age or exposure, including fuse tearing or breaking. • Outages resulting from a component or substance comprising a piece of equipment failing to perform its intended function. • Outages resulting from a failure that appears to be the result of a manufacturer's defect or cannot be described by any other code indicating the specific type of failure.
Directed by Non-PPL Authority	Non-Controllable	• Interruptions under the control of a PPL Electric switchman or direction of a PPL Electric System Operator for the purpose of dropping load or isolating facilities upon request during emergency situations. • Interruptions which cannot be postponed or scheduled for a later time, and include situations like load curtailment during system emergencies, and requests of civil authorities such as fire departments, police departments, civil defense, etc. for interruption of PPL Electric facilities.
Other – Controllable (Lineman provides explanation)	Controllable	• Interruptions caused by phase to phase or phase to neutral contacts, resulting from sleet or ice dropping off conductors, galloping conductors, or any other phase to phase or phase to neutral contact where weather is a factor. • Interruptions resulting from excessive load that cause that facility to fail. • When restoration of service to a facility, which had been interrupted for repairs or other reasons, causes an additional interruption to another facility which had not been involved in the initial interruptions. • Controllable interruptions or Power Service Problems whose cause is not described by one of the previous controllable cause codes.
Nothing Found	Non-Controllable	• When no cause for the interruption can be found. • When there is no evidence of equipment failure, damage or contact after line patrol is completed. This could be the case during a period of heavy thunder and lightning, when a line fuse blows or a single phase OCR locks open. • When closed for test, the fuse holds or the OCR remains closed. A patrol of the tap reveals nothing.

Appendix E

Other Public (Lineman provides explanation)	Public	• All outages resulting from gunfire, civil disorder, objects thrown, or any other act intentionally committed for the purpose of disrupting service or damaging company facilities.
Other – Non-Controllable (Lineman provides explanation)	Non-Controllable	• Any outage occurring because of a fire, flood or a situation that develops as a result of a fire or flood. Do not use when facilities are de-energized at the request of civil authorities. • When an interruption is caused by objects other than trees, such as kites, balls, model airplanes, roofing material, or fences, being accidentally blown or thrown into overhead facilities. • All problems caused by contact of energized equipment with facilities of other attached companies or by trouble on customer owned equipment. • Interruptions or Power Service Problems whose cause is not described by one of the previous non-controllable cause codes, but is not affected by a PPL Electric employee's decisions.

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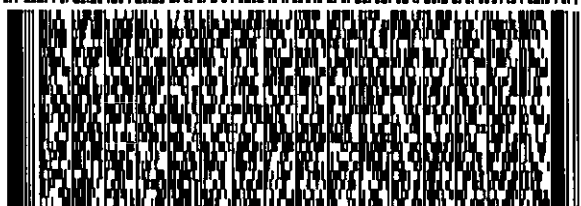
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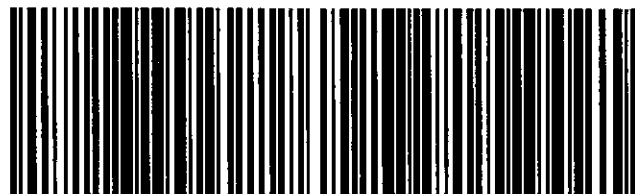
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