Raquel J. Webster
Senior Counsel

April 6, 2016

BY HAND DELIVERY & ELECTRONIC MAIL

Luly E. Massaro, Commission Clerk
Rhode Island Public Utilities Commission
89 Jefferson Boulevard
Warwick, RI 02888

RE: Docket 4237 - Commission Investigation relating to Stray and Contact Voltage Occurring in The Narragansett Electric Company Territories
National Grid 2016 Contact Voltage Annual Report

Dear Ms. Massaro:

Pursuant to R.I. Gen. Laws § 39-2-25 and the Rhode Island Public Utilities Commission's (PUC) Order No. 20950 in Docket 4237, I have enclosed The Narragansett Electric Company's[1] 2016 Contact Voltage Annual Report.

The Annual Report includes the following nine sections:

- Section 1: Background and summary;
- Section 2: Summary of the Company's surveying and testing results of the fourteen designated contact voltage risk areas (DCVRAs) for the period of October 26, 2015 to November 10, 2015;
- Section 3: Contact Voltage Program costs;
- Section 4: Details regarding calls to the Company's Shock Line;
- Section 5: Copy of the Company's current emergency operating procedure (EOP)-G016;
- Section 6: Additional information on the Company's total harmonic distortion (THD) pilot program results;

[1] The Narragansett Electric Company d/b/a National Grid.

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- Section 7: The Company's recommendation for the percentage of DCVRAs to be completed in the fifth year of the program;

- Section 8: Summary of the Company's latest understanding of the current state of electrical standards and mobile equipment technology; and

- Section 9: Summary of the Company's Recommendations for the FY 2017 Contact Voltage Program.

As noted in the enclosed Annual Report, the original three-year contract for the mobile testing was awarded in January 2013. In October of 2015, the Company awarded a new four-year contract to Willbros for the FY 2016, FY 2017, FY 2018, and FY 2019 mobile surveys. The next request for proposals for the contract will be for the FY 2020 mobile survey.

Thank you for your attention to this transmittal. If you have any questions, please contact me at 781-907-2121.

Very truly yours,

Raquel J. Webster

Enclosure

cc: Docket 4237 Service List
Steve Scialabba
Leo Wold, Esq.

Certificate of Service

I hereby certify that a copy of the cover letter and any materials accompanying this certificate was electronically transmitted to the individuals listed below.

The paper copies of this filing are being hand delivered to the Rhode Island Public Utilities Commission and to the Rhode Island Division of Public Utilities and Carriers.

Joanne M. Scanlon

April 6, 2016
Date

Docket No. 4237 – Commission's Proceeding Relating to Stray and Contact Voltage Pursuant to Enacted Legislation Service List updated 04/02/15

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The Narragansett Electric Company
d/b/a National Grid

Rhode Island
2016 Contact Voltage
Annual Report

April 6, 2016

Submitted to:
Rhode Island Public Utilities Commission
RIPUC Docket No. 4237

Submitted by:

nationalgrid

Table of Contents

Glossary of Terms

Term	Definition
Contact Voltage	A voltage resulting from abnormal power system conditions that may be present between two (2) conductive surfaces that can be simultaneously contacted by members of the general public and/or their animals.
Designated Contact Voltage Risk Areas (DCVRA)	Boundaries of areas approved by the Rhode Island Public Utilities Commission in Docket No. 4237 and subsequent proceedings that are based upon the presence of underground electric distribution and situated in pedestrian-dense areas such as neighborhoods, commercial areas, central business districts, tourist-heavy locations, and other places where pedestrians could be exposed to contact voltage.
Guarded – Made Safe	Guarded – Made Safe is defined as an asset being guarded by a person or a protective barrier that prevents public contact if the elevated voltage found is greater than 4.5 volts. If the voltage measures greater than 4.5 volts and less than 8 volts, it is either guarded in person or by installation of a protective barrier that prevents public contact. If the voltage measurement is greater than 8 volts, it is guarded by an equipment elevated voltage inspector or a Company employee that has been trained to stand by on energized facilities; in this instance, an immediate maintenance and repair response is required.

Investigatory Mobile Survey Stop	A stop during a survey where the mobile detection device indicated evidence of elevated voltage (greater than zero (0) volts) and a stop was made to survey for elevated voltage with manual instruments (pen detector). All metallic devices within 30 feet are tested manually for elevated voltage at each stop. The Investigatory Mobile Survey Stop may or may not discover an asset with elevated voltage.
Mobile Event	An Investigatory Mobile Survey Stop where elevated voltage (greater than zero 0 volts) was discovered on an asset (either company or customer-owned). These Mobile Events are divided into three categories: (1) those with readings below 1 volt, (2) those having elevated voltage between 1 volt and 4.5 volts, and (3) those having elevated voltage readings 4.5 volts or greater. The readings above reflect the actual voltage determined by manual shunt meter testing of the asset.
Post-Mitigation Manual Testing	Manual elevated voltage testing performed on assets which had a voltage of greater than 1 volt in the prior year's mobile testing and were subsequently mitigated.
Quality Assurance Manual Testing	Manual elevated voltage testing performed on a random sample of assets in the Designated Contact Voltage Risk Areas after the mobile survey is performed.
Total Harmonic Distortion (THD) Contact Voltage Testing	THD is determined by the use of a Fluke power quality clamp meter or a Fluke scope meter during an investigatory Mobile Survey Stop. THD contact voltage testing applies to any voltage measures greater than 1 volt and less than 4.5 volts that had a total harmonic distortion of less than 10%. A THD of less than 10% will be considered as contact voltage for Mobile testing.

Section 1

Background and Summary

Background and Summary

On June 6, 2012, the Rhode Island Contact Voltage statute, R.I. Gen. Laws § 39-2-25, was signed into law. That statute directed the Rhode Island Public Utilities Commission (PUC) to establish a contact voltage detection, repair, and reporting program, which would be applicable to National Grid.[1] On November 9, 2012, the PUC issued an order (Program Order)[2] approving the Company's amended contact voltage program (Contact Voltage Program). The Program Order established thirteen (13) Designated Contact Voltage Risk Areas (DCVRA)[3] for the State of Rhode Island, and directed the Company to conduct testing and surveys for contact voltage on all conductive surfaces in public right-of-ways identified within these DCVRAs.

On February 1, 2013, the PUC issued a subsequent order (Compliance Order)[4] that directed the Company to complete its initial testing and surveying of all thirteen (13) DCVRAs in the first year. The Compliance Order further required the Company to file the findings and results of this testing in an annual report (Contact Voltage Annual Report) by no later than September 1, 2013. The Contact Voltage Annual Report must identify the specific elevated voltage events found during surveying and testing and explain the appropriate remedial action taken by the Company to ensure public safety. The Compliance Order also required the Company, after the findings and results of its

1 The Narragansett Electric Company d/b/a National Grid (National Grid or Company).
2 Written Order No. 20871 (issued on November 9, 2012 in Docket No. 4237).
3 The initial thirteen DCVRAs include Newport, Pawtucket, Woonsocket, and ten designated sections in the City of Providence (College Hill, Downtown, Elmwood, Federal Hill, Lower South Providence, Olneyville, Smith Hill, Upper South Providence, Washington Park, and West End). As noted below, a section of Westerly has been added as a fourteenth DCVRA.
4 Written Order No. 20950 (issued on February 1, 2013 in Docket No. 4237).

survey and testing were reviewed, to provide the PUC with a recommendation of the specific DCVRAs to be surveyed and tested in the next year of the program. Finally, the Compliance Order further directed the Company to keep the PUC apprised of any advances in elevated voltage mobile technology as part of its Contact Voltage Annual Report.

The PUC directed that the Contact Voltage Annual Report must be provided in Excel or searchable PDF format and must include the information below by DCVRA.[5] Exhibit 1 provides a searchable Excel file that includes the information for each mobile event recorded during testing (#1-14 below):

1. A record number for each contact voltage event (*Exhibit 1, Column (a)*)
2. The date and time of the testing (*Exhibit 1, Columns (b),(c)*)
3. The specific location of the testing (*Exhibit 1, Columns (d),(f),(g),(h),(i),(j)*)
4. An identification of whether it was a Company or customer asset (*Exhibit 1, Column (p)*)
5. The type of the equipment that failed (*Exhibit 1, Columns (n),(o)*)
6. The voltage recorded (*Exhibit 1, Columns (k),(l),(m)*)
7. Whether there was any personal injury to public, pet or property damage (*Section 4*)[6]
8. An identification of any other equipment involved (*Exhibit 1, Columns (n),(z)*)
9. Whether there were any prior incidents for the last five years at that location (*Exhibit 1, Column (u)*)
10. The corrective actions taken at the location (*Exhibit 1, Column (e),(z)*)
11. The number of customers if service is interrupted (*Exhibit 1, Column (s)*)
12. The duration of the interruption (*Exhibit 1, Column (t)*)
13. A summary of the investigation into the cause of the incident (*Exhibit 1, Column (z)*)
14. The date when corrective action was taken and the date on which repairs were made (i.e. temporary and final) (*Exhibit 1, Columns (y),(aa),(ab),(ac),(ad)*)

[5] Program Order at 28-29.
[6] Reports of any injury to the public, pets or property are reported in Section 4 below.

In addition, the PUC further directed that the Contact Voltage Annual Report also include information concerning:[7]

15. The aggregated costs of repair for each contact voltage event by DCVRA (*Section 3*)
16. The number of calls to the Shock Line (*Section 4*)
17. Any additional back-up information currently included in Section 7.3[8] of the Company's current EOP-G016 (*Section 5 and Exhibit 1*)
18. A recommendation on whether any DCVRA should be added or modified with a specific rationale supporting the recommendation (*Section 7*)
19. A recommendation of which DCVRAs should comprise the 20 percent to be tested in the next year (*Section 7*); and
20. Any updates the Company discovered concerning the standards (IEEE) and advances in equipment technology (*Section 8*)

On March 31, 2014, the PUC approved the Company's FY 2013 Contact Voltage Annual Report in Docket No. 4237-A and subsequently issued an order (First Annual Report Order)[9] that amended the Company's Annual Contact Voltage Report to include:[10]

21. The addition of a section of Westerly as a fourteenth DCVRA *(Section 2)*
22. The estimated number of mobile survey stops (*Section 2*)
23. A glossary and listing of terminology in the report (*Glossary of Terms*)
24. A summary of mobile survey events and readings (*Section 2, Table 1 and Table 2*)
25. The inclusion of before and after readings for the Company's Total Harmonic Distortion (THD) pilot program (*Exhibit 1, Column (ac) and Section 6, Table 7 and Table 8*)

On December 16, 2014, the PUC approved the Company's FY 2014 Contact Voltage Annual Report in Docket No. 4237, and subsequently issued an order (Second

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7 Program Order at 28-29, Compliance Order at 8-9.

8 The Program Order directed the Company to include additional back-up information included in Section 7.2 of the Company's EOP-G016, Version 1. This EOP has since been revised (Version 2, attached as Exhibit 4) to include section 7.3, which includes the back-up information applicable for mobile elevated voltage testing to be include in the Annual Report.

9 Written Order No. 21414 (issued on March 31, 2013 in Docket No. 4237-A).

10 First Annual Report Order at 8-9.

Annual Report Order)[11] that directed the Company's Contact Voltage Annual Report to address the following:[12]

> 26. Implement follow-up scans in DCVRAs where remediation work was completed before the next annual mobile survey to verify that the objects found and repaired were fully addressed. (*Section 2 - Post-Mitigation Manual Testing, Exhibit 2*)
> 27. Implement a process where random objects are selected in each DCVRA and manually tested for contact voltage following the mobile testing. (*Section 2 - Quality Assurance Manual Testing, Exhibit 3*)

Similar to last year's Contact Voltage Annual Report, the Company has incorporated these modifications into the charts and exhibits within this filing.

Additionally, on March 14, 2016, the PUC approved the Company's FY 2015 Contact Voltage Annual Report in Docket No. 4237, and subsequently issued an order (Third Annual Report Order)[13] that approved a modified mobile testing schedule proposed by the Company, where mobile surveying and testing will now occur in the April-June timeframe.

Section 2 of the Contact Voltage Annual Report provides a summary of the Company's surveying and testing results of the fourteen (14) DCVRAs for the period of April 1, 2015 to March 31, 2016. Section 3 provides a preliminary summary of the aggregate costs of the Contact Voltage Program (#15 above). Section 4 provides a fiscal year list of calls to the Company's Shock Line and reports of any injury to the public, pets or property (#7 and #16 above). Section 5 includes a copy of the Company's current EOP-G016 (#17 above and Exhibit 4). Section 6 provides additional information on the

[11] Written Order No. 21780 (issued on December 16, 2014 in Docket No. 4237).
[12] Second Annual Report Order at 6.
[13] Written Order No. 22357 (issued on March 14, 2016 in Docket No. 4237).

results of the Company's total harmonic distortion (THD) pilot program, which the PUC approved in the First Annual Report Order. Section 7 includes the percentage of DCVRAs to be completed in the fifth year of the program (#18 and #19 above). Section 8 provides the current state of electrical standards and elevated voltage mobile equipment technology (#20 above). Finally, Section 9 provides the Company's recommendations for the FY 2017 Contact Voltage Program.

Section 2

Survey and Testing Results

1. Mobile Survey and Testing Results

In compliance with the First Annual Report Order, Willbros Engineers (U.S.), LLC. (Willbros), who previously performed mobile contact voltage testing under its subsidiary, Premier Utility Services, LLC (Premier), conducted the surveying and testing of all fourteen (14) DCVRAs over the period of October 26, 2015 to November 10, 2015. Willbros conducted all surveying and testing at nighttime to include the testing of street lights. In total, the surveying and testing of all fourteen (14) DCVRAs covered approximately 117.5 miles.[14] The Company had underground crews and inspectors available to guard any elevated voltage findings discovered during the surveying and testing until such areas could be made safe. When an elevated voltage condition of 4.5 volts or greater was found and verified, the Company followed proper Guarded – Made Safe actions. If the site was customer-owned, the owner or municipality was notified by the Company, and appropriate action was taken to ensure public safety at that location.

In addition, the testing in each DCVRA included the THD pilot during which any voltage measure greater than 1 volt and less than 4.5 volts that had a total harmonic distortion of less than 10 percent was considered contact voltage. The Company remediated ten (10) locations where the THD was less than 10 percent. As such, these locations were safeguarded from the public and appropriate permanent repairs were made. THD was determined by the use of a Fluke power quality clamp meter or a Fluke scope meter. As discussed in more detail in Section 6, although not considered hazardous

[14] The 117.5 miles includes all mileage driven to survey. This includes both sides of a street, not simply linear mileage.

to the public, as part of the testing, the Company also remediated four (4) events where the total harmonic distortion was greater than 10 percent.

Twenty-six (26) mobile events were recorded during the mobile scanning survey having 1 volt or greater. These findings were up from the nineteen (19) mobile events recorded during the FY 2015 mobile survey, and the sixteen (16) mobile events recorded during the FY 2014 mobile survey. Two (2) of the assets tested during the FY 2016 mobile survey were repeats from the FY 2015 mobile survey. Event ID 7 from the FY 2016 mobile survey was the same asset as Event ID 14 from the FY 2015 mobile survey and Event ID 10 from the FY 2016 mobile survey was the same asset as Event ID 19 from the FY 2015 mobile survey.

Table 1 below provides the dates of testing, number of estimated investigatory mobile survey stops, and number of mobile events by shunt voltage readings, summarizing the FY 2016 mobile survey. Of the twenty-six (26) mobile events that were recorded during the mobile survey having 1 volt or greater, twelve (12) were found and documented as having elevated voltage at or above 4.5 volts, and fourteen (14) were found and documented as having elevated voltage below 4.5 volts. In each of these events, the Company took immediate remedial action by disconnecting the asset, placing protective barriers, and/or repairing the asset. All of the Company's assets that registered greater than 1 volt were permanently repaired between November 2, 2015 and March 16, 2016.

Table 1
Mobile Events by DCVRA

DCVRA	Dates Tested	Estimated Investigatory Mobile Survey Stops	Mobile Events	Readings < 1 Volt	Readings > 1 Volt but < 4.5 Volts		Readings >= 4.5 Volts	
				Customer and Company Asset	Customer Asset	Company Asset	Customer Asset	Company Asset
PROVIDENCE								
College Hill	11/04/15		3	1				2
Downtown	10/30/15 to 11/8/15	6	16	7		4		5
Elmwood	10/27/15							
Federal Hill	11/08/15	1	4	1		3		
Lower So. Prov.	10/26/15		2	1		1		
Olnyville	10/28/15		1	1				
Smith Hill	11/04/15		2					2
Upper So. Prov.	10/29/15	1	6	6				
Washington Park	10/26/15		2	2				
West End								
NEWPORT	11/10/15		2					2
PAWTUCKET	11/08/15 to 11/09/15	4	10	8		2		
WESTERLY	11/10/15		1			1		
WOONSOCKET	11/09/15	5	10	6		3		1
Total		**17**	**59**	**33**	**0**	**14**	**0**	**12**

As shown in Table 1 above, during the mobile survey, seventeen (17) stops were made to investigate elevated voltage readings where the mobile detection system indicated increased electric field strength in the area surveyed. All available conductive objects and surfaces in the location were tested with a vast majority of these mobile events resulting in a finding of no actionable voltage on a conductive object or surface.

Overall, over 3,000 manual checks were made on objects and assets over the 16-day scanning period.

Table 2 below provides the same detail on mobile events as in Table 1, but by Asset Type. As shown in Table 2, streetlights are responsible for the majority of elevated voltage readings. This is consistent with the results from the FY 2013, FY 2014, and FY 2015 mobile surveys.

Table 2
Mobile Events by Asset Type

Asset Type	Mobile Events	Readings less than 1 Volt	Readings Greater than 1 Volt but less than 4.5 Volts		Readings Greater than 4.5 Volts	
		Customer and Company Asset	Customer Asset	Company Asset	Customer Asset	Company Asset
Streetlight	53	27		14		12
Traffic Control Box	2	2				
Private Lighting						
Traffic Standard	1	1				
No Parking Sign						
Store Fronts						
Other	3	3				
Total	**59**	**33**	**0**	**14**	**0**	**12**

Table 3 below provides a comparison of the number of mobile events by voltage level, found in the FY 2015 and FY 2016 mobile surveys.

Table 3
Comparison of Number of Mobile Events FY 2015 to FY 2016

Number of Mobile Events	FY 2015	FY 2016
Readings less than 1 Volt	2	33
Readings Greater than 1 Volt but less than 4.5 Volts	12	14
Readings Greater than 4.5 Volts	7	12
Total	**21**	**59**

2. Manual Surveying and Testing Results

As previously noted, in the Second Annual Report Order, the PUC directed the Company to conduct additional testing as part of the Contact Voltage Program and to provide the results in the Contact Voltage Annual Report. This included (1) manually testing the areas where previous remediation work was completed before this year's mobile survey to ensure the repairs were addressed, or post-mitigation manual testing; and (2) manually testing a number of random assets and objects in each DCVRA to spot verify areas not indicated by mobile technology after this year's mobile survey, or quality assurance manual testing.

On May 7, 2015, the Company conducted its post-mitigation manual testing of twenty-one (21) company and customer mobile events from the FY 2015 mobile survey

where repairs were completed. All of the mitigated repair shunt voltage readings[15] for this post-mitigation manual testing were less than 1 volt and no further remediation was required. Additional details of the Company's post-mitigation manual testing are provided in Exhibit 2. In Exhibit 2, columns (a) through (ac) were taken from Exhibit 1 in the FY 2015 Annual Contact Voltage Report filed with the PUC on June 30, 2015, and Columns (ad) though (aj) were from the testing performed on these same assets in the post-mitigation manual testing done on May 7, 2015.

Regarding the manual testing of random assets and objects, to perform its quality assurance audit, the Company selected a random sample of 1,100 Company and customer assets spread throughout the fourteen (14) DCVRAs. This sample size was based on a total population of approximately 5,000 Company-owned assets in the fourteen (14) DCVRAs, using a confidence level of 95% and a confidence interval of 0.004. These included Company assets such as manholes, handholes, street lights, and underground vaults. The quality assurance audit for FY 2016 found no instances of elevated voltage. Therefore, Exhibit 3 is not included in this report. Between December 8, 2015 and December 16, 2015, these 1,100 assets were audited by Company personnel, and the results revealed that no elevated voltage was found on 1,085 of these assets. Fifteen (15)

[15] Exhibit 2, column (ah).

of the 1,100 assets were found to be inaccessible to the Company and the public or not located in the field, and, as such, were not tested.[16]

[16] The Company has continued to make progress with mitigating stray voltage on Westwind Drive in South Kingstown, Rhode Island. In July 2013, the company received initial shock complaints from two customers on Westwind Drive. To date, the Company has reduced the stray voltage from approximately 22.5v down to approximately 12.5v. The Company has continued working with several property owners on Westwind Drive in efforts to secure necessary easement rights to construct a permanent distribution system between Westwind Drive and Julia Court. Installation of this permanent distribution system will reduce the stray voltage down to approximately 6.5v. After the Company has installed the permanent distribution system, it will assess this situation based on stray voltage readings and feedback from customers on Westwind Drive. The Company will notify the PUC when this issue is resolved.

Section 3

Contact Voltage Program Costs

Contact Voltage Program Costs

The cost to perform the mobile survey, post-mitigation manual testing, and quality assurance manual testing in the fourteen (14) DCVRAs was $233,761. In addition, the cost to repair Company locations identified during the FY 2016 contact voltage surveying and testing was $22,144. The cost for Police Traffic Control for the associated FY 2016 repair work was $3,731. These are shown by DCVRA in Table 4 below. The total costs for the FY 2016 contact voltage testing and repair were $259,636. The Company will reconcile these costs as part of its FY 2016 Electric Infrastructure, Safety, and Reliability Plan Reconciliation Filing, which the Company will submit to the PUC on or before August 1, 2016.

Table 4
Aggregate Contact Voltage Testing and Repair Costs

DCVRA	Repair Costs (Company Locations)	Police Traffic Control	Mobile Survey, Post-Mitigation Manual Testing, QA of Manual Testing
Newport	$2,852		
Pawtucket	$1,625		
College Hill	$2,211	$770	
Downtown	$8,334	$1,362	
Federal Hill	$632		
Lower South Providence	$1,365		
Smith Hill	$4,467	$1,599	
Woonsocket	$658		
Total	**$22,144**	**$3,731**	**$233,761**
Grand Total			**$259,636**

Section 4

Shock Line Calls

Shock Line Calls

As previously noted, the Compliance Order directed the Company to report annual calls to its Shock Line. Shock Line calls to the Company record an event of elevated voltage reported by the either the public or other entities such as another utility. For the period April 1, 2015 to March 31, 2016, the Company received three calls of elevated voltage to its Shock Line. The Company responded to these calls by testing for elevated voltage, mitigating conditions where necessary, and repairing facilities as needed. In addition, if the asset was customer owned, the Company notified the customer and informed them of any actions the Company planned to take to remedy the issues. There were no reported personal injuries or damages to property from any of these incidents.

Table 5
Shock Line Calls

Date	Town	Street	Asset	Voltage Found	Owner	Injury
5/20/2015	North Kingstown	5939 Post Rd	Other	0 Volts	Customer	No
11/2/2015	Providence	P16 Friendship St	Traffic Control	17.9 Volts	Company	No
11/4/2015	Providence	P9 Stimson Ave	Steel Pole	Not documented	Company	No

In one call, the Company found voltage that exceeded 4.5 volts. The call was on Friendship Street in Providence, where the Company found 17.9 volts on pole P16. The Company cut power to the pole and made conditions safe. Through investigation, the Company found a loose neutral connection in a nearby handhole that had burned. The Company removed the damaged neutral connection and installed a new splice. After this

correction, there were no instances of elevated voltage at either the repaired handhole or at pole P16.

In two calls, the Company did not find any instances of elevated voltage. The first call was on Post Road in North Kingstown, where the caller reported elevated voltage coming from a secondary riser pipe at a bus shelter. The Company took voltage readings at the pipe and found no instances of elevated voltage at that time. Voltage readings were taken on the taped secondary wires, which read 120 volts. As a precaution, the Company disconnected the wires at pole 04S, retested the wires at the bus shelter, which read zero voltage, and allowed the property manager to cut the riser pipe below grade. The second call was on Stimson Avenue in Providence, where the Company responded to a call of elevated voltage on a street light pole P9. The Company took voltage readings at the street light pole and found no instances of elevated voltage at that time. As a precaution, the Company responded by disconnecting the street light and making conditions safe. The Company will also install a new conduit and cable to the street light.

Section 5

Company EOP-G016

Company EOP-G016

There have been no additional updates or modifications to EOP-G016 since the FY 2015 Contact Voltage Annual Report that was filed with the PUC on June 30, 2015. Exhibit 4 of this filing includes the 2.0 version of EOP-G016, which was last updated and published on September 30, 2013.

Section 6

THD Pilot Program

THD Pilot Program

In the First Contact Voltage Annual Report Order, the PUC approved the continuation of the THD pilot program, noting that THD testing will provide the Company and the PUC with additional information and testing results upon which to make a recommendation for continued THD use and possible modifications or changes to the Contact Voltage Program in future years. The THD pilot testing was performed as part of the fourth year of testing from October 26, 2015 to November 10, 2015. Under the THD pilot testing, during contact voltage testing, any voltage measures greater than 1 volt and less than 4.5 volts that had a total harmonic distortion of less than 10% would be considered contact voltage and treated accordingly. Specifically, these areas would be safeguarded from the public and permanent repairs would be made as needed. However, if the total harmonic distortion was greater than 10% and no visual defects were found, then no further action would be required. THD was determined by the use of a Fluke power quality clamp meter or a Fluke scope meter, both of which have the ability to measure THD. A summary of the results of the THD pilot program are set forth in the table below:

Table 6
THD Readings

Total Readings Greater than 1 Volt but less than 4.5 Volts	Number of Readings with THD < 10%	Number of Readings with THD > 10%
14	10	4

As shown above, the results of the THD pilot program indicate a total of fourteen (14) readings between 1 volt and 4.5 volts (Exhibit 1, Column l). Of that total, ten (10) readings were below the 10% distortion level and, therefore, considered as contact voltage. Four (4) readings were greater than the 10% distortion level and, therefore, not considered as contact voltage. All fourteen (14) of these readings occurred on Company-owned streetlights, where the Company took the appropriate Guarded – Make Safe actions.

Table 7 below provides the THD readings with distortion levels below 10% by Event ID (*Exhibit 1, Columns (a)*), DCVRA (*Exhibit 1, Columns (d)*), street/cross street location (*Exhibit 1, Columns (g),(h)*), the associated shunt voltage reading (*Exhibit 1, Columns (l*), initial THD reading (*Exhibit 1, Columns (m)*), and subsequent THD reading after the Company's repairs (*Exhibit 1, Columns (ac)*).

Table 7*
THD Readings Below 10%

Event ID	DCVRA	Street	Shunt Voltage	THD Before	THD After
1	Providence-Zone 5-Lower South Providence	Broad St & Saratoga St	2.57	6.2	0
2	Providence-Zone 4-Federal Hill	Broadway & Pallas St	1.9	6.4	0
5	Providence-Zone 2-Downtown	Chestnut St & Elbow St	3.9	3.4	0.22
6	Providence-Zone 2-Downtown	Chestnut St & Bassett St	2.9	4.8	0.11
9	Providence-Zone 2-Downtown	Ship St & Richmond St	2.5	5.6	0
16	Providence-Zone 4-Federal Hill	Atwells St & Dean St	1.5	7.2	N/A
17	Providence-Zone 4-Federal Hill	Atwells St & Weeden St	1.2	7.5	N/A
20	Woonsocket	Truman Dr & Clinton St	1.6	2.4	0
22	Woonsocket	Clinton St & Cumming St	2.4	8.2	0
24	Westerly	Main St & Broad St	2.2	2.9	0

* Repairs for these events are described in Section 2.

Table 8 is the same as Table 7, but provides the THD readings with distortion levels greater than 10%.

Table 8*
THD Readings Above 10%

Event ID	DCVRA	Street	Shunt Voltage	THD Before	THD After
15	Providence-Zone 2-Downtown	College St & Benefit St	1.03	10.3	8.3
18	Pawtucket	Park St & Harris Ave	1.1	35.3	0.69
19	Pawtucket	Park St & S Union St	1.4	35.4	0
23	Woonsocket	Clinton St & Cumming St	2.3	11.6	0

* Repairs for these events are described in Section 2.

After reviewing the THD pilot program information as well as the overall mobile survey testing results for the past four years, the Company plans to continue using THD testing during the FY 2017 mobile survey cycle. As evidenced by the low number of elevated voltage readings greater than 1 volt and less than 4.5 volts for the past four years (nine (9) in 2014, twelve (12) in 2015, and fourteen (14) in 2016), the Company believes that the costs of THD testing are minimal and that THD testing will continue to provide the Company and the PUC with additional information to be considered for any possible modifications or changes to the Contact Voltage Program in future periods.

Section 7

DCVRA Recommendation

DCVRA Recommendation

In the Compliance Order, the PUC directed the Company to include in its Contact Voltage Annual Report a recommendation as to which DCVRAs would be included in the 20 percent to be surveyed and tested in the next year of the Contact Voltage Program.[17] In preparing its recommendation, as discussed below, the Company relied on the results of its first four years of surveying and testing. In addition, the Company has also examined additional areas of the state that may qualify as a new DCVRA. At this time, the Company does not recommend any changes to the current list of fourteen (14) DCVRAs.

Regarding surveying and testing for the fifth year, the Company has considered two options. The first option would be to again survey and test 100 percent of the DCVRAs in FY 2017. Testing 100 percent of the DCVRAs in FY 2017 would provide the Company and the PUC with five consecutive years of elevated voltage results for each DCVRA. This option would be operationally efficient because mobile testing for the entire state could be completed in approximately two weeks. Although surveying and testing 100 percent of the DCVRAs in FY 2017 would be more expensive than only testing the 20 percent required by statute, the Company would expect these costs to be similar to those incurred in FY 2016. Given the similar number of events found in FY 2016 as compared to FY 2015, the Company concludes that testing 100 percent of the DCVRAs for another year is a reasonable approach. When balanced against the more timely information and safety benefits of potential elevated voltage and the

[17] Compliance Order at 9.

administrative efficiency of completing the surveying and testing in the same fiscal year period, the Company believes that it is appropriate to incur these increased costs. Again, if approved by the PUC, the Company will negotiate with the vendor as allowed for in the contract.

Alternatively, if the PUC does not agree that surveying and testing 100 percent of the DCVRAs for FY 2017 is warranted, Table 9 below provides the Company's recommendation for the specific DCVRAs to be tested over each of the next four years. In compiling this schedule, the Company considered the 20 percent testing statutory requirement and recognized those areas that had more events and higher level readings from previous mobile surveys. In order to test 20 percent of the DCVRAs each year, the Company will test a minimum of three DCVRAs each year. The Company has rounded up the numbers in determining how to meet the 20 percent requirement, and recommends a four-year cycle rather than a five-year cycle. A four-year cycle would allow the Company to avoid testing of only a portion of a DVCRA and allows for full completion of a cycle prior to starting the next.

Again, the four-year cycle was based on the number and voltage level of contact voltage events in the first four years of testing. The schedule has the larger areas (as measured by miles required to scan) in the earlier years, decreasing the miles required to scan in each subsequent year.

Table 9
DCVRAs Miles and Scan Year

Region	Miles Traveled to Scan DCVRA[1]	Scheduled Year for Next Scan[2]
Providence-Zone 1-College Hill	10	2
Providence-Zone 2-Downtown	28	1
Providence-Zone 3-Elmwood	7	4
Providence-Zone 4-Federal Hill	7	2
Providence-Zone 5-Lower South Providence	4	4
Providence-Zone 6-Olneyville	2	4
Providence-Zone 7-Smith Hill	9	2
Providence-Zone 8-Upper South Providence	8	1
Providence-Zone 9-Washington Park	8	4
Providence-Zone 10-West End	9	3
Newport	14	1
Pawtucket	7	3
Woonsocket	0.5	3
Westerly	4	3
Total	**117.5**	

Year	Miles Traveled to Scan DCVRA
Year One (1)	50
Year Two (2)	26
Year Three (3)	20.5
Year Four (4)	21
Total	**117.5**

1 Miles Traveled to Scan DCVRA is based on actual results from the FY 2016 scan and may include traveling down the same street twice, such as once in either direction or twice in different lanes on a one way street to cover the entire DCVRA.

2 Year 1 = FY 2017 (April 1, 2016 to March 31, 2017), Year 2 = FY 2018 (April 1, 2017 to March 31, 2018), Year 3 = FY 2019 (April 1, 2018 to March 31, 2019), Year 4 = FY 2020 (April 1, 2019 to March 31, 2020).

Section 8

Standards and Equipment Update

Standards and Equipment Update

In its Compliance Order, the PUC directed the Company to continue monitoring advances in elevated voltage mobile technology and keep the PUC apprised of these efforts.[18] On January 29, 2016, the Institute of Electrical and Electronics Engineers (IEEE) Standards Boards approved standard P1695, *Guide to Understanding, Diagnosing and Mitigating Stray and Contact Voltage*. A copy of this guide is currently with the Standards Publications Department pending editorial revisions and approval. As such, the IEEE has not officially published any final documentation or final recommendations on elevated voltage. In addition, the Company is not aware of any additional changes to mobile testing technology. In FY 2017, the Company plans to continue using its existing manual technology and chosen vendor mobile technology for the fifth year of the Contact Voltage Program.

In January of 2013, the Company awarded its first three-year contract to Premier for the FY 2013, FY 2014, and FY 2015 mobile surveys. In October of 2015, the Company awarded a new four-year contract to Willbros for the FY 2016, FY 2017, FY 2018, and FY 2019 mobile surveys. The next request for proposals for the contract will be for the FY 2020 mobile survey.

[18] Compliance Order at 8.

Section 9

Company Recommendations

Company Recommendations

The Company makes the following recommendations for the FY 2017 Contact Voltage Program:

1. As noted in Section 7, the Company is recommending that 100 percent of the DCVRAs be surveyed and tested for the FY 2017 mobile survey.
2. As noted in Section 6, the Company plans to continue using THD testing during the FY 2017 mobile survey.

Exhibit 1
2016 Elevated Voltage Mobile Survey Results

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)
Event ID	Date Found	Time Found	Zone Name	Action Taken	Address Number	Street	Cross Street	Latitude	Longitude	Voltage	Shunt Voltage	3rd Harmonic	Asset Type	Asset Number	Asset Owner	Ground Source	Work Order #	# of Customers Interrupted	Duration of Interruption	Prior EV Hit?	>= 4.5 Volts	NGrid Verification Voltage	Repair Crew	Repair Date	Type of Repair	Repair Due Date	Mitigated Repair Voltage	Mitigated Repair THD	Repair Status	Shunt Voltage Category	Asset Comments
1	10/27/2015	0:23	Providence-Zone 5-Lower South Providence	Installed Barriers	730	Broad St	Saratoga St	41.8042	71.41918	18.8	2.57	6.2	Streetlight	77	Company	Ground Rod	90000128966				Below 4.5 Volts	12	Internal	11/5/2015	Install Ground Rod	Friday, December 11, 2015	0.00	0.00	Repair Complete	1- 4.4 Volts	
2	10/28/2015	0:25	Providence-Zone 4-Federal Hill	Installed Barriers	202	Broadway	Pallas St	41.821	71.4241	15.4	1.9	6.4	Streetlight	21	Company	Ground Rod	90000128965				Below 4.5 Volts	11.89	Internal	11/6/2015	Remade All Connections	Saturday, December 12, 2015	0.15	0.00	Repair Complete	1- 4.4 Volts	
3	10/30/2015	1:53	Providence-Zone 2-Downtown	Guarded	403	Eddy Sy	Point St	41.817	71.40655	31.35	9.98	10.8	Streetlight	23	Company	Ground Rod	90000128963				At or Above 4.5 Volts	0	Internal	11/6/2015	Remade All Connections	Monday, December 14, 2015	0.00	0.00	Repair Complete	4.5 - 24.9 Volts	
4	10/30/2015	1:55	Providence-Zone 2-Downtown	Guarded	403	Eddy Sy	Point St	41.817	71.40662	26.1	11.8	10.6	Streetlight	22-50	Company	Ground Rod	90000128963				At or Above 4.5 Volts	11.5	Internal	11/9/2015	Remade All Connections	Monday, December 14, 2015	0.00	0.22	Repair Complete	4.5 - 24.9 Volts	
5	10/30/2015	3:45	Providence-Zone 2-Downtown	Installed Barriers	150	Chestnut St	Elbow St	41.8183	71.41029	13.9	3.9	3.4	Streetlight	10	Company	Ground Rod	90000128963				Below 4.5 Volts	5	Internal	11/5/2015	Repaired Neutral	Monday, December 14, 2015	0.00	0.22	Repair Complete	1- 4.4 Volts	
6	10/30/2015	4:04	Providence-Zone 2-Downtown	Installed Barriers	131	Chestnut St	Bassett St	41.8185	71.41077	12.8	2.9	4.8	Streetlight	9	Company	Ground Rod	90000128963				Below 4.5 Volts	5	Internal	11/5/2015	Repaired Neutral	Monday, December 14, 2015	0.00	0.11	Repair Complete	1- 4.4 Volts	
7	11/1/2015	22:31	Providence-Zone 2-Downtown	Installed Barriers	196	Richmond St	Ship St	41.8194	71.40934	32	5.3	5.5	Streetlight	5	Company	Ground Rod	90000128963				At or Above 4.5 Volts	12	Internal	11/10/2015	Install Ground Rod	Wednesday, December 16, 2015	0.00	0.00	Repair Complete	4.5 - 24.9 Volts	
8	11/2/2015	0:20	Providence-Zone 2-Downtown	Guarded	166	Friendship St	Chestnut St	41.8195	71.41195	74.1	17.9	19.4	Streetlight	16	Company	Ground Rod	90000128963				At or Above 4.5 Volts	3	Internal	11/2/2015	Remade Splices	Thursday, December 17, 2015	0.00	40.10	Repair Complete	4.5 - 24.9 Volts	
9	11/2/2015	1:55	Providence-Zone 2-Downtown	Installed Barriers	60	Ship St	Richmond St	41.8191	71.4095	26.3	2.5	5.6	Streetlight	2	Company	Ground Rod	90000128963				Below 4.5 Volts	0	Internal	11/10/2015	No Work Required	Thursday, December 17, 2015	0.00	0.00	Repair Complete	1- 4.4 Volts	
10	11/3/2015	1:20	Providence-Zone 2-Downtown	Guarded	UNK	East Approach St	Kennedy Plaza	41.8251	71.41236	66.9	30.35	0	Streetlight	UNK	Customer	Ground Rod	90000128963				At or Above 4.5 Volts			3/16/2016		Friday, December 18, 2015	0.00	NA	Repair Complete	>25 Volts	
11	11/4/2015	0:39	Providence-Zone 7-Smith Hill	Installed Barriers	377	N Main St	Mill St	41.8332	71.41074	73	7.5	25.3	Streetlight	23	Company	Ground Rod	90000128968				At or Above 4.5 Volts	9	Internal	11/13/2015	No Work Required	Saturday, December 19, 2015	0.00	14.00	Repair Complete	4.5 - 24.9 Volts	
12	11/4/2015	1:05	Providence-Zone 7-Smith Hill	Guarded	133	Charles St	Stevens St	41.8362	71.4118	62.1	16.7	5.8	Streetlight	17	Company	Ground Rod	90000128968				At or Above 4.5 Volts		Internal	3/16/2016	No Work Required	Saturday, December 19, 2015	0.00	0.00	Repair Complete	4.5 - 24.9 Volts	
13	11/4/2015	23:22	Providence-Zone 1-College Hill	Guarded	77	Stimpson St	Angell St	41.8294	71.395	38.8	9.2	9.5	Streetlight	9	Company	Ground Rod	90000128961				At or Above 4.5 Volts	6	Internal	11/16/2015	Install New Cable	Saturday, December 19, 2015	0.00	6.00	Repair Complete	4.5 - 24.9 Volts	
14	11/5/2015	2:25	Providence-Zone 1-College Hill	Guarded	75	Thomas St	Benefit St	41.8276	71.40848	110	109	0	Streetlight	Unk	Customer	Ground Rod	90000128961				At or Above 4.5 Volts			3/16/2016		Sunday, December 20, 2015	0.00	NA	Repair Complete	>25 Volts	
15	11/6/2015	3:34	Providence-Zone 2-Downtown	Installed Barriers	46	College St	Benefit St	41.8261	71.40649	3.6	1.03	10.3	Streetlight	2	Company	Ground Rod	90000128963				Below 4.5 Volts	6	Internal	11/13/2015	Remade All Connections	Monday, December 21, 2015	0.00	8.30	Repair Complete	1- 4.4 Volts	
16	11/8/2015	23:05	Providence-Zone 4-Federal Hill	Installed Barriers	196	Atwells St	Dean St	41.8234	71.42442	14.5	1.5	7.2	Streetlight	UNK	Customer	Ground Rod	90000128965				Below 4.5 Volts			3/16/2016		Wednesday, December 23, 2015	0.00	NA	Repair Complete	1- 4.4 Volts	
17	11/9/2015	1:10	Providence-Zone 4-Federal Hill	Installed Barriers	198	Atwells St	Weeden St	41.8234	71.42467	13.2	1.2	7.5	Streetlight	UNK	Customer	Ground Rod	90000128965				Below 4.5 Volts			3/16/2016		Thursday, December 24, 2015	0.00	NA	Repair Complete	1- 4.4 Volts	
18	11/9/2015	2:13	Pawtucket	Installed Barriers	10	Park St	Harris Ave	41.8745	71.38339	9.91	1.1	35.3	Streetlight	3--1	Company	Ground Rod	90000128960				Below 4.5 Volts	0.43	Internal	12/11/2015	No Work Required	Thursday, December 24, 2015	0.43	0.69	Repair Complete	1- 4.4 Volts	
19	11/9/2015	2:21	Pawtucket	Installed Barriers	7	Park St	S. Union St	41.8747	71.38738	9.8	1.4	35.4	Streetlight	2--2	Company	Ground Rod	90000128960				Below 4.5 Volts		Internal	12/11/2015	Remade All Connections	Thursday, December 24, 2015	0.00	0.00	Repair Complete	1- 4.4 Volts	
20	11/10/2015	1:06	Woonsocket	Installed Barriers	UNK	Truman Dr	Clinton St	42.0048	71.51038	21.6	1.6	2.4	Streetlight	2	Company	Ground Rod	90000128976				Below 4.5 Volts	0	Internal	12/2/2015	Remade All Connections	Friday, December 25, 2015	0.00	0.00	Repair Complete	1- 4.4 Volts	
21	11/10/2015	1:26	Woonsocket	Guarded	UNK	Truman Dr	Clinton St	42.0052	71.5105	83	12.1	1.1	Streetlight	1/1B	Company	Ground Rod	90000128976				At or Above 4.5 Volts	0	Internal	12/2/2015	Remade All Connections	Friday, December 25, 2015	0.00	0.00	Repair Complete	4.5 - 24.9 Volts	
22	11/10/2015	3:21	Woonsocket	Installed Barriers	544	Clinton St	Cumming St	42.0076	71.50458	11	2.4	8.2	Streetlight	35	Company	Ground Rod	90000128976				Below 4.5 Volts	0	Internal	12/7/2015	Remade All Connections	Friday, December 25, 2015	0.00	0.00	Repair Complete	1- 4.4 Volts	
23	11/10/2015	3:36	Woonsocket	Installed Barriers	547	Clinton St	Cumming St	42.0078	71.50372	10.76	2.3	11.6	Streetlight	38	Company	Ground Rod	90000128976				Below 4.5 Volts	0	Internal	12/7/2015	Remade All Connections	Friday, December 25, 2015	0.00	0.00	Repair Complete	1- 4.4 Volts	
24	11/10/2015	20:23	Westerly	Installed Barriers	11	Main St	Broad St	41.3776	71.83121	16.1	2.2	2.9	Streetlight	UNK	Company	Ground Rod	90000140013				Below 4.5 Volts			3/16/2016		Friday, December 25, 2015	0.00	0.00	Repair Complete	1- 4.4 Volts	
25	11/10/2015	21:57	Newport	Installed Barriers	UNK	Farewell St	Adm Kalbfus Rd	41.5055	71.31604	16.5	5.2	2.2	Streetlight	N11	Company	Ground Rod	90000128959				At or Above 4.5 Volts	0.8	Internal	12/16/2015	Installed Neutral	Friday, December 25, 2015	0.44	0.06	Repair Complete	4.5 - 24.9 Volts	
26	11/10/2015	22:12	Newport	Installed Barriers	UNK	Farewell St	Adm Kalbfus Rd	41.5059	71.31583	26.3	7.8	2.2	Streetlight	N12	Company	Ground Rod	90000128959				At or Above 4.5 Volts	1.8	Internal	12/16/2015	Remade Grounds	Friday, December 25, 2015	0.08	0.05	Repair Complete	4.5 - 24.9 Volts	

Exhibit 2
FY 2016 Post-Mitigation Audits of Elevated Voltages Found in the FY 2015 Mobile Elevated Voltage Survey (Greater than 1 Volt).
Columns (a) through (ac) were taken from Exhibit 1 in the FY 2015 Contact Voltage Annual Report filed with the PUC on June 30, 2015.
Columns (ad) through (aj) were from the testing performed on these same assets in the post-mitigation manual testing on May 7, 2015.

(a) Event ID	(b) Date Found	(c) Time Found	(d) Zone Name	(e) Action Taken	(f) Address Number	(g) Street	(h) Cross Street	(i) Latitude	(j) Longitude	(k) Voltage	(l) Shunt Voltage
1	3/9/2015	22:49	Providence-Zone 8-Upper South Providence	Guarded	583	Eddy St	Dudley St	41.81163	-71.40703	1.9	1.6
2	3/9/2015	22:54	Providence-Zone 8-Upper South Providence	Guarded	583	Eddy St	Dudley St	41.8119	-71.40697	1.7	1.4
3	3/9/2015	23:07	Providence-Zone 8-Upper South Providence	Below Threshold	583	Eddy St	Dudley St	41.81199	-71.40693	2.1	0.9
4	3/9/2015	23:38	Providence-Zone 8-Upper South Providence	Below Threshold	669	Eddy St	Blackstone St	41.8102	-71.40731	1.0	0.9
5	3/12/2015	0:04	Providence-Zone 7-Smith Hill	Guarded	13-18	William Ellery Place	Doyle St	41.83755	-71.40675	120.0	90.0
6	3/12/2015	0:06	Providence-Zone 7-Smith Hill	Installed Barriers	13-18	William Ellery Place	Doyle St	41.83743	-71.40675	5.0	2.5
7	3/12/2015	0:08	Providence-Zone 7-Smith Hill	Installed Barriers	19-36	William Ellery Place	Doyle St	41.8373	-71.40658	3.3	1.6
8	3/12/2015	0:12	Providence-Zone 7-Smith Hill	Installed Barriers	19-36	William Ellery Place	Doyle St	41.83709	-71.40643	2.2	1.2
9	3/12/2015	0:55	Providence-Zone 7-Smith Hill	Guarded	653	N Main St	Doyle St	41.83844	-71.40932	96.0	86.0
10	3/12/2015	1:40	Providence-Zone 7-Smith Hill	Guarded	250	Charles St	Randall St	41.83738	-71.41351	75.6	49.6
11	3/13/2015	1:54	Providence-Zone 2-Downtown	Installed Barriers	133	Chestnut St	Bassett St	41.8184	-71.4107	4.5	4.4
12	3/13/2015	2:58	Providence-Zone 2-Downtown	Installed Barriers	UNK	Friendship St	Claverick St	41.81812	-71.41309	2.5	1.3
13	3/15/2015	21:34	Providence-Zone 2-Downtown	Installed Barriers	200	Richmond St	Ship St	41.81916	-71.40916	10.6	2.5
14	3/15/2015	21:46	Providence-Zone 2-Downtown	Installed Barriers	196	Richmond St	Ship St	41.8193	-71.40936	11.1	1.3
15	3/15/2015	23:27	Providence-Zone 2-Downtown	Installed Barriers	Signal Pole at SE Corner	Dorrance St	Clifford St	41.8216	-71.40895	11.0	4.0
16	3/16/2015	21:28	Providence-Zone 2-Downtown	Guarded	444	Westminster St	Greene St	41.8208	-71.41585	123.0	46.0
17	3/16/2015	23:15	Providence-Zone 2-Downtown	Installed Barriers	45	Exchange St	Fulton Ave	41.82545	-71.4103	5.4	1.2
18	3/16/2015	23:41	Providence-Zone 2-Downtown	Installed Barriers	48	College St	Benefit St	41.82602	-71.40647	2.8	1.1
19	3/17/2015	1:43	Providence-Zone 2-Downtown	Guarded	UNK	East Approach St	Kennedy Plaza	41.825	-71.41241	65.6	46.0
20	3/18/2015	4:46	Providence-Zone 1-College Hill	Installed Barriers	298	Benefit St	Benevolent St	41.82413	-71.40527	29.4	4.7
21	5/20/2015	1:24	Newport	Guarded	72	Ayrault St	Everett St	41.49006	-71.30499	18.1	17.2

(a) Event ID	(m) 3rd Harmonic	(n) Asset Type	(o) Asset Number	(p) Asset Owner	(q) Ground Source	(r) Work Order #	(s) # of Customers Interrupted	(t) Duration of Interruption	(u) Prior EV Hit?	(v) >= 4.5 Volts	(w) Repair Crew	(x) Repair Date
1	84.7	Streetlight	39	Company	Fence	90000128969				Below 4.5 Volts	Internal	3/13/2015
2	95.0	Streetlight	38	Company	Fence	90000128969				Below 4.5 Volts	Internal	3/13/2015
3	96.0	Traffic Control Box	UNK	Customer	Fence	90000128969				Below 4.5 Volts	External	5/7/2015
4	96.2	Streetlight	43	Company	Ground Rod	90000128969				Below 4.5 Volts	Internal	3/13/2015
5	0.0	Private Lighting	UNK	Customer	Ground Rod	90000128968				At or Above 4.5 Volts	External	5/7/2015
6	29.0	Private Lighting	UNK	Customer	Ground Rod	90000128968				At or Above 4.5 Volts	External	5/7/2015
7	29.0	Private Lighting	UNK	Customer	Ground Rod	90000128968				Below 4.5 Volts	External	5/7/2015
8	29.0	Private Lighting	UNK	Customer	Ground Rod	90000128968				Below 4.5 Volts	External	5/7/2015
9	7.5	Streetlight	55	Company	Ground Rod	90000128968				At or Above 4.5 Volts	Internal	3/13/2015
10	7.4	Streetlight	30	Company	Ground Rod	90000128968				At or Above 4.5 Volts	Internal	3/13/2015
11	5.4	Streetlight	9	Company	Ground Rod	90000128963				At or Above 4.5 Volts	Internal	4/2/2015
12	7.6	Streetlight	6	Company	Ground Rod	90000128963				Below 4.5 Volts	Internal	3/17/2015
13	7.4	Streetlight	51	Company	Ground Rod	90000128963				At or Above 4.5 Volts	Internal	3/19/2015
14	6.0	Streetlight	5	Company	Ground Rod	90000128963				At or Above 4.5 Volts	Internal	3/19/2015
15	1.0	Traffic Standard	UNK	Customer	Ground Rod	90000128963				At or Above 4.5 Volts	External	5/7/2015
16	0.0	Streetlight - City Owned	UNK	Customer	Ground Rod	90000128963				At or Above 4.5 Volts	External	5/7/2015
17	4.6	Streetlight	1	Company	Ground Rod	90000128963				At or Above 4.5 Volts	Internal	3/19/2015
18	10.7	Streetlight - City Owned	2	Customer	Ground Rod	90000128963				Below 4.5 Volts	External	5/7/2015
19	0.0	Streetlight - City Owned	UNK	Customer	Ground Rod	90000128963				At or Above 4.5 Volts	External	5/7/2015
20	5.4	Streetlight - City Owned	137	Customer	Ground Rod	90000128961				At or Above 4.5 Volts	External	5/7/2015
21	9.4	Streetlight	7	Company	Ground Rod	90000128959				At or Above 4.5 Volts	Internal	3/23/2015

(a) Event ID	(y) Type of Repair	(z) Repair Due Date	(aa) Mitigated Repair Voltage	(ab) Repair Status	(ac) Shunt Voltage Category	(ad) Contacted 3rd Party (City, State, Owner)	(ae) Post Mobile EV Mitigation Audit	(af) Audit Date	(ag) Audit Voltage	(ah) Audit Shunt Voltage	(ai) Audit THD	(aj) Audit Comments
1	Remade All Connections	Thursday, April 23, 2015	0	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	
2	Remade All Connections	Thursday, April 23, 2015	0.9	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	
3		Thursday, April 23, 2015	0	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	
4	Remade All Connections	Thursday, April 23, 2015	0.9	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	
5		Thursday, March 12, 2015	0	Repair Complete	>25 Volts			5/7/2015	2.8	0.001	9.2	Below Threshold - No Stencil
6		Thursday, March 12, 2015	0	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	no stencil
7		Sunday, April 26, 2015	0	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	no stencil
8		Sunday, April 26, 2015	0	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	no stencil
9	Replaced Head	Sunday, April 26, 2015	0.028	Repair Complete	>25 Volts			5/7/2015	0	NA	NA	no stencil
10	Replaced Head	Sunday, April 26, 2015	0.32	Repair Complete	>25 Volts			5/7/2015	0	NA	NA	
11	Install New Cable	Monday, April 27, 2015	0.06	Repair Complete	1- 4.4 Volts			5/7/2015	10.6	0.221	5.6	Below Threshold with Shunt Resistor
12	No Work Required	Monday, April 27, 2015	0.6	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	
13		Wednesday, April 29, 2015	0.079	Repair Complete	1- 4.4 Volts			5/7/2015	10.6	0.004	6.1	Below Threshold with Shunt Resistor
14		Wednesday, April 29, 2015	0.006	Repair Complete	1- 4.4 Volts			5/7/2015	17.5	0.241	5.5	Below Threshold with Shunt Resistor
15		Wednesday, April 29, 2015	0	Repair Complete	1- 4.4 Volts			5/7/2015	0.86	0.001	2.9	Traffic control Pole below threshold, has plastic barrier around pole dose not appear to be repared. There is also plastic wrapped around a one way sign, checked sign and was below voltage threshold
16		Thursday, April 30, 2015	0.18	Repair Complete	>25 Volts			5/7/2015	1.4	0.184	4.8	Decorative Double Lamp - one light was out and is wrapped with plastic. Below Threshold, not repaired
17		Thursday, April 30, 2015	0.169	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	no stencil
18	Installed Neutral	Thursday, April 30, 2015	0	Repair Complete	1- 4.4 Volts			5/7/2015	0	NA	NA	
19		Friday, May 01, 2015	0	Repair Complete	>25 Volts			5/7/2015	4.74	0.001	3.1	
20		Saturday, May 02, 2015	0	Repair Complete	4.5 - 24.9 Volts			5/7/2015	0	NA	NA	Decorative Light - Lamp is out.
21	Repaired Neutral	Saturday, July 04, 2015	0.111	Repair Complete	4.5 - 24.9 Volts			5/7/2015	0	NA	NA	Streetlight repaired

Exhibit 3

As referenced on page 15 of the report, the quality assurance audit for FY 2016 found no instances of elevated voltage. Therefore, Exhibit 3 is not included in this report.

nationalgrid	**ELECTRIC OPERATING PROCEDURE** **GENERAL**	Doc. # **NG-EOP G016** Page 1 of 20
	Equipment Elevated Voltage Testing	Version 2.0 – 09/30/13

INTRODUCTION

The purpose of this procedure is to outline the requirements for the annual equipment elevated voltage testing on National Grid Facilities in New York as required by the New York Public Service Commission's "Electric Safety Standards" issued on January 5, 2005, the New York Public Service Commission's "Order Adopting Changes to Electric Safety Standards issued and effective on December 15, 2008, the New York Public Service Commission's "Order Requiring Additional Mobile Stray Voltage Testing" issued and effective on July 21, 2010 and the New York's Public Service Commission "Order Granting Petition In Part and Modifying Electric Safety Standards" issued and effective on March 22, 2013.

This procedure also outlines requirements for equipment elevated voltage testing in Rhode Island and requirements by the Rhode Island Public Utilities Commission in Docket 4237 "Order to Establish a Contact Voltage Detection, Repair and Reporting Program" issued on November 9, 2012, and the subsequent order issued on February 1, 2013.

Additionally the Massachusetts Department of Telecommunications and Energy provided a series of recommendations on December 9, 2005, that have been included in this procedure.

While there are variances in requirements between New York, Massachusetts, and Rhode Island driven by particular regulatory requirements in each State, the minimum requirements are based on sound utility practice.

PURPOSE

This procedure applies to all personnel involved with or responsible for the testing, repair and reporting of facilities designated by this EOP for equipment elevated voltage. It should be noted that the term "Contact Voltage" has been adopted and is used in the EOP (refer to definitions section).

ACCOUNTABILITY

1. Standards, Policies and Codes
   A. Update program as necessary.
   B. Provide personnel guidance and assistance as requested.

2. Inspections & Maintenance
   A. Ensure the equipment elevated voltage program as outlined in this EOP is implemented properly and timely.
   B. Ensure that the program as outlined in the EOP is completed each year.
   C. Provide qualified personnel to complete equipment elevated voltage testing.
   D. Ensure all equipment elevated voltage inspectors have been trained.

3. Equipment Elevated Voltage Inspector
   A. Demonstrate the ability and proficiency to perform equipment elevated voltage testing per this EOP.
   B. Demonstrate the ability to become proficient in the use of the appropriate database.
   C. Possess the ability to do walking patrols, collect information, edit data, and guard unsafe facilities.
   D. Attend equipment elevated voltage training program.
4. Learning & Development
   A. Provide training upon request.
5. Distribution Network Strategy
   A. Provide input into program revisions.
   B. Ensure the equipment elevated voltage program as outlined in this EOP is implemented properly and timely.
   C. Ensure the program as outlined in the EOP is completed each year.
   D. Provide qualified personnel to complete equipment elevated voltage testing.
   E. Ensure all equipment elevated voltage inspectors have been trained.
   F. Provide program management. .

REFERENCES

NYPSC Order 04-M-0159
NYPSC Order Adopting Changes to Electric Safety Standards
NYPSC Order Requiring Additional Mobile Stray Voltage Testing
RIPUC Docket 4237 Order 20871 (November 9, 2012) and Order 20950 (February 1, 2013)
Proposed Rhode Island Electric Contact Voltage Program, Revised October 2, 2012 (Docket 4237)
NYSPSC Order Granting Petition in Part and Modifying Electric Safety Standards
Applicable National Grid Safety Rules & Procedures
Testing Equipment Operation Instructions

DEFINITIONS

Contact Voltage (Draft definition as defined by the Working Group of the Institute of Electrical and Electronic Engineers (IEEE)): Voltage resulting from abnormal power system conditions that may be present between two conductive surfaces that can come into contact by members of the general public and/or animals. Contact voltage is caused by power system fault current as it flows through the impedance of available fault current pathways. Contact voltage is not related to normal system operation and can exist at levels that may be hazardous.

Contact Voltage Area (CVA): Designated underground distribution areas within the cities of Providence, Pawtucket, Newport and Woonsocket established in the "proposed Rhode Island Electric Contact Voltage Program", Revised October 2, 2012 (Docket 4237).

Equipment Elevated Voltage: An A.C. rms voltage difference between utility equipment and the earth, or to nearby grounded facilities that exceeds the lowest perceptible voltage levels for humans.

Equipment Elevated Voltage Inspector: The individual performing the equipment elevated voltage inspection.

Finding: Any confirmed voltage reading on an electric facility or streetlight greater than or equal to 1V measured using a volt meter and a 500 ohm shunt resistor.

Handheld Computer: An electronic data recording device that is used in the field to create a record of conditions found.

Mitigation: Corrective actions performed by the utility to address the stray voltage finding.

Proximity Detection Unit: A low voltage hand held detector used to test exposed metallic surfaces and conductors for the presence of low voltage from 6V to 600V.

Shall: The word shall is to be understood as mandatory.

Should: The word should is to be understood as advisory.

Stray Voltage: As defined by NYPSC the term "Stray Voltage" means voltage conditions on electric facilities that should not ordinarily exist.

Stray Voltage Testing: The process of checking an electric facility for stray voltage using a device capable of reliably detecting and audibly and/or visually signaling voltages in the range of 6 to 600 volts.

Total Harmonic Distortion (THD): This term has come into common usage to define either voltage or current "distortion factor."

Distortion Factor (harmonic factor): The ratio of the root-mean-squared of the harmonic content to the root-mean-squared value of the fundamental quantity, expressed as a percent of the fundamental.

$$DF = \sqrt{\frac{sum\_of\_squares\_of\_amplitudes\_of\_all\_harmonics}{square\_of\_amplitude\_of\_fundamental}} * 100\%$$

DOCUMENT CONTENTS

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1.0 FACILITIES WHERE EQUIPMENT ELEVATE VOLTAGE TESTING/DOCUMENTATION IS REQUIRED – NEW YORK

1.1 Street Lights and Municipally Owned Facilities

1.1.1 Company owned metallic street lighting standards are required to be tested for equipment elevated voltage annually. This test is to be performed while the light is operating.

1.1.2 Municipally owned street light systems that National Grid directly provides energy to shall be tested for equipment elevated voltage annually. National Grid will complete this testing unless assurances of the completion of required testing and transfer of such test data are made by the appropriate municipality. This test is to be performed while the light is operating.

1.1.3 Municipal owned metallic traffic signal standards and accessible devices are to be tested annually for equipment elevated voltage by National Grid.

1.1.4 All street lights identified on public thoroughfares regardless of ownership are to be tested annually.

1.1.5 All street lights under a maintenance contract are to be tested annually. Exceptions not requiring equipment elevated voltage testing: private lighting, park associations, parking lots, fiberglass (or other non-conductive) street light standards, and locations where street light standards are not publicly accessible, such as facilities located in the center of highways that cannot be accessed without stopping traffic or creating potentially hazardous situations for the worker and/or public.

1.2 National Grid Substation Fences

1.2.1 Metallic fencing surrounding substations with National Grid Facilities shall be tested for equipment elevated voltage annually. This fencing can be customer owned for customer stations, if a National Grid facility is part of the station.

1.3 Overhead Distribution Facilities

1.3.1 Towers and/or metallic poles with distribution facilities shall be tested for equipment elevated voltage at an annual rate of twenty percent (20%) in conjunction with field inspections on a five-year cycle.

1.3.2 The following equipment on wood distribution poles requires equipment elevated voltage testing at an annual rate of twenty percent (20%) in conjunction with field inspections on a five-year cycle:

1. Metallic riser guard or conduit (company or non-company).
2. Uncovered or uninsulated down ground (company or non-company).
3. Down guy (company or non-company).
4. Any other publicly accessible conductive piece of equipment (company or non-company) on the pole within reach from the ground.

1.3.3 Exceptions: Customer meters and customer meter poles are excluded.

1.4 Overhead Transmission Facilities

1.4.1 Towers and/or metallic poles with transmission facilities shall be tested for equipment elevated voltage at an annual rate of twenty-percent (20%) in conjunction with field inspections on a five-year cycle.

1.4.2 The following equipment on wood transmission poles or structures require equipment elevated voltage testing at an annual rate of twenty-percent (20%) in conjunction with field inspections on a five-year cycle:

a. Metallic riser guard or conduit (company or non-company).

b. Uncovered or uninsulated down ground (company or non-company).

c. Down guy (company or non-company).

d. Any other publicly accessible conductive piece of equipment (company or non-company) on the pole or structure within reach from the ground.

1.5 Underground Facilities

1.5.1 Annual equipment elevated voltage testing is required on all of the following equipment where accessible to the public.

a. All metallic manhole covers, vault covers and grates, junction box covers, and handhole covers.

1.5.2 Pad-mounted transformers and switchgear are tested at an annual rate of twenty percent (20%) in conjunction with field inspections on a five-year cycle.

1.5.3 Starting in 2010 and continuing thereafter, unless changed by subsequent order of the NY Public Service Commission, two mobile stray voltage surveys shall be conducted annually in Buffalo and one mobile stray voltage survey is required to be conducted annually in Albany and Niagara Falls.

1.5.4 Exceptions: Non-metallic concrete or fiberglass pads or handholes or pull/splice boxes are not required to be tested.

1.6 Daily Job Site Test Requirements

1.6.1 Each job site where National Grid personnel or its contractors complete a work assignment shall be tested for equipment elevated voltage at the start and at the end of the work day or at the start or at the completion of the assignment. This testing requirement is considered good utility practice and does not require specific documentation.

1.6.2 Exceptions:

a. Substation fencing will not require equipment elevated voltage testing unless scheduled as part of the inspection program or if work was done on the fencing.

b. In a storm situation, where mutual aid is required, testing by other than National Grid personnel will not be required.

1.7 Exemptions

1.7.1 A completely fenced in area where access is denied to the general public and where access is only achieved by climbing a fence. Good judgment is required by the tester in these scenarios.

2.0 FACILITIES WHERE EQUIPMENT ELEVATED VOLTAGE TESTING/DOCUMENTATION IS REQUIRED – RHODE ISLAND

2.1 Company Owned Street Lights

2.1.1 Company owned metallic street lighting standards are required to be tested for equipment elevated voltage on a three-year cycle.

2.1.2 Exceptions: Testing shall not be completed at locations where street light standards are not publicly accessible, such as facilities located in the center of highways that cannot be accessed without stopping traffic or creating potentially hazardous situations for the worker and/or the public.

2.2 Overhead Distribution Facilities

2.2.1 Towers and/or metallic poles with transmission facilities shall be tested for equipment elevated voltage at an annual rate of twenty-percent (20%) in conjunction with field inspections on a five-year cycle..

2.2.2 The following equipment on wood transmission poles or structures require equipment elevated voltage testing at an annual rate of twenty-percent (20%) in conjunction with field inspections on a five-year cycle:

a. Metallic riser guard or conduit (company or non-company).

b. Uncovered or uninsulated down ground (company or non-company).

c. Down guy (company or non-company).

d. Any other publicly accessible conductive piece of equipment (company or non-company) on the pole or structure within reach from the ground.

2.3 Underground Facilities

2.3.1 Testing for equipment elevated voltage shall be done while completing scheduled inspections of underground equipment covered by NG-EOP UG006, Underground Inspection and Maintenance. The following items are to be tested on a five year cycle, pad-mounted transformers, pad-mounted switchgears, and metallic handhole covers.

2.3.2 Testing for equipment elevated voltage shall be completed on underground facilities while completing working inspections covered by NG-EOP UG006. The metallic items to be tested are manholes covers, vault covers and grates, handhole covers, splice box covers, junction box covers, pad-mounted transformers, pad-mounted switchgears, and submersible equipment covers.

2.3.3 Starting in Fiscal Year 2013 and continuing thereafter, unless changed by subsequent order of the Rhode Island Public Utilities Commission, mobile contact voltage surveys will be performed in designated Contact Voltage Areas (CVA) The mobile surveys will be performed on a five-year cycle. A survey of 100 percent of the CVA will be performed the first year of the program followed by 20 percent of the CVA in successive years.

2.4 Daily Job Site Test Requirements

2.4.1 Each job site where National Grid personnel or its contractors complete a work assignment shall be tested for equipment elevated voltage at the start and at the end of the work day or at start and at the completion of the assignment. This testing requirement is considered good utility practice and does not require specific documentation.

a. In a storm situation, where mutual aid is required, testing by other than National Grid personnel will not be required.

2.5 Exemptions

2.5.1 A completely fenced in area where access is denied to the general public and where access is only achieved by climbing a fence. Good judgment is required by the tester in these scenarios.

3.0 FACILITIES WHERE EQUIPMENT ELEVATED VOLTAGE TESTING/DOCUMENTATION IS REQUIRED – MASSACHUSETTS

3.1 Company Owned Street Lights

3.1.1 Company owned metallic street lighting standards are required to be tested for equipment elevated voltage on a five year cycle.

3.1.2 Exceptions: Testing shall not be completed at locations where street light standards are not publicly accessible, such as facilities located in the center of highways that cannot be accessed without stopping traffic or creating potentially hazardous situations for the worker and/or public.

3.2 Overhead Distribution Facilities

3.2.1 Towers and/or metallic poles with transmission facilities shall be tested for equipment elevated voltage at an annual rate of twenty-percent (20%) in conjunction with field inspections on a five-year cycle.

3.2.2 The following equipment on wood transmission poles or structures require equipment elevated voltage testing at an annual rate of twenty-percent (20%) in conjunction with field inspections on a five-year cycle:

a. Metallic riser guard or conduit (company or non-company).

b. Uncovered or uninsulated down ground (company or non-company).

c. Down guy (company or non-company).

d. Any other publicly accessible conductive piece of equipment (company or non-company) on the pole within reach from the ground.

3.3 Underground Facilities

3.3.1 Equipment elevated voltage testing is required on all of the following equipment where accessible to the public on a five year cycle.

a. All metallic manhole covers, vault covers and grates, junction box covers, handhole covers, pad-mounted transformers, secondary pedestals, and pad-mounted switchgears.

Exceptions: Non-metallic concrete or fiberglass pads or handholes or pull/splice boxes are not required to be tested.

3.4 Daily Job Site Test Requirements

3.4.1 Each job site where National Grid personnel or its contractors complete a work assignment shall be tested for equipment elevated voltage at the start and at the end of the work day or at the start or at the completion of the assignment. This testing requirement is considered good utility practice and does not require specific documentation.

a. In a storm situation, where mutual aid is required, testing by other than National Grid personnel will not be required.

3.5 Exemptions

3.5.1 A completely fenced in area where access is denied to the general public and where access is only achieved by climbing a fence. Good judgment is required by the tester in these scenarios.

4.0 TEST EQUIPMENT

4.1 A hand held device (proximity detection unit) that is capable of detecting voltage from 6 volts to 600 volts.

4.2 A portable AC digital high impedance volt meter must have the ability to take readings with and without an input load impedance of 500 ohms.

4.3 The handheld devices utilized shall be certified by an independent test laboratory as being able to reliably detect voltages of 6 – 600 volts. The following units have been certified:

4.3.1 HD Electric model LV-S-5 (5-600 volts).

Fluke 85
Fluke 87
Fluke 170 series or equivalent
Fluke 175
Fluke 177
Fluke 179
Fluke 187
Fluke 189

4.4 Mobile Voltage Detection Equipment:
Narda 8950/10 Stray Voltage System
SVD2000 Stray Voltage Mobile Detector

5.0 TEST PROCEDURE

5.1 Job Briefing

5.1.1 At minimum, the following information shall be communicated to all personnel at the beginning of each shift for equipment elevated voltage testing:

a. Structures are never to be touched with a bare hand while performing the tests, only the voltage detector or meter probe is to be used to make contact with the facilities.

b. Appropriate PPE shall be worn.

c. Each individual needs to be aware of his/her surroundings at all times.

d. Make sure to observe all traffic before entering a street, either at intersections or any other point.

e. Traffic safety vest (DOT Compliant Class II) is to be worn at all times when exposed to traffic. Be aware that when bending down, the visibility benefits of the traffic safety vest are diminished.

f. Obey all traffic control devices.

g. When working in the street, face oncoming traffic whenever possible.

5.2 Measurements for voltages will be performed in accordance with the following:

5.2.1 Initial measurements for the presence of voltage shall be made using a certified proximity detection unit as noted in the testing equipment certified equipment list in Section 4.0, 4.3.

a. To verify the proper operation of the proximity detector, follow operating instructions for the particular certified unit being utilized, this is to be done daily.

b. After verification that the detection unit is working, approach the area/equipment to be tested. The proximity detector will illuminate prior to touching the area/equipment being tested if voltage is present. If the proximity detector does not illuminate in close proximity to the area/equipment touch the area/equipment to be tested with the probe of the unit.

5.2.2 If this test detects voltage, repeat the test with the portable AC voltmeter (The 500 ohm resistor is NOT used in this initial test):

a. Measurements with a portable AC voltmeter shall be taken on clean bare metallic surface (structure, ground wire, etc.)

b. When using a portable AC voltmeter, connection shall be made to suitable neutral or ground source with the common (black) lead.

1. In locations where the neutral or ground point is at a distance in excess of the voltmeter lead length, the connection to the neutral/ground shall be made with up to 25' of # 16 stranded copper lead wire (covered), the other end of which shall be securely connected to the negative (black) probe of the meter. When using such "extension leads" appropriate care shall be taken in the placement of such leads so as to not create a physical hazard to workers, pedestrian or vehicular traffic.
2. In locations where a system ground is not available, or the existing ground registered voltage upon the proximity test, a metal rod shall be firmly embedded into the earth to a depth of no less than 6" to create a ground reference point for the measurement to be taken. An alternate method is available for obtaining a ground reference point utilizing an aluminum plate in lieu of driving a ground rod. The reference point should be as close as practicable to the facility being tested to simulate an equipment elevated voltage situation (3' to 4'.) On occasion longer leads may be necessary to find undisturbed earth (up to 25'.)

c. The "live" meter probe lead shall then be placed into contact with the structure under inspection to determine the voltage.
   1. Voltages readings greater than 30 volts shall be recorded in the database for the site.
   2. For voltage readings less than 30 volts, install a 500 ohm input load impedance resistor on the volt meter. Take another voltage measurement and record this voltage in the database for the site.

5.2.3 Measurements for elevated voltages/contact voltage using mobile technology will be performed in accordance with the following:

a. Mobile testing is performed by contract crews driving pre-determined routes in Contact Voltage Areas searching for elevated voltage levels. The equipment used is mounted to vehicles and detects voltage levels greater than 1 volt while driving at speeds of up to 25 mph near underground facilities. Once elevated voltages are detected the crew stops and performs a thorough check with certified manual testing equipment to determine if there is contact voltage present.

5.2.4 Any positive indications by either mobile testing or hand held tools shall be followed up with multi-meter measurements on the target structures. Voltage measurements shall be taken in accordance with Section 5.2.2 above. The investigators shall verify that a suitable ground (i.e. a ground that is not energized) is used as a reference. Ground source location shall be marked with tape, paint or flag for future testing of repair work.

5.2.5 A Total Harmonic Distortion (THD) test method will be implemented as a pilot for Rhode Island mobile elevated voltage testing. THD will be determined by the

use of a Fluke Power Quality clamp meter or a Fluke scope meter both of which have the ability to measure THD.

6.0 CORRECTIVE ACTION REQUIREMENTS FOR ELEVATED VOLTAGE FINDINGS

6.1 State Specific Requirements

6.1.1 New York

If equipment elevated voltage condition is found and verified by the Test Procedure in Section 5.0, the site is to be guarded until made safe by Company personnel or if municipally owned, made safe by the owner or company. Guarded for the purpose of this EOP is defined as guarded by a person or a protective barrier that prevents public contact if the equipment elevated voltage found is greater than 1 volt. **If the voltage measures less than 1 volt and is found to be consistent with system operation design (no visual evidence of a problem upon review) no further action is required.** If the voltage measures greater than or equal to 1 volts and less than 4.5 volts it can either be guarded in person or by a protective barrier that prevents public contact, contact your supervisor for required action. Sound judgment shall be utilized in this application. If the voltage measurement is greater than or equal to 4.5 volts it shall be guarded by an equipment elevated voltage inspector or a Company employee that has been trained to stand by on energized facilities, and immediate response is required using the notification in Section 6.3 below.

6.1.2 Massachusetts and Rhode Island

If equipment elevated voltage condition is found and verified by the Test Procedure in Section 5.0, the site is to be guarded until made safe by Company personnel or if municipally owned, made safe by the owner or company. Guarded for the purpose of this EOP is defined as guarded by a person or a protective barrier that prevents public contact if the equipment elevated voltage found is greater than 4.5 volts. **If the voltage measures less than 4.5 volts and is found to be consistent with system operation design (no visual evidence of a problem upon review) no further action is required.** If the voltage measures greater than 4.5 volts and less than 8 volts it can either be guarded in person or by a protective barrier that prevents public contact, contact your supervisor for required action. Sound judgment shall be utilized in this application. If the voltage measurement is greater than 8 volts it shall be guarded by an equipment elevated voltage inspector or a Company employee who has been trained to stand by on energized facilities; an immediate response is required using the notification in section 6.3 below

6.1.3 Rhode Island Total Harmonic Distortion Pilot

Under the Total Harmonic Distortion (THD) pilot in Section 5.2.5, if during mobile testing of the Contact Voltage Area the voltage measures greater than 1 volt and less than 4.5 volts and has a total harmonic distortion of less than 10% the voltage will be considered contact voltage. These areas will then be safeguarded from the public and permanent repairs will be made. If the total harmonic

distortion is greater than 10% and no visual defects are found, no further action will be required.

6.1.4 New York and Rhode Island

In the event of an elevated voltage finding on an electric facility or street light during the stray voltage test procedure, all publicly accessible structures and sidewalks within a minimum 30 foot radius of the electric facility or street light must be tested for stray voltage.

6.2 The following notification process for personnel to respond shall be utilized.

6.2.1 Notification by location:

a. New York: contact Systems Operations Dispatch 1-877-716-4996

b. New England North, Northborough Distribution Control Center:

1. North Shore (MA) 1-877-247-3606
2. Merrimack Valley (MA) 1-877-247-3607
3. Central (MA) 1-877-247- 3608
4. Western (MA) 1-877-247-3609

c. New England South, Northborough Distribution Control Center

1. Capital (RI) 1-877-247-3610
2. Coastal (RI) 1-877-247-3599
3. Southeast (MA) 1-877-411-3812
4. South Shore (MA) 1-877-411-5599

6.2.2 Inform the operator that this is an equipment elevated voltage call, giving inspector name, company (if not National Grid), unique ID, address where problem is identified, facility number, circuit number , ownership, type of equipment, voltage found and whether they are physically guarding or leaving the site after flagging and installing a protective barrier. National Grid personnel or designee will be assigned to respond.

6.3 Temporary repairs may be used to correct the equipment elevated voltage thereby removing the need to guard the site.

6.4 Except as noted in Section 6, 6.6, permanent repairs to the equipment shall be made within 45 days of the occurrence.

6.5 If permanent repairs can not be made within 45 days due to extraordinary circumstances, the company shall periodically perform site visits to monitor the condition of the temporary repair. For New York, all exceptions shall be identified and justified in the annual reporting of the program to the NYPSC.

6.6 The Stray Voltage Tester/Equipment elevated Voltage Inspector may detect a minimal voltage level that is attributable to the design of the facility and not the result of an improper condition, no corrective action is required in this instance.

6.7 The individuals conducting the equipment elevated voltage tests on street light standards shall have a supply of "Angel guards" available for installation if the cover is missing or wires are found to be exposed to the public at the time of testing. Angel guards shall only be installed after the testing of the street light standard is complete and 1) there is no indication of equipment elevated voltage above 1 volt, or 2) repairs have been completed to correct the equipment elevated voltage.

6.8 The equipment elevated voltage inspector shall report any potentially hazardous conditions found on National Grid facilities seen visually during the survey process.

6.9 Customer Owned Equipment

6.9.1 Where the Company finds equipment elevated voltage above 1 volt and identifies its source as customer-owned equipment, the Company shall guard the site and notify the customer or a responsible person, as appropriate, that a potentially hazardous situation exists. The Company shall advise the customer or responsible person that the cause of the equipment elevated voltage shall be immediately remedied.

6.9.2 Company personnel are encouraged to work with the customer to determine and rectify the problem. If the customer agrees to accept the Company's assistance, the Company may charge a reasonable cost for this effort.

a. The Company may temporarily remove a customer's meter or take such other actions as are appropriate and necessary to protect the public.

7.0 DATABASE REQUIREMENTS

7.1 The database in use shall be easily searchable for information and reporting.

7.2 Information fields required to be completed for facilities:

Survey Date
Region
District
Contractor
GIS ID/Asset # (Unique ID)
Facility Type
Owner
Feeder/Circuit
Line #
Tax District
Pole/Structure/Equipment ID
Street Name
Inspectors Name
GPS Taken
Pre-load Match
Equipment elevated Voltage Test Required
Voltage Found Y/N
Voltage Measurement

Type of Equipment (See Appendix A)
Immediate Action Taken
Person Notified
Permanent Repair Date
Type of Repair
Person Responsible for repair (Employee ID)

7.3 Information fields required to be completed for facilities in mobile testing

Survey Date
Region
District
Contractor
Facility Type
Owner
Pole/Structure/Equipment ID
Street Name
GPS taken
Voltage Measurements
Type of Equipment (see Appendix A)
Immediate Action Taken
Person Notified
Permanent Repair Date
Type of Repair

8.0 NEW YORK ANNUAL REPORTING AND CERTIFICATION REQUIREMENTS

8.1 Each Regional program supervisor shall provide certification to the program manager that the Region they supervise has complied with the equipment elevated voltage testing and inspection program as ordered by the PSC.

8.2 The program manager shall provide certification to the Vice President Distribution Network Strategy and the Senior Vice President of Customer Operations & Maintenance that the organization has complied with the equipment elevated voltage testing and inspection program as ordered by the PSC.

8.3 Written certification of the completion and results of every equipment elevated voltage test and inspection shall be completed, as well as a certification that all unsafe conditions identified have been remediated by appropriate company personnel.

8.4 The President or officer with direct responsibility for overseeing the equipment elevated voltage testing and inspection shall provide an annual certification to the NYPSC that the Company has tested all of its publicly accessible conductive surface electric facilities and all street lights, as well as completed all required inspections.

8.5 The President or officer with direct responsibility for overseeing facility inspections shall provide an annual certification to the Commission that the utility is in compliance with its inspection program and has inspected the requisite number of electric facilities. Additionally, at the end of the five-year inspection cycle, the officer shall certify that all of the utility's electric facilities have been inspected at least once.

8.6 The annual reporting and certification is required by February 15 of each year. In addition to certifications, it shall address the following:

8.6.1 Details the results of stray voltage test results and inspections conducted over the 12-month period ending December 31 of the prior calendar year. (A separate report will be required for inspections from November 1 – December 31, 2008 to account for transition to calendar year reporting.)

8.6.2 Addresses the performance mechanism contained in Section 10 of the PSC Order Adopting Changes to Electric Safety Standard effective December 15, 2008 (December 15, 2008 Order).

8.6.3 Contain certification describe in 8.3, 8.4 and 8.5 of this section.

8.6.4 Contain a breakdown of the voltage findings in a tabular format as detailed in Attachment 1 of the December 15, 2008 Order; for all findings that result in a reading of 1 V or more after completion of mitigation efforts, a detail report of company efforts shall be provided.

8.6.5 Contain a breakdown of the shock reports received from the public as detailed in Attachment 2 of the December 15, 2008 Order.

8.6.6 Discussion of the analysis undertaken on the causes of the stray voltage within the Company's electric system, the conclusions drawn there from, the preventative and remedial measures identified, and the Company's plan to implement those measures.

8.6.7 Description of the priority levels used to gauge the severity of a deficiency, including repair timeframes, and details the requirements for training personnel to properly identify and categorize the deficiencies.

8.6.8 Contain a breakdown of facilities to be inspected, unique inspection conducted per year, and the cumulative number of unique inspections conducted to meet the five year requirement.

8.6.9 Contain a breakdown of the deficiencies found, permanent repair actions taken by year, whether a repair was completed within the required timeframe, and the number of deficiencies awaiting repair. This information should be provided on a yearly basis by priority level and by equipment groupings as detailed in Attachment 3 of the December 15, 2008 Order.

8.6.10 Contain a review and analysis of the inspection results. Identifying areas of concern along with remedial actions or future plans to alleviate inadequacies in current program assets.

8.6.11 Description of the quality assurance program along with the results from quality assurance activities conducted during the year.

8.6.12 Any additional information that is pertinent to the issues addressed by the safety standards should also be included.

8.7 The Company shall file reports on their mobile stray voltage testing with the Secretary of the New York PSC within 45 days after completion of the mobile testing or February 15, 2011, whichever is earliest, and in each subsequent year. The filing shall include the historic results and costs associated with the manual test program in each area listed in Section 1.5 of this procedure.

8.8 The Company is required by the December 15, 2008 Order to have independence in the quality assurance program required by the order. The management and personnel performing the quality assurance activities shall be separate from those performing the required stray voltage testing and inspection activities.

8.9 The Company shall maintain its written certification and other documentary proof of its testing at its' Albany, Buffalo, and Syracuse office facilities. These documents shall be made available to the public for review upon request.

9.0 MASSACHUSETTS REPORTING REQUIREMENTS

9.1 National Grid shall submit an annual report that includes the following:

9.1.1 Annual reports that list inspection and testing data, including number of inspections conducted by equipment type.

9.1.2 Number of equipment elevated voltage events detected by inspection personnel versus call-ins or notification by third parties.

9.1.3 Variance reports on current year inspection targets.

9.1.4 Equipment elevated voltage events detected on equipment that is not included in equipment elevated voltage equipment inspection schedules (which will enable the DTE to determine if the company is inspecting and testing the correct equipment).

9.1.5 Number of exceptional or non-routine events that required reporting to OSHA or other government organizations due to injuries or other substantive impacts

10.0 Rhode Island Reporting Requirements

10.1 National Grid shall submit an annual report that includes the following in a searchable form:

10.1.1 Event record number

10.1.2 Location of testing

10.1.3 Date and time of testing

10.1.4 Company or customer asset

10.1.5 Failed equipment type

10.1.6 Voltage recorded

10.1.7 Personal injuries to members of the public, pets or property damage

10.1.8 Any other equipment involved and age

10.1.9 Prior incidents at this location in the past five years

10.1.10 Corrective actions taken at the location and date taken

10.1.11 Number of customers if service is interrupted while making repairs

10.1.12 Duration of interruption

10.1.13 Summary of investigation into cause of the incident

10.1.14 Number of calls to the company “shock” line

10.1.15 Total repair costs by Contact Voltage Area

10.1.16 All information as provided for in Section 7.3

The Company will provide a summary of the above information as part of the report. In addition, the Company will include a recommendation for which specific CVAs will be tested the following year, whether there are any recommended changes to the CVAs and whether there are any advances in technology for detection of elevated voltages.

11.0 TYPE OF EQUIPMENT - APPENDIX A

TYPE	CODE	EQUIPMENT DESCRIPTION
Distribution	910	Pole
	911	Regulator
	912	Sectionalizer
	913	Recloser
	914	Ground
	915	Guy
	916	Riser
	917	Switch Handle Mechanical Operated
	929	Distribution – Other (use comments)
Transmission	930	Pole
	931	Tower
	932	Guy
	933	Ground
	934	Riser
	935	Switch Hand Mechanical Operator
	949	Transmission – Other (use comments)
Underground	950	Handhole
	951	Manhole
	952	Switchgear
	953	Transformer
	954	Vault – Cover/Door
	969	Underground – Other (use comments)
Street Light	970	Handhole
	971	Standard
	979	Street light – Other (use comments)
Customer Street Light/Other	980	Handhole
	981	Standard
	989	Customer SL/Other – Other (use comments)
Traffic Control	990	Handhole
	991	Standard
	992	Control Box
	993	Pedestrian Crossing Pole
	999	Traffic control – Other (use comments)

12.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	04/01/11	This document supersedes document dated 08/17/09.
2.0	09/30/13	This document supersedes document dated 04/01/11.