TO: THE COMMISSION

FROM: OFFICE OF ELECTRIC, GAS, AND WATER

SUBJECT: Case 04-M-0159 – Proceeding on Motion of the Commission to Examine the Safety of Electric Transmission and Distribution Systems

RECOMMENDATION: This item is for information only and reports on the status of compliance with the Commission's Electric Safety Standards.

SUMMARY

On January 5, 2005, the Commission established specific Electric Safety Standards to safeguard the public from exposure to stray voltage.\(^1\) To accomplish this goal, electric utilities are required to annually test all of their publicly-accessible electric facilities for stray voltage and inspect all of their electric facilities at least once every five years. The utilities are also required to annually test streetlights\(^2\) along public thoroughfares for stray voltage, regardless of who owns them.\(^3\) This testing is generally performed using handheld devices. Consolidated Edison Company of New York, Inc.

\(^1\) Case 04-M-0159, Proceeding on Motion of the Commission to Examine the Safety of Electric Transmission and Distribution Systems, Order Instituting Electric Safety Standards (issued January 5, 2005).

\(^2\) The term "streetlights" means and includes utility- and municipal electric-owned streetlights located on, along, or adjacent to public thoroughfares and area and traffic signal poles and devices; it does not include privately-owned fixtures, such as those located in private parking lots.

\(^3\) By Order issued July 21, 2005, the Electric Safety Standards were modified, extending the deadline for completing the initial round of stray voltage testing of the transmission and overhead distribution systems to August 30, 2006 for all utilities except Con Edison. Case 04-M-0159, supra, Order on Petitions for Rehearing and Waiver (issued July 21, 2005) (July 21 Order).
(Con Edicon), however, has also been using a recently developed mobile detection vehicle to supplement its required testing program. The mobile detector is limited to use in regions served predominantly by underground facilities, but is able to identify stray voltage on a variety of objects, such as scaffolding and railings, not just electric facilities. Con Edicon performs surveys on a system-wide basis as well as smaller sweeps following snowstorms and prior to large public events, such as parades and the New Year’s celebration.

As a result of the Electric Safety Standards, all publicly accessible electric facilities across the State have been tested at least one time for stray voltage. Additionally, the utilities have completed two rounds of testing on streetlights and underground facilities.\(^4\) This memorandum provides a report on utility compliance with the Electric Safety Standards and the findings for 2006. It is being provided for informational purposes only.

Stray voltage testing has been performed on over 3.9 million facilities statewide. In 2006, 6,336 stray voltage instances measuring 1 volt or higher were identified; 6,101 were found by the investor-owned utilities\(^5\) and the remaining 235 instances were found by municipal electric utilities. Handheld devices identified 2,252 instances of stray voltage and 4,084 instances were identified by Con Edicon’s mobile detectors. Streetlights and the underground services supplying the streetlights accounted for 4,435 (70%) of the total instances of stray voltage found in 2006; 4,098 of these were found in Con Edicon’s service territory. Given the number of streetlights in New York

\(^4\) A complete second round of testing on underground residential distribution (URD) facilities was not performed in 2006 because the first round deadline was extended until August 30, 2006 in the July 21 Order.

\(^5\) The investor-owned utilities consist of Con Edicon, Central Hudson Gas & Electric Corporation (Central Hudson), New York State Electric & Gas Corporation (NYSEG), Niagara Mohawk Power Corporation d/b/a National Grid (National Grid), Rochester Gas and Electric Corporation (RG&E), and Orange and Rockland Utilities, Inc. (Orange & Rockland).
City and the high detection rate for streetlights compared to other electric facilities, Con Edison and the New York City Department of Transportation have been working collaboratively to minimize the potential shock hazards on streetlights.

Of the 6,101 stray voltage conditions found by the investor-owned utilities in 2006, 2,521 (41%) were at voltage levels of 8 volts or higher. Incidents on streetlights accounted for 2,444 of the conditions at voltage levels of 8 volts or higher. In addition, Con Edison had more incidents involving streetlights at voltage levels over 25 volts in 2006 compared to 2005. Utility electric facilities, both overhead and underground, comprise 77 of the conditions at voltage levels of 8 volts or higher found by investor-owned utilities. The majority of the stray voltage incidents identified by the municipal electric utilities were associated with overhead distribution facilities.

The Electric Safety Standards require that each utility inspect at least 20% of its electric facilities, collectively, per year. More than two million inspections (56% of the electric facilities statewide) have been performed over the past two years. The investor-owned utilities have identified and repaired approximately 29,000 serious deficiencies that were compromising the safety and/or reliability of the electric system. The inspection program also identified numerous less significant deficiencies that were entered into work order systems for repair as part of scheduled work activities.

In 2006, there were 726 calls from customers reporting shock incidents, slightly higher than the 715 calls received in 2005. Investigations into the calls received revealed 436 confirmed cases of stray voltage; 132 were caused by problems with utility facilities and 304 were traced back to faulty customer equipment or wiring. Since 2005,

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6 The voltage level of 8 volts or higher corresponds to the Commission's minimum acceptable detection range for testing equipment.

7 An inspection requires a qualified individual to evaluate and examine the entire structure to determine its condition and the potential for it to cause or lead to safety hazards or adversely effect reliability. Unlike stray voltage testing, this task requires opening access covers and entering underground facilities, such as manholes.
stray voltage is known to have caused one dog fatality and was speculated in two other animal fatalities.\textsuperscript{8}

Overall, Staff is pleased with the effort put forth by the utilities and the progress made as a result of the Electric Safety Standards. Finding and repairing more than 2,500 instances of stray voltage at levels of 8 volts or higher in 2006 has undoubtedly made the State's electric system safer. Stray voltage found on streetlights continues to be a major concern, particularly in Con Edison’s service territory. Based on the results observed to date, both the stray voltage testing and inspection programs are needed to continue to identify unsafe conditions and maintain overall reliability. Staff also encourages utilities to continue their development of programs focused on known areas of concern, such as streetlights.

Finally, Staff is evaluating whether changes to the Electric Safety Standards are warranted based on the statistics provided in this memorandum and information learned over the past two years. In addition, Staff is analyzing a petition filed by Orange & Rockland that requests a waiver from performing stray voltage testing on distribution and transmission facilities annually. Orange & Rockland proposes that it test for stray voltage on these facilities as part of its five year inspection programs, and continue testing streetlights on an annual basis. Recommendations resulting from Staff’s evaluation will be presented to the Commission following the completion of the 2007 testing and inspection cycle.

BACKGROUND

On January 5, 2005, the Commission adopted a set of Electric Safety Standards that established proactive steps for ensuring the safety of the public from stray voltage.

\textsuperscript{8} In February 2006, a dog was electrocuted from a live service line going to a location where a streetlight had been removed. Two dog fatalities occurred in New York City where cause of death was alleged as electrocution, but could not be confirmed. In both instances, Con Edison tested the location where the alleged shock took place and did not find stray voltage present. One instance was determined to be the result of a stroke.
voltage and enhancing the reliability of the electric system in the State of New York. The Electric Safety Standards include: (1) annual stray voltage testing of electric facilities accessible to the public, using qualified voltage detection devices; (2) inspections of utility electric facilities on a minimum of a five-year cycle; (3) recordkeeping, certification, quality assurance and reporting requirements; and (4) adoption of the National Electric Safety Code as the minimum standard governing utility construction, maintenance, and operations. The Electric Safety Standards also require that where a utility finds stray voltage, it must immediately make the facility safe and repair it within a short time period. A performance mechanism was adopted to ensure the utilities maintain proper focus on safety and compliance with the Electric Safety Standards.9

In the July 21 Order, the Commission modified certain aspects of the Electric Safety Standards in response to a joint petition for rehearing from Central Hudson, NYSEG, National Grid, and RG&E; a petition for rehearing from Orange & Rockland, and a separate petition for rehearing from NYSEG and RG&E. It extended the date for testing of overhead distribution and transmission facilities, including substations, to August 31, 2006 for electric utilities other than Con Edison. All utilities, however, were still required to complete testing on underground facilities and streetlights by

9 The Electric Safety Standards require utilities to use a certified voltage detector able to sense voltages from 8 to 600 volts. All of the investor-owned utilities and many of the municipal electric utilities decided to use the same handheld device, which has a certified voltage range from 4.5 to 600 volts. Whenever any voltage detector indicates the presence of voltage, the utilities would re-test the facility using a portable volt meter with a 500-ohm shunt resistor to determine the level of voltage present. Experience with the voltage detector revealed that it may indicate the presence of voltage below the 4.5 volt rating. When the detector indicated potential stray voltage, the utilities recorded and reported on all voltage reading above one volt.

The proximity detectors have proven to be effective in locating stray voltage on overhead and underground distribution facilities. When testing transmission towers and structures supporting lines carrying voltages of 115 kV, however, the electric and magnetic fields produced by the high voltage conductors interfere with the detectors, resulting in a significant number of false indications of stray voltage. As a result, the utilities test transmission structures for stray voltage using portable voltmeters directly.
November 30, 2005. Additionally, the certification requirements were clarified and the need for interior inspections of fiberglass handholes was eliminated.

STRAY VOLTAGE TESTING

The Electric Safety Standards established annual stray voltage testing requirements to ensure the public safety of electric systems. Utilities are required to complete testing by November 30 of each year. In response to petitions for rehearing filed by the investor-owned utilities serving the upstate region, the Commission modified the schedule for the initial round of stray voltage testing, giving the upstate electric utilities until August 30, 2006, to complete testing on overhead distribution and transmission facilities.

All utilities met the stray voltage testing requirements established in the Electric Safety Standards and revised July 21 Order for the first two years. As of August 30, 2006, over 3.9 million publiclyaccessible electric facilities and streetlights in New York State were tested at least once for stray voltage. In addition, the utilities completed a second round of testing on streetlights and underground distribution facilities as of November 30, 2006. Because the extension of the testing schedule did not apply to Con Edison, it also completed a second round of testing on all its overhead distribution and transmission facilities last year. In addition, Con Edison estimates surveys performed on its system using the mobile detection vehicle between April 1, 2005 and March 31, 2007 equate to 917,598 stray voltage tests on electrical facilities and 496,849 stray voltage tests on streetlights.

Table 1 lists the number of stray voltage incidents detected as a result of the testing programs developed in response to the Electric Safety Standards. In 2006, 6,336 locations of stray voltage were found statewide. Stray voltage testing using

10 The 6,336 conditions found do not include instances of stray voltage discovered by company personnel as part of their routine work or instances found by other means, such as customer reports.
handheld devices found 2,252 of these locations. Of these locations, the investor-owned utilities

\textbf{Table 1:} Summary of Voltages Detected by Year

<table>
<thead>
<tr>
<th>Company</th>
<th>Stray Voltage Incidents for 2005</th>
<th>Stray Voltage Incidents for 2006</th>
<th>Total Stray Voltage Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con Edison – Handheld Devices</td>
<td>1,234</td>
<td>914</td>
<td>2,148</td>
</tr>
<tr>
<td>Con Edison – Mobile Detector</td>
<td>1,067</td>
<td>4,084</td>
<td>5,151</td>
</tr>
<tr>
<td>National Grid</td>
<td>752</td>
<td>115</td>
<td>867</td>
</tr>
<tr>
<td>NYSEG</td>
<td>95</td>
<td>456</td>
<td>551</td>
</tr>
<tr>
<td>Rochester Gas &amp; Electric</td>
<td>255</td>
<td>312</td>
<td>567</td>
</tr>
<tr>
<td>Central Hudson</td>
<td>310</td>
<td>216</td>
<td>526</td>
</tr>
<tr>
<td>Orange &amp; Rockland</td>
<td>79</td>
<td>4</td>
<td>83</td>
</tr>
<tr>
<td>Municipal Electric Utilities</td>
<td>156</td>
<td>235</td>
<td>391</td>
</tr>
<tr>
<td>Total</td>
<td>3,948</td>
<td>6,336</td>
<td>10,284</td>
</tr>
</tbody>
</table>

identified 2,017 locations and the municipal electric utilities discovered 235 stray voltage conditions. The remaining 4,084 instances of stray voltage found in 2006 were identified by Con Edison using its mobile detectors. The majority of the mobile detector findings were located in Brooklyn (1,495) and Manhattan (1,176). The rise in the number of findings by the mobile detection vehicle from 2005 to 2006 is attributed to Con Edison’s increased use of the vehicles last year.

Since the start of the Electric Safety Standards, streetlights have been a concern with regard to stray voltage. Con Edison detected a significant number of stray voltage conditions on streetlights compared to its other electric facilities (over a factor of ten). In addition, Con Edison’s surveys using the mobile detector identified over 4,200 stray voltage conditions on streetlights, which is more than 80% of the total number of stray voltage incidents found by the mobile detector. National Grid and RG&E, the companies with the second and third highest number of streetlights after Con Edison, found about half of their stray voltage conditions were related to streetlights. Central

\footnote{A description of Con Edison’s supplemental mobile detector testing program is presented later in the report.}
Hudson and Orange & Rockland did not have a significant amount of stray voltage cases involving streetlights; however, each of the companies only has a small quantity of streetlights in their territories. A more detailed analysis of stray voltage incidents with respect to streetlights will be discussed later.

**Transmission and Distribution Facilities**

Stray voltage testing was performed on 3.4 million transmission and distribution facilities across the State. In 2006, a second round of testing was completed on underground facilities. Con Edison and several municipalities completed a second round of testing on their overhead transmission and distribution facilities. Table 2 lists the number of incidents where stray voltage was detected on electric facilities for each of the investor-owned utilities over the past two years. Given the low number of facilities compared to National Grid and NYSEG, it is surprising that Central Hudson found the

<table>
<thead>
<tr>
<th>Company</th>
<th>Underground Distribution</th>
<th>Overhead Distribution</th>
<th>Transmission</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con Edison – Handheld Devices¹</td>
<td>47</td>
<td>121</td>
<td>20</td>
<td>188</td>
</tr>
<tr>
<td>Con Edison – Mobile Detector</td>
<td>299</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>299</td>
</tr>
<tr>
<td>National Grid</td>
<td>19</td>
<td>342</td>
<td>79</td>
<td>440</td>
</tr>
<tr>
<td>NYSEG</td>
<td>1</td>
<td>131</td>
<td>254</td>
<td>386</td>
</tr>
<tr>
<td>Rochester Gas &amp; Electric</td>
<td>5</td>
<td>53</td>
<td>201</td>
<td>259</td>
</tr>
<tr>
<td>Central Hudson</td>
<td>0</td>
<td>325</td>
<td>179</td>
<td>504</td>
</tr>
<tr>
<td>Orange &amp; Rockland</td>
<td>1</td>
<td>6</td>
<td>73</td>
<td>80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>372</strong></td>
<td><strong>978</strong></td>
<td><strong>806</strong></td>
<td><strong>2,156</strong></td>
</tr>
</tbody>
</table>

¹ A complete second round of testing on underground residential distribution (URD) facilities was not performed in 2006 because the first round deadline was extended until August 30, 2006 in the July 21 Order.
Notes:

1 Overhead distribution includes substation facilities.
2 Transmission includes both overhead and underground facilities.
3 Con Edison’s results for overhead and transmission facilities reflect two years of testing. By comparison, the remaining investor-owned utilities results reflect one year of testing overhead and transmission facilities as required by the July 21 Order.

most instances of stray voltage on transmission and distribution facilities. Overall, stray voltage testing using handheld devices resulted in a detection rate of 0.049% for the investor-owned electric facilities. Individual detection rates for underground distribution, overhead distribution, and transmission using handheld devices are 0.008%, 0.036%, and 0.419%, respectively. The municipal electric utilities identified 369 stray voltage conditions related to overhead distribution facilities, which equates to a detection rate of 0.24%. Given the low number of facilities owned by the municipal electric utilities, it is not unexpected that the detection rate is greater than that of the investor-owned utilities.

Figure 1 shows the distribution of stray voltage findings by equipment type. Because ground wires are physically connected to the electric return neutral, it is expectable that more than half of the stray voltage incidents associated with electric transmission and distribution facilities were found on the ground wires. Poles and the guy wires used to support the poles are the next largest equipment groups where stray voltage was found. The majority of stray voltage involving underground facilities was found on handhole and manhole covers.

Of the 1,857 stray voltage conditions found by handheld devices on the investor-owned transmission and distribution facilities, 1,636 were low voltage in nature (less than 8 volts) and mostly related to improper grounding issues. Additionally, several

Figure 1: Voltages Detected Using Handheld Devices by Type of Electric Facility
transmission locations that tested positive for voltage were discovered on properly constructed and undamaged structures, but in areas where ideal grounding is difficult to achieve, such as rocky terrain. These findings correlate to the presence of induced voltage\textsuperscript{13} rather than stray voltage due to damaged or faulty transmission equipment. Currently, National Grid is in the process of hiring a consulting firm to further research the relationship between induced voltage and shock hazards. Staff is continuing to evaluate the safety risks associated with the potential for induced voltage to cause injury from electric and magnetic fields on transmission facilities. Staff will make appropriate recommendations to improve the Electric Safety Standards, if needed, based on our investigation.

The investor-owned utilities identified a total of 221 conditions at or above 8 volts on common transmission and distribution facilities using handheld devices; 106 or nearly half of these conditions were found by Con Edison. Figure 2 shows the number of stray voltage conditions over 8 volts found using handheld devices by equipment type.

\textsuperscript{13} Induced voltage is a voltage that naturally occurs on a metal object in the near vicinity of unshielded, high-voltage overhead transmission lines due to the electric and magnetic fields generated by the transmission lines.
and provides a general breakdown of the voltages. Overhead distribution facilities comprise 144 of the 221 conditions, of which 19 were over 100 volts. The stray voltage findings are fairly evenly spread between poles, grounds, risers, and other equipment combined. More than half of the stray voltage incidents over 8 volts on overhead equipment, however, were found by Con Edison. In addition, Con Edison accounts for all but three of the voltage findings over 8 volts on riser pipes. The other three instances on riser pipes were found by National Grid and were measured at voltages between 8 volts and 24.9 volts. Transmission grounds and guys accounted for 44 stray voltage

**Figure 2**: Voltages Detected Using Handheld Devices by Ranges for Electric Facilities

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14 Data provided by some of the municipal electric utilities could not be readily identified as to what specific piece of equipment had stray voltage. Therefore, the municipal electric utilities are omitted from discussions presenting testing results by type of equipment.
conditions over 8 volts. All but five of these incidents, however, were less than 25 volts and none were over 100 volts.

Finally, there were 33 conditions over 8 volts on underground facilities found using handheld devices; 27 of which were found by Con Edison. Con Edison also located an additional 111 stray voltage conditions over 8 volts on its underground system using the mobile detectors. RG&E, National Grid, and Orange & Rockland combined located six stray voltage conditions over 8 volts on underground facilities. Handholes, manholes, and vaults comprised all but two of the 33 incidents. The covers for these facilities are located at ground level, along or adjacent to pedestrian sidewalks and crosswalks. These areas were serious shock hazards, particularly for people lacking insulating footwear and domestic animals.

**Streetlights**

The municipal electric utilities generally own their own streetlight facilities within their territories. Unlike the municipal electric utilities, streetlights in the investor-owned utilities are owned by the cities and towns. As a result, the investor-owned utilities spent significant effort in 2005 to identify and inventory streetlights that met the testing criteria but are owned by other entities. The result of the efforts put forth by the investor-owned utilities identified approximately 295,000 streetlight locations that require testing, with more than half of these locations in New York City. Given the large number of streetlight locations in its territory, Con Edison implemented a program to assist in tracking test results by placing "bar codes" with unique identification numbers on the publicly-accessible streetlights. In general, the bar code system has proven to be effective.

Stray voltage on streetlights is generally a result of a deficiency with the wiring within the streetlight pole or the utility's service leading to the pole, and/or the connection between the two wiring systems. In 2006, the utilities' testing programs

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15 Con Edison operates approximately 55% of the underground facilities in the State.
identified 4,435 streetlight locations with stray voltage. Table 3 indicates the number of stray voltage conditions found on streetlights in each testing year for each investor-owned utility and the municipal electric utilities combined. Of the 4,435 stray voltage incidents in 2006 associated with streetlights, 92% were found by Con Edison. NYSEG and RG&E also show an increase in the number of stray voltage incidents associated with streetlights. RG&E has the highest detection rate for any utility for stray voltage on streetlights found using handheld devices.

Table 4 lists, by year and voltage range, the stray voltage incidents identified by the investor-owned utilities using handheld devices. Con Edison had a reduction of 206 stray voltage incidents. Combined, the Upstate Utilities had a reduction of 267 incidents, despite testing fewer streetlights per year than Con Edison. Although there has been an overall reduction in stray voltage findings on streetlights using handheld devices from 2005 to 2006, Con Edison had more incidents at higher voltages in 2006.

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16 Data provided by some of the municipal electric utilities could not be readily converted into the voltage ranges used in Table 2. Therefore, the municipal electric utilities are omitted from discussions presenting testing results by voltage levels.

17 Surveys using the mobile detector may have also contributed to the reduction in Con Edison’s findings using handheld devices in 2006.
(more than 25 volts) in 2006. In comparison, the Upstate Utilities show a 50% reduction in the amount of higher voltage incidents from 2005 to 2006. It is uncertain why this occurred; however, New York City’s old infrastructure and its exposure to environmental factors such as water and road salt may be likely factors. Nevertheless, this finding is concerning because the higher voltage levels are potentially more harmful shock hazards.

**Table 4**: Voltages Detected Using Handheld Devices by Ranges for Streetlights

<table>
<thead>
<tr>
<th>Voltage Range</th>
<th>Con Edison (176k streetlights)</th>
<th>Upstate Utilities Combined (134k streetlights)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2005</td>
<td>2006</td>
</tr>
<tr>
<td>1.0 Volt to 7.9 Volts</td>
<td>354</td>
<td>320</td>
</tr>
<tr>
<td>8.0 Volts to 24.9 Volts</td>
<td>574</td>
<td>386</td>
</tr>
<tr>
<td>25.0 Volts to 99.9 Volts</td>
<td>137</td>
<td>156</td>
</tr>
<tr>
<td>100.0 Volts or more</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,083</td>
<td>877</td>
</tr>
</tbody>
</table>

**Protective Measures**

After the first round of testing, National Grid identified a high number of streetlights with stray voltage. Most of the defective streetlights were in the Buffalo region and problematic because they were being supplied by temporary overhead cables put in place to circumvent problems with the underground cable. In response to this finding, National Grid implemented a program to permanently repair the underground circuits and developed a program to perform load tests on streetlight circuits to help identify any additional damaged cable. The company also modified its procedures to require neutral wires when installing temporary services in its service territory.

The results of National Grid’s efforts have had a significant impact in reducing the number of stray voltage conditions found on streetlights in the Buffalo region. In 2005, the company found 332 instances of stray voltage. By comparison, only 14 instances of stray voltage were identified during the second round of testing in 2006. National Grid is encouraged by its results and continues to focus programs on ways to minimize the presence of stray voltage on streetlights.
In 2006, RG&E implemented a program to examine and repair damaged streetlight connections based on its results during the first round of testing. The new program was originally scheduled to operate on a four-year cycle and last year, the company performed about 3,800 inspections on streetlights. Based on the second year cycle results, RG&E has established a goal to complete 9,000 inspections in 2007 or 45% of the metallic streetlights it owns. This increase effectively reduces its original inspection schedule by a year.

Given the high number of stray voltage conditions directly related to streetlights, Con Edison also looked into alternative ways to mitigate the public's exposure. One of the company’s efforts was the development of an isolation transformer. Depending on the source of the stray voltage, the flow of electricity may be prevented from traveling through a secondary path, such as a human or animal in contact with the metallic streetlight.

The isolation transformer program initially consisted of Con Edison purchasing 5,000 transformers. Con Edison was to install 1,700 transformers in streetlights previously taken out-of-service due to bonding connector issues and install an additional 300 transformers in Staten Island based on the results of a cable analysis study. The New York City Department of Transportation agreed to install the remaining 3,000 isolations transformers.

Con Edison reports that the New York City Department of Transportation has installed only 33 units to date. As a result, Con Edison decided to continue its practice of installing isolation transformers as part of responding to streetlight work orders. As of June 2007, the company has installed 3,892 transformers, primarily in the boroughs of Brooklyn and Queens. Con Edison expects to complete installing its remaining inventory of transformers by the summer of 2007.\footnote{Approximately 200 of the original 5,000 transformers were shared with other electric utilities or destroyed as part of laboratory testing.} The company also expects 60 more isolation transformers to be installed by the New York City Department
of Transportation. Staff, however, is disappointed that Con Edison did not put enough emphasis on ensuring the isolation transformers were installed in a timely manner. As a result, Staff is continuing to meet with Con Edison regarding its isolation transformer program.

In 2005, Con Edison also began installing new connectors specifically designed for streetlight wiring. The connectors are designed to minimize physical damage to internal wiring and better insulate the connection from environmental conditions that lead to decay and potentially stray voltage. The threaded fuses in streetlights have also been a source of shock hazards, particularly if the base of the streetlight is damaged. As a result, Con Edison is replacing threaded fuses with waterproof cartridge-type fuse holders that break away in a safe manner if the pole is struck by a vehicle.

While these programs do not protect against all stray voltage scenarios, they are a first step to reducing potential shock hazards. Because these programs use new technology, it is uncertain how reliable the protective devices will be after substantial exposure to environmental elements. Staff will continue to monitor the results to determine the effectiveness and long term benefits of these programs.

Con Edison’s Supplemental Mobile Detector Program

As part of its commitment to researching alternate ways to detect stray voltage, Con Edison has helped develop a mobile detector. The detector uses a sensor to measure low level electric and magnetic fields. An operator, viewing a console from the vehicle’s passenger compartment, is alerted graphically and by audio tone to the presence

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19 The New York City Department of Transportation has also implemented several programs of its own focused on stray voltage. The programs include a non-conductive paint being applied to the lower section of streetlight poles to minimize the exposure to the metallic surface and the use of light fixtures that have indicators that show if an abnormal condition exist at the bulb. The indicator does not necessarily mean that stray voltage is present or the streetlight is free of stray voltage; it is only used to signal that the streetlight should be examined by a qualified inspector.
of stray voltage. An independent lab has certified that the detector is capable of detecting 6 volts or higher from round manhole covers, multi-part service box covers, and streetlight poles at a range of 25 feet while moving at a speed of 20 mph.

Unlike the handheld devices used in Con Edison’s manual testing program, the mobile detector does not make direct contact with objects to test for stray voltage. As a result, the mobile detector will identify stray voltage on many objects that are not required to be tested by the Electric Safety Standards, such as scaffolding and private railings. Stray voltages found on such objects when using the mobile detector vehicle are mitigated by Con Edison and the area is made safe.

In 2005, Con Edison purchased five vehicles and began using the mobile detectors to test for stray voltage in addition to the manual testing program required by the Electric Safety Standards. Con Edison has high expectations for the mobile detectors and has recently expanded its fleet to 15 vehicles. The company is looking to use the mobile detector to perform multiple system-wide sweeps of its underground regions per year. In addition, Con Edison uses the mobile detector following major snow events and as a precautionary measure in regions known to draw large crowds, such as parades and the New Year’s celebration at Times Square. Con Edison conducted surveys in

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20 The mobile detector does not readily identify the object(s) with stray voltage, only its presence. Consequently, the mobile detector is outfitted with two cameras facing perpendicular to the vehicle. The operator console records the video imagery and data produced by sensor. Upon detection of a field, the mobile detector pulls off the road and the operator replays the video to determine the likely location of the voltage. Workers must manually check the location using hand-held detectors to find the source of the voltage. The second disadvantage of the mobile detector is that due to its sensitivity, aerial electric lines interfere with the sensor. Therefore, the detector is limited to areas served by underground cable and cannot be used near overhead distribution. The sensor also detects fields emanating from properly working electric devices, such as neon signs and other types of decorative lighting, resulting in a high number of false indications.

21 Con Edison has committed to conduct surveys continuously for at least five days after a snowstorm, which the company defines as the combination of below freezing temperatures, road salting, and visible, persistent ground accumulation of snow.

Staff will continue to monitor the use of the mobile detectors and Con Edison’s programs. We are encouraged by the initial success of the detector and are working with Con Edison to maximize its effectiveness. For instance, Staff is currently exploring whether the detector qualifies as a certified testing device, thereby eliminating the need to use handheld devices in certain locations.

INSPECTIONS OF ELECTRIC FACILITIES

The Electric Safety Standards require the inspection of all electric facilities over a five-year cycle. This requirement was introduced to identify and eliminate deficiencies before they become serious safety hazards. The process involves a careful visual examination of an electric facility to identify any damage that may cause hazardous conditions or adversely impact reliability. Covers of underground facilities, and any water or debris within the structure, must be removed prior to the inspection taking place. Inspections are performed by a combination of company employees and contractors, all of whom first received appropriate safety and other training.

In addition to the five-year goal, the Electric Safety Standards require utilities to complete inspections in fifths; that is 20% of their total facilities in the first year and 40% of their total facilities by the end of the second year. All utilities met or exceeded the overall targets for inspecting their facilities in 2005 and 2006. The requirements have led to inspections on more than two million electric facilities over the past two years.

Figure 3 shows the percentage of visual inspections performed for each of the investor-owned utilities and the municipal electric utilities combined. Given their larger size and territory compared to other investor-owned utilities, it is not surprising
that National Grid and NYSEG have completed the lowest percentage of inspections to date. Conversely, the small sizes of their systems have allowed 40% of the municipal electric utilities to complete inspections on all of their facilities.

Except for Con Edison, all of the investor-owned utilities inspected about the same amount of facilities in 2006 as in 2005. In 2006, Con Edison inspected less than 10% of its total system, however, it met the overall 40% goal because it completed 59% of its total system inspections in 2005. Last year, Con Edison’s inspection program was significantly affected by the power outages in the Long Island City section of Queens in July 2006. As a result of the incident and the ensuing investigation, Con Edison has dedicated its resources to completing repair activities and other requirements. Going forward, Staff will monitor Con Edison’s efforts to refocus its personnel or gain additional workforce to get itself back on track to meet the requirements of the Electric Safety Standards.

Statewide, more than half of the electric facilities have been inspected. Figure 4 shows the percentage of facilities inspected by equipment type for the investor-
owned utilities. Substantial progress has been made in inspecting transmission and overhead distribution, probably due to the openness and easy accessibility to these facilities. Inspections on underground facilities, however, are generally more time consuming and conducted by a smaller subsection of workers compared to overhead inspections. The underground inspections also commonly take place during overnight hours to be less disruptive to automotive and pedestrian traffic, thereby creating a safer working environment. National Grid, NYSEG, and RG&E are the only companies who own streetlights and are required to inspect them in accordance with the Electric Safety Standards. National Grid and NYSEG have inspected over half of their streetlights. RG&E, however, has only inspected 28% of its streetlights. RG&E has recently implemented a change to its inspection program, as previously discussed. The new program has a goal of inspecting 9,000 streetlights in 2007, which is more than double the amount of streetlight inspections previously performed. Given the high stray voltage detection rate on streetlights compared to transmission and distribution facilities, the three utilities owning streetlights should make inspecting all streetlights a priority.

Finally, facilities that require repair are documented and rated based on the degree of damage and potential hazard to the public. Over the past two years, the inspection programs have identified more than 600,000 substandard conditions; 29,234 of which posed a safety hazard and required immediate repair. Combined, the Upstate Utilities identified 1,359 conditions requiring immediate repair; 1,105 of these were

![Figure 4: Percent of Inspections Completed by Equipment Type](image-url)
associated with overhead distribution. Inspections on streetlights only identified three conditions that required immediate repair. Con Edison identified a total of 27,875 conditions requiring immediate repair, all but 280 conditions were associated with underground facilities. The company, however, included preventative measures taken at the time of inspection as part of its immediate repair count. The majority of the conditions found by Con Edison correspond to the installation of heat shrinks caps on cable and sealing ducts. The utilities have reported that all 29,234 safety hazards have been permanently repaired. The remaining substandard conditions identified during inspections do not pose safety hazards and are entered into work order systems for repair as part of scheduled work activities. Staff is currently in the process of evaluating how efficient the utilities are at making repairs to the conditions found. A more detailed discussion of Staff’s activities is presented later in this report.

**SHOCK NOTIFICATIONS**

In addition to testing programs, the utilities become aware of potential stray voltage locations based on reports by the public. Utilities are required to respond to and investigate all shock reports received, including reports involving domestic animals. This requirement also applies regardless of whether there are injuries involved or not. Table 5 provides a summary of the electric shocks reports received by the utilities for the past two calendar years. In 2006, Con Edison and National Grid received 52% and 33% of shock reports, respectively. All shock incidents were reported to Staff in accordance with the notification requirements of the Electric Safety Standards.

Direct physical contact with a streetlight or other utility facility does not have to occur in order for a shock to be felt. Environmental conditions, such as water accumulation from rain or snow, are factors and may expand exposure to stray voltage. Shocks may be felt when being merely on wet surfaces, including saturated concrete sidewalks or steps, adjacent to faulty equipment. Thus, the location of where a customer experienced a shock may not necessarily identify the source of the voltage. To
Table 5: Summary of Electric Shock Notifications by Year

<table>
<thead>
<tr>
<th>Company</th>
<th>2005 Shock Reports</th>
<th>2006 Shock Reports</th>
<th>Total Shock Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con Edison</td>
<td>468</td>
<td>378</td>
<td>846</td>
</tr>
<tr>
<td>National Grid</td>
<td>197</td>
<td>242</td>
<td>439</td>
</tr>
<tr>
<td>NYSEG</td>
<td>3</td>
<td>22</td>
<td>25</td>
</tr>
<tr>
<td>Rochester Gas &amp; Electric</td>
<td>18</td>
<td>31</td>
<td>49</td>
</tr>
<tr>
<td>Central Hudson</td>
<td>6</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Orange &amp; Rockland</td>
<td>22</td>
<td>34</td>
<td>56</td>
</tr>
<tr>
<td>Municipal Electric Utilities</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>715</td>
<td>726</td>
<td>1,441</td>
</tr>
</tbody>
</table>

compensate for this migration effect, utility personnel thoroughly investigate the incident scene in response to a shock report, checking for stray voltage on several items in the vicinity that are capable of conducting electricity. Once the utility verifies the presence and source of any voltage detected, it takes the required steps to make the area safe. In 2006, permanent repairs were performed at the time of the response in more than half of the Con Edison investigations. Other means of making an area safe include cutting the service line, opening customer owned circuit breakers, making a temporary repair at the time of discovery, and barricading the area.

For analysis purposes, the shock reports are classified based on the source of the stray voltage. Investigations of shock reports where the cause of the voltage was determined to be the responsibility of the utility are classified as utility issues. Customer issues include shock incidents that are caused by non-utility facilities or the improper use of customer-owned equipment. Also included in this category are instances of electrical contacts, which are generally defined as a person inadvertently touching an electric facility, either in person or through some conductive material (e.g., when a person carrying an aluminum ladder catches the top of the ladder on an overhead primary line). Finally, a classification is included for voltage not observed, to reflect shock reports where crews subsequently were unable to detect stray voltage in the area at the time of the investigation. As part of these investigations, the utilities may take preventive actions
to lessen the likelihood of stray voltage re-occurring based on information provided by the affected parties or witnesses.

Table 6 gives a breakdown of the electric shock reports received, by the source of the stray voltage. Overall, shock calls were related to customer issues in 40% of the cases and utility issues accounted for 24% of the cases. When looking at the data on a company by company basis, however, stray voltage was caused by Con Edison's equipment in half of its cases, compared to 26% of the cases for other utilities combined.

A closer inspection of the 2006 shock notification data revealed that Con Edison has more than four times the number of shocks due to defective or abandoned service lines compared to the rest of the investor-owned utilities. Con Edison also experienced 46 calls in 2006 regarding stray voltage caused by defective streetlights.

In 2006, there were a total of 58 reported injuries identified in the shock reports, including seven reports involving domestic animals. Twenty four of the injuries occurred in Con Edison's service territory. In addition, stray voltage has accounted for

Table 6: Electric Shock Notifications by Stray Voltage Source

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Con Edison</td>
<td>134</td>
<td>89</td>
<td>223</td>
<td>124</td>
<td>99</td>
<td>223</td>
<td>210</td>
<td>190</td>
<td>400</td>
</tr>
<tr>
<td>National Grid</td>
<td>70</td>
<td>34</td>
<td>104</td>
<td>127</td>
<td>145</td>
<td>272</td>
<td>0</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>NYSEG</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>13</td>
<td>15</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Rochester Gas &amp; Electric</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>12</td>
<td>16</td>
<td>28</td>
<td>4</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Central Hudson</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Orange &amp; Rockland</td>
<td>9</td>
<td>4</td>
<td>13</td>
<td>3</td>
<td>19</td>
<td>22</td>
<td>10</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>Municipal Electric Utilities</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>216</td>
<td>132</td>
<td>348</td>
<td>274</td>
<td>304</td>
<td>578</td>
<td>225</td>
<td>290</td>
<td>515</td>
</tr>
</tbody>
</table>

Notes:
1 Customer issue includes accidental contacts with utility equipment (not necessarily stray voltage).
2 The voltage not observed column lists shock reports received where crews were unable to detect stray voltage in the area at the time of the investigation.
one dog fatality and one near fatality in New York City.\textsuperscript{23} In February 2007, a dog was severely shocked as the result of improper wiring on non-utility owned scaffolding. The dog was resuscitated by a person on location before being taken to a veterinarian for observation. Con Edison’s facilities in the area were in compliance with the National Electric Safety Code.

Con Edison, however, was partly responsible for a dog that was electrocuted in the Park Slope section of Brooklyn in February 2006. The stray voltage was the result of live service wires going to an abandoned streetlight location. The abandoned streetlight location was covered by concrete to complete the sidewalk. As a result of this incident, Con Edison implemented a special program that identified approximately 3,000 abandoned streetlight locations in New York City. Con Edison visited each of these locations and found live service wires in six instances. The company took corrective actions to de-energize these locations and permanently make the areas safe. Con Edison also modified its procedures to require streetlight services be permanently disconnected when a pole is removed to minimize the potential of this type of event reoccurring.

Finally, two other New York City dog fatalities alleged stray voltage as the cause of death. In both instances, Con Edison tested the locations where the alleged shocks took place and did not find stray voltage present. In one of these cases, the dog was later found to have suffered a stroke.

\textbf{CERTIFICATION AND PERFORMANCE MECHANISM}

To ensure the utilities maintain the necessary focus on the safety and reliability of their electric systems, the Electric Safety Standards require an officer to annually certify the results of the testing and inspection programs under penalty of perjury. Each of the utilities provided signed statements certifying that it performed the

\textsuperscript{23} Human and other animal fatalities due to electrocution in the past two years were the result of accidents that involved direct contact with properly working electric facilities or fallen power lines following severe storms.
requisite number of stray voltage tests and inspections in 2006, as required by the Electric Safety Standards.

The Electric Safety Standards also established a generally applicable performance mechanism for the investor-owned utilities to ensure the proper focus on safety and compliance with the Electric Safety Standards. This mechanism includes annual performance targets of 100% compliance for stray voltage testing and a first-year target of 85% of the annual facility inspections. After three years, the inspection target is raised to 95% for annual facility inspections. The mechanism has two potential revenue adjustments for failure to achieve the annual targets, each equivalent to 75 basis points of a company's earnings. All of the investor-owned utilities met the testing and inspection requirements and targets of the performance mechanism for 2006. Therefore, no revenue adjustments are necessary.

COMPLIANCE MONITORING

To ensure proper compliance with the Electric Safety Standards, Staff has maintained frequent contact with all the utilities, individually and collectively, over the past two years. In early 2005, the investor-owned utilities formed a working group to collectively discuss issues related to stray voltage testing. The working group has proven to be an effective means to raise and resolve issues, identify best working practices, and establish a common understanding of the extent of stray voltage across the State. The discussions have evolved over the past two years from addressing implementation issues, such as data collection, to focusing more on stray voltage mitigation efforts, including discussing practices used by utilities outside of New York. One member of the working group also attends the Institute of Electrical and Electronics Engineers subcommittee meetings on stray voltage.

Staff actively participates in the working group sessions. Currently, group discussions are held monthly, either by a conference call or a face-to-face meeting. Staff has also maintained a dialogue with the Municipal Electric Utilities Association of New York State to discuss issues associated with the municipal electric companies’
compliance with the Electric Safety Standards and has participated in its engineering workshops that deal with stray voltage issues. These activities have helped the utilities maintain an overall understanding of Staff’s expectations from the Electric Safety Standards and an understanding of the extent of stray voltage in New York State.

Staff has performed a number of field visits at the investor-owned utilities to determine whether the utilities implemented proper programs to comply with Electric Service Standards. The initial focus of the visits was to ensure that stray voltage testing, inspections, and data collection process were being done properly. Specifically, Staff verified that utilities located and tested all required facilities for stray voltage. The field visits also monitor the quality assurance programs, which generally encompass random sampling of the testing and inspection records to verify the accuracy of data collected.

Staff, however, believes improvement opportunities exist within the quality assurance process and inspection process. A successful quality assurance program should involve a review process that is not open to influence by those conducting or requiring the tests or inspections. In addition, confidence levels associated with statistical sampling are valid only if the audit process is conducted with unbiased reviews. As a result, Staff is working with the utilities to ensure that organizational independence exists in their quality assurance programs for stray voltage testing and inspections.

In regards to inspections, utilities have already begun the process of minimizing mistakes in their data collection processes by requiring certain fields be entered before a record can be saved and offering limited selections based on previous choices (e.g., a phase wire that has detached from an insulator can only be coded as a high priority response). These types of data collection changes should be pursued to maximize the efficiency of the data collection process. Several utilities have separate

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24 The Municipal Electric Utilities Association of New York State includes all regulated municipal electric utilities included in Appendix A with the exception of the Jamestown Board of Public Utilities and Fishers Island Electric Corporation.

25 This approach is similar to that used in the Department’s gas safety programs.
database systems to track inspection and repair work. The utilities should be looking to coordinate the recordkeeping process for inspections, quality assurance and repair activities.

Going forward, and with the recent addition of Staff resources, we intend to conduct more field visits to review the responsiveness of the utilities to information obtained during their inspections. There are five fundamental goals behind the field visits: (1) monitor stray voltage testing, (2) monitor utility quality assurance and quality control programs for stray voltage testing and inspections, (3) verify that inspections are performed properly, (4) assess whether deficiencies identified during inspections are actually repaired, and (5) independently assess utility electric systems. The field visits will also provide an opportunity to assess and evaluate the condition of the electric system across New York State. This information will be useful not only in regards to establishing safeguards from stray voltage, but also in addressing electric reliability concerns.

CONCLUSION

All of the utilities complied with requirement of the Electric Safety Standards. As a result, a significant amount of information was learned during the past two years about the extent of stray voltage in New York State. In 2006, 6,336 instances of stray voltage were found. Streetlights and the underground services supplying the streetlights continue to be a known source for stray voltage, particularly in New York City. Alternative mitigation and detection methods, like those being taken by Con Edison and the New York City Department of Transportation, are positive steps being taken to reduce the public's exposure to stray voltage. We encouraged utilities to continue their efforts to develop new methods for detecting and/or preventing stray voltage.

26 The new employees are trained in electric distribution construction and its safety requirements, specifically the Electric Safety Standards and NESC.
Staff will continue to actively monitor utility compliance and other practices aimed at detecting or minimizing the presence of stray voltage. This year, Staff intends to conduct more field visits to review the responsiveness of the utilities to information obtained during its inspections. In addition, Staff intends to perform independent inspections of utility facilities to determine whether utilities are accurately recording equipment deficiencies and taking corrective actions in a timely manner. These visits will also provide an opportunity to assess and evaluate the condition and reliability of the electric system across New York State.

While the factors causing stray voltage cannot be entirely eliminated, the combination of the testing, inspections, and upgrading of utility facilities should all help reduce the incidence of stray voltage. The requirements of the Electric Safety Standards have resulted in the identification of numerous locations with sizable stray voltage levels where mitigation was essential to maintain public safety. Therefore, the Electric Safety Standards have shown to be an effective means to ensure the safe and reliable operation of electric facilities. Utilities, however, are inquiring about whether the current requirements are needed going forward, or if modifications to the Electric Safety Standards can be made and still provide the public protection from stray voltage. Orange & Rockland has petitioned for a waiver from performing stray voltage testing on distribution and transmission facilities annually. Instead, Orange & Rockland proposes that it test for stray voltage on these facilities as part of its five-year inspection programs, and continue testing streetlights on an annual basis. Staff is evaluating whether changes to the Electric Safety Standards are warranted based on the statistics provided in this memorandum and information learned over the past two years. Recommendations resulting from Staff evaluations will be presented to the Commission following the completion of the 2007 testing and inspection cycle.
APPENDIX A: Regulated Municipal Electric Utilities in New York State

Village of Akron
Village of Andover
Village of Angelica
Village of Arcade
Bath Electric, Gas & Water Systems
Village of Bergen
Municipal electric Commission of Boonville
Village of Brocton
Village of Castile
Village of Churchville
Village of Endicott
Village of Frankfort Electric Department
Incorporated Village of Freeport
Green Island Power Authority
Village of Greene
Village of Groton
Village of Hamilton
Village of Holley
Ilion Board of Light Commissioners
Jamestown Board of Public Utilities
Village of Little Valley
Town of Massena Electric Department
Mohawk Municipal electric Commission
Penn Yan Municipal electric Utilities Board
Incorporated Village of Philadelphia
Plattsburgh Municipal electric Lighting Department
Village of Richmondville Power and Light
Incorporated Village of Rockville Centre
Village of Rouses Point
Salamanca Board of Public Utilities
Village of Sherburne
Village of Silver Springs
Skaneateles Electric Light Department
Village of Spencerport
Village of Springville Electric System
Village of Theresa
Village of Wellsville

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