

**STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
PUBLIC UTILITIES COMMISSION**

IN RE: INVESTIGATION RELATING :
TO STRAY AND CONTACT VOLTAGE : **DOCKET NO. 4237**
:

COMMISSION’S DATA REQUESTS
DIRECTED TO NATIONAL GRID, BIPCO and PUD
(March 15, 2012)

1. What would be the cost and rate impact of requiring all electric utilities operating within the state of Rhode Island to submit quarterly reports (similar to COMM 1-2(c) and Comm 1-2 (d)) to the PUC and DPUC on the incidence of stray and contact voltage, such reports to include without limitation the nature of the incident (including level of voltage), the location and cause of the incident, resulting injuries, the manner in which the incident was reported to the utility, and the date, time and nature of any repairs made as a result of the incident?

PUD ANSWER: Based on current history, where Pascoag has received no reports of stray voltage or contact voltage, and does not anticipate such incidents in the future, costs to submit quarterly reports should be de minimis.

- a. Would these reporting requirements increase your awareness of the incidence of stray and contact voltage?

PUD ANSWER: Not for Pascoag, since Pascoag has not had any reported incidents of stray voltage or contact voltage in the past, and therefore reports would have indicated “no incidents” at each time of filing.

- b. Would these reporting requirements serve to reduce the number of injuries to human or animal life? Why/why not?

PUD ANSWER: Pascoag has not had any incidences of stray voltage or contact voltage. Secondly, we feel that an understanding of the difference between stray and contact voltage terminology would be helpful.

Stray voltage: As generally defined by utility engineers, stray voltage refers to the persistent voltage imposed on the distribution primary neutral. Stray voltages are mostly due to return currents from unbalanced loads. This is a normal

condition of a four-wire, multi-grounded system. In the context of the last 40 years, this voltage is associated with problems in dairy farms and, generally, the voltages do not exceed about 8 V. Stray voltages are not lethal.

TOV: Transient overvoltage's (TOVs) are sometimes referred to as stray voltage, but they are not. TOVs are 60-Hz line-to-neutral overvoltage's that occur on the unfaulted phases of a four-wire multi-grounded system during a fault. As the nomenclature implies, TOVs are transient or temporary in nature. They are not persistent. A single line-to-ground fault creates a shift in the neutral voltage of approximately 35%. While this voltage is relatively high, it only lasts as long as it takes the protective equipment to clear the fault (normally in tens of cycles, usually less than a second). This is not stray voltage.

Contact voltage: This term is normally used to address the condition in which the "hot" lead (120 V or more) contacts the casing of a device, such as a streetlight. This situation can be dangerous and possibly result in death. Contact voltage is not stray voltage, although it is sometimes misused in this context.

PUD ANSWER: As explained earlier, we feel that having reporting requirements would not reduce the number of injuries to human/animal life. Pascoag utilizes stringent construction standards for Overhead and Underground utility work. We currently follow National Grid's Construction Standards dated July 2009 for all work pertaining to utility work. Additionally, Pascoag follows the National Electric Safety Code. These set of standards are guidelines which Pascoag follows and adheres to. This adherence to the standards insures that we install a proper grounding system and have integrity throughout. Pascoag installs down-grounds at each pole to increase the integrity of its system. All grounds are tested to make sure they are at a resistance of 25 ohms or less.

2. National Grid stated in COMM 2-18 that the cost of implementing regular monitoring and/or elevated voltage testing of these facilities, using either mobile or manual testing, would range from \$250,000 to \$1.090M (COMM 2-18, Comm 3-1). Would regular monitoring of stray and contact voltage, through mobile or manual testing, even at the lower end of the price range, on an annual or more frequent basis, increase your utility's awareness of the incidence of stray and contact voltage?

PUD ANSWER: Pascoag is concerned that such an added cost on a system like ours would be unnecessary and would cause an increase in our operating costs which would need to be passed on to our customers. We have never had any incidents. We install down-grounds at each pole to increase the integrity of our system. All grounds are tested to make sure they are at a resistance of 25 ohms or

less. In addition, we ground all fixtures according to the specs provided. All underground fixtures have added grounds to eliminate the possibility of failure.

3. Would regular monitoring for stray and contact voltage, through manual or mobile testing, on an annual or more frequent basis, serve to reduce the number of injuries to human or animal life? Why/why not?

PUD ANSWER: No. We have not had any reported issues, and due to the above described construction techniques, do not anticipate any issues in the future.

4. (BIPCO and PUD only) Is it true that BIPCO and PUD do not regularly inspect underground or overhead equipment or facilities for stray and contact voltage?

PUD ANSWER: Yes, however our system is a grounded WYE and to remediate this we use the following techniques;

For higher-than-acceptable Neutral-to-Earth (NEV). Traditional mitigation techniques include: load balancing, resizing neutral conductors, isolation, improved grounding techniques and equipotential planes.

Load balancing. On three-phase, grounded-wye distribution systems with equally balanced 60-Hz phase currents, the net neutral current should be zero. That is, the neutral current from the three phases effectively cancels out. Unfortunately, in the real world, perfect balancing can be upset by many factors such as phase shift, load unbalance and harmonic currents. This phenomenon can cause current to flow in the neutral conductor and into the ground rod at each of the neutral-to-ground bonding points, which creates a proportional (NEV). Balancing the phase currents can reduce the 60-Hz component of (NEV) across the entire distribution system. Load balancing at a customer's facility can also reduce (NEV), but only at their location.

Resizing your neutral conductors. Currents returning on grounded-wye power systems cause a voltage drop across the impedance of the neutral conductor. Because the neutral conductor is grounded, the impedance of the earth return path in parallel with the impedance of the neutral return path dictates the percentage of earth current and the corresponding (NEV) at that neutral-grounding point. A very simplified way to look at this is to examine a circuit with a current source (neutral return current) and two current paths (neutral path and earth path). All else being equal, current will follow all return paths in proportion to the conducting path impedances. Therefore, reducing the impedance of the neutral effectively reduces the amount of current flowing through the earth path and lowers corresponding (NEV) at that neutral-to-ground bonding point.

5. (BIPCO and PUD only) What are BIPCO and PUDs' cost estimates for implementing regular monitoring of stray and contact voltage, through manual or mobile testing, on an annual or more frequent basis?

PUD ANSWER: Pascoag with its limited resources and manpower would need to hire an outside contractor to perform this service. We have not queried the market for the cost of performing this service on our system.

6. National Grid stated in COMM 2-20 that the cost of implementing Massachusetts reporting requirements (COMM 1-6, Attachment 3, Sec. VIII.) in Rhode Island would be negligible.
 - a. (BIPCO and PUD only) What would be the estimated costs to BIPCO and PUD of implementing the Massachusetts reporting requirements referenced in COMM 1-6. Attachment 3, Sec. VIII.?

PUD ANSWER: Since we have had no stray or contact voltage incidents, we believe the costs of reporting such null information would be de minimis.

- b. Would these reporting requirements increase your awareness of the incidence of stray and contact voltage?

PUD ANSWER: NO, We have had no report of such incidents and do not anticipate any in the future based on our construction techniques.

- c. Would these reporting requirements serve to reduce the number of injuries to human or animal life? Why/why not?

PUD ANSWER: No, see above answers for detail.

7. Please provide an estimate of the annual cost to implement the contact voltage detection and repair program proposed in Senate Bill No. 2387 introduced on February 15, 2012.

PUD ANSWER: Pascoag with its limited resources and manpower would need to hire an outside contractor to perform this service. We have not queried the market for the cost of performing this service on our system.

8. Please provide an estimate of the monthly rate impact of Senate Bill No. 2387 on a typical residential, commercial and industrial ratepayer.

PUD ANSWER: Since this Bill is directed predominantly towards urban development, Pascoag feels that it would be difficult to formulate a number since we have no instances of stray / contact voltage.

9. No. 2387 serves to reduce the number of injuries to human or animal life?
Why/why not?

PUD ANSWER: This Bill would not benefit Pascoag because as stated earlier, we have had no incidents pertaining to stray / contact voltage.