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Via Electronic Mail and U.S. Mail

June 28, 2018

New Hampshire Site Evaluation Committee
Ms. Pamela Monroe, Administrator
21 South Fruit Street, Suite 10
Concord, NH 03301

New Hampshire Public Utilities Commission
Randall S. Knepper, P.E.,
Director, Safety Division
21 South Fruit Street, Suite 10
Concord, NH 03301

Re: SEC Docket No. 2015-05: Public Service Company of New Hampshire d/b/a Eversource Energy ("PSNH") and New England Power Company d/b/a National Grid ("NEP"): Joint Application for a Certificate of Site and Facility for the Merrimack Valley Reliability Project – Post-Construction Measurement Protocol Memorandum for Electric and Magnetic Fields

Dear Ms. Monroe and Mr. Knepper:

Enclosed for filing in the above-captioned docket, please find the Joint Applicants' Post-Construction Measurement Protocol Memorandum for Electric and Magnetic Fields.

Please do not hesitate to contact me with any questions.

Sincerely,

Adam M. Dumville

cc: SEC Distribution List
Mr. Paul Kasper, NH PUC

McLane Middleton, Professional Association
Manchester, Concord, Portsmouth, NH | Woburn, Boston, MA

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MEMORANDUM

TO: Randy Knepper, Director of Safety NH PUC; Paul Kasper, NH PUC; Pamela Monroe, NH SEC Administrator

FROM: Exponent, National Grid, and Eversource

DATE: June 18, 2018

PROJECT: Merrimack Valley Reliability Project (NH SEC Docket 2015-05)

SUBJECT: Measurements of Electric and Magnetic Fields

Introduction

To comply with the Order and Certificate of Site and Facility with Conditions issued by the New Hampshire Site Evaluation Committee (SEC) for the Merrimack Valley Reliability Project on October 4, 2016, as revised by the SEC's Order on Applicants' Motion for Clarification and Amended Order of Certificate of Site and Facility, National Grid and Eversource, through Exponent, provided a proposed protocol in consultation with the Safety Division of the New Hampshire Public Utilities Commission (PUC) for performing measurements of electric and magnetic fields (EMF) before the Project was placed into service. These measurements were carried out in January 2017 and a report on the findings was submitted on March 27, 2017. The measurements were supplemented by the Applicants' Memorandum of Magnetic Field Calibration on April 18, 2018.

The construction phase of the MVRP project is complete, and the MVRP lines are energized and in-service. Post-energization measurements are planned to be performed in July and August 2018 to comply with the revised Certificate condition requiring that measurements be performed at or near summer peak loading of the lines, with the acknowledgement that the Applicants cannot know in advance when peak loading will occur.

Proposed Post-Construction Measurement Protocol

The proposed measurement protocol is divided into several sections including Measurement Preparation, Measurement Procedure, and Reporting.

Locations for measurements in each of the 10 cross sections, specified in Tables A-1 and A-2 in the Application, at Appendix AG were previously selected for pre-energization measurements. Post-energization measurements will be performed at the same pre-energization measurement locations. Where that is not feasible and it is still deemed necessary to take post-energization measurements at another location, the Companies and Exponent will work with the PUC to find another, suitable location for post-energization measurements.

Measurements to be performed July 23 – August 3, 2018

It is anticipated that all measurements can be performed in one week. However, since foul weather (particularly precipitation) will interfere with the function of the measurement instruments and the valid measurement of electric fields, a two-week measurement period beginning July 23, 2018 and extending until August 3, 2018 is proposed. This two-week period is proposed to allow for all measurements to be completed in one measurement trip despite delays caused by foul weather. The Applicants will coordinate with PUC Safety Staff and the SEC administrator to the greatest extent practicable to identify specific dates and times that Exponent will conduct measurements in the field.

This timeframe has been discussed with National Grid and Eversource to confirm that there are no expected line outages, logging or system repairs, or other unusual line conditions scheduled for that period. Additionally, utility personnel will work with appropriate departments to ensure that necessary data (e.g., loadings of all transmission lines at the measurement locations) can be logged and available during the proposed measurement period

Measurement Procedure (same as pre-energization measurements)

At each identified measurement location, the National Grid or Eversource will clear underbrush and other conductive objects, if necessary, which may affect measurements. Exponent engineers will then photo-document the condition of the ROW and transmission lines. Engineers will then lay a long measuring tape on the ground beneath the lines which will be used to identify the horizontal location of conductors. The vertical height of each conductor over the tape will be measured and recorded using an acoustic and/or optical line height sensor. The time and date of the field measurements will be noted so that the loading on each of the lines at the time of field measurements can be matched.

Engineers will then proceed to perform EMF measurements by using measurement equipment and methodology outlined in *Institute of Electrical and Electronics Engineers* IEEE Standard 644-1994 (R2008). Measurements will be performed at a height of 1 meter above ground and will be performed for a transect perpendicular to the transmission line. If a transect other than perpendicular is necessary, the angle of the transect to the transmission lines will be noted and measurement distances will be adjusted accordingly.

Both electric fields and magnetic fields will be measured as the total field computed as the resultant of field vectors measured along vertical, transverse, and longitudinal axes.¹ The magnetic-field will be measured in units of milligauss (mG) by orthogonally-mounted sensing coils whose output is recorded by a digital meter (EMDEX II) manufactured by Enertech Consultants. The electric field will be measured in units of kilovolts per meter (kV/m) with a single-axis sensor accessory manufactured by Enertech Consultants for the EMDEX II meter. The single-axis sensor will be aligned sequentially along vertical, transverse, and longitudinal axes to capture the full vector electric field. These instruments meet the IEEE instrumentation standard for obtaining accurate field measurements at power line frequencies (IEEE Std.1308-

¹ Measurements along the vertical, transverse, and longitudinal axes will be recorded as root-mean-square magnitude, which refers to the common mathematical method of defining the effective voltage, current, or field of an alternating current system.

1994). All meters and measurement accessories will be calibrated by the manufacturer using methods like those described in IEEE Std. 644-1994.

An effort has been made to perform measurements during a time period characteristic of peak loading. However, it is impossible to determine *a priori* whether peak loading will occur during the time of measurements. Therefore, if measurements are performed at line loadings lower than peak levels, field levels will be adjusted for peak loading conditions on all lines for comparisons to values in Table A-1 and A-2 in the Petition.

Measurement Procedure at PUC-Specified Road Crossings

Road crossings are often not suitable for performing detailed measurements and modeling of the EMF levels due to road traffic, line geometry and height in relation to the road, and other EMF sources along the road. Due to these factors, no modeling will be performed for these sites and thus detailed conductor position and height information will not be recorded. However, the measurement procedure will be similar to that outlined above and will include measurements of the total electric and magnetic field at each measurement location. Measurements will be performed specifically beneath the conductors of each transmission line with additional measurements performed between transmission lines as possible given the above described factors.

Report

Exponent will prepare a report detailing measurement methodology and a summary of both measurements taken before and after the Project is placed into service. This report will include aerial maps from Google Earth of each measurement location with annotations reflecting the specific locations of electric and magnetic field measurements as well as a graphical summary of both electric and magnetic field measurements. Consistent with the NHSEC Certificate of Site and Facility, measurements that are performed outside of near-peak or peak loading conditions will be summarized both in raw form as well as adjusted for peak loading conditions.