Northeast Utilities

107 Selden Street, Berlin, CT 06037

Northeast Utilities Service Company
P.O. Box 270
Hartford, CT 06141-0270
(860) 665-5000
www.nu.com

November 10, 2011

Mr. Robert Stein
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: Docket No. LIFE-CYCLE 2011 - LIFE-CYCLE 2011

Dear Mr. Stein:

This letter provides the response to requests for the information listed below.

Response to CSC-02 Interrogatories dated 10/21/2011
CSC-002, 008, 009, 016, 017, 018, 019*

Response to OCC-01 Interrogatories dated 10/21/2011
OCC-012

Very truly yours,

John Morissette/tr

John Morissette
Manager
Transmission siting and Permitting
NUSCO
As Agent for CL&P

cc: Service List

* Bulk material provided.

Witness: Robert E. Carberry
Request from: Connecticut Siting Council

Question:
Are there any additional factors not discussed in the 2006 Council interrogatory responses that have impacted CL&P's capital and construction costs for transmission lines? If so, please identify these factors and the impacts they have on transmission line life-cycle costs.

Response:
CL&P assumes that the reference to 2006 Council interrogatory responses is primarily to CL&P's responses on January 10, 2006 to Second Set questions 2, 4, 5 and 8. Many factors affecting transmission line capital and construction costs in CT were mentioned in those responses, and all of those factors continue to be relevant. Since 2006, additional project experiences that may be relevant include:

- For projects requiring a Permit from the U.S. Army Corps of Engineers, including associated coordination to obtain a Water Quality Certification from the Connecticut Department of Energy and Environmental Protection, consultations with representatives of native American tribes, as required by the National Historic Preservation Act, have led to much field investigation, with associated costs, and project changes.
- Outreach efforts to maintain communications with affected or interested stakeholders have increased throughout the time span of a project's siting and construction.
- More engineering and planning studies have been needed to meet the expectations of participants in siting and permitting proceedings.
- On some transmission projects, capital costs have been reduced by FERC incentive orders allowing recovery of costs for construction work in progress, thus reducing the costs of borrowing funds for construction.
- Larger and high profile projects have required more external resources and larger management teams.

Witness: John R. Morissette
Request from: Connecticut Siting Council

Question:
Since the 2006 Council interrogatories, have there been any updates or changes regarding CL&P's overall philosophy related to siting and constructing new transmission lines?

Response:
CL&P's overall philosophy related to siting and constructing new transmission lines remains as stated in its responses to the 2006 Council interrogatories.

Witness: John R. Morissette
Request from: Connecticut Siting Council

Question:
Specifically, in response to the 2006 Council interrogatories, CL&P stated that there were problems with "multiple, overlapping, and sometimes conflicting permitting requirements." Is this still the case or has that situation been mitigated or resolved?

Response:
In CSC-02, Q-CSC-006 in 2006, CL&P responded:

"With respect to the state siting process, CL&P encourages the CSC to exercise its "exclusive" statutory authority with respect to determinations of the need for, the location of, and alternatives to electric transmission facilities, to the exclusion of other state agencies, and to limit the role of such other agencies with respect to these matters to a commenting function, as envisioned by the Public Utilities Environmental Standards Act, thus eliminating multiple, overlapping, and sometimes conflicting permitting requirements."

CL&P's response remains as stated in the 2006 Council interrogatory.

Witness: Robert E. Carberry
Request from: Connecticut Siting Council

Question:
In CL&P's response to Question 14 of the first set of 2011 Council interrogatories, it was indicated that the Installed Costs shown in Table 5-4 of the 2007 Life Cycle Report should be reviewed. Does CL&P or Northeast Utilities have Installed Cost figures that it believes are more reflective of the installed costs for HVDC lines in Connecticut or the Northeast? If so, provide such figures.

Response:

CL&P and Northeast Utilities have not installed HVDC converter terminals and do not have installed cost figures for such facilities in Connecticut or the Northeast. In the attachment to CL&P's response to CSC-01, question 14 (filed 9/29/11), please note in section 2.2.2 of the of the August 2008 Interstate Reliability Project Solution Report that a consultant provided a preliminary cost estimate in 2008 of $536 million for the two converter terminals of a potential 1,200-MW HVDC line from Millbury, MA to Southington, CT.

Witness: Keith M. Sickles
Request from: Connecticut Siting Council

Question:
This question refers to the first set of 2011 CSC Interrogatories. In CL&P's response to Question 15, CL&P indicated that it has now standardized the use of ACSS conductors as opposed to ACSR. Does CL&P believe that this will have a significant impact on transmission life-cycle costs?

Response:
CL&P believes that ACSS conductors will not have a significant impact on the overall life-cycle costs of transmission lines. While ACSS conductors are more expensive than ACSR conductors, they also sag less than ACSR conductors at maximum operating temperature. This offers the benefit of reducing some structure heights. The cost savings of a reduction in height to a number of structures would likely substantially offset the increased cost of the conductors.

Long-term operation of ACSS is not fully known yet as it has only been installed on the NU Transmission System since the late 1980s, however, CL&P anticipates that ACSS will perform as well if not better than ACSR.

Witness: Robert E. Carberry
Request from: Connecticut Siting Council

Question:
It has been brought to our attention that figure 8.3, "Magnetic Field Profiles for Typical 115kV HPFF Line" in the 2007 Life-cycle report may not be correct and does not adequately account for the cancellation effects of the steel pipe. Do you agree with this statement?

Response:
Yes, although attenuation rather than cancellation is a better characterization. The asterisked note associated with Figure 8.3 in the 2007 report states that "this may not fully account for the magnetic field attenuation afforded by the steel pipe." The carbon steel in the pipe of an HPFF line is a ferromagnetic metal with high magnetic permeability, and this characteristic makes it very effective in reducing magnetic fields above ground. Flux shunting and eddy currents occur in the carbon steel when cables inside the pipe are producing magnetic fields. The net effect of these phenomena is a reduction of the magnetic field outside of the pipe, i.e. shielding, or attenuation. The thicknesses, diameters and magnetic permeability characteristics of carbon-steel pipes vary, but generally magnetic fields are attenuated by the pipes by a factor of at least 10.

Witness: Robert E. Carberry
Request from: Connecticut Siting Council

Question:
If so, please provide any similar information CL&P may regard as typical magnetic field profiles for underground HPFF cable installations. This may include test reports or other measurements of electro-magnetic fields at various distances from the center of the right-of-way.

Response:
Attachment 1 contains graphs of magnetic fields measured on two days in December, 2006 at six locations, in Wilton and Redding, crossing over 345-kV underground HPFF cables. These measurements were previously provided to the Council in a July 5, 2007 "Post-Construction EMF Monitoring Report for the Bethel to Norwalk Transmission Line Project."

An "EMF Management User's Guide for Underground Transmission Systems" prepared for the Electric Power Research Institute in 2008 includes magnetic field measurements and other information for several underground HPFF transmission cable systems which are operated by four utility companies. Attachment 2 is a copy of section 4 from that guide entitled "Pipe-Type Cable Magnetic Fields".

* Bulk material provided.

Witness: Robert E. Carberry
Request from: Office of Consumer Counsel

Question:
Explain how electric and magnetic fields are monitored at underground and overhead transmission plant sites. Specify whether all sites or only certain sites are actively monitored. Summarize monitoring results for the past three years, and include the cost of monitoring.

Response:

CL&P does not regularly monitor magnetic fields associated with its transmission facilities other than as required to comply with Connecticut Siting Council requirements for specific projects.

The Connecticut Siting Council's Application Guides for Substations and for Electric Transmission Lines call for reporting of "Measurements of existing electric and magnetic fields (EMF) at the boundaries of adjacent schools, day-care facilities, playgrounds, and hospitals (and any other facilities described in Conn. Gen. Stat. § 16-50*l*), with extrapolated calculations of exposure levels during expected normal and peak normal line loading." Consequently, in all of CL&P's applications to the Council seeking certifications of new substations or transmission lines, for many years now, CL&P provided spot-in-time field measurements to satisfy this requirement.

Additionally, in its decisions on CL&P's applications, the Council often requires post-construction electric and/or magnetic field monitoring as a condition of its certification decision. Typically, the Council requires that CL&P's monitoring plan be approved by the Council first. The most recent example of a monitoring plan which the Council approved is attached. This example makes clear that spot-in-time monitoring occurs on one or more occasions at a limited number of sites.

Since 2008, CL&P has included spot-in-time field electric and/or magnetic field measurement data in the following applications to the Council:

- Docket 364, Waterford Substation
- Docket 370, Greater Springfield Reliability Project
- Docket 370A-MR, Manchester to Meekville Junction Project
- Docket 398, Sherwood Substation

Since 2008, CL&P has submitted post-construction electric and magnetic field monitoring reports to the Council pursuant to conditions of approval in the following Council dockets:

- Docket 272, Middletown-Norwalk Transmission Project, December 22, 2009
- Docket 292, Glenbrook Cables Project, January 29, 2010
- Docket 311, Wilton Substation, January 20, 2009
- Docket 224, Replacement Long Island Cables, December 29, 2009
- Docket 326, Stepstone Substation, January 7, 2010
- Docket 364, Waterford Substation, October 25, 2010

The measurements and reports for Dockets 272 and 292 were more extensive and were prepared for CL&P by a consulting firm, Exponent, Inc., while measurements and reports for the other dockets were prepared by Northeast Utilities Service Company ("NUSCO"). Total estimated EMF monitoring costs for Dockets 272 and 292 were approximately $180,000 and $85,000, respectively. EMF monitoring costs for each of the other projects were on the order of $10,000.

POST-CONSTRUCTION ELECTRIC & MAGNETIC FIELD MONITORING PLAN

GREATER SPRINGFIELD RELIABILITY PROJECT AND THE MANCHESTER TO MEEKVILLE JUNCTION PROJECT

I. Introduction and Purpose

In accordance with the March 16, 2010 Decision and Order of the Connecticut Siting Council (the "Council") in Docket 370A, the July 20, 2010 Decision and Order of the Council in Docket 370A-MR, and the Council's subsequent D&M Plan approvals in each Docket, The Connecticut Light and Power Company (the "Company") proposes the following post-construction electric and magnetic field monitoring plan for the Greater Springfield Reliability Project and the Manchester to Meekville Junction Project (collectively the "Projects").

A primary purpose for electric and magnetic field ("E & MF") measurements near to transmission lines is to make comparisons to levels predicted by calculations. This purpose is best served by selecting post-construction measurement locations where terrain is relatively flat, conductor configurations and heights are typical and representative, and where few if any confounding field sources and objects exist. A secondary purpose for such measurements can be to make comparisons between levels measured at points of interest before and after new line construction. However, those points of interest may not be at locations which best serve the primary purpose. Also, measurements of magnetic fields should not be so compared because grid and power-flow circumstances can be significantly different at the times of these before and after measurements.

II. Monitoring Locations

The Company's proposed monitoring locations for electric and magnetic fields are listed in Table 1 at the end of this plan. The selected monitoring locations capture each newly constructed overhead line type that is part of the line design, in each town where that type occurs. Additional considerations in location selection are as follows:

1. Lines

At a minimum, the Company chose at least one readily accessible monitoring location within each distinctly different right-of-way cross section along the line routes. Cross sections illustrate changes in the type of line construction.

At each of the monitoring locations listed in Table 1, measurements will be made within the Company's right-of-way ("ROW") or on public roadways, and not on nearby private property outside of the Company's ROW absent landowner approval.

For a ROW cross section continuing through more than one municipality, the Company chose at least one readily accessible monitoring location for that cross section within each municipality.

2. Substations

The Company will take measurements along one continuous path outside the perimeter fence of the North Bloomfield Substation.

3. Measurement Location Characteristics

To the extent possible, the Company chose line measurement locations where: (1) the terrain is relatively flat and bare of vegetation; (2) conductor configurations and heights are typical and representative; and (3) few if any confounding sources, such as local distribution lines, and objects exist.

III. Measurements for Line Segments

The Company will take a post-construction measurement of electric and magnetic fields twice at each of the listed locations within 10 months of commencement of 345-kV line operation

For the locations selected to meet criteria II.1, the Company will measure electric magnetic fields along a transect (i.e., profile) passing perpendicularly beneath new sections of overhead 345- and 115-kV lines, at the listed locations. The measurement path will extend to each ROW boundary where reasonable access exists, else to at least 50 feet beyond the outermost line conductors.

IV. Measurement Instrumentation and Recording

The Company will record all electric and magnetic field measurements at a height of one meter (3.28 feet) above ground in accordance with the industry standard protocol for taking measurements near power lines (IEEE Std. 644-1994 [R2008], "*IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields From AC Power Lines*"). The resultant magnetic field will be measured with a 3-axis, recording digital meter (EMDEX II). Electric fields will be measured with an E-Probe attachment accessory to the EMDEX II meter. This accessory enables the EMDEX II to make single-axis measurements of the electric field. Both the EMDEX II magnetic field meter and the E-probe accessory meet the IEEE instrumentation standard for obtaining valid and accurate field measurements at power line frequencies (IEEE Std. 1308-1994, *"IEEE Recommended Practice for Instrumentation: Specifications for Magnetic Flux Density and Electric Field Strength — 10 Hz to 3 kHz."*) With this instrumentation, magnetic fields can be recorded continuously while walking and then plotted, whereas electric fields can be measured at spots and then recorded by hand in a data table and then plotted.

V. Reporting

Within twelve months of the in-service date of the 345-kV line, the Company will provide to the Council a report on these measurements with "true-up"comparisons to predicted values. "True-ups" are electric and magnetic field calculations that are based on site-specific conditions, including the actual conductor heights at a location at the time the measurement is made, current flows on the lines at the time the measurement is made, and the terrain. These calculations are then compared with the measurements taken at the location. True-up comparisons of measurements with calculations will be performed and reported for some locations to demonstrate model accuracy

The report will also include aerial photographs on a scale of 1 inch equals 100 feet to mark each measurement location. For each magnetic field measurement, the coincident transmission line currents, as recorded by the CONVEX SCADA system, will be noted and reported. Additionally for each measurement location, the size of transmission line conductor types will be reported.

TABLE 1

E&MF MONITORING LOCATIONS FOR THE GREATER SPRINGFIELD RELIABILITY PROJECT AND THE MANCHESTER TO MEEKVILLE JUNCTION PROJECT

Site	Cross Section #	Municipality	Project Portion	Location
1	1	Bloomfield	GSRP	Off of Tunxis Ave, CT Route 189
2	1	East Granby	GSRP	South of Holcomb St
3	2	East Granby	GSRP	South of Turkey Hills Rd
4	2 Split-Phase	East Granby	GSRP	Beyond the End of Copper Hill Terrace
5	2	Suffield	GSRP	Field East of Ratley Rd
6	23	Manchester	MMP	South of Tolland
7	24	Manchester	MMP	Meekville Jct Location