THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF DOUGLAS H. BELL

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name, current position, and business address.

A. My name is Douglas H. Bell and I am a Senior Principal Consultant and President at Cavanaugh Tocci Associates, Inc. My business address is 327 F Boston Post Road, Sudbury, MA.

Q. Please describe your educational background and your work experience.

A. I received a Bachelor of Science degree in Electrical Engineering from the Massachusetts Institute of Technology in 1982, and since that time I have worked in the field of engineering acoustics. My educational experience relevant to this testimony includes course work in acoustics, vibration, physics, and mathematics. In 1989, I joined Cavanaugh Tocci Associates, Inc. as a principal consultant. Cavanaugh Tocci Associates Inc. is a member of the National Council of Acoustical Consultants. As a principal (and later a senior principal) of this firm I have been responsible for all aspects of project management and technical services for a wide variety of projects that are related to sound and vibration control. I have twenty five years of experience in evaluating environmental sound. My environmental sound impact assessment experience includes conducting baseline sound surveys, review of environmental noise regulations, defining appropriate acoustic design goals for projects, developing computer based models to estimate project related sound impact, development of sound mitigation strategies, and conducting post-construction sound compliance testing. I have co-authored a textbook on the topic of Industrial Noise Control and have published several papers in trade related journals. I am a member of the Institute of Noise Control Engineering ("INCE"), and the Acoustical Society of America ("ASA"). Attached to this testimony is a copy of my resume, Attachment A.

Q. What is the purpose of your testimony?

A. For the Northern Pass Transmission Project ("Northern Pass" or the "Project"), as proposed by Northern Pass Transmission LLC ("NPT"), I explain how I (1) conducted baseline sound surveys along the Project route (Report 1 of Appendix 39 of the SEC application) and provided the sound surveys to Dr. Gary Johnson to assess the sound impact produced by the Project's transmission lines; (2) developed acoustic design goals for the Franklin Converter Terminal, the Deerfield Substation expansion, and the Scobie Pond Substation expansion (Reports 2-4 of Appendix 39 of the SEC application); and (3) reviewed construction noise impacts. Report 5 of Appendix 39 of the SEC application.

<u>Baseline Surveys</u>

Q. Please describe the purpose of conducting baseline sound surveys?

A. Sound is a feature of all environments. When a new sound source is introduced into an area, it may be deemed a nuisance or an annoyance when it is inconsistent with the environment, by being either too loud or by being distinct in character. To accurately assess the acoustic impact of a proposed facility, an understanding of the existing acoustic environment in the vicinity of the source is required. To this end, the results of baseline sound surveys provide a basis for making an informed assessment of acoustic impacts.

Q. Please describe the methodology used to conduct baseline sound surveys for the Project.

A. In order to document the time-varying characteristics of ambient environmental sounds in the study areas, I implemented sound monitoring programs which relied on unattended continuous measurements (3 to 7 days periods), and attended intermittent measurements (15 to 20 minutes intervals). The continuous measurements were performed in order to identify typical patterns in existing ambient environmental sound levels, and to obtain a sufficient statistical sample to quantify time-varying background sound levels in the community. Data gathered with the continuous monitors included hourly A-weighted metrics (L_{eq}, L_{max}, L_{min}, L_1, L_{10}, L_{50}, L_{90}, L_{99}), for the entire monitoring periods. The intermittent measurements were conducted in order to obtain detailed observations of the acoustic environment during daytime and late night/early morning hours. Data gathered during the intermittent measurements included A-weighted and 1/3 octave band frequency analysis for each interval (L_{eq}, L_{max}, L_{min}, L_1, L_{10}, L_{50}, L_{90}, L_{99}), and 1-second time histories to identify transient events. The results of the survey allow both quantitative and qualitative analyses of the acoustical environment surrounding the Project. A glossary of acoustic terminology used in this testimony can be found in Annex A of Reports 1-5 in Appendix 39 of the SEC Application.

Q. Where were the baseline sound measurements performed?

A. The baseline sound surveys can be divided into two categories (Stationary Facility Surveys, and Project Route Survey):

1. ***Stationary Facility Surveys***

For these surveys, reviews of the existing land use in the vicinity of the facilities were conducted to identify the closest and most representative receptor locations. On the basis of these reviews, the following locations were selected:

a. *Franklin Converter Terminal:*

i. Continuous monitoring at one location adjacent to the nearest residence east of the Project

ii. Intermittent measurements at three locations (north, east, and south) of the Project

b. *Deerfield Substation:*

i. Continuous monitoring at one location adjacent to the nearest residence west of the Project

ii. Intermittent measurements at three locations (north, west, and south) of the Project

c. *Scobie Pond Substation:*

i. Continuous monitoring at two locations adjacent to the nearest residential properties north and south of the Project

ii. Intermittent measurements at the same two locations as the continuous monitoring (north, and south)

2. Project Route Survey

Seventeen (17) measurement locations were selected to assess ambient sound along the proposed Project route. These locations were selected in order to provide a representative sample of the various acoustic environments that exist along the Project route. Intermittent measurements were conducted at all seventeen (17) locations, and continuous measurements were conducted at two (2) of the selected locations. It should be noted that since this survey was conducted an additional underground length of transmission line has been proposed in the vicinity of Locations 8, 8A, 9, 9 CM and 10. Although transmission line sound will not impact these locations, the data derived is relevant in characterizing similar environments along the route.

Q. When were the baseline surveys performed?

A. The measurements were conducted during a cold weather season with leaves off the trees, and a warm weather season with foliage and insect sounds present. Specific time windows follow:

1. ***Stationary Facility Surveys***
    a. *Continuous Measurements*
        i. Winter: January 30, 2014 – February 6, 2014
        ii. Summer: June 16, 2014 – June 23, 2014
    b. *Intermittent Measurements*
        i. Winter – Daytime: January 30, 2014 (9 a.m. – 2 p.m.)
        ii. Winter – Nighttime: January 31, 2014 (midnight – 4: a.m.)
        iii. Summer – Daytime: June 16, 2014 (noon – 4 p.m.)
        iv. Summer – Nighttime: June 17, 2014 (midnight – 4 a.m.)
2. ***Project Route Survey***
    a. *Continuous Measurements*
        i. Winter: March 24, 2014 – March 27, 2014
        ii. Summer: July 21, 2014 – July 24, 2014
    b. *Intermittent Measurements*
        i. Winter – Daytime: March 24-27, 2014 (10 a.m. – 4 p.m.)
        ii. Winter – Nighttime: March 27-April 3, 2014 (10 p.m. – 4 a.m.)
        iii. Sumer – Daytime: July 21-23, 2014 (9 a.m. – 3 p.m.)
        iv. Summer – Nighttime: July 21-25, 2014 (10 p.m. – 4 a.m.)

Q. Please describe the results of the stationary facility surveys.

A. A primary objective of these surveys was to quantify the background sound levels that typically occur in the vicinity of the facilities. The background sound level is the nearly steady-state level that occurs in the environment devoid of transient sounds. In most environments, background sound levels reach a minimum during the late night or early morning hours when local traffic is negligible. It is comparisons to these lowest background sound levels that serve as our basis for assessing project sound impact. To obtain a conservative estimate of these lowest background sound levels that occur in each Project area, we begin by using the $L_{90(1\text{-hour})}$ metric. This metric represents the sound level that is exceeded for 54 minutes of each measured hour. In other words, the ambient sound only falls below the $L_{90\ (1\text{-hour})}$ for six minutes in the hour. We then select the lowest $L_{90(1\text{-hour})}$ that occurred in each continuous 24-hour period of the survey. There are seven lowest $L_{90(1\text{-hour})}$'s in a week long (168-hour) survey. We then average these seven values to obtain a metric that we refer to as the "nominally lowest" background sound level. Background sound levels rarely fall below this level, and only for brief periods; usually during the early morning hours (between 2 a.m. and 4 a.m.). The "nominally lowest" background sound levels measured during the summer and winter surveys follow:

1. ***Franklin Converter Terminal***
   a. Winter: 21 dBA
   b. Summer: 27 dBA
2. ***Deerfield Substation***
   a. Winter: 24 dBA
   b. Summer: 27 dBA
3. ***Scobie Pond Substation***
   a. Winter:
      i. North monitor: 30 dBA
      ii. South monitor: 31 dBA
   b. Summer:
      i. North monitor: 34 dBA
      ii. South monitor: 36 dBA

<u>Method to Assess Incremental Sound Impact</u>

Q. Please describe your method to assess incremental sound impact.

A. Sound impacts of a Project are often assessed with respect to pre-existing background sound levels. Limits for incremental changes in background sound that result from sound produced by a project can be used as criteria for controlling sound impact. However, appropriate limits for acceptable incremental changes above the pre-existing background can vary greatly depending on the metric used to define the background sound level, and an understanding of the character of both the existing background sounds and the facility sound. To evaluate the potential impact of Project related sounds at the stationary facilities, I have utilized an impact assessment method that is based on incremental increases above the "nominally lowest" background sound level measured in the above discussed baseline sound surveys. Thus the starting point for my assessment is based on a very low sound level that only occurs for brief periods of time typically during the early morning hours. I then defined impact classifications with respect to the incremental amount that the facilities might exceed the "nominally lowest" background sound level, using the following classification scheme to rate the impacts.

Up to 5 dBA– *little or no impact*

5-10 dBA – *minimal impact*

Greater than 10 dBA – *significant impact*

This approach recognizes that the average person can rarely distinguish a 3 dBA change in sound level and that a change in sound level in excess of 10 dBA is readily apparent to the average person. It should also be noted that for the most part, during daytime and evening hours, pre-existing background sound levels significantly exceed the "nominally lowest" level. As such when using this metric as a basis for assessing incremental changes, the above classifications become extremely conservative with respect to the anticipated response from acoustically sensitive receptors.

Acoustic Design Goals

Q. Please describe the purpose of acoustic design goals.

A. Acoustic design goals are used in the engineering and design of facilities in order to achieve certain sound emission criteria. The acoustic design goals are included in the specifications provided to vendors as part of requests for proposals by NPT.

Q. What are the acoustic design goals that you recommend for the Franklin Converter Terminal, the Deerfield Substation expansion, and the Scobie Pond Substation expansion?

A. In order to obtain a characterization of "minimal impact" or less, I recommend the following acoustic design goals:

1. Franklin Converter Terminal

The maximum sound level for continuous sound produced by the operation of all equipment located at the facility shall not exceed 30 dBA at any existing occupied residential receptor property when measured within the boundaries of the receptor property.

2. Deerfield Substation Expansion

The maximum sound level for continuous sound produced by the operation of all equipment located at the facility shall not exceed 29 dBA at any existing occupied residential receptor property when measured within the boundaries of the receptor property.

3. Scobie Pond Substation Expansion

> The maximum sound level for continuous sound produced by the operation of all equipment located at the facility shall not exceed 35 dBA at any existing occupied residential receptor property when measured within the boundaries of the receptor property.

These acoustic design goals will be incorporated into the material procurement contracts. Prior to the purchase of equipment, the contractor will be required to demonstrate using appropriate acoustic modeling methods that the design will meet the acoustic requirements. At the conclusion of construction, the contractor will demonstrate through field measurements that the Project complies with the acoustic specifications.

<u>Construction Noise Impacts</u>

Q. Have you considered construction noise in your evaluation?

A. Construction of the Project will take place over a time frame of approximately two and a half years. For the most part, construction activities will take place during daytime hours. The construction schedule will include many overlapping phases that will occur throughout the extent of the Project route. Construction tasks for this Project can be grouped into the following categories:

- Overhead Transmission Line Construction
- Underground Transmission Line Construction
- Fixed Site Construction

Due to the temporary nature of most construction components of this Project, construction noise is not expected to create an appreciable impact at sensitive receptors. During the detailed design process and during construction, areas where activities may occur for extended periods of time will be identified. The need for noise mitigation measures at these locations will depend on proximity to sensitive receptors and the anticipated duration of sound impact. Construction noise is difficult to control because of the mobile nature of its sources and the flexibility of schedule inherent in most construction. However, as a starting point, the following noise abatement measures will apply throughout the project:

- The federal regulations that define limits for truck noise, for the sale of new trucks will be complied with.

- The construction equipment manufacturers' stock sound muffling devices will be used, and will be kept in good repair throughout the construction process.
- The majority of the potentially noisy construction work will be performed during daytime hours, and as permitted by applicable requirements,
- The Project will maintain communication with the communities during the construction process in order to inform of potential impact during construction, and to respond to community concerns.

Conclusion

Q. Are there any noise regulations that apply to the Project facilities?

A. To the best of my knowledge, there are no Federal, or State regulations that specifically govern the sound produced by the Project facilities. I am aware, however, that the SEC has determined appropriate sound levels in a number of cases. In the Antrim wind case, the SEC relied on the 2009 WHO Guidelines in establishing a sound level condition of 45 dBA or 5 dBA above ambient during daytime at the outside facades of residences, and a nighttime level not to exceed 40 dBA or 5 dBA above ambient, whichever is greater.

Q. How do the Project acoustic design goals associated with the Franklin Converter Terminal, the Deerfield Substation expansion, and the Scobie Pond Substation expansion compare to the SEC precedent?

A. The acoustic design goals I have recommended for the stationary facilities, which apply at all existing occupied residential properties, are very stringent, and well within the limits of the SEC precedent.

Q. What is your opinion regarding construction noise?

A. It is my opinion that if the protocols are observed, sound produced by the construction of the Project will not have an appreciable impact at sensitive receptors.

Q. Have you seen the DEIS released by the Department of Energy for this project?

A. Yes. The findings are consistent with my Testimony

Q. Does this conclude your testimony?

A. Yes.

ATTACHMENT A

Douglas H. Bell

President/Senior Principal

Education:

Massachusetts Institute of Technology, BS 1982

Professional Affiliations:

Member, Acoustical Society of America
Member, Institute of Noise Control Engineering

Publications:

Co-Author, *Industrial Noise Control-Fundamentals and Applications,* Second Edition, Marcel Dekker, Inc., New York, 1993.

Experience:

1989 – Present	Cavanaugh Tocci Associates Inc., Sudbury, MA Currently President / Senior Principal Consultant
1982 – 1989	Bruel and Kjaer Instruments, Inc. Marlborough, MA Application Engineer, Project Manager

As President of Cavanaugh Tocci Associates Inc., Mr. Bell is responsible for both its technical and business activities. He also consults to architects, engineers, and industrial clients in the analysis and control of noise and vibration in buildings and the environment. Typical projects include noise impact assessment and control for industrial facilities and transportation systems, mechanical system noise and vibration control in buildings, and the control of structureborne and groundborne noise and vibration.

Mr. Bell also specializes in the field of vibration with respect to sensitive applications in laboratory, manufacturing, and medical facilities. Typical projects include pre-installation site evaluations, development of appropriate design goals for new laboratory facilities, evaluation and control of occupant induced vibration, and development of vibration isolation recommendations for mechanical systems and sensitive equipment.

Representative projects on which Mr. Bell has consulted include:

- **Bethlehem Energy Center, Bethlehem, NY**
  Environmental noise impact analysis including baseline noise monitoring, facility sound modeling, recommendations for facility sound control, application preparation, and testimony at public hearings for a 750-megawatt combined-cycle combustion turbine power plant.
- **LeMessurier Consultants, Cambridge, MA**
  Design, development and testing of tuned mass dampers to control occupant

induced vibration on long floor spans at the Davis Museum and Cultural Center in Wellesley, MA

- **Dana Farber Cancer Institute, Boston, MA**

  Site vibration evaluation, facility design criteria, and building foundation vibration isolation design for a 14-story building used to conduct vibration sensitive research in an urban environment.