Appendix D: Preliminary Noise Evaluation

Acoustics

The study of sound and its properties is known as acoustics. By considering basic physical properties of sound and the acoustic environment, the potential effect of excess or unwanted sound (i.e., noise) can be modelled prior to construction of the sound source. The relevant acoustics used for modelling the sound levels from outdoor power transformers are found in the International Organization for Standardization (ISO) standard ISO 9613-2 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation" (ISO, 1996).

The principal factor determining the attenuation (reduction) of sound outdoors is the separation distance between the sound source and the receptor. Simply, the further the receptor is from the source, the less sound it will receive from that source. The relationship between the sound attenuation and distance is logarithmic, thus the sound perceived will decrease rapidly in the areas very near to outdoor sound source(s), but more gradually as the separation distance becomes greater. See **Figure 1** below for a chart illustrating this reduction.

Other factors that influence sound propagation are included in ISO 9613-2. These account for atmospheric, meteorological and physical conditions that will slightly affect sound propagation (relative to the attenuation due to the source/receptor separation distance). Some factors considered include: surrounding topography; the ground surface between the source and receptor; acoustic frequency range(s) of the sound; surrounding development; and influence of screens/barriers between the source and receptor. The effects of these other factors are not included in Figure 1 since their combined influence is unique to each location.

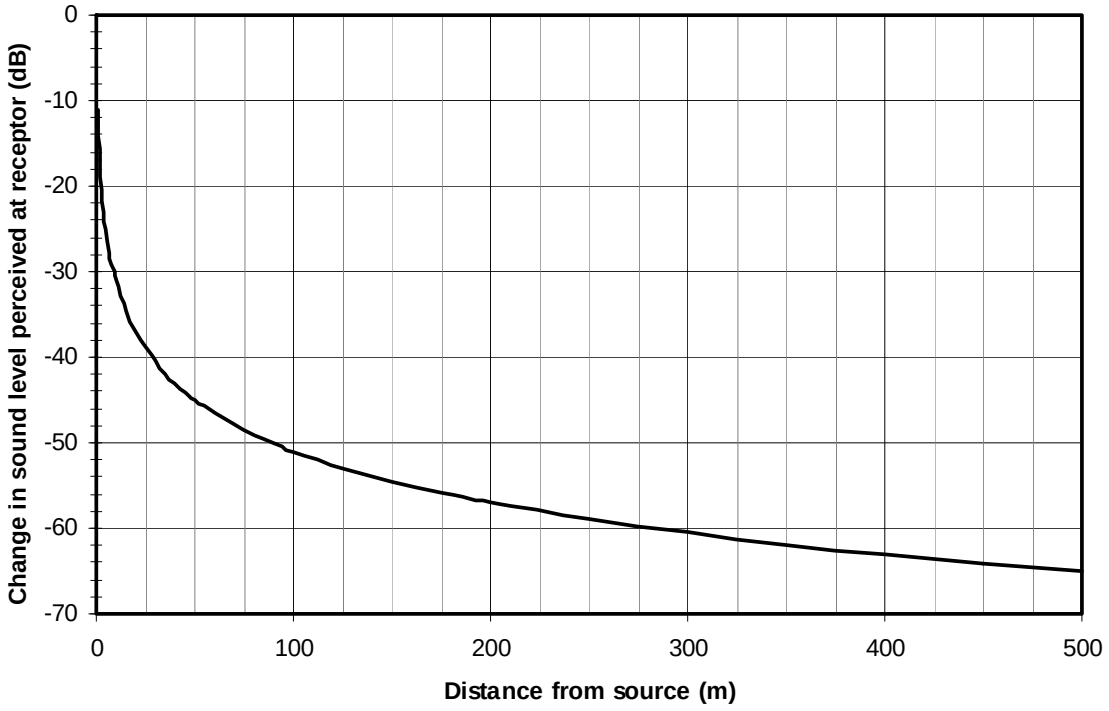

Figure 1: Sound reduction resulting from source/receptor separation distance

Typical Noise Approval Requirements

High-voltage power transformers are subject to an Environmental Compliance Approval (ECA) related to their sound emissions as required under Section 9 of Ontario's EPA. In order to obtain an ECA, Hydro One submits an application package that meets the criteria set out in NPC-233 (MOE, 1995) to MOE for a technical review by the Environmental Assessment and Approvals Branch. The application package includes a description of the site, the surrounding areas, and detailed information about the proposed sound sources. Based on this information, an assessment is made of noise levels at nearby receptors and an ECA is issued if compliance with MOE noise guidelines is predicted.

When the nearest receptors are within 500 metres of the site, a detailed acoustic assessment must be performed and the results reported in an Acoustic Assessment Report (AAR) as part of the ECA application. An acoustic assessment evaluates the existing acoustic environment at the proposed site and uses predictive modelling to anticipate what sound levels may occur due to the proposed sound sources associated with the station. If a sound

level above MOE noise guidelines is expected, the acoustic assessment also identifies appropriate noise control measures for the site. Hydro One has successfully used noise barriers and specialized transformers and cooling fans to control sound at several stations.

The final AAR includes detailed descriptions of the site and proposed sound sources, a summary of the acoustic assessment results, and specifications for sound control measures (as needed). If the reviewer is confident that the proposed transformers will satisfy noise guidelines based on the application, an ECA will be issued for the equipment.

When the nearest receptors are further than 500 metres away, a detailed acoustic assessment is not required for the application. Instead, the MOE has developed a Noise Screening Process (PIBS 4871), which provides the MOE reviewer with enough information to review the ECA application.

The ECA issued by the MOE will establish noise limits for the approved sound sources based on MOE noise guidelines. Based on the normal operation on Hydro One sites, generally the noise limits are 45 dBA in Class 1 or 2 acoustical areas or 40 dBA in Class 3 acoustical areas, but may be louder based on existing background noise levels.

The acoustical class of a site is determined by the predominant sounds of the area. A Class 1 area is "typical of a major population centre, where the background noise is dominated by the urban hum." A Class 3 area is "a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic." A Class 2 area has a mix of the acoustic environments found in Class 1 and 3 areas. A Class 2 area is distinguished from a Class 1 and Class 3 area primarily by the timing of the noisiest periods of the day and the amount of audible human activity at the site (MOE, 1995).

References

Institute of Electrical and Electronics Engineers (IEEE). 2006. IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers.

International Organization for Standardization (ISO). 1996. Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

Ministry of the Environment (MOE). MOE. 1995. Information to be Submitted for Approval of Stationary Sources of Sound (Publication NPC-233). http://www.ene.gov.on.ca/envision/gp/3405e.pdf.

MOE. 1995. Sound Level Limits for Stationary Sources in Class 3 Areas (Rural) (Publication NPC-232). http://www.ene.gov.on.ca/envision/gp/3405e.pdf.

MOE. 1995. Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban) (Publication NPC-205). http://www.ene.gov.on.ca/envision/gp/3405e.pdf.

MOE. 2005. Noise Screening Process for S.9 Applications (PIBS 4871). http://www.ene.gov.on.ca/envision/gp/4871e.pdf.

Environmental Noise Checklist

Site: Proposed Clarington site

Noise Sources	
How many transformers are proposed at this site?	4
What is their electrical rating?	750 MVA; 500/230 kV
What is the specified maximum sound level?[i]	74 dBA

Noise Receptors

What is the land use according to the local official plan for the area(s) adjacent to the proposed site?

☐ Residential ☒ Agricultural ☐ Commercial ☐ Industrial
☐ Institutional ☒ Utility ☐ Park ☒ Greenbelt/Conservation
☐ Other(s):

Receptors within approximately 500 metres of the proposed site? [ii]

Permanent or seasonal residences	☒	Hospitals	☐
Hotels/motels	☐	Campgrounds	☐
Nursing/retirement homes	☐	Schools	☐
Rental residences	☐	Places of worship	☐

See the attached map identifying the four nearest points of reception (POR) described below.

Name	*Description*	*Distance (metres)*
POR1	Residence	290
POR2	Farm building and residence	400
POR3	Residence	880
POR4	Residence	1060

What is the Acoustic Class of the noise environment at the receptors as per MOE guidelines NPC -205 & NPC-232? [iii]

☒ Class 1 or 2
☐ Class 3

Noise Approval Requirements

Is an Environmental Compliance Approval (ECA) under s.9 of the *Environmental Protection Act* required?

☒ Yes ☐ No

Is a detailed technical Acoustic Assessment Report (AAR) necessary for the C of A process?

☒ Definitely (<500 m separation) ☐ Unlikely (>500m separation)

Are noise control measures (i.e., acoustic barriers, specialized equipment) necessary to meet the applicable Ministry of the Environment noise guidelines?

☐ Likely ☐ Unlikely ☒ To be determined by AAR

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[i] Maximum sound level rating as specified in Hydro One procurement specifications, as a measure of sound pressure per standard IEEE C57.12.90-2006. Actual operating sound levels of the installed transformers are generally quieter than specified maximum.

[ii] According to the MOE *Noise Screening Process* (PIBS 4871), electrical power transmission, control and distribution facilities do not require an acoustic assessment for approval when the nearest sensitive receptor is more than 500 metres away. This distance is based on conservative assumptions; noise levels at or below guidelines occur at shorter distances for most Hydro One facilities.

[iii] The acoustic class determines the applicable noise guidelines for the site. Based on Hydro One's typical operating conditions, in Class 1 and 2 areas the sound level limit is the typical One Hour Level Equivalent Sound Level (L_{eq}) measured at the receptor, starting from a minimum value of 45 dBA (MOE publication NPC-205). For Class 3 areas, the minimum limit is 40 dBA at the receptor. In either case the may be higher based on background sound level measurements (NPC-232).