Appendix F: General Acoustics Information

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 for a chart illustrating this reduction.

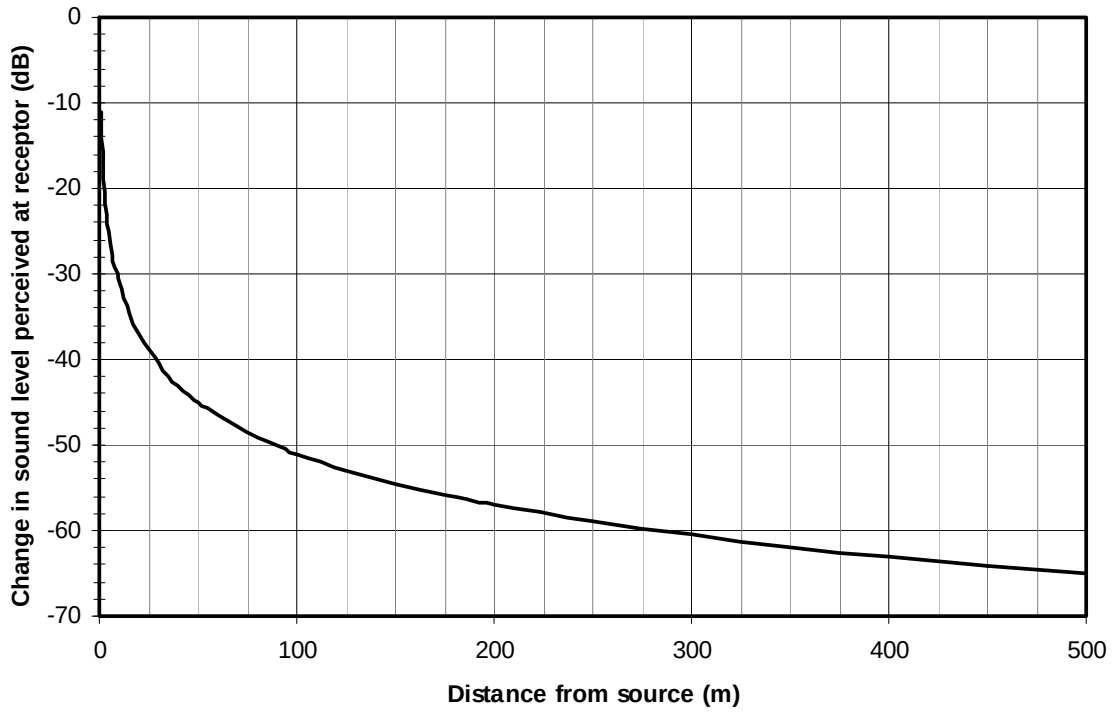

Figure 1: Sound reduction resulting from source/receptor separation distance

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.

Typical Noise Approval Requirements

High-voltage power transformers are subject to a Certificate of Approval (C of A) related to their sound emissions as required under Section 9 of Ontario's *EPA*. In order to obtain a C of A, 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 a C of A 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 as part of the C of A 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 Acoustic Assessment Report 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, a C of A 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 C of A application.

The C of A 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 Class1 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

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