APPLICATION OF ENVIRONMENTAL NOISE GUIDELINES – TWO CASE STUDIES

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1. INTRODUCTION

Many provincial agencies in Canada provide a set of procedures to use when preparing noise impact assessments for proposed and/or existing industrial operations. The application of these guidelines is more of an art than science in many instances. Ontario will be used as a test case for the application of the guidelines contained in the Ministry of the Environment (MOE) publications [1, 2, 3, 4]. Two case studies will be used to highlight the difficulties of interpreting and applying the guidelines to obtain Certificate of Approval (CoA) for industrial operations. The details of these case studies will be presented in this paper.

2. REGULATORY GUIDELINES

Noise, a pollutant under provincial law, must satisfy emission limits as per the guidelines of the Environmental Protection Act of the Province of Ontario. The noise limits are more stringent if located in a rural setting [3]. For plants in an urban setting, the ambient noise is as per Reference 4. The noise limit to be satisfied by the plants is 45 dBA in an urban setting and 40 dBA if located in a rural setting. These levels are expressed as one-hour energy averaged sound level, L_{eq}, in dBA.

2.1 Regulatory Procedures

The Province of Ontario requires all new industries to obtain a Certificate of Approval (CoA) for their operations. It also requires existing industries to obtain or upgrade a CoA to keep their operations current. The industry must show that it is in compliance with the limits of environmental pollutants to obtain the CoA. The noise compliance procedures are outlined in References 1 thru' 4. A brief outline of the procedures is presented below.

- Establish the existing ambient sound levels at the property boundary or at the receptor locations. The ambient sound is the combined noise level of the road traffic and any other plant that is not under investigation;
- Establish the noise limits to be satisfied by the plant under study;
- Evaluate the noise levels of the plant noise sources, either through predictive analysis from the sound power of the sources if the plant is a new development or from measurements (both near field and far field) if the plant is existing and operating during the study;
- Include penalties for source character [1, 2];
- Evaluate the noise impact by comparing the receptor noise levels to the ambient sound levels;
- Design suitable noise control measures if the there is excess;
- Prepare a noise assessment report in a format acceptable to the Ministry of the Environment.

The application of the above procedures is highlighted through the following two case studies.

3. CASE STUDY 1

The first case study deals with an existing plant that requires a comprehensive CoA. Noise impact assessment is part of the approval process. The general lay out of the manufacturing plant is shown in Figure 1. The plant is adjacent to a major freeway with substantial truck traffic. The plant is surrounded by other industries on the other three sides. However, a residential dwelling is located across a local road from the plant and the home is about 70 m from the plant. Most of the in-plant noise levels are well shielded by the building envelope itself. The only possible noise sources are roof top exhausts from plant equipment. The traffic noise dominates the noise environment in this area. As per the guidelines, the planes of the 2nd storey windows at Locations 1 , 2 and 3 during the night time are the receptor locations, where the noise impact must be evaluated.

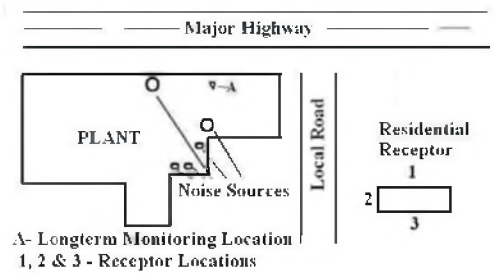

Figure 1. General Layout of the Plant and the Receptor.

The receptor Side 1 is completely dominated by road traffic. The shielded side (Side 3) not only shields the road traffic, but also shields the dominant rooftop exhausts. The receptor Side 2 is also dominated by road traffic and the plant noise is just audible. How does one determine the plant noise levels in such a complex situation when the highway noise is the dominant source and how does one apply the regulatory procedures? The following observations aid in the conclusions and procedures used for this noise assessment:

- Since the plant is located in a city, the urban regulations apply [4];
- Night time limit apply since the plant operates 24 hrs;
- Worst-case scenario conditions are at Location 3, where the traffic noise is well-shielded;
- Reference 2 allows the measurement of 20-minute Leq as a representative sample; MOE also requires measurements over a 48-hr period.

A simplistic method, not necessarily wrong, would have been to obtain a 20-minute Leq at Location 3 when the plant is shut down for a few hours during the earling Sunday morning to represent the ambient sound limit. The noise levels from plant sources is then measured within the plant property, shielded from the highway noise, adjust for distance correction to Location 3. The impact is then assessed. However, the assessment is not representative of realistic conditions. Instead, the following was used: A longterm monitor was set-up on the roof of the plant at Location A; One-hour Leq levels in dBA were measured over one week; The plant was shut down for four of the seven days; the traffic count along the highway was obtained and the noise levels at Locations A and 1 were predicted using methods provided by MOE; the average of the monitored levels agreed well with the predicted results; Five of the roof-top exhausts, as shown in Figure 1, were identified as the most dominat sources; the noise levels from these five sources were not audible at all at Location 3; And hence Location 2 (plane of the second storey window) was chosen for the assessment; Near-field measurements of these five sources were used to predict the noise levels at Locatoion 2. The results at Location 2 are : Plant noise – 56.6 dBA; Highway Noise – 64.7 dBA. It is seen that even if one applied a 5 dB penalty, the plant noise is within the guideline limits.

4. CASE STUDY 2

The second case study also deals with an existing plant that requires a comprehensive CoA. The general lay out of the manufacturing plant is shown in Figure 2. The plant is adjacent to a major freeway with substantial truck traffic. The plant is surrounded by other industries on two of the other three sides. There are a number of single family residences located across a local road from the plant. These houses are located 400 m from the plant. Most of the in-plant noise levels are well shielded by the building envelope itself.

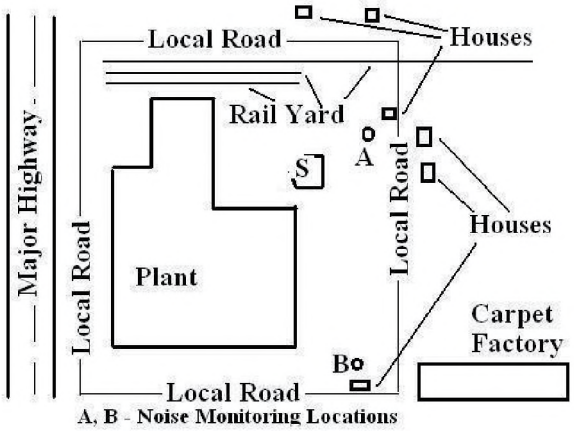

Figure 2. Layout of the Plant and the receptor locations.

The above assessment is simple. A brief outline of the applied procedures and results are:

The houses are more than 1000 m from the highway and would be considered a rural setting [3]. However, because there are medium to large plants surround the main plant, urban setting guidelines are applicable. Long-term monitoring results were obtained from Locations A and B. The night time limits are 50 dBA for house near Location B and 45 dBA for houses near Location A. The plant noise was barely audible at these houses except for two sources: the rail yard activities and metal dumping noise for Source S. (Figure 2). The scrap handling is just audible at night time and the assessment showed that with a tonal penalty, the scrap handling exceeded the guideline by 6 dB. In addition, depending on the load, the locomotive noise, whistling within the yard and revving-up within the yard, exceeded the guideline by more than 10 dB, even though these operations lasted less than a few minutes in each hour. The plant is currently designing an enclosed scrap handling facility. The yard activities are being monitored so as to design an activity plan so that the locomotive sounds would be within the guideline limits.

REFERENCES

1. Model Municipal Noise Control By-Law, Ministry of the Environment, Ontario, Canada, 1978.
2. NPC – 233 "Information to be Submitted for Approval of Stationary Sources of Sound," Ministry of the Environment, Ontario, Canada, October 1995.
3. NPC – 232 "Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)," Ministry of the Environment, Ontario, Canada, October 1995.
4. NPC – 205 "Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban)," Ministry of the Environment, Ontario, Canada, October 1995.