INNOVATIVE AND FEASIBLE NOISE MITIGATION PLANNING

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1 Introduction

For For industrial sites located near residential areas, noise pollution can be a limiting factor in expanding production. When KFP Inc. wanted to upgrade machinery and increase their annual throughput, they faced challenges dealing with increasing noise levels above acceptable limits at the neighbouring residential community. They needed a solution that would achieve continuous noise shielding, however, a permanent noise barrier wall would cost millions of dollars and extend the project timeline. We envisioned a way to arrange for stacks of logs to be used as noise barriers and developed a plan to maintain continuous shielding even as the log inventory is removed for processing. The log wall changeover plan was developed through implementation of parallel walls system. By prototyping this barrier and completing the changeover process with sensors in place, we confirmed that our noise mitigation strategy was successful. This solution demonstrates the value and viability of using available onsite materials to provide noise mitigation solutions and suggests the approach can be applied more widely. With good design, thorough investigation, and creative planning, regulatory compliance and improved noise environment for sensitive receptors in proximity of industrial facilities can be achieved.

2 Methods

2.1 Facility overview

The facility consists of a sawmill building, planer building, two existing kilns, one proposed kiln, a baghouse and an outdoor log conveyor. The facility is located on land that was zoned Heavy Industrial and is surrounded by water on the north, west and south sides. The lands immediately to the east of the site are zoned Heavy Industrial. However, across the water to the north, west and south are residentially zoned areas, with a large existing community less than 500 m to the west, as shown in Figure1.

The background noise, exclusive of that generated by the site, was characterized as a Class 2 (urban) area, as described in NPC-300 [1]. The primary contributors to the background sound during the daytime and night-time periods include road traffic on nearby roads/Highways, including Trans-Canada Highway and Darlington Drive, train noise associated with CP Rail operations along its main line and several road and rail bridge crossings

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Figure 1: Log processing facility in the centre, with receptor locations shown in red indicating residential communities impacted by noise

2.2 Noise measurements and mitigation

The facility operates seven days per week with operations occurring during both daytime and nighttime hours. The dominant noise sources at the facility were identified and individually measured as part of the study. Noise source measurement was conducted in accordance with MECP publication NPC-103 Noise Measurement Procedures [2].

Noise control measures were implemented at the facility, including enclosures over equipment, rubber strips at plant openings, rubber pads at log impact contact points, broad-band mobile equipment back-up alarms, as well as procedures for keeping doors closed and time-of-day restrictions for specific equipment. However, even with these mitigation strategies, field measurements showed that the nearest community was subject to noise levels above the acceptable limits.

2.3 Creative planning and modelling

The standard practice would be to construct a long vertical noise barrier, in this case at the cost of several million dollars, between the facility and the community. However, during site reconnaissance, we observed that large stockpiles of wood were placed all over the yard, waiting to be processed. By collaborating with the facility, we devised a plan to mitigate noise by using the existing on-site stockpiles of logs. We envisioned a two-part solution: 1) 4-5 m high earth berm to be constructed at the northwest end of the stockyard where the available land allows for the wide footprint required for an earth berm; and, 2) 7 m high, 125 m long log pile to be constructed along the western edge of the property to protect the residents closest to the facility. This scheme is displayed in Figure 2. We also developed a changeover plan to maintain continuous shielding even as the log inventory is rotated through for processing. This was achieved by having several parallel log piles with an access corridor in between for the log moving equipment to manage the log piles.

Effective dimensions and locations of the log piles were determined through noise propagation modelling. The model incorporated site-specific features such as elevation, berms, ground absorption, and barriers to predict noise levels at specific receptors.

Figure 2: Proposed noise barrier consisting of a log wall (red) and an earth berm (green).

3 Results

3.1 Modelling mitigation measures

The ISO 9613 based model accounts for a reduction in sound level due to increased distance and geometrical spreading, air absorption, ground attenuation, and acoustical shielding by intervening structures and topography. The model is considered conservative since it represents atmospheric conditions that promote the propagation of sound from source to receiver, Graphic output from the model, illustrating post-mitigation sound level contours and predicted receptor noise levels for noise sources are presented in Figure 3.

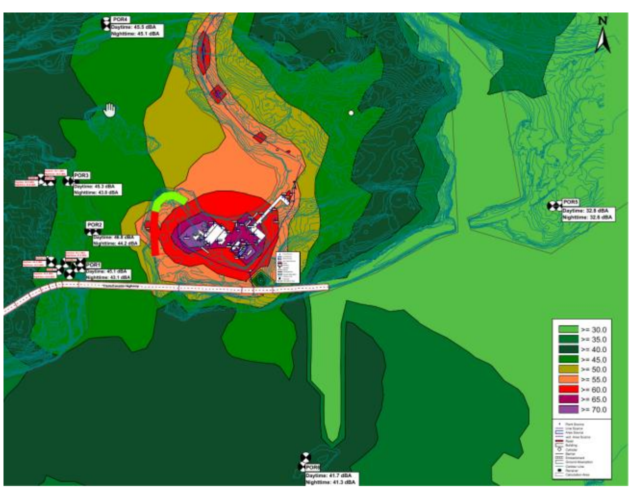

Figure 3: Model indicating non-impulsive noise levels after implementation of log barrier (red) and earth berm (green).

3.2 Permitting and approvals

The earth berm and log wall were constructed and receptor noise verification testing was conducted to verify modelling predictions. This study confirmed that even with the addition of the new machinery and production capacity, the facility was in compliance with the applicable daytime and night-time noise exclusionary limits defined in the MECP's NPC-300, for all sources assessed.

The key to our success in gaining regulatory approval was taking a data-driven approach to design, modelling and implementation, then validating our results in the field through measurement. We also designed a clear, easily executed set of protocols for the facility to follow in order to mitigate noise impact through an effective and cost-neutral solution. Proactive consultation with MECP, supported by thorough investigation and documentation, allowed us to acquire the necessary permits and approvals for the facility to proceed with their expansion.

4 Discussion

One of the most important aspects of the log wall design is that it must be replaced quarterly to rotate stock, ensuring that inventory is not wasted through rot and that the yard remains fully functional. This replacement process is done by constructing several parallel log piles (walls) parallel to the first one so at no time is there a direct line of sight between onsite noise sources and the residential community to the west.

5 Conclusion

This solution demonstrates the value and viability of using available onsite materials to provide effective noise mitigation solutions and suggests the approach can be applied more widely. Through divergent thinking, thorough investigation, and creative planning, innovative solutions to noise pollution are attainable. Assessment and utilization of unique opportunities and/or limitations that may exist for each site/facility is key in developing innovative solutions for noise mitigation.

Acknowledgments

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References

[1] Ministry of Environment Publication NPC-300, Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning, October 2013.

[2] Ontario Ministry of the Environment, Model Municipal Noise Control By-Law Publication NPC-103, August 1978.

[3] International Organization for Standardization, ISO 9613-2: Acoustics – Attenuation of Sound During Propagation Outdoors Part 2: General Method of Calculation, Geneva, Switzerland, 1996.