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Noise Control For Dust Collectors On An Existing Industrial Plant Located Adjacent To A New Residential Development

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INTRODUCTION

As part of an application for a $35 million residential development in Ontario, noise control for an adjacent existing manufacturer of hardwood flooring material is discussed. The industry produces sawdust created by planing, sawing and sanding. Sources of noise, located on the roof, include dust collection systems and exhaust fans for drying kilns. Noise control costs totalled $500,000 including consultants. The location plan is given in Figure 1.

RESPONSIBILITY ISSUES

The local municipality has the responsibility of implementing the noise control guidelines of the Ministry of the Environment (MOE) which require the developer to address noise from all external sources. He hires an acoustical consultant, specialty consultants as needed and a noise control contractor. The acoustical consultant conducts an environmental noise assessment and makes recommendations for noise control. If a stationary source is involved such as an industry, the consultant also prepares an application for a Certificate of Approval (C of A). The C of A is issued by the MOE. The acoustical consultant also reviews the contractor's shop drawings and conducts inspections and preliminary testing.

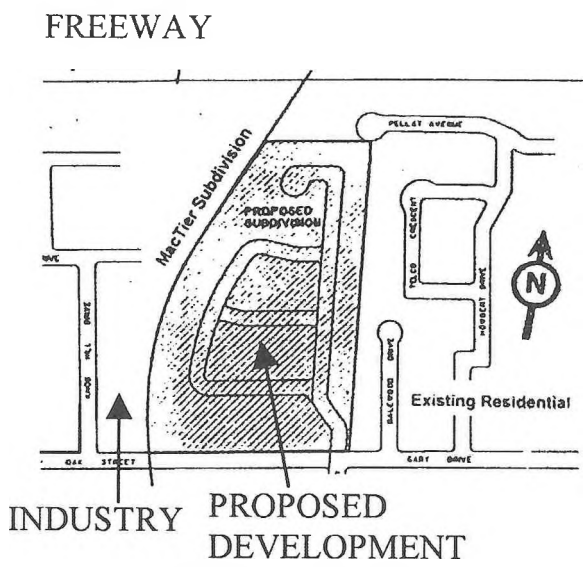


Figure 1 Location Plan

In this case, the specialty consultants include a structural engineer for upgrading of the building to take the weight of noise control measures and an air quality consultant to conduct air-flow measurements needed for the design of the noise control measures such as silencers. In addition, an acoustic specialist is used for lagging design and an independent acoustical engineer is hired to conduct the final acoustical audit required under the C of A.

The factory owner also hires an acoustical consultant to protect the industry's concerns.

The noise control contractor designs, fabricates and installs equipment based on the acoustical consultant's recommendations, calculates anticipated performance of equipment to ensure specifications are met and prepares shop drawing submittals for review prior to fabrication.

LEGAL PROCESS

The developer enters into a legal contract with industry in which the developer agrees to pay the cost of all noise control equipment. The developer posts a line-of-credit (LOC) to ensure completion and payment of costs. The noise control contractor signs a contract with the developer to provide noise control equipment. The scope of work is confirmed. The contractor receives payment as work progresses. Inspections and an acoustic audit are conducted after completion. Holdbacks are paid and the LOC is released.

ENVIRONMENTAL NOISE ASSESSMENT

The noise study identified all noise sources which included a railway line, a freeway, a local road and the industry

Acoustical analyses were then conducted including the prediction of freeway, road and rail noise, field measurements of rail vibration and field measurements of sources at the industry.

The results showed that the railway and freeway were in excess of the guidelines, the local road met the limit due to a large setback and that the industry was in excess of MOE stationary source limits.

The sound level limit for a stationary source such as the industry is the ambient or exclusion level. The measured ambient was 55 dBA daytime (no evening or night shift) while the measured industry level was 65 dBA. The excess

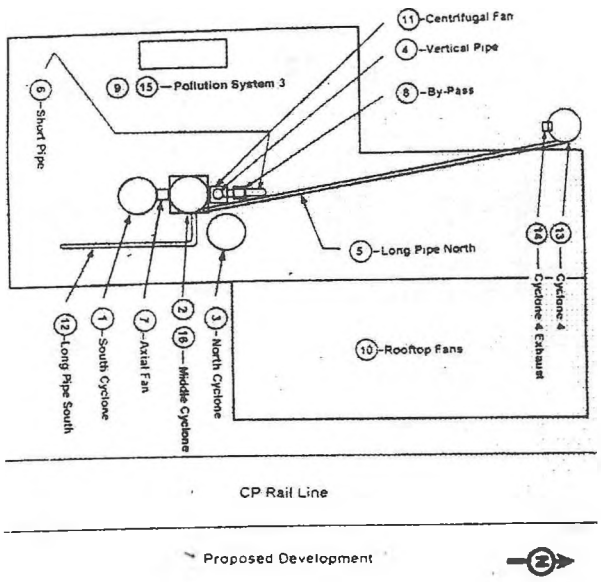


Figure 2 Source Locations

was 10 dBA. However, in case the industry decided to operate at night, measurements were taken and the nighttime level found to be 44 dBA under infrequent conditions (south wind). The MOE guidelines state that typical weather conditions are to be used, in this case, approximately 50 dBA. Consequently a design goal of 45 dBA was set which included an allowance for design and construction inaccuracies.

NOISE CONTROL MEASURES

The noise control measures for the railway and freeway were an acoustic barrier along the railway line, air-conditioning, warning clauses and appropriate house construction. Noise control measures for the industry included:

1. acoustic lagging for 4 dust-collector cyclones:
2. acoustic lagging for all related pipes and ducts
3. silencers on discharges of 3 dust collector fans
4. noise enclosures on 2 fans
5. "doghouse" noise enclosures on 13 roof-mounted exhaust fans for the kilns

Source	Distance (m)	Treatment	Leq With No Mitigation (dBA)	Leq With Mitigation (dBA)	Noise Reduction (dBA)
1 Cyclone 1	97	4" Ins. + 18 ga. Steel	49.8	28.1	22
2 Cyclone 2	97	4" Ins. + 18 ga. Steel	47.7	26.0	22
3 Cyclone 3	97	0.5" ins. + BM1C	50.2	27.7	22
4 Vertical pipe	97	1" Ins. + 18 ga. Steel	49.3	27.2	22
5 Long pipe North	97	1" Ins. + 18 ga. Steel	57.4	34.9	22
6 Short pipe	97	4" Ins. + 18 ga. Steel	48.5	28.6	20
7 Axial Fan	97	Silencer + enclosure	52.7	28.2	25
8 By-pass	97	Silencer	58.0	37.3	21
9 P.S. 3 Discharge	112	Silencer	50.5	27.0	24
10 Roof Exh. Fans	77	Enclosure	55.5	29.6	26
11 Centrifugal Fan	97	Enclosure	53.9	38.6	15
12 Long pipe South	97	1" Ins. + 18 ga. Steel	39.6	20.7	19
13 Cyclone 4 Body	97	4" Ins. + 18 ga. Steel	46.1	22.0	24
14 Cyclone 4 Ex	97	No	15.7	15.7	0
15 P.S. 3 Casing	112	4" Ins. + 18 ga. Steel	46.2	32.3	14
16 Cyclone 2 Bot	97	4" Ins. + 18 ga. Steel	38.2	17.9	20
17 Cyclone 1 Bot	97	No	38.8	38.8	0
18 Cyclone 2 Top	97	No	31.8	31.8	0
19Cyclone 1 Top	97	No	24.1	24.1	0
Combined			64.2	45.1	19.1

Table 1 Summary of Predicted Sound Exposures

Source No.	63 HZ	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
BARRIER SYSTEM/LAGGING/ENCLOSURE INSERTION LOSS (dB)								
1, 2, 6, 13, 15, 16	6	6	18	24	30	36	40	39
3, 4, 5, 12	3	3	8	19	24	35	30	25
10	8	11	22	38	50	40	16	16
11	6	12	18	24	30	36	40	39
SILENCER DYNAMIC INSERTION LOSS (dB)								
7, 9	8	11	22	38	50	40	16	16
8	8	16	22	38	50	40	16	16

Table 2 Minimum Acoustical Performance Requirements In dB.

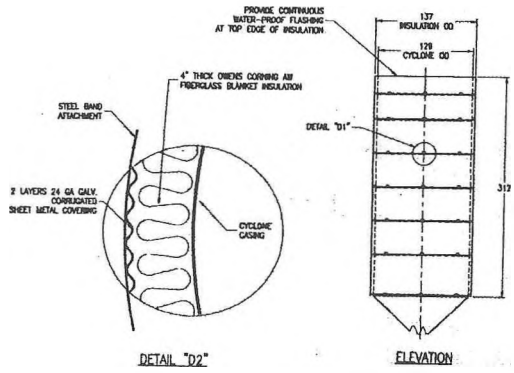
The source locations are shown on Figure 2.

NOISE CONTROL PERFORMANCE REQUIREMENTS

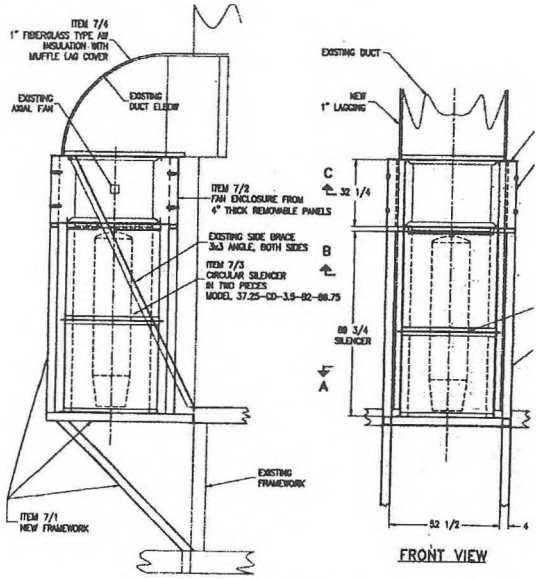
The sound levels at the receptor with and without noise control measures are given in Table 1. Table 2 presents the performance requirements for the control measures.

NOISE CONTROL DESIGN

Selected shop drawings are given below.



Cyclone Lagging Design

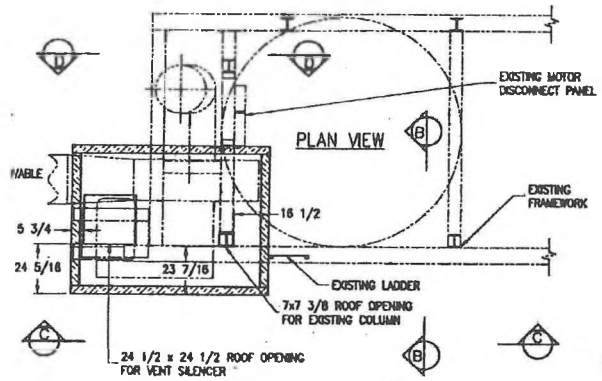


Silencer Design

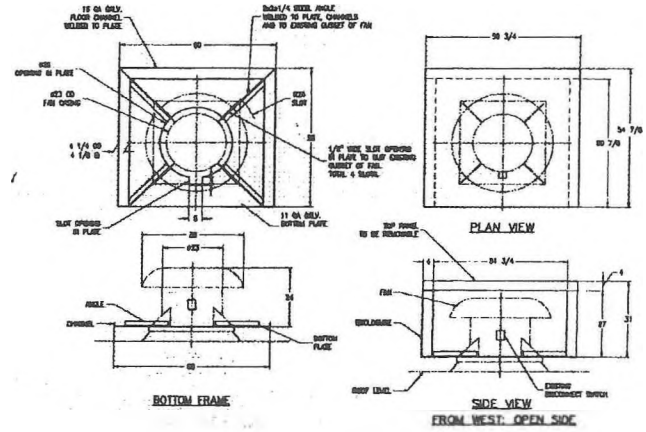
TESTING AND APPROVALS

In order to obtain approval of the subdivision, the noise report was submitted to the municipality and the noise control measures became part of subdivision agreement. The developer was required to pay for the industrial noise control.

To protect the industry, the C of A application was prepared



Fan Enclosure Design



Exhaust Fan Enclosure Design

by the developer's consultant and reviewed by the industry's consultant. The application was approved by MOE and the C of A issued, requiring an acoustic audit by an independent acoustical consultant.

The C of A audit was accepted with a measured nighttime ambient of 56 dBA and a source level of 55 dBA. The homes were occupied after completion of all noise control measures.

CONCLUSIONS

The development of residential lands adjacent to an existing industry is a complicated process requiring the cooperation of the industry. Several contractual agreements between the various parties are necessary in order to protect all involved. Having the developer pay for the industrial noise control potentially confuses the roles played by the consultants. The objective is to ensure that the industrial neighbour does not bother homeowners and that the industry can continue to operate with minimal constraints on the operation of their equipment.