

Managing Noise Nuisance During On-Farm Grain Handling

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INTRODUCTION

While rural areas are generally quieter than urban regions, farming activities can generate significant noise from farm equipment. Specifically, grain dryers that are operating for extended periods of time produce high sound levels. During the peak operating season after grain harvest (September to December), these dryers may run nonstop 24 hours a day for several weeks. The prolonged use of grain dryers can increase sound levels in the local vicinity and impact neighbours. Therefore, it is crucial to minimize overall sound emissions to foster positive relationships within the community.

This factsheet describes common sources of sound emissions during grain handling and drying operations, and strategies to reduce noise nuisances.

DIFFERENCE BETWEEN SOUND AND NOISE

Sound is a mechanical vibration that travels through a medium (such as air or water) and is recognized by a person or a sound meter. Think of sound as changes in air pressure moving around us that we hear. These changes are measured using decibels (dB). The softest sound the human ear can detect is 0 dB, essentially the starting point for sound perception. In contrast, a loud sound that causes discomfort or damage to someone's hearing is approximately 120 dB. [Table 1](#) shows approximate sound levels of common activities. When we talk about

how loud or soft a sound is, we use decibels to express its intensity. A-weighted decibels (dBA) are used for measuring environmental sound levels to match human hearing.

Noise is defined as any unwanted and unpleasant sound, or a mixture of sounds with varying properties, which may be continuous, intermittent, or impact-like, with fluctuating levels, durations and temporal distributions.^[4] Noise is any sound we don't want to hear, particularly when it is unwanted or disruptive. Its description is difficult to define because what sounds annoying to an individual person is very subjective. Whether sound is noise depends on the listener and the circumstances.

CHARACTERISTICS OF SOUND

Understanding the characteristics of sound is essential for assessing its potential impact on people. Sound is not defined by a single property but by several measurable and perceptual factors that influence how it is experienced. These include its amplitude, how loud it is perceived, how it persists over distance and the distinct qualities that give it a particular character. [Table 2](#) summarizes these characteristics.

Table 1. Approximate Sound Levels of Common Activities Measured with a Sound Meter

Legend: = Exposure can lead to permanent hearing loss = Repeated exposure can lead to hearing loss over time
 = Safe Zone, no significant hearing loss = Safe Zone

Noise Level (dBA)	Source	Level of Hearing Damage
130	Jet engine 25 m away	Exposure can lead to permanent hearing loss
120	Rock concert	Exposure can lead to permanent hearing loss
110	Grain dryer fan and burner under full load	Exposure can lead to permanent hearing loss
100	Chain saw, circular saw, irrigation pump	Repeated exposure can lead to hearing loss over time
90	Barn full of finisher pigs, gas lawn mower	Repeated exposure can lead to hearing loss over time
80	Curb side of a busy road	Repeated exposure can lead to hearing loss over time
70	Busy office	Repeated exposure can lead to hearing loss over time
65	Snoring	Safe zone, no significant hearing damage
60	Normal conversation	Safe zone, no significant hearing damage
55	TV or radio at low volume	Safe zone
50	Refrigerator hum	Safe zone
45	Rural ambient background sounds	Safe zone
30	Library, empty church	Safe zone
20	A person breathing, a very soft whisper	Safe zone
15	Normal threshold of hearing for people	Safe zone
0	Threshold of hearing for humans	Safe zone

Source: Adapted from *What Did You Say? How to Prevent Noise Induced Hearing Loss in Agriculture*, Canadian Centre for Health and Safety in Agriculture.

Table 2. Sound Characteristics with Descriptions

Characteristic	Description
Amplitude	Sound level measured in decibels (dB). A-weighting (dBA) reflects human hearing. - Human threshold of hearing: 0 dBA - Threshold of pain: 130 dBA <i>Ontario Occupational Health and Safety Act, 1990</i> limits: 85 dBA for 8 hours, 100 dBA for 15 minutes.
Loudness	Human perception of change in sound level ±1 dBA imperceptible ±3 dBA threshold of perception ±5 dBA clearly noticeable ±10 dBA twice (or half) as loud ±20 dBA fourfold (4X) change
Persistence	How quickly a sound decreases with distance. Some sounds remain detectable far away, but detectability alone does not mean nuisance.
Character	Qualitative qualities of sound: tonality (whine, hum), beating (pulsing from fans/blades), impulse (very short sounds), intermittence (on/off cycling).

FACTORS INFLUENCING NOISE LEVELS

Noise perception varies from person to person and is influenced by how the human ear responds to changes in sound levels (Figure 1). Sound intensity (dBA) also depends on how close the observer is to the sound source.

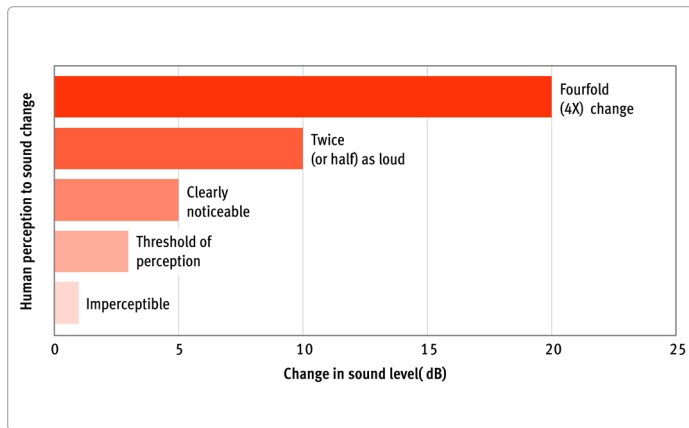


Figure 1. The relationship between the change in sound level and human perception of the change.^[3]

Noise levels can fluctuate based on operational and environmental factors, including:

- duration and timing of operation (day vs night)
- seasonal variations (summer vs winter)
- nature of noise (impulsive, continuous, intermittent)

- sound attenuation characteristics (reduction of intensity)
- proximity to the sound source
- weather conditions (temperature, humidity, air pressure, wind speed, direction)
- topography (hills, valleys)
- presence of structures or barriers (buildings, water bodies, trees) that may block, absorb or reflect sound

NOISE SOURCES FROM ON-FARM GRAIN HANDLING OPERATIONS

Grain drying is an important step after harvest. It helps preserve grain quality by lowering its moisture content to a safe level (14%–17%). Grain dryers are used to remove extra moisture and protect the grain during storage. These dryers may run 24 hours a day for several weeks, depending on grain quantity, initial moisture content and type of grain dryer.

There are multiple sources of sound generation during grain handling and drying operations. These include trucking grain on and off-site, grain elevating and conveying systems, grain bin aeration fans and dryer. Figure 2 shows the different sources of noise production with noise levels during grain handling and drying operations.

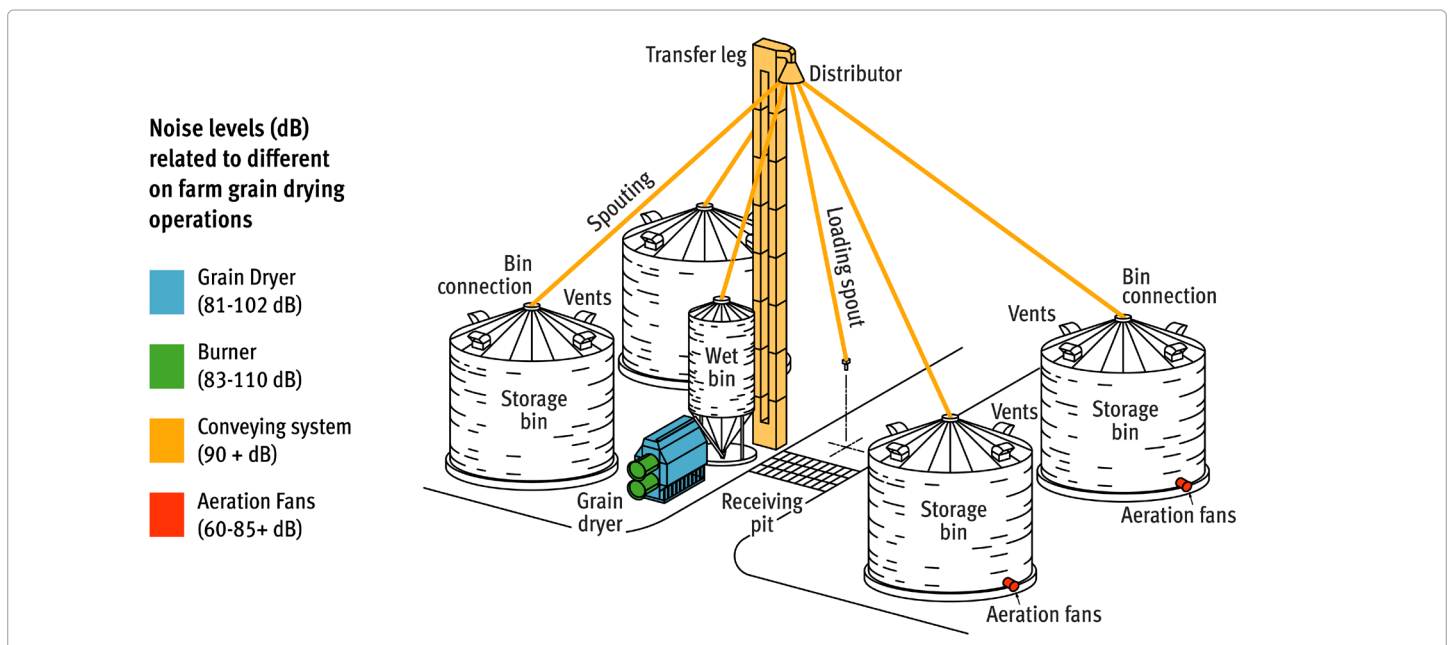


Figure 2. Different sources of noise and noise levels during grain handling and drying operations.

Grain Dryers

Grain dryers generate noise primarily from two sources; the dryer fans and the movement of grain through the drying chambers. Mechanical vibration and turbulent airflow within the system contribute to noise levels, which typically range from 81 to 102 dB depending on the dryer type. As a key component of the dryer, the burner unit supplies the heat needed for grain drying. Burner noise can range from 83 to 110 dB, often characterized by higher-frequency sounds due to the pressurized fuel delivery system used for ignition and to maintain a steady flame.

Transfer and Conveyor System

The grain transfer system, includes augers, pneumatic conveyors, bucket elevators, etc. Sound levels typically exceed 90 dB during operation. The noise is generated from the auger motors, grain movement and impact and friction between moving parts.

Aeration Fans

Aeration fans can produce noise levels exceeding 85 dB. The fan motor hum, blade turbulence and duct resonance contribute to the production of the noise. Aeration fans installed on the storage bins, cause noise that can travel over long distance. These are often operated intermittently but they can run for extended periods of time during warm or humid conditions to maintain grain quality during storage. There are two types of aeration fans: axial flow and centrifugal flow (Figure 3). Axial flow fans are usually louder than centrifugal flow fans due to higher operating speed, open construction, increased turbulence and lack of sound reducing housing.^[1]

REDUCING NOISE EMISSIONS

Siting

The positioning of the grain handling system on a farm plays a critical role in controlling how sound travels and affects surrounding areas. Sound energy decreases as it moves away from its source, so increasing the distance between the grain handling system and sensitive receptors (such as nearby homes) is one of the most effective, passive mitigation strategies.

Sound intensity experienced by an observer near stationary farm equipment is reduced by the square of

the distance from the equipment. When distance from a sound source is doubled, sound level decreases by about 6 dB — 90 dB at 5 m (16 ft) is 84 dB at 10 m (32 ft), 78 dB at 20 m (66 ft).

Note that atmospheric and surrounding conditions also contribute to the decrease in the sound levels.^[4]

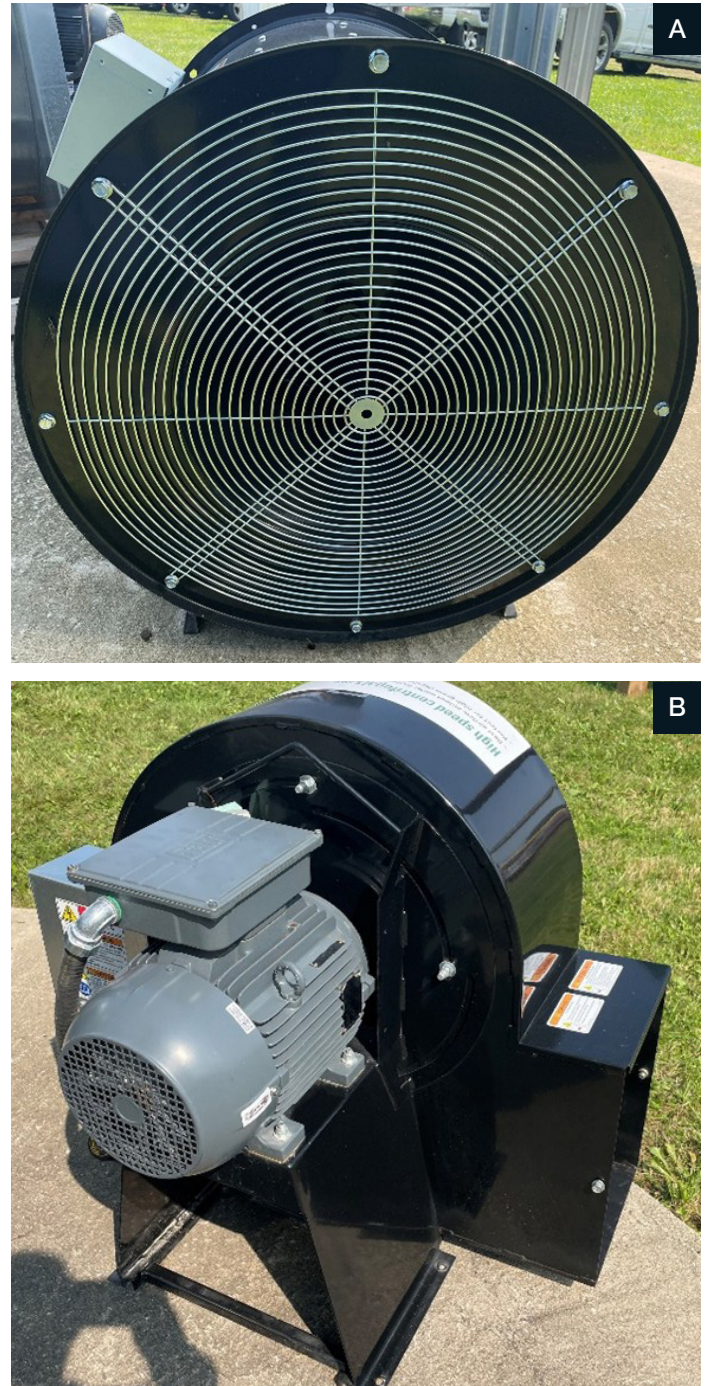


Figure 3. (A) Axial flow fan and (B) centrifugal flow fan.

Sound levels around equipment like fans are often not uniform. Place fans away from sensitive receptors to minimize the noise transmission.

Natural and man-made features in the landscape can act as acoustic barriers. Hills, tree lines and buildings can block or absorb sound waves, reducing the sound that reaches sensitive areas. It interrupts the line of sight between the source and the receptor, which is essential for reducing high-frequency noise that travels in a straight path.

Buffer Zones

Surrounding noisy equipment with quieter machinery or storage structures (grain bins) creates a buffer zone. This layout helps contain noise within a designated area and reduces the chance of it spreading across the farm. It also simplifies other mitigation measures like enclosures or barriers.

The closer the storage structures are to the dryer, the more sound absorption and reduction occurs. Placing the grain bins near fan inlets, forces the sound to travel farther to move around the grain bin, resulting in an increased attenuation. The taller or wider the grain bin, the farther the sound is forced to travel to reach the receiver.

Researchers at the University of Guelph conducted a field study to measure the effect of farm buildings on grain dryer noise. The recorded measurements showed

a reduction of 8 to 12 dB in locations immediately behind barns and silos, demonstrating that nearby structures play an important role in decreasing noise exposure.^{[2],[5]} At greater distances, the impact of a structure on sound level reduction is reduced (Figure 4).

In Figure 4, the orange line shows the noise reduction provided by a 30 m x 10 m (98 ft x 32 ft) barn with a height of 6 m (20 ft) placed 20 m (65 ft) away from a point source that emits the sound emissions recorded from a grain dryer. The blue line represents the predicted average sound level from the grain dryer without any shielding or noisereducing structure present. This figure demonstrates a notable sound reduction occurring directly behind the barn.^[5]

Noise Barriers (Sound Walls)

Noise barriers, commonly referred to as sound walls, are an effective method for reducing noise from grain dryers. They work by interrupting the direct line-of-sight path between the noise source and the receiver, resulting in sound reduction.^[1]

Sound walls block and diffract sound waves traveling from the source to nearby receptors. As sound travels over the top of the barrier, it creates a shadow zone immediately behind the wall (Figure 5). The shadow zone is characterized by significantly reduced sound levels due to increased sound path length and diffraction effects.

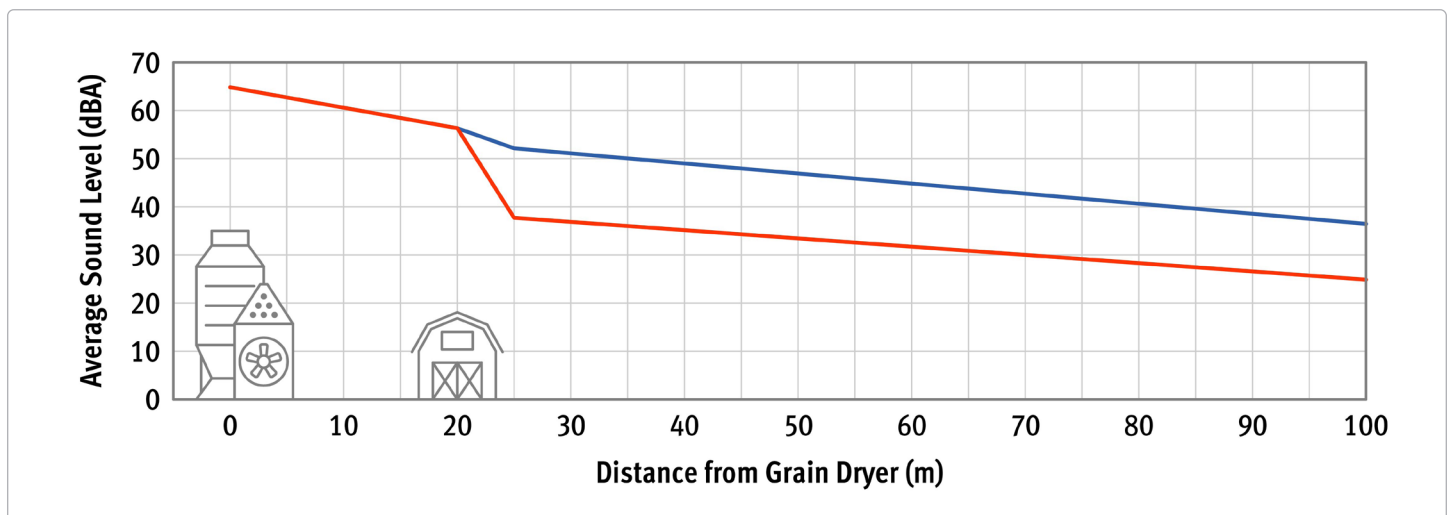


Figure 4. The effect of surrounding buildings on grain dryer noise levels.

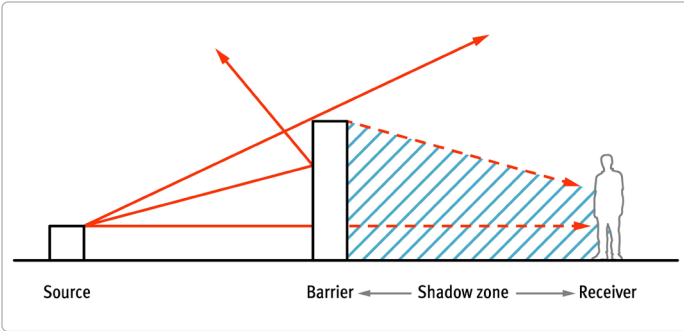


Figure 5. Sound attenuation, diffraction and shadow zone behind the barrier.

When constructing sound walls, there are two key components: wall height and surface density. A sound wall should be tall enough to disrupt the line of sight. A taller sound wall increases sound travel distance and reduces sound levels behind the wall.

Sound wall surface density influences the absorption and attenuation of sound thereby reducing the sound and increasing its effectiveness. Sound walls should have a minimum surface density of 20 kg/m². Surface density (S)^[4] is calculated as:

$$\frac{\text{Mass of the barrier (kg)}}{\text{Area perpendicular to sound waves (m}^2\text{)}} = S$$

Sound walls do not need to be expensive or permanent to be effective. Build temporary or shortterm barriers using materials commonly available on farms (e.g., straw bales).

Straw bales are particularly effective because of their fibrous structure. This allows them to absorb sound effectively. University of Guelph researchers reported that a sound wall constructed from straw bales (1 m x 1 m x 1.8 m) (3 ft x 3 ft x 6 ft) stacked three bales high and two bales thick, achieved a surface density of about 325 kg/m². This noise barrier or sound wall resulted in a sound level reduction of 10 to 12 dB.^[5]

Straw bale barriers are especially well-suited for seasonal use, such as during harvest and drying periods. However, they are best used as temporary solutions, as moisture and longterm weather exposure can reduce their effectiveness and structural stability (Figure 6).

A wide range of materials can be used for building sound walls. Their sound reduction performance increases with the material density (Table 3).



Figure 6. Grain bin axial aeration fan with a straw bale barrier placed at 4.35 m (14 ft) reduced the noise by 10 to 12 dB^[5] in the region immediately behind the bale wall.

Table 3. Performance of Different Sound Wall Materials

Sound Wall Material	Density (kg/m ²)	Performance
Concrete (0.6 x 0.6 x 1.2 m)	1,440	Excellent
Plywood (2.4 x 1.2 x 0.02 m)	500	Very good
Straw bales (1 x 1 x 1.8 m)	325	Good

Mufflers

Mufflers (also referred to as silencers) are widely used for reducing noise generated by grain dryer and aeration fans. Mufflers are usually installed on the fan intake or exhaust ducts, where sound levels are highest (Figure 7).

Mufflers reduce noise by absorbing sound energy and redirecting sound waves so they lose energy before exiting the duct. Absorptive components, often made of fiberglass or similar materials, reduce internal sound reflections. Reactive components (elbows or internal baffles) force sound waves to change direction which further reduces sound levels. Mufflers that combine absorbent linings with solid outer shells generally provide the most consistent performance across a range of noise frequencies.

A properly designed muffler can achieve measurable noise reductions. For example, a 90 degree elbow muffler installed on a fan has shown to reduce noise levels by approximately 6 to 8 dB.^[4] In many situations, even modest reductions of this magnitude are sufficient to improve compatibility with neighbouring land uses.



Figure 7. Dryer fan with silencers.

Sound Blankets

Sound blankets are a flexible noise-control option that is useful where rigid barriers are impractical or specific components of a grain dryer are contributing disproportionately to noise emissions. Sound blankets are multilayered panels designed to both absorb sound and increase noise reduction. They consist of a porous, soundabsorbing outer layer combined with a nonporous inner barrier layer. The interior is made up of fibrous material and plastic foam supported by a reinforcing screen.

Install sound blankets directly on grain dryer structures (plenum walls) or around fan housings, provided airflow and access for maintenance (Figure 8). Installing sound blanket panels on selected sides of a grain dryer, particularly those facing nearby residences, can reduce noise levels by approximately 8 to 9 dB at distances of around 115 m (338 ft).



Figure 8. A heavy, flexible, weather and heat-resistant sound blanket panel installed in front of a bin dryer on the side of a grain storage bin.

Using sound blankets or barriers around grain dryers creates a significant fire hazard by trapping heat, accumulating highly flammable grain dust and restricting airflow, which can cause internal smoldering and ignition of the grain. The blankets themselves may also act as combustible material if not rated for extreme temperatures, while moisture trapped in them can promote damage or fire, particularly if they are not waterproof.

Only use approved materials: Only install sound-dampening materials approved by the dryer manufacturer and that meet local safety codes.

Provide proper ventilation: Ensure that any barrier or insulation does not block or reduce the required airflow for the burner or cooling system.

Regular maintenance: Daily cleaning of screens and removal of dust accumulation around the dryer and barriers is essential.

Monitor constantly: Do not allow soundproofing to restrict visual inspection of the dryer's burners and column areas during operation.

Sound contour mapping demonstrates reductions are greatest in the directions where blankets are installed (Figure 9).

Figure 9A shows sound level contours prior to sound blanket installation on the south and east sides of the grain dryer. Figure 9B shows the sound level contours post sound blanket installation. The yellow line represents the 112 m (367 ft) distance.

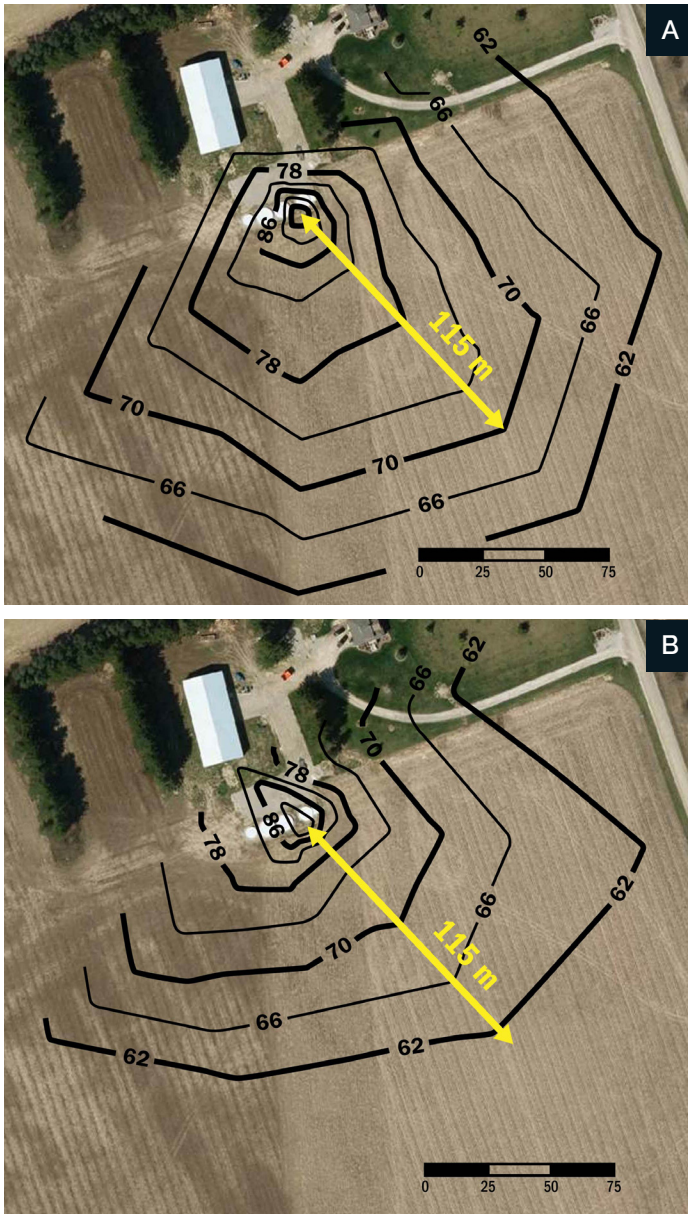


Figure 9. Aerial photography of sound level contours.

Often, the greatest noise reduction is achieved by combining two or more mitigation measures. For example, a muffler is used to reduce fan noise at the

source, while a sound barrier or sound blanket further increases sound attenuation toward the neighboring properties. Selecting the most appropriate combination depends on the type of equipment, available space, duration of operation and proximity of receptors.

DEALING WITH POTENTIAL NUISANCES & NORMAL FARM PRACTICES

Respect and tolerance between farmers and their neighbours are essential for maintaining good community relations. Explaining to neighbours the importance of certain activities or equipment required for farming operations that are prone to creating a nuisance can help build a better rapport with neighbours.

To help prevent nuisance complaints, farmers are encouraged to be proactive in communicating any activities or devices they are using as part of their agricultural operation that could result in a nuisance caused by a disturbance that is covered under the [Farming and Food Production Protection Act, 1998 \(FFPPA\)](#). Explaining the necessity of these activities for successful farming operations can help foster goodwill and reduce the likelihood of complaints. Similarly, neighbours of farming operations (including greenhouses) are encouraged to communicate with the farmers if they experience disturbances. Addressing concerns collaboratively before involving local authorities or the Ontario Ministry of Agriculture, Food and Agribusiness can lead to more effective and amicable resolutions.

Refer to the Resources section for more information on dealing with nuisance complaints.

SUMMARY

Research studies show noise levels can be reduced through effective planning, proper equipment installation and the application of practical, cost-effective best management practices.

Practices such as sound barriers, mufflers and sound blankets have demonstrated meaningful noise reductions when appropriately designed and installed. Applying these solutions in a targeted, site-specific manner can help farms operate efficiently while maintaining good community relations and compatibility with neighbouring land uses and municipal expectations.

RESOURCES

OMAFRA Factsheets

- [Responding to agricultural nuisance complaints](#)
- [The Farming and Food Production Protection Act, 1998 \(FFPPA\) and nuisance complaints](#)
- [Managing dust emissions from on-farm grain handling systems](#)
- [Understanding and reducing noise nuisance from stationary farm equipment](#)

[A Guide to the Noise Regulation under the Occupational Health and Safety Act, 1990](#)

["What Did you Say?" How to Prevent Induced Hearing Loss in Agriculture](#)

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