

## FARM PRACTICE

## VENTILATION

### Description

Ventilation is required in most agricultural buildings to ensure that indoor air is exchanged with fresh outdoor air. For barns housing livestock, ventilation creates an environment in which animals do not merely survive but live comfortably. In many situations, especially in the summer months, air exchange is required to remove heat generated by livestock or poultry. At other times of the year, air contaminated with gases or air that is out of the normally-desired humidity range must be removed. Ventilation in greenhouses, for example, is critical to enable plants to maximize yields. In manure storage structures, on the other hand, ventilation is necessary to prevent the buildup of hazardous gases and to increase the longevity of building components susceptible to corrosion.

A properly-operating ventilation system accomplishes three basic tasks:

1. It introduces fresh air into a structure through strategically-placed openings or inlets.
2. It thoroughly mixes outside and inside air; picks up heat, moisture, and air contaminants; and lowers temperature, humidity, and contaminant levels.
3. It exhausts moist, contaminated air from the building.

For livestock buildings, the most critical gases requiring removal are typically carbon dioxide and ammonia. Although usually present at lower concentrations, hydrogen sulfide, methane and carbon monoxide are other gases that must be removed. In addition, elevated dust and microorganism concentrations must be lowered to manageable levels through effective ventilation.

Ventilation systems are either mechanically-based or naturally-based. Some systems use a combination of the two. Mechanical ventilation systems rely on electrically-powered axial flow fans to create a pressure differential between the inside of a building and the outdoors. Natural ventilation systems operate on pressure differences created as a result of thermal buoyancy effects and on outdoor wind conditions. Inlets and exhaust openings must be properly placed for both types of systems to work well.

### Nuisance Concerns

The three main disturbances mentioned in the *Farm Practices Protection (Right to Farm) Act* are odour, noise and dust. All three nuisances can play a role in farm building ventilation systems to varying degrees.

#### Odour

Odour is the human perception of and response to chemicals in the air. The degree to which individuals perceive an odour to be a nuisance will depend on the frequency, intensity, duration and offensiveness of the odour. Other factors that come into play include a person's sensitivities and personal previous experiences.

Farmers engage in a variety of activities that produce odours. Most farms which incorporate ventilation systems for livestock housing will generate some odour as part of normal operation.

See also Nuisance Reference: [Odour](#)

## **Noise**

Most ventilation equipment generates some noise. Noise is defined as any sound that is audible but judged to be an unwanted, irregular or erratic disturbance. Noise levels vary and will rise when equipment is run at higher speeds. Noise may be generated continuously or intermittently.

See also Nuisance Reference: [Noise](#)

## **Dust**

Dust is defined as fine-grained suspended particulate in air. The degree to which individuals perceive dust to be a nuisance will depend on the frequency, intensity and duration of a dust-generating event or practice.

Farmers engage in a variety of activities that require the use of equipment such as ventilation fans to reduce excessive indoor dust concentrations. Dust is generated as a natural consequence of animal activity in housing facilities. Dust may also be generated in fugitive form when fine particulates are lifted from fields, roads, buildings and yards via air turbulence. Higher levels of dust will often parallel higher concentrations of odours because dust particles provide a vehicle to which significant quantities of odiferous chemicals are attracted and attached. These chemicals dissipate into the air as the dust particles exit the barn. Properly-designed and placed vegetative buffers near horizontally-mounted wall fans can be effective in attenuating dust and odour concentrations.

See also Nuisance Reference: [Dust](#)

# **Activities and Operations**

## **Building Location and Orientation for Natural Ventilation**

While such factors as efficient animal traffic flow and access to buildings often dictate barn and storage location, it is advisable to orient buildings, particularly naturally-ventilated buildings, to take advantage of prevailing winds. In some situations, this may mean locating a barn or storage on a ridge or away from existing buildings. For optimum ventilation, building axes should be oriented at right angles to prevailing winds and buildings should be located at least 15 metres away from other structures or natural obstructions.

## **Dilution**

The purpose of ventilation, whether by natural or mechanical means, is to dilute indoor dust concentrations to a point at which animal and human health are not significantly affected. This is most easily accomplished by exhausting dust-laden air to the outdoors. In situations where barns are located close to residential areas, the negative impact of exhaust dust can be reduced somewhat by placing ventilation fans on the sides of buildings which do not face neighbours or by installing chimney fans to allow exhaust air to be more effectively diluted before entering air spaces where nuisances may become a concern. Fan hoods should be installed on wall-mounted units. Hoods, apart from deflecting exhaust toward vegetation which can absorb and collect odors and dust, help reduce static pressure differences caused by wind, thereby creating a more efficient ventilation system. For large fan units operating at higher speeds during the summer season, hoods may reduce efficiency and are therefore not as

prevalent. This is particularly true for tunnel-ventilated barns for which banks of fan units are installed at one end to maximize air speed flowing over livestock or poultry.

Care must be taken to ensure that dust causes no long-term damage to the respiratory system of humans working inside barns and storage buildings.

For animal and human health reasons, it is common practice in naturally-ventilated barns with manure storage pits under the floors to open as many end and side doors as possible when agitating manure.

While agitation is carried out, odour levels will rise but typically last for short durations. Barn cleaning and agitation activities are usually conducted during daylight hours.

## **Ventilation Fans**

Fans are needed to control the indoor environment of farm structures housing livestock or containing plants. Fans may run intermittently or continuously to achieve and maintain the desired temperature, moisture or gas levels. To prevent excessive noise levels, units should be regularly maintained and operated with blade tip speeds not exceeding 10,000 – 11,000 feet per minute. It is in a farmer's own best interest to keep noise levels as low as possible to prevent long-term hearing damage and to provide a comfortable environment for both animals and humans.

## **Ventilation Duration**

Most ventilation equipment will be required to operate 24 hours a day to ensure that animal health and plant vigour are optimized. Nighttime ventilation rates are usually lower than daytime rates and summer rates are typically 15–20 times higher than those in winter for a given population of animals. These high rates are necessary to keep interior temperatures from reaching levels that could be detrimental to plant growth and animal well-being. For animals that are particularly susceptible to heat prostration, misting or some other form of evaporative cooling is incorporated into the ventilation system.

## **Related Farm Practices**

Other farm practices that pertain to ventilation practices include, but are not limited to, the following.

### **Structures**

Any agricultural buildings which house animals or structures in which respirable products are stored will require some form of mechanical or natural ventilation. Potato storages, for example, will require ventilation to ensure product is kept in optimum condition during the fall and winter season.

In addition, building codes may specify minimum expectations with respect to ventilation exchange rates to ensure animal or human comfort and safety.

See also Farm Practice: Structures

### **Stationary Equipment**

To create an environment that does not compromise the health and well-being of animals and people, fans must be operated continuously. Not only will warm weather generate conditions where greater numbers of fans will be in use, but such fans will be operating at higher speeds as well to maximize building air exchange.

See also Farm Practice: Stationary Equipment

## Legislation

Information on federal and provincial legislation can be found in Appendices B and C. Acts, regulations and bylaws that may affect ventilation practices include, but are not limited to, the following.

### Provincial Legislation

The *Environmental Management Act* protects the soil, water and air environment from pollution.

The *Workers Compensation Act* and the *Occupational Health and Safety Regulations* under the Act outline minimum air quality standards for workers around farm buildings.

## Publications

Publications and fact sheets that provide further information on ventilation include, but are not limited to, the following. Refer to Appendix D for details.

*Fan Ventilation Principles and Rates*

*Farm Workers Health Problems Related to Air Quality Inside Livestock Barns*

*Livestock Building Exhaust Fans – Selection, Installation, and Maintenance*

*National Farm Building Code of Canada*

*Natural Ventilation*

*Protecting Workers in Livestock Buildings from Dust and Gases*

*Selecting Fans for Livestock Buildings*

*Ventilation Handbook – Livestock and Poultry*