

Dust and Gases In the Barn Environment: How to Measure and What to Do About It¹

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▪ Introduction

Air quality in pig barns is important for two reasons; pig health and production depends on good air quality and worker's health inside pig barns depends on having good air to breath. Compared to outside air in Canadian winters, air quality in pig barns is improved considerably by creating a comfort temperature zone that allows pigs to grow without being stressed by temperature fluctuations or extremes. Pigs add contaminants to the air however in the form of manure gases, carbon dioxide from respiration, dust particles from feed, skin cells, bacteria, and manure. Worker health will be affected by the combination of manure and gas exposure. To retain skilled workers, air quality may become an issue.

In this workshop you will learn how to:

- ▶ Improve air quality for pigs by creating good comfort zones in terms of air temperature and air speed.
- ▶ Measure gas levels and temperatures, how to control contaminant levels (dust and gases).
- ▶ Protect your lungs by reducing dust levels and wearing properly fitted dust masks.

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▪ Understanding the Pig Barn Environment

Comfort Zones for Pigs

The comfort zone depends on a number of factors: number of pigs in the pen, floor type, feed intake, and air speed. Pig growth and production is best in the pig's thermo-neutral zone, where the pig is neither cold stressed or heat stressed.

Sources of Contaminants

Carbon dioxide (CO₂) and water are products of the pig's respiration. As long as you have pigs in the barn, they will add carbon dioxide and water. Unvented heaters will also add carbon dioxide and moisture. Both require proper ventilation.

Ammonia (NH₃) and hydrogen sulphide (H₂S) are produced by manure. High levels of hydrogen sulphide are unlikely unless you are agitating manure pits, then lethal levels are possibly generated in the manure storage. Ammonia is produced by the decomposition of nitrogenous compounds in the manure. Feed additives and improved manure management are two research and management areas aimed at reducing ammonia production.

Dust particles in the respirable range are the most serious problem for farm workers. Seventy to ninety percent of the dust is organic or biologically active. This means it will react with the defence mechanisms of the human respiratory system. Sources of dust are feed, manure particles, hair, skin cells, insect parts, molds, fungi, viruses and bacteria. Problems created may include chronic bronchitis, occupational asthma, or organic dust toxic syndrome.

Dilution of Contaminants

A good ventilation system will dilute gaseous contaminants with fresh air and keep gas levels down to safe exposure limits. The fresh air must be introduced to the pig's space without creating drafts and without compromising its comfort temperature zone.

▪ Measuring Air Quality

To control the quality of air in a barn, it is important to be able to measure the factors that describe air quality. Some factors are easy and practical to measure, some such as dust levels are not. In this workshop you will learn about measuring:

Temperature

Choices for temperature measurement are thermometers, maximum-minimum (max-min) thermometers, electronic hand held units, and small data loggers.

Humidity

Humidity is measured by dry bulb and wet bulb temperatures with a sling psychrometer or by electronic humidity sensors.

Air Speed

Drafts and air movement may be observed with smoke tubes. Air speed may be measured by hot wire anemometers.

Carbon Dioxide, Ammonia and Hydrogen Sulphide

Gas detection tube for numerous gases are available from safety supply distributors.

Dust

Dust levels and particle size distribution measuring equipment is more sophisticated, however the measurement will be discussed or demonstrated.

▪ Controlling Human Exposure to Dust

Dust may be controlled by two ways, reducing the source or generation of the dust and by filtering the air before it enters the lungs. To understand the factors involved the following topics will be studied:

Characteristics of Barn Dust

The discussion will review particle sources and particle sizes.

Human Reactions to Dust Exposure

It is important to recognize the organic nature of barn dust and the human defence mechanisms that may lead to health problems.

How to Control Dust By Spraying Oil in the Barn

Protocols have been developed based on research from the Prairie Swine Centre in Saskatoon and research at the University of Alberta for controlling barn dust levels by spraying canola oil.

How to Select, Fit and Wear Dust Protection

The most practical way to control dust exposure is by wearing respirators or dust masks. Important factors are the proper choice of respirator, proper care and storage of masks, and proper fitting to prevent leakage.

