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Factsheet

FARM WORKERS HEALTH PROBLEMS RELATED TO AIR QUALITY INSIDE LIVESTOCK BARNS

Yves Choinière, P. Eng., Farmstead Planning, Health and Safety Specialist, Resources Management Branch, Alfred College
Jim Munroe, P. Eng., Centre for Food and Animal Research, Agriculture Canada, Ottawa

INTRODUCTION

Everybody knows a livestock producer or an employee who has developed some respiratory problems from working in a barn. There are a number of people who can no longer enter dairy barns because of the dust released when hay is being fed or when straw is being spread. Also, many people cannot stay in a pig barn for very long without the onset of serious coughing and chest tightness after the visit.

Often, we think that it will not happen to us and that the people who have reactions are not "tough enough."

However, this is not funny at all for the farmers who have to sell their farm or stay away from the barn because they developed respiratory problems such as chronic bronchitis or occupational asthma or even worse, farmer's lung disease, during their working years.

The purposes of this Factsheet are to describe several farm worker health problems that are related to air quality inside livestock buildings and to consider possible methods to alleviate them.

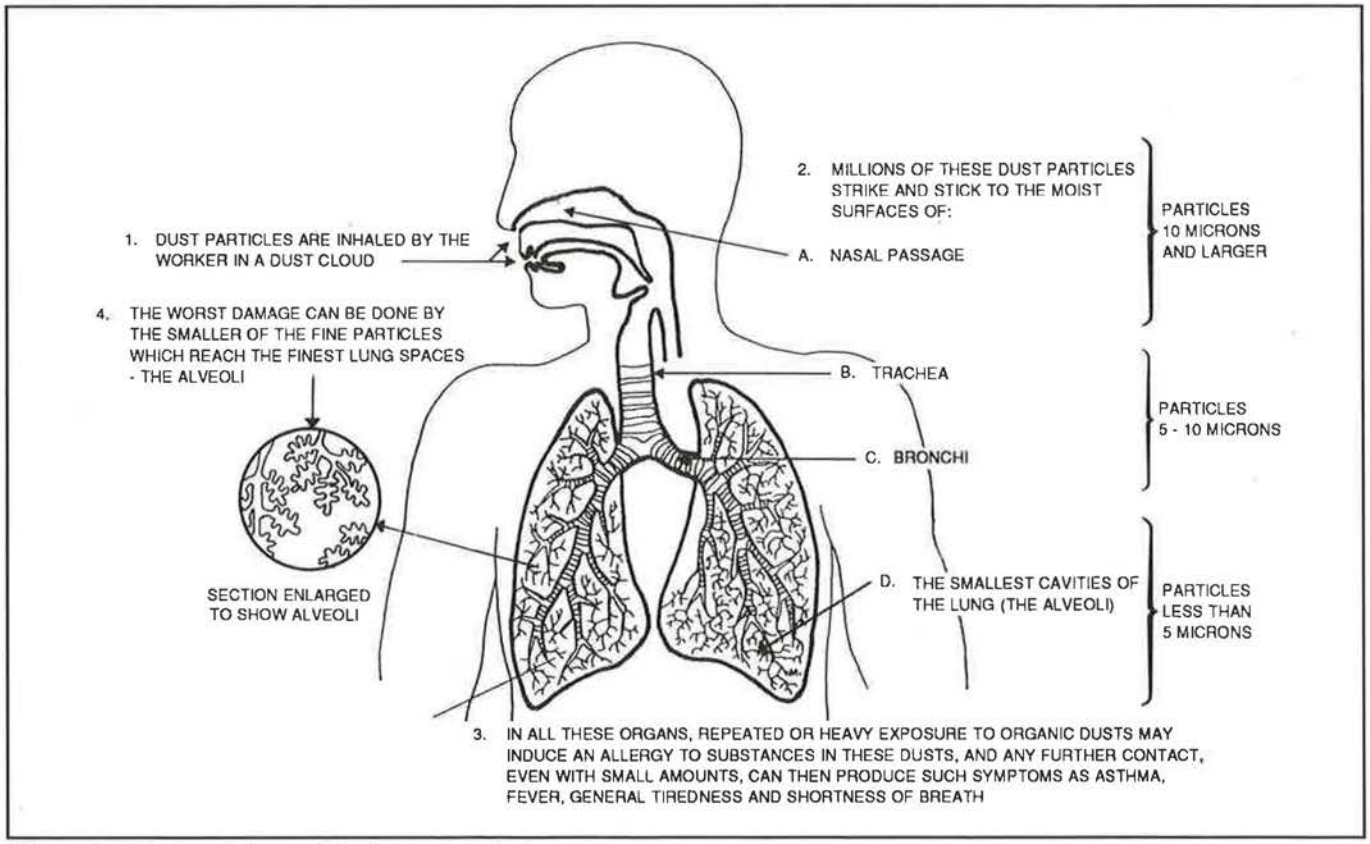

Figure 1. Dust particles and the human respiratory system.

DUST AND YOUR HEALTH

The main problem encountered inside livestock barns is related to respirable dust. When fine dust enters the respiratory system, the human body considers it to be foreign material which should be defended against. The main effects of dust on health are an inflammatory response (chronic irritation) or a toxic response. In effect the particles of dust act as a poison to the cells they come in contact with. Rarely does it cause an altered immune response of the system.

The purpose of the respiratory system is to allow air to come into intimate contact with the blood system in order to exchange oxygen and carbon dioxide. As shown in Figure 1, the lungs are well protected against dust by many filters located in the nose and respiratory channels which trap particles before they reach the bronchi and lung alveoli. Three main factors need to be considered when assessing the risks associated with dust: (1) penetration, (2) reaction, and (3) health effects.

The aerosol particles have to penetrate the respiratory system. The particles must be small enough and the particle concentration has to be high enough to defeat the defence mechanisms, or the dust must be toxic. When the particles penetrate the respiratory system, there will be a reaction to the intruding particles.

Basically, there are two types of reaction: the **immediate symptoms**, and the **delayed symptoms**. The immediate symptoms of a respiratory allergy can be eye irritation, nasal stuffiness, a streaming nose or an itchy throat.

The delayed symptoms include headache, dizziness, nausea, breathlessness, fever, and vomiting, leading to unproductive coughing and breathing difficulties. These symptoms usually appear 3 to 4 hours after exposure, reach a peak in 7 to 8 hours and disappear after 24 hours. "Farmer's Lung" and "Organic Dust Toxic Syndrome" are examples of delayed hypersensitivity of the respiratory system to specific dust.

There are three categories of health effects. First, there can be some **temporary damage** to the respiratory system which will disappear rapidly when the person is no longer exposed to dust. Second, there can be the occurrence of **insidious damage** to the respiratory system such as bronchitis or occupational asthma after long-term exposure to dust. The reaction is not as explosive as an allergic reaction, but has various symptoms such as coughing, shortness of breath, or a reduction of pulmonary capacity. However, when the workers are no longer exposed, the respiratory system may, but not always, recover entirely. Third, farm workers can develop **permanent lung damage** without showing any allergic reactions when they are continuously exposed to dust for long periods of time. This means that some parts of their lung tissue are permanently affected reducing respiration capacity. Unfortunately, this process is irreversible.

HEALTH STATUS OF LIVESTOCK PRODUCERS

A compilation of studies from Australia, Finland, Denmark, Sweden, Scotland, the USA and Canada indicate very high levels of occupational respiratory problems in farm workers. According to Table 1, about 1 dairy producer in 5 has bronchitis problems directly related to the in-barn air quality, 1 in 20 has asthma and 1 in 18 will develop some symptoms related to farmer's lung disease. It is even worse in pig barns.

Table 1. Statistics on the potential respiratory problems for Ontario farm workers

	Percentage Ranges			
Suspected Conditions	**Dairy**	**Pork**	**Poultry**	**Known Symptoms**
Bronchitis				
Acute	N/A	70 - 90%	15 - 25%	Cough, phlegm, tightness of chest, shortness of breath, wheeze
Chronic	10 - 20%	15 - 30%	8 - 15%	
Occupational Asthma	4 - 7%	20 - 30%	5 - 10%	Tightness of chest, shortness of breath, wheeze
Organic Dust Toxic Syndrome (ODTS) Acute or Chronic	N/A	20 - 30%	N/A	Febrile episodes, headaches, muscle aches, flu-like illness, shortness of breath
Farmer's Lung	2 - 10%	N/A	N/A	Same as for ODTS

N/A = not available

BRONCHITIS

Bronchitis is the most common complaint of farm workers. It is characterized by increased coughing and phlegm production. Cells lining the airways produce excess mucus to intercept and expel dust. Bronchitis symptoms usually occur in workers exposed for 2 or more hours a day to dusty barns. An "acute" response refers to a rapid or immediate reaction following exposure. When symptoms last at least three months per year, for at least three years, this is classified as "chronic bronchitis."

Some producers suffer from airway obstruction, which may or may not accompany chronic bronchitis. The overproduction of mucus in the airways tends to reduce the airflow passage and contribute to shortness of breath.

OCCUPATIONAL ASTHMA

Occupational asthma is caused by an increase in the reactivity of the airways. It is a special type of allergic response that develops in individuals with pre-existing, allergy-related asthma. However, most farmers develop these symptoms without having any pre-existing allergies. In these cases, an asthmatic attack (wheezing and contraction of the small airways) can result after one initial exposure to dust components. In others, months or years may pass before the individual has become sensitized to the allergen.

The muscle cells, responding to irritation in the airways, become inflamed and enlarged, then constrict. The constriction causes airways to become narrower and we hear wheezing as air goes in and out. The constriction causes the tight feeling in the chest. Persons who readily develop allergies, such as mite allergy or hay fever, or have had eczema or asthma as a child may be affected severely by both asthma and bronchitis.

ORGANIC DUST TOXIC SYNDROME (ODTS)

Organic dust toxic syndrome results from exposures to particularly high dust and endotoxin levels. Often this occurs after moving or sorting pigs, cleaning a confinement building or grain bin, or taking silage from a vertical silo. Symptoms include fever, muscle aches, chest tightness, a headache, coughing and fatigue. They are usually felt about 4 to 6 hours after the dust exposure and may persist throughout the next day. Full recovery may take 3 or more days. This condition is fairly common, but is often mistaken for the flu.

Researchers suspect prolonged or repeated exposures to low levels of dust result in "chronic ODTS" where producers experience a subtle, general loss of energy in addition to the other symptoms.

FARMER'S LUNG DISEASE

The most well-known example of these particles are the actinomycete spores which cause farmer's lung disease. They have all the worst properties of a dangerous dust: they are very fine particles, are usually present in large numbers, and can cause a substantial reaction in the human immune system.

When hay is not dry enough, and the drying process takes more than 5 to 6 days, heat builds up and causes large amounts of molds and dust. When this moldy hay is later fed to cattle, a worker can inhale an average of about 750, 000 dust particles per minute. Potentially most of these fine dust particles can go deeply into the lungs.

The symptoms of farmer's lung disease are similar to a cold or flu: shortness of breath caused by congested lungs, cough, possible fever and occasional nausea. Most importantly, the symptoms do not strike during or immediately following the exposure to the moldy hay. Instead, they

Figure 2 (A)

Figure 2 (B)

In a dairy barn, fine dust from hay and straw are hardly visible (A) but with strong lighting, as from the sun's rays, the large quantity of dust can be seen. (B)

Figure 3 (A)

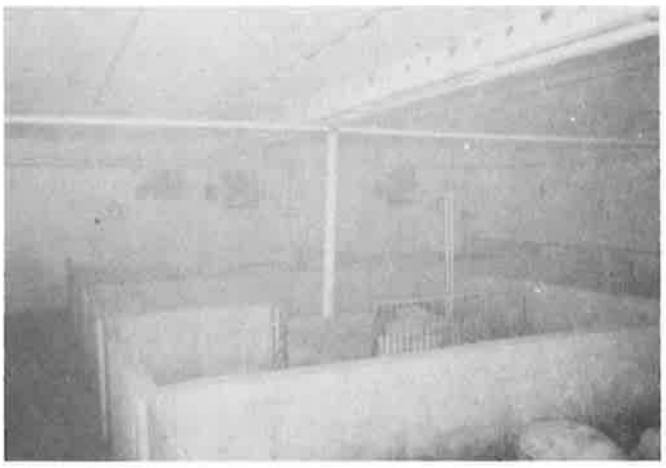

Figure 3 (B)

Even if your eyes do not see fine dust particles on picture (A) there is a large quantity of dust in the air (B) in swine barns.

occur approximately 4 to 8 hours later. Furthermore, this is an allergic reaction and therefore, farmers with farmer's lung disease will have antibodies in their blood to one or more harmful spores found in moldy hay. A doctor could confirm a diagnosis of farmer's lung disease by performing: (1) a blood test (antibodies), (2) a pulmonary biopsy (study of the alveoli), and (3) X-rays of the lungs (observe scaring in the lung tissues).

There are two stages in farmer's lung disease - the acute and the chronic. The acute stage involves a single attack of the symptoms following exposure to moldy hay, which normally resolve within 48 hours or so. When a person has farmer's lung disease in the chronic stage, he or she has permanent lung damage. This stage may develop following a series of acute attacks, or it may develop slowly, without warning. In many cases the disease is first evident at this stage, without the patient ever experiencing an acute attack.

WHAT ARE OUR RISKS OF GETTING THIS DISEASE?

Farmer's lung disease, although rare in comparison to bronchitis and non-allergic asthma, is most commonly an affliction of dairy farmers and grain producers. It is more prevalent in farming areas where there is a high amount of rainfall, especially during harvesting season, and where there is a cold winter, resulting in farmers feeding their animals in barns with minimum ventilation rates. During the winter months, dairy farmers are indoors and they feed their animals from the bottom of the hay pile, where the mold is likely to be. Also, dust is released when silages are fed, mainly because many spores have accumulated during the storage period. This is also the time of the year that most farmers develop the classic symptoms of farmer's lung disease. Even in these dairy farming areas, however, not all farmers will develop the disease. Some are just more sensitive than others, but no one is really sure why this is so.

There is no cure for farmer's lung disease. Once a person is known to be sensitive to this disease, he or she will always be sensitive. Since 10 to 30% of all patients diagnosed as having farmer's lung disease will die within 5 to 6 years from the time of diagnosis, and others will have permanent lung damage, it is important to avoid contracting it.

HOW CAN FARMER'S LUNG DISEASE BE PREVENTED?

First, farmers must do all they can to avoid exposure to moldy hay, silage and grain. Some farmers with severe cases of farmer's lung disease may be forced to leave the farm, but others, if very careful, can continue farming. One safety precaution is to wear a face mask or respirator when working with hay which may be moldy, but such masks need to be effective against very tiny spores (less than 1 millionth of a metre in size). Another precaution is to keep the barn area as clean as possible to reduce bacterial growth and to ventilate the area if possible. Farmers should attempt to store dry hay and grain, to air the hay mow and granary, and to burn moldy hay. There are some organic acids (e.g., propionic acid) which can be applied or sprayed on the hay to stop mold growth.

Doctors have relieved some of the symptoms with medications known as corticosteroids, but these drugs have some negative side effects, and do nothing to stop the sickness itself. Therefore, it is important for farmers and doctors to be able to identify the hazards, take precautions and recognize the symptoms of farmer's lung disease.

CONCLUSION

In Canada there is evidence that numerous farm workers involved with livestock production are directly affected by poor indoor air quality. Between 2 and 10% of dairy farmers show some symptoms of farmer's lung disease and 0.5 to 1% have or will develop some critical reactions and pulmonary capacity reduction over their farming career. Moldy hay, straw and grain produce large amounts of harmful dust but even good fresh hay contains some molds and produces some dust. Pig farmers are even at higher risk and suffer from bronchitis, occupational asthma and from the organic dust toxic syndrome. Operators in poultry buildings are also at risk because the highest levels of dust and endotoxins are present in the air during the working time.

It is strongly recommended that producers wear a respiratory protection system such as an adequate face mask or the more efficient positive pressure respirator, especially during feeding and animal handling time. For further information, also see Canada Plan Service Leaflet M-9707, *Protecting workers in livestock buildings from dust and gases.*

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