12. ORGANIC FARM DUSTS

THE HAZARD

- Agricultural dusts commonly range in diameter from <1 microns to >50 microns. The smaller particles may be deposited throughout the respiratory tract, causing human health problems.

- Exposure to dusts associated with agricultural production can cause both short term and long term respiratory problems.

The following agricultural processes are associated with respiratory problems caused by agricultural dusts:

- Grain harvesting, storage, crushing and handling
- Cotton harvesting and ginning.
- Hay and silage handling
- Animal handling in confined spaces - piggeries, poultry, dairies

Dusts which are associated with respiratory problems include:

- Particles of hair
- Feathers
- Dander
- Pollens
- Grains dust
- Cotton dust
- Bacteria
- Fungi spores.

- These dusts originate in the soil, animals and their breakdown products, animal feeds, plant materials and fungi, insects and decaying stored plant material.

- Other substances on farms, including fumes and gases, can also cause respiratory problems.

Grain Dusts

- Dusts from grain consist of a complex mixture of organic and inorganic particles from sources as diverse as leaves, soil, and insect parts. The mixture varies with the type of grain, where it is grown, growing conditions and methods of harvest, storage and processing.

- Most grain dust particles are biologically active vegetable dusts and a significant amount are able to be breathed into the lungs. Dusts of certain grains such as durum wheat and barley are reported to be more irritating than others. Adverse health effects also increase as moisture content and spoilage increase.

- Most particles are from fruits of grasses such as wheat, legumes such as soybeans, or oil seeds such as rape seed. Bits of leaves and stems may also be present. There are many non-plant contaminants. Animal material (bits of insects, rodents, or birds or their excreta), mites, chemical residues (pesticides used to grow or later treat the grain), and inorganic matter (soil including silica particles) all may be intermixed in small quantities. A variety of fungi and bacteria, their spores and their by-products also pose a respiratory hazard. Species of micro organisms vary with regional climate and change from harvest through storage. Many of the components of grain dust are capable of affecting the respiratory tract individually; together, they produce a wide variety of biological effects.

- Anyone involved in production, storage, transportation, or processing of grain can suffer the effects of regular inhalation of grain dusts. Exposure starts with farmers and farm workers who grow, harvest, sometimes store and then transport grain to local storage facilities. These farmers are exposed to grain dust on occasion. Exposure extends far beyond the farm to workers in feed mills, grain elevators and grain transportation industries. These workers, who are routinely exposed to grain dust, suffer from respiratory responses more commonly and more severely than do farmers. Exposure to grain can occur at any stage of the production process. Clouds of grain dusts are most evident whenever grain is moved, and especially heavy exposures among any grain handlers occur during dumping and loading grain.

Cotton, hay and other organic dusts

- As with grain dusts, cotton dusts, hay dusts and other organic dusts are a complex mixture of plant , fungi, bacteria and insect material.

- Less has been reported about the impact of cotton dust (aside from the occupational condition of byssinosis affecting cotton mill workers) although anecdotal reports from the cotton growing areas of northern NSW indicate that cotton dust generated at cotton harvest and during ginning cause similar problems to grain dusts.

- Mouldy or spoiled hay and silage are known to increase the risk of all the different types of respiratory responses, including hypersensitivity pneumonitis.

Confinement production

- In North America and other parts of the northern hemisphere sheep, cattle and dairy cattle are housed in confined buildings for part of the year, but in Australia we are concerned only with pigs and poultry confinement systems. Because large numbers of animals are confined in small spaces, these buildings must include devices to ventilate the buildings and to dispose of animal wastes.

- Dust is generated from animals, their feed and from animal wastes. These dusts and gases accumulate to concentrations that may be hazardous to human and animal heath. Thus workers who prepare feed, feed animals, clean the buildings, sort and move animals and perform routine vaccinations, treatments or other management and maintenance procedures are at risk of respiratory problems.

- Hydrogen sulphide from manure pits is a hazard where pits are fully or partially beneath the shed. Manure pit gases pose an acute hazard when the slurry is agitated to suspend solids so that pits can be pumped out.

- Inhalation of confinement shed dusts and gases, again produces a complex set of respiratory responses which depends on characteristics mentioned above (characteristics of the inhaled components, individual susceptibility, reactivity of the respiratory airways and smoking history).

Silos

- The atmosphere in confined spaces on farms such as grain silos can be dangerous. Ventilated silos allow enough air flow through to prevent build up of toxic gases. Even after fumigating, toxic concentrations are generally reduced to a safe level after a week.

- However, grain dusts in silos can result in all the conditions associated with grain dusts mentioned above. In particular, persons whose asthma is triggered by grain dusts have a high risk of suffering an attack in an enclosed silo. A number of life threatening asthma attacks have been associated with entry to grain silos.

- Fully sealed silos present quite a different situation and are becoming more common because they allow efficient fumigation for the destruction of insects. These silos not only retain toxic concentrations of fumigants longer, but may also allow a build up of carbon dioxide generated by the natural respiration of grain.

- In a silo with a dusty atmosphere; for example, one being filled from a feed mill, the atmosphere might become explosive, particularly if the humidity is low. A spark from metal striking metal, an electric switch or a match could cause a dust explosion.

- Moving grain in silos and field bins can result in death through grain suffocation.
- Less common in Australia are silage silos which can contain a highly toxic gas, nitrogen dioxide. If sludges are present in old, disused silos, flammable methane might also be present

HAZARD IDENTIFICATION

When conducting an assessment of dust hazards on the farm, look for the sources of dust hazards. Consider characteristics of the worker and the tasks likely to be associated with dust.

Characteristics of the worker which need to be looked at are:

- Whether the worker suffers from asthma, and if so, what triggers the asthma
- Whether the worker is a smoker
- Training in identification of hazards, control measures and appropriate personal protective equipment
- Attitude toward use of personal protective equipment

Tasks which can be identified as likely to produce dust hazards are those such as:

- Harvesting, drying and cleaning, milling and mixing operations, transport or dressing and other handling of grain, hay, silage or cotton
- Maintenance of grain handling machinery or field repairs
- Feeding and handling animals in confined spaces

Refer to the following Health & Safety Guidance notes for further information on dust hazards:

* Farm Machinery (Number 5)
* Piggeries (Number 23)
* Grain Handling Facilities

THE RISK

1. *Who is at risk*

- Many farm workers and people who live in close association with farming activities are at risk of respiratory disease associated with organic dusts.

Those who are involved in the following activities are at risk:

- moving and transporting grain
- breaking open bales of spoiled hay
- mixing feed and feeding animals
- cleaning out mouldy grain
- working in livestock confinement sheds - pigs and poultry

- Farm workers with asthma and rhinitis are at increased risk of respiratory problems.
- Farm workers who smoke cigarettes are at increased risk of respiratory disease.
- Those people who work with organic material which is damp and subsequently contaminated by fungi are at increased risk of respiratory disease.

2. *Nature of potential injury/illness*

Respiratory problems associated with farm dusts vary according to the characteristics of the dusts, and may be acute (immediate) or chronic (long-term) in nature.

In medical terms, respiratory responses to exposure to organic dusts are:

1 . Airway inflammatory response to organic dust exposure
- Rhinitis (inflammation of the lining of the nose)
- Pharyngitis, laryngitis (inflammation of the throat)
- Tracheitis, bronchitis (inflammation of the upper airways)
- Asthma/ hyperactive airways
- Bronchiolitis (inflammation of the lower airways)
- Toxic organic dust syndrome (TODS)

2. Airway immunological responses to organic dust exposures
- Allergic rhinitis (runny nose and eyes, itchy eyes, nose and throat)
- Extrinsic asthma (asthma triggered by the environment)

3. Interstitial (tissue) immunological responses to certain fungi (moulds) and bacteria

Hypersensitivity pneumonitis (extrinsic allergic alveolitis; Farmer's Lung)

In the northern hemisphere, where farmers' work is commonly associated with indoor work with confined animals and handling of silage, bronchitis is the most common agricultural respiratory problem. Between 20 and 90 percent of farmers note cough and sputum (with or without airflow obstruction) depending on the type of farm and associated exposures.

In Australia, the dust-induced asthma assumes a higher relative importance, although there is probably a widespread lack of recognition of other conditions such as toxic organic dust syndrome (TODS) and hypersensitivity pneumonitis.

Asthma is a problem to many farmers because:

- Many farmers have asthma which is triggered by farm dusts (organic dusts) and pollens - grain dusts, especially wheat dust, cotton dusts, hay, rye grass, turnip weed, and many other farm dusts
- Many farmers with severe asthma caused by farm dusts may not wish, or be able, to leave the industry
- Farm families are usually a long distance from medical help when a severe asthma attack occurs
- There is no one easy way of reducing exposure to organic dusts. Face masks may be of limited use
- Some farmers may have a cough or chest tightness and not be aware they have asthma

3. *Degree of risk*

The degree of risk is a function of both the severity of illness caused by the dust hazard, and the frequency of exposure to the dust hazard.

Severity

The severity of the illness depends on the size of the dust and the susceptibility of the individual. Irritant dust has larger particles which do not go down into the lungs but may cause irritation of the nose or upper airways. Respirable dust is made of smaller particles which can collect in the lungs and cause damage. Some dusts (many animal, grain and wood dusts) can trigger an allergic reaction in the lungs. These dusts can also trigger asthma in susceptible people.

Respiratory problems caused by organic dusts

Respiratory disease	Symptoms	Comments
1. Inflammation of the air passages - upper airways response	stuffy nose runny nose sore throat	These very common reactions arebothersome but cause no permanent damage
- acute bronchitis	cough phlegm laboured breathing	
2. Asthma	wheezing laboured breathing cough	Asthma may be an immediate response to grain dust inhalation, may be delayed for several hours, or may recur successive nights following exposure. Can be life threatening.
3. Chronic obstructive pulmonary disease	recurring cough phlegm production for 2 years or more	Cigarette smokers experience these same symptoms. Cigarette smoking grain handlers often get these symptoms sooner, or at a younger age.
- chronic bronchitis	laboured breathing	Prolonged exposure to grain dust can lead to permanent lung damage
- airways obstruction	wheezing	
4. Toxic organic dust syndrome (TODS) Sometimes called grain fever	flu like symptoms - chills, fever, flushed face, muscle pain. general body discomfort	TODS follows heavy exposure to grain dust. Symptoms occur for new workers 4-8 hours after exposure. Symptoms can occur in other workers after temporary removal such as after return to work after days off.
5. Hypersensitivity pneumonitis	cough, fever, chills can cause permanent lung damage and death	Greater risk with decayed grain, hay or silage. Symptoms with even small amounts of dust after person sensitised and start 4-8 hours after breathing dusts

[1]Table derived from American Lung Association *Agricultural Respiratory Hazards Education Series.* Unit 3 Grain dusts

Frequency of exposure

The more often a person is exposed to the dust hazard, the more likely it is that illness will occur. Likewise, the longer the person spends working in the dusty environment, the more likely it is that illness will occur. Therefore, frequency of exposure has a positive effect on the degree of risk. While many farmers and farm workers are exposed to organic dusts, the impact on individuals is variable. The following table indicates the relative prevalence of respiratory responses to grain dusts among grain handlers in the USA.

Organic Dusts-Health Effects[2]

Area Affected	Effect	Prevalence amongst grain handlers
Nose and throat	Nasal stuffiness, runny nose, sore throat	Extremely common
Upper and lower airways	Occupational asthma	Relatively common
	Acute bronchitis	Common
	Chronic airway obstruction	Not common
Lung tissue	Toxic Organic Dust Syndrome (TODS)	Occasional to common
	Hypersensitivity pneumonitis (acute and chronic)	Rare
Non-respiratory	Eye irritation	Extremely common
	Dermatitis	Occasional to common
	Explosion injury	Rare

Note:

Exposure to organic dusts on farms is a common event, more common for those whose work involves animals in confinement sheds - pigs and poultry.

Exposure to grain dust, hay dust and cotton dust is also common but sporadic in nature. Risk is greater for exposure to decaying or mouldy grain and hay.

[2]Adapted from Baker, G. Setting the Scene ii. Proceedings of Conference: Respiratory disease in Australia and in Agriculture. Moree. New South Wales 1989

The effects on individuals is variable, being very severe for susceptible people, and potentially damaging for all exposed people.

Therefore, generally the risk associated with dust hazards will be HIGH, particularly where an individual is particularly susceptible to dusts.

CONTROL MEASURES

The following control measures will not be suitable for all people in all circumstances. They are presented as options which are available to reduce the risk of illness or death while not interfering with farm productivity. In fact, well-designed control measures should increase productivity by decreasing human exposure to farm dusts and reducing the cost of illness. An option which may seem impractical to one person in their particular situation may well be possible for somebody else in their circumstances. Where an option may not be practical at present, it may become so in the future; for instance, when planning the purchase of new machinery or tractors.

1. *Elimination of the hazard*

- Elimination of the hazard of organic dusts on Australian farms is not generally an option.
- A farmer may have to decide not to produce a specific crop or product (pigs, for example) to which s/he or a family member has a serious and disabling hypersensitivity (asthma or hypersensitivity pneumonitis).

2. *Substitution for a lesser hazard*

- Substitution of crops to reduce respiratory responses becomes an option only where a disabling hypersensitivity causes problems. However, other substitution options exist such as the use of pelleted feed for stock rather than dusty grain or hay. Otherwise, adding a dust suppressant like molasses will make animal feed a lesser hazard.

3. *Engineering/design options*

- Design of processes for dust reduction is an important control measure which should be considered in the planning of the farm enterprise.
- Ensure adequate ventilation systems (such as exhaust ventilation) to maintain dust levels to safe levels in all buildings where dust is generated eg seed crushing, cotton ginning, feed milling.

Design of piggeries and poultry confinement sheds has an important bearing on the degree of dust exposure to workers.

Measures include:

- Misters- to dampen dust levels
- Adequate ventilation systems
- Use of appropriate floor surface material
- Feed delivery system by extension spouts into covered feeders

- Consider ways of isolating dusty work processes; for instance, sealed, air conditioned cabins on harvesters and tractors will isolate the operator from dusts generated during harvesting and reduce risk of respiratory problems. Isolation booths such as those seen in cotton gins separate people from the dust hazard.

- Vacuum tools or negative pressure portable tools are useful, particularly when emptying the last amount of grain from flat floored bins. A vacuum with a high efficiency particulate air (HEPA) filter is needed.

- Reduce the time spent in the dusty area by installing additional control equipment eg. a timer to processing machinery.

- Covered chutes and spouts can reduce dust clouds where grain or stock feed is being moved; for instance, a dust/wind sock on the unloading auger of the combine.

- Totally enclosed conveyor belts in grain elevators greatly reduce dust.

- Enclose the grain intake pit.

4. *Safer work practices and procedures*

There are a number of safe work practices which should become routine for workers on farms which involve organic dust production.

Before starting work

✓ Training and information should be provided to all workers on identifying dust hazards and how to reduce exposure.

✓ Maintenance of air conditioners, filters and seals as well as general attention to cleaning up dusty areas and machinery will reduce dust exposure.

While working

✓ Where possible, always work upwind of dust being generated in paddocks or flowing grain/feed.

- ✓ Dusty work areas can be vacuumed and swept with a wet broom to reduce dust.
- ✓ When working with dusty grain or hay which is to be used soon, dampen it with small amounts of water to reduce dust.
- ✓ Use appropriate personal protective equipment such as face masks or respirators where necessary.

Avoid all unnecessary exposure to dusts by:

- ✓ Standing further away and upwind from grain being augured and dumped.
- ✓ Not handling mouldy hay unnecessarily.
- ✓ Not entering dusty confined space without special respiratory protection.

Maintenance of health

- ✓ Quit smoking.
- ✓ Monitor your respiratory health.
- ✓ People who work in dusty environments should have their respiratory health checked regularly. Those who work in eg cotton gins, seed crushing plants, feed mills etc should be checked annually.
- ✓ The doctor will check for symptoms and signs of lung problems and arrange spirometry for workers at high risk.

Those who will require annual testing include:

- ✓ Those working in cotton gins
- ✓ Those working in grain handling
- ✓ Those working in livestock confinement buildings
- ✓ People with a history of bronchitis, asthma or repeated respiratory infections
- ✓ Any agricultural worker who smokes

Workers with asthma MUST take extra precautions to avoid exposure to organic dusts, particularly if asthma is triggered by the particular dust. Precautions include:

- ✓ Maintenance of good respiratory health with the help of your doctor (an asthma management plan).
- ✓ Always carry a bronchodilator puffer.
- ✓ Always let another person know where you are working.
- ✓ Never enter a dusty confined space such as a silo.
- ✓ Quit smoking.

5. *Personal protective equipment and clothing*

Use of personal respiratory protection devices remains an important means of reducing exposure to dusts on farms.

Suitable respirators must be available wherever workers need to work in environments where organic dusts are generated.

Any respirator selected for use should conform to the Australian Standard for respirators.

There are 2 basic types of respirators:

A. Air purifying respirators

These are most commonly required and used on farms.

B. Air supplying respirators

These are self contained units which supply air or oxygen to the worker and are generally used in rescue situations only.

Air purifying respirators

These are available for almost any on-the-farm job. However, as they do not supply air, they cannot be used in an oxygen deficient atmosphere.

They have the function of removing contaminants from the air being inspired. They are of a number of types:

1. Disposable mechanical filter respirators

These are often called dust masks or particulate respirators.

They are designed for use against dust, mists and fumes.

They consist of a shaped piece of filter material held by 2 straps to the wearers head (One strap masks do not have a good enough fit).

When the mask loses its shape or when breathing resistance becomes too great the respirator should be discarded.

These dust masks are not suitable for use in oxygen-deficient atmospheres, spray painting, toxic dusts or chemicals. They must be replaced at least daily in very dusty conditions eg. cleanouts.

2. Mechanical filter respirators

These remove the same airborne particles as do the disposable respirators. However filters in these respirators are replaceable and the face pieces are made to last a long time. Filter life is generally greater than that of the one-piece disposables.

3. Chemical cartridge respirators

These protect against gases and vapours.

They have one or two chemical cartridges containing a sorbent that adsorbs specific gases and vapours. Many different cartridges are available against specific gases or vapours.

4. Gas masks

These also protect against gases and vapours but have replaceable canisters that are larger than cartridges.

5. Powered air-purifying respirators

These are the newer kind of air purifying respirators. They blow filtered air by a motor unit into a face piece. They are cooler because of the constant airflow over the head and face.

Most are powered by a battery pack strapped to the wearers waist or back.

The smaller, lighter weight units have mechanical filters only; others can use filter, canister or cartridge.
Respirators must be comfortable and have a secure fit. A tight face seal must be maintained except with the powered types.

Common interferences to the seal are caused by:

- beards and sideburns
- gum chewing
- prescription glasses (in some cases)

- Maintain respirators to ensure that they are fully functional. Remove respirator filters and set aside. The face piece can be washed in soap and warm water. Valves can be removed and washed as well. Rinse these well, dry with a clean cloth and leave to air in a well ventilated area out of direct sun . The respirator can be stored in a sealed plastic bag or an unused lunch box away from direct sunlight. Wipe the outside surface of respirators but do not allow water to enter the filter. Activated charcoal also needs to be stored properly in a sealed container. Regularly check the one-way valves on your respirator to make sure they are still functioning.

- At this time, check that the face piece of the respirator is still soft, pliable and functioning. Change and use filters according to the manufacturer's recommendations. If a strong perfume can be smelt through a charcoal filter, it needs replacing. Keep goggles and headband clean as the headband is particularly prone to absorption of chemicals. They can be cleaned by soaking for two minutes in a mixture of 30 millilitres of chlorine bleach in 4 litres of water, then rinsed thoroughly with water and allow to dry outside.

RELEVANT LEGISLATION AND STANDARDS

Legislation:

- Exposure to organic dusts by farm workers is an occupational safety issue covered by each state's Occupational Health and Safety Act. These Acts require that employers provide safe systems of work, to ensure the health and safety of all who work or visit the workplace.

  Workers must be provided with adequate training and instruction and provision of appropriate personal protective equipment is obligatory.

Standards:

- **AS/ NZS 1715** Selection, use and maintenance of respiratory protective devices sets out principles of respiratory protection
- **AS/NZS 1716** Respiratory protective devices

USEFUL REFERENCES

1. American Lung Association of Iowa. *Agricultural Respiratory Hazards Education Series.* 1986.
2. *Respiratory Disease in Agriculture.* Proceedings of a Conference held at Moree, New South Wales. 1989. (Suitable for health professionals).
3. Video: *Nobody Ever Died of a Cough.* Australian Agricultural Health Unit. Moree

CONTACTS

State/Territory Occupational Health & Safety Organisations as listed.

* WorkCover New South Wales: Ph: 131 050
* Victorian WorkCover Authority: Ph: (03) 9628 8188
* Queensland Division of Workplace Health & Safety: Ph (1800) 177 717 or (07) 3247 4711
* South Australian WorkCover Corporation: Ph (08) 8226 3120
* WorkSafe Western Australia: Ph (08) 9327 8777
* Tasmanian Workplace Standards Authority: Ph (03) 6233 7657
* Northern Territory Work Health Authority: Ph (08) 8999 5010
* Australian Capital Territory WorkCover: Ph (02) 6205 0200

Australian Agricultural Health Unit
PO Box 256
Moree NSW 2400
Telephone: (02) 6752 8210
Facsimile: (02) 6752 6639

Notes:

AGHEALTH

**This Project has been funded by the
Rural Industry Development Corporation**