PLOWSHARES #20

Breaking New Ground Technical Report

Farming with a Respiratory Impairment

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Introduction

Farmers, by their occupation, are considered a group at special risk to respiratory impairments. Hazards can range from inhalation of animal dander in enclosed barns to toxic gases in silos causing various illnesses.

Typically, farmers are unaware of the effects of respiratory irritants. Symptoms may take the form of sniffles, a slight cold, or sinus problems. More noticeable reactions can occur and are sometimes severe or life threatening. Continuous exposure to an irritant can lead to permanent damage in later years. Reactions to irritants depend on the health status of the individual, type of irritant, and concentration of the irritant; among other things. Any level of reaction a farmer experiences is a nuisance as well as a health risk.

Farming with a respiratory impairment is difficult; however, it is possible. Changes are sometimes required in routines and/or equipment to assist farmers with respiratory impairments so that they can continue to work. The intent of this article is to provide information on some respiratory hazards and the illnesses they can cause, as well as suggestions on prevention and how to continue farming if an impairment does develop. The resources listed at the end of the article can provide additional detailed information.

Case Studies

The following case studies represent individuals who experience respiratory impairments and continue to farm. Equipment and techniques they use to enable them to continue are discussed.

Mike Nelson (Grant County, MN)

Mike, 40, has been a farmer all his life and has always had problems with allergies while working. The family farm he grew up on had beef cattle and hogs. They also grew corn, soybeans, wheat and alfalfa. There were two silos on the farm and barns with wood floors that were covered with straw. Just about everywhere Mike went on the farm he was exposed to some form of dust or grain. This exposure caused him to wheeze and cough and made working more difficult.

About 17 years ago, Mike's mother read an advertisement on a piece of equipment called an Airstream™ helmet *(Fig. 1)*. The ad indicated

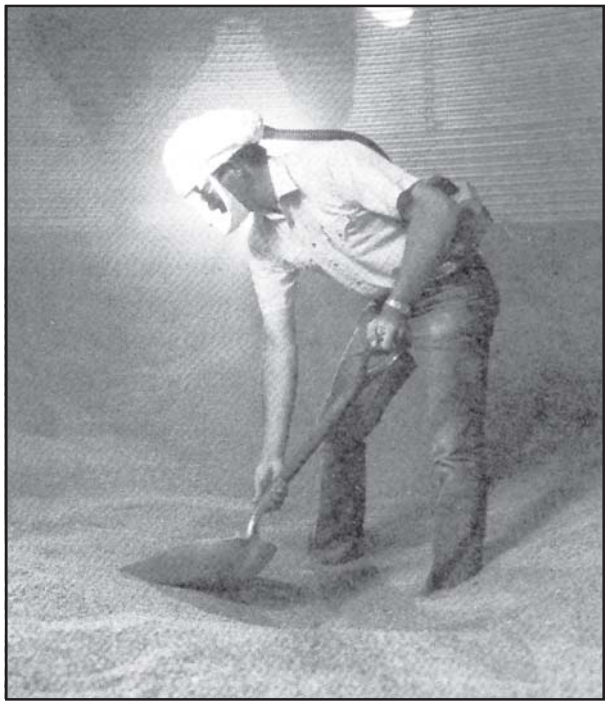

Figure 1. Mike Nelson working in a grain bin wearing an Airstream™ helmet.

that the helmet would minimize the amount of exposure to dusts in the air. Mike decided to try the helmet and according to him it has changed his life.

The first day he used the helmet, they were using a chemical in their wheat bin that generated a great deal of hot pink colored dust. He wore the helmet into the bin and proceeded to work. Normally, Mike would have started wheezing and coughing in about ten minutes, however, he sustained no adverse reaction. Upon examination of the filter in the helmet, he noticed that it was the color of the dust. This, along with the fact that he did not experience his usual reactions to dust while wearing the helmet, convinced him that it was an effective device.

Eighteen months later, after several similar episodes, Mike decided to share his discovery with other people experiencing adverse reactions. He began distributing the helmets to those he knew had similar difficulties. For approximately 8 years, Mike continued to sell the helmets part time in conjunction with farming. As time progressed, the helmet business grew to the extent that Mike was able to change professions from farming. At that time, he and his wife Julie established a full-time Airstream helmet dealership. Mike can still occasionally be found on the family farm with his father, using the Airstream™ helmet when needed. Information about the Airstream™ helmet and other safety related equipment can be obtained by contacting Mike at (800) 328-1792 or (218) 685-4457.

Dale McCallister (Edgar County, IL)

Dale, 68, is the owner and operator of an 850-acre grain farm. He has been farming for over 50 years. About four years ago, Dale was diagnosed with nonspecific asthma. This is a type of asthma where molds, dust, chemicals, etc. can set off an attack. Daily medications help keep it under control; however, changes in farming methods and equipment have been used to assist him.

One method Dale uses to minimize exposure is hired labor. His grain is custom harvested, and his regular help loads the corn planter, works with chemicals, welds any equipment in need of repair, and handles the grain.

Appropriate dust masks and respirators are available on the farm and are worn by all employees. Dale also wears an Airstream™ helmet in extremely dusty situations.

A small portable fan is used to help control dust in the grain bins. This fan is mounted to a piece of plywood and placed over the large fan in the bin *(Fig. 2)*. The portable fan pulls the air out of the bin to allow dust to settle.

Dale also has a tractor cab with an upgraded air filter. This was expensive, but he feels it was worth the investment due to his sensitivity. He cleans the filter regularly so that it can work efficiently. Dale also keeps the tractor cab clean at all times to minimize suspended dust and possible exposure.

Dale is under supervised medical care and is monitored regularly for lung function through spirometry tests. This medical supervision in conjunction with equipment and procedural modifications has allowed him to continue farming.

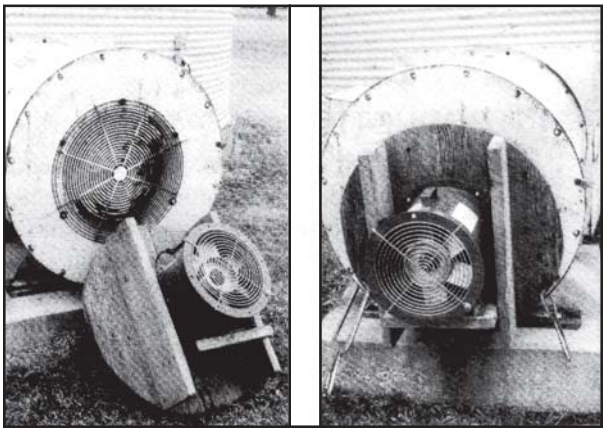

Figure 2. Dale McCallister's portable fan.

Dennis Dodd (Franklin County, VT)

Dennis, 41, is a third generation operator of a family owned, 400 acre dairy farm with 150 head of cattle. (80 of which are milked) He and his wife,

Linda, also own a maple syrup, candy and maple flavored products business for extra income.

At the age of 35, Dennis was diagnosed with Farmer's Lung Disease. He can no longer work with or near hay because he may suffer a relapse. In order for Dennis to continue working with minimal risk of exposure, the Dodds have made some changes to their farming methods and equipment.

They now use round bales, wrapped with plastic film to minimize mold growth on the bales *(Fig. 3)*. Also, the bales are unrolled by machine.

Any chores involving hay (including mowing, baling, handling and feeding) are shared by the hired help or other family members.

Dennis wears a Comfo-II™ respirator at all times when he is in the barn. While he sometimes finds it cumbersome he understands it is a necessary precaution. An Airstream™ helmet is used for extremely dusty situations. The helmet provides good protection. However, for daily use, Dennis finds it a little too bulky to get between cows for milking.

Dennis still experiences a recurrence of symptoms about once a year. Usually this occurs in the winter, when the barns are closed and air circulation is decreased. Though changes in management practices and use of protective equipment have not eliminated the problem completely, they have enabled him to continue doing what he enjoys...farming.

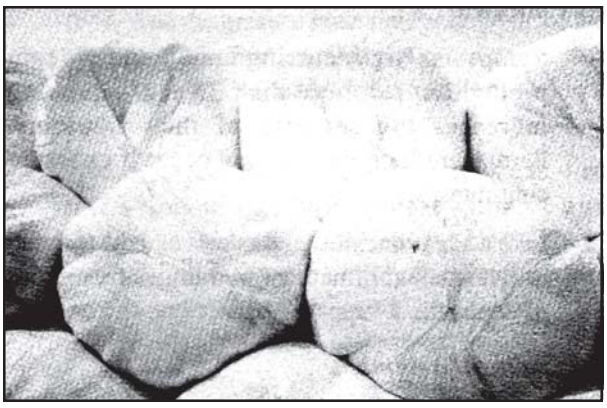

Figure 3. Dennis Dodd wraps his round hay bales in white plastic film to minimize molding.

Respiratory Disease Related to Agriculture—Definition, Symptoms, and Sources

The preceding case studies refer to a few respiratory impairments that one can develop from farming or living on a farm. Following are definitions **(D)**, symptoms **(S)**, and sources of exposure **(SE)** of these diseases as well as a few other respiratory problems. Reactions may differ among individuals and are dependent on health, smoking history, amount of exposure and other variables.

Farmer's Lung Disease

D—An allergic reaction disease. Only those sensitive to certain microorganisms will contract it. Any amount of exposure, even small, can elicit a reaction. There can be an existing sensitivity or a sensitivity can develop after repeated exposure. Permanent lung damage can occur if exposure continues.

S—Symptoms and recovery time are similar to the "flu." They can include cough, fever, chills, labored breathing, muscle pain and general discomfort. Symptoms occur 4-8 hours after exposure. There is no specific treatment and the symptoms usually subside within 2-5 days. Complete recovery can be expected in 10-60 days.

SE—Decayed grain, silage, and bales of hay are sources of exposure. Dairy farmers are the most likely to contract the disease. There is a higher frequency of occurrence during the winter and spring, with December to April being the peak months.

Organic Dust Toxic Syndrome

D—A non-allergic inflammatory reaction. There is no known predisposed sensitivity. Everyone exposed has the potential to be affected and usually are. Large quantities of exposure are necessary for a reaction. It is not known to cause any permanent lung damage.

S—Symptoms include cough, fever, chills, muscle pain, labored breathing, and general discomfort. They appear 5-8 hours after exposure and usually

subside in 2-5 days with no specific treatment. Complete recovery occurs in about 10 days.

SE—Any activity involving exposure to moldy forage crops can elicit reactions. The most common activity is throwing off top layers of moldy silage from the top of stored silage. July to October are the peak months of incidence.

Pulmonary Edema

D—A life threatening illness caused by the lungs filling up with fluid. This can lead to suffocation if not treated soon enough.

S—Shortness of breath, labored breathing, coughing and bluing of skin are some symptoms.

SE—Inhalation of large quantities of fumigants, hydrogen sulfide, anhydrous ammonia and oxides of nitrogen (silo filler's disease) can cause problems.

Irritation of Mucous Membranes

D—Inflammation of the eyes, nose, mouth, and upper airways of the lungs *(Fig. 4)*.

S—Symptoms are stuffy, runny nose and sore throat. Typically there is no permanent damage.

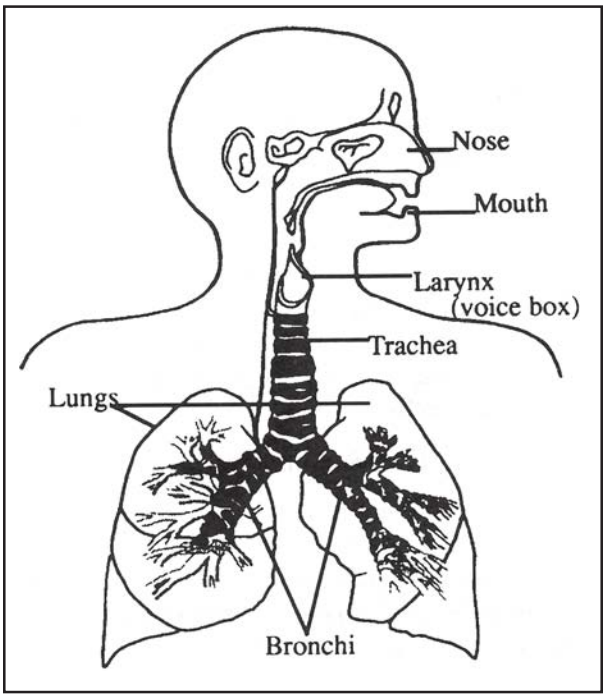

Figure 4. Diagram of respiratory system.

SE—Grain dusts; dusts in livestock confinement buildings; chemicals; and manure and silo gases can elicit these reactions.

Acute Bronchitis

D—Inflammation of the bronchi (see diagram), that develops quickly, has severe symptoms, a short duration, and usually affects the upper portion of the respiratory system. This is a very common respiratory disease among agricultural workers.

S—Associated symptoms are coughing, phlegm production, chest tightness, shortness of breath, and wheezing. Permanent damage typically does not occur unless exposure continues.

SE—Grain dusts and dusts found in livestock confinement buildings are sources of exposure. Swine and poultry buildings present workers with the greatest risk of exposure.

Chronic Bronchitis

D—A long and drawn out illness involving inflammation of the bronchi. Symptoms occur daily for many years and usually lead to a serious disability or death. This is commonly caused by continuous exposure. Swine confinement workers and grain handlers are most often affected.

S—Symptoms are recurring cough and phlegm production for more than 2 years. Smoking increases the severity of the symptoms. Permanent lung damage can occur if exposure continues.

SE—Like acute bronchitis, grain dusts and dusts found in livestock confinement buildings are sources of exposure.

Occupational Asthma

D—Constriction of the bronchi caused by inhalation of irritating dusts and/or vapors, or allergenic materials.

S—Symptoms include shortness of breath, wheezing, coughing and chest tightness. Symptoms may appear immediately, however they usually don't appear until a few hours after exposure. Wheezing

during the night is a more definitive sign of occupational asthma.

SE—Grain dusts, dusts associated with animals, chemical and vapor exposure, and being enclosed in a poorly ventilated area or building can all be potential sources of occupational asthma. Research has indicated that the development of asthma from a workplace exposure, may not necessarily disappear when the irritant is eliminated.

Gases and Chemicals Related to Agriculture—Types, Sources, and Effects

Farmers can be exposed to many gases and chemicals. Many of these can lead to respiratory problems. Following is a list of some of the types **(T)** of gases and chemicals involved in agriculture, as well as their source **(S)** and their effects **(E)** on the respiratory system.

Once again, reactions will be dependent on individual health status, smoking history, type and amount of exposure as well as other factors.

Hydrogen Sulfide

T—A gas that is highly toxic, colorless and produced continually in anaerobically degenerating manure. At low concentrations, the gas smells of rotten eggs. High concentrations paralyze smell receptors making it difficult to notice the gas.

S—Buildings with partial or full manure pits beneath them pose the greatest potential for buildup of the gas. Backflow from outside pits can also increase concentration of hydrogen sulfide inside a building.

E—This is a very dangerous gas. Just a few breaths can cause sudden collapse and unconsciousness followed by death. These reactions make it imperative that manure pits be entered only by trained professionals with appropriate protective equipment.

Carbon Dioxide

T—An odorless and colorless gas which is heavier than air.

S—It is prevalent in grain bins filled with high moisture corn, airtight silos, or confinement buildings. The buildup in confinement buildings is due to animal respiration, manure degeneration, and combustion of heating fuels.

E—Exposure to low concentrations (5% or less) of carbon dioxide causes hyperventilation and mental confusion, which can lead to complications such as disorientation and falling. Inhalation at higher concentrations will cause an excessive and uncomfortable increase in respiratory rate. This can lead to respiratory failure and possible death by suffocation unless fresh air is added to the environment. These situations are a greater risk for livestock than farm workers since the workers have the ability to leave the environment.

Ammonia

T—A gas that has a very strong and pungent odor.

S—It is created when a bacterial reaction occurs with urine and feces on building floors and in any underlying pits. All livestock confinement buildings have some level of ammonia in them. Poultry buildings tend to have the highest concentrations.

E—This gas is very irritating to the eyes, the nose, and the respiratory tract. In fact, it is so irritating that usually the exposed person will leave the environment immediately, thus resulting in minimal or no damage to the lungs.

Carbon Monoxide

T—A poisonous, odorless, colorless, and tasteless gas which makes it difficult to detect.

S—Combustion engine exhaust, especially in an enclosed and poorly ventilated area, is the primary source of exposure for this gas.

E—Inhalation of this gas will cause deep breathing, facial flushing, dizziness, and headaches. These will occur following a small exposure over a long period of time, or a large exposure over a short period of time. In extreme cases unconsciousness and death can occur.

Oxides of Nitrogen

T—Oxygen reacts with nitrates that are stored in plants, specifically in silos, to form different nitrous oxide compounds. Levels are at their highest from 24 hours to 10 days after filling, however dangerous levels can still persist for up to 3 weeks. It is recommended that a silo not be entered unless absolutely necessary.

S—Oxides of nitrogen are produced in silos during fermentation of newly ensiled chopped green plant material. Being heavier than air, the gas will flow down the chute of a silo and enter the feed room and barn, especially if doors are kept open. Detection of the gas, so that exposure can be avoided, is possible. It has a bleach like odor and a yellowish or reddish color. Staining will occur on the silage or any other surface that the gas comes in contact with. Animals will appear ill and dead birds and/or small animals may be found around the base of the silo.

E—Reactions to exposure can be either mild with no long term affect, severe enough to require hospitalization or even cause death. The severity depends on the concentration of gas and length of exposure.

Exposure to low concentrations generates the mildest reaction. Symptoms could include eye irritation, coughing, labored breathing, fatigue, nausea, or sleepiness. Complete recovery occurs 1-2 weeks after exposure. Exposure to higher concentrations causes "silo filler's disease," a disease with reactions and symptoms of pulmonary edema. *(See the section on pulmonary edema for more information.)* Exposure to very high concentrations can be fatal. Within minutes a victim can collapse, become unconscious and die.

Pesticides

T—Pesticides are a group of chemicals that come in many forms: dusts, granules and wettable powders. Organophosphates require special attention. They control pests by inhibiting the enzyme cholinesterase which is found in insects as well as mammals including humans. This enzyme is necessary for transmission of nerve impulses. Exposures disrupt the central nervous system.

S—Applicators are at risk while handling or applying pesticides, especially if they do not wear proper protective clothing. Field workers risk exposure if they enter a field without waiting the proper time period after the field is sprayed.

E—Symptoms of poisoning vary with the chemical type, strength, intensity, duration, and rate of exposure. Poisoning by organophosphates can result in death due to the toxic affect on the brain center controlling breathing. Chemical labels have information on what symptoms to watch for if exposed.

Anhydrous Ammonia

T—This chemical is colorless and has a pungent odor. It is stored as a liquid under pressure that becomes a vapor when released.

S—It is a common fertilizer that is injected into soil.

E—Mild cases of exposure, by inhalation, usually cause upper airway injuries. In extreme cases anhydrous ammonia can cause severe tissue damage, especially if a spill and exposure occur in an enclosed area. The exposure will cause fluid to fill the lungs (pulmonary edema), which may lead to death by suffocation.

Fumigants

T—A restricted group of chemicals that have a strong penetrating action, with some having the ability to penetrate rubber and plastic material of protective clothing and masks. Detection is often difficult since some fumigants are colorless and odorless.

S—Exposure occurs when there is improper ventilation or sealing of a fumigated structure; failure of equipment; accidental spills; improper use of respirators; and handling of grain with residue of persistent fumigants.

E—Depending on the amount of irritation the fumigants cause, injury can occur to either the upper respirator tract or the lung tissues themselves. A very irritating fumigant will typically not be inhaled deeply.

Thus, only the upper respiratory tract is exposed, inducing swelling of the tissues which can lead to suffocation. Less irritating fumigants are typically inhaled deeper into the respiratory tract causing damage to the lung tissues. This can lead to fluid in the lungs (pulmonary edema) and possible death.

Prevention and Reduction of Respiratory Hazards

Those who have experienced a respiratory impairment and those who want to prevent one will find that prevention and reduction of respiratory hazards is a difficult task due to the numerous sources of potential exposure. This does not mean that it is not possible or should not be attempted. The care of ones own health should be a priority. If for no other reason, work does not get accomplished if one is sick.

The following is a solution hierarchy that one can use to assist in determining how best to prevent or reduce a respiratory hazard.

Elimination of the Hazard/Exposure

The best way to prevent exposure is to eliminate the hazard totally. This can be accomplished by:

***Reassignment*—**Is there someone else who is less sensitive who can do the task that generates the exposure? For instance, someone with farmer's lung can have another worker take over the jobs involving hay and seed handling; or when a manure pit needs to be entered, a trained person can be hired to enter the pit for you.

***Elimination of the Task*—**Can the task be eliminated? Consider changing management practices. For example, instead of baling hay, store it as haylage in a silo in order to reduce dust.

***Elimination of the Source*—**Can the source be eliminated or prevented? Examples are: (1) building a manure storage facility outside of the livestock building will help reduce buildup of dangerous gases; (2) changing to less irritating chemicals will reduce exposure; (3) following standard procedures for handling and applying chemicals will help lower the risk of inhalation exposure; (4) storing only top quality grain that is adequately dried will help prevent mold growth; (5) capping silage with a plastic sheet held down with old tires instead of silage will reduce mold and dust in the top layer; and/or (6) keep storage areas clean to avoid the growth of mold and insect infestation.

Modification of the Task

Sometimes, modifying the way things are done can help prevent exposure. For instance: (1) wetting down the top layer of silage before removal will decrease dust levels; (2) handling dusty fodder mechanically, with the farmer at a safe distance, will decrease dust exposure; (3) using round bales of hay will enable the farmer to handle them mechanically and decrease exposure; (4) filling the silo quickly and fully will allow as little time as possible for formation of oxides of nitrogen; (5) pulling the cover off the top of the silage from the ground with a rope will make working inside the silo unnecessary; (6) thoroughly cleaning and disinfecting livestock buildings with a high pressure sprayer on a regular basis will decrease ammonia levels; (7) having wire mesh floors to facilitate self cleaning will decrease ammonia buildup; (8) using pellet feed or adding liquid fat to feed will decrease the amount of dust created; and/or (9) vacuuming dust instead of sweeping will minimize dust clouds.

Maintenance/Modification of Equipment

Equipment maintenance and modification can reduce or prevent respiratory hazards. Some examples are: (1) upkeep of a structure to keep out moisture, which can lead to moldy hay and/or grain; (2) keeping the ventilation system well maintained and increasing ventilation during grain handling will reduce dust levels; (3) a well maintained ventilation system will also assist in keeping the levels of confinement building gases to a minimum; (4) delivering feed by extension spouts into covered feeders will minimize the amount of dust the feed creates; and/or (5) keeping heating units clean, vented and

functioning properly will help reduce the level of toxic emissions and/or explosions or fires.

Personal Protective Equipment

NIOSH-approved respirators should be worn whenever handling chemicals or the environment is very dusty or there is exposure to an allergen by a sensitive individual. Some important things to remember are: (1) the protection is only as good as the condition of the equipment; (2) if the equipment is not maintained or worn properly, it will not protect the individual; (3) the equipment needs to fit the individual properly (facial hair prevents a good fit); and (4) the correct respirator needs to be worn for the specific task.

Some gas measurement devices and self-contained breathing apparatuses are available to the public; however, they are expensive. For more information on this equipment, contact an environmental consulting firm or a safety/health equipment supplier.

Health Care

As one can see, there are many areas of exposure on a farm that can lead to a respiratory impairment. The lungs however, only have certain ways to react to these exposures. This means that different diseases may result in similar reactions.

To assist a physician in diagnosis of the disease, a complete occupational history is a necessity. Information such as occupation, latest exposure, recent tasks, symptoms, and length of reaction assists the physician in obtaining a correct diagnosis.

To help prevent a chronic, debilitating disease from developing, it is recommended that a physician be seen on a regular basis. Usually, the patient's lung function is monitored. This is a simple, painless breathing test called spirometry. Performed in a physician's office, it measures lung abilities and capacities. A baseline is taken when healthy and then again when an illness occurs or on a yearly basis to determine if there are changes in the function of the lungs. This will help in diagnosis of illnesses and in monitoring any potential chronic problems.

Conclusion, References, and Resources

In conclusion, farming with a respiratory impairment is possible if measures are taken to decrease the amount of exposure to irritating substances. It is also possible to prevent these impairments from occurring if the farm is properly managed and maintained. With all the possible health risks involved, it is worth the extra effort.

References

American Lung Association of Iowa, The Institute of Agricultural Medicine and Occupational Health, The University of Iowa. 1986. *Agricultural Respiratory Hazards Education Series*. Des Moines, Iowa: American Lung Association.

Berkow, R. and A.J. Fletcher, eds. 1987. *Merck Manual of Diagnosis and Therapy*, 15th Ed. Rachway, New Jersey: Merck, Sharp and Dohme Research Laboratories.

Dosman, J.A. and D.W. Cockcroft, eds. 1989. *Principles of Health and Safety in Agriculture*. Boca Raton, Florida: CRC Press, Inc. (especially pages 26-34, 47-61, 72-75, and 164-168)

Thomas, C.L., ed. 1977. *Taber's Cyclopedic Medical Dictionary, 13th Ed*. Philadelphia: F.A. Davis Company.

Resources

American Lung Association
1740 Broadway
New York, New York 10019-4374
1-800-LUNG-USA

Breaking New Ground Resource Center
Purdue University
225 S. University Street
West Lafayette, IN 47907-2064
1-800-825-4264

State Extension Safety Specialist
(located at Land Grant Universities)