MECHANICAL HAZARDS

HOSTA Task Sheet 3.1 Core

NATIONAL SAFE TRACTOR AND MACHINERY OPERATON PROGRAM

Introduction

There are many hazards in agriculture associated with mechanical equipment. Knowing every hazard of every machine is very difficult. For this reason, agricultural safety and health professionals group them in ways that help the operator recognize the different types of hazards regardless of the machine.

Your ability to recognize these hazardous components is the first step in being safe.

This task sheet identifies groups of hazards, what the danger is, where the hazards may be found, and gives instruction for avoiding them.

Pinch, Wrap and Shear Points

A ***pinch point*** hazard is formed when two machine parts move together and at least one of the parts moves in a circle (Figure 3.1.a). These types of hazards are often found in power transmission systems such as belt drives, chain drives and gear drives. *Avoid pinch points by keeping machine guards in place.*

Any type of rotating machine component can be considered a ***wrap point.*** The rotating components are often shafts such as the PTO. Individuals can be caught in a wrap point by their loose clothing or long hair. *Guards can protect the operator from wrap points. Attention to dress and care of long hair is important as well.*

A ***shear point*** occurs when the edges of two machine parts move across or close enough to each other to cut a relatively soft material. One of the two objects can be stationary or moving while the second is moving. Hedge trimmers are a good example of a shear point.

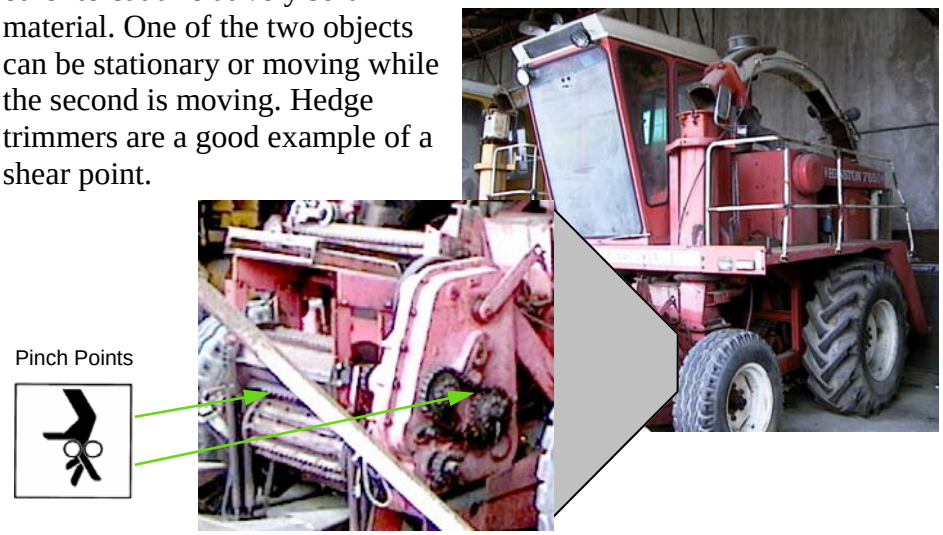

Figure 3.1.a. Pinch points can be found on most machines.

Shielding the worker from the shear point is difficult on many agricultural machines. *The best precaution to take for preventing injury is to shut off the machine before making repairs or adjustments.*

Learning Goals

- To identify the mechanical hazards associated with agricultural machinery
- To avoid mechanical hazards

Related Task Sheets:

Reaction Time	2.3
Hazard Warning Signs	2.8
Making PTO Connections	5.4
Using Power Take-Off (PTO) Implements	5.4.1

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PTO Stub

- Transfers power from the tractor to the machine
- Rotates at 540 rpm (9 times/sec.) or at 1,000 rpm (16.6 times/sec.)
- Some tractors have a stub shaft guard that screws onto the PTO stub.

Master Shield

- Protects the operator from the PTO stub
- Is often damaged or removed and never replaced.

Figure 3.1.b. A PTO stub and a master shield on a tractor. A PTO is a wrap point hazard that causes countless injuries and deaths each year.

Awareness is the best protection from hazards that cannot be eliminated or shielded.

Crush, Pull-in and Burn Points

Crush points are formed when two objects are moving toward each other, or when one object is moving toward a stationary object, and the gap between the two is decreasing. The most common example of a crush point is formed when an implement is attached to a tractor's drawbar. Most often the tractor is moving toward a stationary implement, and the gap between the tractor's drawbar and the implements hitch is decreasing. *Do not permit another person to stand between the tractor and implement while hitching.*

Pull-in points occur most often where crops are fed into harvesting machinery. Rotating parts that come in close contact with each other, such as feed chambers on square balers. *To avoid being pulled into a machine, shut down the engine and the PTO before making repairs or adjustments.*

Hot mufflers, engine blocks, pipes, and fluids (fuel, oils, chemicals) are all examples of possible ***burn points*** on tractors, self-propelled machinery, and pulled machinery. Machine inspection, servicing, and maintenance are the most common types of activities that may result in exposure to a burn point hazard. *To avoid being burned, do not touch the engine or machine parts you are inspecting. Place your hand near the surface of the part to determine if heating has occurred.*

Figure 3.1.c. Pull-in points are found on harvesting machinery.

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Freewheeling Parts

When parts of a machine continue to move after the power to the machine has been turned off, they are called *freewheeling parts.* These hazards exist because many machines require a large amount of rotational force to keep them running smoothly under irregular loading. Bringing this rotational force to a sudden stop is almost impossible. A baler is an example of the freewheeling hazard.
To avoid injury from freewheeling parts, stop the tractor engine, disengage the PTO, and wait for the machine to stop completely before making repairs or adjustments.

Figure 3.1.d. The flywheel on a small square baler is an example of a freewheeling part. The flywheel keeps the baler running smoothly if a large amount of hay is suddenly taken into the bale chamber. Notice that part of the PTO driveline is unguarded.

Figure 3.1.e. Mowers are a frequent source of thrown objects.

Thrown Objects

Thrown object hazards occur as normal machine operations discharge materials into the surrounding environment. These hazards are formed by rotating fan or knife blades that are used to cut, grind or chop materials. The blades can throw small or large objects, such as glass, metal, rocks, sticks or other vegetation. A common example of a thrown object hazard is the material that it discharged from a rotary mower.
To avoid injury from thrown objects, be sure the machine is at a complete stop before nearing the discharge area. Keep the work area clear of bystanders. Wear eye protection when working with this type of hazard.

The ability to identify hazards is the first step in avoiding them.

Stored Energy

Stored energy hazards occur when energy that is confined is released unexpectedly. This hazard is present in pressurized systems and their components. Example include springs, hydraulic, pneumatic, and electrical systems.
Avoid the hazard of stored energy by knowing which parts which may be spring loaded. Relieve hydraulic system pressure when the job is completed. Ask for a demonstration of where you might encounter this potential hazard.

Figure 3.1.f. Hydraulic systems often have stored energy.

Cooperation provided by The Ohio State University and National Safety Council.

Safety Activities

1. Draw a line from the Mechanical Hazard to the correct definition.

Pinch Point ·	• Hot mufflers, engine blocks, pipes, and fluids (fuel, oils, chemicals) are all examples of this type of hazard on tractors, self-propelled machinery, and pulled machinery.
Freewheeling Part ·	• A hazard formed when two machine parts move together and at least one of the parts moves in a circle.
Pull-in Point ·	• This type of hazard occurs when machine parts continue to move after the power to the machine is turned off.
Shear Point ·	• Any type of rotating machine component can be considered this type of hazard.
Crush Point ·	• These types of hazards occur when a machine discharges materials into its surrounding environment.
Stored Energy ·	• A hazard formed when the edges of two objects move across or close enough to each other to cut a relatively soft material.
Burn Point ·	• These hazards are caused by energy that is confined and then released.
Wrap Point ·	• A hazard formed when two objects are moving toward each other or when one object is moving toward a stationary object, and the gap between the two is decreasing.
Thrown Objects ·	• Rotating parts that come in close contact with each other, such as feed rolls, often form these points. They can also be formed by moving components, such as feed chambers on square balers.

2. Find an old and a new machine on your farm or at a local dealership, and identify as many mechanical hazards as you can. Compare the two machines.

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1. Farm and Ranch Safety Management, John Deere Publishing, 1994.
2. ASAE Standards, 45th Ed. 1998. ANSI/ASAE S318 Safety for agricultural equipment. St. Joseph, MI: ASAE.
3. Murphy, D.J. 1992. *Safety and Health for Production Agriculture.* St. Joseph, MI: ASAE.

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NOISE HAZARDS AND HEARING PROTECTION

HOSTA Task Sheet 3.2

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

Farm equipment can generate high noise levels. High sound levels pose serious health risks to the people who work long hours around this equipment. Hearing damage seldom occurs with one loud noise. Hearing damage results from an exposure to loud noises over an extended period of time.

This task sheet will examine the problem of noise hazards and how to protect your hearing.

What Is Noise?

Sound is created by anything that causes pressure waves in the air. Different wave sizes, or frequencies, are formed by different levels of shock to the air. Unwanted sound is called "noise."

All sound, including noise, is measured in *decibels.* The unit of measurement is shown by the designation dB(A). A decibel meter is a tool that measures the dB level. The "A" represents the sound scale used for the measurement.

Not all sound levels are a hazard. Knowing typical sound levels of various sources of sounds helps us understand if the sound level is unsafe. Consider the following decibel level information.

Decibel Level Chart

dB(A) Level	Sound Source
15	A whisper
50	Gentle breeze or babbling brook
60	Normal talk level
85	Tractor at idle engine speed
90	Chopping silage (no cab) or lawnmower at full throttle
100	Tractor at work or table saw in use
110	Stereo with headphones set at mid-volume
120	Bad muffler or rock concert
140	Shotgun blast or jet engine

Sound levels that cause hearing loss begin at about 85 dB(A). Hearing loss occurs more quickly with louder noise. See Table 3.2 for time exposure to various sound levels which can lead to hearing loss.

OSHA standards consider sound measured at 85 decibels or higher as damaging to the eardrum and therefore a risk to hearing.

Figure 3.2.a. A straight pipe used for the exhaust or a worn-out muffler will increase noise levels coming from the engine. Muffler condition should be part of a safety audit.

You don't adapt to loud noise; you lose your ability to hear loud noise.

Learning Goals

- To recognize when sound levels can become a threat to hearing
- To use correct hearing protection devices

Related Task Sheets:

The Work Environment	1.1
Personal Dress	2.7

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Permissible Noise Exposures:

Duration Per Day (hours)	Sound Level, dB(A)
8	90
6	92
4	95
2	100
1	105
1/2	110
1/4	115

Table 3.2. Exposure time limits to sound levels decrease as the db(A) level increases. Use the chart on page 1 to answer the following questions. What is the sound level at your high school dance or at a rock concert? How long should you be exposed to that intensity of sound pressure level?

Is loud music or farm equipment causing you to lose your hearing?

How Does Hearing Loss Occur?

Sound waves have pressure. High frequency sound waves have greater pressure than lower frequency sound waves. This pressure pushes on the ear drum.

Hearing loss occurs over a period of time. Deafness and loss of hearing usually occur with the high frequency sounds and not the lower frequency sounds.

Hearing is lost as auditory nerve endings are exposed to the same frequency of sound for extended time periods. The nerves lose their ability to recover from that hostile frequency. The ability to hear that sound frequency is then decreased forever.

Sound levels may be nearing the danger point for hearing loss if you notice any of these:

- Ears ringing
- Noises in your head
- Your own speech sounds muffled
- You have to shout to be heard by someone working next to you

By the time you recognize any of these events, some hearing loss has occurred.

Hearing loss accumulates over time and cannot be reversed. Hearing aid assistance may be necessary. Many older farmers have developed hearing problems over time. Hearing loss in the young also occurs. With the knowledge gained from this task sheet, the younger farm worker should avoid unnecessary hearing loss.

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Protection of Hearing

Reduction of excessive noise is the first step to hearing protection. Hearing protection starts in the farm shop by keeping the exhaust and muffler system of the tractor in good repair. Machine parts that are not well-lubricated or adjusted also cause loud noises.

What farm tasks have you encountered that require hearing protection?

Reduction of excess noise levels may require a sound proofing barrier between the ear and the source of the noise. Sound-proof tractor cabs are designed to reduce sound levels. Compressor rooms may need to be sound-proofed as well. Sound-insulating building materials can reduce noise levels.

Where on your farm is the highest noise level likely to be found?

Types of Ear Protection

Commercially available hearing protection devices are recommended. There are two devices to use. They are:

- Acoustical Muffs
- Ear Plugs

Acoustical Muffs

Acoustical muffs, or ear muffs, are effective in reducing sound level at the ear. They cover the ear and ear canal to provide a barrier to sound. They do not block out all sounds, therefore, conversation for information and safety purposes is readily heard.

Ear Plugs

Ear plugs are made to fit into the ear opening. A snug, tight fit is necessary for effective sound reduction. Ear plugs can be a source of ear infection; so they must be kept clean and sanitized. Do not share ear plugs with others as ear infection can be spread in this way.

There are two types of ear plugs:

- Formable Plugs

  These plugs are compressed before inserting into the ear. They expand to fill the ear canal. One size fits all.

- Preformed Plugs

  These plugs come in many sizes and must be fitted to the individual's ear. They usually have a cord attached between each plug making them more difficult to lose.

Ear-protection devices are ranked by their Noise Reduction Rating (NRR). An NRR31 rating signifies that noise will be reduced by as much as 31 decibels under ideal conditions. For example, in a 100 dB(A) work area, a device with a NRR of 31dB would reduce the effective sound level to 69dB.

Be sure that the hearing-protection device reduces sound to a safe level. Typical ratings are shown.

Device	dB NRR
Ear Muffs	21-31
Ear Plugs	26-33
Combined	Add 3-5 db

Figure 3.2.b. Acoustical ear muffs offer the greatest level of hearing protection because they cover the entire ear and ear canal.

Cotton stuffed into the ears does not offer hearing protection!

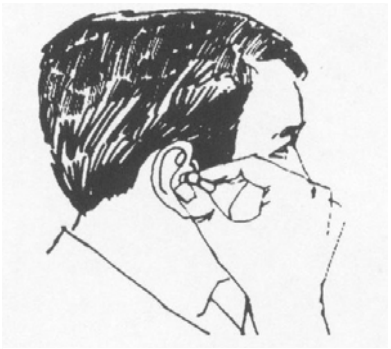

Figure 3.2.c. Ear plugs offer hearing protection, but not as much as full-ear coverage protection devices. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

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Safety Activities

1. Obtain a decibel meter (available at electronics stores if your school or club does not have one), measure and record the decibel levels of the following farming operations:

    A. Tractor being used to agitate liquid manure
    B. Tractor being used to operate ensilage blower
    C. Chain saw in use
    D. Milk-cooling equipment compressor

2. Using a supply catalog, such as Gempler's or NASCO, make a list of the various ear-protection devices, their NRR, and their costs.

3. Call a hearing-protection salesperson and a hearing-aid dealer and request hearing-protection literature, or invite them to make a presentation to your group, family, or coworkers.
4. Have a hearing test done as a baseline test to compare your hearing results on an annual basis.
5. Make arrangements with the school nurse or a volunteer nurse to conduct hearing tests for local farmers.

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1. Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.
2. www.gemplers.com/ Type in search box key word(s), hearing protection/Choose a site.
3. www.howstuffworks.com/Type in search box key word decibel/Choose a site.
4. www.osha.gov.

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RESPIRATORY HAZARDS

HOSTA Task Sheet 3.3

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

The daily activities of farming generate dust and dirt. Working with crops, livestock, and equipment creates more dust and dirt. The worker is placed in conditions perfect for the growth of microorganisms, such as fungi and molds. The worker is often exposed to hazardous gases and vapors. Farm shop work can create respiratory hazards as well. Oxygen-deficient areas present the risk of death.

Continual exposure to breathing hazards creates long-term health problems. Farm workers can suffer from breathing difficulties, such as asthma, "farmers lung," and organic dust toxicity syndrome (ODTS).

This task sheet discusses the problem of respiratory hazards. Respiratory-protection equipment and practices will be discussed in Task Sheet 3.3.1.

Dusts, Mists, and Fumes

Particulates are airborne particles of material that can be measured. Dusts, mists, and fumes make up a group of various-sized particles. They are measured in microns. A micron is 1/25,400th of an inch (50 micron-size particles are visible). Particle sizes over 5 microns are heavy enough to settle quickly without posing a respiration hazard. Finer materials are the major concern to lung health.

Dusts—Dusts include the solid particles (0.1– 25 microns in size) created by handling, crushing, grinding, and moving materials such as rock, metal, wood, and crops.

Crop production exposes the worker to dust particles from the crop, spores from microorganisms growing on the crop, and the fine, airborne particles of soil stirred by field work. Many particle sizes are produced. Fine chopped crop particles can be inhaled into the lungs (respirable dust). As plant materials break down, molds and fungus are also inhaled.

Livestock production exposes the worker to dirt, dust, mites, fungus, and the dry scaly skin found on or around the animal or bird or in its housing area. Antibiotics added to livestock feeds can also pose a respiration hazard.

Mists—Liquid droplets suspended in the air represent mists as a respiration hazard. Paint sprays and cutting oil become airborne breathing hazards.

Fumes —Material that becomes airborne during welding (metal, welding rod, and flux) are examples of fumes. See page 2 for a discussion of toxic gases and vapors.

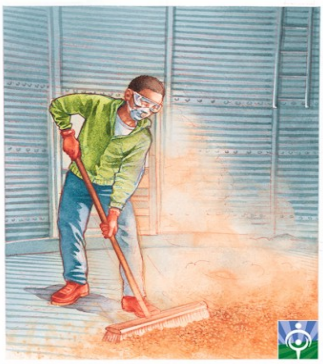

Figure 3.3.a. Dust from agricultural work can lead to eye and lung irritation. Respiratory protection, such as filter masks, are discussed in Task Sheet 3.3.1.

Coal miners can get "black lung" from breathing coal dust. Farmers can get "green lung."

Learning Goals

- To recognize respiratory hazards associated with agriculture

Related Task Sheets:

The Work Environment	1.1
Agricultural Safety and Health	1.4
Personal Protective Equipment	2.10
First Aid and Rescue	2.11
Silos	3.9
Grain Bins	3.10
Manure Storage	3.11
Anhydrous Ammonia	3.12

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Carbon monoxide vapors from engines can kill. This gas is colorless and odorless.

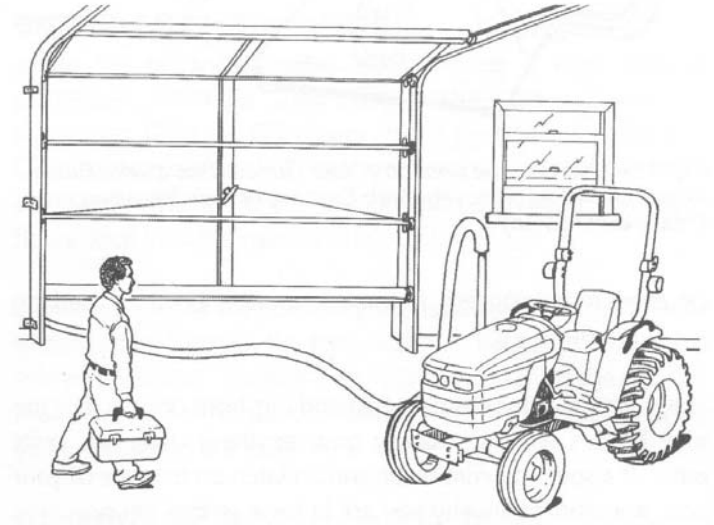

Figure 3.3.b. Internal-combustion engines produce carbon monoxide gas in the exhaust. This colorless, odorless gas can asphyxiate or suffocate a person working on the engine in an enclosed area. Be sure to ventilate the exhaust gases to the outside of the building, or work with plenty of air flow into the building. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

Gases and Vapors

Manure Gases

Manure breaks down chemically when held in storage pits. Hydrogen sulfide, carbon dioxide, ammonia, and methane gases are produced in the manure. These gases intensify in their concentration and are trapped in the manure. The oxygen level of the storage pit or tank becomes too low to support life.

To move the manure from storage to field application, the manure must be agitated and pumped to a spreader unit. The gases are then released into the air.

With equipment breakdowns, unsuspecting farm workers have entered the unventilated, low-oxygen level, confined areas and have been killed by suffocation. Oftentimes a family member has attempted a rescue and has been killed also.

Stay out of manure storage facilities!

Manure gases can cause asphyxiation, eye and nose irritation, or can be explosive (methane). See Task Sheet 3.11 for more details.

Silo Gases

The silage fermentation process produces deadly nitrogen dioxide gas. This yellow brown gas is heavier than air and settles to a low point in the silo or feed room. Workers entering unventilated silos are often overcome with this gas. A few survive the exposure with lung damage, but many victims perish. See Task Sheet 3.9 for further discussion on silo safety.

Farm Shop Gases

The farm shop exposes workers to respiratory hazards during jobs such as welding, painting, and engine repair. Ventilation is needed for each of these tasks. *Check with the owner of the shop as to what safety procedures to follow to activate ventilation fans.*

Welding

Ventilation is necessary during all welding processes. Galvanized metal emits zinc smoke fumes during welding. These fumes can be fatal to inhale. Weld gases such as acetylene can be explosive in high concentrations. The arcing of a light switch can cause acetylene vapors to explode.

Engines

Engines produce deadly carbon monoxide gas. This colorless, odorless gas can asphyxiate the worker who operates an engine in an enclosed area. Do not operate an internal combustion engine inside a closed building!

Solvents and Paint Thinners

Vapors from paint thinners or solvents are released into the air and can be explosive. Paint thinners also produce symptoms of nausea when inhaled. Skin damage is possible. Read the labels on solvents and thinners to learn about ventilation requirements.

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Lung Disease

Inhalation of dusts, mists, fumes, vapors, gases, and smoke causes irritation to the respiratory system. Repeated, prolonged exposure can cause more severe problems. Two of the problems are described here.

Farmer's Lung– Farmer's Lung is an allergic reaction caused by inhaling moldy hay, straw, and grain. When the lungs cannot remove the material, an allergy can develop. Repeated exposure further increases lung tissue damage and allergic reaction. Symptoms are similar to those of pneumonia.

Organic Dust Toxicity Syndrome (ODTS)- ODTS is caused by a reaction to inhaling molds from spoiling grain and forage. ODTS usually does not cause permanent lung damage. Symptoms include cough, fever, chills, body aches, and fatigue. Symptoms can last 1-7 days.

Asthma

Do you know someone who has asthma? They probably use an inhalant (medicine in an aerosol tube) to provide breathing relief. National statistics show an increase in the number of persons suffering from asthma

What is asthma? Asthma is a disease of the respiratory system. It is not known how people develop asthma. The small air tubes of the lungs tend to make more mucous than normal. The air tubes tend to swell, and the muscles around the air tubes tighten when an asthma attack occurs.

Asthma can be triggered by several causes. Some of them are:

- Allergies
- Infection (colds and bronchitis)
- Weather changes
- Smoke
- Physical exercise

Allergies such as exposure to dusts, mists, fumes, vapors, and gases irritate the lungs and can bring on an asthma attack. All of these irritants can be found in agriculture. Weather changes can lead to colds and bronchitis. Hot, humid weather as well as winter cold is a factor in asthma. Cigarette smoking or standing in the smoke of a burning fire is an irritant to the lungs also. Sports activities and physical work can also trigger an asthma attack.

If you are an asthma sufferer, there are two recommendations.

1. Avoid those factors that trigger an asthma attack.
2. Follow your doctor's advice and prescription program.

Since repeated exposure to lung irritants reduces respiratory health, asthma can develop. Take the necessary precautions to protect your lungs from developing asthma and other respiratory problems.

Respiratory-protection devices will be discussed in Task Sheet 3.3.1. Be sure to use the knowledge from this task sheet to select the proper respiratory protection for the materials with which you are working.

Figure 3.3.c. Welding produces fumes. As the metal melts, and the welding rod and flux covering is burned, fumes are produced. These fumes can cause irritation to the nose and lungs.

When you can't breathe, nothing else matters.®
American Lung Association

Figure 3.3.d. Silo gas can leave a person unconscious or dead. It is difficult to rescue a victim from inside of a farm silo.

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Safety Activities

1. Visit the American Lung Association website (www.lungusa.org) to learn more about lung disease.

2. Invite a respiratory therapist to speak to you, your 4-H club, or FFA chapter about lung disease and its prevention.

3. Visit the website www.gemplers.com. Locate the respiratory-protective devices for the following situations, and then make a chart of the device, use, and price:

Device	Used For:	Price Range	NIOSH Rating
_____	Welding Respirator	_____	_____
_____	Dust/Mist Respirator	_____	_____
_____	Nuisance Odor Respirator (livestock odors)	_____	_____
_____	Full-Face Respirator	_____	_____

4. Interview older farmers in the community about their experiences with “farmers lung” and ODTS, then write a news article to submit to an agricultural publication or newspaper in your state.

5. Interview people in your community who are welders. Ask them what they do to protect their lungs.

References

1. Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.
2. Any Internet search engine. Type in asthma. Scroll to various sites to learn about asthma.
3. www.gemplers.com.
4. www.lungusa.org

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RESPIRATORY PROTECTION

HOSTA Task Sheet 3.3.1

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

Many people think that farming means working in the clean, fresh air. Farming, however, has many respiratory (breathing) hazards. Some air will be dirty. Some air can be lethal (deadly) to breathe.

This task sheet discusses respiratory-protection devices to be used in agricultural work. Specific devices must be used with the correct work hazard to reduce lung damage. Failure to use the correct device can be the same as having no protection at all.

Breathing Hazards

The first step in selecting a respirator is to determine what the hazard is. Three categories of respiratory hazards can be found on the farm. They are:

- Particulates (dusts, mists, fumes)
- Gases and vapors
- Oxygen-deficient atmospheres

Particulates

Particulates are airborne particles of sizes that can be measured. Dusts, mists, and fumes are the types of these various-sized particles. Dusts are the largest-size particles. Dust may be dirt, but also can be spores from moldy hay, silage, or grain. Mists are suspended liquid droplets held in the air from mixing, cleaning, and spraying operations. Fumes are particles of airborne solid evaporated metals such as from welding tasks.

Gases and Vapors

Chemical reactions of materials with the air produce gases and vapors. Gases are released from chemical reactions, such as manure decomposition, silage fermentation, and the exhausts of internal combustion engines. The gaseous products of these reactions exist during normal temperatures of the reaction.

Vapors are gases from substances that are normally solid or liquid. Evaporation from liquids, such as pesticides, paints, adhesives, and solvents become vapors. These become airborne breathing hazards.

Oxygen-Deficient Atmospheres

The air we breathe normally contains about 21% oxygen.

Some agricultural storage areas are oxygen-free by design or by the chemical reaction going on inside of them.

- Sealed silos are kept free of oxygen to keep certain bacteria from spoiling the silage.
- Controlled Atmosphere (CA) storages of fruit and vegetables lower the oxygen levels to maintain food quality and storage times.
- Manure storage, especially covered pits, become oxygen-deficient due to manure decomposition depleting the oxygen supply.

Figure 3.3.1.a. Safety signs warn us of immediate danger. This sign tells us that respiratory protection is required. What other safety practices does this warning sign recommend?

Try a different work practice to reduce breathing hazards. If you are still at risk, use a respirator.

Learning Goals

- To be able to select the correct respiratory protection for use in specific agricultural work

Related Task Sheets:

The Work Environment	1.1
Worker Protection Standards	1.2.4
Personal Protective Equipment	2.10
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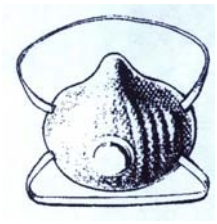
IDLH environments are immediately dangerous to life and health.



A. Disposable toxic dust mask

B. Chemical cartridge mask

C. Powered air purifying respirator (PAPR)

D. Self-contained breathing apparatus (SCBA)

Figure 3.3.1.b. Respirators are available in two main categories. Air-purifying respirators such as the disposable toxic dust mask (A), the chemical cartridge mask (B), and the powered air-purifying respirator (PAPR), (C) shown above. Air-supplying respirators or self-contained breathing apparatus (SCBA), (D) provide clean fresh air from an outside source.

Types of Respirators

There is no such thing as an all-purpose respirator. Specific respirators are used for specific contaminants. A disposable dust mask will not filter chemicals. A self-contained breathing apparatus (SCBA) is not needed to load hay on a wagon.

Respirators can be placed in two categories:

- Air-purifying respirators
- Supplied-air respirators

See Figure 3.3.1.b.

Air-purifying respirators are equipped with filters. The user breathes through these filters. The respirator filters may be disposable or may be replaced according to the material to be filtered. See Figures 3.3.1.c and 3.3.1.d.

Replacement-filter respirators should have filters replaced when your breathing becomes labored, the mask loses its shape or no longer fits your face, or you taste or smell the substance. A mechanical filter for particulates is not a replacement for a chemical-replacement filter.

Gas masks filter chemicals through a cartridge canister filter system. They have a full-face piece. Do not use the gas mask-type respirator in an oxygen limited area as they do not supply oxygen to the user.

Powered Air Purifying Respirators (PAPR) have a motorized blower to force air through a filter to the wearer. A constant stream of air is placed over the user's head and face. They have the appearance of a hard hat with a face shield.

Air-supplying respirators bring an outside source of air to the wearer. These respirators are used in those areas where the oxygen levels are so low that they are considered immediately dangerous to life or health (IDLH).

Air-supplying respirators are of two types:

- Air-line respirator
- Self-contained breathing apparatus (SCBA)

Air-line respirators supply air to a respirator facepiece through a hose connected to an air pump or tank. *Self-Contained Breathing Apparatus (SCBA)* devices have a portable air tank that must be carried on the back like those worn by scuba divers and firefighters. Air-supplying respirators are expensive, and the user must learn and practice how to use them.

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Use and Care of a Respirator

Respirators must be properly cared for if they are to protect your lungs. The device must snugly fit your face to provide lung protection. The respirator must not expose you to harmful residues either. The respirator must be cleaned. Filters must be changed often.

A properly fitted respirator will make an air-tight seal around your mouth and nose but still allow you to breathe. Poorly fitted respirators provide little or no protection. Dirty filters will prevent you from breathing normally.

Respirators must be clean before use. Clean the respirator body with warm soapy water and rinse thoroughly. Change the filters also. Clean the straps as well.

Use disposable filter masks just one time; then dispose of them.

Selecting a Respirator

Approved respiratory protection equipment should have a MSHA (Mine Safety and Health Administration) or NIOSH (National Institute for Occupational Safety and Health) number shown on the device. Letter and number designations can be found. Look for the designation to be sure that the respirator is approved. Older labels will show the MSHA/ NIOSH TC# or approval number. For example, a TC-23C respirator is used for pesticides. There may be older respiratory-protection devices to be found where you are employed.

Newer labels on respirators will show the NIOSH TC approval number and describe the new NIOSH-approved respirator. An example would be the NIOSH TC-23C dual-cartridge half mask with disposable filter used for pesticides and ammonia.

Under current standards, air-filtering masks or respirators are rated according to the filter's efficiency in reducing solid particles of dust, mists, and fumes. Respirators are rated as being 95%, 99%, and 99.97 percent effective at filtering dust particles.

Filters are also rated according to time-use limitations in using the filter for protection against oil-based chemicals or pesticides in the atmosphere. The following designations are found:

N= Not resistant to airborne oils. Becomes plugged quickly.

R= Resistant to airborne oils for up to 8 hours

P= Oil proof– Possibly resistant to airborne oils for more than 8 hours. Change filters after 40 hours of use or every 30 days, whichever is first.

The air-purifying disposable filter mask in Figure 3.3.1.c. could have a N95 rating. The filter respirator in Figure 3.3.d. may have a N99.97 NIOSH rating. This assures you that the filter offers 99.97% protection from exposure to particulates. There are no 100% filters in theory.

Use a respirator for its intended use only, and take proper care of the respirator as well.

Figure 3.3.1.c. A double-strap respirator provides for a snug fit over the mouth and nose. If a respiratory protective device does not fit snugly, it cannot offer effective respiratory protection from small particles that can damage your lungs. A beard may cause the respirator to fit improperly.

Figure 3.3.1.d. The chemical cartridge respirator mask has a replaceable filter to trap dust, chaff, and larger particles. These respirators do not supply oxygen. These respirators do not filter toxic dust and vapor materials.

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Figure 3.3.1.e. The nuisance dust mask is the simplest form of protection. These devices do not filter out small particles of dust that cause respiratory disease. You can identify a nuisance mask by its single strap.

A handkerchief over the nose will not filter gases, fumes, or small particles!

Safety Activities

1. During a farm visit, list as many places as you can that are oxygen-limited structures or locations.
2. Are all silos oxygen-limiting? Why or why not?
3. Visit a local orchard to find out more about controlled atmosphere (CA) storage of apples. Write a report on CA storage.
4. Using a vendor's catalog such as Gemplers, Inc, locate the respiratory-protective devices, and make a chart including the efficiency rating (95, 99, 99.97) and the respirator's rating for exposure to oils in the atmosphere (N, R, P) for each of the devices.
5. Match the recommended respirator type with the situation where that respirator would be used.

A._____ Air-purifying filter mask with double straps	1. Oxygen-limited area, such as a manure pit.
B._____ Chemical cartridge face shield and respirator	2. Nuisance dust areas, such as sweeping a shop.
C_____SCBA	3. Pesticide mixing and filling area.

References

1. www.cdc.gov/niosh (Search the site for respirator use information)
2. www.gemplers.com.
3. Farm Respiratory Protection, Fact Sheet E-36, College of Agricultural Sciences, Department of Agricultural and Biological Engineering, Dennis J, Murphy and Cathleen M. LaCross.
4. Farm and Ranch Safety Management, John Deere Publishing, 1994.

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Credits

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