AGRICULTURAL SAFETY

STUDENT EDITION

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Agricultural Safety
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Agricultural production is the most hazardous occupation in America. Each year, accidents in agricultural work cause thousands of injuries and hundreds of deaths. For young agricultural workers age 15-17, the risk of fatal injury is four times the risk for young workers in other workplaces.

Health and safety hazards in agriculture include:

- chemicals/pesticides
- cold
- dust
- electricity
- grain bins
- hand tools
- highway traffic
- lifting
- livestock handling
- machinery/equipment
- manure pits
- mud
- noise
- ponds
- silos
- slips, trips, and falls
- sun/heat
- toxic gases
- tractors
- wells

Many of the hazards in agriculture are similar to hazards in other career fields. For example, workers in agriculture must be aware of the potential hazards of power tools and use them properly. As in other occupations where much of the work is done outdoors, workers in agriculture must protect themselves against heat and cold, and must recognize the symptoms of heat- and cold-related illnesses. Certainly, the agricultural workplace resembles many others in terms of the opportunities for sprains and strains and for slips, trips, and falls on the job. These kinds of hazards exist in agriculture, as well as in many workplaces.

The agricultural workplace is also unique from other workplaces. For many agricultural workers, the workplace is also their *home*. This often means that workplace safety issues must also address children and others who may be present. Because much of the work in agriculture takes place in rural areas, work-related accidents can have more serious consequences. Many rural communities may not have the same access to emergency medical services as in many non-rural areas.

In addition to many safety and health hazards that it shares with other occupations, agriculture also poses unique hazards. For example, *suffocation in grain bins* is a recognized hazard. Shortly after the grain starts flowing, a funnel-shaped flow pattern develops: grain from the surface flows to the center, then down to the floor in a column. A person entering the bin will be carried to the center and quickly drawn under in this column of grain. The flowing grain behaves like quicksand, making escape very

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difficult. Many agricultural operations also use *manure pits* or *tanks*. Manure pit systems are used primarily on livestock farms (including dairy operations) to allow for the easy cleaning of animal confinement buildings and the efficient underground storage of large amounts of raw manure.

Inside the pit, the manure undergoes anaerobic digestive fermentation to form fertilizer. The digestive process can generate four potentially dangerous gases: methane, hydrogen sulfide, carbon dioxide, and ammonia. As these gases accumulate within the confined space of the manure pit, an oxygen-deficient, toxic, and/or explosive environment results.

Most injuries and fatalities can be prevented with proper training, education, and awareness. This guide can expand your awareness of the potential hazards associated with agricultural work. Increasing your awareness of hazards can help protect you—and others—from accidents and situations that can lead to injury and even death.

UNIT 1 - CONFINED SPACES

Confined spaces have limited openings for entry and exit, have unfavorable natural ventilation, and are not designed for continuous occupancy by workers. Many workplaces involve working in confined spaces. Examples include manholes, pipelines, and storage tanks. Confined spaces common in agricultural work are manure pits and grain storage bins/silos.

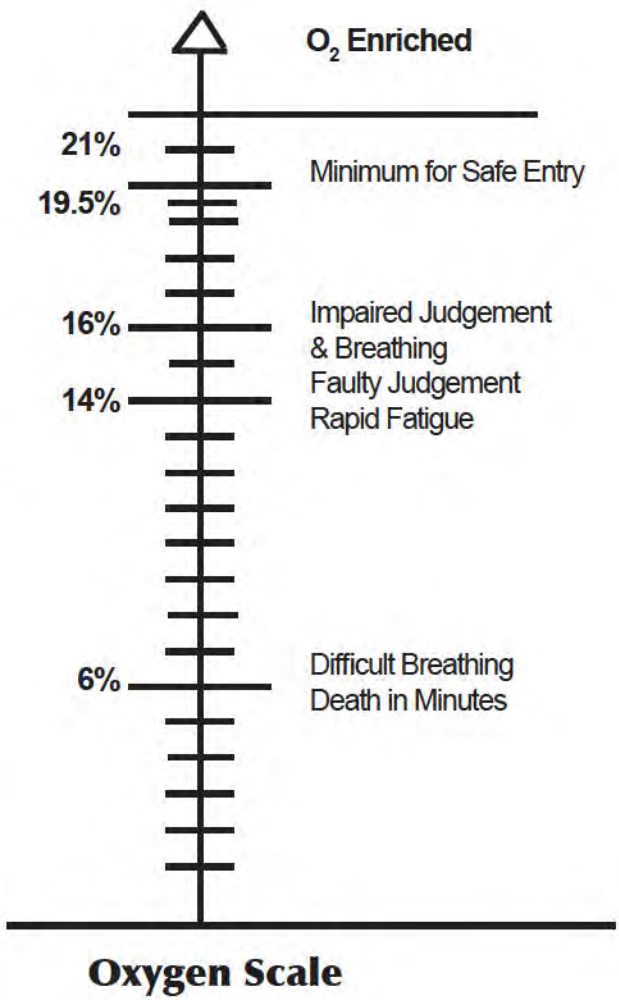
Confined spaces pose *special hazards* for workers. These hazards can result in injury or death.

Hazardous Atmospheres

The atmosphere in a confined space can be extremely hazardous due to the lack of natural air movement. This can result in oxygen-deficient atmospheres, flammable atmospheres, and/or toxic atmospheres.

An *oxygen-deficient atmosphere* has less than 19.5% available oxygen. In a confined space, the oxygen level can decrease due to work being done—such as welding, cutting, or brazing—or due to chemical reactions (rusting) or bacterial action (fermentation). The oxygen level also decreases if another gas takes the place of the oxygen in the confined space. Total displacement of oxygen by another gas—such as by carbon dioxide—will result in unconsciousness, followed by death.

A *flammable atmosphere* results from the oxygen in air and a flammable gas, vapor, or dust in the proper mixture. If a source of ignition—such as a sparking or electrical tool—is introduced into a space containing a flammable atmosphere, an explosion will result. In addition, an atmosphere that is oxygen-rich—above 21% available oxygen—will cause flammable materials to burn violently when ignited. As a result, a confined space should never be ventilated with pure oxygen. Ventilate with normal air.

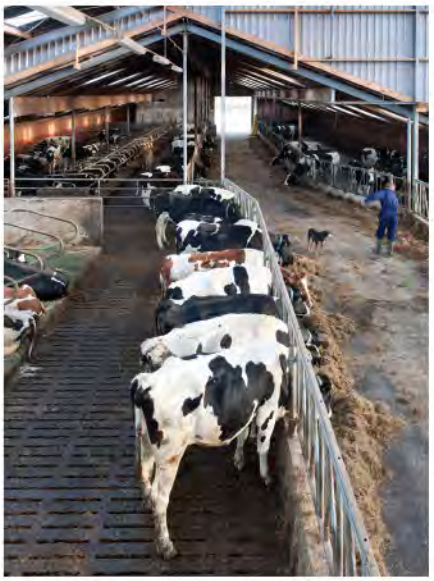


Oxygen Scale

A *toxic atmosphere* in a confined space can have three sources: products stored in the confined space; work performed in the confined space; or work performed in the immediate area of the confined space. Liquids, vapors, gases, mists, solid substances, and dusts are hazardous in a confined space and can create a toxic atmosphere.

Manure Pits

You may be unaware of the immediate danger posed by entry into manure pits. Like other types of confined spaces, manure pits present special problems regarding worker awareness of hazards. The dangerous atmospheric conditions may exist intermittently (on and off).



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The decomposition of waste that occurs in manure pits can create oxygen-deficient, toxic, and/or explosive atmospheres. The anaerobic bacterial action that breaks down the manure can generate methane, hydrogen sulfide, carbon dioxide, and ammonia. These gases may produce toxic effects. More importantly, they can displace oxygen in a confined space. Deaths can occur from lack of oxygen or from the toxic effects of these gases. In addition, methane and hydrogen sulfide may present an explosion hazard.

You should treat manure pits like any other type of confined space. This means:

- all manure pits should be ventilated
- the atmosphere within the pit should be tested before entry
- a standby person should be in constant contact and ready to lift you to safety with mechanical lifting equipment (winch, hoist, or pulley)
- anyone entering a manure pit should wear a safety belt or harness with a lifeline tied to the mechanical lifting device

In addition, a positive-pressure, self-contained breathing apparatus (SCBA) should be used by individuals entering the pit if an oxygen-deficient or toxic atmosphere is detected. If you are not trained to use SCBA equipment, you should never enter a manure pit unless absolutely necessary and only when proper safeguards have been taken! These safeguards include proper ventilation and proper isolation (lock-out, tag-out procedures).

Never enter a manure pit unless someone is standing by and maintaining constant contact. This standby person must:

- remain at the opening of the pit during the entire time the pit is occupied
- have a mechanical device (winch, hoist, or pulley) in place to help remove the person from the pit
- be physically capable of using the mechanical device to lift an unconscious victim from the pit without entering it
- resolve all details of the rescue plan, including availability of rescue equipment, before anyone enters the pit
- remember that a delay of even a few minutes could be fatal in an emergency

Always wear a harness or safety belt with a lifeline when entering a manure pit. Secure the end of this lifeline to the mechanical lifting equipment outside the pit. The use of a harness or safety belt with

a lifeline is critical—it is the only safe means for a standby person to rescue a worker from the pit without proper respiratory protection (i.e., positive-pressure, self-contained breathing apparatus).

Never enter a manure pit to attempt a rescue without proper respiratory protection (i.e., positive-pressure, self-contained breathing apparatus). Rescuers who enter the pit without such equipment will almost certainly become victims. Instead, call the local fire department or rescue squad immediately. They have the training and equipment needed to accomplish such a rescue without endangering other lives.

CASE REPORT

A 43-year-old dairy farm owner (victim #1) and his 23-year-old son (victim #2) died from asphyxiation after entering one of two adjacent 8-foot-deep manure-waste pits that were connected by a tunnel. The pits were located under each half of the end of a dairy holding barn and were connected so that both pits could be pumped from one side. The incident was unwitnessed, but evidence suggests the following sequence of events. The two victims were pumping the manure from the pit into a manure spreader tank using a pump located outside the barn that was being driven by a tractor's power take-off. The workers had pumped the manure from the pit containing the pump intake hose; however, the manure from the adjacent pit could not be pumped because the tunnel connecting the pits was obstructed. The father removed a steel grate cover and descended an aluminum ladder into the nearly empty pit. As he began to clear the tunnel of obstruction, the father was overcome. The son entered the pit in an attempt to rescue his father and was also overcome. The victims were discovered 22 hours later.

Source: National Institute for Occupational Safety and Health

Grain Storage

Suffocation in grain bins usually occurs when a person is buried while the bin is being emptied. Flat-bottomed grain bins are usually emptied through the center of the bin floor. Shortly after the grain starts flowing, a funnel-shaped flow pattern develops in which grain from the surface flows to the center, then down to the floor in a column. A person entering the bin will be carried to the center and quickly drawn under in this column of grain. The flowing grain behaves like quicksand, making escape very difficult. While you usually only sink several inches to a foot in still grain, you can sink to your knees almost immediately in flowing grain. In 10 seconds or less, you will be thigh-deep and unable to free yourself, since the moving grain cannot develop support. Typical unloading rates will completely bury a worker in less than a minute. In addition, some grains, such as flax and millet, cannot support a person, even when still.

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CASE REPORT

In 1999, a 15-year-old worker suffocated in a corn bin while working on his family's farm. He entered a 20,000-bushel corn bin through a door at the top to scoop corn away from a lower door of the bin. The corn in the bin sloped from the sides to the center. The center portion of the bin was empty, and the corn at the sides was about 7 feet high. A co-worker opened the bin door, didn't see the young worker, and assumed he had exited from the bin. About 30 minutes after the young worker entered the bin, two co-workers entered to check on him. They found him suffocated under approximately 4 feet of corn.

Source: Nebraska Department of Labor, cited in NIOSH ALERT: Preventing Deaths, Injuries, and Illnesses of Young Workers (DHHS/NIOSH Publication No. 2003-128)

Suffocation can also happen due to the build-up of deadly gases in storage bins. Fermenting silage produces nitric oxide (NO_2), nitrogen dioxide (NO_2), and nitrogen tetroxide (N_2O_4). NO_2 and N_2O_4 are respiratory irritants. Low concentrations of NO_2 can cause coughing, difficulty in breathing, or nausea. Higher concentrations may cause the lungs to fill with fluid, which can result in death. These symptoms may be immediate or may be delayed for several hours, for example, until night when the person is asleep.

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The suffocation hazard can be eliminated by never entering a silage- or grain-storage structure when it is being loaded or unloaded. The power to all conveying equipment, automatic and manual, should be shut off, locked, and tagged to prevent unexpected operation.

A permanent ladder on the inside of grain bins can help. If workers must enter the bin and unloading starts in spite of proper shut-off, lock-out precautions, they may be able to get to the ladder and climb to safety. Without a ladder, a victim's only hope for survival may be to keep walking around the perimeter of the bin to avoid being drawn to the center with the grain.

Caked or frozen grain or silage is also a suffocation or crushing injury threat. If a bin has been partially emptied below a crust of grain, someone who steps on the crust can fall through and become buried. You should always assume all surfaces are "bridged" with a surface crust. Break up surface crusts from outside the bin with a wooden pole—not a metal one—or a weighted line thrown through the bin door. Do not use metal poles, pipes, or lines—they are electrocution hazards, since they may contact overhead power lines near the grain bin.

Frozen or crusted material sticking to walls can fall on someone trying to break this material loose, crushing or suffocating the worker. It takes very little grain to entrap and suffocate a person. Never enter a storage structure below material that is sticking to the sides of the structure or caked on a wall. Break up this material from above.

A suffocation hazard also exists from the gases given off from spoiling grain. For example, the carbon dioxide (CO_2) given off is heavier than air and will collect above the grain surface. You cannot

smell, see, or taste the CO_2. If enough gas has collected to decrease the oxygen concentration from the normal 21 percent to less than 19.5 percent, you will think less clearly, become drowsy, lose consciousness, or even die. Workers who fall through crusted grain can be killed by CO_2 that has collected under the crust, even if they are not completely buried.

If a grain bin must be entered, three people should be used:

- The person entering the structure should wear a safety belt or harness attached to a lifeline.
- A second person should remain at the bin entrance to watch the person inside the bin and keep tension on the lifeline at all times to prevent the worker in the bin from slipping under the grain.
- The third person should remain on the ground to go for help or assist in freeing the person in the bin, if necessary.

All of the unloading equipment should be turned off, locked, and tagged. If the bin has a ventilating fan, it should be turned on to thoroughly ventilate the bin before entry and should be left on as long as a person is in the bin.

Knowledge Check

1. At what oxygen level is a confined space atmosphere considered unsafe for entry?
2. What are the three possible sources for a toxic atmosphere in a confined space?
3. What are four of the gases that can be generated in a manure pit?
4. Under typical unloading rates, a worker can be completely buried in what amount of time?
5. What particular gas is heavier than air, odorless and tasteless, and will collect above the grain surface?

UNIT 2 - MACHINERY & VEHICLES

Tractors, vehicles, and other farm equipment help farmers and ranchers do hard jobs more quickly and easily. Unfortunately, many serious accidents occur when people are using machinery. Most farm accidents and fatalities involve machinery. Tractor rollover accidents are common. So are injuries from being hit by or caught in the moving parts of machines. Often, these injuries result from the improper use of the machinery. The widespread use of powerful, fast, and unforgiving equipment such as combines, tractors, augers, and trucks—coupled with long workdays and the rush to get crops out of the field—contributes to the risk. However, anytime that equipment is running, it poses a hazard!

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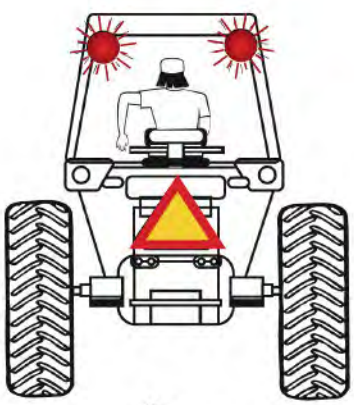
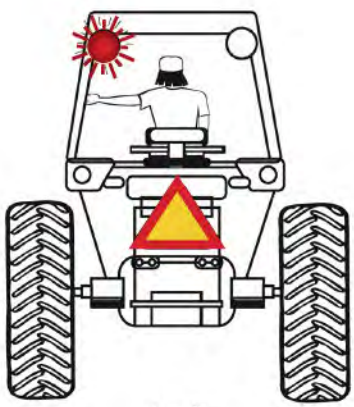
Vehicle Hand Signals

Agricultural work is often noisy. Hand signals allow you to communicate by sight, rather than by speech. Hand signals are used when operating farm equipment on public roads. These signals should be used when stopping or turning. The hand signals should be used in addition to vehicle signal or brake lights.

Many states have regulations that no person may turn any vehicle on public roads without first giving an appropriate signal. No person may stop or suddenly decrease speed without first giving an appropriate signal to any driver to the rear. All hand signals required must be given with the left hand and arm.



Stop



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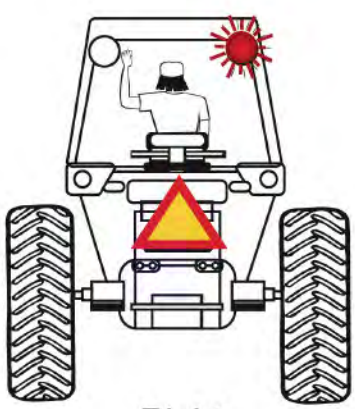

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Slow-Moving Vehicle Emblem

Whenever farm equipment travels on public roads, the slow-moving vehicle (SMV) emblem must be used. This symbol alerts other drivers to the hazard of a vehicle that is moving more slowly than expected. The SMV emblem must be used according to the following regulations:

- The SMV emblem is required on all vehicles that move 25 miles per hour or slower on public roads. Any time equipment is traveling faster than 25 miles per hour, the SMV emblem must be covered or removed.
- The emblem must be mounted point up and in plain sight of traffic approaching from the rear.

- The emblem must be mounted so that the bottom edge is 2 to 6 feet above the ground.
- The emblem must be displayed in addition to any lighting devices or other equipment required by law.
- The emblem must be displayed whether it is day or night.

A clean, unfaded SMV emblem—in combination with flashing amber lights—gives vehicles approaching from behind extra warning of a slow-moving vehicle ahead. It also gives as much as a football field in length of extra stopping distance!

Tractors, Harvesters, and Machinery

Tractors are indispensable to agriculture operations. However, operating a tractor is one of the most dangerous things you can do. You can help prevent tractor accidents by understanding why they occur and by avoiding unsafe situations. Sources of injury from tractor accidents include human error; overturns; mechanical breakdowns; refueling; and falling, runovers, and crushing.

Tractor overturns/rollovers are the largest single cause of agricultural machinery-related deaths. Rollovers can occur so quickly that you cannot react in time to jump off the tractor or get out of the way. Rearward rollovers can occur in 1.5 seconds and rollovers to the side can occur in 0.75 seconds. The point at which the tractor will continue to roll and not fall back on its wheels can be reached in 0.75 seconds for rear rollovers and 0.5 seconds for side rollovers. A person needs 0.3 to 1 second or more to recognize and respond to an unexpected event, depending upon the person, what that person is doing, and the distance the person has to move to respond. In many rollover situations, you simply could not react quickly enough to avoid injury after you realized that the machine had started to roll. The ways to prevent injury from a rollover are to prevent the roll from occurring and to protect yourself from being crushed if a roll should occur.

Human error causes most tractor accidents. Fatigue, haste, and carelessness contribute to unsafe situations with tractors or any farm machinery. To protect yourself and others:

- Pay attention to the task at hand. Don't let yourself be distracted.
- Take a break or stop if you are tired.
- Do not operate machinery when you are sick, medicated, sleepy, or upset.
- Stay alert.

Overturn accidents happen as a result of excessive speed, improper hitching, turning too quickly, or operating on a slope that is too steep. Rear overturns and side overturns are the major types of tractor upsets.

To avoid side overturns:

- Widen the wheel base to the widest setting possible for the job to be done. A wide wheel base provides the best base of stability for the tractor.
- Lock the brake pedals together before driving at transport speeds. Applying the brakes to one wheel only will cause the tractor to swerve abruptly. At high speeds, this will cause a side overturn.
- Restrict speed to suit operating conditions. Travel slowly enough to see and react to hazards such as bumps, rocks, stumps, holes, ruts, and depressions.
- Pull heavy loads and equipment at safe speeds. If the equipment you are pulling weaves, it will pull the tractor from side to side, causing you to lose control.
- Stay a safe distance from ditches, riverbanks, and other steep embankments. A good rule of thumb is to stay as far away from the bank as the ditch is deep. The weight of the tractor can cave-in the bank if the shear line is crossed or approached.
- Operate front-end loaders with the bucket as low as is practical.
- Turn slowly, especially on rough terrain.

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To avoid rear overturns:

- Hitch towed loads only to the drawbar and hitch points recommended by the tractor manufacturer. If the hitch point is raised above the recommended height, or if the load is attached to any other point but the drawbar, the chances of a backward upset are greatly increased.
- Add front-end weights to counterbalance heavy rear-mounted implements and heavy drawbar loads. Check the tractor's operating manual for specifications on front-end weights.
- Start forward motion slowly. Gunning the engine and jerking the foot off the clutch to start a heavy load is one of the surest ways to tip a tractor over backward.
- Stay off slopes that are too steep for safe operation.
- Brake cautiously if you must back down a grade. If a steep grade must be climbed, back the tractor up the grade and come down by driving forward, if possible.
- Back the tractor out of mud or pull it out with another tractor.
- Back the tractor out if the drive wheels become lodged in a ditch. The tractor may tip backward when being driven forward out of a ditch.

Stumps, rocks, ditches, or holes in fields are often forgotten as rollover hazards. It is easy to pay attention to the harvesting behind you and forget to watch for one of these dangers in front of you.

One way to remember these hazards is to mark the field with tall painted stakes or flags when the crop is small (and the hazards can be easily seen). Banks of ditches or streams are also common overturn sites. Banks that were stable at planting may have eroded or may not be able to support the weight of harvesting equipment. Always leave plenty of room when turning or driving near a bank edge. The distance from the tires to the bank edge should equal the ditch depth.

Overturns are also possible when tractors are used to pack silage into bunker silos. To help prevent overturns, use a tractor with a ROPS (see below) and that has dual wheels. The dual wheels may increase the tractor's lateral stability and help prevent a sideways overturn. You should also use a seat belt if the tractor has a ROPS.

Roll-Over Protective Structures (ROPS)

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Safe practices can reduce the chance of a rollover but not completely eliminate it. Roll-over protective structures (ROPS) can greatly reduce your chances of being killed if an overturn does occur. ROPS are designed to limit most rollovers to 90° and prevent operator deaths for rolls greater than 90°. These designs assume that the operator stays in the seat. To make sure you stay in the seat, you should always wear a seat belt on machinery equipped with a ROPS. (You should not use a seat belt on equipment without a ROPS, since staying in the seat on such equipment could increase your chances of injury.)

Newer tractors are equipped with ROPS. (ROPS have been required on tractors since 1976.) If you have an older tractor that does not have a ROPS, you can decrease your chance of being injured by using that tractor for jobs where a rollover is less likely to occur.

CASE REPORT

The victim approached the owner of a field, approximately 3 acres in size, and asked if he could mow the field for hay. The owner of the field gave his permission and offered the use of his tractor; the victim accepted. The victim drove the tractor from the owner's barn to the field approximately 200 yards away. The tractor (a 1950 model) was equipped with a rear-mounted, power take-off driven (PTO), mower assembly with a 7-foot-long cutter bar. The tractor had no rollover protection system (ROPS) or operator restraint system. These features were not required at the time the tractor was manufactured. The victim began mowing the field at one top corner of the field and mowed around the perimeter of the field without incident to the other top corner of the field. The ground at this top corner of the field was level; however, as the tractor progressed around this corner and across the top of the field, the field sloped into a 45-degree bank which was approximately 6.5 feet high. As the tractor approached the top of the bank (the left rear tire track was approximately 1 foot from the top), the tractor overturned in a downhill direction on top of the victim. When EMS personnel arrived at the scene, they summoned the coroner, who pronounced the victim dead at the scene. Although the event was unwitnessed, the tractor tracks and indentations in the ground indicated that the tractor rolled over twice. The location of the victim suggested that the tractor rolled over onto him on the first roll.

Source: National Institute for Occupational Safety and Health

Mechanical breakdowns — A tractor that does not steer, stop, or otherwise operate correctly is dangerous. To avoid danger from mechanical breakdown:

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- Maintain the tractor and auxiliary equipment in good condition.
- Repair any mechanical problems immediately. Pay particular attention to the brakes and steering mechanism—problems in these areas can be disastrous.
- Keep lights, safety belts, and other safety devices in good working order.

Refueling — Refueling equipment is a potentially hazardous situation. An overheated engine, a nearby cigarette, or even static electricity can ignite fumes and result in an explosion. To refuel safely:

- Turn off the engine on gasoline or liquid propane (LP) engines before refueling.
- Do not allow smoking in the area when refueling.
- Allow the engine a few minutes to cool off before refueling.
- Do not overfill the tank or allow spills. If fuel spills happen, give vapors time to dissipate before starting the engine.
- Perform daily checks of the tank and fuel lines for leaks.
- Keep a fire extinguisher readily available.
- Ensure proper ventilation in the refueling area to prevent the build-up of explosive vapors.

Falls, runovers, and crushing — Many people are injured or killed each year by being run over or crushed by a tractor. Carelessness and unsafe practices contribute to these accidents. To protect yourself and others:

- Keep the tractor clean, particularly the steps, platforms, pedals, and windshield.
- Put the tractor in gear or in Park, engage the parking brake, and stop the engine before leaving the vehicle.
- Remain aware of the whereabouts of any people or animals in the area.
- Do not allow extra riders. Follow the "one seat, one rider" rule.
- Keep guards and safety mechanisms in place.
- Read the operator's manual to understand how to properly operate tractors and other machinery.

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CASE REPORT

A 76-year-old farmer was killed while working on a rotary mower in his machine shed. The mower was attached to the three-point hitch of his tractor, which he had backed into a machine shed to change the mower blades. He raised the mower to a sufficient height to work underneath, but did not provide support or blocking for the mower. While he was lying on the floor working on the mower, the tractor hydraulics were leaking and the mower was slowly coming down. He was probably aware of the hydraulic problem, for he had been working with this same tractor and mower for several years. At one point, he apparently tried to roll out from under the mower, but became trapped between the right rear wheel of the mower and the mower deck. The mower continued to come down and pinned him to the floor, crushing him in the chest. A friend of the victim was expecting him to arrive in town for coffee and began to search for him when he did not appear. The farmer was found dead under the mower in his machine shed. The official cause of death was from suffocation.

Source: National Institute for Occupational Safety and Health

Servicing Safety

Many injuries from combines occur while cleaning, repairing, or adjusting the machine. Before performing any service, lower the header to the ground, place the machine in park or neutral, set the brake, stop the engine, and take the key with you. The owner's manual will specify those few operations that must be performed with the engine and machinery running or the header raised.

Never try to clear a clogged harvester with the machine running. If the clogged material clears, you can be pulled into the machine before you can react to let go or pull back. For example, corn is pulled through combine snapping rolls at more than 12 feet per second. If you are 3 feet from the rolls, your hand will be caught in 0.25 seconds. A person needs between 0.3 and 1 second or more to recognize and respond to an unexpected event. You cannot physically react in time; you will be caught! Stop the engine before clearing a clog to avoid this hazard.

CASE REPORT

The 42-year-old farmer was fatally injured when he attempted to adjust the spacing of the cultivator he was using. The deceased had stopped the forward motion of the tractor to which the cultivator was attached, but left the engine of the tractor running. The cultivator was equipped with a hydraulic-powered weeder bar that functioned off of the tractor's power take-off (PTO). Because the engine was still running, the weeder bar was rotating. The farmer raised the cultivator and climbed under it to make adjustments. As the deceased was exiting from under the cultivator, his jacket caught on the connecting bolt of the rotating weeder bar and twisted to the point of strangulation. Co-workers discovered the body, and notified the county sheriff and coroner. The farmer was pronounced dead at the scene.

Source: National Institute for Occupational Safety and Health

Make sure harvester headers cannot come down before getting under them. Use the manufacturer's hydraulic cylinder safety stops, if provided. If you have to use jacks, place them on firm, level surfaces. Use solid blocks to hold the machine when it is in position. Do not rely on jacks or other hydraulics for support—they can slip or develop leaks and you may be crushed.

Check for the rotation of forage harvester knives before opening access doors. The knives can rotate for a long time after the engine power is stopped. Even though the knives may rotate for a long time, let them stop on their own. Trying to stop the knives with a piece of wood or metal can damage the machine, draw you into the knives, or injure you with flying pieces.

Always follow the manufacturer's recommendations when sharpening forage harvester knives, or when replacing knives, forage blower blades, or combine cylinder bars. Be sure to torque the knife, blade, or bar attachment bolts to specifications. A loose bolt, nut, or part can become a deadly projectile.

Road Safety

Some harvester injuries are caused by collisions with other vehicles. Before traveling on the road, adjust hitches, fold unloading augers, or remove headers to make the machine as narrow as possible. Try to alert motorists as far in advance as possible by keeping bright, reflective Slow Moving Vehicle (SMV) symbols on all harvesters, tractors, and wagons. Use warning lights when possible. Signal all turns with lights or hand motions. To allow traffic to pass, wait for a safe place, then pull off onto the shoulder and stop. Do not drive on the shoulder. The shoulder may be rough or have other handling hazards that could lead to an overturn. If your vehicle does start to tip into the shoulder, steering down into the ditch may prevent a complete overturn. When going downhill, leave the transmission in a mid-range or low gear. Don't take the chance of losing control by shifting to neutral or leaving the machine in a high gear.

Consider having an escort vehicle follow to help alert motorists. This is especially important if left turns have to be made. Collisions can occur when machinery starting a left turn is struck by a car passing from behind.

Harvester stability is very dependent upon the header and grain tank. Heavy headers can tip the combine to the front. Keep the header as close to the ground as possible when traveling on or off the road. The weight of the crop in the grain storage tank raises the harvester's center of gravity. Raising the center of gravity makes the machine easier to tip. Avoid traveling at highway speeds with a full grain tank and reduce your travel speed for all turns, on or off the road. Do not extend the tank height beyond that recommended by the manufacturer. Extending the tank too much can make the harvester top-heavy and prone to an overturn, and could possibly damage the combine's frame. Make wide turns on slopes, especially when turning uphill. Tight turns can result in slipping, loss of control, and a rollover.

Moving Large Bales

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Beginning in the mid-1970s, standard small-bale forage balers began to be replaced by large-bale balers in the agricultural industry. The chance for serious injury or death to workers grows with the size and weight of bales. Bales that weigh more than 750 pounds put workers at especially high risk. According to NIOSH analysis of data from the Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries, 74 workers were fatally injured from 1992 through 1998 while harvesting, handling, or working near bales and bale-handling equipment. Forty-two of these workers were killed while preparing bales for transport or while moving them. Farm tractors were involved in 34 of these 42 events. In a number of these deaths, rollover protective structures (ROPS) on tractors and specialized handling equipment were not used, and parked tractors were not secured to prevent them from rolling.

To reduce the risk of injuries and deaths, farmers and their employees should take the following measures:

- Make sure equipment is suitable, in good repair, weighted properly, and able to carry the load safely and securely.
- Use tractors with ROPS and a seat belt. Use seat belt when driving tractors with ROPS.
- Always operate equipment according to the manufacturer's instructions and recommendations.
- Before beginning work, plan the safest travel path. When possible, use travel paths that are flat, firm, free of obstructions, and a safe distance from holes, ditches, and ruts. Because conditions change, continually scout the ground to find the safest travel path.
- Front-end loaders are used to stack, load, or move bales. Use attachments that are designed to handle large bales, such as grapples and front-end bale spears. Do not raise or lower loaders while the tractor is moving.
- Drive tractors with front-end loaders at slow speeds.
- When moving bales but not stacking or loading them on trailers, use tractors that have a rear-end bale spear attachment whenever possible.
- Before moving bales by using front-end loaders or rear-end bale spear attachments, make sure that enough counterweights are added and that attachments are safely placed in the lowered position.
- Use tractors with headlights, taillights, and warning flashers. Be sure this equipment is not obstructed when bales are moved with attachments in the safe, lowered position. Move bales during daylight hours whenever possible.
- When moving up or down sloping land, keep the bale on the up-slope end of the tractor and place the attachment in the lowest possible position. For example, if a front-end loader is used to move a bale, the tractor operator should drive uphill or back downhill. If a rear-end spear attachment is used, drive downhill or back uphill.
- If you must leave the tractor, lower the attachments, stop the engine, remove the key, and secure the tractor to prevent it from rolling. If the tractor's transmission has a park position, shift the lever into park. If there is no park position, shift it into the lowest gear. Set the parking brake if the tractor has one. Chock the wheels front and back to prevent rolling.

CASE REPORT

A part-time farmer died from injuries sustained when a large round hay bale being moved to a cattle feeding lot fell. The victim used a tractor and loader to move a hay bale into the feeding lot. The tractor was not equipped with a general-purpose cab or an enclosed rollover protective structure. The loader bucket was not equipped with a large round bale clamp or bale fork specifically designed to securely hold the bale. The victim tied the bale into the bucket with a 5/8-inch diameter rope. He raised the loader bucket and backed the tractor across the farmyard. As he backed up a slight incline the rear wheels began to spin. The raised bale broke away from the rope that held it in place, tumbled down the loader beams, and struck the victim pinning him in the tractor seat. The victim's wife discovered him shortly after the incident occurred. She called emergency medical personnel who arrived at the scene and freed the victim by moving the bale off of the tractor and the victim. The victim was transported to a local hospital where he died a short time after the incident.

Source: National Institute for Occupational Safety and Health

Power Take-Offs and Drivelines

The power take-off feature (PTO) allows power from the tractor's engine to be transmitted to the equipment attached to the tractor.

Many farm workers are injured or killed each year when their hair, clothing, or body parts become entangled around rotating drivelines or shafts driven by power take-offs. Entanglement in farm machinery can result in scalpings, amputations, and death.

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CASE REPORT

A 17-year-old high school student working part-time for a dairy farmer was killed when his clothing was caught by the unshielded power take-off (PTO) driveline of a grinder-mixer. He had been helping the farmer add sacks of feed supplement to ground corn in the mixer. The task was almost complete and the farmer was closing the hammer mill cover while the youth stood near the PTO driveline in front of the flywheel. Although the flywheel was disengaged, the PTO driveline and unshielded flywheel clutch were rotating at about 200 revolutions per minute (RPM). The farmer heard a thump, then noticed that the boy had been caught and entangled around the driveline at the flywheel clutch. He died instantly from severe head injuries.

Source: National Institute for Occupational Safety and Health

Take the following steps to protect yourself and others:

- Identify all PTO-driven equipment components—such as drivelines, drive chains, or gears—on all farm machinery.
- Examine all PTO-driven farm machinery for U-shaped tunnel guards and replace them with retrofit guards recommended by the manufacturer or dealer.
- Always disengage the PTO and turn off the tractor ignition before leaving the tractor seat and approaching the driveline.
- Do not perform maintenance or adjustments until both the driveline and the machinery have completely stopped moving. Never reach or step across an operating driveline—even if it is shielded.
- Warn anyone who might come near an operating PTO about the entanglement hazard.
- Instruct children and untrained adolescents never to approach, operate, or perform maintenance on PTO-driven farm machinery.
- Follow the manufacturer's instructions whenever maintenance or adjustments are performed on any farm machinery.

- Do not wear loose-fitting clothing or jewelry near operating farm machinery. Work clothes should be well-fitting and should be zippered or buttoned—not open.
- Tie back or otherwise secure loose hair, but be aware that even short or tied-back hair may become entangled in moving equipment.
- Maintain machine guarding according to the manufacturer's most current specifications and OSHA regulations.
- Check periodically with manufacturers, dealers, and county extension agents for updated information about retrofit guards for PTOs.

Children and Machinery

As you move agricultural equipment around in the yard, shed, or from field to field, beware of children who may be playing in the area. Discuss the dangers of farm equipment with them, and put work areas off limits to them. In addition, ensure that any young people who operate hazardous machinery are properly trained and supervised.

Knowledge Check

1. When is a slow-moving vehicle (SMV) emblem required?
2. What type of accident is the largest single cause of agricultural machinery-related deaths?
3. What is the number one cause for tractor accidents?
4. Name the most common ways that overturn accidents can occur.
5. What device has been required on tractors since 1976 and is designed to limit most rollovers to 90 degrees?
6. What are some steps that can be taken to protect yourself and others when working with rotating PTO shafts?

UNIT 3 - ALL-TERRAIN VEHICLES

All-terrain vehicles (ATVs) are very popular and are used for recreation, competition racing, and as work tools. They can weigh up to 600 pounds and travel at highway speeds. The number of injuries associated with ATVs has increased. Persons at highest risk of injury include riders under 16 years old, males, riders of 3-wheelers, inexperienced riders, and riders of ATVs with larger engine size. The most common causes of injury are falls from the vehicle, collisions with a stationary object, and rollovers. The average lifetime cost for each survivor hospitalized with a traumatic brain injury is almost half a million dollars.

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Although the majority of all-terrain vehicle (ATV)-related injuries and deaths occur during recreational use, ATV use in the workplace is widespread and increasing, particularly in the agricultural industry. A December 2011 report by the Consumer Product Safety Commission (CPSC) indicated that 11.688ATV-related fatalities occurred between 1982 and 2011, with over 100,000 injuries reported in 2011 alone.

ATVs allow workers to traverse rough terrain and get to remote locations quickly. However, it is very important that operators drive at a safe speed to accommodate the changing terrain (rocks, logs, ditches, and other obstacles) and to reduce the risk of overturning or rolling over the ATV. Traversing a slope also presents a rollover hazard to ATV operators. Rolling over or overturning an ATV is one of the leading incidents that result in fatalities. About 46 percent (23 of 50) of the occupational injuries and fatalities OSHA investigated occurred when the ATV overturned. According to the investigation reports, operators overturned as a result of excessive speed, unstable load, rough terrain, and excessive incline.

CASE REPORT

A 50-year-old male farmer died when he was trapped under a six-wheel all-terrain vehicle (ATV) that overturned on a hillside where he was repairing fences. The vehicle was equipped with a raised cargo box where he carried his tools and supplies. The vehicle apparently struck a small hay bale that was partially hidden in the grass on the uphill side, and rolled over sideways down the hill. The victim either jumped or was tossed from the vehicle as it overturned, and was pinned underneath. ATV's, including this model, are not equipped with ROPS or a seat belt. When the victim did not return to the farmhouse for dinner as expected, his family searched the farm area but did not locate him. He frequently helped neighbor farmers with their work, so the family assumed he might be involved in a task off the farm and stopped searching for him. When he didn't return the next morning, they resumed their search and found him beneath the vehicle. Emergency services were summoned, and were onsite within six minutes. The coroner pronounced the victim dead at the scene.

Source: National Institute for Occupational Safety and Health

Three-wheel ATVs have not been manufactured since 1988, but older three-wheel ATVs are still in use. While the stability of ATVs as a whole is low, the stability of three-wheel ATVs is generally worse than for four-wheel ATVs. Cornering and traversing slopes on three-wheel vehicles can be particularly dangerous.

Guidelines

Review and understand the operator's manual. ATVs are engineered for certain operating conditions and for handling specific loads. Modifications to an ATV may alter its performance and increase the potential for an accident. Any modification to an ATV should be performed only after obtaining approval from the manufacturer. Modification includes the use of after-market products that are sold as accessories. The cargo (front and rear racks) and passenger weight limits of an ATV should not be exceeded because it affects the ATV's maneuverability and performance. Exceeding an ATV's weight capacity is a common cause of serious ATV accidents.

Do not carry passengers on ATVs. ATVs are not typically designed to carry passengers. A common mistake made by ATV operators is to allow a passenger on their ATV. To effectively steer and control an ATV, the driver often needs to make quick body weight shifts combined with acceleration and braking. A passenger can impair the safe operation and maneuverability of the ATV and the additional passenger weight may exceed the manufacturer's weight limit for the ATV. Passengers are put at a high risk of injury when riding on an ATV. OSHA's data indicate that two occupational injuries occurred when passengers were carried on ATVs designed only for the operator. In one case, a passenger was thrown from the ATV during a turn. In the other, the passenger was pinned under the ATV when it overturned. In both cases, vehicle instability created by the additional rider likely caused the accident.

Conduct a pre-ride inspection of the ATV:

- Check the tire condition and pressure.
- Ensure that the throttle, brakes, and other controls are working properly.
- Ensure that headlight(s) and taillight(s) are working properly.
- Test the steering before starting, initially at low speeds.
- Test the suspension system.
- Report any damage or mechanical failures so that repairs can be made.

Use the appropriate personal protective equipment (PPE) when operating ATVs. The potential rollover hazards require the use of a DOT-approved helmet. The CPSC indicates that 25 percent of those who died from head injuries sustained in recreational ATV accidents would have lived if they had been wearing a proper helmet. In addition to helmets, appropriate boots, gloves, and goggles should also be worn.

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Do not drive ATVs on paved or public roads and in areas with high vehicular or heavy equipment traffic. ATVs are specifically designed for off-road use and are not intended to be driven on concrete or paved roads. Injuries and fatalities can occur as a result of collisions with other vehicles and as a result of the difficulty of controlling an ATV on pavement.

Drive at appropriate speeds. Allow for avoidance of potential hazards and use the speed that is appropriate for the type of terrain (e.g., mud, snow, ditches, gravel, etc.). Be aware of site-specific hazards. Look for excavations, trenches, and areas where ATV use is prohibited.

Haul items according to the manu-facturer's specifications. Never exceed the weight limit. Ensure loads are evenly distributed. Some manufacturers now build certain ATVs with rollover protection systems. Maintain your ATV. Like any piece of workplace machinery, ATVs must have regular maintenance. Poor maintenance contributes to serious accidents and fatalities.

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Knowledge Check

1. Who is at the highest risk of injury on an ATV?
2. List the six steps that should be conducted in a pre-ride inspection of an ATV.
3. What is the appropriate personal protective equipment (PPE) when operating an ATV?

UNIT 4 - LIVESTOCK & OTHER ANIMALS

Any animal can pose a hazard to humans. Most livestock found on farms and ranches are much more powerful than a person. Handling animals must be done with the proper knowledge and equipment to avoid injury. Even small animals may pose a threat to humans due to transmission of certain diseases called zoonoses. Zoonoses are diseases that can pass between species and infect humans.

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Much of production agriculture involves working with animals. While most farm and ranch animals are more interested in protecting themselves than in harming people, certain common situations can lead to injury if the animals are not properly handled. Injury from animals occurs when people are kicked or stepped on, caught between the animal and another surface such as a fence or building, knocked down, or bitten. Accidents involving horses or bulls are statistically the most likely to cause serious injury.

CASE REPORT

A 32-year-old farmer died after being kicked in the chest and head by a horse. He was alone in the pen with four horses while currying one of the horses in a poorly lit area of the barn. The horse he was currying had injured both back legs in a fence. The victim's brother-in-law later speculated that the victim didn't notice the injury on the back of the horse's legs as he was currying, and may have brushed over that area without realizing it, causing the horse to kick him. When the victim failed to return to the house within an hour, the victim's wife found him and called 911. The EMS arrived and performed CPR while transporting the victim to the hospital, where he was pronounced dead.

Source: National Institute for Occupational Safety and Health

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One important safety factor when handling animals is to understand their behaviors. Most livestock are prey species—they are hunted and killed for food by other animals. Therefore, they are by nature easily startled, since this type of quick reaction can help them survive an attack by a predator. Running, striking, and kicking are all defense tactics that such an animal may use. Animals such as pigs and dogs are predators. These animals may inflict injury by biting or knocking down a person.

Animal Behavior Factors

Animal behavior affects how you handle animals as well as their productivity. Ethology—the study of animal behavior in the animal's natural habitat—has provided information on how to handle confined animals effectively. Abnormal behavior can indicate illness, stress, inadequate nutrition, or other problems.

A number of factors influence the behavior of animals:

- "dead ends" — Animals become excited if they sense an area from which they cannot escape. You should avoid right-angle corners and blind alleys. Use diagonal sorting pens, curved sorting chutes, and round pens to reduce the risk.
- disposition — Animal disposition will vary. Disposition is mainly a factor of inherited characteristics. Animals with a wild disposition can be dangerous.
- flight zone — The flight zone represents the "space" that, if violated by you or by another animal, will cause the animal to flee.
- followers — Livestock have a strong desire to follow. They will actively maintain visual contact with each other. Livestock also tend to do the same activity at the same time, such as watering at the same time.
- isolation — Most animals do not like to be isolated. Cattle and sheep will attempt to jump or go through fences if they are isolated and sense other animals nearby.
- loading ramp incline—A loading ramp that is too steep will excite animals:
  - no steeper than 20 degrees for cattle
  - no steeper than 15 degrees for swine
  - 20 degrees or slightly steeper for sheep
- maternal instincts — Mothers, especially cows and sows, may attack if they perceive a threat to their offspring.
- memory — Animals will remember how they were treated. For example, if an animal is mistreated during loading, the animal will react accordingly during future loading attempts.
- movement — Animals are highly sensitive to quick movements within their range of vision. They may run if startled:
  - cattle and swine have a 300-degree range of vision
  - sheep have a 270-degree range of vision
- noises — Animals are sensitive to sudden loud noises. They may run if startled.
- stress — Animals under stress can injure themselves and their handlers. Stress can result from fatigue, transportation, dehorning, overcrowding, abusive handling, the environment (extreme heat, extreme cold and wind, excess moisture), nutritional deficiencies, and weaning.

Livestock Handling Hazards

Handling livestock is one of the most dangerous jobs in agricultural production.

Common injuries in handling livestock include:

- mashed and broken fingers — caused by gates and unexpected animal movement
- bruises and lacerations — caused by kicks and being stepped on
- rope burns — caused by sudden rope movement through an unprotected hand
- eye injuries — caused by dirt and dust
- puncture wounds — caused by splinters, horns, or tools and equipment
- broken arms and legs — caused by falls and unexpected animal movement
- internal injuries — caused by shifting animals forcing the human body against a fixed surface or structure

However, you can reduce the hazards that such jobs present:

- Have adequate restraining and handling facilities.

  ✓**NOTE:** Restraints prevent injury to both the handler and the animal. The type of restraint used depends on the animal and the reason for the restraint. You should never restrain an animal for longer than necessary. If you precondition an animal to handling and to the types of restraint used most often, handling will be easier for you—and less stressful for the animal. The table identifies examples of restraints for cattle, sheep, and swine.

CATTLE	SHEEP	SWINE
mechanical restraints	mechanical restraints	mechanical restraints
– squeeze chute and headgate – cattle stock – tilting calf table – tilting table stock	– trimming stand – panels – chute – pregnancy table	– hog holder – snubbing rope – pig trap
physical restraints	physical restraints	physical restraints
– rope squeeze casting – castration restraint – calf castration tie	– chin catch restraint – castration and docking restraint for small sheep – shearing stance – halter	– vaccination or castration restraint for small pigs – vaccination or castration restraint for large pigs
catching methods	catching methods	catching methods
– flank casting – rope	– flank catch – chin catch restraint	– flank – heart girth

- Keep livestock equipment in good repair.
- Be calm and deliberate when working around livestock.
- Stay alert to the actions of nearby animals. Watch for sudden movements, especially butting, kicking, or charging.
- Be patient with animals. Try to think from their point of view.
- Refrain from scaring, teasing, or otherwise mistreating animals.
- Stay away from animals that seem angry or frightened. Give them time and space to calm down.
- Beware of mature male breeding animals and of female animals with young—they are more likely to behave defensively.

CASE REPORT

A 42-year-old farmer died after he was injured by a bull. The bull had not shown any prior signs of aggression toward humans nor signs of illness or disease. On the day of the incident, the victim had been working with his brother at his brother's farm place. Around 3:00 p.m., the victim left to return to his farm place to do various chores and the evening milking of his cows. The next day, the victim's brother became concerned when his brother did not arrive by late morning to work on various tasks. He drove to his brother's farm and found him lying in a muddy lot near a barn. He notified emergency personnel and, after the victim was examined, they prepared to remove him from the lot. About the same time, the bull became aggressive toward the rescue personnel. The victim's brother tried to herd the bull from the scene, but the bull charged him and pinned him against a fence. A law enforcement officer at the scene responded and used a gun to kill the bull. After the bull was killed and the victim removed, the victim's brother concluded that the dairy cows had not been recently milked. He also found a cow inside an addition built onto the barn. A newborn calf was also in the area and the cow's hind legs were loosely tied. It appeared that the victim may have assisted in "pulling" the calf. In doing so, his hands and clothing may have obtained the scent of the birth of the calf, which may have provoked an attack. An autopsy revealed that the victim had numerous broken ribs and several internal injuries that indicated the victim had been attacked. Because of the aggressive nature of the bull toward rescue personnel, the most likely scenario was that the bull attacked the victim.

Source: National Institute for Occupational Safety and Health

- Use extra caution around animals that you do not know well.
- Make sure you have adequate strength and experience before taking on any livestock handling job.
- Leave yourself an escape route when working in close quarters.
- Have enough help for the job at hand.
- Keep non-working bystanders, children, and unneeded animals safely back from livestock working areas.
- Wear safety shoes or boots, head protection, and hand protection.
- Never tie a lead strap or line to your body. Beware of becoming entangled in lead lines.

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- Keep facilities free of hazards that could cause tripping.
- Eliminate sharp edges and broken boards around livestock areas.
- Put away utensils, tools, and equipment after use.
- Watch your step on slippery surfaces.
- Vaccinate animals against known zoonotic diseases and keep them free of parasites.
- Wear personal protective equipment (PPE)—such as rubber gloves—when treating sick animals and wash thoroughly afterward.

CASE REPORT

A 38-year-old cattleman died as a result of an accidental injection of an animal antibiotic known as Micotil which has no known antidote. The victim was preparing to vaccinate a heifer inside a barn. He was carrying a 12cc plastic disposable syringe in his right hand when a cow in an adjacent pen charged him, striking the fence between the two. The victim was knocked to the ground. Either when struck or from the fall, he was injected with an unknown amount of the antibiotic. He immediately began to feel dizzy and nauseous. He was able to return to the vet room inside the barn and call his wife. An ambulance rushed the victim to a nearby hospital, where he died less than an hour later.

Source: National Institute for Occupational Safety and Health

Animal Disease Hazards

Zoonosis refers to any disease that can be transmitted from animals to people under natural circumstances. According to OSHA, at least 24 of the over 150 such diseases known worldwide are hazards for agricultural workers in North America. Common zoonoses include the following:

brucellosis — a bacterial infection that causes recurrent fever in people; transmitted by contact with tissues, blood, urine, and vaginal discharge

leptospirosis — a bacterial infection that causes an influenza-like illness and possibly death; transmitted through urine from an infected cow; bacteria enters the human body through cuts in the skin or contact with membranes; workers in milking pens are especially at risk due to frequent contact with urine

Lyme disease — an infectious disease transmitted by ticks and mites

rabies — an acute, infectious, often fatal viral disease that attacks the nervous system; transmitted through saliva

ringworm — a fungal disease caused by a few closely-related fungi that results in an itchy, ring-shaped patch on the skin; easily transmitted by touching an infected animal

salmonellosis — any of a number of bacteria causing a wide range of symptoms, including death; transmitted through contact with body fluids and feces, or through eating contaminated dairy products or eggs

spotted fever — an infectious disease transmitted by ticks and mites

tetanus — also commonly called lockjaw; affects the central nervous system; caused by a type of bacteria that normally lives in soil and manure and can remain viable for decades; infection is caused when the spores get into an open wound

✓**NOTE:** The best way to deal with tetanus is to guard against it with a current tetanusm vaccination. Unless you sustain a deep wound, tetanus vaccinations are recommended about every 10 years.

tuberculosis — a disease characterized by the formation of tubercles (small nodules containing pus or dry, yellowish, cheesy material) in any or all organs; transmitted generally by the respiratory system and, in some cases, by contact with infected tissues or fecal material

You can help prevent zoonoses by using these techniques:

- Wear rubber gloves when attending to sick animals.
- Wear protective clothing.
- Maintain a clean and healthy environment by using:
  - proper housing and ventilation
  - proper pasture rotation
  - proper manure disposal
  - proper carcass disposal
- Quarantine sick animals.
- Avoid contact with wild animals.
- Wash your hands thoroughly in warm water after handling animals and before eating.

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Riding Horses

Riding horses involves risk, but many of those risks can be minimized or avoided by following proper safety procedures and rules of etiquette.

Be aware of horse behavior. The main defense of a horse in response to danger is flight (to run away). While working with or around horses, take the following precautions to help prevent a horse from becoming frightened:

- Do not stand directly behind or in front of a horse. These areas are "blind spots" for horses. Horses may become frightened when they cannot see you.
- Approach a horse from its left shoulder. Never approach or walk behind a horse without letting the horse know that you are there verbally, physically, or both. For example, you could speak to the horse or place your hand on the horse's shoulder or neck.

- Avoid making sudden movements or loud noises—these can frighten a horse.
- Know how to use simple means of restraint to control a frightened horse. Talk with a trainer or an experienced individual and have him or her show you proper restraint methods.
- Always use a halter and lead rope to tie a horse. Do not ground tie a horse or use the bridle reins to tie a horse. The bridle reins can break easily if a horse becomes frightened and tries to escape.
- Be aware when riding in new environments. Unknown areas or unfamiliar noises may agitate a horse.

When riding, you are responsible for yourself and your horse. You should ensure your safety—and that of your horse—by following some simple guidelines:

- Groom your horse before saddling.
- Inspect your horse's hooves and shoes before riding (such as picking out the hooves).
- Wear the appropriate clothing and protective gear. For example, a protective helmet is essential for jumping and racing.
- Always inspect your tack before riding. For example, ensure that all of the buckles are fastened on the bridle.
- Use the right tack for the activity. A breast collar can help keep the saddle from slipping too far back.
- Never use tack or equipment in a manner for which it was not intended. Although it may seem obvious to some riders, tying a rope around your waist or wrist to dry to restrain your horse is extremely dangerous!
- Never drop tack or equipment and/or leave it on the ground.
- Never ride when you are not fully capable. If your abilities are reduced due to being tired or ill, or due to medications, you might not follow proper safety precautions or be able to adequately handle an emergency.
- Mount and dismount from the left side, if possible. In certain situations, it may be safer to mount from the off side (right side), such as when trail riding. However, before doing so, you should be sure that your horse is accustomed to riders mounting from either side.
- Always warm up and cool down your horse. For example, begin with a walk and progress to a jog. Always use consistent hand or voice cues when riding. Your horse should not have to guess what you want to do.
- Treat your horse with respect, but be firm and in control.
- Never become angry and/or abusive toward a horse. When a horse misbehaves, address the problem appropriately. Do not let bad habits continue. If your horse continues to have bad vices when riding, such as rearing, consult with a trainer about methods to correct the problem.
- If a horse is too difficult for you to ride, do not attempt to ride that horse.

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When you ride with other riders, you should:

- Treat other riders as you would like to be treated.
- Never "horseplay" when riding. You can never be certain how another rider's horse will react.
- Always keep enough distance between you and other riders. Some horses will kick at riders behind them.
- Do not ride quickly up to other horses—this may frighten them. Also, do not pass other riders quickly.
- If passing other riders going in the opposite direction, you should pass on the left. Your left shoulder should pass the other rider's left shoulder.
- If riding on a trail, take a first aid kit, a telephone, and contact numbers for emergencies. Let someone know where you are going and when you expect to return.
- Approach hazards cautiously and know the capabilities of your horse. For example, not every horse can swim well enough to cross deep water.
- Avoid riding in areas that pose greater risks, such as in heavy traffic areas, around heavy equipment, etc. If your horse becomes frightened easily, take extra precautions to avoid areas or situations that may pose an increased risk.
- Respect vehicle traffic and traffic laws. When crossing hazardous road areas, such as bridges, it may be best to walk your horse across.

Dog Bites

Dogs are common in agricultural workplaces both as pets and as working dogs.

Even though many people think of dogs as their best friends, someone in the United States seeks medical attention for a dog bite-related injury every 40 seconds. More than 4.7 million people are bitten each year. Each year, 800,000 Americans seek medical attention for dog bites; half of these are children. Of those injured, 386,000 require treatment in an emergency department and about a dozen die.

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The rate of dog bite-related injuries is highest for children ages 5 to 9 years, and the rate decreases as children age. Children are at greater risk of injury and death from dog bites. Many children do not know how to behave around a dog. Their small size and their inability to fend off attacks may put children at added risk. Almost two-thirds of injuries among children ages four years and younger are to the head or neck region. Injury rates in children are significantly higher for boys than for girls.

Dog owners, through proper selection, socialization, training, care, and treatment of a dog, can reduce the likelihood of owning a dog that will eventually bite.

Male and unspayed/unneutered dogs are more likely to bite than are female and spayed/neutered dogs. To prevent dog bites:

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- Avoid dogs that have a history of aggression if children are around.
- Be sensitive to cues that a child is fearful or apprehensive about a dog.
- Spend time with a dog before buying or adopting it.
- Spay/neuter virtually all dogs—this often reduces aggressive tendencies.
- Never leave infants or young children alone with any dog.
- Socialize and train any dog entering the household. Teach the dog submissive behaviors, such as rolling over and letting go of food without growling.
- Get professional advice—such as from a breeder or veterinarian—if a dog develops aggressive or undesirable behaviors.
- Do not play aggressive games with your dog.
- Teach children basic safety guidelines around dogs:
  - Never approach an unfamiliar dog.
  - Never run from a dog and scream.
  - Immediately report stray dogs or dogs displaying unusual behavior.
  - Do not disturb a dog that is sleeping, eating, or caring for puppies.
  - Do not pet a dog without allowing it to see and sniff you first.
  - Report any bite to an adult immediately.

Animals and Rabies

Rabies is a preventable viral disease of mammals most often transmitted through the bite of a rabid animal. The vast majority of rabies cases reported to the Centers for Disease Control and Prevention (CDC) each year occur in wild animals like raccoons, skunks, bats, and foxes. Domestic animals account for less than 10% of the reported rabies cases, with cats, cattle, and dogs most often reported rabid.

Rabies virus infects the central nervous system, causing encephalopathy and ultimately death. Early symptoms of rabies in humans are nonspecific, consisting of fever, headache, and general malaise. As the disease progresses, neurological symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation, difficulty swallowing, and hydrophobia (fear of water). Death usually occurs within days of the onset of symptoms. The number of rabies-related human deaths in the United States has declined to one or two per year. In the United States, human fatalities associated with rabies occur in people who fail to seek medical assistance, usually because they were unaware of their exposure.

If you are exposed to a potentially rabid animal, wash the wound thoroughly with soap and water, and

seek medical attention immediately. A health care provider will care for the wound and will assess the risk for rabies exposure. The following information will help your health care provider assess your risk:

Info for the doctor

- the geographic location of the incident
- the type of animal that was involved
- how the exposure occurred (provoked or unprovoked)
- the vaccination status of animal
- whether the animal can be safely captured and tested for rabies

Steps taken by the health care practitioner will depend on the circumstances of the bite. Your health care practitioner should consult state or local health departments, veterinarians, or animal control officers to make an informed assessment of the incident and to request assistance. The important factor is that you seek care promptly after you are bitten by any animal.

To prevent the spread of rabies, be a responsible pet owner:

- Keep vaccinations up-to-date for all dogs, cats and ferrets. This requirement is important not only to keep your pets from getting rabies, but also to provide a barrier of protection to you, if your animal is bitten by a rabid wild animal.
- Keep your pets under direct supervision so they do not come in contact with wild animals. If your pet is bitten by a wild animal, seek veterinary assistance for the animal immediately.
- Call your local animal control agency to remove any stray animals from your neighborhood. They may be unvaccinated and could be infected by the disease.
- Spay or neuter your pets to help reduce the number of unwanted pets that may not be properly cared for or regularly vaccinated.

You should also avoid direct contact with unfamiliar animals:

- Enjoy wild animals (raccoons, skunks, foxes) from a distance. Do not handle, feed, or unintentionally attract wild animals with open garbage cans or litter.

Don't touch these!

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- Never adopt wild animals or bring them into your home. Do not try to nurse sick animals to health. Call animal control or an animal rescue agency for assistance.
- Teach children never to handle unfamiliar animals, wild or domestic, even if they appear friendly. "Love your own, leave other animals alone" is a good principle for children to learn.
- Prevent bats from entering living quarters or occupied spaces in homes, churches, schools, and other similar areas, where they might come in contact with people and pets.

Did You Know?

Bats are a major predator of night-flying insects, including pests that cost farmers billions of dollars each year. Bats are not blind, they are not rodents or birds (but they are mammals), they will not suck your blood, and most do not have rabies.

Knowledge Check

1. What is one of the most important safety factors when handling animals?
2. List five ways to reduce the hazards when working with livestock.
3. What type of disease can be transmitted from animals to people under natural circumstances?
4. What are 3 ways to help prevent dog bites?
5. Domestic animals account for how many of the reported cases of rabies?

UNIT 5 - EXPOSURE HAZARDS

Agricultural work involves heat and cold hazards. Unprotected exposure to the sun can lead to sunburn, skin cancer, and eye problems (such as cataracts and other damage). Prolonged exposure to heat can cause:

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Heat cramps — muscle spasms due to overheating and dehydration

Heat exhaustion — headache, nausea, dizziness, flushing or paleness

Heat stroke — a medical emergency that is potentially fatal and is the most severe type of heat-related illness

To avoid heat stress, you should:

- Dress appropriately for the weather—lightweight, light-colored, loose-fitting clothes.
- Block out direct sun or other heat sources.
- Use cooling fans/air conditioning.
- Drink plenty of fluids—such as one cup of water every 15 minutes. Don't wait until you are thirsty. Avoid alcoholic and caffeinated beverages or drinks with large amounts of sugar. (They tend to cause dehydration.)
- Avoid heavy meals.
- Perform the heaviest work during the coolest part of the day.
- Rest regularly.

Cold weather hazards are affected by temperature, wind, and moisture. A relatively mild temperature can still lead to a cold-related illness if it is accompanied by wind or wetness.

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Exposure to cold can cause:

Trenchfoot — damage to the foot caused by long-term exposure to both cold and wetness

Frostbite — parts of the body, such as fingers, toes, and nose, freeze and the tissue dies

Hypothermia — severe loss of body heat that can result in death

To avoid cold stress, you should:

- Dress appropriately for the weather—warm, layered clothing:
  - Wear an inner layer that moves sweat away from the skin, a middle layer that insulates, and a breathable outer layer that blocks wind and water.
  - Wear warm socks and insulated, waterproof boots.
  - Wear headgear that prevents heat loss from the head and protects the ears. Add face protection in very cold or windy conditions.
  - Wear gloves heavy enough to protect the hands from cold, wind, and wetness.
- Perform work during the warmest part of the day. Use the buddy system (work in pairs).
- Take frequent, short breaks indoors to warm up. Get out of the cold if you experience uncontrollable shivering or feel uncomfortably cold.
- Drink warm, sweet beverages (sugar water, sports-type drinks). Avoid drinks with caffeine (coffee, tea, hot chocolate) or alcohol. Eat warm, high-calorie foods. If you are following a low-salt diet, check with your doctor before using sports-type drinks.

Did You Know?

You can lose up to 40% of body heat when your head is exposed.

Skin Cancer and Melanoma

There are more than 100 types of cancer. Cancer begins inside a cell, the basic building block of all living things. Normally, when the body needs more cells, older ones die off and younger cells divide to form new cells that take their place. When cancer develops, however, the orderly process of producing new cells breaks down. Cells continue to divide when new cells are not needed, and a growth or extra mass of cells called a tumor is formed. Over time, changes may take place in tumor cells that cause them to invade and interfere with the function of normal tissues. It takes many years for the development of a tumor and even more years until detection of a tumor and its spread to other parts of the body. Growths or tumors can be benign or malignant:

Benign growths are not cancer:

- Benign growths are rarely life-threatening.
- Generally, benign growths can be removed. They usually do not grow back.
- Cells from benign growths do not invade the tissues around them.
- Cells from benign growths do not spread to other parts of the body.

Malignant growths are cancer:

- Malignant growths are generally more serious than benign growths. They may be life-threatening. However, the two most common types of skin cancer cause only about one out of every thousand deaths from cancer.
- Malignant growths often can be removed. But sometimes they grow back.
- Cells from malignant growths can invade and damage nearby tissues and organs.
- Cells from some malignant growths can spread to other parts of the body. The spread of cancer is called *metastasis*.

Most cancers are named for the organ or type of cell in which they begin to grow. The two most common types of skin cancer are *basal cell cancer* and *squamous cell cancer.* These cancers usually form on the head, face, neck, hands, and arms. These areas are exposed to the sun. But skin cancer can occur anywhere. Basal cell skin cancer grows slowly. It usually occurs on areas of the skin that have been in the sun. It is most common on the face. Basal cell cancer rarely spreads to other parts of the body. Squamous cell skin cancer also occurs on parts of the skin that have been in the sun. But it also may be in places that are not in the sun. Squamous cell cancer sometimes spreads to *lymph nodes* and organs inside the body.

Did You Know?

One American dies of skin cancer every hour. One in five Americans develops skin cancer. People get 80 percent of their lifetime sun exposure by the age of 18.

Melanoma is the most serious type of cancer of the skin. Each year in the United States, more than 53,600 people learn they have melanoma. Melanoma occurs when melanocytes (pigment cells) become malignant. Melanoma is one of the most common cancers. The chance of developing it increases with age, but this disease affects people of all ages. It can occur on any skin surface. In men, melanoma is often found on the trunk (the area between the shoulders and the hips) or the head and neck. In women, it often develops on the lower legs. Melanoma is rare in African-Americans and others with dark skin. When it does develop in dark-skinned people, it tends to occur under the fingernails or toenails, or on the palms or soles.

No one knows the exact causes of melanoma. Doctors can seldom explain why one person gets melanoma and another does not. However, research has shown that people with certain *risk factors* are more likely to develop melanoma. A risk factor is anything that increases a person's chance of developing a disease. Still, many who do get this disease have no known risk factors. Risk factors for melanoma include:

Many (more than 50) ordinary moles — Having many moles increases the risk of developing melanoma.

Fair skin — Melanoma occurs more frequently in people who have fair skin that burns or freckles easily (these people also usually have red or blond hair and blue eyes) than in people with dark skin.

Personal history — People who have been treated for melanoma have a high risk of a second melanoma.

Family history — Melanoma sometimes runs in families. Having two or more close relatives who have had this disease is a risk factor. About 10 percent of all patients with melanoma have a family member with this disease. When melanoma runs in a family, all family members should be checked regularly by a doctor.

Severe, blistering sunburns — People who have had at least one severe, blistering sunburn as a child or teenager are at increased risk of melanoma. Because of this, doctors advise that parents protect children's skin from the sun. Such protection may reduce the risk of melanoma later in life. Sunburns in adulthood are also a risk factor for melanoma.

Ultraviolet (UV) radiation — Experts believe that much of the worldwide increase in melanoma is related to an increase in the amount of time people spend in the sun. This disease is also more common in people who live in areas that get large amounts of UV radiation from the sun. In the United States, for example, melanoma is more common in Texas than in Minnesota, where the sun is not as strong. UV radiation from the sun causes premature aging of the skin and skin damage that can lead to melanoma.

Artificial sources of UV radiation—such as sunlamps and tanning booths—also can cause skin damage and increase the risk of melanoma. Doctors encourage people to limit their exposure to natural UV radiation and to avoid artificial sources.

Skin cancer can be curable if you detect it early. To help recognize potential problems, conduct periodic self-examinations and watch for growths that meet one of the 'ABCDs' of melanoma:

ABCDs of Melanoma	
Asymmetry: One half of the growth doesn't match the other half.	**B**order irregularity: The edges of the growth are ragged, notched, or blurred.
Color: The pigmentation of the growth is not uniform. Shades of tan, brown, and black are present. Dashes of red, white, and blue also may appear.	**D**iameter: Any growth greater than 6 millimeters (about the size of a pencil eraser) is cause for concern.

If you notice any changes in the appearance of moles or freckles, contact a dermatologist.

Protecting Your Skin

Doctors recommend that people take steps to help prevent and reduce the risk of melanoma caused by UV radiation:

- Avoid exposure to the midday sun (from 10 a.m. to 4 p.m.) whenever possible. When your shadow is shorter than you are, remember to protect yourself from the sun.
- If you must be outside, wear long sleeves, long pants, and a hat with a wide brim.
- Protect yourself from UV radiation that can penetrate light clothing, windshields, and windows.
- Protect yourself from UV radiation reflected by sand, water, snow, and ice.
- Help protect your skin by using a lotion, cream, or gel that contains sunscreen. Many doctors believe sunscreens may help prevent melanoma, especially sunscreens that reflect, absorb, and/or scatter both types of ultraviolet radiation. These sunscreen products will be labeled with "broad-spectrum coverage." Sunscreens are rated in strength according to a sun protection factor (SPF). The higher the SPF, the more sunburn protection is provided.
  - Sunscreens with an SPF value of 2 to 11 provide minimal protection against sunburns.
  - Sunscreens with an SPF of 12 to 29 provide moderate protection.

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- Those with an SPF of 30 or higher provide the most protection against sunburn.

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- Put sunscreen on before you go outside, even on slightly cloudy or cool days. The sun's UV rays can damage your skin in as little as 15 minutes. Put it on again if you stay out in the sun for more than two hours, and after you swim or do things that make you sweat.
- Wear sunglasses that have UV-absorbing lenses. The label should specify that the lenses block at least 99 percent of UVA and UVB radiation. Sunglasses can protect both the eyes and the skin around the eyes.

Did You Know?

The sunscreen lotion that you apply to your skin contains chemicals that absorb the harmful UV radiation from the sun before it reaches your skin. A sunscreen's sun protection factor (SPF) indicates how long your skin will be protected. For example, if you could normally stay in the sun for 10 minutes before getting burned, a sunscreen with SPF 15 will protect you for 15 times longer, or about 150 minutes. (This only works if you apply the sunscreen properly and reapply it after it washes or wears off.)

Poisonous Plants

Poison ivy, poison oak, and poison sumac have poisonous sap (urushiol) in their roots, stems, leaves, and fruits. The urushiol may be deposited on the skin by direct contact with the plant or by contact with contaminated objects, such as clothing, shoes, tools, and animals. Approximately 85 percent of the general population will develop an allergy if exposed to poison ivy, poison oak, or poison sumac. Reactions, treatments, and preventive measures are the same for all three poison plants. Avoiding

Poison Ivy

Poison Oak

Poison Sumac

direct contact with the plants reduces the risk but doesn't guarantee against a reaction. Urushiol can stick to pets, garden tools, balls, or anything it comes in contact with. If urushiol isn't washed off those objects or animals, just touching them—for example, picking up a ball or petting a dog—could cause a reaction in a susceptible person. Urushiol that has rubbed off the plants onto other things can remain potent for years, depending on the environment. If the contaminated object is in a dry environment, the potency of the urushiol can last for decades. Even if the environment is warm and moist, the urushiol could still cause a reaction a year later.

To protect yourself, you should:

- Wear long-sleeved shirts and long pants, tucked into boots.
- Wear cloth or leather gloves.
- Keep rubbing alcohol available—it removes the oily resin up to 30 minutes after exposure.

If you've been exposed to poison ivy, oak or sumac, stay outdoors—if possible—until you complete the first two steps:

- First, cleanse exposed skin with generous amounts of isopropyl (rubbing) alcohol. Do not return to the woods or yard the same day. Alcohol removes your skin's protection along with the urushiol and any new contact will cause the urushiol to penetrate twice as fast.
- Second, wash skin with water. Water temperature does not matter; if you're outside, it's likely only cold water will be available.
- Third, take a regular shower with soap and warm water. Do not use soap before this point—soap will tend to pick up some of the urushiol from the surface of the skin and move it around.
- Finally, wipe off any clothes, shoes, tools, and anything else that may have been in contact with the urushiol with alcohol and water. Be sure to wear gloves or otherwise cover your hands while doing this and then discard the hand covering.

If you don't cleanse quickly enough, or your skin is so sensitive that cleansing didn't help, redness and swelling will appear in about 12 to 48 hours. Blisters and itching will follow. For those rare people who react after their very first exposure, the rash appears after seven to 10 days. The rash will only occur where urushiol has touched the skin; it doesn't spread throughout the body. However, the rash may seem to spread if it appears over time instead of all at once. This is either because the urushiol is absorbed at different rates in different parts of the body or because of repeated exposure to contaminated objects or urushiol trapped under the fingernails.

Because they don't contain urushiol, the oozing blisters are not contagious nor can the fluid cause further spread on the affected person's body. However, scratching the blisters could transfer germs from your fingernails and cause an infection.

The rash, blisters and itch normally disappear in 14 to 20 days without any treatment. However, few people can handle the itch without some relief. For mild cases, wet compresses or soaking in cool water may be effective. Oral antihistamines can also relieve itching. Over-the-counter topical corticosteroids (commonly called hydrocortisones under brand names such as Cortaid and Lanacort) are safe and effective for temporary relief of itching associated with poison ivy. For severe cases, prescription topical corticosteroid drugs can halt the reaction, but only if treatment begins within a few hours of exposure.

Knowledge Check

1. What are 5 ways to avoid heat stress and over exposure to the sun?
2. What is the difference between a benign and malignant tumor?
3. What is the most serious type of skin cancer?
4. If you believe you have been exposed to a poisonous plant, what the four steps you should do?

UNIT 6 - SEVERE WEATHER

Working outdoors means being prepared to respond to the weather. Most weather situations require only the appropriate clothing and personal protective measures. However, severe weather requires shelter indoors. Severe weather conditions kill hundreds of people every year. Knowing the signs of severe weather and how to protect yourself are important for anyone who works outdoors.

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Did You Know?

One inch of rain yields 27,000 gallons of water per acre.

Source: EPA

Thunderstorms

At any given moment, some 1,800 thunderstorms are in progress somewhere on the Earth. This amounts to 16 million storms each year! The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. About ten percent of the thunderstorms that occur each year in the United States are classified as severe. According to the National Weather Service, a thunderstorm is severe if it produces hail at least 3/4-inch in diameter, winds of 58 miles per hour or stronger, or a tornado.

Thunderstorms present hazards in the form of lightning, damaging hail, and flooding. Lightning is an extremely dangerous weather-related hazard. The powerful electric field can kill people and animals even without a direct hit, and buildings can catch fire from the intense heat. One ground lightning stroke can generate between 100 million and 1 billion volts of electricity. Lightning is the result of the buildup and discharge of electrical energy. The air in a lightning strike is heated to 50,000 degrees Fahrenheit. It is this rapid heating and cooling of the air that produces the shock wave that results in thunder. Lightning causes an average of 80 fatalities and 300 injuries each year. Most lightning fatalities and injuries occur when people are caught outdoors in the summer months during the afternoon and evening. Lightning occurs with all thunderstorms.

Did You Know?

Sound is generated along the length of the lightning channel as the atmosphere is heated by the electrical discharge to the order of 20,000 degrees Centigrade—three times the temperature of the surface of the sun. This compresses the surrounding clear air producing a shock wave, which then decays to an acoustic wave as it propagates away from the lightning channel. Although the flash and resulting thunder occur at essentially the same time, light travels at 186,000 miles in a second, almost a million times the speed of sound. Sound travels at the relatively snail's pace of one-fifth of a mile in the same time.

Source: NASA, Global Hydrology & Climate Center

Lightning often strikes outside of heavy rain. It may occur as far as 10 miles away from any rainfall. People have been killed by lightning while:

- Boating
- Swimming
- Golfing
- Bike riding
- Standing under a tree
- Riding on a lawn mower
- Talking on the telephone
- Loading a truck
- Riding a horse
- Playing soccer
- Fishing in a boat
- Mountain climbing

Lightning rods are designed to help protect structures by providing a safe path for the lightning to travel to the ground. The system consists of a metal rod attached to the top of a building. The metal rod is connected to a thick wire, which leads to a conductive grid buried in the ground. The idea is that any lightning strike that occurs in the vicinity is likely to find the metal rod rather than less conductive materials. The electric charge of the strike should follow the path of the system to the ground and reduce the damage done to the building.

Although large hail rarely causes fatalities, it is the most destructive element associated with severe local storms and can cause considerable property damage. Large hailstones (2 inches or more in diameter) fall at speeds faster than 100 miles per hour. Hail causes more than $1 billion in crop and property damage each year. Flash flooding is the leading cause of deaths associated with thunderstorms.

To protect yourself:

- Listen to weather warnings. Postpone outdoor activities and seek protection indoors before severe weather arrives.
  - Count the number of seconds between a flash of lightning and the next clap of thunder.
  - Divide this number by 5 to determine the distance to the lightning in miles.
- Follow the 30/30 lightning safety rule. If the time between seeing lightning and hearing the thunder is less than 30 seconds, you are in danger. Go indoors. Stay indoors for 30 minutes after hearing the last clap of thunder.
- If you are in a vehicle during a thunderstorm, stay inside the vehicle (if it is a hard-top vehicle)—the metal frame offers increased protection from lightning if you are not touching metal. However, rubber-soled shoes and rubber tires offer no protection from lightning.
- If you are outdoors during a thunderstorm, stay away from tall objects (they attract lightning). Find a low spot away from trees, fences, and poles. Choose a location that is not subject to flooding. If you are in the woods, take shelter under the shorter trees. Do not take shelter in small sheds, under isolated trees, or in convertible automobiles.
- During heavy rain or flooding, avoid low-lying areas, flooded roads, and bridges.
- Do not drive into flooded roadways—Turn around instead.

  CAUTION: Vehicles float because of buoyancy. Most cars can be swept away in 18-24 inches of moving water. Trucks and SUVs do not fare much better.
- Seek protection from hail inside substantial structures or under overpasses (out of traffic lanes).

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CASE REPORT

A 17-year-old ranch helper was struck by lightning while moving sheep between camps. The victim had left the safety of a sheepherder's wagon and was found lying under a tree, the victim of a lightning strike. While there were no witnesses to the incident, it appears that the victim had stepped outside the wagon either to look down the road for the manager or to watch the storm when he was struck. Based on evidence that the victim was found lying on his back with his hands in his pockets, that his cap was lying a few feet away and his clothes had burn holes, and that the tree showed signs of a lightning strike travelling toward the victim, it was determined that he was struck by the lightning bolt that struck the tree. He was brought to a nearby ranch house where CPR was administered. Ambulance personnel from a town 20 miles away arrived at the scene about 25 minutes after a 911 call had been placed, and transported the victim to an out-of-state hospital a few miles across the border. He was pronounced dead 3 and 1/4 hours after ambulance arrival.

Source: National Institute for Occupational Safety and Health

Tornadoes

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. Tornadoes cause an average of 70 fatalities and 1,500 injuries each year. They produce wind speeds in excess of 250 miles per hour. Tornadoes can be one mile wide and can stay on the ground for over 50 miles. The average forward speed of a tornado is 30 miles per hour, but may vary from nearly stationary to 70 miles per hour.

TORNADO MYTHS AND FACTS

MYTH:	Areas near lakes, rivers, and mountains are safe from tornadoes.
FACT:	No place is safe from tornadoes.
MYTH:	The low pressure with a tornado causes buildings to "explode" as the tornado passes overhead.
FACT:	Violent winds and debris slamming into buildings cause most structural damage.
MYTH:	Windows should be opened before a tornado approaches to equalize pressure and to minimize damage.
FACT:	Leave the windows alone. The most important action is to immediately go to a safe shelter.
MYTH:	If you are driving and a tornado is sighted, you should turn and drive at right angles to the storm.
FACT:	The best thing to do is to seek the best available shelter. Many people are injured or killed when remaining in their vehicles.
MYTH:	People caught in the open should seek shelter under highway overpasses.
FACT:	Take shelter in a sturdy reinforced building if at all possible. Overpasses, ditches, and culverts may provide limited protection, but your risk will be greatly reduced by moving inside a strong building.

Tornadoes are most likely to occur between 3 PM and 9 PM, but they can happen at any time. Tornadoes can occur at any time of the year.

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To protect yourself:

- Move to a pre-designated shelter, such as a basement. If an underground shelter is not available, move to a small interior room or hallway on the lowest floor and get under a sturdy piece of furniture. Put as many walls as possible between you and the outside.
- Stay away from windows.
- If caught outside or in a vehicle, lie flat in a nearby ditch or depression and cover your head with your hands. Do not try to outrun a tornado in your vehicle.
- Be aware of flying debris—it causes most fatalities and injuries.

Winter Storms

A major winter storm can last for several days and can be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. Each year, dozens of people die due to exposure to the cold. In addition, hypothermia and frostbite can lead to the loss of fingers and toes, or cause permanent kidney, pancreas, and liver injury—even death. The greatest hazard in winter storms is the cold. The National Weather Service issues alerts indicating when travel is not advised due to cold, wind, or poor visibility. Winter storms can also leave large amounts of snow in some areas. This snow causes additional risk from collapsing roofs, entrapment, and snow removal. Homes and farms may be isolated for days and unprotected livestock may be lost. Heavy accumulations of ice can bring down trees and topple utility poles and communication towers. As a result, power and communication can be disrupted for several days before repairs are made.

Did You Know?

Wind chill is not the actual temperature, but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. Animals are also affected by wind chill, but plants and objects are not.

Source: National Weather Service

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To protect yourself, listen to weather alerts and stay indoors during severe winter weather.

To be prepared in a vehicle:

- Plan your travel. Check weather reports to avoid a winter storm.
- Check and winterize your vehicle before winter arrives.
- Carry a winter storm survival kit:
  - Mobile phone, charger, batteries
  - Blankets/sleeping bags
  - Flashlight, extra batteries
  - First aid kit
  - Knife
  - High-calorie, non-perishable food
  - Extra clothing to keep dry
  - Small can and waterproof matches to melt snow for drinking
  - Sack of sand or cat litter for traction
  - Shovel
  - Windshield scraper and brush
  - Tool kit
  - Tow rope
  - Battery booster cables
  - Water container
  - Maps and compass
- Keep your gas tank near full to avoid ice in the fuel tank and in fuel lines.
- Avoid traveling alone.
- Call ahead—let someone know your schedule and the route(s) you plan to take.

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To be prepared on the farm:

- Move animals to sheltered areas.
- Take extra feed to nearby feeding areas.
- Have water available. Most animals die from dehydration in winter storms.
- Make sure pets have plenty of food, water, and shelter.

CASE REPORT

The fatal accident occurred sometime during the night hours on a Friday evening or early Saturday morning. At 3 PM the victim and her husband left the ranch headquarters to round up their sheep and bring them to the ranch buildings for protection. A major snowstorm was developing in the area. The victim separated from her husband to chase down a second flock of sheep. Very shortly a high wind arose and created whiteout conditions in the area. The husband was unable to locate the victim and returned to the ranch to obtain additional help from his son. As darkness set in, the son was sent to town to call for help. The sheriff's department took the call at 10 PM and notified the local volunteer fire department, the emergency medical service, and search and rescue units from two counties. The search continued until 3 AM when it was decided to wait for daylight. At 7:45 AM, the victim was found.

Source: National Institute for Occupational Safety and Health

If you are caught in a winter storm:

OUTDOORS	IN A VEHICLE	INDOORS
Find shelter: • Try to stay dry. • Cover all exposed body parts. **No shelter:** • Build a lean-to, windbreak, or snow cave for protection from the wind. • Build a fire for heat and to attract attention. • Place rocks around the fire to absorb and reflect heat. **Melt snow for drinking.** **CAUTION:** Eating snow will lower your body temperature.	**Stay in vehicle**—You will quickly become disoriented in wind-driven cold and snow. • Run the motor about 10 minutes each hour for heat. • Open the window a little for fresh air to avoid carbon monoxide poisoning. • Make sure the exhaust pipe is not blocked. **Be visible to rescuers:** • Turn on the dome light at night when running the engine. • Tie a colored cloth (red if possible) to your antenna or door. • After snow stops falling, raise the hood to indicate you need help. **Exercise:** From time to time, move arms, legs, fingers and toes vigorously to keep blood circulating and to keep warm.	**Stay inside:** When using alternate heat from a fireplace, wood stove, space heater, etc., use fire safeguards and properly ventilate. **No heat:** • Close off unneeded rooms. • Stuff towels or rags in cracks under doors. • Cover windows at night. • Eat and drink. Food provides energy for producing body heat. Keep the body replenished with fluids to prevent dehydration. • Wear layers of loose-fitting, lightweight, warm clothing. Remove layers to avoid overheating, perspiration, and chill.

Source: National Weather Service

Knowledge Check

1. What classifies a thunderstorm as severe?
2. What should a person do in the case of an approaching tornado?
3. If you are caught in a winter storm, in a vehicle, what steps should you take to increase your chances survival?

UNIT 7 - ELECTRICITY

Many people believe that everyday household current is not lethal. Others believe that overhead powerlines are insulated and pose no threat. The truth should be frightening: Electrocution is quick and deadly. The current drawn by a tiny 7.5 watt, 120-volt lamp, passed from hand to hand or hand to foot across the chest, is enough to cause electrocution. Electrocution can result from contact with a broken lightbulb as well as with an overhead powerline.

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Electrical hazards are often overlooked in agricultural work. Every year, 62 farm workers are electrocuted in the United States. Some 3.6 percent of the deaths of youths under age 20 on farms are caused by electrocution each year. The most common causes of electrocution are portable grain augers, oversized wagons, large combines, and other tall equipment that contacts overhead power lines.

CASE REPORT

The employee was attempting to correct an electrical problem involving two non-operational lamps. He proceeded to the area where he thought the problem was. He had not shut off the power at the circuit breaker panel nor had he tested the wires to see if they were live. He was electrocuted when he grabbed the two live wires with his left hand and then fell from the ladder.

Source: Occupational Safety and Health Administration

Electricity Basics

Electricity is dangerous. Coming in contact with an electrical voltage can cause current to flow through the body. Electrical shock, burns, and death can result. Electrical hazards include inadequate wiring; exposed electrical parts; overhead power lines; defective insulation; improper grounding; overload hazards; wet conditions; and others. Electrical hazards are present at work and at home. Because electricity is a familiar part of our everyday lives, many people may not treat electricity with the caution it deserves.

An electrical shock is received when electrical current passes through the body. Current will pass through the body in a variety of situations. Whenever two wires are at different voltages, current will pass between them if they are connected. Your body can connect the wires if you touch both of them at the same time. Your risk of receiving a shock is greater if you stand in a puddle of water. But, you don't even have to be standing in water to be at risk. Wet clothing, high humidity, and perspiration also increase your chances of being electrocuted. Even contact with another person who is receiving an electrical shock may cause you to be shocked.

Did You Know?

Pure water is a poor conductor. But small amounts of impurities in water like salt, acid, solvents, or other materials can turn water itself and substances that generally act as insulators into conductors or better conductors. Dry wood, for example, generally slows or stops the flow of electricity. But when saturated with water, wood turns into a conductor. The same is true of human skin. Dry skin has a fairly high resistance to electric current. But when skin is moist or wet, it acts as a conductor.

Source: Occupational Safety and Health Administration

The danger from electrical shock depends on ADP—the Amount, Duration, and Path of the shocking current:

- The severity of injury from electrical shock depends on the amount of electrical current and the length of time the current passes through the body. For example, 1/10 of an ampere (amp) of electricity going through the body for just two seconds is enough to cause death. You will be hurt more if you can't let go of a tool that is giving a shock. The amount of internal current that a person can withstand and still be able to control the muscles of the arm and hand can be less than 10 milliamperes (milliamps or mA; 1 mA = 1/1,000 of an ampere). Currents above 10 mA can paralyze or "freeze" muscles. When this happens, a person is no longer able to release a tool, wire, or other object. The electrified object may be held even more tightly, resulting in longer exposure to the shocking current.

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- High voltages can cause additional injuries. High voltages can cause violent muscular contractions. You could lose your balance and fall. High voltages can also cause severe burns.
- The path of the electrical current through the body affects the severity of the shock. Currents through the heart or nervous system are most dangerous.

Some injuries from electrical shock are not visible. A person may suffer internal bleeding and destruction of tissues, nerves, and muscles. These hidden injuries can result in a delayed death. Shock is often only the beginning of a chain of events. Even if the current is too small to cause injury, your reaction to the shock may cause you to fall.

The most common shock-related, nonfatal injury is a burn. Electrical burns can result when you touch electrical wiring or equipment that is used or maintained improperly. These burns typically occur on the hands. Electrical burns are one of the most serious injuries you can receive. They require immediate attention. Clothing may also catch fire and cause a thermal burn from the heat of the fire.

Static Electricity

Static electricity can also cause a shock. Static electricity can build up on the surface of an object and, under the right conditions, can discharge to a person, causing a shock. For example, this happens when you reach for a doorknob or other metal object on a cold, dry day, and receive a shock.

Static electricity can also have more serious results. Friction causes a high level of static electricity to build up at a specific spot on an object. This can happen when you handle plastic pipes and materials or when you operate rubberized drive or machine belts. Static electricity can potentially discharge when flammable or combustible substances are present nearby, resulting in an explosion. Grounding or other measures may be needed to prevent the build-up and the result.

Grounding

Grounding a tool or electrical system means intentionally creating a low-resistance path that connects to the earth. This prevents the build-up of voltages that could lead to an electrical accident. Grounding is normally a secondary protective measure—it does not guarantee that you will not receive a shock or be injured or killed by electric current. Grounding will substantially reduce the risk.

A service or system ground is designed mainly to protect machines, tools, and insulation against damage. One wire, called the "neutral" or "grounded" conductor, is grounded. In an ordinary low-voltage circuit, the white or gray wire is grounded at the generator or transformer and at the building's service entrance.

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An equipment ground helps protect the equipment operator. It provides a second path for the current to pass through from the tool or machine to the ground. This additional ground protects the operator if a malfunction causes the tool's metal frame to become energized. The flow of current that results may activate the circuit protection devices.

Circuit protection devices automatically limit or stop the flow of current in the event of a ground fault, overload, or short circuit in the wiring system. Examples of circuit protection devices include fuses, circuit breakers, and ground-fault circuit interrupters (GFCIs).

- Fuses and circuit breakers open or break the circuit automatically when too much current flows through them. When that happens, fuses melt and circuit breakers trip the circuit open. Fuses and circuit breakers are designed to protect conductors and equipment. They prevent wires and other components from overheating and open the circuit when there is a risk of a ground fault.
- GFCIs are used in wet locations, construction sites, and other high-risk areas. They interrupt the flow of electricity within as little as 1/40 of a second to prevent electrocution. GFCIs compare the amount of current going into electric equipment with the amount of current returning from it along the circuit conductors. If the difference is greater than 5 milliamperes, the device automatically shuts off the electric power.

Power Line Facts

Power lines are not insulated against contact. Power lines may be covered to protect against weather. However, they have no insulation to guard against contact by a person or an object (such as a ladder). Birds and squirrels can remain unhurt on power lines because they do not represent a path to ground.

To be in danger from a power line, you do not have to be in contact with it. Electricity can jump, or arc, from a power line to a person who is too close to the power line. According to the Electrical Safety Foundation International, the best insulator is a lot of space—at least 10 feet. Personal protective equipment will not protect you if you contact a power line. Gloves and rubber boots provide no protection. Space is the best insulator.

CASE REPORT

Five employees were constructing a chain link fence in front of a house and directly below a 7200-volt energized power line. They were installing 21-foot sections of metal top rail on the fence. One employee picked up a 21-foot section of top rail and held it up vertically. The top rail contacted the 7200-volt line, and the employee was electrocuted.

Source: Occupational Safety and Health Administration

Agricultural Machinery and Power Lines

Farm machinery can accidentally brush against or become entangled in overhead power lines.

This often happens with:

- Tractors with front-end loaders
- Portable grain augers
- Fold-up cultivators
- Moving grain elevators
- Irrigation pipes
- Equipment with antennas

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For example, the grain auger—a portable piece of farm equipment, 50 to 60 feet long and weighing hundreds of pounds—is used to move grain from one location to another. It is moved on inflatable-type car tires, then raised into position. The auger is usually powered by connecting a universal joint to the PTO on a tractor or other piece of farm equipment. After transferring the grain, the grain auger should be lowered to a horizontal position for safe transportation to another location. However, the auger is not always lowered before being moved. This unsafe practice can be life-threatening if the auger contacts overhead power lines (or tips over) during transport.

To protect yourself, you should:

- Know where power lines are located. Survey the property to locate these hazards.
- Treat all power lines as if they were bare and uninsulated.

- Be aware of power lines when using ladders, harvesting tree crops, and moving equipment.
- Keep all equipment away from overhead lines. Lower the grain auger to a horizontal position before moving it.
- When moving equipment, pre-plan your routes to avoid power lines.

If the equipment you are operating comes into contact with a power line:

- Stay on the equipment.
- Ask someone to immediately contact the utility company.
- If an emergency exists and you must leave the equipment—such as an electrical fire—jump as far away from the equipment as possible.
- Do not allow any part of your body to touch the equipment and the ground at the same time.
- Shuffle away from where you jumped—do not take large strides. Too large a step could put each foot in a different voltage zone, and electrocute you.
- Once you are away from the equipment, NEVER GET BACK ONTO IT OR TOUCH IT. Many electrocutions happen when the person dismounts, then gets back onto the equipment.

CASE REPORT

After lunch, two workers for the grain company were given orders to go to one of the grain storage areas and bring back a truckload of grain for processing. The two workers (a truck driver and a warehouseman) proceeded to the grain storage area to load the grain from the storage bin into the truck for transport to the plant. When the workers arrived at the site, the auger (61' long) was in the loading position (upright) against the grain bin. Both workers had commented on the overhead power lines when they arrived at the site and were aware of the hazard while moving the auger. To unload the bin, it was necessary to pull the auger away from the grain bin, lower the auger, and turn the auger 180^0 so the lower end would be at the bottom of the bin. The workers attempted to pull the auger back by hand but were unsuccessful. Attempts to lower the auger were also unsuccessful, since the auger had been in the upright position for some time and could not be lowered. The workers attached a chain between the tractor and the auger and started to pull the auger back away from the grain bin. The truck driver was operating the tractor, and the warehouseman was on the ground guiding the auger. The chain between the auger and tractor was adjusted and the workers decided to turn the auger in the upright position. As the tractor pulled the auger back, the warehouseman guided the auger with both hands. The auger contacted two phases of a 12,400-volt distribution system, electrocuting the warehouseman on the ground. The driver on the tractor saw the man on the ground fall, he immediately jumped off the tractor and was shocked (briefly stunned) when he hit the ground. The truck driver then flagged down a passing vehicle and requested the driver call for help. The rescue squad arrived shortly thereafter, and the warehouseman was pronounced dead at the scene.

Source: National Institute for Occupational Safety and Health

Safe Work Practices

You can prevent electrical accidents by following safe work practices. Such practices include deenergizing electric equipment before inspecting or repairing it; maintaining power tools properly; working cautiously around power lines; and using the right personal protective equipment for the job.

Hand-held power tools pose a potential danger because they make continuous good contact with your hand. A break in a tool's or machine's insulation can cause its metal parts to become "hot" or energized. This means that they conduct electricity. Touching these energized parts can result in an electrical shock, burn, or electrocution. The best way to protect yourself is to establish a low-resistance path from the device's metallic case to the ground. Cord and plug equipment with a three-prong plug is a common example of equipment that incorporates this ground conductor. Another way to protect yourself is to use listed or labeled portable tools protected by an approved system of double insulation or its equivalent.

Did You Know?

Power drills use 30 times as much current as is needed to kill a person.

CASE REPORT

One employee was climbing a metal ladder to hand an electric drill to the journeyman installer on a scaffold about five feet above him. When the victim reached the third rung from the bottom of the ladder he received an electric shock that killed him. The investigation revealed that the extension cord had a missing grounding prong and that a conductor on the green grounding wire was making intermittent contact with the energizing black wire, thereby energizing the entire length of the grounding wire and the drill's frame. The drill was not double insulated.

Source: Occupational Safety and Health Administration

Another electrical hazard involves the use of flexible power cords. These cords can be more vulnerable than fixed wiring. Flexible cords are subject to damage through aging, door/window edges, staples/fastenings, abrasion, and activities near the cord. The improper use of flexible cords can lead to shocks, burns, or fire. Improper uses include using flexible cords in place of fixed wiring; running the cord through walls, ceilings, floors, doors, or windows; or concealing the cord behind building surfaces or attaching it to building surfaces.

CASE REPORT

A 37-year-old farmer (victim) was electrocuted while working on a bale conveyor. The victim and his son were performing general maintenance on the bale conveyor in the hayloft of a farm barn. The conveyor was suspended horizontally near the peak or ridge of the barn roof. It was powered by an electric motor that was mounted on a metal frame of the conveyor. Although the conveyor was mounted in a permanent configuration in the hayloft, electrical power was provided via a long electrical cord and/or an extension cord. The electrical cord insulation was frayed near the motor and apparently contacted the metal frame on which the electric motor was mounted. While they worked on the conveyor, the victim's son told his father that he received an electrical shock when he contacted the conveyor. The victim touched the conveyor, completed a path to ground and received an electrical shock. The electrical shock caused him to fall from a stack of bales on which he was standing. The victim's son heard his father call for help and immediately ran and turned off the circuit breakers that controlled power to the conveyor. Emergency medical personnel arrived at the scene approximately 10 minutes after being notified. They performed resuscitation efforts at the scene and while the victim was transported to a local hospital, where he was pronounced dead approximately one hour after the incident occurred.

Source: National Institute for Occupational Safety and Health

To avoid electrical accidents outdoors, consider these guidelines:

- Protect outdoor electrical outlets with outlet covers.
- Be careful not to overload any electrical circuit. Know the capacity of each circuit.
- Keep power tools away from sources of water, including puddles.
- Never remove the third prong on a three-prong plug.
- Replace damaged cords.
- Use power tools and equipment properly:
  - Read the instruction manual.
  - Use the appropriate personal protective equipment.
  - Follow all safety rules.
  - Never bypass a safety rule or device.
  - Do not use power tools and equipment when you are upset, angry, or in a hurry.
- Turn off and unplug tools and equipment that are not in use. Do not leave unattended tools and equipment running.
- Unplug extension cords when they are not being used. Do not leave a cord plugged into an outlet without a product plugged into the cord.
- Use only extension cords that are rated for outdoor use. Do not use indoor extension cords outdoors.
- Use only one extension cord with a tool or piece of equipment—do not plug one extension cord into another.
- Use only the length of extension cord that you need.
- Never carry power tools or equipment by their cords.
- Store power tools, electrical equipment, and extension cords indoors.

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- Before digging or drilling, contact the appropriate authorities to locate buried power lines and cables. Use the appropriate "one-call" number in your area.
- Know the locations of overhead power lines before working outdoors (working with machinery, painting, trimming trees, working with ladders, etc.).
- If a metal ladder starts to fall toward an overhead power line, let it go. Call the power company to cut off the electricity to the line before touching or moving the ladder.

To avoid electrical accidents indoors, consider these guidelines:

- Follow the manufacturer's instructions for using small appliances and power tools.
- Check outlet and switch covers for:
  - cool to touch—If warm or hot to the touch, stop using the switch or outlet immediately and contact a qualified licensed electrician.

- good condition—If a cover is cracked, chipped, or missing, replace it.


CAUTION: Exposed wiring creates a shock hazard!

- no discoloration—If a cover or the area around it darkens, stop using the switch or outlet immediately and contact a qualified licensed electrician.


CAUTION: The darkening may be a sign of a dangerous build-up of heat!

- Use the correct wattage for light bulbs in light fixtures.


CAUTION: Using a light bulb that has too high a wattage for a fixture, such as a lamp, can lead to overheating. It can also cause a fire! Check the light fixture for the appropriate wattage to use with that fixture.

- Locate halogen floor lamps away from furnishings and curtains.


CAUTION: Halogen lamps can get very hot and can create a fire hazard! Think about replacing them with lamps that use fluorescent light bulbs (which are cooler).

- Check power cords and extension cords:
  - In good condition (not cracked or frayed)?
  - Placed out of traffic areas (so it will not trip someone)?
  - Have no furniture resting on them?
  - Are not nailed or stapled to a wall or other surface?
  - Are not covered by rugs, carpets, or baseboards?

    ✓**NOTE:** Power cords require ventilation.

  - Are not wrapped around themselves or other objects?


CAUTION: Damaged power cords and extension cords can overheat and cause a fire!

  - Use extension cords for temporary uses only.
  - Rearrange furniture, lamps, appliances and other items to reach electrical outlets without using extension cords.
  - Contact a qualified licensed electrician to install extra outlets.


CAUTION: Extension cords are designed for short-term use only. They are not designed to be permanent household wiring. Overloaded extension cords lead to fires!

- To unplug a power cord, tug on the plug—NOT on the cord.
- Unplug small appliances when you are not using them.

EXAMPLES: hair dryers, curling irons, toasters, clothes irons, coffee makers

- If you use portable space heaters:
  - Place the heater at least three (3) feet away from flammable materials.

    EXAMPLES: rugs, curtains, newspapers, furniture coverings, firewood, walls

  - Plug the heater directly into an outlet—do not use an extension cord.

    ✓**NOTE:** Any product with a heating element, including portable space heaters, can require a lot of power.

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  - Place the heater on a firm surface that is out of the way.

    ✓**NOTE:** Many space heater fires are caused by children or pets tipping over the heater.

  - Never leave a space heater unattended.
  - Never use a space heater to dry clothing or other items.
  - Unplug and store a portable space heater when you are not using it.

- Make sure appliance cords cannot come in contact with a hot surface.
- Make sure that bathroom outlets have GFCI's—ground fault circuit interrupters—and test them regularly. (You can usually press a Test button to disconnect the power from the protected circuit and press a Reset button to restore power.)

Did You Know?

More than one out of every five residential fires is related to the use of supplemental room heaters, including gas space heaters and electrical heaters.

Source: U.S. Fire Administration, U.S. Department of Housing and Urban Development, and the National Institute of Standards and Technology

- If an electrical outlet does not work, or the lights and appliances in a room suddenly stop working, check the circuit box.
  - Electricity enters the building from the meter and through the box. The circuit breakers inside the box disconnect the electric current when the current exceeds the safe level for that circuit. When this happens, the circuit breaker has "tripped." Circuit breakers can be tripped by a broken appliance that draws more electricity than the circuit can handle. They can also be tripped when you use too many appliances on the same circuit (such as a microwave oven and a coffee maker and a toaster at the same time).

- To find a tripped circuit breaker, open the circuit box. Look for a switch inside the box that is not in the same position as the others. If you see a switch that seems to be halfway between the OFF and ON positions, that circuit breaker has been tripped.
- Reset the circuit breaker by moving the tripped switch all the way to the OFF position, then back to the ON position. If the circuit breaker trips again, disconnect any appliances on that circuit and reset the breaker again. If the circuit breaker stays ON, then one of the appliances may be the problem. If the circuit breaker still trips with nothing turned on or plugged in, then the circuit breaker may be faulty. You should contact a qualified licensed electrician to service the circuit box.
- The circuits inside the box should be labeled to identify the rooms or appliances that each circuit protects. This will help you locate the cause of a tripped circuit breaker. If the circuits are not already labeled, you can create your own circuit "map." Simply shut off each circuit breaker one at a time and identify the outlets, light fixtures, and appliances affected.

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- Get a complete electrical system inspection if:
  - your property is 40 years old or older; or
  - you are not the original owner of the property; or
  - your property has had a major renovation or addition within the last 10 years (including adding new major appliances); or
  - your lights often dim or flicker briefly; or
  - your circuit breakers trip often; or
  - you can hear sizzling or crackling sounds from your outlets; or
  - any outlet or switch covers are warm or hot to the touch, or are discolored; or
  - you constantly use power strips and extension cords.

A qualified licensed electrician or electrical inspector can perform a home inspection for you. You can locate them in your local telephone directory.

Knowledge Check

1. What is ADP?
2. Explain how grounding an electrical current can protect equipment and operators.
3. What are two ways to ensure that electrical devices are used safely?

UNIT 8 - FIRES & WILDFIRES

Fire is a constant threat in agricultural work. Water may be scarce in agricultural areas, and firefighters often must rely on inadequate pumper trucks to put out fires. Because many agricultural operations are located in rural areas and can be far from the nearest fire station, fires can damage or destroy property long before firefighters can arrive. Equipment and resources in volunteer fire departments are sometimes minimal—often, firefighters can only monitor and contain a fire.

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When a fire happens, the cost can be devastating. According to the U.S. Fire Administration, an estimated 20,000 agricultural fires each year result in $102 million in direct property loss. Fires can spread very quickly and can easily take the lives of people and animals, destroy equipment and buildings, and ruin feed supplies and pastures. Controlling even small grass fires is important, since they can ignite fuels and chemicals.

Fires present multiple hazards:

Lack of oxygen/suffocation — Most fire-related deaths are due to smoke inhalation. The normal level of oxygen in the atmosphere is 21%. At levels of 19% and below, you will experience a range of possible effects. These include impaired judgment, increased heart rate, impaired coordination, unconsciousness, coma, and death.

Toxic gases — Fire produces carbon monoxide, which is odorless, colorless, and tasteless. In high concentration, it can immediately cause unconsciousness leading to death. Even in moderate amounts, carbon monoxide can impair your mental functions.

Heat — A building fire can create heat near 1,500 degrees Fahrenheit. (Most foods are cooked at temperatures lower than 500 degrees Fahrenheit.)

Explosion — Gas mains, propane tanks, and even ammunition can explode and result in serious injury.

Building collapse — A fire can affect the structural integrity of the building. Ceilings and walls can collapse on top of you, floors can fall from beneath you, and stairways and porches can collapse.

Electrocution — Electrical lines can become exposed inside the building and can fall from outside the building.

Common Causes of Fire

Fire is usually caused by an ignition source that accidentally comes in contact with a flammable material. Ignition sources are things that can start a fire in flammable material. For this reason, ignition sources and flammable materials must be kept separate. Flammable material is anything that will easily catch on fire. Improper storage or disposal of flammable material causes many fires. Examples of flammable materials include: debris such as papers, dried vegetation, wood, and cloth; hay, straw, silage, and bedding materials; fuels, paints, and solvents; manure piles; and chemicals, pesticides, and fertilizers.

According to the U.S. Fire Administration, the leading causes of agricultural fires are: open flame, including candles, matches, bonfires, and welding equipment; incendiary/suspicious (arson); and natural sources, including lightning and spontaneous combustion. For agricultural structure fires, the leading causes are open flame, electrical distribution, and natural sources. When a piece of equipment is involved in igniting the fire, the leading equipment involved is a vehicle—a car, truck, or tractor. Other types of equipment involved are processing equipment, fixed wiring, and torches.

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Agricultural storage fires—in barns, stables, silos, and grain elevators—cause five times more damage than other fires. This may be due to the loss of revenue from the destruction of the stored agricultural products, combined with the damage to the storage facility. Storage fires often start in the structure's framing—such as when a fuse short circuits and causes a spark that ignites the structural members. Silos enclose and protect silage. To prevent fermentation and spoilage, silos are designed to keep air and water out.

Some silos are sealed to prevent oxygen from entering. Openings at the top and bottom are normally sealed with rubber gaskets. When these hatches are tightly closed, the oxygen concentration in the silo should be insufficient to support a fire.

However, if they are left open or are not properly maintained, spontaneous combustion can occur. This situation causes a smoldering fire, which then allows combustible gases to accumulate. Any additional increase in oxygen content creates an explosive atmosphere!

In addition to agricultural fires and storage fires, heating fires are a common cause of fire in rural areas. Heating fires are caused by working or malfunctioning central heating units, fixed or portable local heating units, fireplaces, chimneys, and water heaters.

Reducing Fire Dangers

- Precautionary measures will help reduce the opportunity for a devastating fire to start.
- Never allow smoking in barns or near flammable materials. Post "No Smoking" signs in these areas. Do not allow smoking near fuel storage areas or when refueling vehicles—fumes from the fuel can easily ignite and cause an explosion!
- Never refuel engines inside buildings or while the engine is running.

- Never store fuel inside a building. Locate above-ground fuel containers at least 40 feet from any structures.
- Ensure that electrical systems in all buildings are properly grounded.
- Maintain electrical wiring, fixtures, and appliances in good working order. Keep excessive moisture, dust, and cobwebs away from these items. Encase wires in metal conduit pipes to prevent them from being accidentally damaged by livestock, machinery, or rodents.
- Store chemicals in a separate building with signs warning of the contents. Keep a list of all chemicals stored on the premises and their locations. Should a fire occur, firefighters will need to know about these chemicals to prevent injury from poisonous fumes or explosions.
- Maintain heating systems and operate them according to the manufacturer's instructions.
  - Use electric heaters only if they have a thermostat and tip-over protection.
  - Keep flammable materials away from flames or heating elements.
  - Set up kerosene or oil-burning heaters to prevent them from tipping over or touching flammable surfaces.
- Maintain motorized equipment—such as tractors and combines—to prevent sparking, fuel leaks, and overheating.
- Obey "burn ban" laws that regulate the burning of trash and debris.
- Store feeds, bedding, and other highly combustible materials—such as wool and animal fats—properly to prevent spontaneous combustion. Make sure that stored hay is properly dried—moisture causes a build-up of heat. Check silage for heat, steaming, smoke, and a charred smell.
- Locate manure piles—also prone to spontaneous combustion—away from structures. This reduces the chance of fire spreading.
- Keep all areas free of debris and clutter. Clutter can help spread a fire or may be the cause of a fire starting, should an ignition source be added. Arrange barns and shops so that flammable materials and ignition sources are safely separated.
- Keep smoke detectors and fire extinguishers in every structure. Place extinguishers near exits and near flammable materials. Clearly mark their locations.
- Prepare for water storage—develop an outdoor water supply, such as a pond, well, or pool.
- Plan and practice emergency fire procedures. These include:
  - how to get away from a fire quickly
  - how to stop a fire from spreading
  - whom to call
  - evacuation procedures

  

  CAUTION: Once you are out, stay out. If you escape from a burning building, do not re-enter the building. In a fire, you are competing with the fire for the available oxygen. You cannot win that competition.
- Keep emergency numbers—including those for your neighbors—up-to-date and near the telephone.

Wildfire Safety Zones

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Although some trees and shrubs are more flammable than others, all vegetation is fuel for a wildfire. To reduce the risk, you should modify or eliminate brush, trees, and other vegetation near your home and other structures. The greater the distance between a structure and vegetation, the greater the protection. The guidelines that follow are from the Federal Emergency Management Agency (FEMA).

Create a 30-foot safety zone around the house. Keep the volume of vegetation in this zone to a minimum. If you live on a hill, extend the zone on the downhill side. Fire spreads rapidly uphill. The steeper the slope, the more open space you will need to protect your home. Swimming pools and patios can be a safety zone and stone walls can act as heat shields and deflect flames. In this zone, you should also do the following:

- Remove vines from the walls of the house.
- Move shrubs and other landscaping away from the sides of the house.
- Prune branches and shrubs within 15 feet of chimneys and stove pipes.
- Remove tree limbs within 15 feet of the ground.
- Thin a 15-foot space between tree crowns.
- Replace highly flammable vegetation such as pine, eucalyptus, junipers and fir trees with lower growing, less flammable species. Check with your local fire department or garden store for suggestions.
- Replace vegetation that has living or dead branches from the ground-level up (these act as ladder fuels for the approaching fire).
- Cut the lawn often, keeping the grass at a maximum of 2 inches. Watch grass and other vegetation near the driveway, a source of ignition from vehicle exhaust systems.
- Clear the area of leaves, brush, evergreen cones, dead limbs and fallen trees.

Create a second zone at least 100 feet around the house. This zone should begin about 30 feet from the house and extend to at least 100 feet. In this zone, reduce or replace as much of the most flammable vegetation as possible. If you live on a hill, you may need to extend the zone for several hundred feet to provide the desired level of safety.

- Clear all combustibles within 30 feet of any structure:
- Install electrical lines underground, if possible.
- Ask the power company to clear branches from power lines.
- Avoid using bark and wood chip mulch.
- Stack firewood 100 feet away and uphill from any structure.
- Store combustible or flammable materials in approved safety containers and keep them away from the house.
- Keep the gas grill and propane tank at least 15 feet from any structure. Clear an area 15 feet around the grill. Place a 1/4-inch mesh screen over the grill. Always use the grill cautiously, but avoid using it at all during high-risk periods.

Using a Fire Extinguisher

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The label on the fire extinguisher will tell you if you can use that extinguisher on a certain type, or class, of fire. The basic classes of fire are:

Class A — Ordinary combustibles, such as wood, paper, cloth

Class B — Flammable liquids, such as grease, gasoline, paints, and oil

Class C — Energized electrical equipment, such as motors, switches, computers, and breaker panels

Class D — Combustible metals, such as titanium and magnesium

To use a fire extinguisher:

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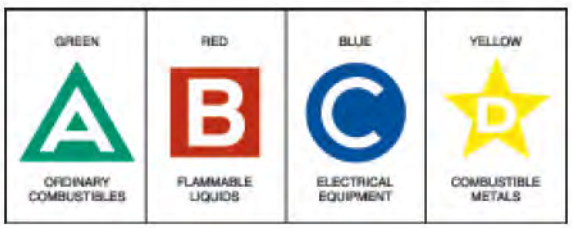
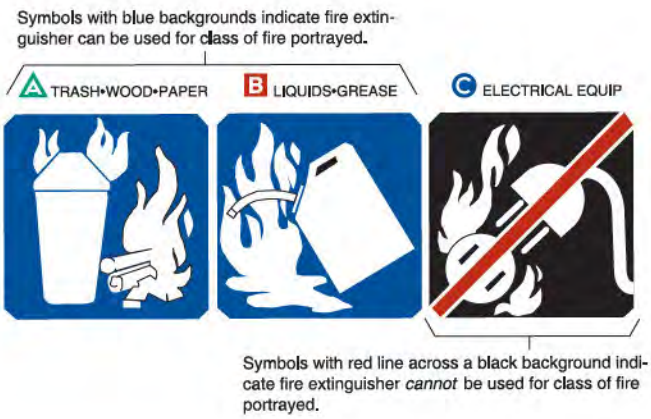
1. Pull the pin on the extinguisher. This unlocks the operating lever. (Some extinguishers have other devices to prevent accidental operation.)
2. Aim low. Point the nozzle or hose at the base of the fire.
3. Squeeze the lever below the handle. This will discharge the extinguishing agent.
4. Sweep from side to side until the flames appear to be out.
5. Release the lever to stop the discharge. (Some extinguishers have a button that you press.)
6. Check to make sure the fire is out.

The fire extnguisher may identify the class(es) of fire by a letter symbol and/or a pictorial symbol:





To understand and practice fire safety, it's important to understand how fires work. People were once taught about fire triangles, in which the combination of oxygen, heat and fuel led to fire. We now know that the fire triangle is really a fire ***tetrahedron*** – a triangle with four sides.

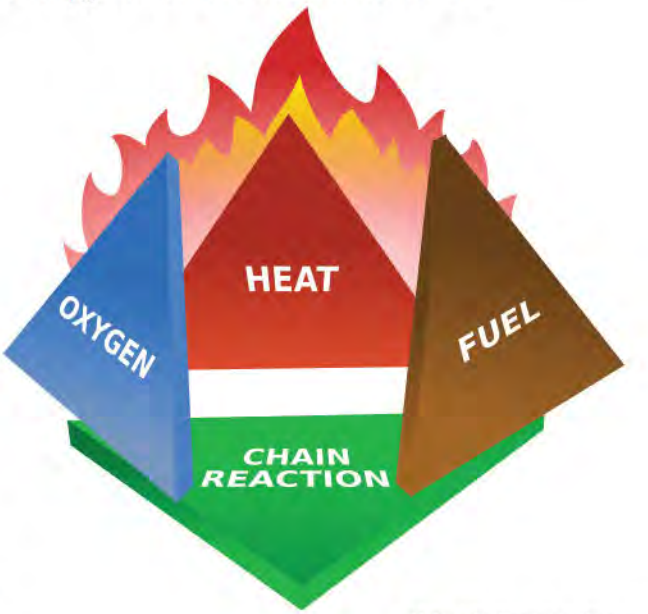
Side 1 is fuel or a combustible material.

Side 2 is heat that will ignite the combustible material.

Side 3 is oxygen that sustains the combustion.

Side 4 is a chemical chain reaction. Vapors or gases from the burning are released back to the flame, which leads to a chemical reaction.

When these four things come together, you have a fire that sustains itself; therefore it's important to keep these elements apart from each other. Since oxygen is all around us, it is the one thing that is hard to control. But if the ground is dry or there is a lot of underbrush, you want to keep any flame away from it.



Wikipedia Commons Image

CASE REPORT

A farmer who had spilled gasoline or diesel fuel on his clothes was killed in a granary fire. He was apparently trying to burn a tree stump when the fire ignited and spread to the surrounding building.

Source: U.S. Fire Administration

Knowledge Check

1. Most fire related deaths are due to this hazard?
2. Name the four basic classes of fire extinguishers and describe the type of fires for which they are used.
3. What are the four parts of the fire tetrahedron?

UNIT 9 - FIRST AID & EMERGENCIES

First aid is emergency care provided for injury or sudden illness before emergency medical treatment is available. Knowing basic first aid procedures is important in the workplace. According to OSHA (the Occupational Safety and Health Administration), private industry reports nearly 3.0 million workplace injuries and illnesses every year. For workers in agriculture, basic first aid skills may be especially important: many rural areas do not have easy access to hospitals and emergency medical facilities.

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Prompt and proper first aid treatment can make the difference in the time needed for recovery and in the severity of the injury. First aid can even mean the difference between life and death. You can obtain training in first aid procedures from the American Heart Association, the American Red Cross, the National Safety Council, and other organizations. In addition to basic procedures, training is also available for responding to life-threatening emergencies, including:

- performing CPR (cardiopulmonary resuscitation);
- using automated external defibrillators;
- controlling bleeding through direct pressure;
- responding to medical emergencies—stroke, seizures, impaled objects, and other emergencies;
- and other life-threatening emergencies.

Cuts—Minor and Severe

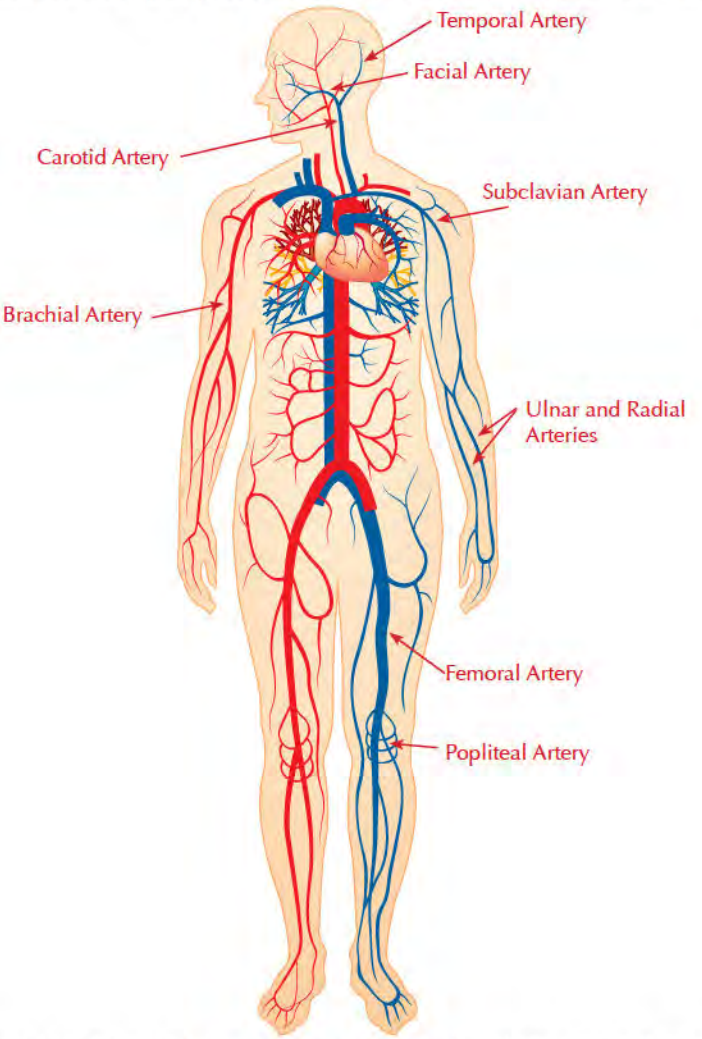
If the cut is minor:

- Wash the cut.
- Apply dressing and bandage.

If the cut is severe:

- Obtain medical attention.
- Put a dressing over the cut and apply pressure.
- Elevate the wound. If you suspect a broken bone, do NOT elevate the wound.
- Put a bandage over the dressing.
- If bleeding continues after applying a dressing and bandage, place an additional dressing and bandage over the first one.

- If bleeding still does not stop, put pressure on a pressure point (nearby artery).



- Do not remove an object impaled in a wound. Wrap dressings around the object to keep it in place.
- If a body part is severed, wrap it in sterile gauze, place it in a plastic bag, and put the bag on ice. The severed part should be taken to the hospital with the victim.
- Wash your hands and any areas that may have contacted a bodily fluid.

Sprains and Strains

A sprain is an injury to a ligament (tissue that connects two or more bones at a joint). In a sprain, one or more ligaments is stretched or torn. A sprain can result from a fall, a sudden twist, or a blow to the body that forces a joint out of its normal position and stretches or tears the ligament supporting that joint. Sprains usually occur when people fall and land on an outstretched arm, land on the side of their foot, or twist a knee with the foot planted firmly on the ground. The usual signs and symptoms of a sprain include pain, swelling, bruising, instability, and loss of the ability to move and use the joint. However, these signs and symptoms can vary in intensity, depending on the severity of the sprain. Sometimes, people feel a "pop" or tear when the injury happens.

A strain is caused by twisting or pulling a muscle or tendon. An acute strain is associated with a recent trauma or injury; it can also occur after improperly lifting heavy objects or overstressing the muscles. Chronic strains usually result from overuse: prolonged, repetitive movement of the muscles and tendons. Two common sites for a strain are the back and the hamstring muscle (in the back of the thigh). Typically, people with a strain experience pain, limited motion, muscle spasms, and possibly muscle weakness. They can also have localized swelling, cramping, or inflammation and—with a minor or moderate strain—usually some loss of muscle function. People with a strain typically experience pain in the injured area and general weakness of the muscle when they try to move it. Severe strains—strains that partially or completely tear the muscle or tendon—are often very painful and disabling.

Treatments for sprains and strains are similar. To reduce swelling and pain during the first day or two, health care providers usually advise you to:

Rest the injured area. If your ankle or knee is hurt, you might be advised to use crutches or a cane.

Apply ice on the injury for 20 minutes at a time, 4 to 8 times a day. You can use a cold pack, ice bag, or plastic bag filled with crushed ice and wrapped in a towel.

Compress (squeeze) the injury using special bandages, casts, boots, or splints. This may help reduce swelling. Your health care provider will advise which is best for you.

Elevate the injured area on a pillow—above the level of the heart—to help decrease swelling.

Take medicines, such as aspirin or ibuprofen, as advised.

If you have any concerns about the seriousness of a sprain or strain, you should contact your health care provider. You may need physical therapy. You should see a health care provider for a sprain when:

- You have severe pain and cannot put any weight on the injured joint.
- The injured area looks crooked or has lumps and bumps (other than swelling) that you do not see on the uninjured joint.
- You cannot move the injured joint.
- You cannot walk more than four steps without significant pain.
- Your limb buckles or gives way when you try to use the joint.
- You have numbness, coolness, or discoloration in any part of the injured area.
- You see redness or red streaks spreading out from the injury.
- You injure an area that has been injured several times before.
- You have pain, swelling, or redness over a bony part of your foot.
- You are in doubt about the seriousness of the injury or how to care for it.

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Back Pain

Back pain affects an estimated 8 out of 10 people. The first attack of low back pain typically occurs between the ages of 30 and 40. Back pain becomes more common with age and can range from a dull, constant ache to a sudden, sharp pain. It can come on suddenly—from an accident, a fall, or lifting something that is too heavy—or it can develop slowly. You can prevent back pain by exercising regularly, eating a healthy diet, and practicing good posture.

In most cases, it is not necessary to see a doctor for back pain; the pain usually goes away with or without treatment. However, you should see a doctor if you experience numbness or tingling, if your pain is severe and does not improve with medications and rest, or if you have pain after a fall or an injury. It is also important to see your doctor if you have pain along with any of the following problems: trouble urinating; weakness, pain, or numbness in your legs; fever; or unintentional weight loss. Such symptoms could signal a serious problem that requires treatment soon.

Hot or cold packs—or sometimes a combination—can be soothing to chronically sore, stiff backs. Heat dilates the blood vessels, improving the supply of oxygen that the blood takes to the back and reducing muscle spasms. Heat also alters the sensation of pain.

Cold may reduce inflammation by decreasing the size of blood vessels and the flow of blood to the area. Although cold may feel painful against the skin, it numbs deep pain. Applying heat or cold may relieve pain, but it does not cure the cause of chronic back pain—pain that comes on quickly or slowly, and lasts a long time (3 months or longer).

Although exercise is usually not advisable for acute back pain, proper exercise can help ease chronic pain and may reduce its risk of returning. Acute back pain—pain that hits you suddenly—usually gets better on its own and without treatment, although you may want to try acetaminophen, aspirin, or ibuprofen to help ease the pain. A wide range of medications are used to treat chronic back pain. Some you can try on your own; others require a doctor's prescription.

6 Steps for Safe Lifting

1. Check the load for rough surfaces, nails, splinters, sharp edges, etc. Use the appropriate personal protective equipment—cotton or canvas gloves for light jobs, leather or metal-reinforced gloves for rough or abrasive materials or sharp edges.
2. Size up the load to be sure you can handle it alone. If you can, then place your feet close to the object and about 12 inches apart.
3. Bend your knees, grip the object securely, then lift the load straight up. Push with your legs, keep your back straight, and keep the load close to your body.
4. Turn with your feet to turn your body after lifting the load into a carrying position. Do not twist at the waist!
5. Check your path of travel. Make sure it is clear of people and objects. Keep your fingers out of the way when putting the load down and when moving the load through tight spaces (such as doorways).
6. Lower the load by bending your knees.

Burns (and Scalds)

A burn is defined as tissue damage caused by a variety of agents, such as heat, chemicals, electricity, sunlight, or nuclear radiation. Most common are burns caused by scalds, building fires, and flammable liquids and gases.

First-degree burns affect only the outer layer (called the epidermis) of the skin.

Second-degree burns damage the epidermis and the layer beneath it (called the dermis).

Third-degree burns involve damage or complete destruction of the skin to its full depth and damage to underlying tissues. People who experience such burns often require skin grafting.

The swelling and blistering characteristic of burns are caused by the loss of fluid from damaged blood vessels. In severe cases, such fluid loss can cause shock, requiring immediate transfusion of the patient with blood or a physiological salt solution to restore adequate fluid levels to maintain blood pressure. Shock is defined as "circulatory collapse," when the blood pressure in the arteries is too low to maintain an adequate supply of blood to the body's tissues. Shock is characterized by cold and sweaty skin, weak and rapid pulse, irregular breathing, dry mouth, dilated pupils, and reduced flow of urine. Shock can be caused by internal or external bleeding, dehydration, burns, or severe vomiting and/or diarrhea—all of which involve the loss of large amounts of bodily fluids. Other causes of shock include: the presence of microorganisms in the bloodstream, a severe allergic reaction, drug overdose, alterations in the ability of the heart to pump blood effectively, and extreme emotional upset due to personal tragedy or disaster.

Burns often lead to infection, due to damage to the skin's protective barrier. In many cases, topical antibiotics (creams or ointments applied to the skin) can prevent or treat such infection. According to the American Burn Association, each year in the United States, 1.1 million burn injuries require medical attention. Approximately 45,000 of these require hospitalization, and roughly half of those burn patients are admitted to a specialized burn unit. Each year, approximately 4,500 of these people die. Up to 10,000 people in the United States die every year of burn-related infections; pneumonia is the most common infectious complication among hospitalized burn patients.

To treat a burn:

- Remove any clothing and jewelry from near the burned area. If the clothing is stuck to the skin, do not remove it. Do not pop any blisters.
- For a first- or second-degree burn, run cool water over the burned area.
- Apply a gauze bandage to a small first-degree burn.
- Get immediate medical attention if:
  - for a second- or third-degree burn
  - for infected burns
  - for large burns or burns on your face, head, hands, or genitals
  - or burns caused by electricity or fire

Hot Weather Emergencies

Prolonged exposure to heat can cause heat cramps, heat exhaustion, and heat stroke. Heat stroke is a medical emergency that is potentially fatal and is the most severe type of heat-related illness.

Responding to heat cramps — Heat cramps usually occur in the abdomen, arms, or legs. If medical attention is not necessary, you should:

- Stop your activity and sit in a cool place.
- Drink clear juice or a sports drink.
- Wait a few hours after the cramps stop, before returning to any strenuous activity. If you return to work too soon, heat exhaustion or heat stroke could result!
- Get medical attention if the cramps do not subside in one (1) hour.

Responding to heat exhaustion — Warning signs of heat exhaustion include:

- Heavy sweating
- Paleness
- Muscle cramps
- Tiredness
- Weakness
- Dizziness
- Headache
- Nausea or vomiting
- Fainting

The skin may be cool and moist. The pulse rate will be fast and weak, and breathing will be fast and shallow. If heat exhaustion is untreated, it may progress to heat stroke. Seek medical attention immediately if symptoms are severe or if you or the victim has heart problems or high blood pressure. Otherwise, cool off (or help the victim to cool off), and seek medical attention if symptoms worsen or last longer than 1 hour. Cooling measures that may be effective include the following:

- Cool, nonalcoholic beverages
- Rest
- Cool shower, bath, or sponge bath
- An air-conditioned environment
- Lightweight clothing

Responding to heat stroke — Warning signs of heat stroke may include:

- An extremely high body temperature (above 103°F, orally)
- Red, hot, and dry skin (no sweating)
- Rapid, strong pulse
- Throbbing headache
- Dizziness
- Nausea
- Confusion
- Unconsciousness

Heat stroke is a medical emergency — It can cause death or permanent disability if emergency treatment is not provided. If you see any of the above signs, you may be dealing with a life-threatening emergency. Have someone call for immediate medical assistance while you begin cooling the victim. Do the following:

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- Get the victim to a shady area.
- Cool the victim rapidly using whatever methods you can. For example, immerse the victim in a tub of cool water; place the person in a cool shower; spray the victim with cool water from a garden hose; sponge the person with cool water; or if the humidity is low, wrap the victim in a cool, wet sheet and fan him or her vigorously.
- Monitor body temperature, and continue cooling efforts until the body temperature drops to 101-102°F.

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- Do not give the victim fluids to drink.
- Get medical assistance as soon as possible. If emergency medical personnel are delayed, call the hospital emergency room for further instructions.

  Sometimes a victim's muscles will begin to twitch uncontrollably as a result of heat stroke. If this happens, protect the victim from injury, but do not place any object in the mouth and do not give fluids. If there is vomiting, make sure the airway remains open by turning the victim on his or her side.

Cold Weather Emergencies

Cold weather can result in frostbite and hypothermia. With frostbite, parts of the body, such as fingers, toes, and nose, freeze and the tissue dies. Hypothermia involves a severe loss of body heat that can result in death. According to the National Weather Service, more than 75% of injuries related to cold happen to males.

Responding to frostbite — Frostbite involves freezing in the deep layers of skin and tissue. The skin appears pale and waxy-white in color, the skin becomes hard and numb, and the areas that are usually affected are the fingers, hands, toes, feet, ears, and nose. You should:

- Move to a warm, dry place (or move the other person, if you are not the victim). Do not leave another person alone.
- Remove wet or tight clothing — it could cut off the blood flow to the affected areas.
- Do not rub the affected areas — rubbing damages the skin and tissue.

- Gently place the affected areas in a warm water bath (105°F) and monitor the water temperature to slowly warm the tissue (over a period of 25-40 minutes).

CAUTION: Do not pour warm water directly on the affected areas. It will warm the tissue too quickly, causing tissue damage.

- After warming the affected areas, dry the areas and wrap them to keep them warm.

CAUTION: If the affected areas could become cold again, do not warm the skin. If the skin is warmed and then becomes cold again, severe tissue damage will result.

- Get medical attention as soon as possible.

Responding to hypothermia —Hypothermia is a medical emergency! With hypothermia, a person's normal body temperature drops to or below 95°F, the person experiences fatigue or drowsiness, uncontrolled shivering, slurred speech, clumsy movements, and irritable, irrational, or confused behavior, and the skin is cool and bluish. You should:

Did You Know?

A wind chill of –20 degrees Fahrenheit will cause frostbite in just 30 minutes.

Source: National Weather Service

- Call for emergency assistance (ambulance or 9-1-1).
- Move the person to a warm, dry place. Do not leave the person alone.
- Remove any wet clothing and replace them with warm, dry clothing or wrap the person in blankets.
- Give the person warm, sweet drinks (sugar water or sports drinks) if the person is alert.

✓**NOTE:** Avoid drinks that contain caffeine (coffee, tea, hot chocolate) or alcohol.

- Have the person move his/her arms to create muscle heat. If the person cannot do this, place warm bottles or hot packs in the armpits, groin, neck, and head areas.

CAUTION: DO NOT rub the person's body or place the person in a warm water bath. This may stop the person's heart!

If in water:

- Call for emergency assistance (ambulance or 9-1-1).
- DO NOT remove any clothing. Button, buckle, zip, and tighten any collars, cuffs, shoes, and hoods—the layer of trapped water that is closest to the body provides a layer of insulation that slows the loss of heat. Keep the head out of the water and cover the head with a hat or hood.
- Get out of the water as quickly as possible or climb onto anything floating. DO NOT try to swim unless a floating object or another person can be reached. Swimming or other physical activity uses the body's heat and reduces survival time by about 50 percent.
- If getting out of the water is not possible, wait quietly and conserve body heat by folding your arms across your chest, keeping thighs together, bending the knees, and crossing ankles. If another person is in the water, huddle together with chests held closely.

Heart Attacks and Sudden Cardiac Arrest

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During a heart attack, a clot blocks the flow of blood to the heart. Heart muscle begins to die. The more time that passes without treatment, the greater the damage. Unfortunately, many people take a "wait and see" approach to the warning signs of a heart attack:

Chest discomfort — Most heart attacks involve discomfort in the center of the chest that lasts for more than a few minutes, or that goes away and returns. This discomfort can feel like uncomfortable pressure, squeezing, fullness, or pain.

Discomfort in other areas of the upper body — This can include pain or discomfort in one or both arms, the back, neck, jaw, or stomach.

Shortness of breath — This often comes along with chest discomfort. It can also happen before the discomfort.

Other signs — Other signs can include breaking out in a cold sweat, nausea, or light-headedness.

Most heart attack victims wait two hours or more after their symptoms start before they seek medical attention. This delay can result in death or permanent heart damage—damage that can greatly reduce your ability to do everyday activities.

Sudden cardiac arrest is caused by abnormal, uncoordinated beating of the heart or loss of the heartbeat altogether—usually as a result of a heart attack. Some 250,000 sudden cardiac arrests happen each year outside of a hospital. Workplace events such as electrocution or exposure to low-oxygen environments can lead to sudden cardiac arrest. Overexertion at work can also trigger it in people who have underlying heart disease.

A heart attack is not necessarily a sudden and intense event, as it appears in the movies. Many heart attacks start slowly as mild pain or discomfort. You may not be sure what is wrong. Your symptoms may come and go. Fortunately, clot-busting drugs and other artery-opening treatments can stop a heart attack. If they are given immediately after symptoms begin, these treatments can prevent or limit damage to the heart. To be most effective, these treatments need to be given within one hour of the start of heart attack symptoms.

Heart disease is the number one killer of both men and women in the United States. In men, the risk for heart attack increases after age 45. In women, they are more likely to occur after about age 50. Besides age, other factors increase the risk for a heart attack:

- A previous heart attack or angina (chest pain) — Angina is chest pain or discomfort that occurs when your heart muscle does not get enough blood. Angina may feel like pressure or a squeezing pain in your chest. The pain may also occur in your shoulders, arms, neck, jaw, or back. It may also feel like indigestion. Angina is a symptom of coronary artery disease (CAD), the most common type of heart disease. CAD occurs when plaque builds up in the coronary

arteries. As plaque builds up, the coronary arteries become narrow and stiff. Blood flow to the heart is reduced. This decreases the oxygen supply to the heart muscle.

- A family history of heart disease — If one or more members of your family had a heart attack at an early age (before age 55 for men or 65 for women), you may be at increased risk.
- Diabetes — If you have diabetes, you are at least twice as likely as someone who does not have diabetes to have heart disease or a stroke. People with diabetes also tend to develop heart disease or have strokes at an earlier age than other people. Women who have not gone through menopause usually have less risk of heart disease than men of the same age. But, women of all ages with diabetes have an increased risk of heart disease because diabetes cancels out the protective effects of being a woman in her child-bearing years. People with diabetes who have already had one heart attack run an even greater risk of having a second one. In addition, heart attacks in people with diabetes are more serious and more likely to result in death. High blood glucose levels over time can lead to increased deposits of fatty materials on the insides of the blood vessel walls. These deposits may affect blood flow, increasing the chance of clogging and hardening of blood vessels.
- High cholesterol — The body needs cholesterol to function normally. However, the body makes all of the cholesterol that it needs. Over a period of years, extra cholesterol and fat circulating in the blood are deposited in the walls of the arteries that supply blood to the heart. These deposits make the arteries narrower and narrower. As a result, less blood gets to the heart and the risk of coronary heart disease increases.
- High blood pressure — Blood pressure is the amount of force exerted by the blood against the walls of the arteries. Everyone has to have some blood pressure, so that blood can get to the body's organs and muscles. Usually, blood pressure is expressed as two numbers, such as 120/80, and is measured in millimeters of mercury (mmHg). The first number is the systolic blood pressure, the force used when the heart beats. The second number, or diastolic blood pressure, is the pressure that exists in the arteries between heartbeats. Depending on your activities, blood pressure may move up or down in the course of a day. Blood pressure is considered high when it stays above normal levels over a period of time. If you have high blood pressure—also called hypertension—your heart must work harder to pump blood. High blood pressure can strain the heart, damage blood vessels, and increase your risk of heart attack, stroke, eye problems, and kidney problems.

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- Cigarette smoking — There is simply no safe way to smoke. Although low-tar and low-nicotine cigarettes may reduce the lung cancer risk to some extent, they do not lessen the risks of heart disease or other smoking-related diseases. The only safe and healthful course is not to smoke.
- Being overweight — Central obesity means carrying extra weight around the waist, as opposed to the hips. A waist measurement of more than 40 inches for men and more than 35 inches for women means you have central obesity. Your risk of heart disease is higher because abdominal fat can increase the production of LDL (bad) cholesterol, the type of blood fat that can be deposited on the inside of blood vessel walls.
- Physical inactivity — Heart disease is almost twice as likely to develop in inactive people. Being physically inactive is a risk factor for heart disease. The more risk factors you have, the greater your chance for heart disease. Regular physical activity—even mild to moderate exercise—can reduce this risk.

Minutes matter! Anyone with heart attack warning signs needs immediate medical attention. DO NOT WAIT MORE THAN A FEW MINUTES—5 MINUTES AT MOST. Call 9-1-1. By calling 9-1-1, you can get to the hospital sooner. In addition:

- Emergency personnel can begin treatment immediately—even before you arrive at the hospital.
- Your heart may stop beating during a heart attack. Emergency personnel have the equipment and training to get your heart beating again.
- Heart attack patients who arrive by ambulance tend to receive faster treatment when they arrive.

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If you cannot call 9-1-1, ask someone else to drive you to the hospital at once. Never drive yourself, unless you have absolutely no other choice.

Choosing foods wisely, being physically active, losing weight, quitting smoking, and taking medications (if needed) can all help lower your risk of heart disease and stroke. If you have any warning signs of a heart attack or a stroke, get medical care immediately—don't delay. Early treatment of heart attack and stroke in a hospital emergency room can reduce damage to the heart and the brain.

Not all chest pain or discomfort is angina. Chest pain or discomfort can be caused by a heart attack, lung problems (such as an infection or a blood clot), heartburn, or a panic attack. However, all chest pain should be checked by a doctor.

Bee Stings

If you are stung by a honey bee, one of the most important things to do is not to panic. Panic by the person stung or those around him/her can produce a systemic reaction in itself. Many people believe they are allergic to honey bees when, in fact, they are experiencing symptoms of a normal reaction. Only a very limited portion of the population (one or two out of 1000) is allergic or hypersensitive to bee or wasp stings. The average person can safely tolerate 10 stings per pound of body weight. This means that although 500 stings could kill a child, the average adult could withstand more than 1100 stings. Most deaths caused by multiple stings have occurred in elderly individuals who may have had poor cardiopulmonary functioning.


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If stung by a honey bee, the first thing you should do is remove the stinger. The end of a sting is barbed and will remain stuck in the skin even if the bee is removed. Muscles in the stinger allow it to continue pumping venom into the victim, even if it is no longer connected to the bee, for up to a minute or until the stinger is removed. The sooner the stinger is removed, the less venom will enter the wound. Honey

bees are able to sting only once and eventually die after they have released their stinger. To remove the stinger, do not pull the stinger out with your fingers or tweezers—this will squeeze out more venom. Instead, scrape the stinger out with your fingernail, the edge of a credit card, a dull knife blade, or other straight edged object.

CASE REPORT

A farmer's tractor overturned, rolling over twice and coming to rest on its side as the victim was attempting to turn while on a hill. According to the victim's wife, he had a variety of health problems. He had a heart attack and was on heart pills for water retention, and had been diagnosed with cancer in his throat. His wife also indicated that the victim's doctor told him that the victim was allergic to bee stings. His wife stated that the victim had been stung before and had needed medical attention in the hospital emergency room as a result of the sting. She indicated that he had experienced breathing difficulties after being stung, and each subsequent reaction was more severe than the previous reaction. The victim did not carry a 2-way communication device. Although the sequence of events are unknown, if he had experienced a medical emergency and carried a communication device, he possibly could have called his wife or another family member to call for emergency response. With emergency response on the way, he may have waited at the base of the hill for help instead of backing his tractor up the hill.

Source: National Institute for Occupational Safety and Health

Two kinds of reactions are usually associated with bee stings and those of other stinging insects as well: (1) local, or (2) systemic, allergic, or life-threatening. A local reaction is usually characterized by pain, swelling, redness, itching, and a wheal surrounding the wound made by the stinging apparatus. Swelling can sometimes be severe. For instance, if stung on the finger, the arm may be swollen even up to the elbow. Swelling such as this is fairly common, even though it may be alarming. However, a more serious allergic reaction may be indicated if other parts of the body besides the general area in which the sting occurred begin to swell. For example, if stung on the left hand and the right hand or neck shows swelling, you should seek medical attention immediately.

Normal swelling may last up to a few days. During the days following a stinging incident, the wound may itch. This is the reaction of a majority of persons and those suffering it are considered to be at little risk of death, unless the mouth or throat is affected so that the respiratory tract is obstructed. Swelling may be reduced by icing the wound and/or taking an antihistamine such as Benedryl. Topical solutions such as calamine may also help to alleviate pain associated with stinging. It is beneficial to drink plenty of water.

Bee stings can also result in systemic, allergic, or life-threatening reactions. It is possible to have a severe allergic reaction to a bee sting that is not life-threatening. If an allergic reaction occurs, seek medical attention immediately, but try not to panic. Panic will only worsen the reaction. Allergic reactions to bee stings can develop anywhere on the body and may include:

- Rash or hives
- Stomach cramps, nausea, vomiting, or diarrhea
- Dizziness or severe headache
- Swelling that is not in the general area of the sting site, especially in the throat, neck, or tongue
- Shortness of breath or difficulty in swallowing
- Shock
- Unconsciousness
- Drop in blood pressure

If you experience any of these symptoms, seek emergency medical assistance immediately. Symptoms can begin immediately following the sting or up to 30 minutes later and might last for hours. Anaphylaxis, or the inability to breathe, will occur within seconds or minutes of a sting. Anaphylaxis, if treated in time, usually can be reversed by epinephrine (adrenaline) injected into the body. Individuals who are aware that they are allergic to stings should carry epinephrine in either a normal syringe (sting kit) or an auto-injector (Epi-Pen) whenever they think they might encounter stinging insects. Epinephrine is obtainable only by prescription from a physician.

Poisonous Snake Bites

Poisonous snakes in the United States include pit vipers and the coral snake. Copperheads, water moccasins (cottonmouths), and 13 species of rattlesnakes are related to the family of pit vipers (Crotalidae). Their poison affects the circulatory system (heart and blood flow). Pit vipers have triangular or heart-shaped heads. While the bite of a copperhead is usually not fatal, the water moccasin and even small rattlesnakes are extremely dangerous.

Copperhead

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Water Moccasin

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Rattlesnake

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The venom of the coral snake affects the nervous system and is very toxic. Coral snakes have red, yellow, and black rings around their body with the red and yellow rings touching ("red touch yellow, kill a fellow").

Coral snake

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To treat a snake bite:

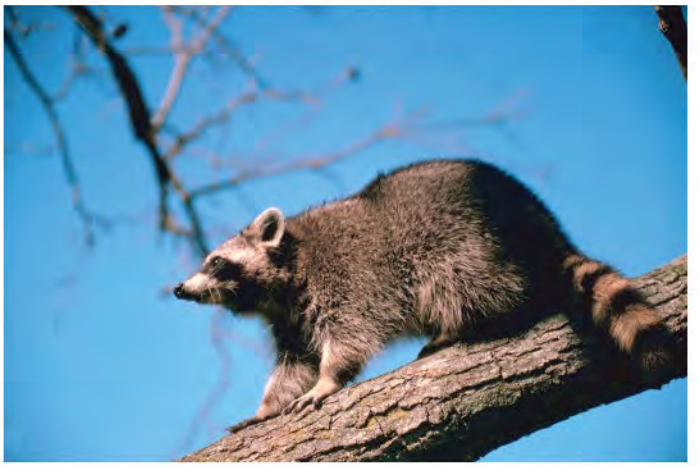
- Remain still and calm to slow the spread of venom in case the snake is poisonous.
- Seek medical attention as soon as possible. Note the color and shape of the snake's head to help with treatment.
- Do not cut the wound or attempt to suck out the venom. Apply first aid—lay the person down so that the bite is below the level of the heart, and cover the bite with a clean, dry dressing.

To protect yourself from snakes:

- Watch where you place your hands and feet when removing debris. If possible, do not place your fingers under debris you are moving. Wear heavy gloves.
- If you see a snake, step back and allow it to proceed. A snake's striking distance is about 1/2 the total length of the snake.
- Wear boots at least 10 inches high.
- Watch for snakes sunning on fallen trees, limbs or other debris.

Wild Animals

If you are bitten or scratched, get medical attention immediately.



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Insects, Spiders, and Ticks

Stinging insects—bees, hornets, some ants, wasps and yellowjackets—may sting you, but they do not transmit diseases. Biting creatures—mosquitoes, ticks, flies—may transmit diseases. For example:

West Nile Virus is transmitted by mosquitoes. Some species that are affected by it are humans, horses, and birds. The disease is often relatively mild, but it can also manifest as a life-threatening brain inflammation.

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Ticks can carry Lyme disease. Lyme disease is a bacterial disease. Within 1 to 2 weeks of being infected, people may have a "bull's-eye" rash with fever, headache, and muscle or joint pain. Some people have Lyme disease and do not have any early symptoms. Other people have a fever and other "flu-like" symptoms without a rash. After several days or weeks, the bacteria may spread throughout the body of an infected person. These people can get symptoms such as rashes in other parts of the body, pain that seems to move from joint to joint, and signs of inflammation of the heart or nerves. If the disease is not treated, a few patients can get additional symptoms, such as swelling and pain in major joints or mental changes, months after getting infected.

Ticks that carry Lyme disease are very small and can be hard to see. These tiny ticks bite mice infected with Lyme disease and then bite people or other animals, such as dogs and horses, passing the disease to them.

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Some spider bites can be serious. One example is the brown recluse spider, one of two poisonous varieties found in Oklahoma. The brown recluse lives in dark, quiet places and is only likely to bite if you put a hand or foot on it. Pain from the bite can be severe. A bite can occasionally cause death. With proper treatment, victims generally recover completely. However, tissue damage at the site of the bite may leave the victim with a sunken scar.

Treatment options:

- Treat bites and stings with over-the-counter products that relieve pain and prevent infection.
- Check for ticks daily and remove them promptly. Embedded ticks should be removed by using fine-tipped tweezers. (Do not use petroleum jelly, a hot match, or nail polish.)
- Cleanse the area with an antiseptic.

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Knowledge Check

1. What can make the difference in the time needed for recovery and the severity of an injury?
2. To avoid back injuries and strains, you should lift and lower heavy equipment using what part of your body?
3. What are the symptoms of hypothermia?
4. What are four warning signs of a heart attack?
5. If you are stung by a bee, what is one of the most important actions to take?
6. What three things should you do if bitten by a poisonous snake?
7. What are the insects associated with West Nile and Lyme disease, and how are they transmitted to humans?

UNIT 10 - HAND TOOLS, POWER TOOLS & LADDERS

Hand tools and power tools are vital to all areas of agricultural work. Using the right tool for the job can make the task easier; using the wrong tool—or using the right tool in the wrong way—can result in a poor job or even personal injury.

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Power tools can make projects go more quickly and easily. However, they can also lead to injury and even death if you do not handle them correctly. Common causes of accidents with power tools include:

- Human failure—using the wrong tool for the job, using the right tool in the wrong way, or using a defective tool
- Hazardous equipment
- Pure accident

According to OSHA, the greatest hazards posed by hand tools result from misuse and improper maintenance.

Safety Every Day

- Wear appropriate clothing that fits properly.
- Use the right kind of personal protective equipment.
- Remove rings and dangling jewelry and tie back long hair.
- Keep work areas clean and organized.
- Return all tools to their proper storage areas after each use.
- Use the right tool for the job.
- Keep tools and equipment properly adjusted and repaired.
- Know the locations and proper use of fire extinguishers.
- Make sure that fire extinguishers are charged.
- Place oily or greasy rags in covered metal containers.
- Turn off electrical equipment after each use.
- Replace frayed electrical cords.
- Use safe lifting techniques.
- Stay alert to possible hazards.
- Report or correct any unsafe conditions.

Using Hammers

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Hammers are driving tools. Driving tools are used to force other objects to move.

- Use the right kind of personal protective equipment.
- Use the right hammer for the job.
- Wear safety goggles when using a hammer with a striking tool, such as a chisel or stake.
- Never strike a mushroomed tool.

CAUTION: Splinters could strike you in your eyes.

- Do not strike two hammer faces together.
- Hold the hammer near the end of the handle.

✓**NOTE:** This will increase your accuracy and decrease your chances of hitting your fingers.

- Check for a tight handle before using a hammer.
- Strike hammer blows squarely with the face of the hammer.

Using Screwdrivers

Screwdrivers are turning tools. Turning tools are used to turn fasteners such as screws, nuts, and bolts.

- Use the right kind of personal protective equipment.
- Use the right screwdriver for the job.
- Use the right size blade or bit for the screw.

✓**NOTE**: The wrong size blade or bit can cause the screwdriver to slip.

- Do not use a screwdriver to pry objects.
- Do not hold onto the screw while using a screwdriver.

CAUTION: The screwdriver could slip and cut your hand.

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- Keep the tip of a screwdriver away from power outlets and other sources of electrical current.
- Clean screwdriver handles after every use.

Using Wrenches

Wrenches are turning tools. Turning tools are used to turn fasteners such as screws, nuts, and bolts.

- Use the right wrench for the job:
  - Crescent/adjustable wrench—use to apply force in one direction
  - Open-end wrench—use where you have room for movement
  - Box-end wrench—use where you have limited room for movement
  - Combination wrench—use when you need an open-end or box-end wrench
  - Pipe wrench—use to work with pipes and rods
  - Socket wrench—use when the fastener is recessed or hard to reach

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- Make sure the wrench fits tightly on the nut or bolt.

✓ **NOTE:** Make sure the wrench fits the fastener.

- Do not use an "extender" on the handle of any wrench.

CAUTION: You could injure yourself, damage equipment, or break the wrench if the extender slips.

- With crescent/adjustable wrenches, apply force on the fixed jaw—not on the adjustable (weaker) jaw.

Using Pliers

Pliers are holding tools. Holding tools are used to grip and securely hold materials or objects.

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- Use the right kind of pliers for the job.

  EXAMPLE: You could damage long-nose (needle-nose) pliers by using them to bend thick wire.

- Use the right kind of personal protective equipment.
- Do not use pliers to hammer an object.

Using Files

- Use the right kind of file for the job.

✓**NOTE**: The right file can help prevent injuries, increase the life of the file, and make the job easier.

- Do not use a file that does not have a secure handle.

CAUTION: The exposed tang could pierce your hand and cause a serious injury.

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- Clean files with a file-cleaning card only—not by striking the file against another object.

✓**NOTE**: Files can chip easily.

- Do not hammer or pry an object using a file.

✓**NOTE**: Files can chip and break easily. Use a file for filing, not for hammering, prying, punching, chiseling, or other uses.

- Clamp the work to be filed in a vise at about waist-height.

✓**NOTE**: To file, you must apply pressure. The pressure could cause the object to move or to slip.

- Hold the file handle securely in one hand and guide the point of the file using the thumb and index finger of the other hand.

✓**NOTE**: This technique will help you to control the file and to complete the job safely.

- Push the file forward as you press down on it, then release your pressure on the file on the return stroke.

✓**NOTE**: If you do not release your pressure on the return stroke, you will wear out the file teeth quickly.

Using Handsaws

- Use the right kind of personal protective equipment.
- Use the right kind of handsaw for the job:
  - Crosscut saw—use to cut across the grain of wood
  - Ripsaw—use to cut with the grain of wood
  - Compass/keyhole saw—use to cut inside corners, curves, and circles

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- Coping saw—use to cut curves and to shape ends of molding and trim for joints
- Hacksaw—use to cut metal

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- Check the cutting material for nails and other metal before cutting.
- Hold the cutting material securely.
- Keep your hands at a safe distance from the saw blade as you cut.
- Do not force a saw blade into a cut—it could bend or break the saw blade.

EXAMPLE: Coping saw blades are thin and can break easily.

- Ease up on the pressure when reaching the end of the cut.
- Clean saw blades with a lightly oiled cloth after each use and before storing.
- Use the proper guards on saw blades after use.

Using Power Tools

- Wear the right clothing for the job.

CAUTION: Loose clothing or jewelry can become caught in moving parts.

- Never carry a power tool by its cord.
- Never use a damaged power tool.
- To disconnect a power tool, tug on the plug, not on the cord.
- Keep cords away from heat, oil, and sharp edges.
- Disconnect power tools:
  - When you are not using them,
  - Before servicing and cleaning them, and
  - When changing accessories such as blades, bits, and cutters.
- Secure the work with clamps or a vice, as appropriate.
- Avoid accidental starting—keep your fingers off the starting switch/button while carrying a tool that is plugged in.
- Keep power tools clean and sharp for top performance.
- Follow the user's manual for instructions about maintenance and accessories.
- Maintain a good footing and balance while operating any power tool.

Using a Portable Circular Saw

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- A portable circular saw is common for cutting lumber and masonry materials.
- Keep the power cord free of the blade.
- Make sure the automatic guard is free and retractable. Never remove the guard or lock it in the retracted position.
- Check the stock for nails and any other metal before cutting.
- Use a good, solid support for the stock while cutting.
- Allow the saw to reach its maximum speed before starting the cut.
- Set the blade deep enough to cut through the stock only.
- Lay the saw on its side after finishing the cut.

CAUTION: Do not put the saw down until the blade stops completely.

Using a Portable Drill

A portable drill can be used for both turning and cutting. Fitted with the proper bit, it can turn screws and bolts or drill holes. Cordless drills are powered by rechargeable battery packs. Keyless-chuck models are designed for hand-tightening of the drill bit.

- Wear the proper type of eye protection (such as safety goggles).
- Remove the chuck key before starting the drill.

✓**NOTE**: The chuck key locks the drill bit into the chuck.

- Do not stop the drill by holding onto the chuck.
- Do not force the drill bit into the stock.

CAUTION: Secure small items being drilled, to keep them from moving.

- On deep cuts, back out the drill often to clear the hole.
- Never hold the drill against your body.

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Using a Power Nailer/Nail Gun

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A power nailer—also called a nail gun—uses compressed air to drive nails quickly and efficiently.

- Never point a nail gun or staple gun at anyone.
- Do not lift the tool by its power cord.
- Use only the nails and staples designed for the tool.
- Keep your hands and body away from the discharge end of the tool.

Using Chain Saws

Chain saws are efficient and productive portable power tools. A chain saw can also be one of the most dangerous tools. It is essential to operate and maintain chain saws properly
Before starting the chain saw:

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- Check the controls, the chain tension, and all bolts and handles to ensure they are working properly and are adjusted correctly.
- Fuel the saw at least 10 feet from sources of ignition.

While running the chain saw:

- Use the right kind of personal protective equipment—head protection, hearing protection, eye/face protection, foot protection, and hand protection.
- Keep your hands on the handles and maintain a secure footing.
- Clear the area of obstacles that might interfere with cutting or with retreating (if necessary).
- Do not cut directly overhead.
- Shut off or release throttle before retreating.
- Shut off or engage the chain brake whenever you carry the saw more than 50 feet, or across hazardous terrain.
- Be prepared for kickback; use saws that reduce the danger from kickback (with chain brakes, low kickback chains, guide bars, etc.).

Tree Trimming Tips:

- Always assume that power lines are energized!
- Use extreme caution when moving ladders and other equipment near power lines.
- Assess the hazards of the work area before you start.
- Know where other people are located.
- Use the right kind of personal protective equipment.

Did You Know?

In a living tree, the heartwood is entirely dead and only a comparatively few sapwood cells are alive. Therefore, most wood is dead when cut, regardless of whether the tree itself is living or not.

Source: USDA, Forest Service

- Have a retreat path so you can reach safety while a tree is falling.
- Be aware of broken or hanging branches, attached vines, or a dead tree that is leaning—these are hazards that can lead to injury.
- If you have to cut a dead tree, be careful—the top could break off.
- Never turn your back on a tree as it falls.

Using Ladders

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- Keep ladders free of oil, grease, and other slipping hazards.
- Do not load ladders beyond their maximum intended load or the manufacturer's rated capacity.
- Use ladders only for their intended purpose.
- Use ladders only on stable and level surfaces. Do not use ladders on slippery surfaces unless the ladder is equipped with slip-resistant feet.
- Secure ladders placed in areas near doorways, driveways, walkways or other locations near activity or traffic.
- Keep areas clear around the top and bottom of ladders.
- Do not move, shift, or extend ladders while using them.
- Face the ladder when moving up or down.
- Hold onto the ladder when climbing.
- Do not carry objects or loads that could cause you to lose your balance and fall.

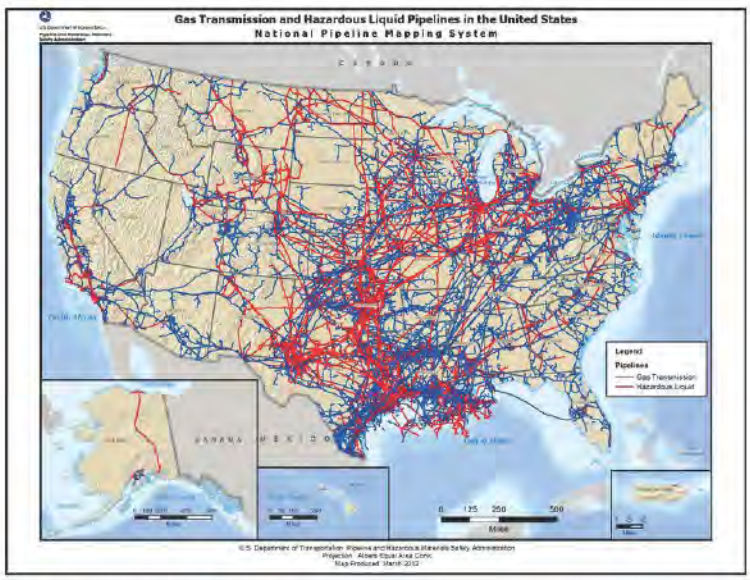
Knowledge Check

1. Name three common causes of accidents with power tools.
2. According to OSHA, the greatest hazards posed by hand tools result from misuse and improper maintenance. List 7 steps to follow when using hand tools.
3. Describe the proper way to use one of the following tools and the hazards to avoid when using it: hammer, screwdriver, wrench, pliers, file, handsaw, power tool, circular saw, portable drill, nail gun, chain saw, or ladder.

UNIT 11 - UNDERGROUND PIPELINES

From fueling our cars to heating our homes, natural gas and oil are part of everyday American life. Pipelines are the safest and most efficient way to transport these products across our nation. These underground pipelines are an integral part of our country's expanding infrastructure. They fill a vital public need by transporting natural gas and petroleum products to heat homes, cook our food, fuel electric generation plants, power vehicles, and increase U.S. energy security.

The energy transportation network of the United States consists of more than 2.5 million miles of pipelines. That's enough to circle the earth about 100 times. These pipelines are operated by approximately 3,000 companies, large and small.



Source: National Pipeline Mapping System

To ensure we have the energy needed to power our daily activities, pipeline safety is regulated by federal and state agencies. The U.S. Department of Transportation Pipeline & Hazardous Material Safety Administration (PHMSA) oversees and inspects interstate pipelines. These are the pipelines that run through two or more states. The PHMSA delegates responsibility to the states for intrastate pipelines, which are pipelines that only run within one state. As a result, pipeline systems are recognized as the safest, cleanest and most economical way to transport and distribute large quantities of crude oil, natural gas, petroleum products, liquid petroleum gases, chemicals and other related products from production to the consumer.

Did You Know?

Natural Gas and Petroleum Products Stats

- Heat 76 million homes in North America
- Generate 30% of the electricity in North America
- Used by farmers for fertilizer and in pesticides
- Used as a fuel source by trucks to move goods to markets
- Used for developing products such as laundry detergent

Pipeline Rights-of-Way

Pipelines are generally constructed in a corridor of land called a right-of-way (ROW), or easement, on which the pipeline operator has the rights to construct, operate, and maintain a pipeline and other associated assets. A ROW agreement gives a pipeline company the right to use a strip of land owned by someone else for operations. It does not, however, convey ownership. The ROW is normally about 25 to 150 feet wide, containing one or more pipelines. The pipeline may be laid on top of the ground or buried below the surface.

A pipeline right-of-way provides pipeline personnel access for inspection, maintenance and any emergencies. It also provides an unobstructed view for aerial patrols and another layer of protection against excavation damage.

Structures or objects such as fences, sheds, swimming pools and wildlife feeders that overlap a ROW are known as encroachments. Residential encroachments may not pose a problem if they can be easily removed or dismantled. If you are unsure about an encroachment, contact the pipeline operator using the phone number provided on the pipeline marker sign.

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Activities such as erecting buildings or other permanent structures, planting large trees, excavating or crossing with heavy equipment are prohibited on a ROW.

Pipeline Marker Signs

To identify that pipelines are in your area, marker signs are positioned to provide information on the type of product transported, and the name and emergency contact telephone number of the pipeline operator. The markers are placed where a pipeline intersects a street, highway, railway, and at some other points along the right-of-way to indicate that a pipeline is nearby.

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Operators use painted metal or plastic posts like the one in the photo. Pipeline vents are another indicator of a pipeline in the area. Pilots use the tent-shaped markers to patrol the right-of-way from the air.

Although each operator's markers may look a little different, the purpose and information on each marker will be similar.

A pipeline can also be marked temporarily with a yellow flag. The markers are not intended to show the exact location, depth, pressure or number of pipelines buried. Pipeline routes are rarely built as straight lines and will sometimes make abrupt turns and tie in with other pipelines.

Pipeline Products

Product	Appearance	Characteristics	Hazard(s)
Anhydrous Ammonia	Colorless liquid or gas and has a pungent odor similar to household ammonia	Vapors are lighter than air	Toxic if vapors are inhaled; vapors may burn in the presence of open flame or spark (not easily ignited); contact with vapor or liquid will burn skin/eyes and cause severe injury or frost bite
Butane	Colorless and odorless	Vapors are heavier than air and can travel great distances to a source of ignition and flashback	Extremely flammable; explosive if allowed to enter into drains or sewers; direct eye or skin contact with butane can result in burns or frostbite
Carbon Dioxide	Colorless liquid or gas and is odorless	Vapors are heavier than air	Inhalation can cause serious respiratory damage
Crude Oil and Refined Petroleum	Occurs in a liquid form ranging from a water-like substance to a very thick tar; amber to black in color	Vapors are heavier than air	Exposure can cause moderate irritation including headaches and dizziness
Diesel	Clear to straw-colored liquid with a kerosene odor	Highly combustible and is easily ignited by heat, spark or flames	Inhalation of vapors or mist may cause mild irritation to the upper respiratory tract; high concentrations may result in central nervous system depression, headache, dizziness and nausea
Ethane	Colorless, odorless gas found in natural gas and natural gas liquids	Extremely flammable and may explode if exposed to extreme heat	Vapors may form explosive mixtures with air at room temperature and may spread to ignition sources, causing a flashback; exposure can result in asphyxiation or cause frost bite and skin damage if in direct contact
Hydrogen Sulfide	Colorless, toxic, poisonous gas with a rotten egg smell at low concentrations; known as H_2S or "sour gas"	Vapors are heavier than air; burns with a blue flame; levels at or above 100 parts per million (ppm) are immediately dangerous to life and health	Vapors settle in low-lying areas where accumulated concentrations can injure or kill livestock, wildlife and people; can also migrate into surface soils and groundwater; explosive in concentrations between 4.3% and 46%
Mercaptan	Skunk or rotten egg smell	Vapors are lighter than air	High concentrations are extremely irritating to smell
Natural Gas	Usually colorless and odorless gas; smells like "rotten eggs" once odorant is added for product distribution	Vapors are lighter than air	Can ignite when it comes into contact with a spark or flame Exposure can cause asphyxiation in a confined space
Natural Gas Liquids	Colorless to straw colored liquid with a petroleum	Vapors are heavier than air	Vapors are highly flammable and heavier than air, meaning they will accumulate in low areas and may travel long distances to a point of ignition and flash back
Propane	Colorless and odorless in its natural state	Vapor is heavier than air and may collect at low levels; flammable liquefied gas under pressure	Vapors replace oxygen and may cause suffocation in confined spaces – use only with adequate ventilation; liquid can cause freeze burn similar to frostbite

Pipeline Monitoring

After pipelines are operational, pipeline operators employ a number of safety precautions and procedures to minimize the risk of a pipeline incident. Monitoring and maintaining are important for the safety of pipelines.

One example of how safety is monitored is a pipeline control center, which is staffed 24 hours a day, 365 days a year. When the control center receives an emergency call, staff members immediately take steps to control the problem and work to protect people and the environment. This could involve dispatching employees, remotely initiating emergency shutdowns, starting and stopping pumps or compressors, and opening or closing valves. The control room uses remote technology to track the pressure and flow of the product in the pipeline.

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In addition to monitoring the pipeline, there are several other procedures in place to maintain the safety of the pipeline, including pipeline markers and leak detection equipment. Aerial and ground patrols are also used to ensure no construction activities are taking place too close to a ROW.

Internal inspections of a pipeline can be done using "pipeline pigs" that are inserted into and travel throughout a pipeline. Smart pigs carry a small computer to collect, store and transmit information about the condition of the pipeline. Corrosion in pipelines is also controlled by injecting chemicals into a pipeline to reduce general corrosion and to prevent harmful bacteria from corroding pipelines with water present.

Pipeline Damage

Establishing damage prevention is one step for pipeline safety. Not every activity can be monitored around the pipeline. Other damage prevention activities include educating our communities on how to live and work around pipelines safely.

Although pipeline operators diligently monitor pipelines and facilities, not every activity that takes place along the pipeline system can be monitored. One of the greatest challenges to safe pipeline operations is accidental damage to a pipe or its coating. This damage can be caused by any form of excavation – digging, grading, trenching, boring, etc. – or can result from road and highway maintenance, general construction and many farming activities, as well as new home construction and certain routine homeowner activities. Damage from excavation-related activities is a leading cause of pipeline incidents in the U.S.

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Even if a pipeline is not punctured or severely damaged resulting in an immediate incident, slight unreported damage can cause corrosion, which could result in a serious incident months or even

years later. Minor scratches, scrapes, gouges, dents or creases to a pipeline or its coating can result in future safety problems.

Pipeline safety is a shared responsibility. Suspicious activities on or near a pipeline, exposed pipe or damaged facilities should be reported to the pipeline operator as designated by the pipeline marker. In a time of heightened national security, it is more important than ever to guard pipelines against damage or attack.

When reporting suspicious activity, specific information should be given to the pipeline operator – what happened, where it happened, how many people were involved, and when it occurred.

When reporting a suspicious person, personal characteristics such as age, gender, hair color and length, height, weight, build, ethnicity, facial features, clothing and tattoos are valuable in identifying the individual.

Suspicious vehicles can also be reported. The vehicle make, model and color along with license plate number and state, bumper stickers and body damage are important in identifying the automobile.

CASE REPORT

A 62-year-old male was killed when the tractor he was operating punctured an aboveground gas line. He had recently moved to the area and was in the process of acquiring some land for farming. The land was overgrown with weeds and brush about 5 feet high. On a warm, clear afternoon he went out to clear the land with a tractor and rotary mower. Although the incident was not witnessed, he apparently began mowing the field near a roadway and was likely on the third pass when the front of the tractor ran into an aboveground valve of a natural gas pipeline that was obscured by the overgrown brush. The 6-inch diameter steel pipe was punctured allowing natural gas to escape and causing an explosion that caught the tractor on fire and sent flames 40-50 feet into the air. By the time the first firefighters arrived on the scene, the fire had destroyed the tractor and had burned a 40-foot circle around it. The victim's body was found lying on the ground near the tractor, but rescue personnel could not reach him until the fire was contained almost an hour later. The coroner was called to the scene and pronounced the victim dead at 3:30 p.m.

Source: National Institute for Occupational Safety and Health

Call Before You Dig

Because pipelines must cross the countryside to deliver products over long distances, the pipeline has many neighbors. The pipeline crosses creeks and rivers, highways and roads, farmers' fields, parks, and may be close to homes, businesses or other community centers.

To protect the communities, pipeline neighbors, sensitive environmental areas, as well as the pipeline itself, the pipeline industry and other operators of underground facilities joined together in creating notification centers that are used by anyone preparing to conduct work close to the pipeline.

These centers – called one-call centers – serve as the clearinghouse for excavation activities that are planned close to pipelines and other underground utilities. One-call centers help to protect 911 emergency telephone service, underground power lines, water and sewer pipes and energy pipelines.

A call center is set up so that anyone who will be digging or excavating using mechanized equipment – commercial contractors, road maintenance crews, telephone pole installers, fence builders, landscape companies, or home owners (to name a few) – can make one telephone call to give notice of their plans

to dig in a specific area 48 and sometimes up to 72 hours prior to any excavation activity.

By calling 811, you are automatically connected to your state's one-call center, which will then notify pipeline and utility operators in the project area. A representative from the affected pipeline or utility companies will be sent free of charge to locate and mark – with a temporary flag or spray paint using the color code system – the buried facilities before you dig. When calling 811, you will need to provide particular information – project location and address where digging will occur, project description including depth, project duration, special instructions for identifying the site, contact information for onsite project contact person. For more specific information on the requirements for your particular state, contact a customer service representative by dialing 811.

If agricultural or farming activities include deep plowing, fence post installation, trenching, leveling, subsoiling, installing drain tile or other excavation work, it is vital to call 811 before starting any digging.

Color Code System

Calling to have pipelines and other utilities marked is an important step in protecting people and property. Striking a pipeline could disrupt services and lead to expensive fines and repair costs. If a leak occurs, it could interfere with farming and ranching operations.

Remember the steps for safe digging start with white-lining the project site, then making the 811 call. Always remember to:

1. Call before you dig.
2. Wait the required time.
3. Respect the marks.
4. Dig with care.

Tolerance Zone

As another safety measure, a tolerance zone is the width of an underground facility such as a pipeline or utility line, plus a specified tolerance distance – typically two feet on both sides of the facility – where only non-mechanical digging with a shovel is allowed. Mechanical digging with a backhoe or trencher is not allowed in the tolerance zone. The asset owner should be on-site for any work associated with the tolerance zone. This ensures any digging inside the tolerance zone will not damage the pipeline.

Leak Recognition

Although leaks on natural gas or petroleum pipelines are uncommon, it is important to be able to recognize the possible warning signs. You should use your senses of sight, sound and smell to detect a pipeline leak. If you suspect a leak, look around for a pipeline marker, and contact the pipeline operator or 911 immediately.

A pipeline leak can be detectable by sight. Some of the warning signs could include a dense white cloud or fog, discolored or dead vegetation, flames coming from the ground, a pool of liquid on the ground, a slight mist of ice or frozen area on a ROW, a rainbow or sheen of water, or dirt being blown or thrown into the air.

You should also suspect a pipeline leak if you smell strange or unusual gaseous or petroleum odors. Natural gas is odorless and colorless until an odorized gas-additive, mercaptan, is added, which gives the gas a distinctive, pungent smell similar to a skunk. It is also important to note that if natural gas is not odorized, there will be no strong scent. The additive is not added to natural gas until distribution into our homes and businesses. Natural gas gathering and transmission pipelines will not have this odor. These types of pipelines are often found on farms and ranches.

Other leaks may smell like the strong chemical or petroleum odor at a gas station. Each petroleum product has its own characteristic smell.

You may also be able to recognize a leak using your sense of hearing. You should suspect a leak if you hear unusual noises like hissing, whistling or roaring sounds.

DO	DO NOT
Turn off, if safe to do so, and abandon any motorized equipment	Do NOT touch, inhale or make contact with leaking liquids or gas
Quickly and cautiously evacuate the area by walking into the wind, away from possibly hazardous fumes	Do NOT use open flames or anything that could ignite a spark (cell phones, flashlights, motor vehicles, tools, etc.)
Call 911, or your local fire or police department and the pipeline operator (or 811 if operator is not known) once you have reached a safe location	Do NOT attempt to extinguish a natural gas fire OR attempt to operate pipeline valves

Accidents can happen even with the proper precautions. If an accident occurs, it is critical to know how to respond to the incident. Always leave the area immediately, warn others to stay away and call 911. Never use a phone in the leak area as this could be an ignition source, which could create an explosion, if there is a vapor leak.

Education is key to avoiding pipeline accidents. You should always be aware of your surroundings and call 811 before digging or excavating. Any and all suspicious activity or leaks should be reported. This could be the difference between safely repairing a pipeline and a fatal accident.

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Knowledge Check

1. Why is the pipeline rights-of-way important?
2. What information is found on a pipeline marker sign?
3. When calling 811, what information should you be prepared to provide?
4. What are three things you could look for if a pipeline leak is suspected?

RESOURCES

Introduction

Publications

- A Guide to Safety in Confined Spaces (DHHS/NIOSH Publication No. 87-113). Morgantown, WV: National Institute for Occupational Safety and Health, 1987
- OSHA Fact Sheet: Farm Safety. Washington, DC: Occupational Safety and Health Administration, 2005.

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- NIOSH Fatality Assessment and Control Evaluation Program
  http://www.cdc.gov/niosh/face/
- CDC Leading Causes Charts
  http://www.cdc.gov/ncipc/osp/charts.htm
- NIOSH Agricultural Fatality Investigation Reports
  http://www.cdc.gov/niosh/injury/traumaagface.html
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

Confined Spaces

Publications

- A Guide to Safety in Confined Spaces (DHHS/NIOSH Publication No. 87-113). Morgantown, WV: National Institute for Occupational Safety and Health, 1987.
- Preventing Deaths of Farm Workers in Manure Pits (DHHS/NIOSH Publication No. 90-103). Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 1990.
- Safe Grain and Silage Handling (NIOSH Publication No. 95-109). Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 1995.

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

Machinery & Vehicles

Publications

- Agricultural Education I. Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Career and Technology Education, 2004.
- Federal Laws and Regulations Affecting Agricultural Employers (Agricultural Handbook No. 719). Washington, DC: U.S. Department of Agriculture, 2000.
- Hazard ID 13: Hazards Associated With Using Farm Tractors to Move Large Bales (DHHS/NIOSH Publication No. 2001-146). Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 2001. Available online at: www.cdc.gov/niosh/hid13.html.
- Job Safety & Health Quarterly, Fall 2001. Washington, DC: Occupational Safety and Health Administration, 2001.
- NIOSH ALERT: Preventing Scalping and Other Severe Injuries from Farm Machinery (DHHS/NIOSH Publication No. 94-105). Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 1994.
- NIOSH Warns: Improper Hitching to Tractors Can Be Fatal (DHHS/NIOSH Publication No. 97-108). Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and

Prevention, National Institute for Occupational Safety and Health, 1997. Available online at: www.cdc.gov/niosh/tractor1.html.

- Safe Grain and Silage Handling (NIOSH Publication No. 95-109). Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control andPrevention, National Institute for Occupational Safety and Health, 1995. Available online at: http://www.cdc.gov/niosh/contents.html.

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- National Academy of Engineering "Greatest Engineering Achievements of the 20th Century" website
  www.greatachievements.org
- NIOSH Fatality Assessment and Control Evaluation Program
  http://www.cdc.gov/niosh/face/
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

All-Terrain Vehicles (Atvs)

Publications

- Hazards Associated with All-Terrain Vehicles (ATVs) in the Workplace (Safety and Health Information Bulletin 08-03-2006). Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 2006.

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- Oklahoma State Department of Health "All-Terrain Vehicle Safety" website
  www.health.state.ok.us/program/injury/ATV/index.html
- NIOSH Fatality Assessment and Control Evaluation Program
  http://www.cdc.gov/niosh/face/
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

Livestock & Other Animals

Publications

- Agricultural Education I. Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Career and Technology Education, 2004.
- Animal Science. Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Vocational and Technical Education, 1994.

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- CDC "Rabies" website
  www.cdc.gov/ncidod/dvrd/rabies/
- NIOSH Fatality Assessment and Control Evaluation Program
  http://www.cdc.gov/niosh/face/
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

Exposure Hazards

Publications

- Agricultural Education I. Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Career and Technology Education, 2004.
- Cancer and the Environment: What You Need to Know, What You Can Do (NIH Publication No. 03-2039). Washington, DC: U.S. Department of Health and Human Services, National Cancer Institute and National Institute of Environmental Health Sciences, 2003.
- OSHA 3154. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 2006.

- OSHA 3156. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 1999 (revised).
- OSHA Fact Sheet: Working Outdoors in Warm Climates. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 2005.
- "Outsmarting poison ivy and its cousins." Washington, DC: Food and Drug Administration, FDA Consumer magazine, 1996.
- What You Need To Know About Cancer (NIH Publication No. 05-1566). Bethesda, MD: National Institutes of Health, National Cancer Institute, 2005.
- What You Need To Know About Melanoma (NIH Publication No. 02-1563). Bethesda, MD: National Institutes of Health, National Cancer Institute, 2002.
- What You Need To Know About Moles and Dysplastic Nevi (NIH Publication No. 99-3133). Bethesda, MD: National Institutes of Health, National Cancer Institute, 1999.
- What You Need To Know About Skin Cancer (NIH Publication No. 05-1564). Bethesda, MD: National Institutes of Health, National Cancer Institute, 2005.

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- OSHA "Poisonous Plants" website *www.osha.gov/SLTC/etools/sawmills/poison.html*
- NIOSH Fatality Assessment and Control Evaluation Program *http://www.cdc.gov/niosh/face/*
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications) *www.csrees.usda.gov/qlinks/partners/state_partners.html*

Severe Weather

Publications

- Agricultural Education I. Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Career and Technology Education, 2004.
- thunderstorms...tornadoes...lightning...Nature's Most Violent Storms—A Preparedness Guide (NOAA/PA 99050). Washington DC: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, no date.
- Winter Storms—The Deceptive Killers: A Preparedness Guide. Washington DC: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, 2001.

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- NIOSH Fatality Assessment and Control Evaluation Program *http://www.cdc.gov/niosh/face/*
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications) *www.csrees.usda.gov/qlinks/partners/state_partners.html*

Electricity

Publications

- Controlling Electrical Hazards (OSHA 3075). Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 2002
- CPSC Guide to Home Wiring Hazards. Washington, DC: U.S. Consumer Product Safety Commission, no date.
- Electrical Safety: Safety and Health for Electrical Trades. Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 2002.
- Outdoor Electrical Safety Check: Tips for the Safe Outdoor Use of Electricity. Rosslyn, VA: Electrical Safety Foundation International, no date.
- Preventing Grain Auger Electrocutions (DHHS/NIOSH Publication No. 86-119). Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 1986.

Online Resources

This content was written using these resources in the original publication. Links to resources may no longer be available.

- OSHA Youth in Agriculture "Agricultural Hazards" website
  www.osha.gov/SLTC/youth/agriculture/index.html
- National Safety Council "Agricultural Safety" website
  www.nsc.org/issues/agrisafe.htm
- Electrical Safety Foundation International
  www.electrical-safety.org/
- NIOSH Fatality Assessment and Control Evaluation Program
  http://www.cdc.gov/niosh/face/
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

Fires & Wildfires

Publications

- Agricultural Education I. Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Career and Technology Education, 2004.
- Agricultural Fires, Topical Fire Research Series, Vol. 2, Issue 10. Emmitsburg, MD: U.S. Fire Administration, National Fire Data Center, March 2002 (revised).
- Agricultural Storage Fires, Topical Fire Research Series, Vol. 1, Issue 11. Emmitsburg, MD: U.S. Fire Administration, National Fire Data Center, December 2001 (revised).
- Escape from Fire: Once You're Out, Stay Out! Emmitsburg, MD: U.S. Fire Administration, 1991.

Online Resources

This content was written using these resources in the original publication. Links to resources may no longer be available.

- FEMA "Fire" website
  www.fema.gov/hazard/fire/index.shtm
- NIOSH Fatality Assessment and Control Evaluation Program
  http://www.cdc.gov/niosh/face/
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

First Aid & Emergencies

Publications

- Act in Time to Heart Attack Signs (NIH Publication No. 01-3525). Bethesda, MD: National Heart, Lung, and Blood Institute, 2001.
- Agricultural Education I. Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Career and Technology Education, 2004.
- Back Pain (NIH Publication No. 05-5282). Bethesda, MD: National Institute of Arthritis and Musculoskeletal and Skin Diseases, 2005.
- Best Practices Guide: Fundamentals of a Workplace First-Aid Program (OSHA 3317-05N). Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 2006.
- Check Your Physical Activity & Heart Disease I.Q. (NIH Publication No. 96-3795). Bethesda, MD: National Heart, Lung, and Blood Institute, 1996.
- Cold Stress Card (OSHA 3156). Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 1999 (revised).
- High Blood Cholesterol: What you need to know (NIH Publication No. 05-3290). Bethesda, MD: National Heart, Lung, and Blood Institute, 2005.
- OSHA QUICK CARD: Rodents, Snakes and Insects (OSHA 3265-09N-05). Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration, 2005.
- Questions & Answers about...Sprains and Strains (NIH Publication No. 04-5328). Bethesda, MD: National Institute of Arthritis and Musculoskeletal and Skin Diseases, 2004.

Online Resources

This content was written using these resources in the original publication. Links to resources may no longer be available.

- National Heart, Lung, and Blood Institute "Heart Attack Signs" website
  www.nhlbi.nih.gov/actintime/index.htm

- Mayo Clinic First-Aid Guide
  www.mayoclinic.com/health/FirstAidIndex/FirstAidIndex
- American Red Cross "Causes and Signals of Choking" website
  www.redcross.org/services/hss/tips/choking.html
- National Library of Medicine "Burns" website
  www.nlm.nih.gov/medlineplus/burns.html
- USDA Bee Stings/Safety
  www.ars.usda.gov/Research/docs.htm?docid=11067
- Los Angeles Fire Department "Heart Attack, CPR, and Choking" website
  www.lafd.org/heart1.htm
- University of Washington "Learn CPR" website (including video demonstrations)
  http://depts.washington.edu/learncpr/quickcpr.html
- CDC "Extreme Heat" website
  http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp
- NIOSH Fatality Assessment and Control Evaluation Program
  http://www.cdc.gov/niosh/face/
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

Hand Tools, Power Tools & Ladders

Publications

- Agricultural Education I. Stillwater, OK: Curriculum and Instructional Materials Center, Oklahoma Department of Career and Technology Education, 2004.
- A Guide for Protecting Workers from Woodworking Hazards (OSHA 3157). Washington, DC: Occupational Safety and Health Administration, 1999.
- OSHA Fact Sheet: Working Safely with Chain Saws. Washington, DC: Occupational Safety and Health Administration, no date.
- Stairways and Ladders: A Guide to OSHA Rules (OSHA 3124). Washington, DC: Occupational Safety and Health Administration, 2003.

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- NIOSH Fatality Assessment and Control Evaluation Program
  http://www.cdc.gov/niosh/face/
- USDA Cooperative State Research, Education, and Extension Service map (to locate extension publications)
  www.csrees.usda.gov/qlinks/partners/state_partners.html

Underground Pipelines

Online Resources

This content was written using these resources in the original puplication. Links to resources may no longer be available.

- Access Midstream Partners
  http://www.accessmidstream.com/Information/Safety/Pages/Safety.aspx