



A Guide to Farm Safety and Health



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Acknowledgments

A Guide to Farm Safety and Health was prepared for the North Carolina Department of Labor by the late Darrell L. Roberts, Ph.D., P.E. Dr. Roberts was a professor and extension safety specialist at Clemson University, Clemson, South Carolina. The information in this guide was updated in 2008.

This guide is intended to be consistent with all existing OSHA standards; therefore, if an area is considered by the reader to be inconsistent with a standard, then the OSHA standard should be followed.

To obtain additional copies of this guide, or if you have questions about N.C. occupational safety and health standards or rules, please contact:

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Additional sources of information are listed on the inside back cover of this guide.

The projected cost of the NCDOL OSH program for federal fiscal year 2008–2009 is \$17,042,662. Federal funding provides approximately 30 percent (\$4,090,400) of this total.

Revised 04/08



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Foreword

North Carolina's agriculture industry, including food, fiber and forestry, contributes over \$46 billion annually to the state's economy. The revenue accounts for nearly one-quarter of the state's income and employs 22 percent of the workforce. In 2006, farm cash receipts totaled more than \$8 billion.

Safety programs help employers and employees to maintain an efficient and productive industry. Disabling work injuries and fatalities are very costly. In addition to the deep personal tragedy, the medical expenses, lost wages, insurance administration, and uninsured costs have long-term detrimental effects on the industry. *A Guide to Farm Safety and Health* has been developed to assist in the prevention of and protection against farm injuries and fatalities.

In North Carolina, NCDOL inspectors enforce the federal Occupational Safety and Health Act through a state plan approved by the U.S. Department of Labor. The Occupational Safety and Health Division of the N.C. Department of Labor offers many educational programs to the public and produces publications, including this guide, to help inform people about their rights and responsibilities regarding occupational safety and health.

When looking through this guide, please remember the mission of the N.C. Department of Labor is greater than just enforcement of regulations. An equally important goal is to help people find ways to create safe workplaces. Reading and understanding *A Guide to Farm Safety and Health* will help you form effective occupational safety and health practices in your work.

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Introduction

Compared to other industries, agriculture presents a broad array of occupational hazards in terms of both safety and health. This is particularly true for the family-operated farm or small farm where workers must perform all jobs and thereby encounter the entire array of hazards. Employees of large commercial and private farms generally encounter fewer types of job hazards but still experience numerous hazardous situations.

The principal types of injury producing hazards can be classified by form of energy. Examples include the following:

1. Kinetic: machine collision and overturn; falling loads; being kicked, butted or stepped on by animals; turning power transmission components; pressurized fluids; and falls
2. Thermal: sun and ignition of fuel or other flammable material
3. Electrical: electrocution and ignition of volatile and other explosive concentrations
4. Chemical: acidic and caustic materials and drugs

This guide is principally about prevention of and protection against farm injuries and fatalities. Some attention, however, is given to prevention of and protection against health disorders resulting from energy hazards as well as other agricultural hazards. Other hazards include both biological and nonbiological contaminants such as toxic solids and gases, dusts, bacterial and fungal spores, oxygen deficient environments, noise, and environmental and workload stresses.

A large number of topics appear in this guide because agricultural work settings possess many kinds of hazards. A good way to use this guide is to address its topics individually at different times. A single topic may be an excellent tool for group discussion and a springboard for further learning. Readers can use the information to compare their own skills, practices, knowledge and experiences.

Hazards, Accident Prevention and Protection

This section presents information on principal farm hazards and agents producing accidental injury and death. Principal farm hazards and agents include the following:

Safety Hazards	
Farm Tractors	Storage Structures
Other Field Machinery	Electricity
Material Handling Equipment	Farm Animals
Maintenance Equipment	Fire and Explosions

Health Hazards	
Environmental Extremes	Chemicals
Respiratory Contaminants	Noise

This section also considers ways in which accidents occur, recommends measures of prevention and protection, and discusses hazards leading to health disorders.

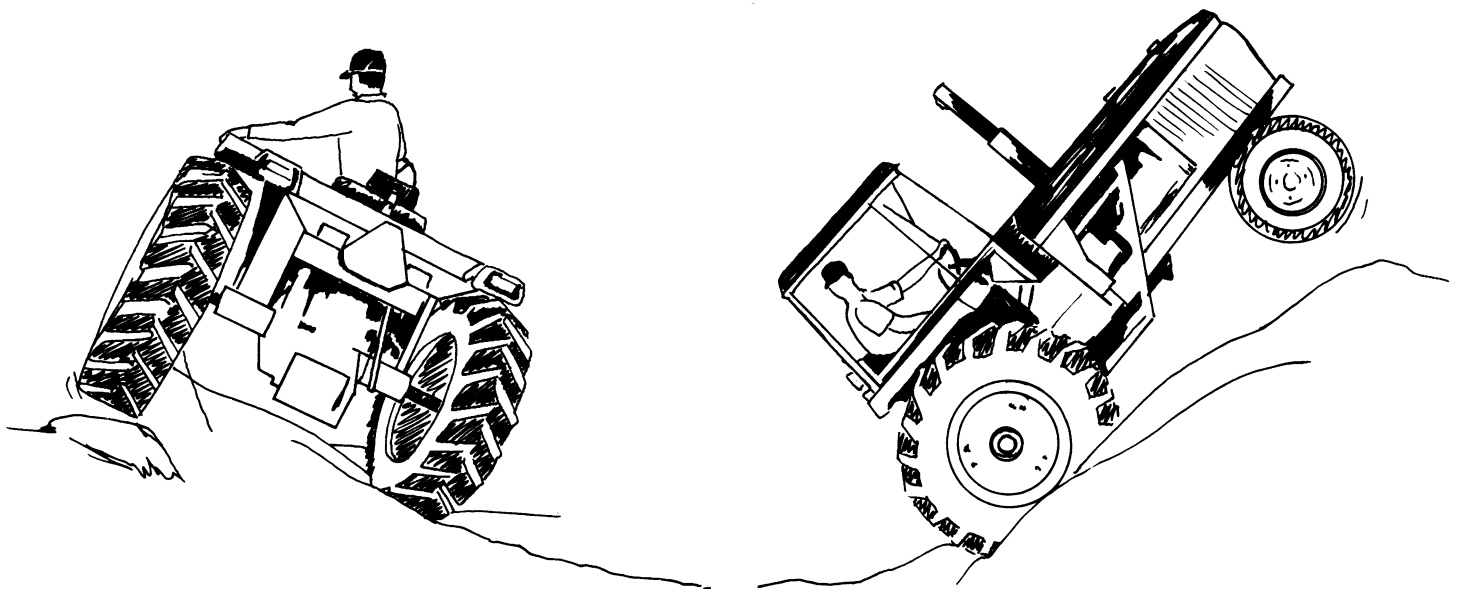
Farm Tractors

Overturns

Tractor overturns account for more farm work deaths than any other accident type. Figure 1 illustrates side and rear overturns. About four out of five overturns are side overturns. These overturns occur more frequently with tricycle-type tractors than with wide front-end (utility) type tractors.

Figure 1

Side and Rear Overturns



To prevent overturns, every operator should learn basic safety principles related to:

- Center of gravity and how it changes
- Centrifugal force
- Effects of tractor loading:
 - Wheel and front-end weights
 - Hitching
 - Positioning of load in a front-end loader
- Human limitations

Such principles emphasize, for example, that spacing tractor wheels out as widely as possible increases the stability of the tractor. These principles are found in many sources.¹

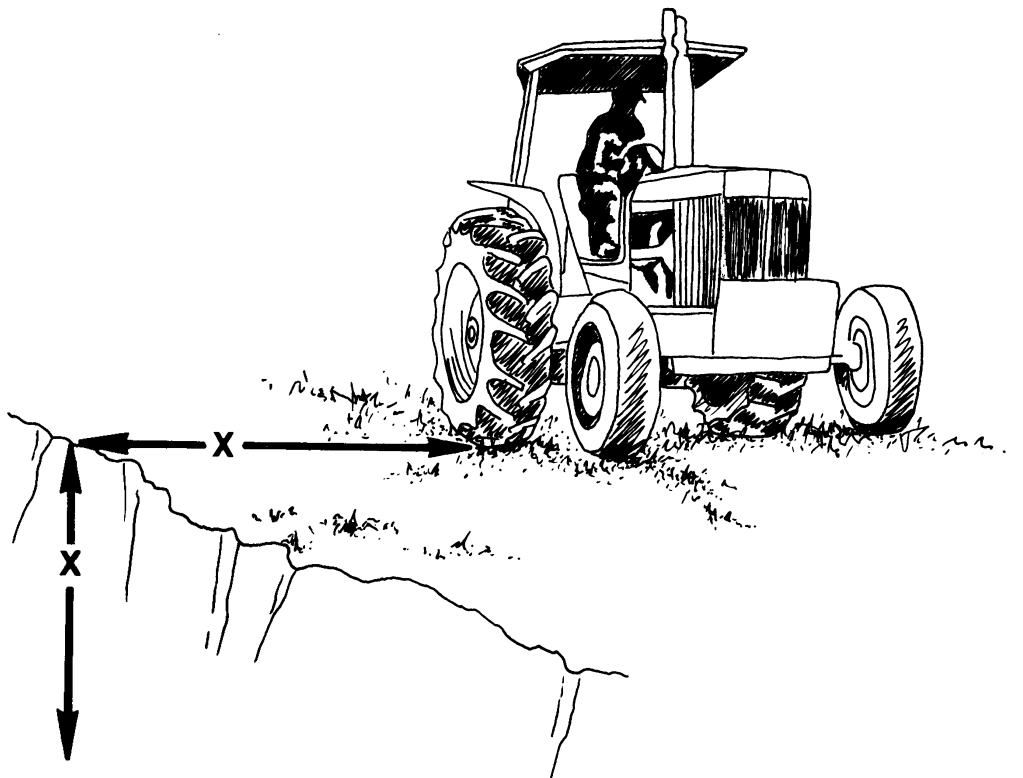
Side overturns take place primarily when the tractor is operated in the following conditions:

- Too close to ditches, embankments or ponds
- On too steep a slope
- Too fast for road or field conditions such as road curves, sharp turns or field depressions

To avoid side overturns when operating tractors near ditches, trench silos, embankments or ponds, keep the tractor wheels beyond the shear line. As Figure 2 illustrates, this means that the bank will not shear off if the wheels are further from the bank than the ditch is deep.

Figure 2

Safe Operating Distance From a Ditch Is Greater Than the Ditch Depth



Driving up or backing down slopes that are too steep causes the entire weight of the tractor to be placed on the rear wheels. Continuing to rotate the rear wheels causes the weight to shift rearward and overturn the tractor. This can happen even on a marginally steep slope if:

- The rear wheels hit a depression,
- The front wheels hit a hump or elevated obstruction, or
- Brakes are sharply applied when the tractor is being backed down the slope.

The best prevention is to stay off slopes. If you must operate on slopes, add weights to the tractor to improve stability. Operate the tractor slowly and use carefully controlled movements. Space the rear wheels as far apart as possible. Avoid running through depressions on the downhill side and over elevated bumps or obstructions on the uphill side. Keep any rear- or side-mounted implements operating on the uphill side of the tractor. Also avoid making sharp turns uphill.

Excessive speed is a major contributor to side overturns. Before traveling on roads, ensure that brake pedals activate the rear wheel brakes equally; if they do not, adjust or repair them before continuing. Then lock the brake pedals together. Quick braking of a single wheel while turning at excessive speeds can cause a side overturn. Even without braking, centrifugal force can cause the tractor to overturn when traveling at high speeds while making too sharp a turn. When traveling at speeds excessive for turning, slow down by using the throttle early enough to depend on the engine braking. If engine braking is not enough, then use the brakes.

Losing control of a tractor while pulling heavy loads may also cause side overturn and collision accidents. This is particularly true when going downhill if a heavy load starts to weave and takes control of the tractor away from the operator. Use the same gear pulling the load downhill as pulling it uphill. Select a gear and speed that allows control of the tractor and load. Do this before starting downhill or uphill. If using heavily loaded wagons, ensure that the wagons are also equipped with brakes.

Rear overturns usually result from three conditions:

- When the tractor is incorrectly hitched to a load,
- When the rear axle is restrained while the wheels are stuck, or
- When the tractor is operated forward (up) or rearward (down) on too steep a slope.

Rear overturns that involve improper hitching usually result from the load being hitched to positions higher than the drawbar. When a load is hitched too high and power is applied, the line of pull runs near or above the center of gravity. This causes a lifting and rotation of the front-end of the tractor about the rear wheels. To prevent this type of rear overturn, hitch to the fixed drawbar.

When the rear axle of a tractor is restrained and power is applied to the rear wheels, the tractor can flip over backward. For example, when a tractor is stuck in a field and the operator continues to spin the wheels, the wheels can hit some heavy resistance. The resistance can come from the soil or from something like a post being tied to the tractor wheels. The result is a rear overturn. To prevent this type of overturn, avoid situations in which the tractor is likely to become stuck and, if the tractor gets stuck, use a larger tractor and safe hitching to pull the smaller tractor out.

Driving up or backing down slopes that are too steep causes the entire weight of the tractor to be placed on the rear wheels. Continued forward rotation of the rear wheels causes the weight to shift rearward and overturn the tractor. This can occur even on a marginally steep slope if:

- The rear wheels hit a depression,
- The front wheels hit a hump or elevated obstruction, or
- Brakes are sharply applied when the tractor is being backed down the slope.

The best means of preventing these types of rear overturns is to stay off slopes. If you must operate on slopes, add weights to the tractor to improve its stability and operate the tractor slowly, using carefully controlled movements. Also space the rear wheels as far apart as possible. Avoid running through depressions on the downhill side or over elevated bumps or obstructions on the uphill side. Keep any rear- or side-mounted implements operating on the uphill side of the tractor. Always avoid making any sharp turns uphill.

Loading and unloading a tractor on transport trailers or truck beds can also produce overturns. To prevent this type of accident, the following practices are recommended:

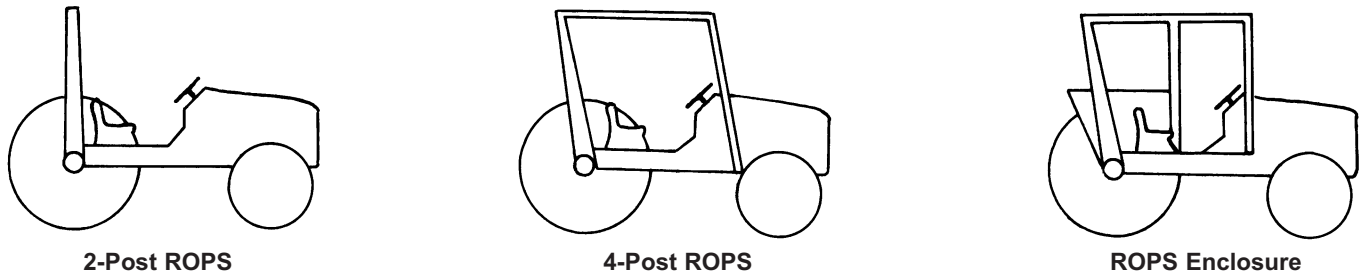
- Use a trailer with adequate width and load capacity for safe loading and transport.
- If, instead of a tilting deck, a fixed bed trailer or truck is being used, ensure that the loading ramp or dock lines up suitably with the bed height.
- When loading from a ditch bank, especially where the ditch bank does not line up with the bed, back onto the bed so that the tractor is positioned with the desired weight distribution.
- Bolt rails of 4" x 4" timbers or angle iron to the bed inside or outside the wheels of the tractor to prevent side movement of the load.

- Use tie-down chains with chain binders to secure the load and prevent it from moving forward, backward or sideways.

Pulling wide equipment on roadways is hazardous, particularly if the equipment is as wide or wider than the right traffic lane. Whenever possible, convert the equipment to the transport position so that it will run completely in the right lane. When driving on the shoulder, reduce speed and be especially careful as the implement or tractor can run into a washout, ditch, guardrail or culvert and overturn.

Figure 3

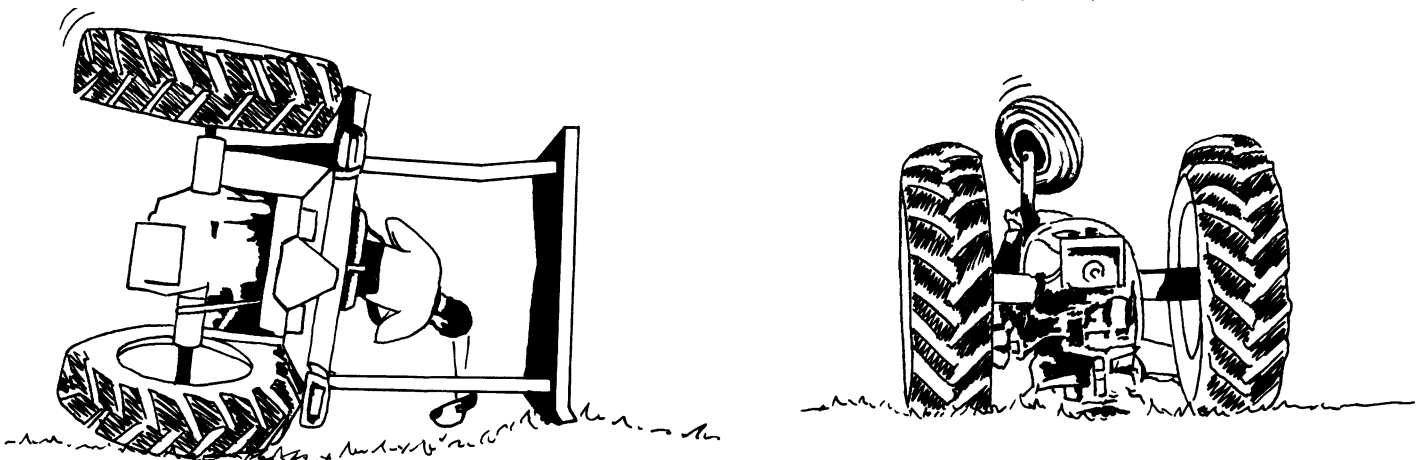
Basic Types of Rollover Protective Structures (ROPS)



Using a rollover protective structure (ROPS) and a seat belt provides the tractor operator the best available protection in an overturn. Figure 3 shows three types of ROPS designed to withstand an overturn—a two-post roll frame or bar, a four-post frame, and a cab. According to 1928.51(b), agricultural tractors manufactured after Oct. 25, 1976, shall, among other items, have roll-over protective structures and seat belts installed. ROPS shall be provided by the employer for each tractor operated by an employee. Except as stated in 1928.51(b)(5), a ROPS used on wheel-type tractors shall meet the test and performance requirements of 29 CFR 1928.52, 1928.53, or 1926.1002 as appropriate. A ROPS used on track-type tractors shall meet the test and performance requirements of 29 CFR 1926.1001. If a ROPS is installed, a seat belt must also be installed. See 1928.51(b) for details and other requirements. The ROPS provides a zone of protection for the belted operator since it is designed to deflect only so far when impacted during an overturn. Figure 4 illustrates overturns with and without ROPS.

Figure 4

Overturns With and Without a Rollover Protective Structure (ROPS)



Falls

Falls from a moving tractor often result in serious injury or death of an operator or rider.

Falls occurring while mounting or dismounting a parked tractor are more common but result in less serious injuries. Most if not all fall accidents can be prevented.

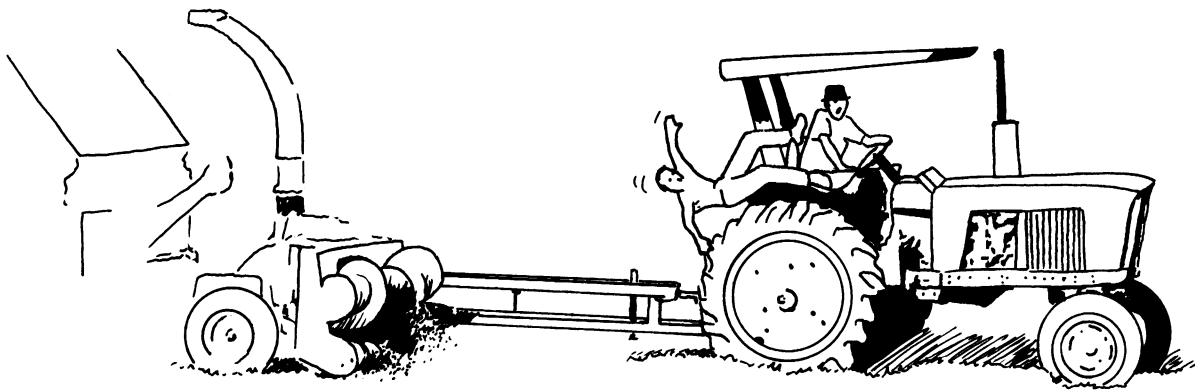
Fall accidents from moving tractors result from:

- A rider beside or behind the operator loses grip from inattention, play or rough ground.
- A tractor part fails, such as a fender that a rider is sitting on or holding onto.
- Low-hanging branches strike and drag the operator off the tractor.
- An unseated or bending operator is thrown off when the tractor hits rough ground.
- Stinging insects attack the operator or rider.
- The operator or rider mounts or dismounts.

To prevent falls from a moving tractor, do **not** mount or dismount, do **not** permit riders, and do **not** stand or reach to extreme lengths. Mounting or dismounting a moving tractor is a dangerous practice because the climber can stumble, trip or slip and fall into the path of the tractor or a trailing implement such as a hay wagon. A rider should be present only when training to become an operator and when using the safest operating conditions and locations. (Start the trainee on a small tractor like a garden tractor or riding mower to master the needed skills before learning to operate a farm tractor.) The operator must stay seated to have full control of the tractor. If other positions are required, stop the tractor until the tasks can be completed. Operators can help avoid falls by wearing seat belts when tractors are ROPS-equipped and by being especially attentive to driving responsibilities, hazardous terrain, stinging insects, tree branches and obstacles in the field.

Figure 5

Fall Hazard-Rider on Tractor



Using safe movements and reasonable housekeeping helps prevent falls while mounting or dismounting a parked tractor.

- Take time to mount and dismount the tractor carefully.
- Use the steps and handholds to climb to and from the operator's platform.
- Wear safety shoes with skid-resistant soles.
- Keep the steps, handholds and platform clear of mud, grease, plant debris, snow and ice.
- Do not jump from the tractor.

Runovers

Some victims of runover accidents are hit after falling from a tractor or trailing implement. Other victims are hit while standing on the ground. About half of the victims of fall accidents are also run over.

To prevent runover accidents, observe the following rules:

- Start the tractor only from the tractor seat with the transmission in park or neutral.
- Repair a starter as soon as it malfunctions.
- Keep the battery charged.
- Do **not** wire around *neutral* to start the tractor by using a contact across the starter solenoid terminals.

Old tractors can be started by battery or hand crank. Failure to ensure that such a tractor was out of gear before hand cranking it from the front caused many runover accidents in the past. This can still happen with old tractors unless the battery system is maintained.

Principal runover accidents include the following situations:

- Bypass starting a tractor while standing on the ground in front of a rear wheel with the tractor unknowingly in gear (see Figure 6).
- Failure of the operator to notice a person in front of or behind a moving tractor.
- Operator control error while backing the tractor to hitch an implement when a person is standing beside the implement to hitch it.
- Forgetting to apply the parking brake before dismounting when the tractor is on a slope.

Figure 6

Runover Hazard-Starting Tractor From Ground



Tractor operators and others working around farm machinery must know and use safe procedures. Tractor operators must develop a keen sense of observation to detect any person in the working area of the tractor or field machine. Similarly, other people must be taught to stay out of the work area unless they have a job to do.

A fail-safe means of communication must be established between the tractor operator and other workers. Standard hand signals can be used.² If there are communication problems, stop the machinery and ensure clarity before proceeding.

To hitch implements to the tractor safely, the operator must line up the drawbar or three-point hitch with the hitch point(s) of the implement. Using an assistant on the ground to help with hitching makes fail-safe communication and good control of the tractor essential. Have the assistant stand to the side of the tractor while backing the tractor up to the implement to align the hitching holes. Shift to neutral or park and set the hand brake before asking the assistant to complete the hitch. Failure to follow safe hitching procedures results in many crushed fingers and some runovers.

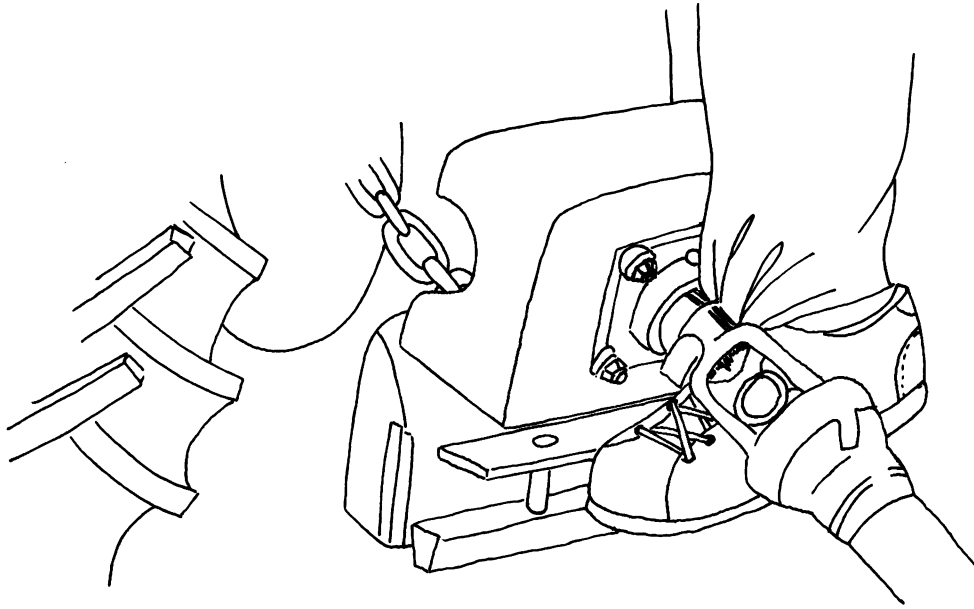
Power Takeoff (PTO) Hazards

The power takeoff (PTO) shaft transmits power from the tractor to stationary or trailing implements. (Stationary equipment includes such items as augers, elevators and posthole diggers; trailing equipment includes equipment such as forage harvesters, hay balers and rotary mowers.) The drive shaft is powered at 540 revolutions per minute (rpm) or 1,000 rpm, depending on the tractor. This means that the shaft turns 9 times per second or $16\frac{2}{3}$ times per second, respectively.

PTO accidents produce a number of serious injuries and deaths. Unguarded power takeoffs, powered drivelines and U-joints are all hazardous components within the PTO drive system. These components can grab and entangle loose or frayed clothing, long hair or other items such as strings on a hood, coat or shoes. If the victim of such an entanglement is fortunate, the clothing or other item will tear or break. If not, the victim may be wrapped around the shaft causing lacerations, broken bones, amputation or suffocation (see Figure 7).

Figure 7

Power Takeoff Entanglement

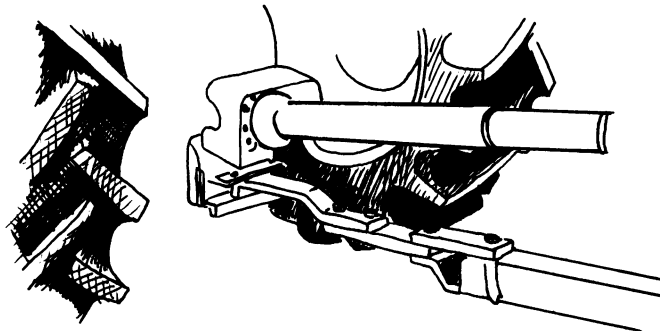


To help prevent PTO entanglements, follow these guidelines:

- Wear comfortable, close-fitting clothing when working around powered machinery.
- Use shields that give adequate protection for the PTO drive system (see Figure 8).
- Keep shields in place and repair them if they are damaged.
- Before leaving the tractor to check the powered equipment:
 - Disengage the PTO,
 - Turn off the tractor engine, and
 - Remove the ignition key before dismounting.
- Never step across a rotating power shaft, even if it is shielded.
- When the power is off, periodically check the driveline shield to ensure that it rotates freely and independently of the drive shaft.

Figure 8

Shielded PTO and Driveline



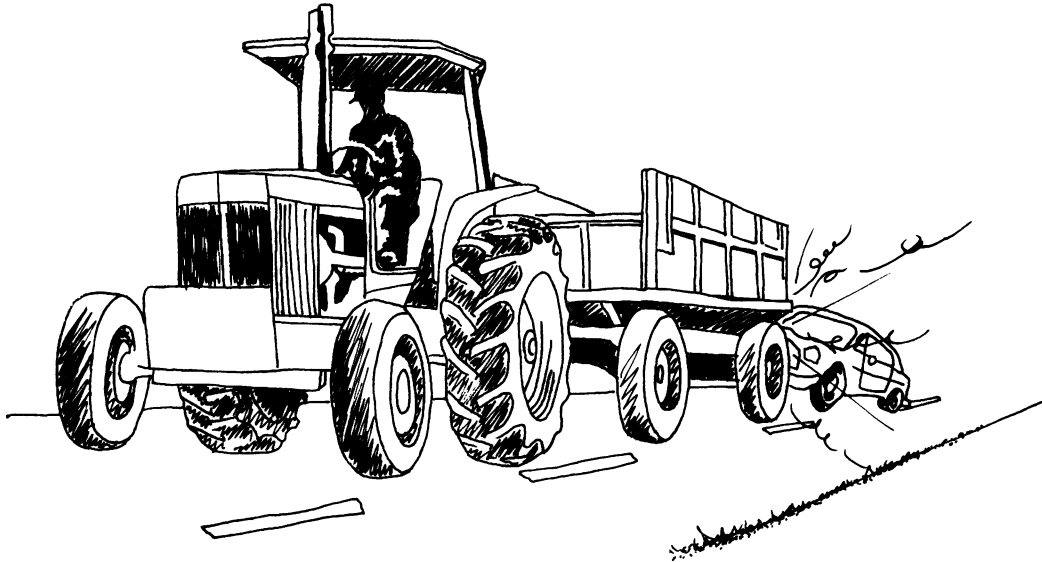
Another potential tractor hazard is the separation of the telescoping portion of the driveline. The broken or disconnected portion driven by the PTO can swing and strike the operator or someone standing near the tractor. To prevent this from occurring, ensure that the length of the telescoping portion is the length recommended for the equipment by the manufacturer. If the length is correct, the drive will telescope in or out as the changing terrain requires. Check the operator's manual for the appropriate overlap in order to phase the U-joints and position the drawbar correctly. Train all equipment operators in proper installation, maintenance and operating procedures for PTO drive systems.

Roadway Accidents

Most roadway accidents involve collisions between a farm tractor and another vehicle. Often the tractor is pulling a transport wagon or trailer. The most frequent violations by tractor operators include failure to yield the right of way, improper lighting, improper turning, improper or no signal and failure to see if the movement could be made safely. The most frequent violations by other vehicle operators include exceeding safe speed, improper overtaking and following too closely (see Figure 9).

Figure 9

Roadway Collision With Farm Equipment



The large number of rear-end collisions and collisions where tractors are entering or exiting the highway suggests that operators of motor vehicles need to be more aware of the slow-moving vehicle (SMV) and to judge with greater accuracy the differences in speed and the closure rate between two vehicles. Any SMV (normal operating speeds not in excess of 25 mph) operated on roadways should display an SMV emblem. For full effectiveness, periodically clean the emblem, and, about every two years, replace the triangular center so it will maintain its fluorescence.

Farm equipment operators should use flashing amber lights when they travel on roadways during the day or night. Lights should conform to the requirements of the N.C. Department of Transportation for other lights and their mounting.

Owners of tractors and other farm equipment used on roadways should keep them in safe operating condition. Operators of the equipment should be trained to operate the equipment correctly, to recognize the hazards of roadway operation, and to assume individual responsibility in safe operation and defensive driving.

Other Field Machinery

This guide covers three other classes of field machinery—tillage and planting equipment, chemical equipment, and harvesters. Always use the proper equipment for the job at hand. Using unsuitable equipment leads to operator frustration and accelerated equipment failure. Both factors increase the potential for accidents and injuries.

Tillage and Planting Equipment

PTO shaft and driveline hazards exist on all combinations of tractors and powered implements. To prevent injuries on tillage and planting equipment, provide and maintain appropriate guards on equipment and train farm workers to observe safe operating procedures.

Any equipment with hydraulic fluid presents potential hazards. Hydraulic pressures are often between 2,000 and 3,000 pounds per square inch (psi). Stored energy can be released when a pinhole leak develops, a line breaks or another component fails. Hydraulic problems should be corrected when first detected. The source may be undetectable to the naked eye. Never check for a leak by hand because hydraulic fluid from a pinhole at less than 1,000 psi can penetrate the skin.

When connecting hydraulic hoses to the tractor, ensure that the hydraulic control direction is correct. If there is any doubt, check the owner's manual. If the control direction is backwards, use safe procedures to switch the hoses, then recheck the connection.

To prevent equipment from being dropped on a worker, lower the equipment to the ground when it is not in use. If the machine has to be above the ground, use safety stands and/or stable blocking.

Check the operator's manual for recommended hitching procedures. This will save time and help prevent injuries. It is important to preplan for later hitching when an implement is unhitched. Be sure to use safety hitch pins of proper size for drawbar connections. For three-point hitches also ensure that proper hitch links that can be pinned in place.

Serious injuries may occur when an individual falls in the path of a disk harrow. Most of these accidents are extra rider falls. Never allow extra riders.

If wide tillage or planting equipment has to be pulled behind a tractor rather than carried on a truck, plank and attach it in the narrowest transport position. Refer to the owner's manual to ensure that the equipment is kept to the right of the centerline during transport.

Chemical Equipment

Hazards with dry chemical (mostly fertilizer) application equipment include those discussed in the previous section. However, anhydrous ammonia is a commonly used fertilizer that presents additional equipment hazards. Anhydrous ammonia is liquid when stored under pressure in the applicator tank and becomes a gas when it is released in the soil. Its accidental release into the air can cause very serious injuries if it contacts workers. It is critical to keep the anhydrous ammonia within the hose system when it is transferred and safely contained in the tank when it is not being released through the hose and injectors into the soil. To prevent the caustic chemical from contacting workers, maintain complete control by using safe transfer and application procedures, wearing personal protective equipment and servicing equipment regularly. Contact your local anhydrous ammonia supplier for details about transporting the chemical on public roads and about safe usage and equipment maintenance.

Protect yourself, particularly your eyes, by carrying an emergency water supply on the tractor and/or the applicator tank. This should be at least a 5-gallon fresh water supply. Operators may carry a small squirt bottle in their shirt pockets for aid until they reach the 5-gallon supply.

The objective of using chemical equipment is to deliver the desired amount of pesticide with the desired coverage on the target area without subjecting the operator or the environment to unacceptable exposure. Pesticide application equipment should be selected, prepared, operated and maintained to accomplish the desired objective.

Excessive chemical exposure can occur when:

- Equipment leaks are not corrected,
- Improper procedures are used during calibration, service or repair,
- Inadequate personal protection is worn during calibration, service or repair,
- Machinery decontamination or washdown procedures and protections are inadequate, and
- Drift of pesticide spray particles is excessive.

To reduce personal and environmental exposure significantly, use proper personal protective equipment and follow safe procedures that reduce the incidence of drift, spillage, leaks and other discharges.

Harvesters

Harvesters commonly used in North Carolina include grain combines, hay balers, forage harvesters, cotton pickers, tobacco harvesters, peanut combines and corn pickers. These harvesters perform aggressive functions such as:

- Cutting a crop
- Separating grain or leaves from stalks
- Wrapping hay into a cylindrical shape
- Separating seed cotton from its stalk

During these and other harvester functions severe accidental injuries may occur. Such injuries usually result from entanglement or other contact with powered components. Other injuries also occur when equipment overturns, catches fire, falls onto the victim or contacts power lines.

Entanglement, cutting and crushing injuries occur during operation adjustment and maintenance of harvesters. The most common injuries are to the fingers and hands. Such injuries occur when the pinch points between belts and pulleys catch these parts of the body. These accidents may cause burns or cuts or result in amputation. Pinch points with chain and sprocket drives or gear drives may produce severe crushing injuries. To prevent such injuries, always keep body parts away from turning components. Remember to replace guards after adjusting or working on power transmission components.

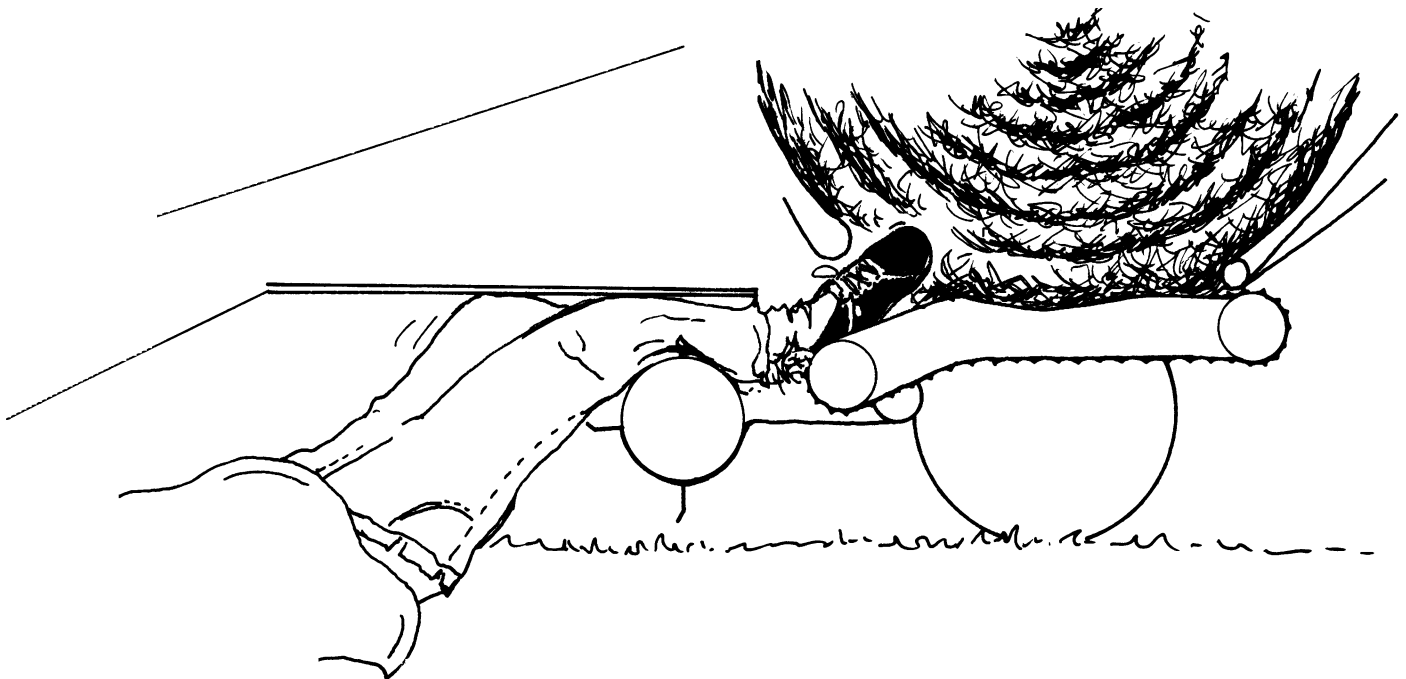
Severe injuries occur when a person is:

- Cut while contacting an operating cutter bar (mower, mower-conditioner, grain combine),
- Cut by a flail pickup, or
- Entangled in the intake components (pickup tines, belts, slats, feed rolls, cross-feed augers, snapping rolls, and spindles and doffers) of a harvester.

Figure 10 illustrates entanglement in a large round baler. Such accidents often occur when the operator is trying to clear a plugged condition with a hand or a foot. The powerful feeding mechanism may grab or cut faster than expected and can pull the victim into the machine.

Figure 10

Entanglement in Baler Intake



To prevent the types of accidents described above:

- Always cut the engine power and take the ignition key with you when getting down to inspect or unplug machinery. It is never safe to work on powered equipment when contact with the moving parts is possible.
- Use the harvester operator's manual to help establish safe procedures for operation, adjustment and maintenance.
- Adjust the ground speed and harvester operating components to changing crop and ground conditions. These adjustments will reduce plugging and subsequent operator frustration and will improve harvesting efficiency.

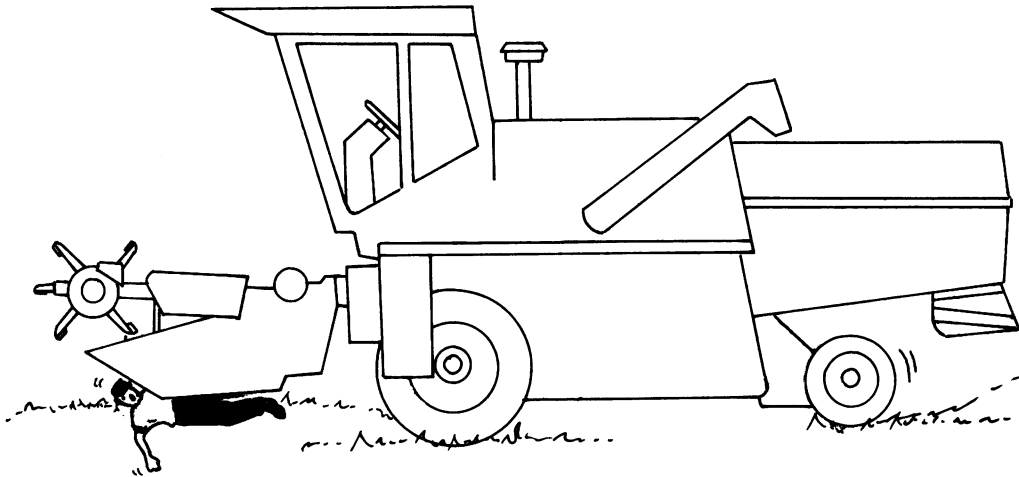
Another mechanical hazard on some harvesters is the auger. Whether it is used for cross feeding a crop at the intake or for unloading a commodity, serious injuries may occur when a body part is pulled between the auger and housing. Anyone riding or working on the grain tank of a combine may get caught in the unloading auger. Even when someone

observers such an accident, the observer may not be able to save the victim. Use caution when inspecting an unloading auger. Never get into the tank or ride on the tank when the auger is moving or can be started.

Each year death or serious injury occurs when someone is working under a harvester or tractor that falls on the individual. The victim can be crushed by a load weighing thousands of pounds. Such accidents may involve the rear of a grain combine or a cotton picker when a tire is being changed or when a combine header is being changed or repaired (see Figure 11). Sometimes a worker gets under a raised header and a hydraulic line fails or someone inadvertently drops the header on the victim.

Figure 11

Failure to Block Heavy Load—Victim Crushed



Most falls during header changes are preventable, if care is taken to position the equipment properly on a stable surface. This means having effective blocks or stands to support the header at the right height and angle for reattachment. Other machine-fall accidents may be prevented in a similar manner. When preparing to work under a machine, use header stands, cylinder locks and effective, stable blocking. Always chock the wheels before getting under the machine.

Harvesters, like tractors, may overturn when operated without extreme caution on steep or rough terrain or too close to ditches. Overturns may also occur when a harvested commodity, such as cotton, is stored in a basket considerably above the ground. Such storage raises the center of gravity of the harvester. When the basket is being dumped, the center of gravity is elevated even more and is moved to the side. If the ground is rough, there is also potential for overturn. This risk increases if the harvester is driven away and makes a turn before the basket is lowered. Always lower the basket before driving the harvester and use extreme caution when turning at row ends.

Overhead power lines are hazardous whenever contact by harvesters is possible. Contact with electrical wires can severely injure or kill harvester operators. To prevent such accidents, harvester operators should observe the following rules:

- Be aware of all low-hanging power lines so that contact is avoided.
- Know the relative heights of harvesters and power lines both when they are harvesting and when they are unloading.
- Allow plenty of clearance when dumping a loaded basket.
- Keep trailers well away from power lines so the picker can safely dump into the basket without maneuvering problems.

Contact the power company if there is a potential problem with tall harvesters and combines, such as tobacco, to see if the electrical lines can be repositioned.

The potential for fire is present in most harvesting operations, but particularly in hay or straw baling, grain combining, and cotton picking. Generally such fires do not produce injury but often produce considerable property loss. Prevention is the key to avoiding such fires and to reducing property loss. Equipment should be kept well serviced, particularly the exhaust systems, to reduce field and machinery fires caused by exhaust sparks.

A dry chemical ABC fire extinguisher should be mounted on harvesters in an easily accessible location. To prevent trash, dust and lint fires, frequently clean around the engine and screen as well as other areas on the tractor or harvester. Harvesting conditions will determine how often this is required. To avoid fires caused by friction, components, such as belts and rollers on balers, should be turned regularly. Also, the doffer area on a cotton picker should be periodically adjusted and cleared of excess debris.

Materials Handling Equipment

Materials handling equipment is involved in many farm accidents. This equipment includes portable augers and elevators, front-end loaders, forklifts, bale stackers and handlers, wagons and trailers, silo blowers and unloaders, and manure spreaders. Some accidents with materials handling equipment produce serious injuries. Many of these accidents can be prevented by observing the following rules:

- Before unclogging, lubricating, adjusting or repairing PTO-powered equipment, such as a forage wagon:
 - Disengage the feed control,
 - Cut the engine's power, and
 - Take the ignition key equipment.
- Wear close-fitting clothing when working around powered shafts, augers and elevators.
- Keep guards maintained and in place when equipment is running.
- Train operators to understand the hazards associated with each piece of equipment, referring to the owner's manual for specific recommendations.
- Do not allow children to operate materials handling equipment until they are physically and emotionally mature enough to handle the job.
- Keep children away from hazardous equipment and situations and teach them about such hazards.

Portable Augers and Elevators

Entanglement accidents and collapse and overturn hazards are common with portable augers and elevators. Entanglement injuries often occur between the screw and the housing at the auger intake and in unguarded belt-pulley or shaft drives on augers or elevators. Such injuries have also occurred to adults and children as they (1) pushed grain from the hopper into an unguarded screw, (2) tried to recover something that was dropped into the grain, or (3) slipped into the auger from an unsafe position near the hopper. Accidents such as these can be prevented by adhering to the following rules:

- Guard the auger intake.
- Keep young children out of auger work areas.
- Teach and encourage workers to use safe work procedures.

Entanglements in belt-pulley or PTO shaft drives can be prevented by following the above recommendations as well as ensuring that belt drives are guarded on electric or gasoline powered equipment and that the drive shaft is guarded on PTO-powered equipment.

Equipment collapse or overturn accidents may occur when the equipment is moved over uneven ground or when the equipment is unstable and too difficult to handle manually. The key to preventing such accidents is preplanning for safe movement. Preplanning includes the following:

- Lower the equipment before moving it.
- Use a vehicle to move heavy equipment.
- Ensure that there is a safe clearance between low-hanging power lines and the equipment being moved under them.

Loss of control when such equipment is being raised or lowered sometimes happens when the hand crank of a winch system slips out of the operator's hand or is released without being locked into place. Loads, such as grain or hay, should be unloaded from the equipment before it is raised or lowered. The operator should stand beside, not under, the equipment when raising or lowering it. The hand crank should be operated with care and at a reasonable rate. If the crank gets away from you and spins out of control, do not try to catch it with your hand. Keep the locking mechanism on the winch system maintained.

Front-end Loaders, Forklifts and Round-Bale Loaders

A forklift or a tractor with a loader often becomes unstable when the load is raised too high. Such instability leads to overturns, particularly if equipment is operated on slopes or rough ground or is turned too rapidly. This can be avoided by not overloading the equipment, keeping the load low and driving with care.

Carrying a large round bale too high in a tractor loader, without a firm grasp of the bale, can allow the bale to roll down and crush an operator. The load should be kept low, and a fork or grab should be used to contain the bale. Rear loaders forks and unrollers are better suited to safe bale handling than front-end loaders. To increase tractor stability, add appropriate weights for the front-end wheel or tire ballast as needed. For steering control, at least 20 percent of the tractor plus load weight should be on the front wheels.

When work with a front-end loader is completed, set the bucket on the ground. Do not leave it in the air. If the tractor is to be used, but the loader is not to be used for some time, remove the loader, so that the bucket will not be a hazard during the other work. **Never** use the bucket of a loader to carry passengers.

Forklifts handle quite differently from tractors with loaders. All forklift operators should learn the driving and lifting capabilities of each forklift. These include the amount of rear swing when turning, load capacity, fork tilt and lift controls, fork spread, and load placement for balanced loads. The forklift operator should also know how to start and stop with and without loads, how to keep the load off of the operator's cage and how to select the settings for safe operation.

Wagons

A variety of wagons and trailers are used to transport harvested crops on the farm and the public roads. Most forage and feed wagons are powered by the PTO shaft of the tractor. Most injuries on wagons are due to contact or entanglement with chain sprockets, gears, belts or shafts. Some serious injuries occur when the victim is entangled in the powered unloading beaters or augers. No one should be allowed to enter the forage wagon when it is being unloaded. Operating controls should be in good repair. The operator should always be at the controls when the wagon is being unloaded.

Self-unloading or gravity unloading wagons are used to empty a large amount of grain in a brief period. Both adults and children should stay out of the wagon and off of its side as it is being unloaded. There is a significant potential for suffocation should someone get caught in the path of the grain flow.

Silo Blowers and Unloaders

Both the loading and unloading of silos present hazards. Loading hazards include those associated with the forage wagon, feed table and blower as well as the PTO-powered driveline. Silo unloading hazards include those associated with the electrically powered unloader, falls while climbing and toxic silo gases.

Prevent falls and hand entanglement in the feed auger or blower by keeping all unnecessary people out of the forage feeding and blowing work area. If something falls into the feed table, disengage power to the feed auger and blower before trying to retrieve it. Never step on or over the feed table while the feed auger and blower are operating. When feeding problems occur, stop the equipment and fix the problem rather than trying to force-feed the equipment.

PTO drive-related hazards include driveline separation, entanglement in unguarded components and excessive blower-pipe vibration. Ensure that the blower and the tractor are kept in a stationary position and are properly hitched. Before attempting to lubricate, make adjustments or unclog the blower, always disengage power, cut the engine and take the key. Wait for the blower fan to come to a complete stop. Be sure all people are clear before engaging power to the blower.

Entanglements in silo unloaders sometimes occur when a person tries to unclog or work on a moving unloader or when the unloader is turned on without realizing another person is in the silo. To prevent such accidents, use the following rules:

- Never work on a moving unloader.
- Use a good lockout procedure to ensure that the unloader is not turned on when you are in the silo.
- Establish an effective way to communicate if the job requires one person at the top and one at the bottom of the silo; for example, use two-way radios.
- Follow the recommended procedure in the owner's manual for raising or lowering the unloader.
- Keep the winch system maintained so there are no surprises with mechanical failure.

Nitrogen dioxide and carbon dioxide are toxic gases produced during ensiling. The gases are at dangerously high levels for a few weeks after the silo is filled. Do not enter the silo or silo chute during this period. Ventilate the silo room two to three weeks after filling the silo. If it is necessary to enter the silo, run the blower at least 30 minutes before entering and use a self-contained breathing apparatus for oxygen.

Maintenance Equipment

Mowers, posthole diggers and chain saws are the agents of many serious injuries.

Mowers

Most hazards associated with mowers are found in rotary mowers pulled behind tractors and riding lawn mowers. Rotary mowers pulled behind tractors are commonly called bush hogs. Hazards include falls into the mower's path, over-turn, mower projectiles, PTO driveline entanglement, reaching or slipping into a turning blade, and machine failure.

Mower injuries can be prevented by using safe procedures and by maintaining equipment. Follow these rules:

- Do not allow extra riders on farm or lawn tractors.
- Operate mowers at speeds appropriate to the ground conditions and only in areas where stability is maintained.
- Avoid turning so sharply that the mower hits a rear wheel.
- Add weights to the front end of the farm tractor if the rear-mounted mower causes unacceptable steering control.
- Keep people out of the mowing area so that they cannot be struck by a projectile from the mower.
- Operate the mower at heights that allow the chain guard and the metal housing to contain any object that is hit and thrown by the mower.
- Keep the guards maintained and in place.
- Before servicing the mower or clearing an obstruction entangled in the mower blades, be sure to:
 - Shut down the PTO and tractor engine,
 - Take the keys, and
 - Set the brakes.
- Use the mower to cut only those materials it was designed to cut. Cutting heavy brush or saplings with a light-duty mower will lead to premature machine failure and possible injury.
- To prevent entanglement injuries, protect PTO drivelines for mowers and posthole diggers by using guards and shields.
- Always put guards and shields back in place after they have been removed.

Starting the tractor with the PTO disengaged, engaging it at a low speed and gradually increasing it to operating speed improve machine life and safety.

Posthole Diggers

Posthole diggers have a shear pin that will break if there is too much force on the digger. When it breaks, replace it with another shear pin. Then correct the problem rather than defeating the safety feature of the shear pin by replacing it with a harder bolt. The owner's manual recommends ways to obtain the best performance from the digger and ways to overcome problems such as dislodging a stuck digger.

Death or permanent injury can result from trying to force a PTO-powered posthole digger to dig faster or deeper. Obtaining a guarded digger suited to the job can prevent entanglements with an unguarded driveline or auger. Never try to force the digger into the ground by using your muscles and weight, whether the digger is guarded or not.

Chain Saws

The chain saw is one of the most useful power tools on the farm. It is also one of the most hazardous since the saw chain is very aggressive in wood and even more so in flesh. In addition to the cutting hazard, other injury and health hazards include falling trees and branches, rolling logs, and noise and vibration.

More deaths occur as a result of trees or branches falling on the operator or bystander than from cutting injuries. Most chain saw injuries are preventable if safe operating procedures are followed and the chain saw is properly maintained.

Procedures for safe chain saw operation³ include:

- Never cut alone.
- Before starting to saw, study the owner's manual to learn:
 - The features of the saw,
 - The details of hazards, and
 - How to prevent accidents.
- Never operate a saw when fatigued or taking strong medication or alcohol.
- Keep the handles of the saw clean and dry, and always use both hands to saw.
- Avoid cutting trees on windy days. Plan the path of tree fall and a safe line of retreat.
- When operating the saw, keep other people out of your working area.
- Avoid conditions that contribute to kickback.
- Keep anti-kickback devices in working order.
- Keep the saw well serviced, particularly the cutters, to reduce fatigue and frustration.
- Keep the line of the saw and bar to your side when cutting.
- Cut on the uphill side of a downed tree to prevent rollover.

Storage Structures

Storage structures at agricultural sites present the hazards of confined spaces, including, but not limited to, oxygen deficient and/or toxic environments. For more information about working safely in confined spaces, contact the Education, Training and Technical Assistance Bureau (ETTA), Occupational Safety and Health Division, N.C. Department of Labor. Make requests in writing to the following address:

N.C. Department of Labor
ETTA
1101 Mail Service Center
Raleigh, NC 27699-1101

To contact by telephone, call (919) 807-2875 or 1-800-625-2267 or send facsimiles to (919) 807-2876. To obtain information in person, visit the ETTA office located on the fourth floor of the Old Revenue Building at:

111 Hillsborough Street
Raleigh, NC

To view a complete listing of OSHNC publications, visit the Web site of the N.C. Department of Labor at:

www.nclabor.com

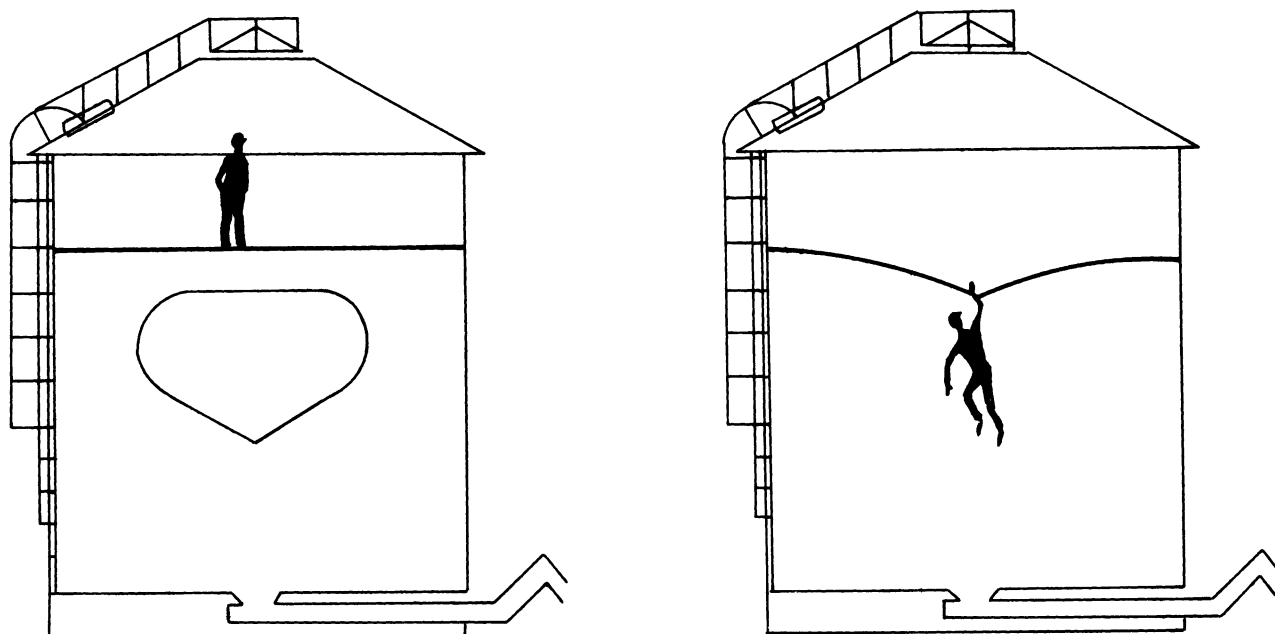
Suffocation accidents occur in grain bins and in grain transport equipment. Most entrapments and suffocations occur in grain bins when someone either is caught in flowing grain or falls through a crusted layer and is covered by grain. People enter grain bins for several reasons, such as to monitor the grain condition, break a crusted layer, retrieve something dropped into the grain, or check the grain or bin during loading or unloading. Also, children may enter a bin to play.

Most bins are bottom-unloaded with the inlet for the unloading auger at the center of the bin floor. During unloading a vertical column of grain flow forms a funnel-shaped path directly over the inlet for the running auger. When an object like a shovel or a person gets in this flowing path, it is rapidly pulled down with the grain. It takes only a few seconds to be knee deep, only about five seconds to be unable to break free, and only a few more seconds to be completely engulfed.

Figure 12 illustrates a person stepping on a layer of crusted grain. In this case suffocation can occur whether grain is being removed or not.

Figure 12

Grain Bin Entrapment After Breaking Through a Crusted Layer



Here are some precautions to prevent these accidents:

- Inform all family members and employees of the hazards around and in grain bins, and make grain bins off limits to children.
- Never enter a bin of flowing grain.
- Have a plan for safe entry and exit when you need to enter the bin.
 - Stop the unloading auger if it is running. Lock it out so it cannot be started while you are inside.
 - Always tell someone when you are entering a bin.
 - Use a safety harness with rope and secure it to a point outside the bin.
 - When possible have two people outside the bin capable of lifting the inside person should the need arise.
- Do not enter a bin that has a crusted layer. Use another means to break the crust.
- Install ladders inside bins.
- If you are being trapped in flowing grain, try to reach the bin wall and keep walking around the bin next to the wall. Remember grain is moving slowest at the bin wall and fastest at the center.
- If you are being submerged in grain, you can help yourself by cupping your hands over your mouth and nose and taking small breaths. This helps keep the respiratory tract free of grain.
- Use extreme caution if entering a bin having wet, moldy or spoiled grain in it. Air hazards may include toxic gases, dusts and reduced oxygen content. Turn on the blower and use respiratory protective equipment in such situations.
- Plan ahead for appropriate emergency response to serious farm accidents in potentially hazardous environments such as grain bins.⁴

Chemicals

Three major sources of hazards from chemicals in agricultural settings include pesticides, toxic gases and anhydrous ammonia. Anhydrous ammonia is also discussed in part in the section on field equipment.

Anhydrous Ammonia

This chemical freezes the skin upon contact and, unless treated rapidly, it continues to dehydrate and destroy cells. The process is particularly fast with soft tissue like the eyes, mouth and respiratory tract since it attracts water from the tissue.

The best treatment is to dilute the anhydrous ammonia with a steady flow of water—for at least 15 minutes—to flush the affected body area.

Toxic Gases

Silos, manure pits and grain bins are areas where the levels of toxic gases produced can cause death or serious health disorders. The gases include hydrogen sulfide, ammonia, methane and carbon dioxide. Hydrogen sulfide smells like rotten eggs, is heavier than air and is the most toxic of the gases. Ammonia has a sharp, penetrating odor (similar to household ammonia), is lighter than air and, even in moderate concentrations, causes severe respiratory disorders. Methane is odorless, lighter than air and flammable. Like ammonia, it rises to the top of a confined space and can asphyxiate anyone working in that area. Carbon dioxide is odorless, is heavier than air and can also asphyxiate people. A mixture of these gases is toxic and also causes oxygen depletion in any confined space.

Take the following precautions to help prevent loss of life and serious health disorders to humans and animals:

- Never enter confined spaces like manure storage pits or grain bins unless you know what is in them and the safety precautions to take. Fermenting grain generates high levels of carbon dioxide that can overcome a person.
- Do not smoke or have any other ignition source in the area of a manure pit. The concentration of methane can be such that fire or explosion is produced in a confined space if the gas is ignited.
- Have a good ventilation system in any building with a manure pit. Equip the ventilation system with a monitoring system that will alert the farm manager of ventilation system failure. A backup system is advisable in case of power failure.
- Ventilation is important at all times and critical during agitation of pit contents. Ensure that you have adequate ventilation during this period of increased gas discharge. Keep humans and animals out of dangerous areas of the building during agitation until gas levels are reduced to safe levels.
- Use air rather than oxygen to purge toxic gases from confined spaces. Oxygen concentrations above the normal 21 percent level increase the flammability range of combustible gases.
- A recently emptied manure pit should be considered dangerous since it may be oxygen deficient. Toxic gases will likely escape into the pit from porous walls and the small amount of organic material and remaining sludge.
- Use an approved air-supplied respirator with a safety harness and lifeline if it is essential to go into a pit in an emergency situation. Run the ventilation equipment before and during the time you are in the pit. Have backup support, preferably two people strong enough to pull you out during an emergency situation.
- Occasionally check the level of manure in the pit so it does not get close to the slats and make sure there is adequate space to displace the gases through ventilation.

Nitrogen dioxide, also known as silo gas, and carbon dioxide are produced as silage ferments. Nitrogen dioxide is heavier than air and very toxic. It causes serious respiratory problems at low to moderate concentrations and death at high concentrations. As both of these gases are formed, they cover the silage and spill down the chute when chute doors are open above the silage level. Without ventilation these gases flow into the silo room and any adjacent building open to the silo room.

To help prevent serious health disorders and loss of life, take these precautions:

- Do not enter the silo chute and silo during the first few weeks after filling. Warn others to stay away from silo gas areas.
- If you must enter the silo, ventilate the chute and silo for at least a half hour before entering and keep the blower running.
- Learn to recognize nitrogen dioxide gas. At high concentrations nitrogen dioxide has a bleach-like smell and a yellow-brown color.
- Keep silo doors to an adjacent building closed and ventilate the silo room to the outside for at least two weeks after filling.
- If a worker is overcome or has inhaled the gas, get a doctor immediately or call emergency medical rescue to attend to the victim.

Carbon dioxide displaces air and can asphyxiate workers. High concentrations of carbon dioxide in sealed silos have killed workers who entered the silos to correct problems. The only way to enter such environments safely is to have a reliable air supply. It is even safer to call a service representative who has experience with the equipment necessary in such situations.

Pesticides

Pesticide hazards include the toxic effects of insecticides, fumigants, herbicides and other pesticides used on the farm. Workers are exposed when pesticides are absorbed through the surface of the body, inhaled or swallowed. The toxic effects of such exposure depend upon many factors. Adequate personal protective equipment is needed to protect those working with pesticides.

Pesticides may be absorbed into the body through the skin. The hands and face are the most likely places for excessive exposure during handling, mixing and applying pesticides. Dermal exposure is increased by drift and early reentry into sprayed fields. Different areas of the body have different absorption rates. Cracks in the skin allow increased absorption. The scrotal area and the head have much higher absorption rates than the forearm and hand.

Inhalation exposure occurs anytime contaminated air is breathed into the respiratory tract. Such exposure can be high during mixing and application if workers do not use safe work practices and wear appropriate respiratory protection.

Exposure by ingestion is usually the result of carelessness. The most common mistake leading to fatal accidents is storing pesticides in unmarked containers or containers that look like food or drink containers. A child or adult who is unaware of the nature of the contents may consume enough to cause death. More frequently, workers receive smaller toxic ingestions when pesticides are accidentally splashed or sprayed on the mouth. Failure to wash the hands prior to eating, smoking or drinking also causes some pesticide ingestion.

DANGER/POISON, WARNING and CAUTION are the signal words used on pesticide labels to indicate toxicity. DANGER is the signal word for most toxic pesticides. People mixing, loading or applying pesticides should have a high level of literacy in English to be able to follow label directions closely. Special consideration and evaluation should be given to seasonal/migrant farm workers who perform any of those duties.

Some recommendations for prevention and protection against undue exposure to pesticides⁵ include the following:

- Read and follow the label. It provides recommendations and restrictions about use, precautions, protections, and treatment for people and the environment exposed to pesticides.
- Protect yourself by wearing appropriate personal protective clothing and equipment. It is most important during mixing to use a chemical cartridge respirator, rubber gloves, hat, goggles, and coveralls or long-sleeved shirt and pants. Your pesticide supplier can help select appropriate clothing and respirators.
- Wear either a gas mask or self-contained breathing apparatus. Fumigants are very hazardous to the respiratory system. A regular cartridge respirator does not provide adequate protection.
- Keep all people who are not working with pesticides out of storage, mixing and application areas.
- If pesticides are mixed or applied inside a structure, be sure there is adequate ventilation and use personal protection as recommended on the label.
- Avoid mixing and applying pesticides when outside conditions are too windy.
- Periodically calibrate and maintain spray equipment for more satisfactory performance. Wear rubber gloves when maintaining and checking hoses, connections, nozzles, etc.
- Use an accepted triple-rinsing procedure to prepare plastic, metal or glass pesticide containers for disposal. Contact your county extension service office if there are questions about specific pesticides or about disposal of containers or pesticides.
- When mixing or applying pesticides, change clothing daily or more frequently if contaminated with pesticides. After usage, shower with soap and shampoo to reduce dermal absorption. Launder contaminated clothing with detergent in a separate load from other laundry.
- Clean and maintain respirators as recommended by manufacturers.
- Always store pesticides in their labeled containers and in a location inaccessible to children or animals.
- Keep emergency response telephone numbers handy.

Electricity

Any form of stored energy like electricity has associated hazards. Generally, in North Carolina two to five electrocutions occur each year in agriculture environments.

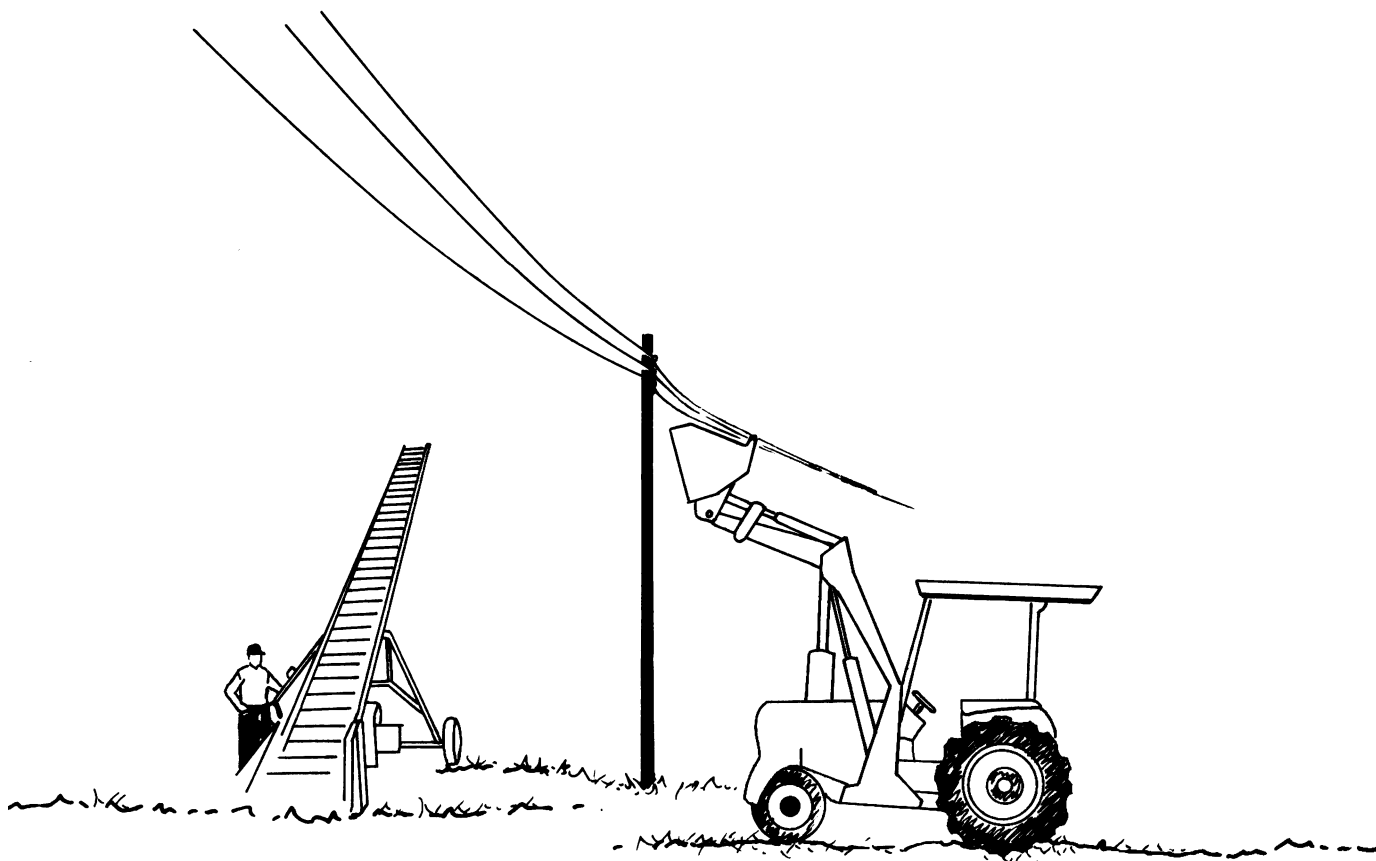
Improper management of electricity in agricultural workplaces causes electrocutions, injuries and major property losses due to fire. Many electrical fires are caused by overloaded circuits and inadequately maintained components and by lightning. Personal injury or death occurs when current flow leaves the path of the normal conductor and takes the path of least resistance to ground. Sometimes the person is in this path.

Electrocutions and electrical injuries are primarily due to contact with overhead power lines and contact with the housing of nongrounded, electrically energized equipment. Many situations occur on the farm where contact is made with an inadequately grounded power tool, motor or structural circuit. The framework of the device receiving electrical power is energized and becomes a current conductor to the unsuspecting person.

Contact with overhead power lines on farms is a serious hazard that can, and does, cause deaths. Such contact may involve portable augers, elevators, irrigation pipes, antennas, metal ladders, powered machines and implements (see Figure 13).

Figure 13

Electrocution Hazards With Power Lines and Farm Equipment



Following these precautions and reminders will help prevent personal and property loss due to electrical energy:

- Stay away from fallen power lines.
- Stay clear of any equipment or a victim in contact with a power line. Always assume the line is energized until you can be sure power is off.
- In cases of downed lines or items contacting overhead lines, keep other people away and call the power company to give details of the situation so it can respond more quickly. If the line is a service line in a building, disconnect the source of electric current at the breaker or fuse box.

- High voltage overhead lines are not insulated. Thus, current flow to a human occurs by touching or even coming close (near contact) to the line.
- Before moving equipment or devices under power lines, make sure there is adequate clearance. Request help from the power company.
- Lower grain augers and elevators before moving them under power lines.
- Allow a safe distance from power lines for field stacking and unloading operations, such as dumping cotton from the picker into a wagon and stacking hay or straw.
- Do not overload electrical circuits.
- Insist that grounding for new electrical systems meets the standards of the National Electrical Code, whether the systems are for a new structure or field installation like a center pivot irrigation system.
- If a fuse blows, replace it with one of the size specified on the fuse box diagram. Do not bypass the fuse.
- Remember that there is less resistance to current flow when one is wet or contacting a wet surface.
- Ground all heavy-duty equipment and power tool electrical cords.
- Make sure antennas and guy wires are far enough away from power lines for safe installation and maintenance. Citizen and base and television antennas are unwieldy during installation and sometimes fall or are later blown over onto power lines.
- When using a metal ladder make sure there is a safe distance between your work and any power lines. Better yet, use a wooden or fiberglass ladder.
- Use only electric fence controllers that are approved for the intended use. Electrocutions may occur from homemade controllers, as they may improperly control current flow.
- Protect yourself from lightning by staying inside during electrical storms. If you cannot get inside, stay in a low area such as a ditch and away from items like trees or fences and off farm equipment.

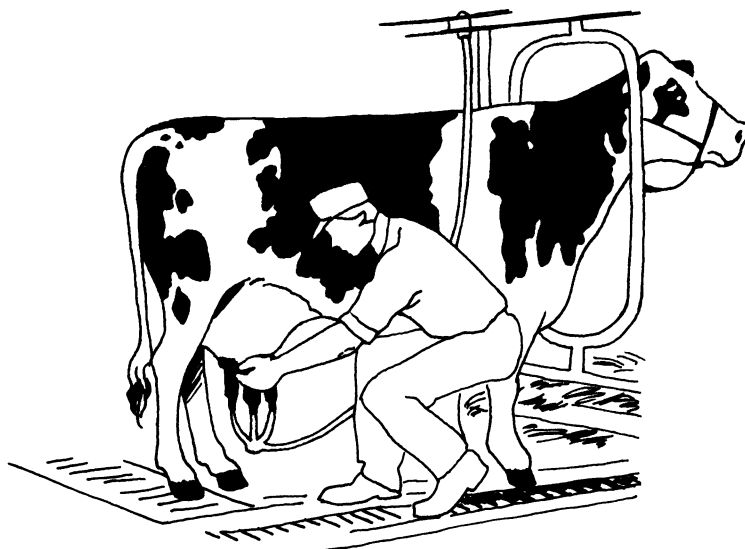
Farm Animals

Farm animals produce few traumatic injuries and fewer deaths compared to most of the hazards previously discussed. Nevertheless, according to national figures, they are the cause of about one out of eight farm injuries. Contact injuries include being kicked, stepped on, fallen on, butted and crushed against objects.

Many animal-related accidents occur on dairy farms. This is not unexpected since workers handle and interact with each milk cow at least twice a day (see Figure 14).

Figure 14

Working With Farm Animals



A number of diseases can also be transmitted to workers, particularly if infected cattle are not given adequate health care and other recommended hygienic measures are not followed.

The following safe practices⁶ are recommended:

- Learn the behavioral and sensory properties of each class of animal. This will help ensure the safety and health of the worker and animal.
- Speak to or place a hand on the cow, particularly if you are stepping between cows to be milked in a stanchion barn. Cattle are startled by sudden or shrill noises. They cannot see a person approaching directly from the rear.
- Help new cows and first-calf heifers to get used to the new environment and your presence. Help heifers by bringing them into the milking barn or parlor and familiarize them with the milking patten a few days before calving.
- Take precautions when examining, treating or milking cows. Usually cows kick when they are startled or injured or when they fear milkers, either machine or human. Teat and udder inflammations are common in heifers. Inflammation from mastitis also occurs in older cows. If only one quarter is affected, approach the cow from the non-affected side. Use kicking restraints on injured cows or chronic kickers if you cannot approach with being kicked.
- Be aware that cows that are mistreated are more likely to kick without warning.
- Be cautious when handling mother animals because some will attack. Use halters or other restraints if needed to separate the cow and new calf. Mother animals are very protective of their newborns.
- Use mangates for bullpens. Dairy bulls are aggressive by nature and can seriously injure people by attacking or playing. There must be good confinement and restraining facilities to keep bulls safely. Confinement facilities should be constructed so that no contact with the bull is necessary for feeding or breeding.
- Use appropriate personal protective equipment for animal care, handling and shipping jobs. Wear steel-toed work shoes, long trousers, gloves, safety glasses and a bump cap.
- Use hygienic measures to reduce diseases. Such measures include a continuous program of dairy sanitation for milk handling, prompt treatment or disposal of infected animals, use of worker protection such as splashguards in elevated milking parlors, and personal protective equipment.

Other hazards exist when working with *beef cattle*, *horses* and *swine*. A summarized mixture of information and recommended practices to prevent injuries follows:

- Most *beef cattle* accidents occur as a result of handling incidents. Most practices discussed for dairy cattle also apply to beef cattle.
- Handling facilities should be well designed, strong and safe for handlers and cattle. These facilities may include a holding pen, crowding pen, working chute, squeeze chute or headgate, loading chute, and scales. Make sure these facilities are well lighted, free of tripping hazards, and free of protruding boards, bolts, nails and hooks that can injure workers. Padding can also be used to reduce injury.
- Cattle are more dangerous when handled in confined areas. This is more evident when crowding a subordinate animal against a dominant animal or when working with new cattle. Stay alert to avoid being run over or crushed against the corral.
- Most work-related *horse* accidents result from a rider falling from or being thrown by the horse. Handling injuries are often due to being kicked, stepped on or crushed against an object.
- Speak to the horse before approaching it and approach from an angle, never from the rear.
- When working around the legs of a horse, stand near the side of the legs.
- When leading a horse, position yourself to the left of the horse and even with its head to shoulder region. When turning, always turn the horse to your right, keeping it on the inside to protect your feet and body. Wear boots or hard-toed shoes. Never wrap the lead strap or reins around your hand or wrist. Use a long strap that is folded accordion-style, and keep it in your left hand.
- Stallions, like bulls, are unpredictable, particularly when they detect mares in season. Experience is needed to work with stallions.

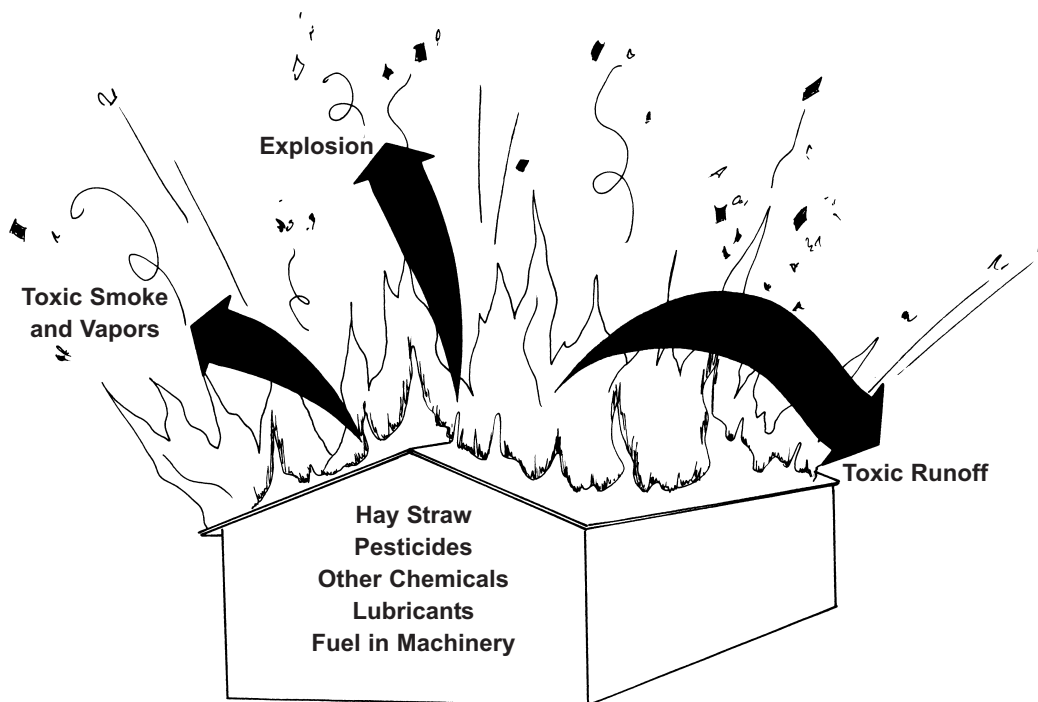
- *Swine* injure people by biting them, using tusks to slash them or knocking them down. A boar or a sow with a young litter, particularly one that is hurt or threatened, can be very dangerous. Be extremely careful when sows are kept in open pens. Keep children and elderly people away.
- Design and use facilities that do not require a handler to enter the pen to feed or care for boars.

Fire and Explosion

Most work-related farm fires are not life threatening, although many produce significant property loss, including loss of farm animals. Less frequent, farm-related explosions are more life threatening. Most farm fires may be classed under three broad groups—machinery, structures and field/forest fires. Machinery fires involve tractors, combines, cotton pickers and all other field machines, as well as other powered equipment used for maintenance or materials processing such as grain dryers. Structural fires involve all farm structures, as well as the materials used or stored in them—commodities, fuels, pesticides, heaters, equipment and electrical circuits and equipment (see Figure 15). Field and forest fires include forests, field crops and stubble, and commodities stored outside, for example, hay, straw and lumber.

Figure 15

Farm Building Fire and Explosions Hazards



The following information on farm fires and explosions emphasizes prevention and protection:

- Prevention is the best approach to dealing with fires. Protection means understanding the three principal classes of fires and how to extinguish them.
 - Water is the best extinguishing agent for *Class A* fires—ordinary combustibles like wood, paper, hay and crop residue.
 - Use dry chemical extinguishers for *Class B* and *Class C* fires. Class B fires involve flammable materials such as fuels, grease, oil and paint. Class C fires involve live electrical items such as wiring in the barn or on machines and motors.
- Place portable, all-purpose dry chemical extinguishers on tractors and harvesters and in stationary locations likely to need protection.
- When designing new buildings, consider ways to lower the potential for future fire loss—site selection, structural materials, electrical and heating systems, and fire stops. Seek help from builders and your insurance carrier.
- Good housekeeping can prevent many farm fires. Watch for areas that collect combustible crop residue, oil, grease

or dust, any of which can be ignited by sparks or heat sources that reach ignition temperatures. Periodic removal of these materials from harvesters, engine screens, heaters, electrical components and buildings is necessary.

- Proper maintenance can also prevent some farm fires and explosions. Maintain all exhaust systems for tractors and other power units, fuel lines and components, and electrical components that can overheat. Sparks from a poorly maintained tractor or harvester exhaust can cause field fires. Make sure that all gas connections are tight and that there are no leaks before lighting a burner in an area such as a tobacco-curing barn.
- Most space heater fires are due to fueling problems, failure to maintain the heater and surroundings, and poor site selection.
- Electrical fires occur in many structures due to electrical systems that are inadequately designed for the load and service conditions, component failure and inadequate maintenance. Lightning is another cause of electrical fires. A good grounding system will prevent lightning losses to structures.
- Agricultural chemical fires are very hazardous since they produce highly toxic products both in the air and on the ground. Observe recommended storage procedures. Do not allow smoking or other sources of ignition such as welding in chemical storage buildings. If you store large quantities of chemicals, develop a plan for handling chemical fires.
- Silo fires and haymow fires can result when hay is placed in the silo to dry or in the mow to wet. Such hay can heat internally and, if heat loss is not adequate, the material will continue to heat until gases ignite in the presence of oxygen. Such conditions can produce fire in haymows, conventional silos or oxygen-limiting (sealed) silos. Explosion potential exists when air is introduced into an oxygen-limiting silo with silage on fire or ready for ignition. The best preventive measures are to put hay in a silo or mow that is in a safe moisture range and to check the temperature of the hay periodically.⁷

Respiratory Contaminants

Respiratory disorders occur on the farm as a result of excessive exposure to dusts, molds, toxic gases, fumes, smoke, bacterial and fungal spores as well as other animal and plant substances. Dust levels (including molds, spores and other particles) are often high in grain and hay harvesting, handling, and storage and in animal confinement. Toxic breathing zones form when air contains manure gases, silo gases or farm chemical gases, vapors or solids, or when the air is oxygen deficient.

These hazards cause some farm workers to suffer short-term irritation and others to suffer permanent disability or even death. Information and recommendations for preventing respiratory disorders⁵ follow:

- Identify the respiratory hazard(s), the level of hazard and potential worker exposure in the work environment, so actions can be taken to reduce the hazard and protect the worker.
- Eliminating or removing the hazard is preferred. If that is not possible, guard and warn against the hazard. Since zero health risk is rarely possible, it is essential to train workers how to reduce health risks in the work environment.
- Exhaust ventilation may be used to control a hazard by carrying it from its point of origin to a place outside the work environment. Sometimes a fogging water spray can be used to extract contaminants before they reach the breathing zone. Another example of ventilation is dilution of contaminated air through the addition of fresh air.
- Air filtration is also used to dilute contaminated air, such as filters for buildings, machinery cabs, or facemasks and respirators. Filters must be carefully selected and maintained.
- When possible, replace agricultural chemicals with less hazardous ones.
- The most common guard against respiratory hazards has been the use of dust masks and respirators. The type of contaminant, level of toxicity and percent of oxygen determine the type of respirator. In toxic environments of manure and silo gases, an air-line respirator or self-contained breathing apparatus is needed. One of those or a respirator with an approved canister is needed to work safely in fumigant environments.
- Select only respirators approved by the National Institute for Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA).
- Since any respirator imposes additional demands on the wearer, the respirator must be well fitted and create as little discomfort as possible.

- Always select the appropriate respirator for the hazard. Replace respirator cartridges for pesticides as soon as a taste or smell is detected, and replace filters as recommended by the manufacturer. Establish a schedule for total respirator maintenance.
- Some people are sensitive to dust and pesticides. If they cannot work in such environments without suffering serious impairment, encourage them to consider other areas of employment.
- Establish good housekeeping and maintenance procedures that reduce the level of contaminants.
- Where possible, shorten the length of exposure to contaminants. Some farms have enough employees to rotate personnel to avoid overexposure until the hazard is eliminated.

Environmental Extremes

Each year some residents of North Carolina suffer cold or heat-related injuries resulting in permanent and temporary disabilities or loss of life. Most health disorders due to exposure to environmental extremes can be avoided.

Generally the body can maintain an internal temperature of 97 F to 99 F, since it can balance heat loss and heat gain. When conditions are such that heat loss continues to be greater than heat gain, there will be a lowering of body temperature—a condition called hypothermia. Hypothermia can occur though temperatures are considerably above freezing. A body temperature of 95 F or less is considered too low because vital organs may suffer damage at this level.

Older people and people having health problems such as diabetes, arthritis, hypothyroidism, Parkinson's disease, alcoholism or stroke are more susceptible to hypothermia. As the body temperature drops to 95 F and below, symptoms include shivering, confusion, speech difficulty, slow breathing, stiff muscles, poor coordination, puffy face and decreased heart rate. Symptoms culminate in a loss of consciousness near 80 F.

To prevent hypothermia:

- Eat well and drink plenty of liquids, but avoid alcoholic beverages.
- Dress to contain body heat for warmth and comfort. As much as half of the body heat can be lost through the head.
- Bedtime warmth is critical as air temperature and body temperature general fall when one is asleep.
- Exercise and other physical activity cause the body to produce more heat. At the same time, perspiration carries heat from the body by vaporization and lowers body temperature. Thus, moisture control is important for protection from the cold. Change to dry clothing whenever you get wet in cold weather.
- Keep the working and living space sufficiently warm, particularly for those with health problems.

When conditions are such that heat gain continues to be greater than heat loss, there will be a rise in body temperature—a condition called *hyperthermia*. Heat disorders include heat rash, fatigue, cramps and the more serious heat exhaustion and heat stroke. Heat exhaustion and stroke can produce permanent injury. Heat stroke kills about half of its victims. Heat stroke occurs at a body temperature near 108 F.

People at increased risk to heat disorders include the following:

- The elderly
- Those not physically fit
- Diabetics in poor control
- Those with a history of severe heat disorder
- People suffering from heart, lung or kidney diseases
- Those taking medication—diuretics, sedatives or tranquilizers

Symptoms of heat exhaustion include the following:

- Profuse sweating
- Glassy eyes
- Rapid pulse
- Dizziness

- Near normal body temperature
- Headache
- Unusually pale and clammy skin with the victim being chilled

Unconsciousness can occur with heat exhaustion but is more common with heat stroke. Heat stroke symptoms include hot dry and flushed skin, confusion, disorientation, incoherent speech and convulsions.

To prevent heat disorders during temperature extremes:

- Start the day well rested. Fatigue and poor physical condition lower one’s resistance to heat stress.
- Dress for the heat by wearing loose, lightweight clothing that permits perspiration to evaporate. • When working in the sunshine, wear a wide-brimmed hat.
- Use sunscreen to protect your skin.
- Schedule heavy work during cooler parts of the day or on other days.
- Where possible, reduce the workload or seek the shade.
- Establish a work/rest schedule or heavy work/light work schedule.
- Keep a balanced diet and replenish evaporation losses by frequently drinking water or juice. With high temperature and humidity the body requires more liquid than is needed to satisfy normal thirst.
- The elderly and many others with health problems are at higher risks in heat extremes, so plan accordingly.

Noise

Most farm workers who are regularly exposed to excessive levels of sound suffer undue hearing loss. Noise also produces other effects detrimental to job performance and well being. Noise is considered by most people to be any sound that is undesirable. This guide considers noise to be those sound levels that cause permanent hearing loss in most people who are exposed excessively.

Sound level is expressed in decibels (dB), a logarithmic unit with a commonly used range of 0 (acute threshold of hearing) to 140 (threshold of pain). The decibel expression dBA refers to a measurement scale that most closely corresponds to the human ear.

The OSHA standards specify a maximum exposure of eight hours per day to a continuous 90 dBA sound pressure level and a halving of the exposure time for each 5 dBA increase. This means a maximum exposure of four hours per day to a continuous 95 dBA level, two hours to 100 dBA, one hour to 105 dBA, 30 minutes to 110 dBA or 15 minutes to a continuous 115-dBA level. Table 1 offers some typical sound levels of familiar sources with allowable exposure specified for unprotected hearing.

Table 1

Common Sounds and Levels

dBA	Sound Source
0	Acute threshold of hearing
30	Whisper
60	Normal conversation, background music
70	Noisy office
85	<i>16-hour OSHA limit</i> , inside acoustically insulated tractor cab
90	<i>8 hour OSHA limit</i>
95	<i>4 hour OSHA limit</i>
100	<i>2-hour OSHA limit</i> , combine, all terrain vehicle (ATV), motorcycle
105	<i>1-hour OSHA limit</i> , noisy tractor
110	<i>30-minute OSHA limit</i> , chain saw, grain dryer
115	<i>15-minute OSHA limit</i> , basketball crowd
130	Jet takeoff, amplified music
140	Threshold of pain, gunshot

Since most workers are exposed to different levels of sound and to each level for different lengths of time, OSHA has developed a way to determine the total daily noise exposure. This can then be compared to allowable levels. Corrective action should be taken when noise exposure on the farm is excessive.

Control measures to protect people from noise-induced hearing loss include:

- Reducing the sound level at the source
- Reducing the sound level along the path from source to the ear
- Reducing the sound level at the ear

Those measures are referred to as source, path and receiver controls.

Reducing the sound level at the source is best but is difficult to achieve with machines one already owns. It is best done by manufacturers and involves selection of materials, dampening noise and vibration, and using other design techniques. An innovative user might make design improvements, but most users achieve more effect on noise at the source by having a good maintenance and repair program.

Reducing the sound level along the path can be accomplished by diverting or absorbing acoustic energy with a barrier or absorbing material. A cab for the tractor or harvester serves this purpose. Other examples include the use of work-rooms, vegetative plantings or portable acoustic shields.

Reducing the sound level at the ear is accomplished by using hearing protection. Two common types of hearing protection are ear plugs and ear muffs. To be effective, hearing protection must be selected and fitted for the individual user. Since both plugs and muffs have advantages and disadvantages, and there are many types available, a physician or audiologist should be contacted for selecting the best protection for specific uses. This is important for all exposed workers but critical for those who are especially sensitive to noise or those who are already hearing impaired.

A Loss Control Program

Every farm should have a loss control program. A loss control program is needed to help protect the safety and health of workers as well as the economic health of the business. Most farms have some loss control activities built into their operations. This section looks at the foundation for a loss control program and offers some ideas for its application to a farm enterprise.

A good loss control program⁸ includes seven elements to prevent accidents and health disorders and to minimize economic losses. The seven elements are:

1. Management leadership
2. Assignment of responsibility
3. Maintenance of a safe working environment
4. Employee training
5. Managing losses
6. Medical assistance and worker health
7. Employee awareness and responsibility acceptance

Since each farm enterprise is unique, some activities within each of these seven elements will differ. *Effective communication* between management and employees is the key to a successful loss control program. As you develop a loss control program, consider the characteristics of your farm enterprise (workers, equipment, structures, storage, transportation, animals) and applicable local, state and federal regulations.

Every manager should obtain at least one good, general safety reference. A nominally priced reference is the two-volume *Best's Safety Directory*.⁹ It contains sections on safety guidelines, training, monthly safety training topics, technology, product applications, purchase sources, OSHA summaries and OSHA self-inspection checklists.

If you need help establishing or improving your loss control program, contact your insurance carrier or the Consultative Services Bureau, Occupational Safety and Health Division, N.C. Department of Labor. Make requests in writing to the following address:

N.C. Department of Labor
Consultative Services Bureau
1101 Mail Service Center
Raleigh, NC 27699-1101

To contact by telephone, call (919) 807-2899 or 1-800-625-2267 or send facsimiles to (919) 807-2902. To obtain information in person, visit the Consultative Services office located on the third floor of the Old Revenue Building at:

111 Hillsborough Street
Raleigh, NC

To obtain information online, visit the Web site of the N.C. Department of Labor at:

www.nclabor.com

Management Leadership

To establish an effective program, management must follow these guidelines:

- Set a good example.
- Develop specific objectives that are clear and realistic.
- Develop a safety policy that reflects management's philosophy.

- Develop a set of written safety rules that incorporate applicable safety regulations.
- Assign responsibility.
- Be involved; include safety topics in meetings and encourage employees to work safely.

Management must set a good example by establishing safety policy, objectives, and safety and health rules that are supported and enforced. Management may be the owner of the family farm, or management may be a number of people directing a large, diverse enterprise. When management shows it is not committed to safety, employees also do not show full commitment to safety and health rules.

Safety objectives should be specific, clear and attainable within a stated period. Some objectives are short-term (less than a year) while others are long-term. The short-term objectives should support the long-term ones. An example of a short-term objective is the harvesting of 1,000 acres of corn and transporting the grain to storage without any injuries during a single harvest season. An example of a long-term objective for a company is a two-year decrease in injuries from milking the dairy cattle to one-third the current rate.

Those two examples illustrate that safety objectives can be written along with the development of production objectives. For example, when setting an objective for seasonal harvesting efficiency for the corn crop, set an accompanying safety objective. Set realistic safety objectives, based on current circumstances and an analysis of the specifics of past accidents.

Establish safety rules that reflect specific hazards of the enterprise, management's policy, and applicable federal, state and local regulations. Rules must be enforced to be effective. It is management's responsibility to establish rules and to enforce them. Solicit the help of experienced employees and supervisors when drafting rules.

When developing rules, consider only one hazard area of the farming operation at a time. For example, one might develop rules for safe operation of farm tractors and then for safe operation of other specific field machines. The rules for safe tractor operation can be further grouped for tractors with ROPS versus those without ROPS. Develop rules for safe tractor operation in the field, on roadways, while mowing, while transporting field machinery or loaded wagons, when near ditches, when the PTO is powering machines in stationary or traveling positions, when trailing equipment clogs, etc.

Remember to consider occupational safety and health standards. Farm employers of 11 or more employees and farm employers who maintain temporary labor housing are regulated by the Occupational Safety and Health Act of North Carolina and must:

- Furnish employees employment and a place of employment free from recognized hazards causing, or likely to cause, death or serious physical harm. N.C. Gen. Stat. §95-129(1).
- Report work-related fatalities and catastrophes to NCDOL within eight hours of the incident.
- Maintain recordkeeping forms (300, 300A and 301) on recordable occupational injuries and illnesses of employees in accordance with OSHA standard 29 CFR Parts 1904 and 1952.
- Post recordkeeping summaries annually in accordance with OSHA standard 29 CFR Parts 1904 and 1952.
- Display the NCDOL poster, which explains the protection and obligations of employers and employees in North Carolina.
- Conform to the requirements for the handling and storage of anhydrous ammonia, OSHA standard 29 CFR 1910.111.
- Provide living facilities for temporary labor in accordance with Migrant Housing Act of North Carolina (N.C. Gen. Stat. §§95-222 through 95-229) and the OSHA Standard for Temporary Labor Camps, 29 CFR 1910.142.
- Provide sanitary toilet and handwashing facilities as well as potable drinking water and time to access the same in accordance with the OSHA Field Sanitation Standard, 29 CFR 1928.110.
- Display slow-moving vehicle insignia in accordance with OSHA standard 29 CFR 1910.145.
- Conform to the requirements for pulpwood logging operations in accordance with the OSHA Logging Operations Standard, 29 CFR 1910.266.
- Conform to the OSHA standard for tractor rollover protective structures (ROPS), 29 CFR 1928.51 through 29 CFR 1928.53.

- Guard farm field equipment and farmstead equipment in accordance with OSHA standards 29 CFR 1928.57(a), (b), (c); and guard cotton gin machinery and install a warning device in accordance with OSHA standard 29 CFR 1928.57(d).
- Train employees in accordance with OSHA standards 29 CFR 1928.51(d) for tractor operations; 29 CFR 1928.57(a)(6) for farm field equipment, farmstead equipment and cotton gins; and 29 CFR 1928.57 (d)(1) (viii) for operating and servicing gin equipment.
- Communicate information to employees on hazardous chemicals as specified in the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

The Hazard Communication Standard covers all industries including farming. It requires that information on hazardous chemicals be communicated to employees through labels, material safety data sheets (MSDSs) and training programs. A written hazard communication program and recordkeeping are required. Compliance by non-manufacturing sectors is also required. Details of the standard and related assistance are available from the Education, Training and Technical Assistance Bureau (ETTA), Occupational Safety and Health Division, North Carolina Department of Labor. Make requests in writing to the following address:

N.C. Department of Labor
 ETTA
 1101 Mail Service Center
 Raleigh, NC 27699-1101

To contact by telephone, call (919) 807-2875 or 1-800-625-2267 or send facsimiles to (919) 807-2876. To visit in person, go to the ETTA office located on the fourth floor of the Old Revenue Building at:

111 Hillsborough Street
 Raleigh, NC

To view OSHNC information, see a complete listing of OSHNC publications or order online, visit the Web site of the N.C. Department of Labor at:

www.nclabor.com

OSHA Standard 29 CFR 1928.51(d)—Tractor Driver Instructions

Every employee who operates an agricultural tractor must be informed of the following operating practices and of any other practices dictated by the work environment. Such information must be provided at the time of initial assignment and at least annually thereafter.

- Securely fasten your seat belt if the tractor has a rollover protective structure (ROPS).
- Where possible, avoid operating the tractor near ditches, embankments and holes.
- Reduce speed when turning, crossing slopes, and on rough, slick or muddy surfaces.
- Stay off slopes too steep for safe operation.
- Watch where you are going, especially at row ends, on roads and around trees.
- Do not permit others to ride.
- Operate the tractor smoothly—no jerky turns, starts or stops.
- Hitch only to the drawbar and hitch points recommended by tractor manufacturers.
- When the tractor is stopped, set brakes securely and use park lock if available.

OSHA Standard 29 CFR 1928.57(a)(6)—Operating and Servicing Equipment

At the time of initial assignment and at least annually thereafter, the employer must instruct every employee in the safe operation and servicing of all covered equipment with which he or she is or will be involved, including at least the following safe operating practices:

- Keep all guards in place when the machine is in operation.
- Permit no riders on farm field equipment other than people required for instruction or assistance in machine operation.

- Stop the engine, disconnect the power source, and wait for all machine movement to stop before servicing, adjusting, cleaning or unlogging the equipment, except where the machine must be running to be properly serviced or maintained, in which case the employer must instruct employees as to all steps and procedures necessary to service or maintain the equipment safely.
- Make sure everyone is clear of machinery before starting the engine, engaging power or operating the machine.

OSHA Standard 29 CFR 1928.57(d)(1)(viii)—Operation and Maintenance of Equipment in Cotton Gin Power Development Room

In power plants and power development rooms where access is limited to authorized personnel, guard railings may be used in place of guards or guarding by location. Authorized employees who have access to power plants and power development rooms must be instructed in the safe operation and maintenance of the equipment in accordance with paragraph (a)(6) of this section.

Assignment of Responsibility

Every employee has a responsibility to follow safe and healthful work practices and to attempt to protect co-workers. Management must assign extra responsibility to key individuals and encourage them to set a good example for other employees. Extra responsibilities for key individuals include employee training, maintaining a safe work environment, accident investigations and follow-up, and maintaining a flow of information between management and employees. Table 2¹⁰ presents example duties and responsibilities of the supervisor as they relate to worker safety.

Table 2

Duties and Responsibilities of the Supervisor

1. *Provide leadership*
 - a. Show interest in safety
 - b. Promote safety among subordinates
2. *Provide safe working conditions (safe environment)*
 - a. Analyze work area hazards
 - b. Correct unsafe conditions and unsafe acts or practices
3. *Maintain orderly, well-kept work areas*
 - a. Provide adequate storage space
 - b. Teach workers to work in an orderly manner
4. *Regular safety instructions*
 - a. New workers
 1. General hazards
 2. The safe method of doing specific jobs
 - b. Experienced workers—unsafe practices
 - c. Materials handling (lifting, stacking, etc.)
 - d. Use of guards (how to use properly)
 - e. Neat methods of working (good housekeeping)
 - f. Correct clothing to wear and protective equipment to use
 - g. The importance of prompt attention to all injuries, serious or otherwise
5. *Set a good example*
6. *Act on fundamental principles of safety*
 - a. Develop a list of hazards by work areas
 - b. Analyze each job in the work area for hazards to be used to instruct workers
 - c. Use inspection forms to bring about systematic and thorough inspections
 1. Housekeeping
 2. Unsafe acts or unsafe conditions
 - d. Issue necessary orders
 - e. Follow up until the orders are carried out
 - f. Know the safety rules and enforce them
7. *Take definite action on willful violation of safety rules*
8. *Make good comprehensible accident reports*
 - a. Analyze past reports and safety records for information for future improvements

- b. Compare reports and safety records between work areas and within the industry
9. *Cooperate with others to bring about a good safety program*
 - a. Attend safety meetings
 - b. Standardize procedures
10. *Show persistence in safety mindedness so that it becomes ingrained in each worker*
11. *Know each employee's record in safety and health so as to prevent placing people in positions for which they are neither mentally nor physically capable*
12. *See that the injured receive proper care*

Three basic causes of accidents are a lack of knowledge or skill, an improper attitude, and failure to follow safe practices. All three accident causes can be overcome if supervisors fulfill their responsibilities in the safety program. This requires keen and frequent observation of employees, inspection of procedures and equipment in use, and discipline of employees immediately following infractions.

Maintenance of a Safe Working Environment

Maintaining a safe working environment involves the following:

- Regular housekeeping
- Periodic inspection to detect and correct physical hazards
- Preventive maintenance of equipment, machinery and structures

Self-inspection checklists identify areas and items that need scheduled housekeeping, inspection and maintenance. They also serve as a record of unsafe conditions and employee actions that need attention. Some hazards require immediate attention, while others can be scheduled for later corrective action. Make checklists specific to your farm enterprise.

Preventive maintenance and good housekeeping are essential parts of an effective loss control program. These practices reduce fires, property losses and injuries due to accidents. They also increase production efficiency. In addition to keeping facilities relatively clean, good housekeeping facilitates an orderly flow and arrangement for all materials.

Employee Training

Safety and health training should be a component of all training for:

- New employees
- New procedures
- Job performance problems
- Refresher education

Employee training must include the identification of known job hazards and instruction on how to accomplish the job safely by eliminating or controlling hazards. Safety training must be an integral part of job training to be most effective.

When training, use positive, simple, easy-to-understand language. Give all new employees safety orientation similar to that in Table 3. Experienced employees facing a new job need training to ensure safety and confidence in job performance. Reducing the anxiety of employees, particularly new ones, is very important.

Proper job instruction has four parts:

1. Prepare the employee by putting him or her at ease, learning what he or she knows about the job and stressing the importance of the job.
2. Tell, show and demonstrate the job or procedure. Stress key points and encourage discussion.
3. Give the employee a performance tryout. Ask the employee to tell, show and demonstrate key points. Correct any errors and misunderstanding until initial performance is acceptable.
4. Tell the employee whom to go to for help, if it is needed. Frequently check with the employee during the initial learning period and reduce supervision as performance progresses.

Hold brief weekly safety meetings to refresh employees on topics that need attention and to get management-employee interchange. Place special emphasis on training for high-hazard jobs and operations, for example, lockout procedures for any equipment that can be inadvertently started while another employee is cleaning, unplugging, repairing or maintaining it. Other examples include high-hazard tractor operations, operating harvesters in difficult crop conditions and transporting large equipment on roadways.

A useful training tool for employees is involvement in analyzing job hazards and establishing safe procedures. When employees learn to separate a job into parts and identify hazards, they are better able to follow safe procedures and to protect themselves and others.

Table 3
New Employee Safety Orientation

Check

- I. Use of Personal Protective Equipment
 - _____ A. Safety helmet
 - _____ B. Goggles/safety glasses
 - _____ C. Dust mask
 - _____ D. Gloves
 - _____ E. Ear protection
 - _____ F. Work shoes
 - _____ G. Safety belts

- II. General Safety Rules
 - _____ A. Smoking/no smoking areas
 - _____ B. Blowing off clothing with compressed air
 - _____ C. Walking/working surface above ground level
 - _____ D. Removal and replacement of guards
 - _____ E. Loose clothing
 - _____ F. Special safety procedures for unchocking machinery
 - _____ G. Lockout procedures
 - _____ H. Housekeeping
 - _____ I. Proper lifting
 - _____ J. Fire protection and prevention-emergency action plan
 - _____ K. Use of tools
 - _____ L. Prompt report of accidents
 - _____ M. Use of ladders
 - _____ N. When in doubt, ask first
 - _____ O. Welding safety procedures
 - _____ P. Forklift operating rules
 - _____ Q. Welding safety procedures
 - _____ R. Tractor operating rules
 - _____ S. Discussion of other special farm rules

Date _____ Supervisor _____

Employee _____

Employee signature verifies that he or she received training from the supervisor regarding the above checklist.

Managing Losses

Managing losses involves:

- Medical treatment
- Accident investigation to determine causes
- Analyzing accident records
- Preventive action and follow-up

Accident investigation helps identify deficiencies in your safety program when causes of accidents are determined. Investigation should begin as soon after the accident as possible. Make sure every employee understands that the purpose

of such investigation is to determine causes so measures can be taken to prevent the accident from reoccurring and not to fix blame. Table 4 is an example of the contents for an accident investigation.

Table 4

Supervisor's Accident Investigation Report

Notes: Complete within eight hours of injury. Explain that you are completing the report to prevent reoccurrence of the accident, not to blame the injured for suffering the accident.

Date of accident: _____

Name of injured: _____

Parts of body injured: _____

Nature of injury.

Name of agent involved.

How did the employee describe the accident?

Did the witness describe accident the same way as the injured employee?

- What were the differences?

What unsafe condition permitted accident to occur?

Was equipment operating properly?

What unsafe act contributed to accident?

Was standard procedure being followed at time of injury?

Was commonly accepted procedure violated?

What kind of training in the work did the employee have?

Did the employee understand how to do the work properly?

- If not, why not?

What factors contributed to accident (such as type of work being performed)?

Has the exact source of the accident been identified?

- If not, keep asking the why, how, what, when, where and who questions about the accident until the cause is clear.

What did the employee suggest to prevent this type of accident from happening again?

Immediate steps taken to prevent reoccurrence of the accident.

Permanent steps taken to prevent reoccurrence.

Date action taken: _____

Investigated by: _____

Date: _____

Analyzing previous accident records and subsequent accident investigations helps to identify accident causes and suggests ways to prevent their recurrence. Preventing the recurrence of accidents frequently involves changing the physical conditions creating the hazard, changing job procedures, using additional or better personal protective equipment, providing additional job training, and reassigning employees.

Medical Assistance and Worker Health

Medical assistance means:

- Having pre-employment medical screening
- Preventing occupational health disorders
- Caring for injuries and illnesses

This element of loss control involves preplanning activities to minimize injuries, illnesses and health disorders. It also includes post-loss activities to provide medical care for injuries, illnesses and health disorders.

Employers should determine the medical condition of each prospective employee to minimize the incidence of pre-existing health disorders and chronic injuries. Although a physical examination should uncover medical problems, all prospective employees should complete a pre-employment medical questionnaire as well.

Occupational health disorders are lessened by requiring the use of personal protective equipment (PPE) in designated areas and by requiring the use of acceptable work practices everywhere. Require hearing PPE, either plugs or muffs, when employees work in areas that have high noise levels. Require breathing PPE, either dust masks or respirators, when the work areas have high dust levels. Since some people are more susceptible to noise and respiratory problems than others, reassigning them to work areas with lower noise or dust levels may be advisable.

Health hazards associated with excessive heat can generally be addressed through training, proper dress, ventilation and time away from the heat. Likewise, health hazards associated with heavy lifting can generally be addressed through training, periodic breaks and the use of materials handling equipment.

Establish a clear procedure for reporting injuries and illnesses. Ensure that all employees understand the procedure and have emergency telephone numbers readily available. All employees should also receive first-aid training. This may be critical for accident victims on farms located far from emergency medical facilities or personnel.

It is helpful to have an emergency medical guide⁹ for quick reference to assist you as a first responder. Such a guide should contain information on accident management, bleeding, burns, CPR, chest pains, choking, convulsions, diabetic reactions, drowning, electrical shock, fractures, sprains, frostbite, heat stress, poisoning, drug overdose, shock, and snake and insect bites.

Safety and Health Employee Awareness and Responsibility Acceptance

The most effective loss control programs are those in which both management and employees fully participate. Management must offer a clear message of support by establishing realistic safety policies, by involving employees at each stage of the program and by participating in safety training. Additionally, they must set good examples and encourage employees to cooperate with and contribute to the loss control program.

Employees need to be able to see tangible benefits if they are to participate fully. Thus, management must effectively communicate the safety program by involving employees in rewarding activities. Commitment and endorsement are key elements for both employees and managers.

3

Additional Information

If you would like to request a copy of any of the listed information, call (919) 807-2923 or 1-800-625-2267 or write to:

N.C. Department of Labor
Agricultural Safety and Health Bureau
1101 Mail Service Center
Raleigh, NC 27699-1101

The Cultivator is an informational bulletin of the Agricultural Safety and Health Bureau at the N.C. Department of Labor.

Posters: All posters listed in this section contain English and Spanish versions unless otherwise indicated:

- On the Farm: Health and Safety Tips: Anaphylactic Shock: Medical Emergency
- On the Farm: Health and Safety Tips: Tuberculosis or TB
- On the Farm: Health and Safety Tips: Insect Bites and Stings: Ticks—Rocky Mountain Spotted Fever
- On the Farm: Health and Safety Tips: Insect Bites and Stings: Ticks—Lyme Disease
- On the Farm: Health and Safety Tips: Insect Bites and Stings: Bee Stings
- On the Farm: Health and Safety Tips: Insect Bites and Stings: Spider Bites
- On the Farm: Health and Safety Tips: Heat Stress: Heat Cramps
- On the Farm: Health and Safety Tips: Heat Stress: Cramps, Exhaustion, Stroke
- On the Farm: Health and Safety Tips: Heat Stress: Heat Stroke
- Migrant Farmworker Housing: Health and Safety Tips

Note: The poster, North Carolina Workplace Laws, Notice to Employees, **must** be conspicuously posted (in English) at every workplace. The poster is printed in English on one side and Spanish on the other. If you would like to request copies, contact the Education, Training and Technical Assistance Bureau (ETTA), Occupational Safety and Health Division, N.C. Department of Labor. Make requests in writing to the following address:

N.C. Department of Labor
ETTA
1101 Mail Service Center
Raleigh, NC 27699-1101

To order posters by telephone, call (919) 807-2875 or 1-800-625-2267 or send facsimiles to (919) 807-2876. To obtain copies in person, visit the ETTA office located on the fourth floor of the Old Revenue Building at:

111 Hillsborough Street
Raleigh, NC

To view a complete listing of OSHNC publications or to download the poster in English or Spanish, visit the Web site of the N.C. Department of Labor at:

www.nclabor.com

References

1. Deere and Company. 1987. *Agricultural Safety—Fundamentals of Machinery Operation*. Moline, Ill.
2. ASAE. 1982. *Hand Signals for Use in Agriculture*. ASAE Standard S351, American Society of Agricultural Engineers, St. Joseph, Mich.
3. Roberts, D.L., G.E. Sabin, and J.W. Davis. 1984. *Chain Saw Selection and Operation*. South Carolina Cooperative Extension Service, Clemson University, Circular 637.
4. Baker, L.D., W.E. Field, R. Schnieder, C.W. Young, R.A. Parsons, and D.J. Murphy. 1986. *Farm Accident Rescue*. Pub. NRAES-10, Northeast Regional Agricultural Engineering Service, Ithaca, N.Y.
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6. Aherin, R.A., L. Schultz, and K. Sharifzadeh. 1983. *Safe Work Practices on Dairy Farms*. Pub. AF-FO-0878, Agricultural Extension Service, University of Minnesota, St. Paul.
7. Arble, W.C., and D.J. Murphy. 1988. *Extinguishing Silo Fires*. Pub. NRAES-18, Northeast Regional Agricultural Engineering Service, Ithaca, N.Y.
8. Price, E.E. 1988. *A Loss Control Program Designed for FFVA—SIF Members*. Florida Fruit and Vegetable Association Self-Insurers' Fund, Orlando, Fla.
9. Safety Publications Division. 1995. *Best's Safety Directory*. v.1 and v.2, A.M. Best Company, Oldwick, N.J.
10. Shanoian, R. 1989. *Gin Safety Rules*. J.G. Boswell Company, Corcoran, Calif.

The following industry guides are available from the N.C. Department of Labor's Occupational Safety and Health Division:

- #1. *A Guide to Safety in Confined Spaces*
- #2. *A Guide to Procedures of the N.C. Safety and Health Review Commission* (downloadable PDF **ONLY**)
- #3. *A Guide to Machine Safeguarding*
- #4. *A Guide to OSHA in North Carolina*
- #5. *A Guide for Persons Employed in Cotton Dust Environments* (downloadable PDF **ONLY**)
- #6. *A Guide to Lead Exposure in the Construction Industry* (downloadable PDF **ONLY**)
- #7. *A Guide to Bloodborne Pathogens in the Workplace*
- #8. *A Guide to Voluntary Training and Training Requirements in OSHA Standards*
- #9. *A Guide to Ergonomics*
- #10. *A Guide to Farm Safety and Health* (downloadable PDF **ONLY**)
- #11. *A Guide to Radio Frequency Hazards With Electric Detonators* (downloadable PDF **ONLY**)
- #12. *A Guide to Forklift Operator Training*
- #13. *A Guide to the Safe Storage of Explosive Materials* (downloadable PDF **ONLY**)
- #14. *A Guide to the OSHA Excavations Standard*
- #15. *A Guide to Developing and Maintaining an Effective Hearing Conservation Program*
- #16. *A Guide to Construction Jobsite Safety and Health/Guía de Seguridad y Salud para el Trabajo de Construcción*
- #17. *A Guide to Asbestos for Industry*
- #18. *A Guide to Electrical Safety*
- #19. *A Guide to Occupational Exposure to Wood, Wood Dust and Combustible Dust Hazards* (downloadable PDF **ONLY**)
- #20. *A Guide to Cranes and Derricks*
- #23. *A Guide to Working With Electricity*
- #25. *A Guide to Personal Protective Equipment*
- #26. *A Guide to Manual Materials Handling and Back Safety*
- #27. *A Guide to the Control of Hazardous Energy (Lockout/Tagout)*
- #28. *A Guide to Eye Wash and Safety Shower Facilities*
- #29. *A Guide to Safety and Health in Feed and Grain Mills* (downloadable PDF **ONLY**)
- #30. *A Guide to Working With Corrosive Substances* (downloadable PDF **ONLY**)
- #31. *A Guide to Formaldehyde* (downloadable PDF **ONLY**)
- #32. *A Guide to Fall Prevention in Industry*
- #32s. *Guía de Prevención de las Caídas en la Industria (Spanish version of #32)*
- #33. *A Guide to Office Safety and Health* (downloadable PDF **ONLY**)
- #34. *A Guide to Safety and Health in the Poultry Industry* (downloadable PDF **ONLY**)
- #35. *A Guide to Preventing Heat Stress*
- #38. *A Guide to Safe Scaffolding*
- #40. *A Guide to Emergency Action Planning*
- #41. *A Guide to OSHA for Small Businesses in North Carolina*
- #41s. *Guía OSHA para Pequeños Negocios en Carolina del Norte (Spanish version of #41)*
- #42. *A Guide to Transportation Safety*
- #43. *A Guide to Combustible Dusts*
- #44. *A Guide to Respiratory Protection*

Occupational Safety and Health (OSH) Sources of Information

You may call 1-800-NC-LABOR (1-800-625-2267) to reach any division of the N.C. Department of Labor; or visit the NCDOL home page on the World Wide Web: <http://www.nclabor.com>.

N.C. Occupational Safety and Health Division

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Local Telephone: (919) 807-2900 Fax: (919) 807-2856

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning education, training and interpretations of occupational safety and health standards contact:

Education, Training and Technical Assistance Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2875 Fax: (919) 807-2876

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 4th Floor)

For information concerning occupational safety and health consultative services and safety awards programs contact:

Consultative Services Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2899 Fax: (919) 807-2902

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning migrant housing inspections and other related activities contact:

Agricultural Safety and Health Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2923 Fax: (919) 807-2924

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information concerning occupational safety and health compliance contact:

Safety and Health Compliance District Offices

Raleigh District Office (3801 Lake Boone Trail, Suite 300, Raleigh, NC 27607)

Telephone: (919) 779-8570 Fax: (919) 420-7966

Asheville District Office (204 Charlotte Highway, Suite B, Asheville, NC 28803-8681)

Telephone: (828) 299-8232 Fax: (828) 299-8266

Charlotte District Office (901 Blairhill Road, Suite 200, Charlotte, NC 28217-1578)

Telephone: (704) 665-4341 Fax: (704) 665-4342

Winston-Salem District Office (4964 University Parkway, Suite 202, Winston-Salem, NC 27106-2800)

Telephone: (336) 776-4420 Fax: (336) 776-4422

Wilmington District Office (1200 N. 23rd St., Suite 205, Wilmington, NC 28405-1824)

Telephone: (910) 251-2678 Fax: (910) 251-2654

To make an OSHA Complaint, **OSH Complaint Desk:** (919) 807-2796

For statistical information concerning program activities contact:

Planning, Statistics and Information Management Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2950 Fax: (919) 807-2951

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information about books, periodicals, vertical files, videos, films, audio/slide sets and computer databases contact:

N.C. Department of Labor Library

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2848 Fax: (919) 807-2849

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 5th Floor)

N.C. Department of Labor (Other than OSH)

1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 733-7166 Fax: (919) 733-6197