

## HEALTH AND SAFETY OF PERSONNEL IN AGRICULTURE

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### Summary

Agriculture is one of the most hazardous industries in the world in which to work. Many agricultural workers suffer serious and fatal injuries each year, and many others suffer work-related illnesses. Farmers, farm operators, and farm contractors have invested a great deal of time and money in their operations, and have a financial as well as moral obligation to take seriously the health and safety hazards on farms and to protect the health and safety of their workers and family members. Children who live on or visit farms must also be protected. Farm hazards include tractors and other machinery, animals, confined spaces and storage structures, electricity, fires, chemicals, respiratory hazards, repetitive motions, noise and others. Developing and implementing a safety program, including searching out and eliminating or minimizing hazards on a farm, is the most important thing that can be done. Proper training of all who work on the farm or with various types of equipment, including family members, is necessary. Being a

good neighbor means protecting the health and safety of the general public and neighbors to the farm.

## **1. Introduction**

Agricultural workers are involved in one of the most hazardous industries in the world. In the United States, according to worker death rate statistics from the National Safety Council, agricultural workers, including farm owner/operators, family workers and hired workers, are five times more likely to suffer a fatal injury than the national work force as a whole. In addition to 720 fatal injuries in 1997, agricultural workers in the United States suffered an estimated 140 000 injuries serious enough to cause at least one-half day lost from normal activities. A different study of five states in the upper Midwestern United States showed one farm in five had a work-related injury each year serious enough to require professional medical care or resulted in at least four hours of restricted activity. This does not include the countless work-related illnesses and chronic injury conditions which occur to workers over longer periods of exposure.

Injuries and illnesses on farms can be prevented by being proactive and consciously deciding to have a safe operation. Hazard control is the most effective way to do this; the farm manager and workers need to search out and eliminate or reduce the hazards on each farm. Safe behaviors to avoid hazards are a secondary but necessary method of injury prevention when hazards cannot be eliminated.

This article discusses potential hazards and the most basic ways of eliminating or avoiding them. It is important that agricultural workers understand the basics and have a positive safety orientation. There may be hazards on particular farms or in particular countries, involving different cropping or livestock practices, that are not mentioned here. Each farm operator should acquire more detailed information about all farm hazards on his or her farm. For example, additional information can be obtained from machinery owner's manuals and by contacting appropriate governmental agencies.

## **2. Tractors**

Tractors are the most-used machines on most farms, and are involved in more fatal injuries than any other single agent of injury. In fact, the tractor rollover, which occurs when the tractor turns over on top of the operator, is the single most common fatal farm injury.

Tractors more commonly tip over to the side, although they can tip over to the rear as well. Some of the causes of sideways tractor rollovers include operating near hazards like ditches, gullies, holes, or stumps; operating on steep slopes; carrying heavy loads high; taking turns at high speeds; loss of control with towed loads; or roadway collisions. Any action that results in the tractor's center of gravity being moved outside of its wheelbase, whether due to slopes, bumps, or centrifugal force, can result in the tractor tipping over sideways. Rearward overturns are usually caused by improper hitching, where the load is hitched above the drawbar and helps pivot the tractor up and over its rear axle, or improperly trying to move a tractor that is stuck in the mud and having it pivot up and over rearward.

Safe operating procedures are necessary to minimize the likelihood of a tractor rollover. These include both proper handling of the tractor, and also proper set up, such as proper weighting and wheel spacing. Thus, tractor operators must be trained in the preparation, operation and maintenance of their tractors. However, because situations occur which may be beyond the control of even the safest and most competent operator, such as hitting a hidden obstacle, losing control on an icy road, or having an unexpected mechanical failure, tractors must be capable of rolling over and still protecting the operator from being crushed. The most important way to prevent tractor rollover injuries and deaths is for every tractor to have a Rollover Protective Structure (ROPS) or ROPS cab, which provides a zone of protection around the operator in case of a tractor rollover. In addition, the operator should wear the seat belt if one is provided with the ROPS, particularly on open-station (non-cab) tractors, to prevent being thrown off the seat and outside the zone of protection.

The tractor run-over, when one or more of the tractor wheels runs over the victim, is the second most common tractor-related fatal injury. Many run-over injuries involve extra riders who fall off and end up under the wheels. Children who ride on a tractor with a parent or other person are at great risk. Other run-overs often involve unseen bystanders who are unaware of the danger or movement of the tractor. Small children who may not understand the need to get out of the way are at particular risk if they are present in traffic areas. Preventing run-over injuries means never allowing extra riders, being aware of the locations of all bystanders, and keeping small children away from work areas.

Tractors and machines operated on the road should always have proper lighting and markings, as required by law, to minimize the likelihood of a collision with another vehicle. In some countries, such as the United States, the engineering standards applicable to farm machinery, such as those promulgated by the American Society of Agricultural Engineers (ASAE) exceed the requirements of local laws and should be followed, in order to maximize safety of both the machinery operators and the other motorist on the road. Operators must use good judgement and safety practices when operating farm machinery on roads, as the speeds and widths are usually different than other motor vehicles. Operators must remember that other motorists may not be familiar with farm equipment and the manner in which it is transported.

### **3. Other Farm Machinery**

Farm machines other than tractors are involved in many fatal and permanent injuries. Whether it is mobile equipment used in the fields, or stationary equipment used around the farmstead, these machines have a variety of hazards that must be eliminated or avoided. Entanglement in moving parts is the major hazard, including such power transmission components as chains and sprockets, belts and pulleys, and power take-off (PTO) drivelines and connectors. Other common sources of entanglement are the crop or material handling and processing components, which are designed to compress, control, cut, grind, or transport materials, but do not know the difference between the material being processed and an errant hand or foot. A variety of injuries can occur during entanglement, depending on the body part and machine component involved. Injuries as serious as severe lacerations, loss of flesh and muscle, amputations,

mangling and crushing, spinal injury, or death can result.

To prevent entanglement injuries, all shields and guards must always be in place, including the master PTO shield on the tractor. Shield and guards should be repaired or replaced if broken or missing. In addition, proper training and operating practices are necessary. Whenever machines are to be unplugged, adjusted, or repaired, the machine must first be shut off and the power turned off, including the tractor if the machine is PTO-driven. Electrically-operated equipment should have the electrical power locked out, so that nobody else can inadvertently turn on the power and injure the person working on the equipment.

Proper machine maintenance and adjustment will also minimize the risk of entanglements. Properly maintained and adjusted machines operate with fewer problems such as plugging or field breakdowns. Machines that often require unplugging or repair in the field provide many more opportunities for operators to reach into or under a machine and become injured.

Machines can also be involved in pinning the operator or mechanic who works under an inadequately-supported machine, or who enters and exits beneath a skid-steer loader with the bucket in the raised position. A failure in the hydraulic system, or an unexpected movement of a control, can allow a machine to unexpectedly drop. No one should ever work under any machine supported by hydraulics unless it is properly blocked up or a safety stop is in place. Proper jacks or support blocks must be used when working under any machinery, to prevent it from falling.

Machine hydraulic oil also poses a hazard. Hydraulic lines carry very high pressures, and a pin-hole leak can easily penetrate the skin and cause severe tissue damage. Operators or mechanics looking for leaks should always use paper or cardboard and not their hands.

Like tractors, machines can be involved in run-over injuries. Extra riders on tractors or machines can fall off and be run over by the trailing machine even if the fallen person manages to avoid the tractor wheels. Unseen bystanders, particularly small children, may be struck by machines that are being backed up. Thus, extra riders should be prohibited, and unseen bystanders should be kept from the work area.

Children in general should not be allowed around equipment. They may not appreciate the extreme hazards posed by machines in operation, and may reach in or otherwise get too close. Children who play on a parked machine may get injured if they fall from it or have it fall on them. Some children have had their clothing entangled or hung on levers or other components of machines they were playing on, and ended up strangling. Parked equipment should always be lowered to the ground, and large items like extra tractor wheels leaning up against a wall should be secured to prevent them tipping over and crushing someone. Children should not be allowed to play around machinery. Some children have had their clothing entangled or hung on levers or other components of machines they were playing on, and have ended up being strangled.

## **4. Animals**

Large farm animals are responsible for many injuries on dairy and livestock farms. Bulls, particularly dairy bulls, can suddenly attack someone and cause fatal injuries, and should never be trusted. Bulls which have been raised as pets do not understand their tremendous strength and may injure someone while simply trying to butt or be playful. Stallions are also dangerous and should be handled with extreme care. Boars can seriously rip and tear with their tusks, while rams can attack by butting. Any male animal is especially dangerous at breeding time. In addition, new mothers, such as cow or sows, will vigorously defend their young. Even if the animal makes no intentional move toward a handler, any large animal can easily pin a handler against a wall or fence, or step on hands or feet. Facilities should be designed for safe animal handling to minimize the opportunity for such injuries.

## **5. Confined Spaces and Storage Structures**

Confined spaces are defined as spaces with limited access, not intended for constant occupancy, but which a person can enter and work. Storage structures, such as grain bins, silos, and manure pits are confined spaces with serious hazards, which can lead to death. Some transport units, in particular bottom-unloading grain wagons, have similar hazards to storage units.

### **5.1. Grain Bins**

Downward-flowing grain in grain bins can lead to entrapment and suffocation. A person can walk in grain when it is not flowing, sinking in several centimeters, but when the grain is flowing downward to the outlet, the grain is like quicksand. The person will be pulled beneath the surface in as little as 20 seconds, ultimately asphyxiating. The person will even continue all the way to the bottom of the bin as long as the grain is flowing, complicating rescue efforts (assuming they are discovered). No one should ever enter a grain bin during unloading. This is also true in grain wagons/trailers; the downward flow during unloading can easily entrap and asphyxiate a child.

When entry is required into a grain bin, lockout/tagout procedures must be followed to prevent another person from turning on the unloading equipment. Lockout/tagout procedures involve placing a lock on the electrical switch box after the power has been shut off, and the person entering the bin or working on the equipment is the only person who has the key. Thus the power cannot be switched on until the worker is safely out of the bin and unlocks the switch box. An alternate procedure, in absence of a lock, is to tag the switch box to warn others that the power should not be turned on. Sometimes grain stored in less-than-optimum condition will crust over at the surface. If some of the grain beneath the crust has been unloaded, an unseen pocket may exist. Persons entering the grain bin to break up the crust can and have fallen into these pockets, as the crust gives way, and the grain forms an avalanche which falls down onto and covers the person, leading to suffocation. Large chunks of crusted grain hanging up on the wall of a storage unit may also unexpectedly collapse into an avalanche. Crusted grain should always be broken up from outside the bin, with a long pole, to minimize the chance of such entrapments.

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### **Bibliography**

Aherin R.A., D.J. Murphy, J.D. Westby. (1992). *Reducing Farm Injuries: Issues and Methods*, 58 pp. St. Joseph, MI, USA: American Society of Agricultural Engineers. [This reviews past and current methods at controlling agricultural injuries].

Bellinger P.L. (1994). *Farm and Ranch Safety Management*, 346 pp. Moline, IL, USA: Deere and Co. [This is a text focusing primarily on machinery-related safety, aimed at farmers and farm machine operators and agricultural students].

Langley R.L., R.L. McLymore, W.J. Meggs, G.T. Roberson, eds. (1997). *Safety and Health in Agriculture, Forestry, and Fisheries*, 758 pp. Rockville, MD, USA: Government Institutes Inc. [This is an in-depth technical treatment aimed at professionals and students in occupational safety and health].

McDuffie H.H., J.A. Dosman, K.A. Semchuk, S.A. Olenchock, A. Senthilselvan, eds. (1995). *Agricultural Health and Safety: Workplace, Environment, Sustainability*, 617 pp. Boca Raton, FL, USA: CRC Press Inc. [This is the proceedings of the Third International Symposium: Issues in Health, Safety, and Agriculture, May 10-15, 1992, Saskatchewan, Canada].

Murphy D.J. (1992). *Safety and Health for Production Agriculture*, 253 pp. St. Joseph, MI, USA: American Society of Agricultural Engineers. [This is a text aimed at college-level students and professionals in agricultural safety and health].

### **Biographical Sketch**

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