Chapter

18

Rice Farm Safety

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Farm activities often expose workers to dangerous situations. Each year, more agriculture-related deaths occur than that for any other industry. Agriculture has the greatest number of deaths per 100,000 workers at 25.4, which is twice that for the next highest industries of mining and transportation and warehousing (Table 18-1). Injury and death rates in almost every survey published are higher from April to September for agricultural work, when most farm activities occur. It is important to be aware of potential hazards in day-to-day farm operation to reduce the possibility of injury or death.

Table 18-1. Unintentional injuries at work by industry (preliminary), United States, 2009.

Industry Division	Hours Worked† (millions)	Deaths†		Deaths Per 100,000 Full-Time Equivalent Workers†		Medically Consulted Injuries
		2009	Change From 2008	2009	Change From 2008	
All industries	254,771	3,582	-19%	2.8	-15%	5,100,000
Agriculture‡	4,147	527	-18%	25.4	-14%	110,000
Mining‡	1,580	101	-42%	12.8	-28%	20,000
Construction	16,685	776	-17%	9.3	-1%	360,000
Manufacturing	28,049	280	-23%	2.0	-13%	600,000
Wholesale trade	7,665	165	5%	4.3	13%	130,000
Retail trade	27,469	133	-16%	1.0	-9%	580,000
Transportation and warehousing	9,527	526	-27%	11.0	-19%	250,000
Utilities	1,849	17	-54%	1.8	-55%	30,000
Information	5,874	28	-22%	1.0	-9%	60,000
Financial activities	18,075	53	-18%	0.6	-14%	140,000
Professional and business services	27,221	341	-3%	2.5	4%	240,000
Educational and health services	36,879	92	-16%	0.5	-17%	920,000
Leisure and hospitality	19,857	110	-7%	1.1	0%	390,000
Other services‡	11,927	103	-21%	1.7	-19%	170,000
Government	37,822	336	-19%	1.8	-14%	1,100,000

Deaths are preliminary data from the U.S. Bureau of Labor Statistics, Census of Fatal Occupational Injuries. All other figures are National Safety Council estimates based on data from BLS.

† Deaths include persons of all ages. Workers and death rates include persons 16 years and older. The rate is calculated as (number of fatal work injuries x 200,000,000/total hours worked). The base for 100,000 full-time equivalent worker is 200,000,000 hours. Prior to 2008, rates were based on estimated employment, not hours worked.

‡ Agriculture includes forestry, fishing and hunting. Mining includes oil and gas extraction. Other services excludes public administration.

Source: *National Safety Council Injury Facts*, 2011 Edition.

General Precautions

Work can be done safely on equipment powered by electricity with a "lock-out, tag-out" approach. Anyone working with equipment powered by electricity should carry a lock with his personal key and tag. These are readily available from local electrical suppliers. Before starting work, always disconnect the power supply and lock the switch "off." If you are interrupted or are not visible from the switchbox, this key prevents someone else from reconnecting the electricity. You can remove the lock from the switch lever after completing the work. Always use the heel of you left hand to throw lever switches and turn your face away as you move the control to minimize flash-fire burns.

A federal regulation intended for personal safety prohibits anyone or any equipment from coming within 10 feet of an overhead power line. If field equipment or other traffic cannot maintain a 10-foot gap under the power line, request that your power supplier raise the power lines.

Diesel-powered generators, electric-powered pressure washers, hand tools (drills, angle grinders, etc.) and welders should be adequately grounded. Grinders, drills and other electrical tools bouncing around in a truck tool box can develop "shorts." If the electrical service entrance at the shop is grounded with an 8-foot ground rod (National Electric Code standard), all ground wire leads, including the extra grounding plug on power cords, should be connected to reduce the risk of electrocution when the short occurs. Use electric tools on dry soil, concrete, etc., to reduce the potential of a fatal current surge passing through your body.

Someone on the farm should have current CPR training and certification. The local EMT, ambulance and fire department numbers should be posted by every permanent phone and programmed on "speed dials." Each one on the farm should be prepared to call emergency rescue should an accident occur.

Observe pesticide labels for proper use, mixing and disposal. Appropriate personal protective equipment is specified on the label. The label and material safety data sheet (MSDS) contain specific inhalation, dermal, ingestion and emergency information. These documents should be kept readily accessible so they can be referred to in case of an emergency. If a mishap occurs, use the label to help your physician and the poison center to start proper treatment.

Fire extinguishers on tractors and combines may also protect your safety and equipment investment. Dry chemical all-purpose 3A-40B:C or 4A-80B:C extinguishers are good choices for tractors and combines. Once a fire extinguisher is 10 years old, it is generally wise to replace it unless it exceeds requirements in a thorough test.

Have a Plan to Reduce Hazards

One approach is to set long-range goals to eliminate hazards while finding safer ways to complete routine tasks. Assess the potential kinds of severe accidents and how frequently a person is exposed to that hazard. Develop a simple plan that you can follow to minimize these exposures. Serious consideration should be given to the risks of road collision, tractor overturn and a person being run over or crushed by farm equipment. Consider all aspects of your farming operation to identify weaknesses and then seek remedies.

If a person must work alone, make sure another person knows where the lone worker is and that regular contact is made. If a lone operator sees a hazardous situation, getting help to resolve it is essential. Everyone should be trained to contact the manager immediately about any serious safety concern.

Field Safety

A few field dangers cause many farm-related injuries and fatalities. Since 2001, the number of agricultural work-related injuries has declined from 87,503 in 2001 to 47,332 in 2009 (Table 18-2). The primary source of injury has remained largely unchanged, with persons/plants/animals/materials, structures/surfaces and other sources responsible for the majority of work-related injuries in agriculture.

In crop production alone, 245 deaths were reported in the U.S. in 2011. Of those deaths, most were caused by transportation incidents including, but not limited to, highway and non-highway fatal injuries and fatal injuries resulting from being struck by a vehicle (Table 18-3).

Tractor overturns are the leading cause of death for farmers and farm workers. Most tractors used for rice production have a roll-over protective structure (ROPS). The risk of serious injury from an overturn

is lower if the operator fastens his seat belt on a tractor equipped with ROPS! Practicing this safety habit may also reduce injury from a traffic collision. Operating a tractor, sprayer or combine too fast for conditions causes many overturns. Turning too short can cause an overturn. Misjudging the distance from an embankment can be serious, because the bank may crumble under the weight of the tractor or implement. A fact sheet available from your county Extension office, FSA1026, *Safe Tractor Operation*, http://www.uaex.edu/Other_Areas/publications/pdf/FSA-1026.pdf), has more suggestions that may be useful for training farm labor.

Table 18-2. National estimates of agricultural work-related injuries to adults (20 years and older) on U.S. farms by source of injury.

Injury Source	2001	2004	2009
Machinery	6.2%	9.5%	4.8%
Parts/materials	10.7%	5.8%	8.1%
Persons/plants/animals/ materials	27.0%	28.9%	19.3%
Structures/surfaces	24.4%	23.9%	18.5%
Tools/instruments/equipment	8.3%	7.5%	7.8%
Vehicles	7.7%	7.5%	5.4%
Other sources†	15.7%	16.9%	36.1%
Total‡	87,503	80,329	47,332

†Includes chemicals and chemical products, containers, furniture/fixtures and other/unknown sources.

‡Estimates may not sum to total due to rounding.

Source: *Occupational Injury Surveillance of Production Agriculture Survey*, 2001, 2004 and 2009.

Table 18-3. Fatal occupational injuries by event or exposure, 2011.

Event or Exposure	Percent of Fatalities
Violence and other injuries by persons or animals†	4.9%
Transportation incidents‡	55.5%
Fires and explosions	2.9%
Falls, slips, trips	7.3%
Exposure to harmful substances or environments	9.0%
Contact with objects and equipment	19.6%

†Includes violence by persons, self-inflicted injury and attacks by animals.

‡Includes highway, non-highway, air, water, rail fatal occupational injuries and fatal occupational injuries resulting from being struck by a vehicle.

Source: *Bureau of Labor Statistics 2001 Census of Fatal Occupational Injuries*.

Whether calibrating a planter or sprayer or moving a combine, don't move equipment until you see that everyone is out of danger. Starting a tractor in gear from the starter terminal (jump-starting) is a common reason farm workers have been run over. Transmission interlocks prevent tractors from starting in gear, unless the safety is bypassed. A victim does not have enough time to jump away from a tractor left in gear before the engine builds hydraulic pressure and the tractor rolls over him.

Whenever noise prevents you from hearing someone, stop the engine and what you are doing and move to where you can talk to clear up any confusion. Hand signals are easily misunderstood, unless both individuals understand the meaning of a hand movement in advance. It takes good communication and cooperation for two people to safely hitch heavy toolbars or towed equipment. Make sure signals are not confusing before moving the tractor to align the connection.

Using a proper hitch support may prevent a dangerous hitching incident. If the hitch or lift pins do not align, movement may knock the support from under the equipment; the toolbar or hitch may spring out of control or drop and crush someone's foot or leg. Two severe accidents in 2002 may be instructive. One employee was killed trying to remove a pin when the hitch broke free and struck him in the head. Another victim removed a latch pin and was crushed by a folding cultivator because the hydraulic cylinder did not support the weight. If supports are not sturdy, stable and at the proper height when disconnecting an implement, difficulty is likely when hitching the next time. Set the safety locks on the lift cylinders before working under a combine header. Never work under hydraulic lifts, mowers, or toolbars without sturdy supports.

Combine entanglements are rare the first time the machine is choked and plugged. It's the fourth or fifth time, or later, when the operator is tired or irritated, in a hurry and judgment lapses. Vibration and excessive noise dull an alert person's senses to hazards. Since fatigue slows reaction time, rest breaks help refresh the body. Falls from combines, grain bins, etc., may be prevented with proper work platforms or sturdy ladders. Keep work areas neat and free of hose or electrical cord loops, etc., which could pose trip hazards.

Professionals mount large implement tires with a protective cage. Mishaps while inflating tires can

maim or kill. If appropriate equipment to handle these tires safely is not available, it is best to call a professional tire service company.

Irrigation risers, discharge pipes and "washout" holes where water discharges may become hazards if they are not clearly visible. If field equipment runs over a riser or washout, it can cause temporary loss of control in addition to damaging the equipment and/or the riser. Placing some type of readily visible marker around each riser and controlling weeds so the marker is readily visible should help to alert drivers. Anchor and guy wires from power poles located near or in fields should also be permanently marked. Putting some type of solid protection around guy wires for power poles is a good idea to help avoid clipping or dislodging them with field equipment. Fill washout holes and use some erosion control structure or method to prevent large washouts under discharge pipes.

Agricultural aviators have little reaction time to dodge hazards as they apply fertilizer and pesticides. Always warn the pilot of any risks that you are aware of to help him be better prepared. If a field has aerial hazards, consider whether ground equipment may be more appropriate.

Grain Handling Safety

Flowing grain and entanglement are the top causes of fatalities in grain handling facilities. Entanglement from moving fans, blades, augers, power take-offs (PTOs), belts, gears and pulleys can severely injure, disfigure, amputate or cause death to workers. Flowing grain, on the other hand, is the number one cause of fatalities for grain handlers. Large or unstable quantities of grain can flow like liquids. Unlike water, which allows a person to swim, it is difficult or impossible for a grain handler to move if he/she is caught in grain. If a grain handler is caught in a grain flow, he/she can be buried in a few seconds, which may result in suffocation in grain.

The number of agricultural confined-space incidents in the U.S. between 1964 and 2012 totaled 1,500 cases, as reported by a Purdue University database (Table 18-4). The majority of these cases are related to entrapment or engulfment in free-flowing grain. Other cases are related to machinery entanglement inside grain storage facilities or from asphyxiation due to toxic atmosphere in partially closed storage structures.

Table 18-4. The number of nonfatal and fatal incidents related to grain entrapment in the U.S. (adapted from Issa and Field, 2013).

Year	2007	2008	2009	2010	2011	2012
Nonfatal	15	17	22	26	19	11
Fatal	16	17	19	31	11	8
Total	31	34	41	57	30	19
Fatal/Total	51.6%	50.0%	46.3%	54.4%	36.7%	42.1%

Source: Issa and Field, 2013. *Summary of Grain Entrapments in the United States*. http://extension.entm.purdue.edu/grainlab/content/pdf/2012GrainEntrapments.pdf.

Grain Bin Entrapment and Engulfment

The term entrapment implies an incident when a grain bin worker becomes buried in the grain beyond the point of self-extraction. On the other hand, the term engulfment implies an incident when a grain bin worker is completely buried or submerged beneath the surface of the grain, as shown in Figure 18-1. In many cases, grain entrapment leads to engulfment which, in turn, is always fatal.

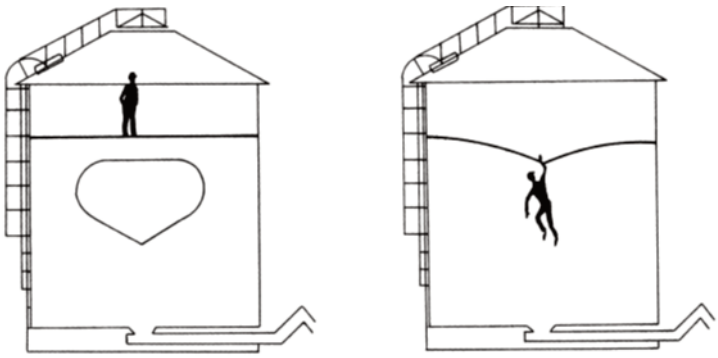

Figure 18-1. Grain bin engulfment (right).

Causes of Grain Bin Entrapment

According to the Occupational Safety and Health Administration (OSHA), most entrapments suffered by grain handlers who have entered bins or silos resulted when:

1. Grain handlers were without personal protective equipment.
2. Grain handlers did not follow proper safety procedures.

3. Grain handlers entered bins or silos while grain was flowing and equipment was running and he/she was sucked under the grain.
4. Grain handlers fell through bridged grain into an air pocket which was formed beneath spoiled grain (Figure 18-2).
5. Grain handlers tried to break a vertical grain wall (Figure 18-3).

Figure 18-2. Bridged grain.

Figure 18-3. Vertical grain wall.

Duration of Grain Bin Engulfment

The following example will provide an idea of how fast engulfment occurs. Normally, a bin-unloading auger moves grain from farm storage at 2,000 to 10,000 bushels per hour. Assuming the grain moves at a rate of 4,086 bushels per hour, this is approximately 85 cubic feet of grain moved per minute. The volume that a 6-foot-tall person takes up is roughly 7.5 cubic feet. At 85 cubic feet of grain movement per minute and from the time the auger starts, the entrapped person has 2 to 3 seconds to react. This person will be trapped in about 15 seconds. The entire body of a 6-foot-tall person can be completely engulfed within grain in about 30 seconds. Without immediate rescue, this person will suffocate.

Tips to Help Avoid the Danger of Grain Entrapment and Engulfment

Grain bin entrapment and engulfment are avoidable events. The best prevention for grain engulfment is to avoid entering the grain bin. However, it should be mentioned that flowing grain incidents could occur from loading and unloading trucks and bins, collapsing surface crusts and collapsing steep or vertical grain piles. Accordingly, the following tips may help avoid these deadly incidents.

1. Grain handlers should avoid entering a bin of flowing grain. If a grain-probe or shovel is dropped in grain bin, the flow of grain should stop first before taking any action to retrieve the lost item.
2. Grain handlers should know or be wary about a grain bin's history before entering. He/she needs to get help if the grain surface appears moldy or caked. It is advisable that grain handlers strike the grain surface hard with a pole or long-handled tool before entry to avoid falling into a crusted layer.
3. Grain handlers should lock out/tag out related power equipment before entering any bin. It may also be wise for the grain handler to post a sign on the control box.
4. Grain handlers should padlock the control gate to keep it closed if a bin is unloaded by gravity flow.
5. Grain handlers entering a grain bin should have a body harness tethered to a lifeline that is manned by at least two others outside the bin; one should be able to see the grain handler inside the bin while the second can provide aid if necessary.
6. Grain handlers should be able to use prearranged arm and hand signals due to difficulty hearing when grain handling or drying equipment is operating nearby.
7. Grain handlers trying to rescue one victim should not endanger another person.
8. Grain handlers should prepare appropriate breathing apparatus if the victim has been unable to get sufficient oxygen or has been breathing air containing grain toxins.
9. Grain handlers should take into account all preventative safety measures which include proper ladders, scaffolds, etc.

Grain Bin Entrapment Rescue Technique

Remember, entrapped persons need immediate help. It is much easier to help and successfully rescue the trapped person if you have an accident response plan. The trapped person should contact the helper waiting outside the bin immediately. It should be mentioned that pulling a trapped person from grain could be very difficult due to the friction forces transferred from the grain to the trapped person's body. Therefore, it is not advisable to winch a person from grain if the person is buried deeper than knee deep. This may cause joint dislocation, paralysis and other severe injuries. The grain

must be removed from around the person to get him/her out. It can be done by cutting balanced holes in the sides of the grain bin or by creating a cofferdam around the person and bailing out grain with a vacuum or bucket. Grain cofferdams can be constructed by driving sheets of plywood around the person. They can also be constructed out of plastic barrels. Currently, there are several commercially available grain rescue tubes. They have linking pieces that are connected and driven into the grain to create a cofferdam. Commercial rescue tubes typically have steps on the inside to assist the victim in climbing out of the grain.

Traffic and Road Transport Safety

The National Highway Traffic Safety Association recently reported that approximately 40 percent more fatal crashes and fatalities occur in rural areas compared to urban areas. Experience over the last four years in crop areas of Arkansas seems to reinforce national statistics. Changes like wider road shoulders, adding warning signs for curves with poor visibility, updating narrow bridges and, possibly, adding crossbars at railroad crossings should reduce rural traffic accidents. In some situations, it may be possible to convince town, county, state or railroad officials to clear right-of-ways to allow better traffic visibility.

Modern toolbars, combines and wide equipment typically require almost two normal traffic lanes. Motorists are often poor judges of the slow speed, width or weight of farm machinery traveling on roadways. Using an escort with flashing lights is probably the best way to alert motorists. Being diligent to keep SMV signs, reflectors and taillights bright, cleaning them before entering a road, will improve their visibility during night and day.

Lock both brakes together and start onto roadways slowly. Go slowly enough to manage the momentum of the tractor with a full grain cart, grain drill or toolbar, particularly those that raise overhead. Dump all of the rice from the combine into a grain cart or truck prior to road travel to lower the center of gravity and increase the ability to maintain control in a sudden emergency. Always check traffic from both directions before making turns, especially left turns, to prevent collision, extensive damage and injury.

Railroad crossings are increasingly dangerous for growers on farm equipment. Some cabs may "tune out" the diesel train noise. In order to hear more effectively, reduce the speed of the cab fan and turn off the radio as you approach a crossing. If you gear down well in advance, you can control the load, either to stop or to proceed when the track is clear. In some cases, either historical evidence and/or community effort may help to get the railroad to add crossbars.

Irrigation Safety

A qualified electrician should routinely check electrical circuits on irrigation pumps and center-pivot systems. Items to review are proper grounding and adequate circuit protection, including immediate replacement of circuit boxes damaged by electrical storms or circuit overheating. If a box has overheated or shorted, switching the disconnect lever may cause arcing and severe flash burns that may take months for merely partial recuperation. Always use the heel of your left hand to throw switch levers and turn your face away to minimize hazard exposure as the control is moved.

Be cautious when working around electrical circuits, especially when opening electrical control boxes and around any circuits that are "hot." Wasps commonly nest in and around electrical control boxes and may also appear from electric motor shrouds, gear head covers, power unit platforms, irrigation well sheds and irrigation pipe openings. In order to prevent an injury, it may be wise to keep wasp and hornet spray insecticide handy when working on irrigation wells. Stings are not only painful; they can be fatal for one who is severely allergic to insect stings. Further injury can also occur if a wasp startles you and causes you to jump away. A sudden reaction that puts you in contact with an unguarded drive gear or energized electric circuit may cause serious injury.

Entanglements may occur with irrigation well power shafts if safety shields are not in place. In general, power-take-off (PTO) hazards are respected, but more emphasis needs to be placed on shielding unguarded power shafts on irrigation wells. Power shaft covers can be obtained from suppliers, such as Menard Manufacturing in DeWitt, Arkansas (1-888-746-3130) to protect those doing maintenance around diesel, propane or electric power units. Power shafts

for relifts or well pumps should be shielded; any concentric sleeves that do not spin freely should be repaired or replaced.

If a power unit is not securely mounted and anchored, vibration may misalign the drive or break it loose from the supports. A loose power unit may cause a dangerous flailing power shaft or other hazards due to broken electrical wires, fuel lines or battery cables. Power units and battery mounts should be securely anchored to a substantial support platform and routinely checked for stability. A secure latch to keep the clutch of the power unit in neutral is a good safety device. This can help prevent accidentally bumping and engaging he clutch when working close to the power unit.

Typically, weather is very hot when irrigation is needed, and physical stresses may bring on heat stress. Anyone working in these conditions should drink plenty of fluids, such as water and nutrient-replenishing drinks. Breaks and rest periods should be taken as needed to avoid heat stress, fatigue and exhaustion. Fatigue and exhaustion, of themselves, are health hazards, but they may also contribute to poor judgment, causing other accidents and injuries.

Reservoirs and open irrigation distribution ditches may present concerns. Normally, a clear warning on a sign about the water hazard, unusual currents around culverts, etc., and potential bank washouts will caution outdoorsmen or others who may enter. Evaluate a location with respect to residences or public access to determine whether it may attract youngsters. Gates and fencing may be used around accessible areas to prevent ATV riders or children from getting into danger. Posting no trespassing signs or a drowning warning is primarily useful only for adults.

OSHA

Employee safety is regulated by the Occupational Safety and Health Administration. Regulations change periodically, so for the most current information, please refer to the following website: https://www.osha.gov/index.html.

Summary

These suggestions are a start to help manage hazards and find ways to avoid them. These hazards are only highlights. Review your techniques and farm work sites in order to reduce potential hazards.

A grower's leadership is the key to influencing employees and others on the farm. Employees must know that working safely is expected, for their welfare as well as that of their employer. During the noncrop season, it is wise to make a careful hazard audit. Review the previous season's activities and field records to bring to mind hazards or incidents, especially considering situations when someone narrowly avoided serious injury. Making changes may save someone's life the next season.

In most situations, equipment is not the underlying cause of an accident. A single thoughtless reaction can make you a victim. Never get in a hurry. Plan ahead to ensure there is enough time to do the job properly and safely.

Contacts That May Prove Helpful

Emergency Rescue	911 or_____
Poisoning	1-800-222-1222
Family Physician	
Local Electric Power Supplier	
County Sheriff	
Local Implement Dealer (assist with extrication)	
Local Implement Dealer (assist with extrication)	
Arkansas State Highway and Transportation Department (Police: Oversize and over-weight permits, etc.)	501-569-2381
Commercial Driver's License (CDL) Info	501-682-1400
State Fire Marshal, Arkansas State Police (Fuel storage questions)	501-618-8624
Arkansas State Plant Board	501-225-1598
Arkansas Department of Environmental Quality	501-372-0688
LPG (Liquified Petroleum Gas) Board	501-324-9228