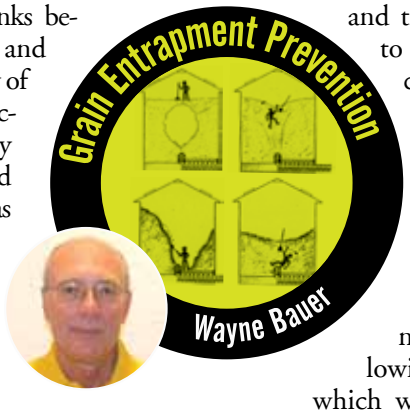
The Quality/Safety Link

MAINTAINING GRAIN QUALITY REDUCES THE NEED TO ENTER A STORAGE TANK



There are many links between grain quality and safety. I will share a few of them and their connection in this article, as they relate to one another and their relationship to areas like grain entrapments, grain conditioning, employee training, types of storage, and safety programs and policies.

The past year (2010) was the worst year on record for fatalities due to grain entrapments and engulfments around commercial grain handling facilities, as shown in Tables 1 and 2.

We averaged about one reported grain entrapment every week during the first 10 months of 2010, according to Purdue University. Keep in mind that these entrapment numbers only reflect the reported incidents. Everyone anticipated high numbers following the horrendous corn harvesting conditions experienced with the 2009 crop.

That crop was harvested very late, and the grain industry tried to handle a corn crop that came off the field with extremely high levels of moisture, low test weight, and a great deal of damage.

We witnessed the same high level of grain entrapment numbers in 1993 following the 1992 harvest, which was very similar to the 2009 harvest. The 2009 crop had a very short shelf life, probably only 40% to 50% of the shelf life expected from the 2010 crop just harvested.

Wet Harvest Traits

Dr. Charles Hurburgh Jr., professor of agricultural engineering at Iowa State University, Ames, points out that grain harvested in 1992 and 2009 shared similar traits.

Both crops were harvested in extremely wet conditions, with corn having low test weights, often 52 lbs. per bushel or less, that did not increase significantly after drying. There also were higher-than-normal levels of damaged kernels and mycotoxin contamination, including vomitoxin, zearalenone, and fumonisin.

The quality of the 2010 corn crop is good though not excellent, test weights at 54-56 lbs. per bushel but with little field damage. The warm, dry fall caused most corn to come out of the field at less than 17% moisture, with some below 14%. This meant that a small amount of corn had to be dried, resulting in fewer broken kernels and improved storage life.

Soybeans routinely had less than 12% moisture, Hurburgh says.

Maintaining Quality

Regardless of the type of commodity harvested and handled, we must learn to do a better job of maintaining grain condition and quality. The crop must be dried properly, cleaned, and cooled, before putting it into storage. The temperature and other conditions must be monitored regularly after storage. In steel bins, in particular, we must make better use of exhaust fans to reduce the sweating on the underside of roofs caused by convection currents.

Dr. Carol Jones, professor of stored product engineering at Oklahoma State University, Stillwater, offers a few thoughts on maintaining grain quality.

"Whether managers monitor grain conditions manually or with high-tech electronic monitoring systems, the key to success in maintaining quality in grain is consistency and diligence. You cannot manage what you don't know about. Thus, monitoring is essential.

"A good temperature, moisture, and general storage condition assessment program is easy insurance and goes a long way toward preventing accidents. If grain is kept in good condition, the reasons to enter a bin are reduced drastically, thus reducing the opportunity for engulfment due to bridging or avalanches from walls of moldy or crusted grain.

"Monitoring grain at least once a ▶

Table 1 **U.S. Grain Entrapments**

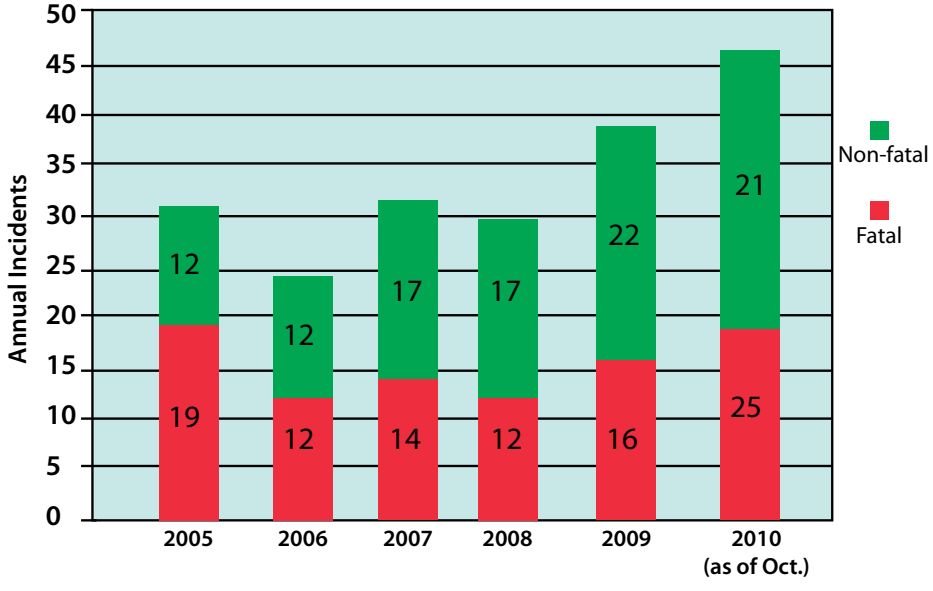


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Table 2

Grain Entrapment Stats

(2005-2010) as documented by Purdue University

	Fatalities	Total # of Reported Entrapments	Fatalities as % of Entrapments
1st 10 months of 2010	25	46	54%
2009	16	38	42%
2008	12	29	41%
2007	14	31	45%
2006	12	24	50%
2008	19	31	61%
5 Years & 10 months	98	199	**49.2% - Avg.**
	16.8 Yr. - Avg.	**34.1/Yr. - Avg.**	

week during high moisture or temperature weather is a good policy and at least every two weeks, when conditions are not as critical.

"Employees should be trained in the signs to look for when handling grain and particularly when a bin entry is anticipated. Whether grain has a shiny surface or a dull sheen during unloading from a bin is a good indicator of the presence or absence of a bridge.

"Methods of dislodging stuck grain, without entering the bin, should be explained to employees, so they understand that entering the bin is not the only or even the best remedy.

"When grain is in a compromised condition, as with the 2009 crop, before it is placed in storage, the monitoring of conditions and management of aeration and air movement is even more critical.

"If grain is kept in good condition, the reasons to enter a bin are reduced drastically."

-Dr. Carol Jones, Oklahoma State University

Quality never improves during storage. The best we can hope for is to maintain what quality exists, when the crop goes into storage.

"The proper use of aeration and ventilation is a form of insurance for grain quality preservation. Proper sizing and maintenance of roof vents is important to help manage condensation. Not enough vent capacity reduces the effectiveness in removing moisture from temperature changes, convection currents, and 'crop sweat.'

"Aeration systems are only as effective as the air movement they create. If air has no place to go, moisture and temperature removal is limited, and top and bottom surface moisture is increased. Always work with aeration contractors and specialists to make sure your aeration system is sized appropriately for your conditions and that existing installations are in good working order.

"During snow and ice conditions, make sure vents are open and clear, before aeration is turned on. Serious roof damage in steel bins can occur with negative-pressure or pull-type aeration systems, if vents are ▶

closed or clogged. With positive-pressure or push-type systems, excess moisture will collect under the roof, if vents are not open or are sized too small.

"Both financial and safety risk can be reduced with the proper management of grain quality through the use of aeration systems and a good, consistent grain quality monitoring program. Diligence and discipline are the keys to quality maintenance and employee safety. A little effort and investment can save untold dollars, frustration, and even catastrophe in the days ahead.

"While the 2010 crop appears to be in much better condition than the 2009 crop, maintaining that quality and its value through the critical temperature changes going into winter and spring is the challenge."

Storage Construction Options

The industry has been moving steadily to cheaper storage options within our grain handling systems. Over the past 25 or 30 years, we have been building more steel grain storage, outside piles, and using various membranes vs. slipped concrete. The cost per bushel for these options initially is less to build than concrete. However, there are some tradeoffs in areas like the ability to maintain grain quality, safety, and long-term handling efficiencies.

Allan Tedrow, grain industry leader with Bratney Companies, a contracting firm in Des Moines, IA notes:

"We averaged about one reported grain entrapment every week during the first 10 months of 2010"

-Wayne Bauer, Star of the West Milling Co.

"As crops get larger, the need to capture these crops and keep them in usable condition is always a concern. There is no doubt that the least-cost method to capture the grain from the field is to pile it in outside piles.

"The same is not true for reclaiming and preserving the quality of the grain in the piles. Reclaiming the grain from a pile means that it will be handled several times – first while picking the grain up off the ground, loading it into a truck, unloading the truck into the elevator pit and leg, and then on into storage. Spoilage is always a concern with this, as well.

"One viable solution for piled grain is to cover it with a temporary cover, but this adds cost, and the longevity of these covers is relatively short, from one to three years. Temporary piles are meant to be just that: temporary.

"Steel storage is a very viable means for storing grain. This method is more expensive than a covered grain pile but costs less than concrete. The cost for steel depends greatly on the size of the bin, the method for filling and reclaiming grain from the bin, and the foundation requirements.

"With the advent of larger bins, rescue from entrapment in these bins has opened the door for bin manufacturers to add tie-offs inside the bin to accommodate in-bin rescues. These additions come at a cost to the end user but do aid in rescues.

"Steel also provides the ability to maintain grain quality through proper aeration and grain temperature monitoring. ▶

"The frequency of filling and emptying the steel bin needs to be addressed in the bin design. Filling and emptying the bin more often than it was designed for will shorten its life cycle.

"Proper maintenance of the bin such as checking for wear, missing bolts, etc. is critical in determining the bin's longevity.

"The latest trend in steel bin design has been to raise its structure more above ground, so that the reclaim tunnel is above grade. This is a great feature but adds cost to the total project.

"Steel structures, for all their flexibility, do take up a significant amount of property in the larger capacity sizes. A 1.5-million-bushel tank requires a diameter in the neighborhood of 150 feet, with ring footings extending beyond this diameter.

"Concrete is a more expensive option than steel but has some advantages. Concrete can accommodate more frequent filling and emptying. It can store more bushels in less square footage. It is not uncommon for concrete bins to reach 150 feet or taller, which reduces the required diameter. With slipform concrete, bins may be configured to allow storage space – interstices – in between the bins.

"Longevity also is an issue in choosing concrete. Bins built in the 1940s are still in use today, with minimal maintenance. Also, structural support towers are easier to site with concrete than with other grain storage methods."

Structural Integrity

Grain engulfment fatalities in the past 10 years also have occurred as a direct result of bin failures or collapses. This was the case when two young men died in a concrete silo collapse in Kansas in June 2010.

There is a critical need to train grain handlers about the proper loading of grain structures. Every owner, manager, and employee must learn the signs and signals that indicate that a bin is headed for failure or collapse.

Sid Fey, loss control manager with Nationwide Agribusiness Insurance, Columbus, OH, points out that as our grain storage infrastructure ages, and the speed of grain handling increases, more and more attention needs to be placed on education, knowledge, maintenance, and the structural integrity of grain storage structures.

"There is a critical need to train grain handlers about the proper loading of grain structures."

-Sid Fey, Nationwide Agribusiness Insurance

Failures and total structural collapses will continue to be an issue, as these structures get older. Construction methods, the quality of workmanship, and proper use of these structures are the most important factors determining their life expectancy.

Fey also points out that concrete elevators and annexes built prior to 1980 may have been built with different utilization, design standards, and expectations. Most were not designed or built to cycle or turn inventory 15 to 30 times per year, year after year, as may be the case today with the advent of unit train shipping.

Wayne Bauer is safety and security director of Star of the West Milling Co., Frankenmuth, MI; 989-652-7026.