Use Caution When Salvaging Out-of-Condition Grain

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Grain improperly stored at moisture levels above 14-15% for long periods or during warm, humid weather, is at risk of spoiling or going out-of-condition. Out-of-condition grain can also be caused by heavy insect infestation or re-wetting of grain due to leaks in the storage structure, such as through the roof, eves, or ventilation hoods. In addition, improper use of ventilation fans can reintroduce moisture during days with high humidity. For example, operating the bin fan on a cold, rainy day with 90% humidity can quickly raise the grain moisture content to above appropriate storage levels of 14-15%. All of these conditions or practices can lead to the growth of mold and premature spoilage that makes removal of the grain from storage difficult.

Out-of-condition grain can exhibit itself in several ways, including:

- Formation of a solid crusted surface over the top of the grain that can become so firm that a person could actually walk on it.
- Formation of chunks of crusted grain that “float” within the grain mass and eventually end up at the bottom of the bin potentially plugging the floor wells or openings.
- Crusted sheets or ledges of grain that become adhered to the walls of the bin after the free-flowing grain has been removed. These heavy chunks of grain are highly

unstable and can easily collapse or break free presenting a hazard to anyone under them.

- Formation of free standing vertical piles or columns of crusted grain that look like towers or statutes within the structure. These columns can contain literally tons of spoiled, moldy grain stuck together that is highly unstable. This form of spoilage can be caused by even slow leaks in the roof or ventilation system that allow outside moisture to seep into the grain and migrate to the floor. Along the path of the moisture, the grain can easily spoil forming a column of hard crusted grain. When the loose grain surrounding the column is removed, the column becomes a dangerously unstable, free-standing pile that could easily collapse if disturbed.
- Piles of non-flowable, crusted or damaged grain that piles up over the floor wells causing them to plug both the opening and in floor unload auger.

Removing or attempting to salvage, out-of-condition grain can be difficult, time consuming, expensive, and most important – DANGEROUS. In fact, research at Purdue University has shown that there is a direct correlation between the presence of out-of-condition grain and an increased probability of entrapment or engulfment. In the vast majority of documented incidents, farmers or employees at a commercial grain handling facility were attempting to break up and remove crusted grain when they become victims of entrapment. This included activities such as walking on crusted surfaces, walking down the grain as it was unloaded to remove crusted grain from the inside walls of the structure, or attempting to unplug the unloading wells while standing on the grain surface with the unloading system energized. In addition, cases have been documented in which workers were using grain vacuum machines to

remove damaged grain and become pulled into the flow. The bottom line is that attempting to remove spoiled or out-of-condition grain can be dangerous.

The simplest solution to reducing the risks associated with out-of-condition grain is to prevent grain from spoiling by adopting best grain storage management practices. It takes too much work to produce high quality grain from the field and then allow excessive moisture or insects to spoil it while in storage. Damaged grain will also result in a substantial loss in value or being rejected at the elevator if sold. For more information on maintaining grain quality, check with your local County Extension Office, or search online for resources under the term “grain quality”.

One method to detect the onset of grain spoilage is to monitor the air coming out of the ventilation system. If it is warm, or smells sour or moldy, there is a high probability that the grain is deteriorating. In some cases, just opening the roof hatch will help identify spoilage from the odor and the appearance of the grain. There is no need to enter the structure to know whether or not there is a problem.

If stored grain appears to be going out-of-condition, the response should be to address the problem immediately. The quality of grain in a bin that has begun to spoil will never improve by itself – it will only continue to deteriorate. Failing to respond quickly can result in a significant crop loss, and even damage to the structure. Your investment is too great to ignore. Steps must be taken immediately if further deterioration of the grain is to be prevented. This could include coring the bin to remove the central core where there is a greater concentration of fines, foreign material, and insect damage. Increased levels of ventilation might help temporarily but will not solve the problem since the spoilage process has begun. In most cases, grain that is spoiling needs to be moved out of storage and utilized as quickly as possible.

If attempts to remove the spoiling grain become difficult or impossible due to plugging of the floor wells, the use of a professional grain salvage company might have to be considered. Their crews are trained and equipped to salvage as much grain as possible, while minimizing damage to the structure. They generally use large, truck mounted, grain vacuum machines to unload the structure from the top, or accessing the grain through openings cut into the side wall through which they insert a portable auger. Salvaged grain has value as an ingredient for cattle feed, if not too badly spoiled. But the salvage operation is not cheap and will be a significant long-term reminder of the importance of following safe grain storage practices.

As already noted above, attempting to unplug and/or empty a bin of out-of-condition grain alone, can be extremely dangerous. The risks, based upon past incidents, are simply too high. Precautions to consider if attempting to remove spoiled grain from storage include:

- **Never** attempt removing out-of-condition grain alone. Ask a co-worker or neighbor, or contract with the local elevator to assist so that there will always be someone to monitor the scene, or to be available to shut off equipment if needed, or call for help in the event of an emergency. This activity requires a team approach rather than a "lone ranger".
- **Never** enter a bin in which the surface of the grain has crusted over. This can be confirmed if grain has been removed from the bottom of the bin but there has been no or little deformation of the surface. This means that a void has formed under the crusted surface. Attempting to walk on the surface can cause it to collapse resulting in complete engulfment as grain avalanches into the void.
- **Never** enter the bottom access door of the storage structure in which there are crusted chunks of grain adhering to the bin walls. A simple shock such as closing the bin door

or vibration from a passing truck could cause the grain to break free burying anyone beneath it.

- **Never** attempt to break up a vertical, free-standing column of grain while standing at its base, or by using a grain vacuum machine. These columns of crusted grain are highly unstable and could collapse without warning. Anyone in close proximity would be buried in seconds.
- Once grain begins to flow out the unload system, **never** attempt to "walk down" the grain in order to break up crusted chunks of grain or to scrape off the walls. Sudden shifts in the grain can cause a worker to be drawn into the grain flow and become entrapped with no potential for self-extrication. This practice is so unsafe that it is considered illegal under the current OSHA Grain Handling Safety Standard.

Another hazard that should be considered when salvaging out-of-condition grain is exposure to air borne grain dust and mold that are generated when spoiled grain is disturbed. Some of the mold produced as grain spoil is toxic and can cause severe respiratory distress, including flu like symptoms.

All workers exposed to the dust during salvaging operations should be equipped with appropriate respiratory protection such as N-95 respirators. If the concentrations of dust are high, the respirators will need to be replaced frequently to be effective. Care should be taken to not transport toxic dust back home on contaminated clothing. Use of disposable coveralls might be appropriate.

In summary, there is no easy solution to removing spoiled grain from storage. But "difficult" should not be translated into being life threatening. The key is storing the grain at appropriate moisture levels, continued monitoring, and acting quickly if spoilage is detected.

Any approach used to salvage damaged grain must place the highest priority on the safety and well-being of those engaged in the process.