



# GRAIN ENTRAPMENT

by Rebecca Sherratt, Features Editor, Milling and Grain

**I**n this issue of Milling and Grain magazine we are very lucky to feature both a Guest Editor column as well as an interview with Mr Samuel Goldberg, Producer of the film ‘SILO: Edge of the Real World’.

Mr Goldberg’s film depicts the tale of Adam Fox and Clay Althoff who are both deeply affected by the death of a fellow community member via grain entrapment. The film delves into the often-overlooked dangers of the agriculture industry and thoughtfully considers both the risks and rewards of farming.

Grain entrapment is a danger that not only affects farmers, but people from all walks of life and so it is a surprise that the danger is not more widely discussed, especially in rural communities.

Grain entrapment takes place when an individual becomes sunken in unstable grain that collapses in on itself, trapping the individual inside. Once the victim is completely buried under the grain, it becomes grain engulfment, often resulting in death from asphyxiation.

The suction-like quality of the grain in a silo causes grain entrapment and engulfment to take place terrifyingly quickly. Human bodies take mere seconds to sink within grain and then only minutes before their bodies are completely submerged.

Bodies often take several hours to then recover, once the person engulfed is discovered to be missing. Entrapment often takes place in silos or grain elevators but can also take place almost anywhere where large bulks of raw materials are stored.

## Statistics and prevention

Purdue University conducted a study in 2011 and its National Agricultural Confined Space Incident Database documented an alarming 900 reported entrapments since 1964. When searching these reported incidents for patterns, Purdue University discovered that the most common raw material wherein entrapment most often occurs is corn. As a result of this, the most incidents take place in states in America known for their corn production such as Illinois, Minnesota, Iowa, Ohio and Indiana.

Despite various regulations being put into place that are aimed to prevent grain entrapment incidents, deaths from engulfment reached an all-time annual high in 2010 with a reported 26 deaths. From 2009 to 2010 there was a 34 percent increase in cases of entrapment.

Over 70 percent of modern-day grain engulfment victims are minors working on farms. Smaller farms are exempt from the vast majority of federal labour regulations, thereby children working for parents often are not granted the same safety laws as those in larger farms, wherein those under 16 years of age are not permitted to enter confined spaces.

One of the most prominent regulations preventing grain engulfment deaths on larger farms was the implementation of the regulation by the United States Occupational Safety and Health Administration (OSHA) that forbids augers opening at the bottom of a grain storage facility when someone is currently inside a silo, also known as ‘walking along the grain’.

However, despite this regulation, the dangers of grain entrapment can also occur when silos or grain elevators are

being cleaned, as damp or encrusted materials can fall and cause potential problems.

On a slightly more positive note, despite the unpleasantly high numbers of grain entrapment incidents, the rate of successful rescues from grain entrapment are increasing yearly. Prior to 2005, only a quarter of grain entrapment victims on average were saved, whereas since then over half of the victims on average are recovered.

Storing grain properly and following the correct regulations is the most effective way to prevent grain entrapment. Grain should be stored at 14 percent or less moisture content and sealed away tightly so it cannot fall victim to the elements and create clumps or areas of irregular density prone to collapse.

Should grain become spoiled, it is more likely that it will give way and be at risk of causing an entrapment. One additional effective method for ensuring your grain doesn't spoil is thorough 'coring', wherein grain from the centre of the storage facility is removed, as this is where the broken and smaller grains prone to insect infestations are often present.

It is also crucial for workers to never be permitted to enter silos or grain elevators on their own. If this cannot be avoided, then workers are required to have a phone or radio with which they can communicate to their colleagues outside. No one who is not permitted to enter a grain storage facility should ever enter.

## Rescues

Rescuing grain entrapment victims proves to be an exceedingly difficult task.

Once victims fall within the raw materials breathing instantly becomes a difficult task. Toxic gases such as nitrogen oxide and carbon dioxide are released from spoilt grains, which can cause asphyxiation, should the area not be sufficiently ventilated. Raw material dust can also contain various toxic spores or moulds that have been known to cause allergic reactions within individuals who breathe them in for extended periods of time.

Temperature also becomes a dangerous factor for grain entrapment victims. Grain silos and dryers keep grain cool by blowing cold air onto it, but this can often lower the temperature of grain to as low as -1 - -5°C, putting victims at serious risk of hypothermia. Grain loading and unloading equipment should all be immediately switched off, should an incident occur.

As the majority of incidents take place on rural farms, getting the suitable rescue teams and emergency services to the area takes time, something which grain entrapment victims don't have much of. The confined spaces make rescues very difficult and it is important to also ensure that the emergency services aren't also put at risk whilst saving the victims.

Extracting a grain entrapment victim from grain also isn't as simple as lifting them out of the materials. The suction-like behaviour of the grain creates an incredible level of friction, resisting all pulling force. To remove a human submerged up to their waste from grain takes 180kg of pulling force, whilst it takes 410kg to remove a person fully engulfed in grain, both amounts being too excessive and able to easily cause dangerous spinal injury to the victim.

If you can't simply pull an entrapment victim out of the raw materials, then how do you get them out? It is quite an elaborate process. Emergency services usually build makeshift walls around the victim in the grain with plywood, tarpaulins or sheet metal. Following this step, a makeshift cofferdam is created within the grain, enabling workers to remove grain by hand, shovel or grain vacuum so they can be extracted.



Another technique used is to cut a hole in the side of the silo or grain elevator, although this often requires a consultation with an engineer to ensure that this will not compromise the integrity of the silo.

### **Plan ahead, should an incident occur**

It is integral that farms and storage facilities have plans in place for if a grain entrapment scenario should ever occur. Workers should be trained on what to do in an entrapment scenario which covers entry procedures, recognising grain quality issues, using safety equipment and emergency response.

Farms should also ensure they have phones on site and each worker has access to either a phone or radio on their person at all times. Emergency numbers for rescue should also be up in visible spaces where colleagues can clearly see them in case of emergency.

Teaching your workers how to conduct themselves safely around silos and raw materials is key to prevent any accidents occurring and it is your employees' rights to receive proper training and have proper safety measures in place when handling raw materials.