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Imperial Sugar explosion in 2008 – Image: US CSB

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Compliance vs. Competence – what makes you safer?

When doing ATEX presentations, Declan Barry, Managing Director of ATEX Explosion Hazards Ltd., is frequently asked which is more important; Compliance or Competence. His usual answer is: “people cause explosions, not plants”.

In the materials handling industry, we try to establish a “basis of safety” through seven primary headings.

- 1. Material Properties:** Identify the hazard, is it explosive, do you know the following:
 - Minimum Ignition Temperature (MIT)
 - Minimum Ignition Energy (MIE)
 - Lower Explosion Level (LEL)
 - Thermal stability
 - Explosibility in bar m/s K (dust, gas or vapour)
- 2. Equipment:** Equipment and protective systems in the places where hazardous explosive atmospheres may be present must be chosen in accordance with the categories in Directive 94/9/EC, unless otherwise provided in the explosion protection document, based on the risk assessment.
- 3. Maintenance procedures** should be in place to define methods by which equipment and plant can be safely (for the maintenance team and the plant), promptly and economically restored to safe, effective and efficient operating conditions.
- 4. Human Factors:** Training of maintenance employees should enable tradesmen to
 - Maximum Explosion Pressure in barg Pmax
 undertake maintenance work effectively, so that they themselves are safe and that they do not jeopardise the safety of the plant or the people who work on it.
- 5. Acceptable residual risk:** Is the risk or danger of an event, despite all the prevention and protection measures applied, acceptable to the organisation’s targets for, and approach to safety?
- 6. Deviations:** Written procedures should be in place, which ensures that all modifications are authorised only by competent personnel.
- 7. Explosion Prevention and Protection.** Additional measures to prevent the start of an explosion like gas monitoring or spark detection. In the event that an explosion



Didion Milling Company explosion in 2017, before and after – Image: US CSB



cannot be prevented, applying measures to mitigate its consequences to people and/or plant, such as:

Explosion –

- Containment
- Venting
- Suppression
- And/or Isolation

Looking back, there have been many examples of incidents which can be learnt from.

January 2019 – A&D Logistics, UK

In January 2019, a worker suffered flash burn injuries from an explosion that occurred after they opened a container door. The team leader at UK logistics haulier A&D Logistics Limited had been asked by management to dry out condensation from the office accommodation container. The custom and practice was to use a propane fuelled open-flame gas torch attached to a LPG cylinder, which was left burning within the container. Returning four hours later to check on the progress of the container, the worker opened the door by putting his hand in the gap between the doors and pulling. There was an explosion and he was thrown by force against a steel workshop container. Whilst on the ground he felt his arms burning, saw they were on fire, and felt the same of his face and hair.

An investigation by the HSE found that the company allowed the gas torch and propane cylinder to be left unattended with the torch lit whilst the team leader attended other work. The container did not contain sufficient oxygen to support safe combustion because of inadequate ventilation. Yard personnel had no 'hot work' training. The work-wear worn by the team leader was not suitable for 'hot work' activities. Formal training and instruction for drying out wet containers with a propane gas torch was absent.

May 2017 – Didion Milling Company, US

In May 2017, five employees were killed and 14 others were injured after an explosion at Didion Milling Company in Wisconsin, US. Two days before the explosion, Didion had a fire inside a dryer, which propagated to the dust collector on the roof. This meant staff were already on high alert before the explosion.

A Bauermeister gap mill grinds corn into smaller pieces by forcing the pieces to hit each other and internal mill components, causing them to break apart through a process referred to as mechanical impact grinding. A series of unfortunate events led to the explosion at the mill.

Firstly, workers believed the conditions at

the mill on the night of the incident were "normal," and up until just moments before the explosion(s), workers either were unaware of any problems or assumed their troubleshooting efforts would reveal a typical and manageable situation.

Approximately 15 to 30 minutes before the explosion, workers saw and/or smelled smoke in area 1B of the plant. Just before the incident, individuals were walking around various levels in A and B Mills, and no one observed any other problems beyond the smell of smoke.

In trying to find the source of the smoke, observations led workers to focus on a gap mill in 1B that was part of the bran system. After inspecting the gap mill, workers witnessed an air filter from the air intake line of the mill blow off, releasing corn product and flames from inside the equipment into the air, followed by multiple explosions throughout the milling facility.

July 2015 – Wood Treatment Ltd, UK

On July 17, 2015, four workers at Wood Treatment Ltd in Bosley, Cheshire, were killed after an explosion. It caused the collapse of a four-storey building and the incident is still in the courts. We know that there were problems with wood dust and equipment and that there were engineering issues in the silo and mill area. Employees have said they remember waking up after the blast with no roof over their head and flames all around blocking the emergency exits. One employee jumped out a window into a river to get away.

What are acceptable risks in your Basis of Safety?

So, we have had similar incidents in the US with plenty of detail reported but in the UK, there is not much data published. They both have similar guidance/regulations on hazard and risk.

NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities, 2017

Section 3.3 General definitions:

...an explosion, "the bursting or rupture of an enclosure or container due to the development of internal pressure from a

deflagration," where deflagration is the "propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium."

OSHA requires manufacturers to provide Safety Data Sheets (SDSs) to communicate hazards of their products (29 CFR 1910.1200(g)). The SDSs that Didion produced for several of its products, including corn bran, flour, grits, and meal, identified that "dust air mixtures [of these products] may be explosive." Didion workers' job responsibilities included cleaning and those interviewed described how they performed these activities daily.

Reported amounts of dust in the mill on the day of the incident rely upon individual perceptions, which varied widely among Didion employees. Some Didion workers described the plant as "dusty" while others indicated it was "clean", while observations

varied between the plant being "spic and span" to "I was covered in [dust] everyday!".

Recent investigations and reports have revealed that, amongst other things, serious issues with both ATEX equipment certification and hazardous area classification continue to be key issues.

Hazard Area Classification (HAC)

A procedure by which sections of the plant where explosive atmosphere may exist identified and the extent of the hazard determined.

Continuous source	(> 1000 hrs.yr-1)	yields a Zone 20
Primary source	(10 - 1000 hrs.yr-1)	yields a Zone 21
Secondary source	(<10 hrs.yr-1)	yields a Zone 22

These are a general broad brush approach, originally designed for gases and vapours. In reality, experienced experts in their respective industries are now coming to the

conclusion that HAC needs to be specific to the hazard in each specific plant taking into account the experience of the plant operators and equipment suppliers. If dust layers cannot be prevented, then an explosive atmosphere has to be considered as a continuous source yielding a Zone 20.

I hope this article may open your mind to whether just complying with regulations like ATEX are the way forward to preventing or protecting your colleagues from explosion hazards or if you need to improve specific competence in your workforce. ■

About the author



Declan Barry MD of ATEX Explosion Hazards Limited based in the UK and Ireland. ATEX Explosion Hazards Limited with offices in Cheshire is part of an international group of companies around the globe with our HQ in Germany. Explosion Hazards limited has been providing Explosion Safety Solutions to industry for nearly 50 years.



Bosley Mill explosion in 2015 – Image: Cheshire Fire & Rescue