It makes obvious sense to learn from unwanted outcomes to avoid repetition, and to share the lessons learned in order to minimize the number of times the same lessons have to be learned.

This straightforward thinking is reflected in common sayings:

- Those who cannot remember the past are condemned to repeat it - Santanyana
- History repeats itself, first as tragedy, then as farce - Karl Marx

Case (wood pellet facility) offers a textbook example of these truisms.

Key arguments of this presentation

- No serious mechanism for investigation, identification and dissemination of lessons learnt following an accident
- Accidents occur, and recur

Wood pellet facility. Building I (raw materials) and II (intermediate dust storage and production)
Wood pellet producer in Aars, Denmark

16 NOV 2015
FAILURE TO LEARN AFTER ACCIDENTS

Explosion in 2002, no casualties (sheer luck)
facility destroyed, re-built, root causes not identified

16 NOV 2015
FAILURE TO LEARN AFTER ACCIDENTS
Repeat 2010 explosion (fatal), facility destroyed, not re-built, root causes STILL not identified

Wood chips → Hammer mill → Pelletizer → Ship product

Source: Company’s environmental permit

Shaft with cardan joints

Source: Silberwolf, Wikimedia
Dust Explosion - Imperial Sugar Company, USA, 2008, with 14 killed and 36 injured

› (sugar is not a dangerous substance)

› (wood dust is not a dangerous substance)

Babine Forest Products Ltd, British Columbia, Canada, (2 dead, 20 injured)

The 2012 explosion was powerful enough to throw debris 400 metres, and shake buildings and rattle windows several kilometres away.
2010 Explosion at wood pellet facility, Aars, Denmark

Volvo front loader
Failure to learn after accidents - Lamentable situation in Denmark
16 Nov 2015
LUCRAM, Lund, Sweden

Source: local DK workplace authority
Investigation closed the very next day (!)

› Conclusions:
› The cardan transmission shaft had failed mechanically, damaging the numerous electrical cables that were routed underneath the chassis resulting in arcing and sparking, which had ignited the dust (incorrect finding).
› The shaft had been probably been weakened by fractures near the weld zone (incorrect finding).

› These findings closed the police investigation, as there was no indication of wrongdoing, only of bad luck
Arbejdstilsynet (workplace safety Authority)

› Concerned that a non-ATEX approved wheel loader was operating in an ATEX 22 location
   Order (1): STOP THE WORK, **immediately**.

› The Authority was also concerned that the company could not present inspection records for the wheel loaders. Regulations require that such vehicles are inspected once a year by a competent person.
   Order (2): INSPECT VEHICLES, immediately.

› Order (3): ensure work is carried out in a safe manner, immediately.

› The Authority informed that it considered **legal action and a penalty**.
Lamentable situation in Denmark

16 Nov 2015

LUCRAM, Lund, Sweden

Bhopal (1984)
Intermediate storage of MIC

Capacity: 2 x 50 tons

Alternative production philosophy
No intermediate storage of MIC

Carbaryl insecticide
The intermediate wood flour storage is the problem - root cause not identified 2002, 2010
Parking brake – design shortcoming
- root cause not identified

- The parking brake on some of the older Volvo loaders is mounted directly on the shaft.
- If the driver forgets to release the parking brake, the system rapidly overheats and fails.
- Real direct cause of 2010 accident: the overheated red-glowing parking brake had ignited wood dust that is inevitably made airborne when the driver raises the bucket.

Basic information on this accident not shared

- On the contrary, documents are locked away in the archives of the police and other Agencies and can be released only using Freedom of Information Acts (lengthy and onerous task)
- Info in public domain is misleading (mechanical failure of cardan joint)
- There is absolutely no information to help accident prevention professionals prevent a repeat accident elsewhere

- Rudimentary information indicates that at least two earlier explosions have taken place involving Volvo loaders and wood pellets, in February 2008 and in February 2010, possibly in Belgium and/or The Netherlands. No learning.
Learning opportunities missed repeatedly, in 2002, in 2010

- Significant root causes not identified;
- Principles of inherent safety in design ignored;
- The hazardous area classification was based on flawed reasoning; the ATEX assessment was inadequate as it dealt only with electrical installations, ignoring work operations; and powered industrial trucks had not been recognized as a source of ignition.
- Perhaps most importantly, guidelines for hazardous area classification for combustible dust are insufficiently developed and give ample room for potentially erroneous subjective individual judgment.

Structural issues (1) - Knowledge

- The trend in industrial accident prevention in Denmark has been a shift away from standards and codes that define specific minimum safe practices toward a risk based approach where each case is judged on its own merits.
- For a risk-based approach to be effective, availability of relevant information is critical - or risks may go unrecognized or be scored too low.
Structural issues (2) – no information sharing, barriers at company level

› There is no evidence that the company has engaged in information sharing activities, for instance with other stakeholders in the biomass pellet industry.
› This is natural and only to be expected.
› Milton Friedman’s dictum "The business of business is business" implies that spending company resources to investigate and report lessons learned for the benefit of others would make a weak business case.
› Only expenses are visible; negative publicity is a concern and benefits are at best uncertain and intangible.

Structural issues (3) - no information sharing, barriers at producer/vendor level

› The producer of the wheel loader does not appear to have engaged in information sharing activities.
› A reluctance to do so is natural and only to be expected.
› Common sense suggests that a company will not aggressively inform its customers and competitors about product issues which could potentially lead to brand damage and hurt sales.
Structural issues (4) - Polluter Pays Principle

› The Polluter Pays Principle (PPP) plays an important role in Danish policy.
› Care should be taken not to misapply this principle to accident investigation and learning, delegating such obligations to the parties directly affected.
› It appears critical to provide some sort of institutional support to facilitate learning

Limited recognition amongst key actors that current situation is unsatisfactory

› Key actors have been approached
› Wood pellet case, and other similar Danish cases, have been presented, to promote the idea that current situation is unsatisfactory
› Perhaps the most surprising revelation:
› Limited recognition amongst key actors that a problem exists – that learning opportunities are foregone. (All rules and regulations complied with, problems at the site have been "fixed", etc, etc.)
› This is astonishing
› - Suggestions welcome, please !
Conclusion

- Major accidents cannot be prevented solely through command and control regulatory requirements but by understanding the fundamental root causes, widely disseminating the lessons learned, and integrating these lessons learned into safe operations.
- Few would argue that these goals are wrong.
- Yet, evidently, there are major difficulties in making this seemingly simple and straightforward idea work in practice.
- Structural issues abound, mindset and attitude issues abound, etc.

Thank you for listening!