

WHAT WENT RIGHT

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OUTLINE

- Introduction
- Process Safety Events and Success
- Process Safety Resources and Success
- Process Safety Concepts and Success
- Learning from Success
- Conclusion
- Acknowledgements

INTRODUCTION

■ Scope

- Process safety and lessons learned

■ Motivation

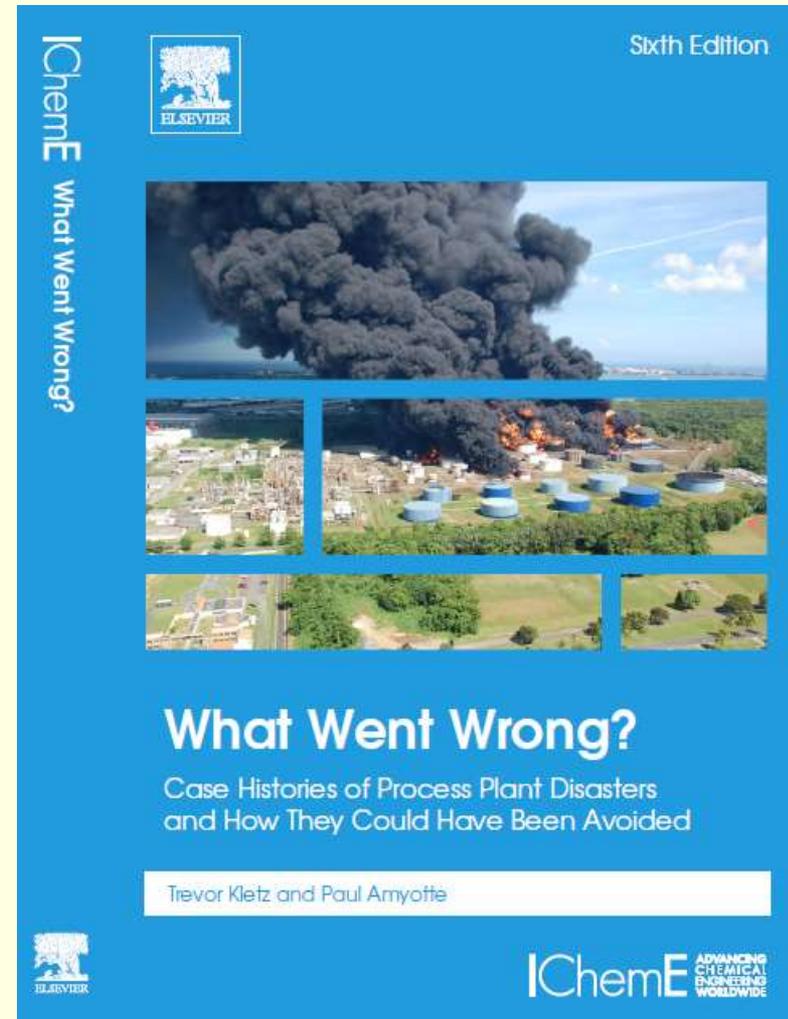
- Case histories tend to focus heavily on process safety failure; lessons can also be learned from process safety success

■ Objective

- Identify process safety successes – events, resources and concepts – that convey valuable lessons for prevention and mitigation of process incidents

Background

- Spent better part of 2018 working on sixth edition of *What Went Wrong?*
- Essentially a book on case histories and lessons learned: mostly, from things that went wrong

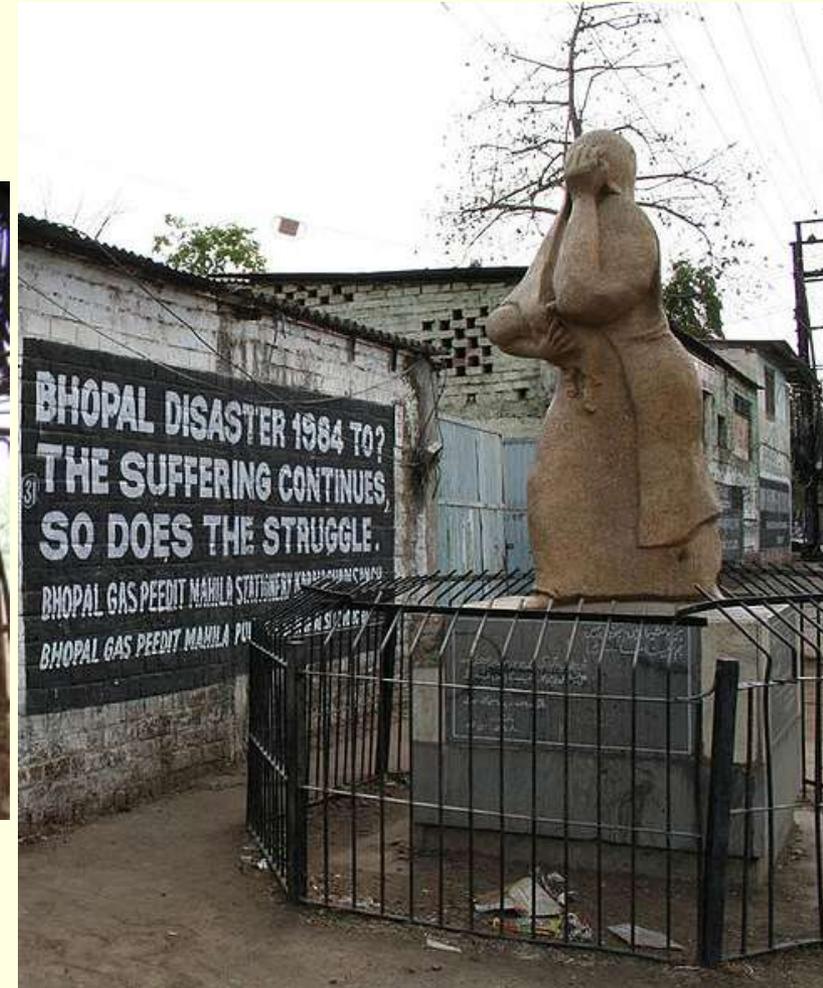


Flixborough (1974)

Seveso (1976)



Bhopal (1984)



Mexico City (1984)

Piper Alpha (1988)



Phillips 66 (1989)



Westray (1992)



Toulouse (2001) BP Texas City (2005)



Buncefield (2005)

BP Horizon (2010)



Fukushima (2011)

Tianjin (2015)



Background

- MKOPSC (2012): *Process safety is...largely... advanced by tragic events that, ironically, underscore the importance of the field only after the fact. Even today,...a disturbing school of thought exists: if nothing bad happens, it is because there are no hazards, and if there are no hazards, then there is no need to take preventive measures.*
- Anonymous reviewer of this paper: *I think looking at the positive side is very important...Some people only learn from seeing what good looks like rather than seeing what bad looks like.*

Procedure

- List of items that were helpful in preparing sixth edition of *What Went Wrong?*
 - Process safety events, resources and concepts
- Anonymous reviewer of abstract for this paper: *I hope from the title that the full paper will be about potentially serious incidents where protective barriers worked, which would be interesting, rather than a story about process safety resources and institutions.*
- Learning from success in other fields: business/management/sociology/education/psychology/...

PROCESS SAFETY EVENTS AND SUCCESS

- Life's work of Professor Trevor Kletz (1922-2013)
- Formation and continued funding of US Chemical Safety Board 
- Visionary partnership of IChemE Safety Centre and MKOPSC
- Founding of Journal of Loss Prevention in the Process Industries (1988)
- Acknowledgement of information/knowledge management and communication paradigm
- Promotion of systems approach to major accident prevention

Hierarchy of controls

INHERENT SAFETY

**PASSIVE ENGINEERED
(ADD-ON) SAFETY**

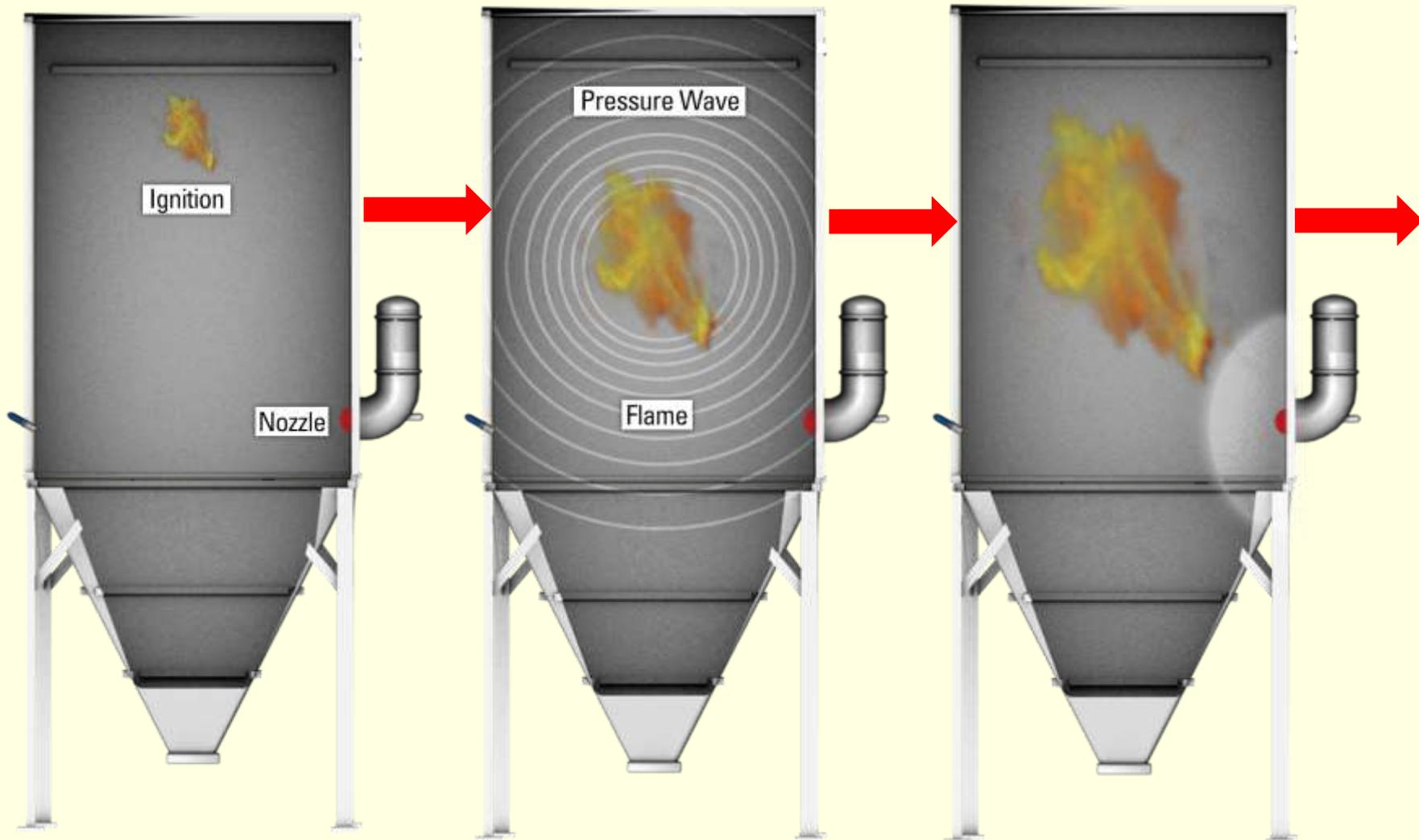
**ACTIVE ENGINEERED
(ADD-ON) SAFETY**

**PROCEDURAL
(ADMINISTRATIVE) SAFETY**

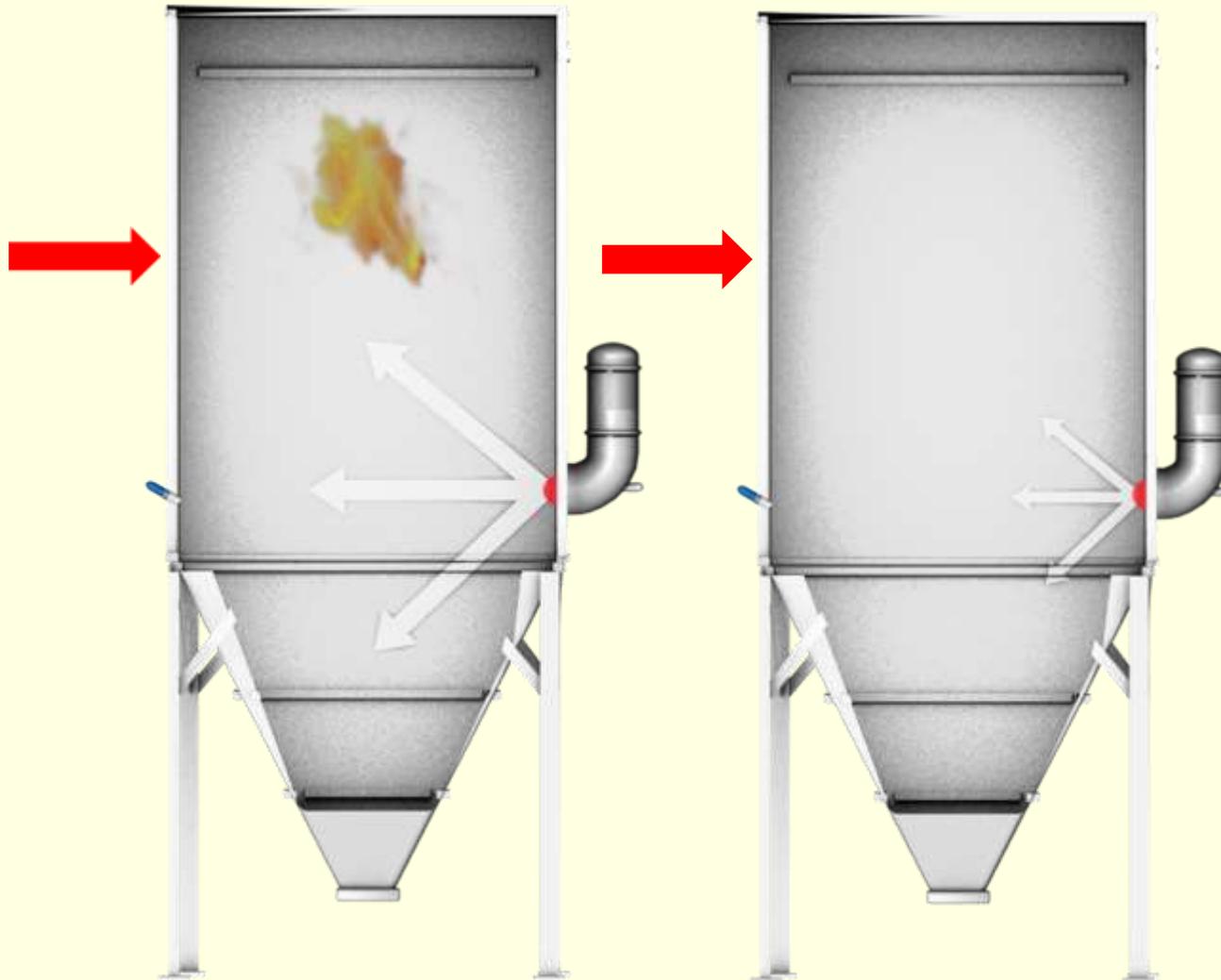
Passive safety (CSB, 2011)



Explosion suppression sequence



Explosion suppression sequence (continued)



Active safety (CSB, 2015)



PROCESS SAFETY RESOURCES AND SUCCESS

- IChemE Loss Prevention Bulletin
- IChemE/BP Process Safety Series
- Safety culture books written by Professor Andrew Hopkins
- Books and guidelines prepared by CCPS; Process Safety Beacon 
- Various symposium series
 - IChemE
 - CCPS
 - MKOPSC
 - EFCE Working Party on Loss Prevention

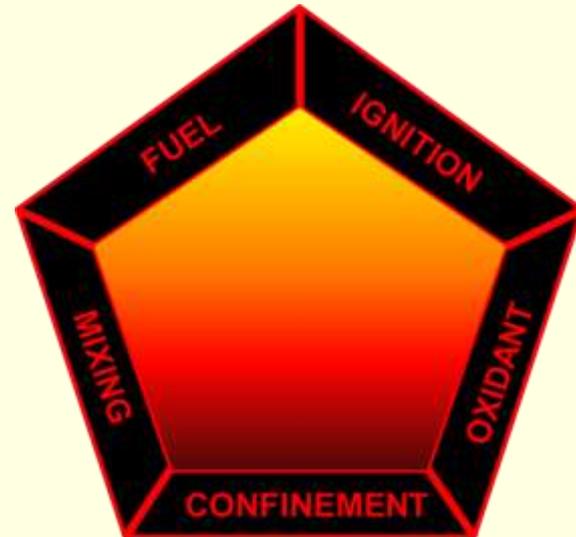
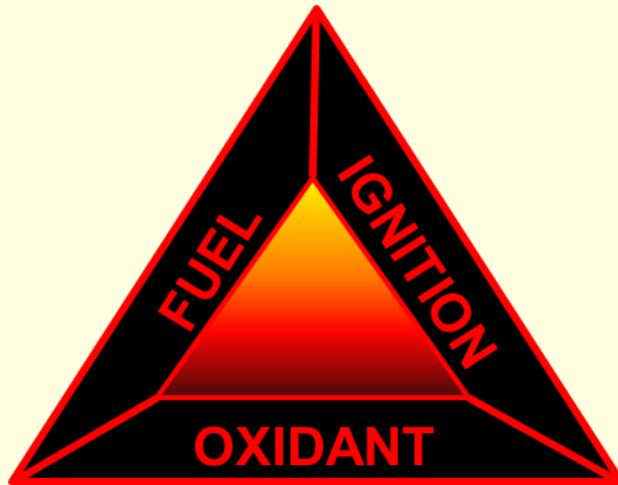
Process Safety Beacon, *Chemical Engineering Progress* (Dec 2015)

An engineer noticed accumulated dust as well as a dust cloud near equipment containing combustible solids.

Electrical equipment and sources of electrostatic sparks presented potential ignition sources for an explosion. The equipment was stopped, the room was cleaned, and corrective actions to contain the dust were implemented.

What went right?

- Knowledge of chemistry
- Knowledge of physics



- Non-normalization of deviation
- Reporting culture

PROCESS SAFETY CONCEPTS AND SUCCESS

- Process safety applications in laboratories, pilot plants and other manufacturing facilities
- Process security
- Domino effects
- Natech (natural hazard triggering technological disasters) incidents 
- Black  swan events

Thunderstorm effects (lightning) on Milford Haven oil refinery (1994)



- Prevention of domino escalation by cooling of nearby vessels holding flammable material
- Consequence mitigation by on-site and county firefighting teams
- Integrity assurance of adjacent unit due to design, construction and operation features



LEARNING FROM SUCCESS

■ Engineering

- Karthikeyan, *CEP* (March 2019)
- Risk-based process safety: 1 out of 12 a success

■ Business/Management

- Sutton (2007), *Learning from Success and Failure*
- *After people succeed at something, it is especially important to have them focus on what went wrong.*

■ Sociology

- Hopkins (2009): *There is, however, another way that we can hope to prevent accidents, and that is by studying organisations that don't have them – so-called high reliability organisations [HROs].*

LEARNING FROM SUCCESS

■ Education

- Schechter, *International J. Educational Research* (2012)
- *It seems that learning from success is more natural because we, as human beings, tend to relate to successes. However, until now we learned from ours and others' failures in order not to redo them. It is better to learn from ours and others' successes because in this way we learn from a positive perspective. When learning from success, we can see ways of positive work...*

■ Psychology

- Positive Psychology Center (<https://ppc.sas.upenn.edu/>)
- *The scientific study of the strengths that enable individuals and communities {process plants?} to thrive*

CONCLUSION

- It seems we focus more on failure than success for our lessons learned in the field of process safety
- We have learned much about concepts like human factors and safety culture from other fields (psychology, sociology)
- Is learning from success another such concept?
- How do you learn from success in your organization?

ACKNOWLEDGEMENTS

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