

Personal Journey – 11 years of Process Safety Management at Shell

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Agenda and Opening

Agenda

1. Being involved in a major incident
2. Increase Process Safety Competence
3. Process Safety Dilemmas

About the Presenter

1. PhD in Chemical Engineering
2. With Shell since 2004 in different technology and process engineering roles
3. Teamleader Process Safety since 2013



Confucius said:

By three methods we may learn wisdom

1. By reflection, which is the noblest
2. By imitation, which is the easiest
3. By experience, which is the bitterest

Being involved in a major incident

Fire at the lower olefins unit in 2015



Sunday 10th May 2015

I was called in as part of the emergency response team

This is what I saw







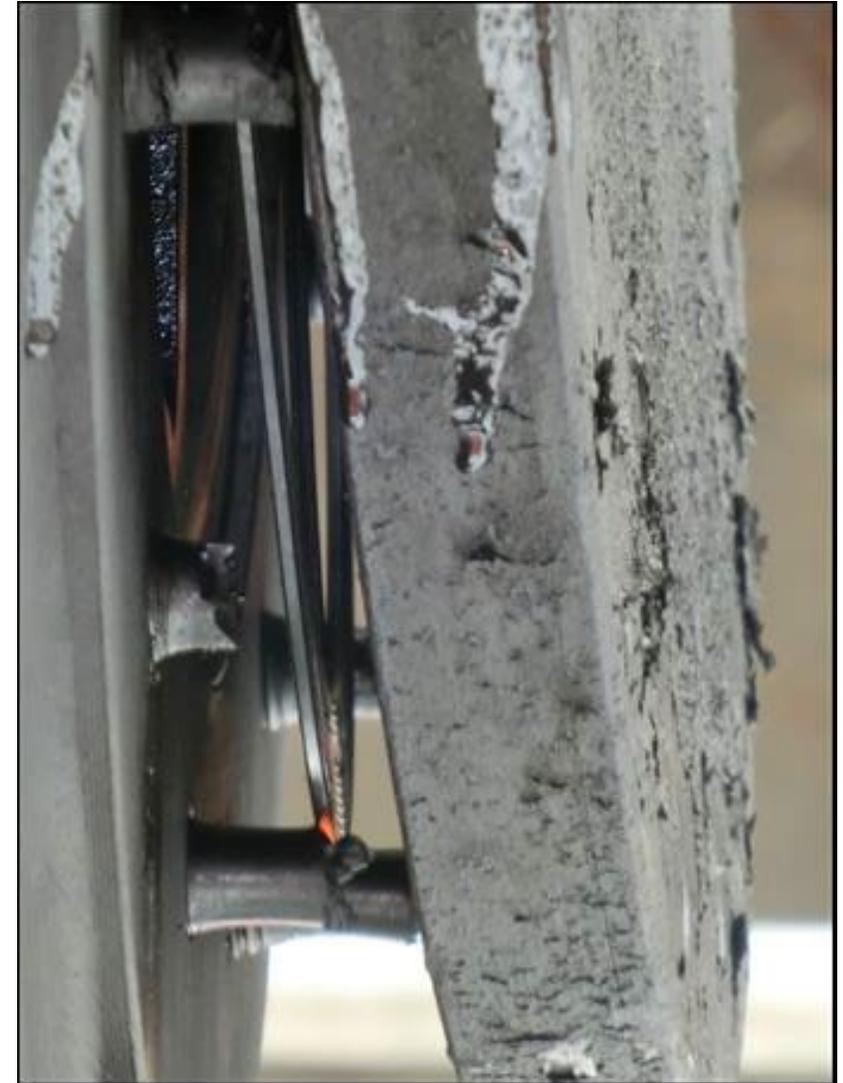
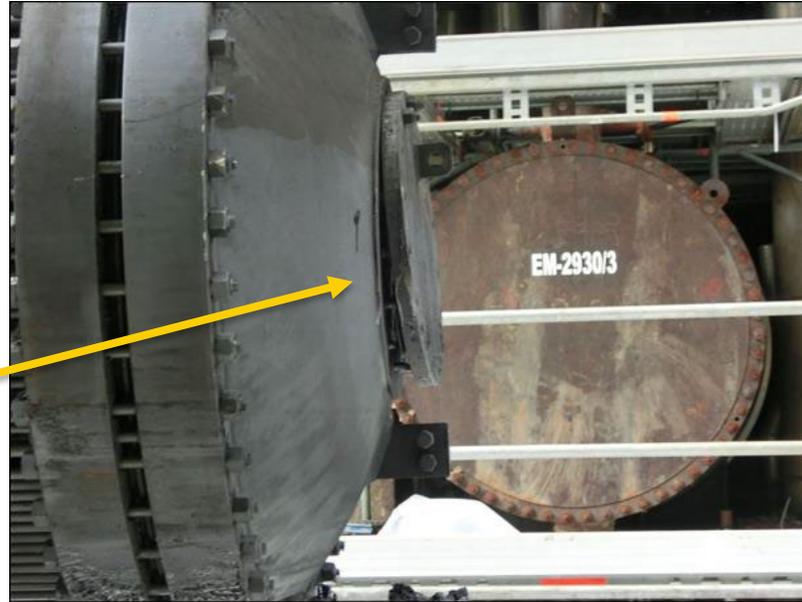


Why it happened – bolt failure

- Caustic Induced Stress Corrosion Cracking of bolts on
- Internal floating head inspection hatch

Caused by:

- Clogged Blowdown System
- Some higher than normal Caustic addition





40 s Video: The effect of embrittlement of bolts caused by caustic stress corrosion cracking

My learnings from the causal learning investigation

A major revamp project for capacity expansion and safety improvement was executed in that plant in 2014

- A lot of big and complex technical changes were implemented, e. g.
 - More than 30 new heat exchangers due to a higher duty requirement and partly due to vibration issues
 - More than 400 new sensors
 - A two-digit number of new safety instrumented functions (“SIFs”)
 - More than 40 re-designed relief valves
 - A new flare line DN600 about 100 m long
 - 2 column retrays
- However, there were also a lot of smaller changes
 - Some of these changes did not receive the appropriate attention and scrutiny.
 - They lacked MY attention.
 - In the end, this proved to be fatal
- Hyman Rickover put it like this: "The man in charge must concern himself with details. If he does not consider them important, neither will his subordinates. Yet the devil is in the details."

Increase Process Safety Competence

What did we do to increase our competence in the last decade?



Why is competence critical?

Confucius said:

By three methods we may learn wisdom

1. By reflection, which is the noblest
2. **By imitation, which is the easiest**
3. By experience, which is the bitterest

Imitation means that we learn from the experiences of others by imitating their behavior.

For example: Follow a certain design standard to avoid a process safety problem.

Imitation is not as easy as it sounds.

You have KNOW the experience of others and to ACT based on that knowledge.

Hyman Rickover: "I also have found in my 57 years of naval service that engineering problems are most often solved through the efforts of **technically competent individuals**, not through the establishment of huge organizations or management systems."



How to increase process safety competence?

DO the job **YOURSELF!**

You will not become competent by assigning tasks to contractors.

INsourcing not **OUT**sourcing!

Charles Haddon-Cave (QC): "You cannot outsource your thinking."

What did we at the Shell Energy and Chemicals Park Rheinland insource in the last decade?

1. Facilitation of hazard analyses (HAZOP, ROGA, EGA)
2. Consequence and dispersion modelling using FRED and ProNUSs
3. Flare system modelling using Unisim Flare
4. Two-Phase relief cases according to API 520
5. Writing and compilation of safeguarding memoranda (pressure hazard analyses according to API 521)
6. Writing and compilation of HSE cases

What can you do to increase your process safety competence?

DO the job YOURSELF!

Look for assignments and development opportunities where you actually DO process safety related work. The list of the activities we insourced (see previous slide) is a good starting point for relevant process safety skills. However, there is much more.

Moreover, you should READ.

Read A LOT.

4 h per week as a minimum. The more the better.

For example:

1. Read books (e. g. Sidney Dekker, Trevor Kletz, Andrew Hopkins)
2. Read incident reports, or watch the videos of the CSB: <https://www.csb.gov/videos/>
3. Read standards (API 520, API 521, ISO 4126, ISO 23251, internal Standards)

Process Safety Dilemmas

What are we struggling with and why?

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Process Safety is about avoiding the negative not about achieving the positive

A lot of time and resources is used for process safety to **avoid** serious incidents (loss of containment, fires, explosions and the like).

This is essentially a negation. We do process safety, because we want something **NOT** to happen.

This is by nature abstract.

However, the job of most of our colleagues, who work in e. g. manufacturing, project, or in commercial roles is to **MAKE TANGIBLE THINGS** happen. Things like

1. Produce x kt of product y
2. Make a margin of z M\$
3. Execute project xyz and thereby bring a new asset into being

There is no such thing as an ultimate truth in process safety

Process safety is about scenarios and the evaluation of risk. What is the problem with that?

1. Most people (luckily) have never experienced such a scenario become reality (i. e. an event)
2. Risk is very subjective and human beings are essentially irrational, N people have N risk perceptions/assessments. It is also subject to manipulation. Peter Webb put it like this “risk-assessment is like torturing a spy. If you do it for long enough you get the answer you want!”
3. We cannot do experiments. Why? How would such an experiment look like? Do we want to do this?
 - i. Overpressure a crude oil distillation column
 - ii. Release more than 100 t of hot crude
 - iii. Check whether the resulting vapor cloud ignites – this means we have to repeat the experiment several times, because not every vapor cloud ignites
 - iv. Once the vapor cloud ignites: Examine the resulting carnage to determine the asset damage and the number of fatalities

Therefore, process safety is about applying a framework and rules, like RAM, Riskgraph, API 521.

What is the problem with rules and frameworks?

You have to know the rules and the framework in the first place -> COMPETENCE!

Rules have to simplify, therefore they cannot adequately account for every possible contingency. Again you need competence to appropriately assess the applicability of a rule.

Rules limit the decision-making freedom of powerful people.

Andrew Hopkins: "The decision makers are likely to be more powerful, and hence more resistant to limitations on their decision-making freedom and more able to point to the inevitable inconsistencies and inefficiencies in all blanket restrictions."

Summary

What did we learn?

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Summary

1. Try to avoid learning process safety the hard and bitter way by experiencing a major incident yourself
2. The devil is in the details
3. Competence matters, it is crucial
4. You gain process safety competence by doing actual process safety work
5. Process safety is about applying rules in a framework
6. The rules in this framework limit the decision-making options of powerful people



Ron

a subject that
is interesting

somebody
who asks
a question

Questions and Answers

Are you able to handle an overflow?

Q&A

Sources of more information

- Sidney Dekker, *The Safety Anarchist: Relying on Human Expertise and Innovation, Reducing Bureaucracy and Compliance*, [link to amazon](#)
- Charles Haddon-Cave (QC), *The Nimrod Review, Ordered by the House of Commons to be printed 28th October 2009, HC 1025* London: The Stationery Office
- Andrew Hopkins, Risk-management and rule compliance: Decision-making in hazardous industries, *Safety Science*, 49 (2011), 110-120
- Trevor Kletz, What went wrong, [link to amazon](#)
- Hyman Rickover, *The never-ending challenge of engineering*, [link to amazon](#)
- Hyman Rickover, *Doing a Job*, <https://govleaders.org/rickover.htm>
- Peter Webb, *Prescription – A Step on the Road to Dependence, or a cure for process safety ills?*, *Hazards XXI*, 2009

Cautionary Note: Some of these documents contain controversial views and challenge the conventional wisdom about process safety. You will need to THINK about them. Sapere aude!

our shared responsibility to protect society

