PROCESS ACCIDENT CASE · INADEQUATE ISOLATION

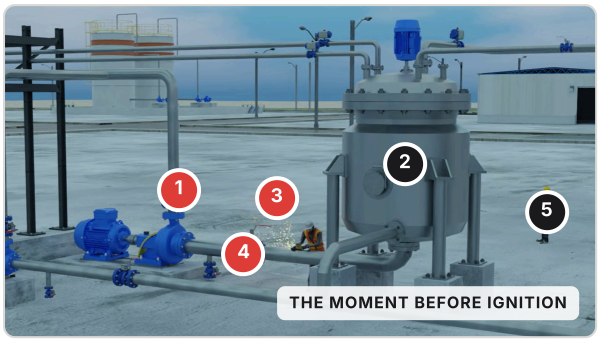
The valves were closed. The reactor was not isolated.

No welding, no entry, so valves seemed enough. **The cutting wheel was hot work.**

UProcess

From Trevor Kletz, *What Went Wrong?*

2 killed



1. **The closed valves.** Trusted as the isolation. Vapour passed through them.
2. **The reactor.** Washed out for maintenance. About 7 kg of vapour was enough.
3. **The cut.** A high-speed abrasive wheel through an attached line: it throws a flame and the pipe glows red.
4. **The flange.** Where a slip-plate or a removed spool would have ended it.
5. **The men at the vessel.** The head was blown off. Two men were killed.

WHAT HAPPENED, IN ORDER

Seven kilograms of vapour. Two men killed. Every valve closed.



Washed out
Reactor prepared for maintenance and washed out

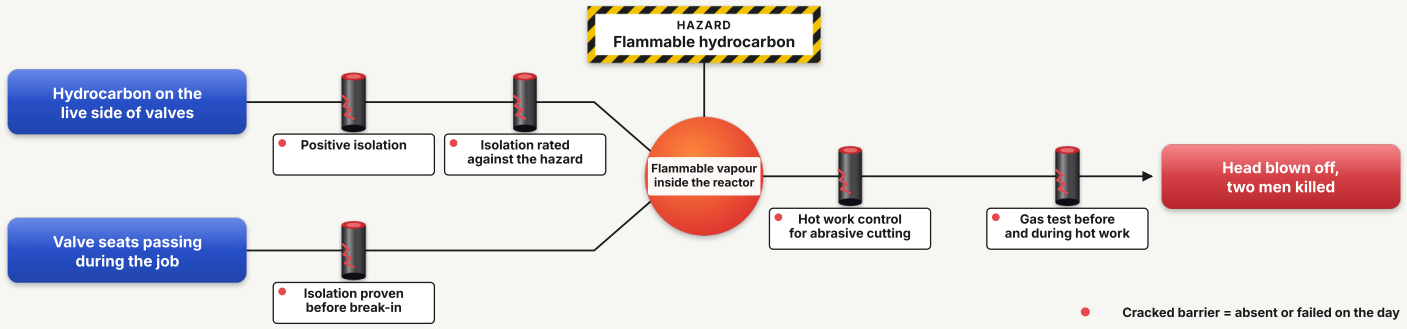
Valves relied on
No welding, no entry: valves relied on, no slip-plates

Vapour leaks
Flammable vapour leaks through the closed valves

Abrasive cut
An abrasive wheel cuts a pipeline on the vessel

Ignition
Vapour ignites. Head blown off; two men killed

BOW-TIE · NONE OF THE FIVE BARRIERS WAS IN PLACE ON THE DAY



THE FIVE BARRIERS

BARRIER	WHAT IT IS	WHAT HAPPENED INSTEAD	SYSTEM ELEMENT
1 · Positive isolation	Every line into the vessel slip-plated or physically disconnected before anyone works on it.	Valves were relied on because no welding and no entry were planned.	Safe work practices
2 · Isolation rated against the hazard	The isolation follows what the lines contain, not the task: a valve-only isolation is rated before anyone accepts it.	Decided on the task — no welding, no entry — not on what the lines held.	Hazard analysis
3 · Isolation proven before break-in	Before a line is cut, the isolation is proven: vented, drained, no flow, no vapour.	No proof of isolation is described. Vapour leaked through the closed valves.	Operating procedures
4 · Hot work control for abrasive cutting	Cutting and grinding are hot work: the same permit and precautions as welding.	Welding was counted as the ignition risk; the abrasive wheel was not.	Safe work practices
5 · Gas test before and during hot work	The atmosphere at the cut and inside the vessel is measured before the work and repeated while it lasts.	No gas test is described. About 7 kg of vapour was enough for the explosion.	Safe work practices

THE RULE **A closed valve is not an isolation. Before anyone breaks into a line, it is blinded or disconnected.**

SAFETY TALK · ASK THE CREW

1. Which lines into our next vessel are only valved?
2. Who decided the isolation — the hazard, or the task?
3. Which of our tools make sparks without being called hot work?

Positive isolation · Slip-plate · Break-in · Hot work · Gas test

BEFORE BREAKING INTO A LINE

- [ ] Every line blinded or disconnected
- [ ] Any valve-only isolation rated and approved
- [ ] Isolation proven before the cut
- [ ] Cutting and grinding under a hot work permit
- [ ] Gas test before and during the work

"A closed valve is not an isolation. Valves are not good enough."

After Trevor Kletz, What Went Wrong?

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