Normalization of Deviation

AIChE Benelux Nov 2019

Tijs Koerts
Operations Director EPSC

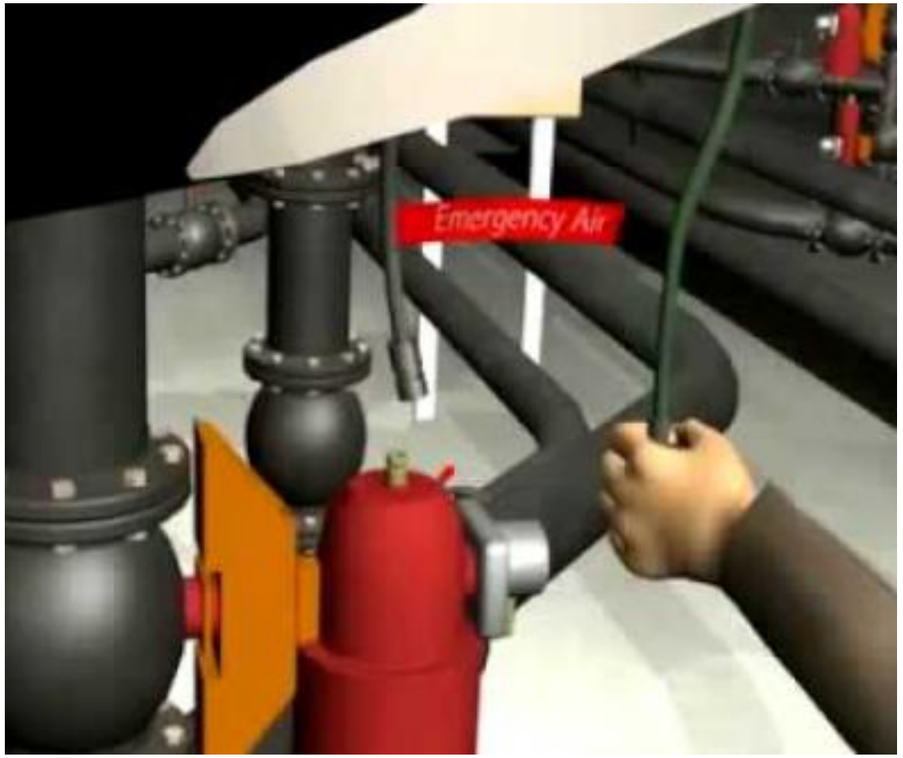
Normalization of Deviation examples Inspired by Jim Conner

- Column overfill – BP TCR
- Ethylene explosion – Philips Conoco
- VCl2 explosion – Formosa
- Furnace start-up – Exxon Mobile
- Draining caustic

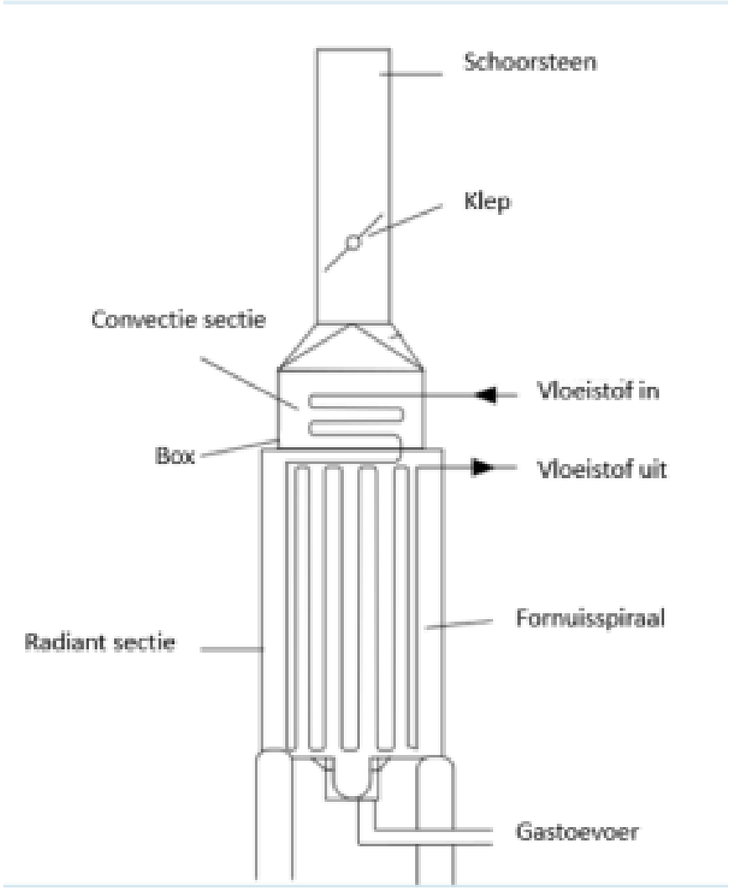
Column overfill – BP Texas City Refinery 2005

Philips Conoco 1989

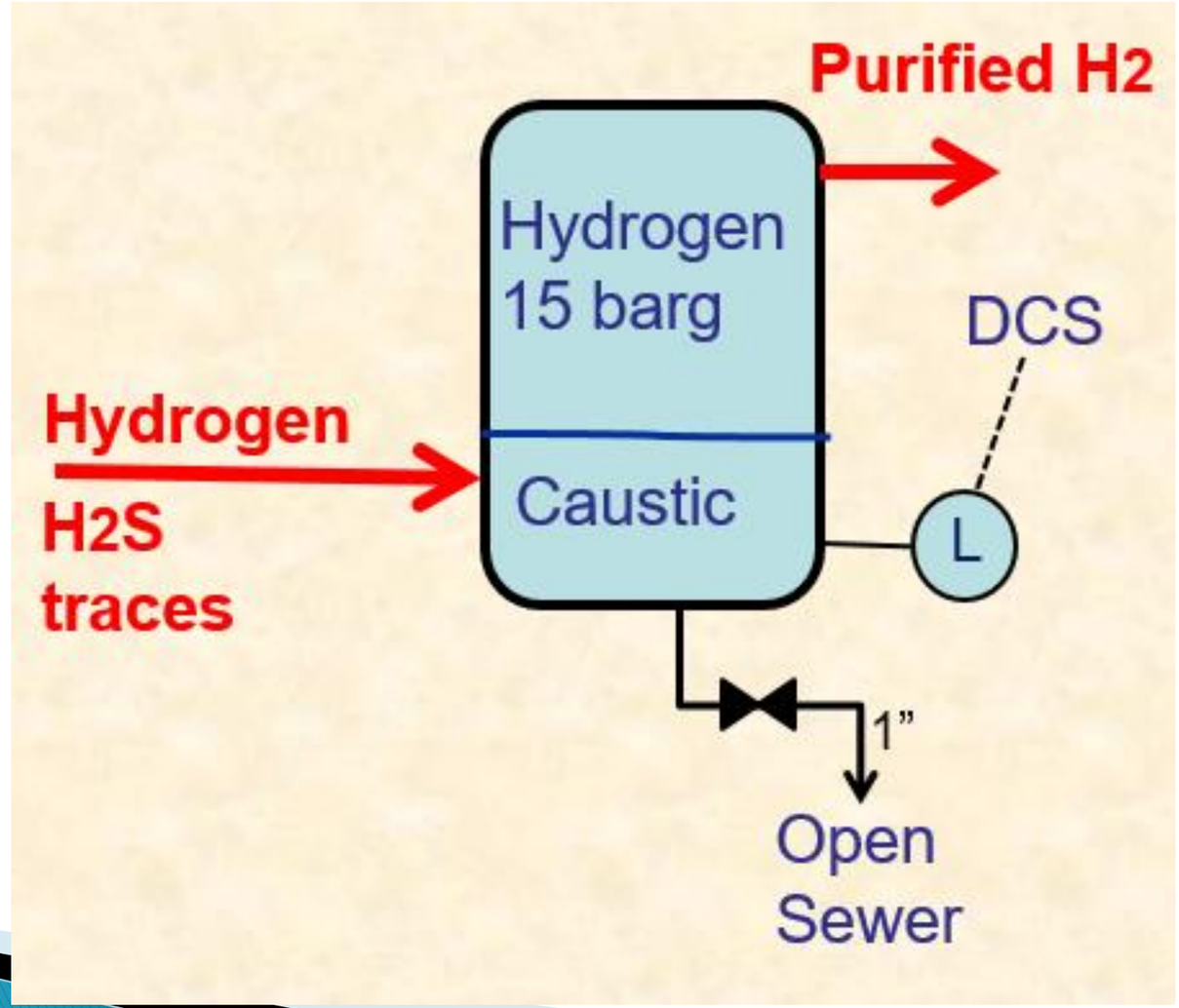
VCl_2 explosion – Formosa



Furnace start – Exxon Mobile



Refinery – Draining caustic from a H_2S scrubber



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Release from Flare system

EPSC Learning Sheet , May 2019

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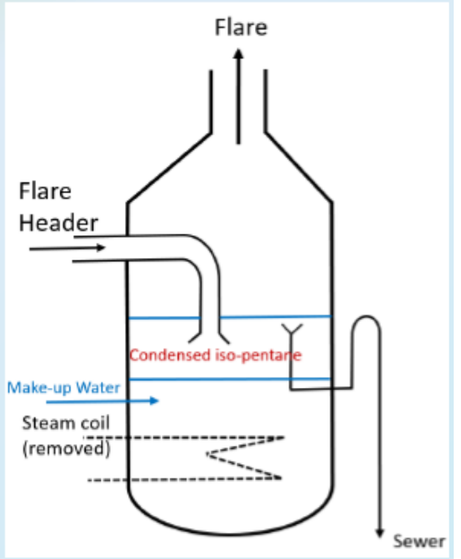
What Happened:
During the start-up of a refinery, high amounts of iso-pentane did leak through an off-gas vent of a distillation column, to the flare. This condensed in the cold water seal of the flare and was able to overflow into the oily water sewer, where it evaporated and triggered gas alarms. The large gas cloud was not ignited.



Aspects:

- Operators were unaware of the mechanical failed open vent control valve, indicated as closed on DCS
- Iso-pentane has a boiling point of 26 °C, when released as a gas it passed the KO drum, condensed in the cold water seal vessel and flow-over into the sewer as a liquid, as its swims on top of the water. In the closed sewer it was mixed with condensate, evaporated and lifted several pit covers
- In the past the steam coil in the water seal drum was taken out of service after it corroded, as its function was unclear. Warm water in the seal could have limited the release
- If water is removed at a lower point in the seal drums, condensed hydrocarbons get more time to re-vaporate
- This rare scenario was not described in the hazard analysis

Start-up requires additional attention

Thank you for your attention