

LFI: LP & HP Flare Header Pressures dropped to below Zero.



What Happened?

- Nitrogen and fuel gas are used as purge gases to maintain positive pressure on the LP flare and HP flare, respectively.
- *Fuel gas supply maintains pressure on both LP and HP when nitrogen is unavailable, or not enough.*
- When the Offshore Platform tripped, boilers were taken off therefore there was no steam for fuel gas unit (41ES101), meaning no fuel gas supply to maintain the LP and the HP flare pressure.
- *When the boilers were taken offline, there was insufficient nitrogen to supply the LP flare. Flare header pressures therefore dropped to below zero.*

What Happened?

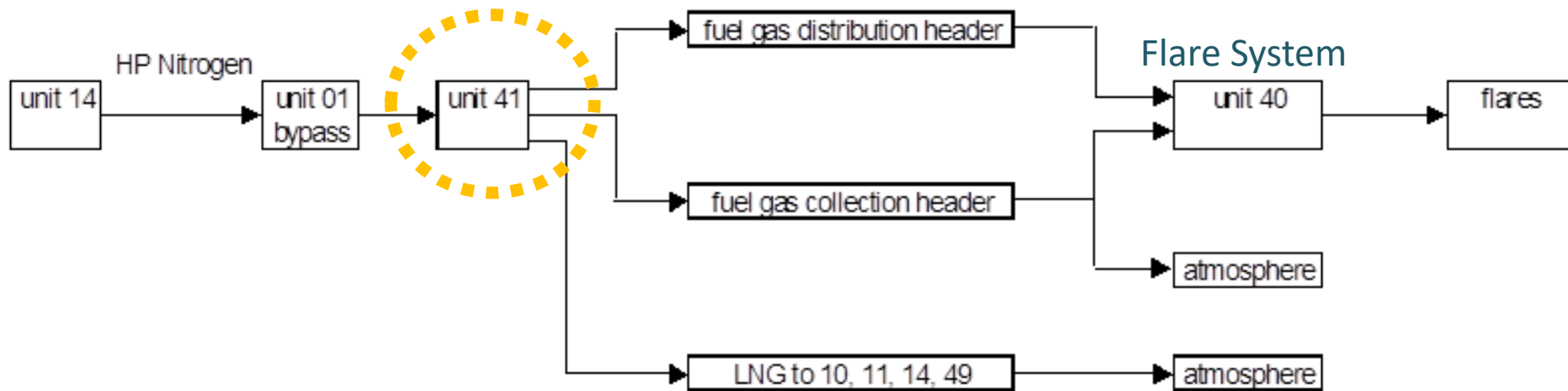
Time	Activity - Event	Condition
Day 1	Factory line pressure started decreasing from 4700 kPa.	Boiler 1; Boiler 2; 03KC101 and 48GT102 were online.
Day 6	Line decreased further to 3800 kPa.	Power generation was reduced from 6MW to 5MW.
Day 8	Line pressure dropped to 3700 kPa.	Power generation was reduced from 5MW to 4MW.
Day 9	Factory Line pressure dropped to about 3500 kPa.	Boiler 1 was taken off and 48GT102 was put on barring.
Day 10	Offshore Platform tripped due to total power failure.	Factory line pressure continued to decrease.
Day 11 @ 07H30	Factory line pressure decreased to 3279 kPa due to Platform outage.	Unit 03 was taken offline resulted in having no nitrogen supply to the factory. Boiler 2 was also taken offline which resulted in no steam supply to the factory.
Day 11 @ 17H40	Steam supply to 41ES101 was cut off.	Pressure valves 41PV1003A/B/C and 41PV1004A/B/C tripped shut, shutting off the fuel gas supply to HP controller.
Day 14	Flare pressure was unstable.	The pressure went on negative again.
Day 16		Flare pressure went on negative again.

Why it Happened?

- Low pressure nitrogen supply the pressure control valve to the LP flare, and fuel gas supply the pressure control valve on HP flare - to maintain positive pressure on the flares.
- *Backup fuel gas supply is also used to maintain the pressure on the LP flare, and is sufficient to maintain both LP and HP flare pressures in case of nitrogen shortage.*
- Platform then tripped and the Boiler Units were shut down to support the supply line pressure, and that resulted in shutdown of the Air Separation Unit.
- *Steam supply to the fuel gas unit (ES101) was thus also shut off, and caused the pressure control valves to the flare to trip shut due to low temperature - consequently shutting off the fuel gas supply to the HP flare header pressure control valve.*
- No nitrogen was available per AirSep shutdown to supply the pressure controller on the LP Flare, and also no fuel gas to supply the pressure controller on the HP flare header. The flare pressure became unstable and dropped below zero.

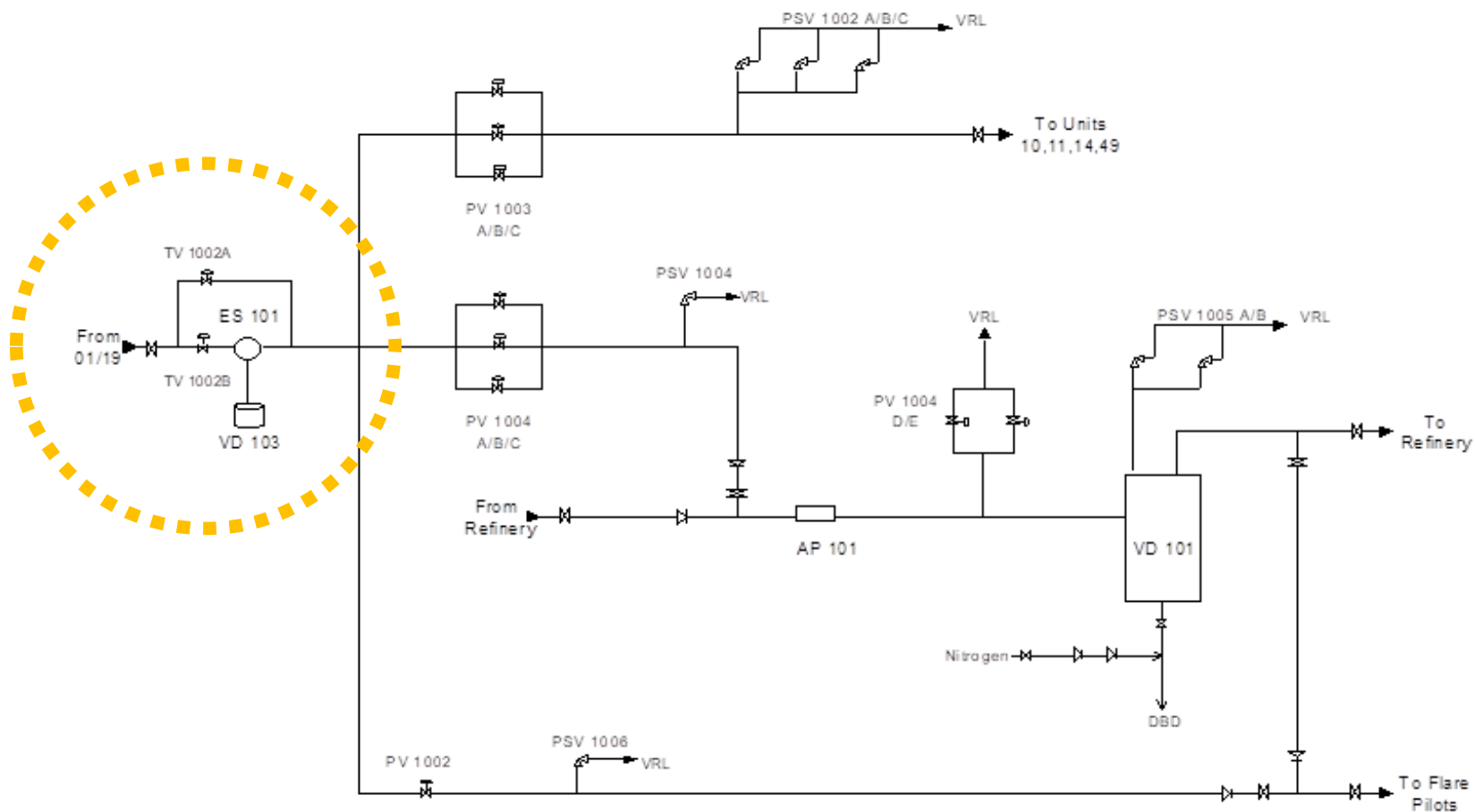
Why it Happened?

HP Nitrogen purging of Fuel Gas system



Why it Happened?

FUEL GAS SYSTEM SCHEMATIC



Causal Factors

Substandard Acts:

- Hazard identification and recognition:
 - hazards likely of operating the flare with intermittent supply of nitrogen.
 - *Besides the MOCA instituted, an Operational Risk Assessment (ORA) is procedurally required prior to MOCA (technical) and is a new part of the MOC landscape.*
 - Manual fuel gas supply to flare not used to support flare header pressure – operator training
 - *Refresher training on Flare, Fuel Gas and Nitrogen System SOPs for process operators.*

Substandard Conditions:

- MOC - Rollout of the new ORA procedure practice – not effective.

Root Causes

Workplace Factors:

- Inadequate Training / Knowledge Transfer:
 - ORA process and application viz-a-viz MOCA a.
 - hazards likely of operating the flare with intermittent supply of nitrogen.
 - Besides the MOCA instituted, an Operational Risk Assessment (ORA) is procedurally required prior to MOCA (technical) and is a new part of the MOC landscape.
 - Manual fuel gas supply to flare not used to support flare header pressure – operator training
 - Refresher training on Flare, Fuel Gas and Nitrogen System SOPs for process operators.
- Leadership - inadequate HazID, linked to ORA.

System Deficiencies:

- Leadership – hazard recognition.
- Competency Training and Communication – new ORA process and SOP Refreshers
- Management of Operational Risk and Change – ORA MOC not effective.

Thank You



#KeepItInThePipe