



WASTE HEAT BOILER SHELL RUPTURE

What happened?

- A waste heat boiler shell ruptured (fish mouth) due to high temperature (lack of cooling medium) which resulted in the release of 43 bar steam to atmosphere.
 - The steam drum level valve was accidentally closed resulting in low level in the steam drum
 - Because of no boiler feedwater flow on the waste heat boiler shell side, the temperature of the steam inside the shell increased to above design temperature, weakening the shell, and resulting in the shell to rupture and release steam



Causes

- Process factor: Product condition - Loss of the liquid level in all four wet legs
- Justification for 10% trip is not documented
- Lapse of concentration while performing a critical task.
 - The operator was busy warming up food and eating while busy with decommissioning
- The operator expected Train 2 alarms to activate and acknowledging alarms without checking it being generated from the expected equipment.
- Safety system failed to activate on the low-level trip due to level transmitter zero error.
- The low-level trip setting is not allowing for any measurement error.

Learnings

- **Transmitter setting and alarms**

- Always ensure that the wet leg are verified frequently to prevent loss of liquid:
 - Process upset have a potential to displace wet leg (medium or filling liquid) and if no action is taken there could be a significant impact on the level transmitter zero error. This could provide false indication to the operators and prevent low level trips to activate.
- The set point for trips and alarms must be set with adequate safety margins to cater for instrument inaccuracy and errors or drift between calibrations.

- **Wet leg Application(Glycol)**

- Ensure that all employees are made aware of the importance of maintaining the wet leg transmitter applications.
- Consider utilising condensate instead of glycol for applications that cannot freeze in the winter months

Learnings

- **Panel Operators**
 - Any alarm on a panel should be verified before acknowledging these alarms.
 - Ensure that all panel process artisans are focused and without distraction whilst commissioning and decommissioning equipment
 - Prevent distractions by limiting the use of mobile phones and eating at the panel.



Questions