

Sasol Secunda Operations

Learning: Loss of containment of steam

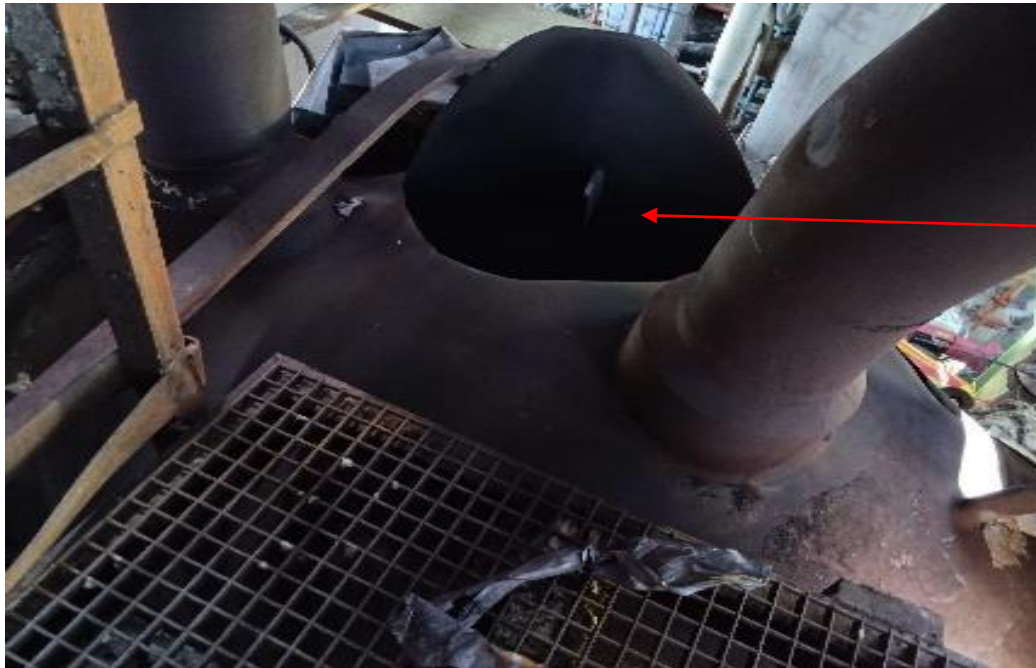
Incident description:

A waste heat boiler shell ruptured (fish mouth) due to high temperature (lack of cooling medium) which resulted in the release of 43bar 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.

Pictures of the scene



Waste heat boiler shell ruptured due to operating above design.

Causes

RC1

Process factor: Product condition - Loss of the liquid level in all four wet legs

Level transmitter zero error due to a combination of dilution, liquid loss in all four wet leg AND low trip point (not adequately allowing for measurement error)

- If the only error was dilution with 5% effect – the trip system would have activated.
- Combined with liquid loss +8% = >10% rendered the trip system ineffective.

Justification for 10% trip is not documented:

- To protect the WHB – agreement that it would only need 10% liquid in steam drum to adequately protect the WHB
- Any higher setting could have been reasoned to possibly introduce nuisance trips – not documented though
- No documented consideration for possible measurement error in setting the trip level

Causes

CF1 – Human factors: Inattention, lack of awareness or human factors

Distraction by the others or situation:

- Lapse of concentration while performing a critical task.
- The operator was busy warming up food and eating while busy with decommissioning 021DM-203.

Poor judgement of the situations:

- A number of Train 1 alarms were generated when decommissioning activities took place. The operator expected Train 2 alarms to activate and acknowledging alarms without checking it being generated from the expected equipment.

Causes

CF2

Condition factors: Inadequate or defensive protective/defense system.

Safety system failed or inadequate in the situation:

- Safety system failed to activate on the low-level trip at 10% due to level transmitter zero error. The low-level trip setting is not allowing for any measurement error ($\pm 5\%$ error would be acceptable for glycol dilution).

Design: Ineffective assessment of hazards, risk and controls:

- Safety factors not factored in the low-level trip at 10%.

Key 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

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 cellphones and eating at the panel.