PetroSA LFI: Non-Availability of FireWater on Demand

1. What happened?

- At ±01h40 on Sunday, 14 Feb 2021, the top pump around pump in the hot quench tower section suddenly started making a sharp noise.
- Outside operator went to investigate, noticed and reported that the pump was glowing hot and that smoke was coming out. Suspected that the bearing failed.
- The deluge system activated and the fire water spray valve then opened.
- The fire alarm activated but no firewater came out of the firewater sprayers onto any of the three top pump around pumps.
- The pump was immediately stopped and the suction line electrical valve closed from the hand-station.
- There was no fire at the pump and no injuries to personnel.

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2. Why did it happen?...Sub-standard Behaviours

- The firewater impairment practice was not followed - Operational Risk Assessment was not done to assess the firewater coverage.
- The Clearance for Operation (CFO) procedure was not followed. The train was started up on an expired CFO document (older than 72 hours). In addition, the deluge systems were not tested as required by the procedure under the "ready for commissioning checklist".
- Communication gap during shift handover of the Shift Managers. The Shift Managers Log stated the following "*Firewater header pressure control repairs were not successful, pressure overshot which resulted in further fire water line leakages*". The verbal shift handover included that firewater valves were closed, but it was not relayed that Synthol HQT area was cut-off from the firewater supply and thus had no firewater.

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2. Why did it happen?...Root Causes (Human Factors)

The ORA Procedure was not followed.

- *The ORA procedure is adequate for identifying the risks caused by firewater leaks. The ORA was not updated as per the ORA conditions after the leaks had occurred on the 10/02/21. The firewater impairment practice of filling out the safety authorization and firewater impairment checklist and updating the plot plan drawing was also not done. By completing this practice the water coverage would have been assessed and communicated adequately to all the impacted areas.*

Lack of planning which lead to the CFO procedure not being followed.

- *The train was started up without reviewing and verifying that the deluge system was tested and that firewater was available. The decision to start with the de-inventory activities was given on a Friday after having been placed on hold earlier in the week. During start-up there is normally operational challenges, in-order to prevent incurring extra costs due to call-outs the supervisor started the unit without reviewing the CFO documentation.*

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2. Why did it happen?...Root Causes (Human Factors)

Competency Management - Inadequate training provision

On the CFO documentation signed on the 08/02/21 the deluge system was indicated as "not done". The deluge system at the unit is generally tested only after a turnaround (Open clean shut) activity. This understanding is not in accordance with the procedure. The CFO procedure is not included in the training profiles of all Shift Supervisors across site.

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3. What were the learnings

- A formal risk assessment (ORA) with all the affected areas ensures that the risks are assessed adequately and the risks are well communicated and widely known.

- Process Safety Fundamental : We apply procedures. Following procedure is of utmost importance. Procedure checklists aid in preventing incidents of this nature. In this incident the ORA, CFO and Shift Handover procedures were not followed.

- The works procedure competency matrix (POE system) is important for ensuring that operating practices are continuously refreshed and maintain aligned to authorised and current recommended practices on the unit.

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4. Recommendations for Improvement

- Develop Operational Risk Assessment (ORA) training material and conduct site-wide ORA training to embed the procedure and ensure that there is an understanding that the risk assessment should be done no later than two days after the deviation has been noted.

- Develop Clearance for operation (CFO) training material and conduct site-wide CFO training.

- Update the GTL Refinery training database.

PetroSA LFI: Pump Bearing Failure (Linked Prelim)

Technical Findings: Stripping of Pump Around Pump

- Definite indications of heat transfer to the seal coming from the overheated & failed bearing.
- No specific damage to the inboard seal detected
- Outboard seal radically worn with signs of overheating.... this seal has possibly been installed for approx. 2 years.

Summary:

The mechanical seal suffered no catastrophic failure or damage but cannot be re-installed as is. Standard reconditioning is required to bring the seal back to its operating spec.

Carbonization formation due to heat

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Carbonization formation due to heat

Sludge inside bearing housing

Failed ball bearing cage

Mechanical Seal - intact

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PetroSA LFI: Pump Bearing Failure (Linked Prelim)

2. Why did it happen?...Sub-standard Behaviours

Causal Factor:

Ineffective plant inspections:

- A detailed inspection of the pump during operation (pump ran for approximately 1.5 days) could have indicated closed cooling water lines. Increased bearing temperatures could have been detected prior to failure in a plant inspection.

Root Cause:

Incorrect commissioning procedure followed.

- Cooling water supply and return lines not commissioned, leading to overheating of bearing and causing premature failure of the bearing and pump. The excessive heat from the bearing lead to overheating of the oil causing smoke/fumes and then activating the fire alarm.

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3. What were the learnings

- Rotating equipment to be present for commissioning of critical pumps.
- Checklist to be completed by production when commissioning a pump.
- Planned job observation to be done by the production shift supervisor to assess the practice of commissioning these pumps. Identify any training gaps/needs. It has been noted previously that these pumps are not always commissioned correctly and this must be addressed with the teams.
- Firewater systems to be intact and available whenever the plant is live.

Thank You….

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