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Agência Nacional
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Safety Alert 017 - ANP/SSM

Deck Boiler Overheating

This Operational Safety and Environment Superintendence alerts the oil and gas industry and other stakeholders about Deck Boiler Overheating in FPSO.

What happened?

Boiler overheating induced by lack of water inside it. The equipment was supplying steam to the charge pumps turbine. The lack of water occurred due to possible damage to the boiler pipes, bringing water from the pipes to the oven. Once the water level decreased, the steam pressure and the temperature of the combustion gas increased: the pressure reached the set point of the PSVs, being limited to 17 barg, while the temperature reached values that were sufficient to melt the metal of generating tubes and the wall of the boiler membrane. The smoke detectors triggered the platform's general alarm and the temperature reduction of the equipment and adjacent areas occurred about 30 hours after the start of detection. There were no casualties.



Images of the damaged boiler.

Potential consequences

During the event, security layers were broken, resulting in the incident. Some of these layers were overcome due to boiler internal pipe holes, unassisted operation and failure to check process alarms, as well as the failure of the interlocks. On the other hand, some barriers were effective, such as the activation of process alarms, the performance of the PSVs, activation of smoke detectors, general alarm announced and emergency response. The event caused loss of production for more than 100 days and damage to asset, but could have caused injuries and eventual fatalities, in addition to major damage to the facility.

Identified causes

- Failure in Management of Mechanical Integrity:
 - Inspection method used was not able to identify the entire length of the boiler pipes, causing the non-inspection of structures with less thickness that collapsed in the event;
 - The low-low level key tag was not migrated to the new system (SAP), leading to no maintenance on the device, which was not yet classified as a critical element in the old platform, which led to its non-performance;
 - Unusual flow control valve (FCV) behavior was identified days earlier. There was no maintenance plan for this equipment.
- Monitoring Failure:
 - absence of constant monitoring of the conditions of the boiler and its components during operation, causing boiler operation with water level below the minimum value for a long time at several moments;
 - the quality of the water used was outside the parameters for a long period, contributing to the wear of the boiler tubes;
- Failure in Management of Change - the high-high pressure switch setpoint was not reduced as suggested change due to poor boiler integrity, making impossible for it to work in a way that cuts off the gas supply);
- Failure in Training Management - it was observed that boiler operators did not have training in the Unit's boiler Work Instruction;
- Failure in Management of Operational Procedures - absence of information related to the boiler reserve feed pump configuration. This was not set to go into operation in the event of the principal's trip;

Lessons learned

- Ensure that inspections take place in accordance with the requirements of NR-13 and its good practices;
- Ensure that all boiler components comply with the maintenance philosophy;
- Ensure that there will be trained personnel to operate the boiler and their training certificates up to date;
- Ensure that at least one boiler operator is in the boiler control room during the entire period of operation;
- Check the operation of the boiler alarms and its components in the engine room, and in case of failure, arrange for the repair;
- Improve monitoring devices for water supply tanks;
- Include water supply tank level monitoring and water quality monitoring in the work instruction;
- Perform an audit on the boiler components migrated to the new system (SAP) and evaluate the criticality of boiler systems and their migrated components;
- Carry out reinforcement training with the entire offshore team regarding maintenance reports in the new system (SAP);
- Promote refresher training on the assessment of security layers for technical authorities in order to have a better assessment in case of management of change;
- Evaluate whether the condition of the boiler control loops is in manual mode, developing an action plan to normalize them;
- Ensure that the boiler has protective barriers in accordance with the Safety Performance Requirements present in the Risk Studies.

Regulatory Framework

According to the SGSO technical regulation annexed to ANP Resolution No 43/2007:

Item 3.3.4 - establish the qualification and training necessary to carry out the activities provided for in the operational procedures.

Item 6.3.1 - establish and maintain documented procedures to regularly monitor and measure the main characteristics of your operations and activities that may cause incidents.

Item 13.2.1 - establish plans and procedures for inspection, testing and maintenance, in order to seek the mechanical integrity of your systems, structures, equipment and critical systems of operational safety. Such documentation should be aligned with manufacturer's recommendations, rules, standards and good engineering practices.

Item 13.3.4 - ensure that all Critical Operational Safety Equipment and Systems are covered by inspection, testing and maintenance plans.

Item 15.2.1 - elaborate, document and control the operational procedures for the operations that are carried out in the Installation, with clear and specific instructions for carrying out the activities safely, taking into account the operational specificities and complexity of the activities.

Item 16.3 - establish and implement a procedure to manage changes that may affect Operational Security.

Contact

For additional information regarding this safety alert, please contact ANP Operational Safety and Environment Superintendence at incidentes@anp.gov.br