HSE Health and Safety Executive

Flare system impaired by cooling water loss through bursting disc failure on an Intercooler Heat Exchanger

Safety alert: 01/2008 **Issue date:** October 2008

Introduction

This alert advises duty holders of an incident involving failure of a bursting disc on the shell side of a shell and tube heat exchanger, which led to an inability to flare gas safely on an offshore installation.

The purpose of this alert is to advise duty holders of the incident at an early stage so that lessons can be learned and appropriate action taken by duty holders to avoid a similar incident.

Background

A bursting disc protecting the seawater side (shell side) of a high pressure (HP) gas intercooler suffered a low pressure (LP), in-service failure. This resulted in an uncontrolled flow of seawater into a platform flare system.

The intercooler had two pairs of bursting discs each with inter-disc space pressure sensors and tell-tale velocity check valves.

It appears that that following sequence of events occurred:-

1. A gas intercooler shell side primary bursting disc ruptured, followed by the secondary disc of the pair, allowing seawater to flow into the HP flare knock-out (KO) drum;
2. The bursting disc inter-disc space pressure sensor failed to initiate an alarm signal and no evidence of water via the inter-disc tell-tale was observed;
3. The HP flare KO drum high liquid level alarm was activated followed by a high-high level trip which shutdown the process plant without blowing down, and without shutting down the seawater supply pumps, as per the design intent;
4. The ESD actuated cooling water inlet valve failed to achieve tight shut-off on closure, and as neither the bursting disc telltale nor the inter-disc alarm indicated disc rupture, it took several hours to identify the source of seawater entering the flare system. During this time the HP flare KO drum drain was opened to the closed drains drum;

5. The closed drains drum overboard dump remained closed and the drum eventually filled with seawater and back flowed into the LP flare KO drum as the drain line from this vessel to the closed drains drum was also open.
6. There was a pressure transmitter, but no alarm on HP flare KO drum, the reading being displayed on mimic panels offshore and onshore. Impairment of the flare system was only realised when it was noted that the pressure had reached 4 barg, indicating that the seawater level was approximately 40 m above the level of the drum.

It should be noted that it was not possible to monitor the actual liquid level in the HP flare KO drum once the level was above the high-high trip.

Once both flare drums were full of water there was no clear path to either flare and any event leading to the flaring of gas at this stage could have resulted in the release of hydrocarbon gas with potentially very serious consequences.

Lessons learned

This incident highlights the need for duty holders to be aware of the potential for impairment of the flare and relief system from the uncontrolled flow of cooling water / cooling medium into the flare knock-out drum as a result of bursting disc rupture.

It also highlights the need for duty holders to ensure that bursting disc rupture will initiate measures to ensure isolation of the cooling water / cooling medium supply (and return where appropriate) to the protected item of equipment, so that the integrity of the flare and relief system is not compromised.

Relevant legal requirements

The main relevant legal requirements include:

- Provision and use of Work Equipment Regulations1998
- Management of Health and Safety at Work Regulations 1999
- The verification requirements of the Offshore Installations (Safety Case) Regulations 2005
- The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (PFEER)

There are legal duties on both the owner and the operator of the plant.

Further information

Any queries relating to this alert should be addressed to:

Team Leader – OSD 3.1 Process integrity
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Hazardous Installations Directorate
Offshore Division
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Merton Road
Bootle
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This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.