

‘INCREDIBLE’

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On Thursday 16th February 2006, the Rough 47/3 Bravo offshore platform was evacuated having suffered a catastrophic vessel failure and a resultant very large hydrocarbon fire.

‘Incredible’ is a video providing a clear account told by those directly involved, of the incident, the investigation and the platform’s swift reinstatement.

The Objectives of the session will be to:

- (i) Share the broader learning’s from the incident
 - Highlight the root cause (heat exchanger design).
 - Safety critical system performance.
 - Effective restoration and response.
 - The human impact.
 - Plant inherent risk.
- (ii) Describe what really happened:
 - Present a complete picture, pulling together all aspects of the event and follow-up activities.
 - Demonstrate the professional approach of Centrica Storage Limited and all the individuals involved.

The session will:

- Demonstrate Centrica Storage’s commitment to share lessons and its desire to achieve high levels of safety performance.
- Challenge the historical approach to communicating and sharing lessons from major accidents in Hazardous Industry.

In summary the DVD will provide broader lessons for the oil and gas, and supporting parts of the industry. This emphasis however must be placed on the audience deciding what this means to their organisations.

The following safety alert was distributed to operators to draw their attention to the root cause of the incident which was identified during forensic investigation.

CATASTROPHIC FAILURE OF SHELL AND TUBE PRODUCTION COOLER

Safety alert: 01/2006

Issue date: May 2006

INTRODUCTION

1. A recent serious incident occurred that involved the catastrophic failure of a shell and tube heat exchanger, and there is a potential risk of failure to heat exchangers of the same, or similar, design. This notice describes the incident and outlines the action that should be taken by duty holders.

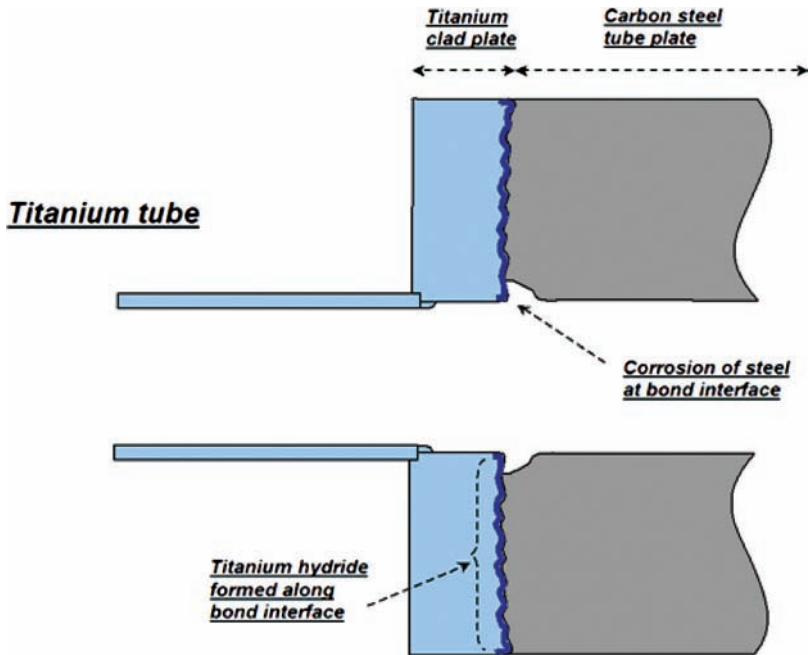
BACKGROUND

2. The incident on an offshore gas production platform occurred when a shell and tube production cooler suffered a catastrophic failure. Seawater was being used to cool High Pressure (HP) hydrocarbon gas. The shell, tubes and titanium cladding sheet were torn from the steel tube sheet and propelled across the deck with sufficient force to rupture an adjacent exchanger. The cooling water pipe work and vent pipe work were torn off the shell and the tube sheet and channel end were ripped off the supports. There was a significant and immediate gas release followed by ignition and an explosion. Fortuitously there were only two relatively minor injuries, but under slightly different circumstances there could have been significantly more serious casualties.

HEAT EXCHANGER INFORMATION

3. The heat exchanger operates with sea water on the shell side and HP hydrocarbon gas plus condensates and water on the tube side. The tube sheet had been manufactured from carbon steel with an explosively bonded, 13 mm thick titanium cladding plate on the sea water side to provide corrosion protection. A key feature of this design is that it allows the HP hydrocarbon gas, condensates and water to come into contact with the steel tube sheet/titanium interface, thus creating the potential for in-service degradation mechanisms as detailed in paragraph 4 below.

Tube to Tube sheet and Titanium cladding to Steel tube sheet interface detail.



REASONS FOR FAILURE

4. Based on the results of an ongoing forensic investigation, the current evidence suggests the following sequence of events:

- That the explosively formed bond between the titanium cladding and the tube sheet was fit for purpose at the time of manufacture.
- It is probable that liquid in the process stream led to galvanic corrosion of the steel tube sheet at the intersection of the tube holes and the steel/titanium interface (bond interface).
- Hydrogen released by the corrosion process had reacted with the titanium and resulted in the progressive formation of brittle titanium hydrides at the bond interface.
- The growth of titanium hydrides weakened the bond interface sufficiently to cause a sudden, dynamic failure of the bond.
- Failure of the bond resulted in rapid pressurisation of the bond interface, complete separation of the titanium cladding plate from the steel tube sheet, followed by over pressurisation of the shell and catastrophic failure of the cooler.

ACTION REQUIRED

5. HSE considers that the emerging findings of this investigation are significant enough to require immediate action by duty holders in the light of the sudden and possibly catastrophic nature of this type of heat exchanger failure. Therefore, duty holders should:

- Identify whether they have any heat exchangers manufactured to the same design or to a similar design incorporating this type of steel-titanium interface.
- In the light of this notice, undertake a risk assessment of the continuing use of any heat exchangers so identified, in collaboration with the plant manufacturer (if still in business) and/or third party verifiers and other specialist advisers.
- Implement any remedial actions in the light of the risk assessment.

RELEVANT LEGAL REQUIREMENTS

6. The main legal requirements include:

- Provision and use of Work Equipment Regulations 1998.
- Management of Health and Safety at Work Regulations 1999.
- The verification requirements of the Offshore Installations (Safety Case) Regulations 2005.

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

FURTHER INFORMATION

Any queries relating to this notice should be addressed to:

Team Leader – OSD3.4 Mechanical Systems
Health and Safety Executive
Hazardous Installations Directorate
Offshore Division
5N.2 Redgrave Court
Merton Road
Bootle\Merseyside L20 7HS
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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.