

## MAJOR ACCIDENT CASE STUDIES

The following case studies were compiled with the aim of highlighting **some** of the common contributory factors attributed to major accidents.

### Piper Alpha Explosion

#### OFFSHORE

##### *Summary*

In 1988, an explosion and subsequent fire on a North Sea oil and gas platform resulted in 167 people being killed.

During the day shift, staff had removed a pressure safety valve from the relief line of the pump. The valve had been replaced with a blank flange. The blank fit was not tight enough, and when unaware night shift staff then attempted to restart the pump, condensate (light oil) leaked through, causing the explosion (Reducing error and influencing behaviour HS(G) 48).

##### *Primary causes*

The flange placed over the valve was a **temporary measure** and was inadequate to deal with operational gas pressures. Staff in the control room were unaware of any work that had been done in this area, as the Permission To Work (PTW) certificate had been lost. They subsequently activated the valve and caused a massive system pressure overload. Condensate escaped from the piping and ignited causing a large explosion.

##### *Underlying causes*

A combination of basic **communication failures**, occurring at **shift handover**, and a lack of commitment to the **permit-to-work system** (concerning the valve maintenance), resulted in the night shift staffs' ignorance regarding the valve removal.

These failures and weaknesses had been identified during previous inspections, and subsequently judged to have been improved, signifying that the **regulatory processes employed were inadequate**.

As Piper Alpha was never designed to pipe gas as well as oil, the **new gas pipes** were installed wherever there was room. Unfortunately, the lines affected by the explosion were located next to the control room and the resultant explosion rendered essential disaster management impossible. Although the emergency stop button was pressed, **no alarm was sounded** throughout the rig and the **fire suppression system was never activated**. The **deluge system that pumped water from the sea into sprinklers located throughout the station could only be activated from the control room** as it **was**

**switched off** to allow divers to work below the rig. The fire spread unchallenged and eventually ruptured a gas riser causing a massive explosion that engulfed the whole platform.

**Inadequate fire containment and corroded sprinklers** on the gas platform, along with the associated **difficulties in escaping or evacuating** the North sea platform meant the lives of rescuers were also at risk in the incident.

The **emergency procedures** specified staff were to congregate in the galley area in the event of an incident. The lack of any alternative announcements resulted in staff making their way there. Unfortunately, the accommodation area was in the direct path of the resultant fireball, and many staff members, who followed the emergency procedures, died.

### ***Reaction and Going Forward***

The company that owned Piper Alpha, Occidental Petroleum Caledonia (OPC), issued multiple statements in the immediate aftermath of the accident. In each they referred to their excellent safety record to date and outlined that Piper Alpha had been signed off as safe. As the investigation continued it became obvious that, although Piper Alpha had indeed been inspected, its approval was a damning indictment of the inspection system rather than a certificate to ensure worthiness.

The Cullen enquiry made a number of sweeping recommendations to the offshore industry, all of which were accepted. As a result of good will and an acceptance of the need to change the industry also became a test bed for human factors and safety research allowing development of safety culture surveys. Most significant organisational safety culture measurement tools have, in part, been developed on the work completed through partnerships between researchers and the offshore industry. The offshore industry body is also participating with the HSE to develop 'Stepchange', a policy that aims to reduce the number of accidents taking place on rigs and in refineries. An interesting element of this is the accident and near miss reporting system developed online that allows individuals to log incidents with or without personal information being made public.

### **Addition resources:**

The Causes of Major Hazard Incidents and How to Improve Risk Control and Health and Safety Management: A Review of the Existing Literature HSL/2006/117, APPENDIX A: MAJOR ACCIDENT CASE STUDIES , Page 41  
[https://www.hse.gov.uk/research/hsl\\_pdf/2006/hsl06117.pdf](https://www.hse.gov.uk/research/hsl_pdf/2006/hsl06117.pdf)

The Public Inquiry into the Piper Alpha Disaster: - HSE  
<https://www.hse.gov.uk/offshore/piper-alpha-disaster-public-inquiry.htm>

The Case for Safety The North Sea Piper Alpha Disaster

[https://sma.nasa.gov/docs/default-source/safety-messages/safetymessage-2013-05-06-piperalpha.pdf?sfvrsn=3daf1ef8\\_6](https://sma.nasa.gov/docs/default-source/safety-messages/safetymessage-2013-05-06-piperalpha.pdf?sfvrsn=3daf1ef8_6)

Photos:

<https://www.thesun.co.uk/news/6675347/piper-alpha-disaster-pictures-30-years-ago/>

**Video**

The Night the System Failed - The Piper Alpha Inferno (Civil Aviation Safety Authority (CASA) )

<https://youtu.be/DP4ZTXYqCA4>

Remembering Piper Alpha - Step Change in Safety

<https://youtu.be/qxHfaweV3vs>

The legacy of Piper Alpha - Petroleum Safety Authority Norway

<https://youtu.be/oWQxxV7ejg8>

Piper Alpha - 25 years on – IOSH

[https://youtu.be/bLAio7nfk\\_c](https://youtu.be/bLAio7nfk_c)

Piper Alpha Appleton BBC - Lecture by Brian Appleton (Technical Adviser to the Enquiry) on Piper Alpha Accident.

[https://youtu.be/S9h8MKG88\\_U](https://youtu.be/S9h8MKG88_U)