Lessons Learned Database
Individual Incident Summary Report

IChemE
Safety & Loss Prevention
Special Interest Group

Incident Title	**Deethaniser Overhead Line Rupture**	
Incident Type	Explosion and Fire	
Date	16th April 2001	
Country	UK (England)	
Location	South Killingholme (Lincolnshire)	
Fatalities	**Injuries**	**Cost**
0	5	US$ 136 m (2018) – Ref. 3

Incident Description

Credit: UK Health & Safety Executive

The Deethaniser overhead line of a Saturated Gas Plant (SGP) suffered a catastrophic failure at an elbow immediately downstream of a washwater injection point. The release caused a huge vapour cloud which ignited after 20 – 30 seconds, resulting in a massive explosion and fire. The pressure wave from the blast caused widespread damage to houses and businesses within a 1 km radius of the site. Debris from the explosion was spread over a wide area including on an adjacent public highway. Some 10 – 15 minutes later, a second release occurred which also ignited and caused the fire to increase in size and intensity. Several other pressurised piping systems in the fire zone overheated and ruptured. The fire was brought under control within 70 minutes and was extinguished 5 hours and 40 minutes later. The damage to the SGP caused the refinery to be shut down for several weeks, followed by a phased startup.

Fortunately, the incident occurred on a public holiday when there were only 185 people on site rather than the normal weekday workforce of around 800 staff and contractors. Only a few people were outside when the explosion occurred because most were inside preparing for shift handover.

Incident Analysis

Basic cause was erosion-corrosion of an elbow at a point downstream and close to a water injection point that was not part of the original design.

Critical factors included: 1) Continuous rather than intermittent injection of washwater, 2) Absence of an injection quill or other atomising device and poor injection point pipe geometry (leading to erosion of the protective iron sulphide scale layer), 3) Absence of an in-service pipework inspection plan.

Root causes included: 1) Failure to conduct a Management of Change (MoC) review (continuous vs occasional washwater injection), 2) Inadequate design (injection point pipe geometry and absence of atomising device), 3) Inadequate communication (Operations failed to alert other groups when the washwater injection strategy was switched), 4) Inadequate corrosion management system (insufficient resources and failure to meet industry best practices for inspection and maintenance of piping at injection points).

Lessons Learned

1) Erosion-corrosion of carbon steel piping in sour service tends to be most pronounced high turbulence areas such as elbows and tees because erosion damages the protective internal iron sulphide scale layer, 2) Washwater injected into process piping should be via a quill or other atomising device in order to minimise erosion of the sulphide scale layer an atomising device or quill in order to minimise erosion of the sulphide scale layer, 3) API 570 (“In-service Inspection, Repair, and Alteration of Piping Systems”) and NACE Publication 34101 (“Refinery Injection and Process Mixing Points”) describe good practice for in-service inspection of injection points.

More Information

1) “Public Report of The Fire and Explosion at the ConocoPhillips Humber Refinery On 26th April 2001”, Health & Safety Executive (2005): https://www.hse.gov.uk/comah/conocophillips.pdf
2) “Explosion at the Conoco Humber Refinery - 16th April 2001”, J. Carter, P. Dawson and R. Nixon, IChemE Loss Prevention Bulletin 151 (2006).
3) “The 100 Largest Losses 1978 – 2017”, Marsh Property Risk Consulting Practice, 25th Edition (2018).

Industry Sector	Process Type	Incident Type
Oil & Gas	Saturated Gas Plant	Explosion & Fire
Equipment Category	**Equipment Class**	**Equipment Type**
Mechanical	Piping	Fittings (Elbow)

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