# Lessons Learned Database
## Individual Incident Summary Report

IChemE Safety & Loss Prevention Special Interest Group

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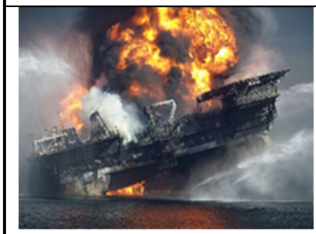
| **Incident Title** | **Oil Well Blowout During Temporary Abandonment Operation** |
| **Incident Type** | Explosion and Fire |
| **Date** | 20th April 2010 |
| **Country** | USA (offshore) |
| **Location** | Gulf of Mexico, LA |

| Fatalities | Injuries | Cost |
|---|---|---|
| 11 | 17 | $644 m (2018) – Ref. 2 |

**Incident Description**



An uncontrolled release of oil and gas ("blowout") occurred at the Macondo oil well during a temporary well abandonment procedure which involved plugging the well with specially formulated cement so it could be left in a safe condition until a production facility arrived at a later date to extract the oil and gas. The escaping hydrocarbons found an ignition source on the Deepwater Horizon drilling rig and caused an explosion. Eleven people died, 17 were injured and 115 people were evacuated. The drilling rig sank within 36 hours of the initial explosion. It took 87 days to arrest the oil spill. Nearly 5 million barrels of oil were released, causing massive marine and coastal damage.

**Incident Analysis**

**Basic cause** was failure of the cement plug installed during the temporary well abandonment procedure to contain oil and gas within the well bore.

**Critical factors** included: 1) The cement formulation used was inadequate for the intended service, 2) The operating crew misinterpreted the results of pressure tests carried out to verify the well was sealed, 3) The blowout preventer (BOP) failed to close, 4) The diverter system was designed to route overflowing hydrocarbons to the mud gas separator (MGS) located on the rig rather than overboard, 5) The gas-in-riser event rapidly progressed to an uncontrolled blowout, 6) The onboard gas detection system failed to operate.

**Root causes** included: 1) Failure to verify availability of the two redundant automated mode function (AMF)/deadman systems which initiate closure of the blind shear ram in the blowout preventer (BOP) to shear the drillpipe and seal the well, 2) Inadequate design (the MGS was not rated for the pressure and flow of a gas-in-riser event or a blowout), 3) Inadequate crew training (data interpretation), 4) Inadequate leadership (too much focus on personal rather than process safety metrics), 5) Poor communication (between the rig operator and sub-contractors), 6) Inadequate regulation of offshore activity (eg. US Minerals Management Service rules-based regulatory system).

**Lessons Learned**

1) Large pressure differences between the inside and outside of a drillpipe can cause effective compression and bending or buckling of the drillpipe in a blowout preventer (BOP) even after the well has been sealed (potentially incapacitating the BOP), 2) The complexities of multi-part risk management between an operator and a drilling contractor need better role clarity and more oversight, 3) Risk analysis and mitigation studies should consider worst case scenarios (eg. uncontrolled subsea release), 4) The International Association of Oil and Gas Producers (IOGP) established a multi-year programme to capture learnings from these and similar incidents, and to enhance future prevention and preparedness.

**More Information**


1) "Drilling Rig Explosion and Fire at The Macondo Well" Executive Summary Report of the US Chemical Safety and Hazard Investigation Board, Report No. 2010-10-I-OS (2016),
2) "The 100 Largest Losses 1978 - 2017", Marsh Property Risk Consulting Practice, 25th Edition (2018),
3) "Response Strategy Development Using Net Environmental Benefit Analysis (NEBA)", IOGP-IPIECA (2016). [NEBA now called SIMA]
4) "Guidelines on Implementing Spill Impact Mitigation Assessment (SIMA)", IPIECA (2018),
5) "Offshore Oil and Gas in the UK – an independent review of the regulatory regime", Professor G. Maitland et al (December 2011).


| Industry Sector | Process Type | Incident Type |
|---|---|---|
| Oil & Gas | Offshore Drilling Platform | Explosion & Fire |
| **Equipment Category** | **Equipment Class** | **Equipment Type** |
| Mechanical | Pipe | Casing Seal |