

Incident Title		Gas Condensate Reinjection Pump Leak	
Incident Type		Explosion and Fire	
Date		6 th July 1988	
Country		UK (offshore Scotland)	
Location		Piper Oil Field (North Sea)	
Fatalities		Injuries	Cost
167		Unknown	US\$ 2.4 bn (2021) – Ref. 3
Incident Description		<p>A standby condensate pump for reinjecting gas condensate into an oil export line on the Piper (Alpha) platform had been de-energised for maintenance. Its discharge pressure safety valve (PSV) was also removed and blind flange assemblies were fitted to the open PSV pipe connections. Meanwhile, the running condensate pump failed and would not restart. Liquid levels in the gas/liquid separation system were rising and would eventually trigger a total shutdown of the platform if not reversed. Night shift operators were aware the standby pump had been taken out of service for maintenance by the day shift but believed the work had not yet begun, so they decided to re-energise and start the standby pump. Gas condensate leaked from a PSV blind flange assembly; it found an ignition source and exploded. The explosion was soon followed by an oil pipe rupture and pool fire. The incident escalated rapidly as 3 high pressure gas lines ruptured after 20, 50 and 80 mins, respectively, creating a towering inferno. Smoke and flames outside the accommodation module made evacuation by helicopter or lifeboat impossible.</p>	
 <p>Credit: PA/PA Archive/PA Images</p>			
Incident Analysis		<p>Basic cause (most probable) was a loss of primary containment (LOPC) of hydrocarbon condensate due to overpressure of a temporary blind flange assembly after a pump undergoing maintenance was started in error.</p> <p>Critical factors included: 1) The platform was originally designed to produce and export oil only but was extensively modified to also enable export of gas, 2) Gas compression and condensate reinjection facilities were retrofitted beneath the control room, electrical utility and accommodation modules, 3) Absence of fire protection for structural steel and gas risers, 4) Continued operation of inter-connected oil production platforms after the first explosion.</p> <p>Root causes included: 1) Inadequate control of work (work permit systems), 2) Poor communication (shift handover and inter-platform), 3) Inadequate management of change (retrofitting a gas treatment system on a congested platform), 4) Inadequate protection (absence of automatic shutoff valves and dedicated deluge systems for gas risers), 5) Poor emergency preparedness (failure to conduct evacuation drills and to depressure the subsea pipelines), 6) Inadequate leadership (personal safety prioritised over process safety).</p>	
Lessons Learned		<p>1) Offshore safety legislation should be goal-setting rather than rule-based to foster innovation and continuous improvement in installation integrity, 2) Owner/operators of fixed and mobile offshore installations should submit a Safety Case document to the regulator detailing how major accident risks and safe evacuation, escape and rescue of personnel are managed, 3) Production platforms should be provided with fire and gas detection systems, explosion protection and active (water deluge) and passive (insulation) fire protection systems, 4) Production platforms should have temporary safe refuges (TSRs) which protect personnel from external fire and smoke while an emergency is assessed and/or preparations are made for evacuation, 5) Evacuation drills should be routinely practised.</p>	
More Information		<p>1) "Public Inquiry into the Piper Alpha Disaster, Volumes 1 and 2", Her Majesty's Stationery Office (HMSO), ISBN 0-10-113102-X (1990). 2) "Piper Alpha - What Have We Learned?", F. Macleod and S.M. Richardson, IChemE Loss Prevention Bulletin 261 (2018). 3) "100 Largest Losses in the Hydrocarbon Industry", Marsh Property Risk Consulting Practice, 27th Edition (2022).</p>	
Industry Sector		Process Type	Incident Type
Oil & Gas		Offshore Production Platform	Explosion & Fire
Equipment Category		Equipment Class	Equipment Type
Mechanical		Piping	Blinds