

Piper Alpha Disaster

8 July 1988

Lessons Learned

Piper Alpha: Offshore platform in the North Sea

A massive explosion & fire occurred on July 8, 1988

- * 226 men on board, 62 on night shift, most stayed in LQ,
 - Evacuation by helicopter or life boats was not possible,
 - 61 survived by climbing down ropes, hoses or by jumping from 210 ft into the sea,

- * 165 died, 109 by inhaling smoke,
 - 14 while attempting to escape &
 - a few died of burns.
 - 135 bodies were recovered

- * Total Death = $165+2 = 167$

What Happened ?

- A condensate pump was taken out of service for maintenance by day shift
- PSV of the pump was taken out of service and blind was installed loosely (bolts not tight)
- Fire water system was on manual for diving operations
- 21:45 two condensate pumps tripped, restarted by night shift without knowing the PSV was removed and blind improperly installed. Leaking occurred after the pump was re-started. A large amount of condensate was released which created an explosive vapor cloud

What Happened ? (cont.)

- 22:00 first explosion occurred resulting in oil leaking from separation module and main oil line to shore
- 22:20 second major explosion due to rupture of one of the incoming pipeline risers
- On 22:50 & 23:20 the third and fourth explosion occurred as a result of the failure of the other two pipeline risers.
- A few hours later, only a few pieces of steel structure above the sea surface were the only remains of the Piper Alpha platform.
- 165 lives were lost.

Findings

- Failure of Permit to Work System
- No formal hand-over from Day Shift to Night Shift
- Non compliance to Company procedures
- Company management was easily satisfied with the safety system (lack of control)
- No proper training
- Safety policy and procedures were in place but not in practiced

Findings (cont.)

- Emergency induction was not provided or inconsistently given
- No drills or exercises were conducted to test emergency preparedness
- No emergency response training was provided
- Failure to conduct Risk Assessments
- Inadequate guidance or means to assess effectiveness of Safety Management System
- Poor Management System

Recommendations (Cullen Report)

- Safety Case
- Auditing of Operators' Management of Safety
- Independent Assessment and Surveys of Offshore Installations
- Legislation - General
- Establish Regulatory Body
- Safety Committee and Safety Representatives
- Permit to Work and Incident Reporting
- Control of Process
- Hydrocarbon Inventories, Risers and Pipelines

Recommendations (Cont.)

- Fire & Gas Detection and Emergency Shutdown
- Fire & Explosion Protection
- Accommodation, TSR, Escape Routes and Safe Embarkation Points
- Emergency Centers and Systems
- Pipeline Emergency Procedures
- Evacuation, Escape and Rescue - General
- Helicopters

Recommendations (Cont.)

- TEMPSC (Totally Enclosed Motor Propelled Survival Craft)
- Means of Escape to the Sea
- Personal Survival and Escape Equipment (Smoke Hoods)
- Stand-by Vessels
- Command in Emergencies (Organization)
- Drills, Exercises, Mustering and Evacuation
- Emergency Management Training for OIM's
- Emergency Training for Control Room Operators and Crew

Detailed Recommendations

Safety Case

- Operators of fixed and mobile installations, both planned and existing, to submit a formal safety assessment of hazards in design and operations

The Safety Case should include:

- 1) Adequate Safety Management System
- 2) Potential major hazards and risks must be identified, and appropriate controls provided through Quantitative Risk Assessment (QRA)
- 3) Provision to be made for a Temporary Safe Refuge (TSR) or Safe Haven, including means of safe and full evacuation, escape and rescue

Auditing of the Operator's Management of Safety

- The Operator is responsible for auditing compliance with own Safety Management System (SMS), including Operations, Engineering, Management etc.
- Regulatory agency should review Operator's SMS audit program and results on a selective basis at least annually.
- The agency should conduct its own audits to verify an Operator's effectiveness in conducting objective audits, and regular site inspections to verify the effectiveness of the SMS itself.

Independent Assessment & Surveys of Installations

- Third party audits by Certifying Authority must be conducted and “Certificate of Fitness” issued to ensure safety of offshore installations

Safety Committee and Safety Representatives

- Management, in particularly first line supervisors, should ensure that the entire workforce (employees and contractors) are actively involved in day-to-day safety.
- Safe Operating Procedures are needed, they are to be reviewed, revised to ensure compliance.
- Offshore employees must be part of the review team.
- Elected Safety Representatives to be trained, have authority to effectively conduct relevant safety activities.

Permit To Work

- PTW is part of the Operator's management system
- PTW system must be improved and personnel must be adequately trained.
- PTW and required Mechanical/Electrical Isolations should remain in force until work is completed.
- A mechanical isolation procedure is required for physical "lock-out" and "tag-out" of isolation valves.
- Improve shift handover and control of suspended PTW.
- Physical locking of valves will slow down work, and increased offshore operator headcount may be required.

Incident Reporting

- Regulatory Authority should maintain a data base of hydrocarbon leaks, spills and ignitions in the oil industry

Control of Process

- Control Room of Piper Alpha was principally a monitoring station with equipment operation being handled within individual plant modules.
- As a result of the incident, new Control Rooms are more centralized and manned 24 hours.
- Key process variables as determined by Safety Case are to be monitored and controllable from the C/R.
- Control Room operators to be trained and qualified for their duties.
- Control Room operator must be capable of handling emergencies.

Hydrocarbon Inventory, Risers and Pipelines

- Pipeline SDV must be installed as near sea level as practicable
- SSIVs (Sub Sea Isolation Valves) are determined by Safety Case for risers affecting integrity of the accommodation
- Minimization of hydrocarbon inventories during emergency situation
- Minimize pipeline connections to platforms
- Passive Fire Protection of risers

Fire Detection and Emergency Shutdown

- Arrangement for activation of Emergency Shutdown Valve (ESDV) and Sub Sea Isolation Valve (SSIV's)
- Studies to be done to determine the vulnerability of ESDV's to severe accident conditions and to enhance their ability to survive such conditions
- Operator to submit fire risk analysis to regulatory body
- The ability of Fire Water Deluge System, including Fire Pump, to survive severe accident conditions should be a feature of the Safety Case

Accommodation, TSR, Escape Routes and Embarkation Points

- TSR to be provided on each installation, specific proposals with regard to the provision of fire protection, breathable atmosphere, prevention of smoke ingress
- Marking and protection of escape routes to embarking point, illuminant tape
- Smoke Hazard, portable smoke hoods must be provided

Emergency System

- Standardization of lights and alarms
(Flashing Light Beacons, Gaitronic Systems)

Evacuation and Escape

- Evacuation of non essential personnel
- Helicopter is the most convenient way of evacuation
- TEMPS
- Secondary evacuation system in the event that evacuation by helicopter or life boat is not possible, i.e. ladders, steps, ropes, nets etc. are to be considered

Helicopters

- Establish communication plan for contacting helicopters from other operators or government authorities to assist in an evacuation

Totally Enclosed Motor-Propelled Survival Craft (TEMPS)

- 100 % capacity for personnel on board
- Free fall life boats to be installed if appropriate

Stand-by Vessels (Boats)

- Stand-by boat capable of accommodating all Personnel On Board - POB within 5 miles of the installation
- Vessel to be capable of SAR (Search & Rescue) and fire fighting

Emergency Command

- OIM is Commander in emergency event
- Designated alternate in case OIM cannot carry out this task
- Evaluate OIM and alternate competency level
- OIM and alternate to be properly trained and certified for Emergency Commander

Drills and Exercises

- Exercises covering all credible accident scenarios are to be held in accordance with UKOOA Guidelines

Training

- Personnel who work offshore are required to attend 5-day Basic Emergency Safety Training
- No one is allowed to work offshore without valid certificate