# Process safety – a view from the field

While the number of low consequence incidents in the North Sea has dramatically dropped since Piper Alpha, the threat of a similar catastrophe still looms large as Colin McWhirr explains.

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A quarter of a century has passed since a series of explosions brought Piper Alpha – once the biggest production facility in the North Sea – to a horrific and tragic end, claiming the lives of 167 men. The subsequent Cullen Report demanded a major overhaul of all offshore safety practices and procedures, and today the industry is in many ways unrecognisable from the 70s and early 80s.

However, the sad and shocking fact is that serious offshore accidents continue to occur globally; Deepwater Horizon (2010) which killed 11 people, the Montara blowout offshore Australia (2009), the loss of the Kolskaya rig on the east coast of Russia (2011) and the fire and explosion on the Endeavour rig offshore Nigeria (2012) are key examples. The recent gas leak on the Elgin field and the well kick on Gullfaks C in 2010 could have resulted in catastrophic consequences under slightly different circumstances.

## Battling complacency

There is therefore a mounting need to challenge complacency and to increase general awareness over key process safety issues. The aim is to stimulate thinking and to re-energise industry professionals to improve process safety delivery. Process safety is the vital engineering area which ensures the complex offshore process plant stays within a safe design envelope and in particular, avoids loss of containment of highly hazardous fluids.

The barrier approach, increasingly adopted by today's oil and gas companies, use the bow-tie risk model as an underpinning concept. Bow-tie barrier models can greatly assist with the identification of critical barriers and sets out in a simple figure the scenarios that may occur and steps to mitigate risk. This model, unlike previous approaches, encapsulates the human role in risk prevention through decisions taken. In order for it to make a true difference to the occurrence of any incident, there must be a balance between aptitude and attitude of the people, solid and rigorous processes and robust design of the plant.

## The pertinent problem of plant design

The fundamental issue of plant design in particular, is an area which has probably seen the least improvement over the past 30 years. Despite extensive studies and reviews being carried out by project teams, the design process is still delivering poor quality, which it's believed may be attributable to lack of competency and cohesion. Many do not see the benefit of early philosophy writing and a lot of system designing is being carried out in discipline silos using inter-discipline checking and not by system integrating engineers. An integration of all the engineering disciplines, such as mechanical, piping, instrument, process, etc., would have a radical effect in this area. The benefits of joined-up thinking to deliver best practice consistently, far outweighs an often costly and complicated fragmented approach.

The HAZOP (Hazard and Operability) study in particular, is one of the most widely used hazard identification methods and has found applications in many aspects of the offshore industries. Its intention is to identify many potential problems through the examination of new, modified or existing designs, procedures and operations using a systematic and structured approach.

The assertions made are based on a root cause analysis of common themes/issues resulting from 30 years of offshore engineering and technical safety experience. Practice has shown that few process safety reviews yield negligible recommendations, resulting in around one third of HAZOP reviews being terminated due to either 'fatal' findings, inadequate information or failure to assemble a competent HAZOP team. For example, a recent three day process HAZOP study yielded 154 recommendations which clearly indicate that the design had not been suitably developed. A particular worry or trend is for the HAZOP to be used in the design process rather than as a final quality assurance of a process design.

As a result, we keep seeing the same issues in both the technical area and in information availability. Typical issues seen are pipeline high pressure to low pressure systems interface management, cold start Joule-Thompson effects not being considered properly, interconnection of systems via drains, poor consideration by design for operations and maintenance, and little effort expended into plant simplification and inherent safety.

Information and knowledge is another common problem area where as-built information is often found to be lacking or there is a loss of critical information and knowledge. Similarly, real plant operating reliability data collection is often of insufficient quality and this leads to critical reliability analysis being carried out using very poorly conditioned data sets. In order to achieve maximum effectiveness HAZOP studies require skilled chairs as well as experienced and committed team members. This, over time, has raised a number of challenges in terms of demographic and availability of fresh talent.

## A reality check for the next generation

The average age of experienced HAZOP chairs in the UK offshore sector is over 60 and there is little sign of potential new candidates. Very few HAZOP chairs have been trained in the oil and gas industry, with most coming from other industries such as petrochemicals, refining and nuclear. The results of the root cause analysis indicate ▸

that this is partly due to difficulties within the industry in giving staff sufficiently rounded training in engineering, operations, real-site experience, and high pressure protection management, etc.

As technology improves in the industry, young engineers are relying more on desktop training from onshore offices rather than practical experience and understanding of working life and its issues offshore, this is an extremely worrying trend which could have serious implications for the industry in the future. If the new generation of engineers, innovators and developers do not get the opportunity to learn at the coal face, then we are encouraging an industry which deals in virtual knowledge rather than hands-on expertise. Real life visualisation and hands-on experience can never be substituted.

As a result we need to establish far better process safety information and learning sharing across the sector including training schemes which allow engineers better access to offshore facilities and operations experience. This increasing lack of real plant experience and learning being fed back to design engineers highlights another key issue with the industry failing to share information, anecdotes and good practice in the process safety area. Compared to downstream refinery and petrochemical plant performance, the offshore industry often has shockingly poor plant uptime and production efficiencies despite having generally simpler process configurations. The reasons behind this need to be better understood as the economic impacts of low availability are high in the upstream sector.

There is a wide spectrum of training initiatives and skill levels observable between different companies but in general the level of learning and development investment is poor and this must in part contribute to the poor performances observed. A particular area of concern is seen as the increased nature of the industry to subcontract work and to use agency workers. There is less willingness to invest in their staff if they are employed on an agency basis and for the contract staff to be interested in developing young talent (who may take over their position).

### Learning lessons from the past for a safer future

The UK industry's response to the recommendations and lessons stemming from Lord Cullen's report has been significant, but with an ageing offshore infrastructure, the rise and arrival of newer technologies, challenges with human resourcing, and even the changing physical size and shape of the workforce, the industry must rise to this challenge and overcome new pressures. There is a serious and immediate need to improve the availability and quality of process safety training/development in the oil and gas sector and to be far more open and effective in information and learning sharing.

Piper Alpha and other such horrendous events are tragic reminders of the vital necessity for thorough and advanced safety and risk management and implementation across all operations in the high hazard oil and gas industry. This viewpoint is aimed at generating debate within the industry in order to improve the delivery of safe plant. It also calls for further empirical research to better understand the demographic concerns and information management system issues to better share learning and information ■