South Cumbria &
North Lancashire Branch

Joint meeting
12th December 2019

South Cumbria Occupational
Health & Safety Group

Topic: ***Using case studies to improve risk assessment of potential major accident hazards***

Speaker: John Gould, Director, Process Safety Technical Advisory Service &
Lecturer, Process Safety Management & Loss Prevention, Sheffield University

Venue: *The Netherwood Hotel*, Lindale Road, Grange-over-Sands, Cumbria LA11 6ET.

Gary McAteer, Vice Chairman, *South Cumbria & North Lancashire IOSH Branch,* welcomed *IOSH* and *SCOHSG* members to the meeting. He then introduced John Gould, who has a wide range of experience in assessing workplace hazards that have the potential to cause major accidents.

John explained that he planned to discuss the characteristics of major hazards, as well as ways of identifying hazards that have the potential to trigger major workplace incidents, by using a series of case studies and by considering who should be responsible for identifying workplace hazards.

He said that it was important for organisations to have a clear understanding of their workplace hazards because they could not afford to have a major accident that could lead to severe human, environmental, financial and reputational loss. He gave some examples of these costs:

Human:	*Bahawalpur explosion*, 2017, 219 deaths; *Amuay explosion*, 2012, 48 deaths *Piper Alpha*, 1988, 165 deaths and *Bopal*, 1984, 1900 deaths.
Environmental:	*Seveso*, 1976, 3300 animals died, 80,000 slaughtered, 4500 acres of land contaminated; *Sandoz*, 1986, 250 km stretch of the Rhine contaminated, thousands of fish killed.
Financial:	*Flixborough* UK, 1974, 280 $; *Piper Alpha* 1988,1857 $; *Longford*, Australia 1998, 779 $; *Texas City*, 2005 1500+ $; *Deepwater Horizon*, 2010, 20000+ $; *Texas City*, 2005, 265 $; Mumbai, High North India, 2005, 490 $; *Deepwater Horizon*, 2010, 609 $ and *Stanlow*, UK 2013 153 $ (all 2015 values, in US $).
Reputational:	Following the *Deepwater Horizon* incident, 2010, *BP*'s share price and dividends dropped significantly and had not reached their previous levels three years after the accident.

John went on to explain that most major workplace accidents resulted from well-intentioned minor failings such as poor communication, 'patching up' or bypassing a small part of the main process system to avoid unscheduled 'shut- downs' for more complicated maintenance work. He used evidence about the causes of the *Piper Alpha*, 1988, to illustrate this.

He then observed that most major workplace accidents were entirely preventable. For instance, after the *Buncefield explosion,* 2005 safety improvements were introduced in the UK's petroleum distribution sector to help prevent a similar accident in future. These included new safety and environmental standards for fuel storage sites such as: SIL1 (min) tank overfill protection systems, tank capacity definitions, fire safety shut-off valves, fire-resistant bund joints. In addition, there have been recommendations for improved process safety leadership principles and emergency preparedness, by the development of response and recovery plans for major incidents that need to be reviewed regularly.

However, John then pointed out that accident causes, similar to the *Buncefield explosion,* 2005, had been identified for earlier major workplace explosions such as: *Challenger Space Shuttle*, 1986, *Piper Alpha*, 1988, and a gas line rupture in Belgium in 2004 but the

knowledge gained from investigating the causes of these accidents had not been used to improve risk assessments in other organisations.

Next John used the 'black swan' theory to illustrate his point. This theory says that 'black swan' events are: outside the realm of regular experience, have a massive impact and afterwards and that they are found to be explainable and predictable. For instance:

- *Flixborough Disaster*, 1974 - cyclohexane leak and explosion
- *Bhopal Disaster*, 1984 - water entered a tank of methyl isocyanate that caused an exothermic reaction and MIC to be released from a safety valve.
- *Chernobyl nuclear disaster*, 1986 - safety systems shut down for a technical exercise on the turbine generator
- *Piper Alpha Disaster,* 1988 - a gas release and explosion following the reinstatement of an LPG pump that was not fully isolated.
- *Longford Fire*, 1998 - process upset caused overcooling of a heat exchanger, brittle failure and fire.
- *Buncefield storage depot explosion*, 2005 - undetected petrol overfilling event and explosion.

John said that his work assessing the cause of major accidents had led him to conclude that all major workplace accidents have the following characteristics:

1. They are unaffordable – because they cause massive human, environmental, financial and reputational damage.
2. They are entirely preventable.
3. They typically arise from the accumulation of well-intentioned, minor failings that have often already been noted as causes of previous major accidents in detailed accident reports but not acted on by other similar organisations.
4. They can happen in any workplace, even on the *Titanic*!

Other contributory factors included over-familiarity with the job leading to the adoption of 'short-cuts' and complacency because there had been no 'near misses' or accidents within the workplace memory. Members agreed that it was important that managers were alert to the developmennt of such workplace cultures and took steps to ensure that they did not become the 'norm'.

John then looked at the three main ways of identifying hazards – past experience, other people's past experience and by lateral thinking about what might go wrong. He used the following hazard definition:

A hazard is something e.g. an object, a property of a substance, a phenomenon or an activity, that can cause adverse effects.

He explained that one of the problems with identifying potential hazards was that the hazard level varied according to the environment of the hazard and it can also be subjective. To illustrate this point he used an assessment to show that a hose might be a trip hazard but that this dependeed on where it was, and/or whether it was being used.

Next he considered the more complex problem of identifying hazards that could lead to major incidents including the use of standard systems such as: HAZOP, What if, HAZID and Bowtie diagrams. He also reminded members that there are a number of organisations, including *HSE*, who provide information with helpful case studies. John then used some examples of case studies documented in the *Loss Prevention Bulletin* (published by *ICemE*) and in official *Major Accident Reports* to demonstrate that most major workplace accidents are the result of cumulative small changes in safe management systems where possible 'knock-on' effects to

the whole process system have not been considered and where risk assessments have not been reviewed.

He particularly recommended a book, *What went wrong*, by Trevor Kletz.

John then looked at the problem of who was competent to undertake hazard identification. Members agreed that all hazard and risk assessments should ideally be undertaken by those who were doing the tasks in conjunction with their managers and the process designers (if applicable). He said that for complex and inately hazardous processes looking at case studies of relevant accidents was often useful, but, it was crucial that the person who looked at the case study was able to to summarise the problems clearly and present them in a way that could be easily understood by others involved in the process risk assessment and emergency planning.

Throughout John's presentation members engaged in discussion with John and added examples of risk assessment methods and workplace incidents that they had encountered.

Gary, thanked John for giving members such an worthwhile interesting overview of the problems associated with identifying major hazards in the workplace and presented him with a small token of our members' appreciation.

He then encouraged members to network with one another and the speaker over tea and coffee.

Related *HSE* web site links:

Managing risk and risk assessment at work: https://www.hse.gov.uk/simple-health-safety/risk/index.htm?utm_source=hse.gov.uk&utm_medium=refferal&utm_campaign=risk&utm_content=home-page-info

Regulating major hazards: https://www.hse.gov.uk/regulating-major-hazards/index.htm

Major hazard regulatory model: https://www.hse.gov.uk/regulating-major-hazards/major-hazards-regulatory-model.pdf

Control of major accident hazards: https://www.hse.gov.uk/comah/index.htm