RISKworld

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the newsletter of risktec solutions limited

In This Issue

Welcome to Issue 13 of RISKworld. If you would like additional copies please contact us, and feel free to pass on RISKworld to other people in your organisation. We would also be pleased to hear any suggestions you may have for future editions.

Contact Steve Lewis (Warrington)

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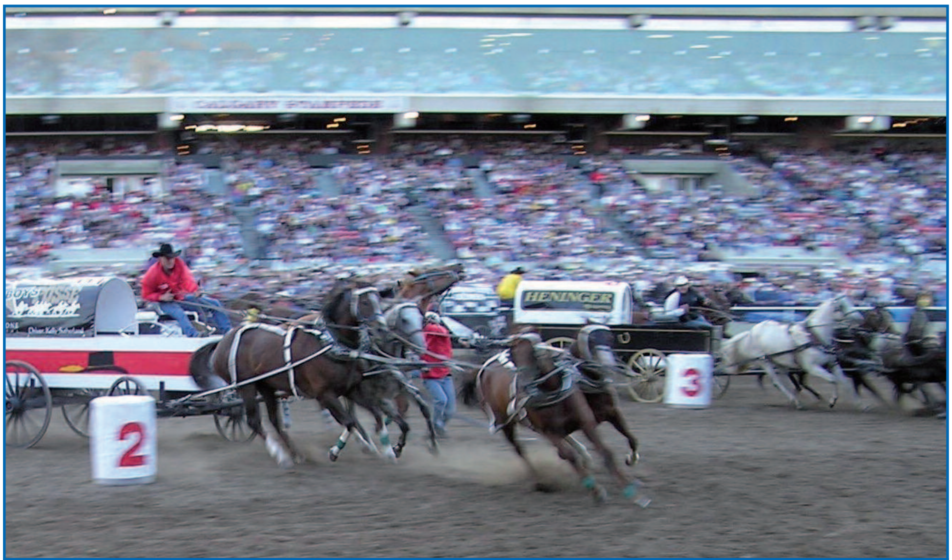


The annual 10-day Calgary Stampede, which has been running since 1912

One year on from becoming a wholly employee owned company, Risktec has continued to grow strongly, with annual revenue for 2007 in excess of £10m. We have also grown our range of services and broadened our client base. Earlier this year we established Risktec in Calgary, which again demonstrates our commitment to operating close to our major markets – in this case the multi-billion dollar energy market in Alberta, which is seeing a sustained expansion as investment increases in the oil sand deposits.

Managing Director, Alan Hoy, comments, "Risktec is increasingly recognised as a provider of a comprehensive range of high quality safety and risk services. We are extremely pleased with the expansion of our services and our financial growth. Importantly, we have managed to maintain our high level of quality, as our recent customer survey confirmed. All of our clients who participated in the survey said they would recommend Risktec to other organisations. This is a real vote of confidence in our personnel and our approach to business. We have welcomed a lot of new people into Risktec over the last few years and it is very pleasing to see the contribution they are making to the company."

This edition of RISKworld coincides with the introduction of the Corporate Manslaughter and Corporate Homicide Act 2007 in the UK, which came into force in April. This represents a significant shift in emphasis from the prosecution of specific individuals to the organisation itself.

While it is still unclear what the full ramifications for industry will be, Risktec's 'prevention' focused approach applies. Here we advocate a clear understanding of hazards and risks, controlled through effective engineering and management systems, and implemented by competent personnel. In this way we help organisations prevent incidents and demonstrate that they are discharging their responsibilities.

For further information, contact Alan Hoy (Warrington)

Sub-prime Safety?
Lessons from another world

The widely reported 'sub-prime' crisis in the financial markets has had global implications. In simple terms, extremely complex and sophisticated financial engineering created an illusion of security [see Fig 1]. In reality, the foundation to this financial engineering was mortgage loans to people in the US with poor credit ratings, seeking to benefit from rising house prices.

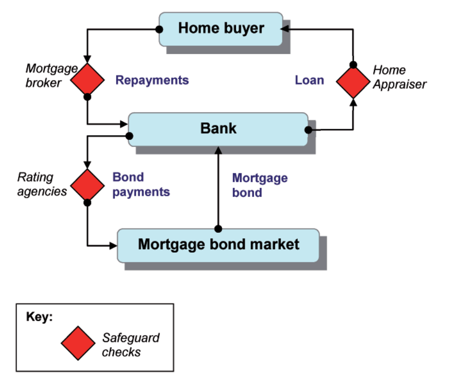


Figure 1 – Sub-prime mortgage model

As house prices in the US stalled and loan repayments rose (after initially attractive repayment periods), numerous mortgage holders defaulted on their loans, precipitating the global credit crisis as banks held onto cash and restricted short term lending.

To what extent can hazardous industries learn lessons and is there the potential for 'sub-prime safety'?

Parallel worlds

There are a number of parallels between the financial and industrial worlds, for example:

- Extensive national and international regulation
- Complex processes and systems
- The potential for major consequences should things go wrong
- Many layers of stakeholders and numerous interfaces
- Highly technical language and extensive use of acronyms
- Reliance on the views and opinions of experts
- The overriding need to make a profit
- The potential for seemingly uncorrelated events to combine and escalate

Could it happen here?

Major industrial incidents typically accelerate the introduction of improved standards, and may have wider repercussions. For example in the civil nuclear industry the Three Mile Island (1979) and Chernobyl (1986) accidents had a major impact on the worldwide use and regulation of nuclear power generation.

Similarly, the Seveso (1976) and Piper Alpha (1988) accidents had a major impact in the chemical, process and oil & gas industries.

However, despite considerable worldwide initiatives, major accidents are still occurring (for example, Texas City and Buncefield in 2005).

Investigations into the causes of major accidents reveal a variety of influences, many of which are sub-prime in nature [see Box 1]. A consistent finding is that all historical major accidents were inherently preventable.

Box 1 – Sub-prime safety characteristics

- Ad-hoc, piecemeal assessment of risk
- Lack of independence in due process
- 'It will never happen here' attitude
- Lack of focus on key risk contributors
- Sweeping 'motherhood' statements
- Little evidence of systematic safety management processes
- Ineffective leadership, ill-defined accountabilities and closed culture
- Dominant 'production at all costs' culture
- 'Everyone does it this way' approach

Sub-prime prevention

Regulatory and corporate processes are designed to prevent 'sub-prime safety', as they mandate extensive review and approval, with supporting independent due process.

To ensure such requirements are effective, strong management commitment to safe operation is required. This commitment must run throughout the planning, design, operational and decommissioning phases, ensuring that safety is not compromised by programme and operational pressures.

A range of safeguards capable of preventing 'sub-prime safety' are identified in Box 2.

Box 2 – Sub-prime safety prevention

- Clear understanding of risks, uncertainties and inter-dependencies
- Clear weighting towards evidence rather than opinion
- Experience embedded in safety process
- Risk assessment clearly linked to risk controls
- Effective due process & audits
- Continuous improvement culture
- Robust safety management processes
- Effective change assessment and control
- Open, safe operating culture
- Effective regulatory/corporate enforcement

Conclusion

The sub-prime crisis in the financial markets serves as a timely reminder to industry, particularly in the UK with the recent introduction of the Corporate Manslaughter & Corporate Homicide Act.

For complex systems, it can be very difficult to identify and assess the correlation between seemingly unconnected systems, and the potential for small incidents to escalate into major accidents with widespread consequences to the business and society.

The challenge, to all parties involved, is to maintain high professional standards and ensure that operational risks are acknowledged at all levels, and are truly tolerable and as low as reasonably practicable.

For further details, contact Alan Hoy (Warrington).

Piper Alpha accident, 1988

Quantitative Risk Assessment Across Major Hazard Industries

A brief history of QRA

The terms QRA (Quantitative Risk Assessment), PSA (Probabilistic Safety Assessment) and PRA (Probabilistic Risk Analysis) are used synonymously in different industries to describe various techniques for evaluating risk. Whilst quantification of risk for specific issues has been around for a long time, the grandfather of modern probabilistic assessment of the overall risk for an entire major hazard facility is generally accepted to be WASH-1400, commissioned by the US Nuclear Regulatory Commission in 1975. This quantified the safety risks associated with the operation of all electricity generating nuclear power plants in the US. The nuclear industry led the way, motivated by a desire to demonstrate that the actual risk was less than other industrial facilities and counter the public's perception that nuclear stations are very risky because the worst case consequences are potentially so catastrophic.

It is not surprising that the petrochemical industry followed suit shortly after, since the toxic effects of large chemical releases can disperse many miles and affect large numbers of people in local towns and cities. Explosion effects can also be devastating. For example, an explosion in 1974 at the Flixborough chemical plant in the UK killed 28 people.

Flixborough explosion, 1974

One of the first major QRAs for petrochemical installations was the highly industrial area of Canvey Island near London, in 1978.

The UK's offshore oil and gas industry came relatively late to formal QRA of overall risks, prompted by the Piper Alpha disaster in 1988 in which 167 workers lost their lives. The rail industry in the UK also started formal QRAs in the early 1990's, against a background of train accidents, including the Clapham Junction crash in 1988 when three rush-hour trains collided, killing 34 people.

Why conduct QRA?

All industries were motivated to use QRA for much the same reasons – to provide insights into the nature of the facility that is being managed, to design defence in depth, to understand any constraints on operating the facility and any issues that require further investigation.

It is fair to say that in each industry, at various points in time, QRA has been misused, typically in efforts to 'prove' that calculated risk levels meet numerical risk acceptance criteria (see Box 1). This perhaps stems from the heavily engineering-biased culture within major hazard industries, where there is desire to have a precise answer represented by a number.

Whenever this has happened the industry has tended to redeem itself, getting back to a sensible use of QRA to help reduce risk by making better risk-informed decisions. In particular, the probabilistic approach of QRA can be extremely useful in demonstrating that a broad range of scenarios have been considered. This contrasts with more traditional deterministic approaches which are always left open to yet another "what if?" question and yet another study. A robust, well developed QRA can readily handle such questions and put the findings in the context of the total risk profile.

Are there any differences in QRA between industries?

A formal QRA attempts to answer the questions:

1. What can go wrong?
2. How often does it happen?
3. How bad are the consequences?
4. Is the risk acceptable?

In addressing these questions, there are a number of subtle differences in the way the nuclear, petrochemical, oil and gas, and rail industries go about their QRAs. These differences tend to be shaped by the risk criteria, technology involved, the nature of the hazard itself, and whether or not the system being modelled is static.

Risk criteria. The QRA must be able to generate risk results in the right form to allow comparison with the risk criteria set by the regulator or the operator. For example, where members of the public are exposed to toxic chemicals, the QRA may need to be able to generate 'FN-curves', which are plots of the frequency F of events which may cause N or more fatalities. In contrast, the nuclear industry tends to require that the frequency of a given radiological release and associated doses are less than defined levels. On an offshore platform however, where only workers are exposed, the emphasis is more on the individual risk to personnel.

Box 1 – Misuses of QRA

- Using unrealistic or inaccurate models and data
- Ignoring the uncertainties involved
- Manipulating the results to justify desired decisions
- Arguing everything is safe because a calculated risk level is lower than a numerical criterion
- Neglecting deterministic arguments

Technology involved. In the nuclear reactor industry, for example, a great deal of effort is expended in analysing the causes and frequency of initiating events because a lot of complex engineering has to fail before a reactor core can be damaged and radio-nuclides released from the containment. The petrochemical and oil and gas industries, on the other hand, tend to start their QRAs with historical frequencies of gas or oil leaks because leaks are quite common and data are readily available. There is also less redundancy and diversity in safety systems to model than for nuclear power plants.

Chernobyl nuclear accident, 1986

Nature of the hazard. Another difference relates to analysing the impact of the hazardous event. A fire or explosion in a chemical plant or a train derailment or collision both have the potential to cause fatalities immediately, within seconds of the event. Nuclear releases however may cause latent health effects, the extent of which may not be known until many years later. For example, the Chernobyl nuclear accident in 1986 caused 31 immediate deaths, but by 1991 some 7,000 clean-up workers were believed to have died and some estimates of the eventual death toll are as high as 75,000 [Ref. 1]. Clearly, QRAs are sensitive to the models used to estimate the likelihood of fatality from the magnitude of the hazard.

Dynamic or static conditions. Unlike nuclear stations or chemical plants, which are located at a single site, trains can travel hundreds of miles through different local environments, picking up and putting down differing numbers of passengers. Rail industry QRAs are specifically designed to handle these transitory aspects.

There are other differences between industries as well, such as the way that fatalities are modelled during evacuation, or the extent to which frequencies and consequences are integrated into an overall risk picture, but what is evident is that the differences are not as great as one might first think – the level of detail and the focus of the analysis are shifted to enable QRA to help answer the specific questions unique to the industry.

So what is the same?

One thing that all major hazard industries do agree on, however, is the best uses of QRA (see Box 2).

Box 2 – Best uses of QRA

- Helping to reduce risk by supporting risk-based decision-making
- Comparing options during the design phase or for modifications during operations
- Supporting the demonstration that risk levels are reduced as low as reasonably practicable (ALARP)
- Defining requirements for land-use planning
- Defining requirements for emergency response planning
- Not using QRA to support removing protective measures

Even so, QRA is not without its limitations (see Box 3). Because QRA involves lots of numbers it appears to be objective when in fact there are many judgements throughout the analysis. Some judgements are explicit but many more are hidden within data and methods. It is the role of QRA practitioners to interpret results in the context of the uncertainties inherent within the analysis.

In general, attitudes have changed from early scepticism, not helped by over-selling by QRA enthusiasts, to one of positive support for QRA approaches that provide clarity of focus to controlling hazards.

Box 3 – Limitations of QRA

- Implies a level of accuracy that does not exist
- Can divert attention from precautionary or preventive measures
- Lack of reliable data in specific areas
- Often dominated by hardware issues and rigid handling of human factors
- Theoretical modelling may not reflect actual operations

Where is QRA today?

Today, the nuclear industry is arguably taking an increasingly integrated approach to QRA, in that there is a more transparent combination of the frequency and consequences of events. It will be interesting to see how this plays out in light of the swelling interest in building new nuclear power stations.

Offshore UK, which is a mature operating environment, has seen the regulator pulling back somewhat from QRA and placing a much greater emphasis on the operational management of asset integrity. Nevertheless, internationally, there is an increasing demand for QRA and the value it can add, especially on major design projects.

The rail industry in the UK is using QRA more and more, applying it to increasingly complex situations to obtain a greater understanding for important risk-based decisions.

Conclusion

Modern QRA has been around for over 30 years, led by the nuclear and onshore petrochemical industries, shortly followed by the offshore and rail industries. The differences in the focus and level of detail of QRA in each industry arise from the need to understand the critical risk issues unique to the industry.

But all industries agree that while QRA is not a panacea, it does help to make better risk-informed decisions, thus saving lives, protecting the environment, reducing economic loss and preserving the reputation of the associated organisation.

Contact Steve Lewis (Warrington) for further information.

References

1. Loss Prevention in the Process Industries, Lees, 1996

Did you know…?

… that the UK government's Health & Safety Executive (HSE) has started to debunk notorious health and safety-related myths. These include:

- The requirement for toy weapons in a play to be locked-up and registered with the police
- That risk assessments should always be long and complex
- Children being banned from riding in a donkey derby
- The need to wear safety goggles to play conkers
- Qualified workers required to put up Christmas decorations
- The use of stepladders being prohibited
- That all office equipment must be tested by a qualified electrician each year
- New regulations requiring trapeze artists to wear hard hats
- That every possible risk should have a safety sign

Each "myth of the month" comes with a cartoon and is available as a downloadable poster at www.hse.gov.uk/myth/index.htm

Nuclear Powered UK: From Requirement to Reality

Nearly two years on from the publication of the UK government's energy review in July 2006, the prospect of new nuclear power stations in the UK is edging closer to reality. May 2007 saw the "Meeting the Energy Challenge" White Paper state that the government was "proceeding, on a contingent basis". The January 2008 Nuclear Energy White Paper confirmed that it would be in the public's interest to allow private sector companies the option of investing in new nuclear power stations.

These announcements have led to a significant increase in activities in the UK involving reactor designers, operators, utilities, investors, contractors and manufacturers from around the world, all interested in playing a part in this long-awaited nuclear renaissance.

The story so far

In response to the 2006 Energy Review, four potential reactor vendors sought support from potential nuclear operators and in the Spring of 2007 applied for their design to be considered in the opening phases of the UK regulators' "generic design assessment" of new nuclear reactors, i.e. the generic pre-licensing of their designs.

The four reactor designs are:

- AECL's Advanced Candu Reactor – ACR 1000
- Areva's Evolutionary Pressurised Water Reactor – EPR
- GE-Hitachi's Boiling Water Reactor – ESBWR
- Westinghouse's Advanced Pressurised Water Reactor – AP 1000

By September 2007, all four designers had made their Phase 1 Step 2 pre-licensing submission to the UK Regulators [see Table 1] with the aim of demonstrating that, in principle, their generic designs were capable of being licensed in the UK.

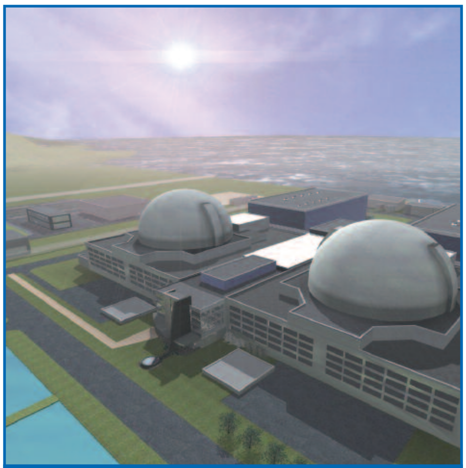
This phased and progressive generic pre-licensing process aims to reduce regulatory and planning risks and introduces a number of innovative ideas in the UK regulatory framework including:

- An integrated Security, Safety and Environmental Regulatory process managed via a Joint Programme Office comprising:
  - OCNS (Office of Civil Nuclear Security)
  - NII (Nuclear Installations Inspectorate)
  - EA (Environment Agency).
- The initial use of a generic site envelope rather than a specific site.
- An expectation that designs and safety cases would be largely 'off the shelf' but still demonstrate UK-specific regulatory requirements.
- Consideration of assessments carried out by foreign regulators.
- Openness and public involvement.

The public involvement process required vendors to publish their pre-licensing submissions and encourage public review and comment of their design submission. This has required a difficult balance between openness on one hand and the need to safeguard commercially sensitive information and national security.

The regulators have recently completed their Step 2 assessment of each of the four designs, informed by the public involvement process. Overall, they conclude that there is no fundamental reason why each of the designs should not proceed to Step 3. This milestone marks the start of the government's prioritisation process which is expected to identify the three designs that are most likely to be built in the UK. Until this decision is made vendors are proceeding with their second submission at their own risk.

A great deal of parallel activity has also been ongoing with potential investors, utilities and operators exploring partnerships with designers, builders, manufacturers and their supply chain to understand the technologies on offer as they relate to constructability, operability, maintainability and return on investment. Such is the interest in new build that there were over 80 participants, representing over 15 organisations from 7 countries at a recent seminar for potential operators run by the UK regulators.



AECL's ACR-1000 design

Future timescales

Current timescales are driven by the government requirement that new nuclear power stations should be licensed and operational in the UK within the 2016-2022 timeframe. The view in industry is that the first plant could be operational by 2017 – however, this will require site-specific work to commence in 2009, a planning application in 2010 and a start on construction in 2013.

Challenges ahead

The ability to meet these timescales is itself a challenge, noting that all four potential vendors and many of the potential operators are new to the UK regulatory environment. However, despite the increasing acceptance of nuclear power as part of the future energy mix, there are a number of issues that remain a threat to making nuclear power a reality in the UK, such as:

- Nuclear safety and security
- Waste management and disposal
- Construction cost and time over-runs
- Limited international manufacturing capacity

While navigation through these and other issues may not be easy, the nuclear industry and UK government can take confidence in coming this far in less than 2 years.

For further information contact John Llambias (Warrington).

Table 1 – Licensing Process

Step		Timescale
Phase 1: Design Acceptance (Pre-licensing)		
1	Design and safety case preparation	Complete
2	Fundamental safety review	Complete
3	Overall design safety review	6-12 Months
4	Detailed assessment for design acceptance	2 Years
Phase 2: Site Licensing		
1	Site license assessment	6-12 Months

Secrets of Successful Competency Management

The success of Risktec's booklet 50 Secrets of Successful Knowledge Management (which has even been translated into Russian!) has prompted the development of a more in-depth set of guidelines for competency and training management. Whilst this subject has come under close scrutiny in large companies – particularly those operating in safety regulated industries – it is of equal relevance to smaller organisations. Here's a selection of tips inspired by these guidelines:

1. Have a clear understanding of Competency and Competency Management

Competencies are demonstrable knowledge, skills, attitudes and behaviours that are required to perform a particular job to a predetermined standard. They are important because if employee competence is not maintained then accidents, injuries or near misses may result or the product may not meet business requirements.

Competency Management is a systematic approach that an organisation can employ to address this issue. This should cover assessment and training of its current employees as well as the way it undertakes new recruitment and succession planning.

2. Competency Management should be regarded as a continuous process vital to business operations

If your organisation operates in a highly regulated, safety focused industry then one of the main factors that determines the safe operation of facilities is the competence of the people that use, maintain and manage them.

Historical evidence of major incidents reveals that staff may lack important safety knowledge and skills despite having received relevant training. It is therefore important that competence is both demonstrated and assessed rather than simply assumed based on past training and experience.

3. Define and maintain roles and responsibilities

Organisations should develop an appropriate process to define the collective roles and responsibilities that reflect the scope of desired competency control across the organisation. Once established, each post-holder will need to understand the requirements of their role and the associated responsibilities. Thereafter, there should be a process for controlling change and, where necessary, updating roles and responsibilities as the organisation evolves.

4. Define the skills and knowledge needed to perform specific roles and tasks

For each defined role, or for specific tasks performed by a role, the skills and knowledge needed should be identified. These competencies can then be assessed to demonstrate the level of a person's competence in each area. Any gaps should be addressed in an individual's training and development plan, which should identify the specific training needs and the associated timescale, taking into account risks to the individual, the public and the business.

5. Align employee training with the needs of the business

Employee development should be driven by a tangible safety benefit or desire to improve business efficiency and productivity. There should be a clear link to competency assessment. Organisations should consider implementing refresher training for infrequent or critical safety tasks.

6. Communicate key information

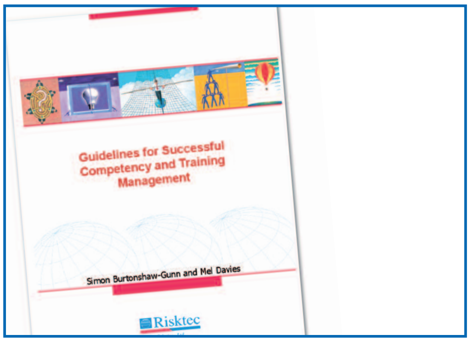
Good communication is crucial for effective Competency Management. Employees benefit from positive reinforcement of key principles and processes through diverse communication channels, such as email, intranet, procedures, presentations and formal training. Communicating with those not directly employed, such as subcontractors and suppliers, can be equally important.

7. Build the process of Competency Management into your business

Successful Competency Management should be fully integrated into day-to-day business processes, rather than a bolt-on extra. The effects of any organisational and process changes should be fully reflected. A regular performance review of an organisation's approach to Competency and Training Management should be undertaken to identify if the recruitment, qualification and training process is functioning effectively and allow any remedial steps to be taken if necessary.

8. Seek expert help when you need it

A small amount of money spent up-front can help identify and mitigate many of the downstream problems likely to be encountered. For implementation, the use of internal resource is more likely to achieve 'buy-in'.



More Secrets

For more tips on Competency and Training Management, visit www.risktec.co.uk (Downloads) or contact Mel Davies (Warrington) or Professor Simon Burtonshaw-Gunn (Warrington).

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