RISKworld

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In This Issue

Welcome to Issue 20 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 feedback you may have on this issue or suggestions for future editions.

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Contents

Risktec

10 years, 20 RISKworlds!

This, the 20th edition of RISKworld, marks the 10 year milestone for Risktec. In that time, the company has grown from a start-up business of the then Nutec Group, to an independent, employee-owned company with over 130 staff, providing a comprehensive range of risk and safety consulting and training services.

We are delighted with what we have achieved so far, which is a testament to the quality and hard work of our people, and the long-term support of our clients. We have strived to maintain many of our 'start-up' values, including a strong desire to understand fully our customers' requirements and deliver value for money, while being straightforward and easy to do business with. We are always receptive to feedback, particularly on how we might improve our service.

Our training business continues to develop strongly. The established face-to-face classroom-based postgraduate programmes, leading to PgCert, PgDip or MSc awards from Liverpool John Moores University, are now complemented by web-based distance learning programmes. This makes our training accessible to people across the world, with the added benefit of flexible study to fit around work and personal commitments.

This edition of RISKworld presents a number of topical articles. Despite the endeavours of high hazard industries, serious accidents continue to occur. Whether the initiator is man-made (such as the Gulf of Mexico blowout) or natural (as at the Fukushima nuclear plant), the impact on lives and livelihoods can be devastating.

We continue to advocate the rigorous, yet proportionate, assessment of risk and the implementation of appropriate controls to prevent major accidents from happening. However, recent events have also reinforced the need for a well prepared emergency response.

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State of Emergency
The Challenge of Responding to Extreme Events

Earthquake and tsunami damage at the Fukushima nuclear power plant

The recent events at the Fukushima Daiichi nuclear power plant in Japan have caused the international nuclear community to review their approach to extreme events [e.g. Ref 1] and, in particular, emergency preparedness.

On the 11th March 2011, having survived a powerful Magnitude 9 earthquake, the nuclear reactors were shut down safely only to find post-trip reactor cooling compromised by the 14 metre tsunami that hit the site about one hour later. With the unprecedented destruction to the plant and surrounding infrastructure, the loss of off-site and on-site power led to loss of cooling and core meltdown. Over the next week or so, cooling water was injected into reactors by previously untried and unplanned means. Electrical supplies were gradually re-established and uncontrolled radioactive discharges were eventually brought under control.

Emerging lessons

As the international community continues to investigate this event, the lessons emerging relate to:

- Underestimating the likelihood of extreme events.
- The lack of emergency preparedness for such extreme events.
- The added difficulty in the command, control and coordination of emergency response in the aftermath of extreme events, including availability of off-site equipment and resources.
- The need to ensure the welfare of emergency response personnel, as well as the nearby public.
- The importance of full, clear and timely public communication.

However, it is the culture of the plant personnel and emergency services in the face of an extreme emergency that, perhaps, gives the most food for thought. The fact that there has not yet been a single fatality directly attributed to the Fukushima nuclear accident is a testament to the exemplary response of the people involved, who were highly resourceful and dedicated.

Whether this was influenced by Japanese culture or not, it highlights the need for the international community to improve the understanding of human behaviour under such stressful conditions, and test the capability of the local and wider organisations to respond. Considerations include:

- The ability of site personnel to deal both physically and emotionally with the developing situation, and act quickly and decisively in view of the potential devastation at the plant.
- The extent of knowledge, skills and training necessary to respond rationally to unforeseen events without outside expert advice.
- The effect of a reduced number of personnel on-site at night and weekends.
- The willingness of personnel from the site and emergency services to work within the radiation exclusion zone.
- Whether additional on-site or nearby emergency equipment should be available.

Conclusion

Extreme natural events will happen. Such events do not differentiate between developed or emerging nations and the consequences do not respect plant, regional or national boundaries. In spite of unforeseen devastation and intense scrutiny from the rest of world, the Japanese nation succeeded in providing effective leadership and resources to limit the consequences of the Fukushima nuclear accident. Is the rest of the world prepared to deal with such an extreme event?

References

1. ONR, Japanese Earthquake and Tsunami: Implications for the UK Nuclear Industry, Interim Report, May 2011.

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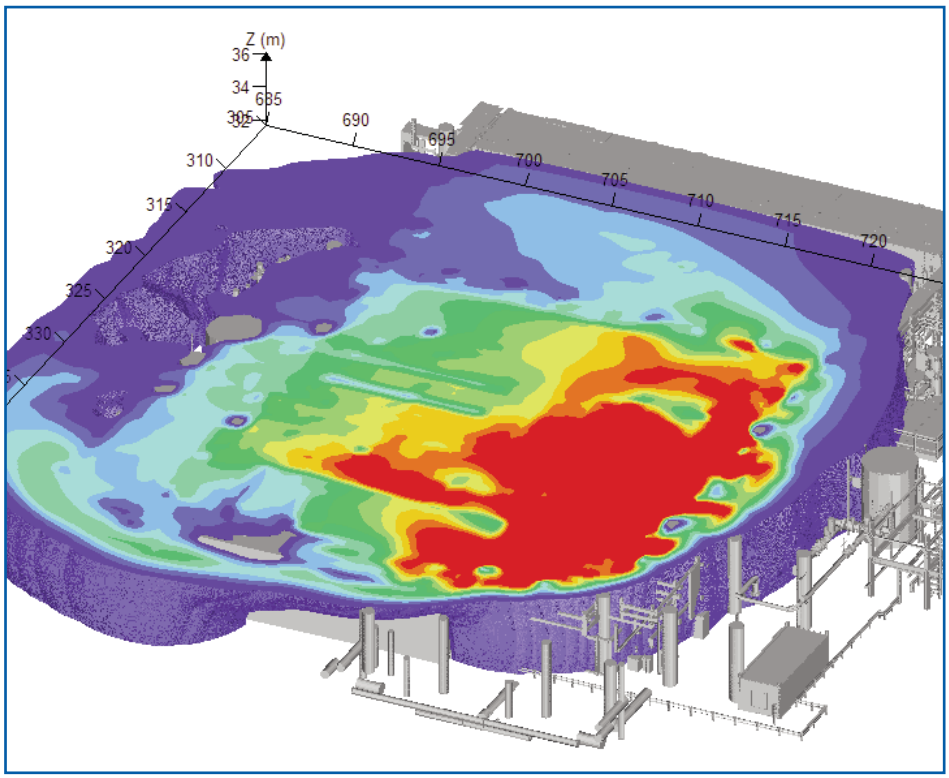
Integrated use of CFD in QRA



CFD for design

Computational Fluid Dynamics (CFD) studies are often performed to assess the dispersion of flammable or toxic releases, or overpressures resulting from explosions. Traditionally, the output of such studies is a report containing 2D and 3D graphical presentations of results, sometimes accompanied by short videos showing how the dispersion or overpressures develop over time. The results may also be combined with event frequencies to derive 'exceedence plots' which indicate the likelihood of overpressures exceeding certain magnitudes.

These studies are generally targeted at designers with a view to improving understanding and informing the design, e.g. for developing a blast wall design to protect against a 1 in 1,000 year explosion.

Quantitative Risk Assessment (QRA) is often used to assess probabilistically the risks associated with a facility, including those due to explosions.

In principle, CFD should enable more refined QRA modelling of explosions, but often the CFD output is of limited benefit due to a range of factors, including, for example:

- The large number of scenarios that need to be considered in the QRA, compared to the limited number of design cases.
- Extracting information from a CFD report can often be difficult and time consuming, and relies on manual estimates from figures or interpolation from data tables.

Ironically, this means that non-CFD consequence modelling software may have to be used instead, noting that this approach is unable to take specific account of the facility geometry.

In summary, the traditional CFD approach produces a fairly standard set of outputs which is not suited to the development needs of QRA models.

CFD for design & QRA

Better integration of CFD studies and QRA can be achieved by specifying the outputs required by the QRA in advance and having raw data from CFD simulations delivered in electronic formats that can be interrogated easily. In the past, this has been hampered by the significant volume of data involved, but modern data storage and transfer arrangements mean this is no longer such an issue. With the whole dataset available, the inherent limitations of the data published in the CFD report no longer applies.

Making it clear from the start what results are needed for QRA can also reduce the requirement for additional analysis runs. For example, by specifying a grid of overpressure results across the facility rather than just at specific design elements means that it can also be used by the QRA to answer much wider questions relating to the effect of overpressures at different locations (an issue that would traditionally involve time consuming iterations with the CFD analyst).

Recent experience tells us that it is possible to obtain targeted outputs of raw data from CFD studies without significantly affecting cost, provided they are specified in advance.

Optimising QRA

Making the most of CFD data depends on building the QRA model so that CFD output can be imported directly, without the need for post-processing. Achieving this relies on a consistent specification and format between the QRA and CFD. On occasion it is also possible to automate this data transfer process. Overall, this makes things much more efficient and enables more straightforward updates to the QRA following revisions to the CFD.

Ultimately, this should result in a QRA that is informed more explicitly by CFD results, enabling a more representative evaluation and understanding of risk, and its sensitivity to potential explosions.

Conclusion

As the use of CFD to support QRA continues to increase, getting the interface right at an early stage can reap real benefits in cost-effectiveness, as well as producing a better understanding of risk and, by extension, more focused risk mitigation.

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Debunking the ALARP Principle – Four Myths and Realities

Fig. 1 – The nature of ALARP assessment varies according to risk

The ALARP principle recognises that no industrial activity is entirely free from risk and, quite sensibly, requires that risks are reduced to levels that are As Low As Reasonably Practicable, or 'ALARP'.

The ALARP level is reached when the time, trouble and cost of further reduction measures become grossly disproportionate to the additional risk reduction obtained.

Determining if this is the case normally relies on ensuring compliance with accepted good practice, and evaluating options for improvement at key points throughout the lifecycle of a facility.

While simply stated, the mechanics of when and how to apply the ALARP Principle, are for some, shrouded in mystery – perhaps because ALARP decision-making is not black and white.

As a result, there are many 'myths' or misconceptions about the ALARP Principle. Below, we debunk four common myths by portraying the reality of a good ALARP justification.

Myth #1 – Ensuring that risks are reduced ALARP always means continuously improving safety

Reality #1 – ALARP assessment is not synonymous with continuous improvement

While it is true that as technology develops, new and potentially better methods of risk control may become available, it is not a given that they should be adopted. It is the responsibility of the operator/owner to assess the options available periodically and determine whether the cost, time and trouble of implementing new risk controls are grossly disproportionate to their risk reduction, in which case improvement is not warranted.

Myth #2 – ALARP assessment should focus on quantitative cost-benefit analysis

Reality #2 – A balanced ALARP decision is needed, which considers a range of factors

Cost and risk reduction are just two of many potential factors that should be considered during ALARP decision-making. The overriding decision should be based on sound engineering argument supported by a range of factors. This should start with benchmarking against good practice, followed potentially by qualitative consideration of the benefits and detriments of an appropriate range of options. In less clear-cut situations quantitative cost-benefit analysis may help, but should always be supported by other means of assessment. The nature of ALARP decision-making should also vary according to risk (see Fig. 1).

Myth #3 – ALARP assessment is a separate activity to design

Reality #3 – The ALARP process should feature prominently at every stage of the facility/project lifecycle

The ALARP principle is an extremely powerful tool that can be used to great effect as a front-end activity. In this role it can influence not only the design but also the amount of analysis and the level of application or interpretation of codes and standards. A good design review process should identify improvements early on (when they are cheapest). In the operational phase, as operational feedback grows, ALARP assessment can be used as a risk-based decision tool for improving procedures and processes. Decommissioning options should also be assessed using the ALARP principle, since a short-term increase in risk can often be weighed against the long-term reduction in risk.

Myth #4 – If a few organisations have adopted high standards, these define ALARP levels

Reality #4 – ALARP relates to risk reduction based on accepted good practice

In the context of the ALARP principle, good practice has a very precise meaning in the UK – it refers to those standards for controlling risk which are recognised by the UK's Health & Safety Executive (HSE) as satisfying the law when applied to a particular circumstance, and includes Approved Codes of Practice, HSE guidance, national and international codes and standards [Ref 1]. Although some organisations may implement higher standards than this to meet corporate goals, this does not constitute accepted good practice. Equally, an improvement should not be immediately discounted simply because it is not recognised as good practice. Organisations should make their own assessment of the available options, taking into account their own particular circumstances.

Key to success

The key messages that come across are that ALARP decision-making should:

- Be applied throughout the whole project/facility lifecycle.
- Be integrated with existing safety processes.
- Consider accepted good practice.
- Identify options and consider a range of factors.
- Be underpinned by sound engineering argument.

The more complex the project, the more sophisticated the supporting ALARP process is likely to be, involving as it does a larger number of potentially affected stakeholders. Equally, the higher the associated risk, the more robust and comprehensive the supporting arguments and evidence should be.

Conclusion

To some, the ALARP principle may seem like another legislative hurdle. However, in the right hands, the ALARP principle is a very powerful means of choosing between improvement options or showing that no further improvement is warranted. As the ALARP principle is applied with increasing success, we can only hope that the myths surrounding its use will fade away.

References

1. http://www.hse.gov.uk/risk/theory/alarpglance.htm

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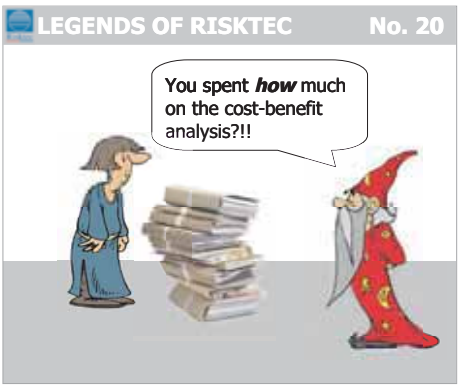

Risk and Safety Management Education

Classroom and distance learning

Risk and safety management is a relatively new profession, yet the demands on risk management practitioners are greater than ever due to increasingly complex legal requirements, coupled with higher company standards and new technologies.

To meet this challenge, forward-thinking organisations and individuals need to develop their practical risk and safety skills, knowledge and experience by the most cost-effective route.

Risktec's solution

As a validated partner of Liverpool John Moores University (LJMU) in the UK, Risktec goes beyond traditional training and delivers postgraduate qualifications via face-to-face (F2F) classroom teaching and web-based distance learning (DL) methods.

Programmes may be customised to industry sector and client requirements.

Our main award programmes are:

- Certificate of Professional Development (CPD) for single modules.
- Postgraduate Certificate (PgCert).
- Postgraduate Diploma (PgDip).
- Masters Degree (MSc).

Our training can also be delivered on an attendance-only basis, without assessment. Options range from individual modules to multi-year staff development partnerships.

All of our teachers have been through a comprehensive development process and University validation in order to teach at postgraduate level. As a result, we provide a unique mixture of theory and practical experience.

Key benefits

The key benefits to the student include:

- Receipt of a formal qualification from a recognised institution.
- Demonstration of learning rather than just attending a training course.
- Specific learning, with case studies directly related to the place of work, which also reduces the self-study burden.
- Pathways through programmes that are tailored to individual needs.

The key benefits for the client company include:

- More skilled resource with formal qualifications and greater staff retention.
- Relevant learning, by tailoring case studies and methods.
- Up-to-date topics delivered by approved risk practitioners.
- A modular approach that maximises flexibility.
- Effective use of training budget through targeted, client-specific learning.

For a copy of our new training catalogue contact: Peter Moar (Warrington) peter.moar@risktec.co.uk or visit www.risktec.co.uk

Risktec

Training & Education

in partnership with

energy INSTITUTE APPROVED TRAINING PROVIDER

JMU

Postgraduate Programmes in *Risk & Safety Management*

Postgraduate Certificate
Core module plus any 5 (see notes 1, 2)

Postgraduate Diploma
Core module plus any 11 (see note 2)

Master of Science
Core module, Research Methods module plus any 10 before starting Project

Note 1: For inexperienced students studying to PGCert, 4 recommended modules are shaded orange, plus any 1 of 3 recommended options are shaded green

Note 2: For experienced students, example pathways comprise either technical or managerial modules, or a balanced mixture

Note 3: Pre-requisites for QRA module are indicated by [PR]

Key features:

- Corporate face-to-face (F2F) or distance learning (DL) programmes available
- Each module typically involves 100 hours of study and a formal written assessment
- Modules and assessments can be tailored to client's facilities and operations
- F2F programme can be delivered at client's premises and timing is flexible
- DL programme includes online tests, discussion forums and virtual classroom
- Modules can be delivered as PgCert, PgDip or MSc programme, stand-alone for CPD awards or without assessment for CPD evidence

Core Module
- Introduction to Practical Risk Mgmt

Research Methods
- Research Methods

Identification and Assessment
- Hazard Identification
- Hazard Assessment
- HAZOP Study
- Human Factors in Design & Operations
- Bowtie Analysis
- Oil and Gas Lifecycle Hazards & Risks
- Functional Safety (including SIL)
- Nuclear Lifecycle Hazards & Risks
- Availability, Reliability & Maintainability (ARM)
- Rail Industry Hazards & Risks
- Fault Tree & Event Tree Analysis [PR]
- Environmental Risk Assessment
- Physical Effects Modelling [PR]

Management Systems
- Health, Safety & Environment (HSE) Mgmt Systems
- Safety/HSE Cases
- Accident Investigation & Analysis
- Emergency Response Planning
- Workplace Safety
- Business Continuity Management

Assurance and Improvement
- Performance Monitoring, Auditing & Mgmt Review
- Competency Mgmt, Culture & Behaviour

Risk-Based Decision Making
- Risk Reduction & ALARP
- Engineered Risk Control Systems & Perf (Oil & Gas)
- Engineered Risk Control Systems & Perf (Nuclear)
- Oil & Gas & Process Industry QRA (note 3)
- Oil & Gas & Process Industry Risk Studies
- PSA in Nuclear Industries
- Rail Safety Analysis

MSc Project
- Project

Other Training Courses

Unaccredited
- Process Hazard Analysis
- BowTieXP Software
- Investigator 3 Software
- Security Risk Management
- Project Risk Management
- Asset Integrity Management

Accredited Marine Safety & Security Courses
- Company Security Officer
- Ship Security Officer
- Port Facility Security Officer
- Maritime Security Officer

Unaccredited Nuclear Foundation Modules
- Nuclear Reactor Basics
- Implementing a Regulatory Regime
- Nuclear Reactor Safety Principles
- Radiological Protection
- Principles of Regulatory Systems
- Radioactive Waste Management

Sending the Right Signals – New Signalling Technology for the Jubilee Line

Courtesy of Tube Lines

On 23 June 2011, a new signalling technology, known as 'moving block', was quietly enabled on the Jubilee Line of the London Underground. While passengers may have been oblivious to this change, the new technology allows the number of trains per hour to increase and journey times to reduce without changing the existing infrastructure – an improvement that will come into its own during the 2012 Olympics.

On the move

A moving block signalling system has a number of advantages over a traditional fixed block system. A fixed block system relies on track circuits or axle counters to confirm when a train has left a defined section of track (the block) before allowing another train into that area. The block sizes or, equivalently, the number of clear blocks required between trains depends predominantly on the line speed and braking distances. A moving block system, on the other hand, can adjust train separation in real time – the control system provides a braking curve [see Fig 1] and movement authority to a train based upon its reported location, speed and the distance to the train ahead. The system allows trains to run closer together and reduces train waiting time, while ensuring a minimum safe braking distance between trains is maintained, so trains can brake to a stop before reaching the train in front.

The new Transmission Based Train Control (TBTC) system on the Jubilee Line was developed by Thales UK, with safety and assurance support from Risktec Solutions.

On the Jubilee Line, the TBTC system consists of five Vehicle Control Centres (VCCs), which manage five sections of the line, and communicate with one normal and one standby Vehicle On-Board Computer (VOBC) on each train. A failsafe design ensures that on failure of a VCC or VOBC or loss of communication, the brakes engage automatically.

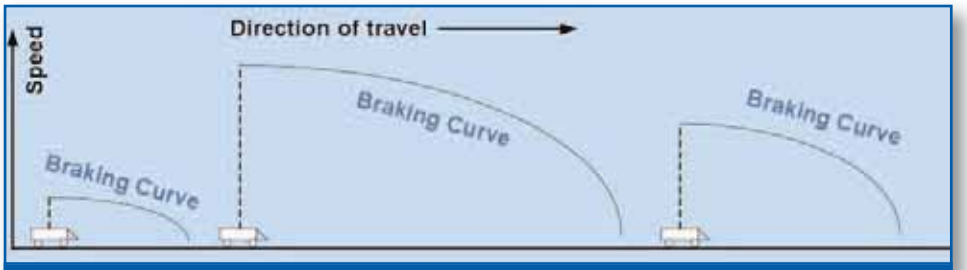

Figure 1 – Moving block braking curves

Operational challenge

Previous applications of the moving block signalling system have been on green field sites, such as for the KCRC network in Hong Kong, Docklands Light Railway in London, Las Vegas Monorail, and the Vancouver Skytrain, from which the generic baseline was developed. The challenge with the Jubilee Line was to install, test and commission the TBTC system on an operating railway, having modified the system to meet the operational needs of London Underground.

Testing solution

To limit the disruption to tube operations, the TBTC was installed initially on just one section of the line. Testing was constrained to night-time and weekends, when signalling would be switched from the existing fixed block system to the TBTC system. Moving block signalling was successfully introduced into service for this section of line in December 2010, whilst testing continued on the remaining section. This transitional period brought its own challenges, since trains had to switch from the fixed to the moving block system as they crossed between line sections. The added potential for loss of signal control resulted in specific alarms, protection devices and failsafe braking systems at the shared boundary.

To reduce the potential for human error, each line section was also segregated from the other, in terms of signalling hardware, control room staff, maintenance crews and testers.

All systems go

The TBTC system has been fully operational along the length of the Jubilee Line since June 2011, and has lived up to its promises, delivering increased capacity and shorter journey times, while demonstrating its reliability. What's more, TBTC is now being rolled out to the Northern Line.

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