RISKworld

issue 14 autumn 2008

the newsletter of risktec solutions limited

In This Issue

Welcome to Issue 14 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)

Contents

Risktec

Capital investments for Risktec

Classic views of Edinburgh, Muscat and Washington DC

Risktec has extended its geographical coverage by establishing operations in the capital cities Edinburgh, Muscat and Washington DC. Risktec now operates from 11 offices, located to provide our services close to our client base.

In the seven years since we started trading, Risktec has matured into a recognised provider of high quality consulting and training services. Risktec's Managing Director, Alan Hoy, explains further, "The continued growth of Risktec is essentially driven by our clients. A recent analysis of our business indicates that our client base has grown by about 40% each year over the last few years. Nonetheless, we found that 80% of our revenue was repeat business, suggesting we are providing a very good service to our existing clients. These figures portray two of our key goals – the ability to attract new clients and then build long-term relationships."

This issue of RISKworld illustrates the range of Risktec's capabilities and the industries where our services are being deployed. The consistent theme throughout all the articles is the growing challenge of maintaining safe operations as society demands higher levels of safety assurance, facilities get older and the demand for energy increases.

Our message remains simple – have a good understanding of the risks you face; have specific systems in place to manage those risks; and have competent people to operate those systems.

This message is backed up by our collective, hard-earned experience and practical outlook gained from working across a wide range of different industries, environments and cultures.

For further information, contact Alan Hoy (Warrington).

Nuclear Life Extension: Bridging the Energy Gap

Whilst the construction of new nuclear power stations in the UK is looking increasingly likely, it will be 2018 at the very earliest before they start to generate electricity. Meanwhile, many of the UK's existing nuclear power stations are reaching the end of their design life, potentially leaving an energy gap of over 10% of the nation's electricity demand. One solution to this problem is to extend the lives of the existing nuclear power stations, particularly British Energy's ageing fleet of 7 Advanced Gas Cooled Reactor (AGR) stations, one of which is already operating within a justified life extension [see Fig 1].

This presents an interesting challenge for British Energy. Ageing plant generally needs more care and attention to ensure it operates safely and reliably. Unforeseen issues may be identified through rigorous surveillance. Refurbishment or replacement of certain systems and components, some of which may be obsolete, may be required to overcome age related problems. Compounding these challenges, continued safe operation must be assessed against current standards, which have evolved significantly over the stations' operating lives.

Not surprisingly, the As Low As Reasonable Practicable (ALARP) principle plays a pivotal role in the justification of life extension, because the stations were not originally designed with current standards in mind. The aim, therefore, is to target the more significant risks where improvements will deliver the most benefit, so that overall risk is reduced so far as is reasonably practicable.

To deliver this aim British Energy manages a range of diverse projects with the common goal of demonstrating continued safe operation of the AGRs. Box 1 illustrates Risktec's involvement.

Box 1 – Life Extension in Practice

Periodic Safety Review

To satisfy the requirements of their nuclear site licence, a licensee must conduct a systematic review of its safety cases at pre-determined intervals. For each station, this entails a review of operating experience, plant modifications and changes to design standards to establish their impact on the safety case.

Hartlepool BCU Recovery Project

During the October 2007 statutory outage of Reactor 1 at Hartlepool, corrosion was detected within the pre-stressing wires of one of the Boiler Closure Units (BCUs). As a precautionary measure, Reactor 2 was also shut down. Following a detailed review, a programme of remedial work is being implemented to enable the safe return to service of both reactors. This includes enhancements to instrumentation to monitor the BCUs during operation.

Hunterston B Vessel Entry Project

Manned entries into the reactors at Hunterston B and Hinkley Point B have been performed during statutory outages throughout their life by operators wearing specialist air-cooled suits. With the likely increase in the requirement for inspections and repairs as the stations near the end of their life, British Energy is looking at ways of improving or replacing the existing entry suits and associated equipment to reduce task time and radiological dose.

Graphite Core Inspection Equipment

The graphite cores of the AGRs are subject to ageing mechanisms that could potentially degrade their performance. To counter this risk, British Energy has developed graphite core inspection equipment to determine the condition of the cores during periodic reactor shutdown [see inset].

British Energy Pays Tribute to Andy Reynolds

British Energy has dedicated its Mk 2 New In-Core Inspection Equipment (NICIE) to Andy Reynolds, a founding member of Risktec, who sadly passed away on the 5th May 2007. Andy, a highly respected and charismatic engineer and risk management consultant, was instrumental in the development of BEs graphite core inspection equipment.

Mk2 New In-Core Inspection Equipment (NICIE)

British Energy, in conjunction with BNS Nuclear Services Ltd (formerly Alstec) and Risktec, has developed the new equipment to enhance graphite core inspection operations. The Mk2 NICIE is capable of performing channel bore/tilt measurement and TV inspection activities in a CO_2 or air reactor atmosphere at Hartlepool, Heysham 1, Hunterston B and Hinkley Point B. Risktec provided safety/design integration and safety case expertise.

For further details, contact Steven Roach (Glasgow).

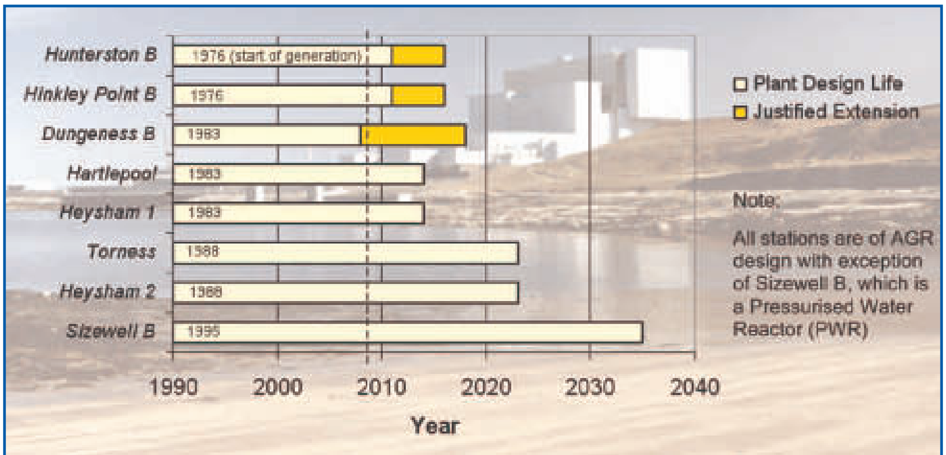


Figure 1 – Remaining Life of British Energy Nuclear Power Stations

Wind of Change

The Risks & Rewards of Wind Power

It is now widely accepted that global temperatures are increasing due to the increased emission of greenhouse gases trapping the sun's heat in the Earth's atmosphere.

In an effort to tackle this global warming, the Kyoto Protocol sets binding targets for industrialised countries to reduce greenhouse gases, with the UK agreeing to a 12.5% reduction from 1990 levels by 2012 [Ref 1].

In 2003, for example, electricity generation was directly responsible for a quarter of all UK greenhouse gas emissions [Ref 2]. As a result, the electricity industry is being targeted by the UK government in the drive to meet Kyoto targets. More specifically the Renewables Obligation, the UK Government's mechanism to promote renewable energy development, requires licensed electricity suppliers to source a percentage of their electricity they supply from renewable sources — 9% for 2008/09 rising to 15% by 2015/16 [Ref 3].

Wind of fortune

Whilst work continues in the development of other renewable energy technologies (wave, tidal, solar, geothermal, biomass etc.), wind power is perhaps the most immediately viable option in the UK due to the relatively simple, available technology, coupled with the country's climate and geography.

As a result, the UK has seen a rapid growth in the number of wind power generation schemes [see Fig 1], with this trend likely to continue into the future.

Hazards of wind power

Planning applications for wind power developments and media coverage have tended to focus primarily on environmental issues, such as visual impact, noise, and the effect on wildlife. Yet, there are a number of other potentially significant hazards associated with the operation of wind turbines.

Failure of the turbine tower or its foundations could result in toppling, posing a risk to people and surrounding infrastructure. Failure of a turbine blade, due to a structural defect or turbine overspeed for example, could cause all or part of the blade to be shed at high speed, potentially travelling large distances. Similarly, any ice formed on the blades could be shed as a result of an increase in wind speed or temperature.

The consequences of these hazards are largely dependent on the physical location of the turbine. A large wind farm on desolate moorland in rural Scotland, for instance, is likely to present a reduced risk compared with a single turbine in an urban setting.

This brings the relatively recent and growing trend of installing small scale turbines on schools, shops, houses etc. into sharp focus. Similarly, whilst the siting of large wind turbines on brown-field sites presents a number of undoubted advantages (e.g. land remediation, availability of grid connection and ease of access), the consequences of blade shedding or tower collapse may be considerable if they are located adjacent to populated buildings or industrial facilities with hazardous materials or processes.

Accessing wind turbines to complete maintenance or repairs also presents its own hazards. With the majority of electromechanical equipment located anything up to 100m above ground level there is an obvious risk of a fall from height. Accessing offshore wind turbines by boat poses additional challenges, especially if the weather worsens.

Lessons from the past

The worst case consequences of wind power hazards are much less severe than those associated with other industries such as nuclear power, oil & gas and rail transport.

Nevertheless, the wind power industry has the opportunity to read across and adapt relevant risk assessment and management techniques and processes in order to demonstrably control any significant hazards.

Until this is achieved, the wind power industry remains exposed to the risk of a major incident, which could dramatically affect public opinion and limit future development, at least in the short term.

Contact Gareth Ellor (Glasgow) for further information.

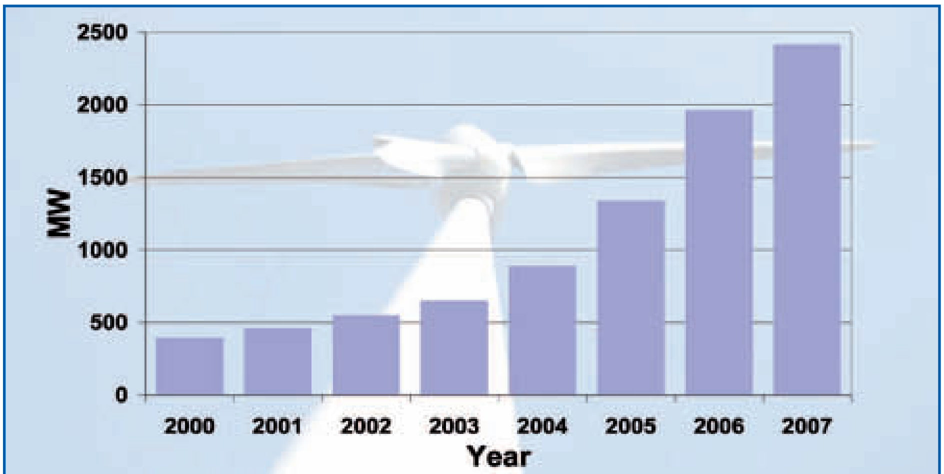


Figure 1 – The Growth of UK Wind Power Generating Capacity [Ref 4]

References

1. Department for Environment, Food and Rural Affairs [www.defra.gov.uk]
2. UK Statistics Authority [www.statistics.gov.uk]
3. Department for Business Enterprise and Regulatory Reform [www.berr.gov.uk/energy/sources/ renewables]
4. British Wind Energy Association [www.bwea.com]

Preventing 'Sub-prime Safety'

There are many parallels between the causes of the current credit crisis in the financial markets and the causes of major accidents in high risk industries [see RISKworld Spring 2008]. These include ineffective leadership, weak management systems and a 'profit at all costs' culture, as well as a lack of understanding of the underlying technical risks and their inter-dependencies.

Leading from the top

So how should organisations prevent 'sub-prime safety'? A recent UK HSE conference "Leading from the Top" involving CEOs, industry leaders, regulatory bodies, unions and government ministers, defined seven key elements (see Box 1) for effective safety risk management [Ref. 1].

Box 1 - Avoiding major accidents

- Leadership demonstrated by actions from the top
- Accountability at all levels
- Real and dynamic risk assessments
- Robust management of change processes
- Sustainability focusing on the long-term
- Well trained and competent people at all levels
- Learning and looking for lessons both within and without

Understanding risk scenarios and their controls

To allow all levels of an organisation to play their part, clear accountabilities should be defined and everyone should understand the risks faced and their role in controlling those risks. Whilst complex risk assessments have their place, it is questionable whether the comprehension of a numerical quantification of risks is necessary at the board level or at the work site.

Risk assessments must always be fit for purpose. Tools such as bow-ties [Ref. 2] have been proven time and again to remove the mystique from risk management and allow people to focus on what really matters (see Fig. 1).

The simple graphical format allows for immediate understanding of the complete picture – the causes and consequences of business upsets and how these are prevented and mitigated. In this sense it is true that "a picture paints a thousand words".

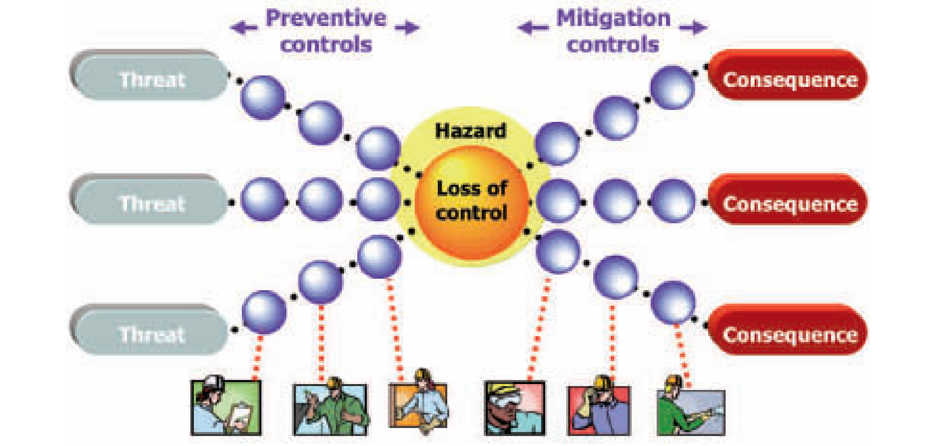


Figure 1 – The bow-tie method: helping to ensure that risks are managed rather than just analysed

Really understanding the controls

Every control should be closely examined by the organisation to confirm its effectiveness. Typical areas of uncertainty may include:

- Does the control actually exist and work as intended, e.g. level switches at Buncefield?
- Are responsibilities for the control clearly defined, e.g. permit-to-work at Piper Alpha?
- Will the control continue to work in the future, e.g. O-rings on Challenger space shuttle?
- Is supporting documentation in place, sufficient, controlled and available, e.g. management of change at Flixborough?
- Is the level of control suitable and sufficient, e.g. safety systems at Bhopal?

Such questioning of the risk controls provides for a thorough, transparent review of the risk management process. It not only establishes a snapshot today, but also ensures control is maintained for the future. This approach also provides a benchmark against which change can be reviewed, whether to hardware, the organisation, or to personnel.

Identifying the jobs that are critical to implementing the controls highlights the need for the personnel doing those jobs to be well trained and competent to fulfil their roles. This direct link between risk control and personal responsibilities promotes understanding and ownership and can be further enhanced by the use of competency management systems such as SkillsXP [Ref. 3].

Reviewing the bow-tie controls against incidents occurring within the organisation and also externally, allows valuable lessons to be learnt as to whether the overall risk control is weak or could be further improved.

Conclusion

Following the investigation into the Texas City refinery explosion, the safety review panel concluded [Ref. 4], "We are under no illusion that deficiencies in process safety culture, management, or corporate oversight are limited to BP. Other companies and their stakeholders can benefit from our work." Similarly, the lessons of the sub-prime mortgage crisis apply to all of us, irrespective of industry.

Bow-ties are not a panacea for all risk management problems, but their spread across companies, industries, countries and from industry to regulator is not surprising given the power of the approach. What's more, their application can embrace all risks, whether safety or financial.

Risktec regularly runs a masterclass in the application of the bow-tie method. For further information, contact Andy Lidstone (Warrington).

References

1. Leading from the Top - Avoiding Major Incidents, Apr-08, http://www.hse.gov.uk/leadership/mhconference.htm
2. RISKworld Issue 6, Autumn 2004.
3. RISKworld Issue 8, Autumn 2005.
4. Report of the BP US Refineries Independent Safety Review Panel, January 2007.

Integrating Human Factors in Safety Management

Leonardo Da Vinci's Vitruvian Man

To err is human

The perfect geometric symmetry of Leonardo Da Vinci's Vitruvian Man belies man's innate capacity for error. For example, the UK's Health and Safety Executive (HSE) estimates that up to 80% of accidents are attributed to human error – factors can include poor design, poor maintenance, attitudes to health and safety, inadequate training or supervision, lack of emergency preparedness, poor work planning and an ineffective organisation.

As the technical complexity of equipment increases, the potential for unsafe events can also increase. However, a study by the Health and Safety Laboratory [Ref 1] found that the adequacy of the safety management system and the health of the safety culture were the major determinants of accident rate, not the level of technological complexity.

Human factors

The human factors discipline applies knowledge of human characteristics to optimise the performance and inherent safety of products, equipment, systems, environments and organisations.

Human factors are often seen as a design and operations issue, and somehow not relevant in a broader organisational context. However, organisational issues are both crucial and often under-recognised. HSE research [Ref 2] indicates that although the immediate causes of major incidents frequently involve human error of operators or maintenance personnel, the root cause of these errors were the responsibility of those more senior in the organisation [see also Six Steps for Successful Incident Investigation on page 6].

Viewing the scope of human factors from the perspective of organisational management, rather than just design and operations, has far-reaching implications. The link between organisational and risk performance is illustrated by the key factors which affect risk management of major hazards [see Box 1]. Each factor is clearly influenced by human fallibility.

Box 1 – Key Risk Factors

- Allocation of resources (equipment and personnel)
- Determining priorities
- Planning and scheduling of work activities
- Learning lessons from operating experience
- Recognising and managing change
- Competency assurance systems
- Leadership
- Risk analyses, audits, associated decision-making and action

Integration is key

For risk assessments to be meaningful and to assure continued safe operation, assumptions on human performance must be identified transparently and then addressed effectively and consistently across the organisation, albeit in a targeted way. Where human factors assessment takes significant credit for human action, whether explicitly or implicitly, this should be backed up by specific provision, typically through:

- Ergonomic design
- Optimised procedures
- Supporting assessment and demonstration (e.g. during commissioning)
- Sufficient competent personnel
- An effective supporting organisation

Implementation

There is a wide array of tools and techniques available for assessing and managing human factors [see Box 2], but the choice and level of detail should vary according to the application, the level of associated risk and the influence of human factors. The aim should be to gain a complete oversight and target areas that offer the largest benefit in terms of risk reduction, while ensuring a clear audit path.

Box 2 – Typical HF Tools & Techniques

- Human factors integration planning
- Hazard & operability study (HAZOP)
- Task analysis
- Human reliability assessment
- Ergonomic assessment of design
- Workload analysis
- Competency assessment & management
- Training management
- Change management planning
- Incident investigation (root cause analysis)
- Cultural & behavioural assessment

Conclusion

The consideration of human factors in design, operations, and maintenance is generally accepted practice. However, its use in shaping and improving an organisation's approach to safety management in an integrated manner is largely untapped, and yet potentially offers the greatest rewards.

For further information, contact John Hobson (Warrington).

References

1. http://www.hsl.gov.uk/case-studies /accidents.htm
2. Behavioural Safety and Major Accident Hazards: Magic Bullet or Shot in the Dark? Martin Anderson, Health and Safety Executive.

Six Steps for Successful Incident Investigation

Organisations investigate business upsets because they are required to by law or their own company standards, or the public or shareholders expect it. But, whatever the motivation, the goal is to identify why the incident happened and to take action to reduce the risk of future incidents.

Investigations often find that similar scenarios have occurred previously but, for a variety of reasons, did not result in serious consequences. This is increasingly recognised in high-risk industries where "near misses" are also investigated as well as incidents which actually resulted in loss.

A six-step, structured approach to incident investigation (Fig 1) helps to ensure that all the causes are uncovered and addressed by appropriate actions.

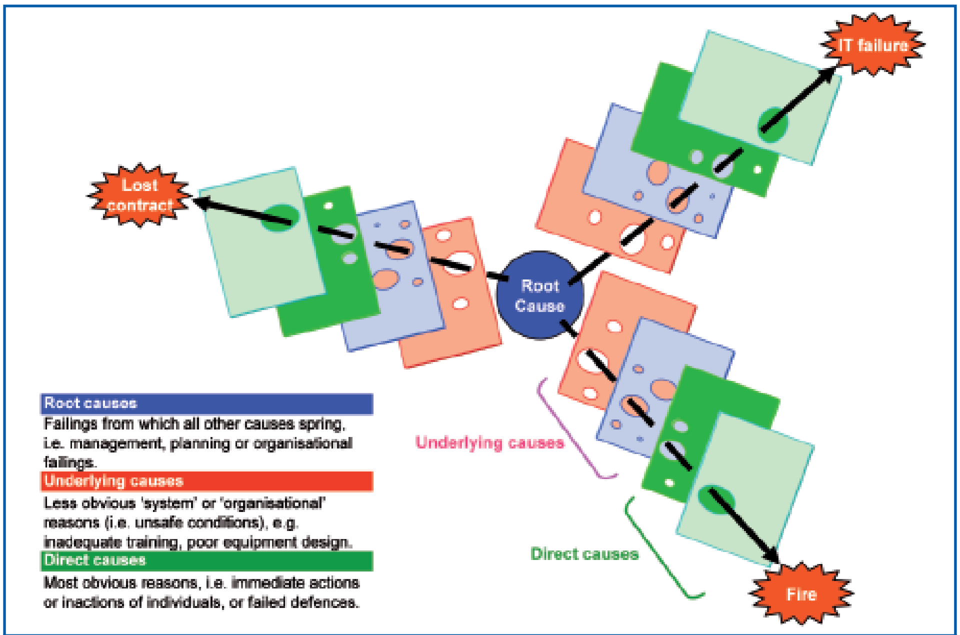


Figure 2 – The potential for a single root cause to result in different types of business upset

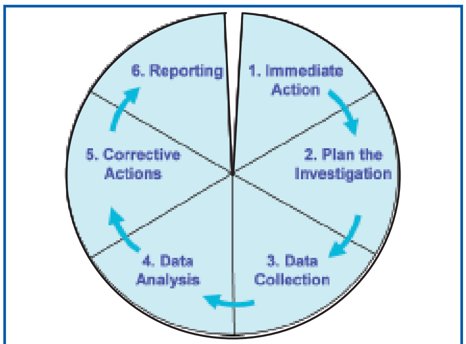


Figure 1 – Six steps of incident investigation

Step 1 - Immediate action

In the event of an incident, immediate action to be taken may include making the area safe, preserving the scene and notifying relevant parties. The investigation begins even at this early stage, by collecting perishable evidence, e.g. CCTV tapes, samples.

Step 2 - Plan the investigation

Planning ensures that the investigation is systematic and complete. What resources will be required? Who will be involved? How long will the investigation take? For severe or complex incidents, an investigation team will be more effective than a single investigator.

Step 3 - Data collection

Information about the incident is available from numerous sources, not only people involved or witnesses to the event, but also from equipment, documents and the scene of the incident.

Step 4 - Data Analysis

Typically, an incident is not just a single event, but a chain of events. The sequence of events needs to be understood before identifying why the incident happened.

When asking why, we need to identify the root and underlying causes, as well as the direct causes. Failures and mistakes don't just happen by themselves; organisations allow error-enforcing environments that encourage direct causes to develop and persist. Such environments, and the basic management failings behind them, are the root causes – the ultimate source of the incident.

While human error plays a part in the majority of incidents, people are not generally stupid, lazy, forgetful or wilfully negligent. Human errors occur because of influencing factors associated with the work, the environment, an individual's mental or physical abilities, the organisation and its management systems. Any investigation which sets out to find someone to blame is misguided.

Step 5 - Corrective actions

Many investigations make the mistake of raising actions which deal only with the direct causes – a quick fix, putting last-lines-of-defence back in place. By ignoring the root and underlying causes, not only do they miss an opportunity to reduce the risk of recurrence of the incident, but they also leave open the possibility that other, dissimilar incidents may also occur, arising from the same, common root cause (Fig 2).

Step 6 - Reporting

The investigation is concluded when all outstanding issues have been closed out and the findings have been communicated so that lessons can be shared. Communication mechanisms include formal incident investigation reports, alerts, presentations and meeting topics.

Tools to help

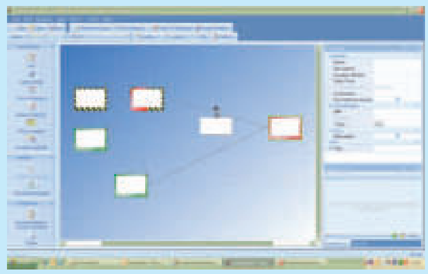
Checklists, proformas and posters can be useful when setting terms of reference, collecting and structuring information, analysing causes, etc.

There are also software tools available to help with the entire incident investigation and analysis process, for example TOP-SET Governors' Investigator3 (see Box 1), and also for recording and tracking incident statistics, their causes and the actions arising from the investigation.

For further information, contact Sheryl Hurst (Warrington).

Box 1 – Investigator 3

Investigator3 includes the Kelvin TOP-SET® planning tools, which support the structured collection of evidence, and provides a choice between Root Cause Analysis and the Tripod Beta method for incident analysis.



UK Principal Office
Wilderspool Park
Greenall's Avenue
Warrington WA4 6HL
United Kingdom
Tel +44 (0)1925 438010
Fax +44 (0)1925 438011

Other UK Offices
Aberdeen
Ashford
Edinburgh
Glasgow
London

Middle East
Dubai
Muscat

North America
Calgary
Houston
Washington, DC

For further information, including office contact details, visit:
www.risktec.co.uk
or email:
enquiries@risktec.co.uk