

RISKworld

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In This Issue

Welcome to Issue 28 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.

Contact: Steve Lewis (Warrington)
steve.lewis@risktec.com

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Who better to let us into the secrets of good HAZOPs than those unsung heroes, the HAZOP scribes. Annette Kyle reports.

RAM 101

Paul Laughlin gives a whistle stop tour of Reliability, Availability and Maintainability modelling. What is it, how do you apply it and why?

Safe and secure

When security threats are constantly evolving and resources are becoming more and more stretched, doesn't the integration of safety and security make complete sense? Keilson Foote thinks so.

Cost-conscious safety

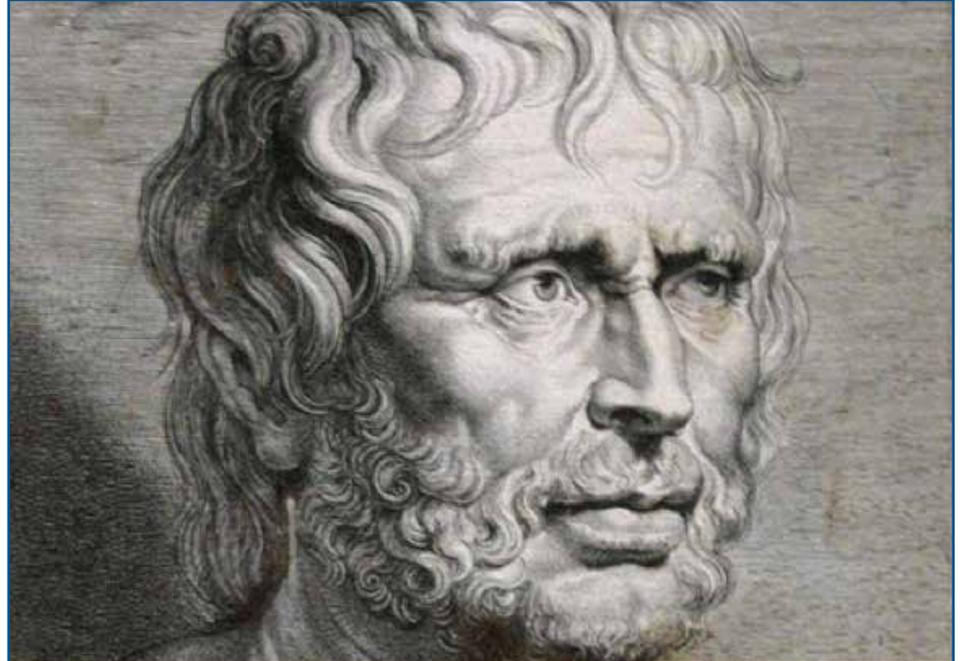
As budget cuts deepen and projects are shelved, what does this mean for safety professionals? A prime opportunity to innovate and improvise, argues Steve Lewis.

Gold blend

Vicky Billingham introduces us to the concept of blended learning. What is it and why is it growing in popularity?



Meeting the Challenges Ahead



*"Difficulties strengthen the mind, as labour does the body."
Seneca. Roman philosopher circa 4 BC - 65 AD*

Organisations operating in high hazard industries face considerable inherent challenges and scrutiny from many quarters. On top of this, factors beyond the direct control of the organisation can have a considerable influence. Today, worldwide economic uncertainty, the low oil price and the threat from terrorism are of increasing concern to many of these organisations.

Risktec's Managing Director, Alan Hoy comments, "We are very conscious of the evolving challenges faced by our clients around the world and are highly focused on delivering high quality, value for money services. We are extremely pleased with the very positive feedback received from our most recent six-monthly client survey and we remain committed to follow up and resolve any issues. The overwhelmingly positive feedback motivates all of us to strive to maintain and improve this high standard.

"On a separate note, Risktec has settled very well into the TÜV Rheinland Group and we are working closely with our colleagues in a number of regions and sectors to develop and enhance our services. One particular area of strength is Asset Integrity

Management where we offer an extensive integrated service to our clients, at a time when many assets are ageing and financial constraints are deepening."

In this edition of RISKworld we present a range of topical articles which provide some insight as to how we are continuing to develop our business to meet the current and future needs of our clients. The relevance of security and efficiency continues to rise, whilst established techniques, such as RAM and HAZOPs are always in demand. Our training and education services now include the innovative approach of blended learning and we also took great pride in seeing the students from our first distance learning programme receive their MSc award at the summer graduation ceremony in Liverpool.

As the quote from the Roman philosopher Seneca indicates, difficulties and challenges are nothing new and no doubt new safety and security issues will emerge. How they are understood and responded to is the responsibility of everyone involved.

Contact: Alan Hoy (Warrington)
alan.hoy@risktec.com

Secrets of Successful HAZOP Scribing

Hazard and Operability (HAZOP) studies are one of the most commonly used hazard identification methods in the high hazard process industries. Experienced HAZOP leaders are crucial to the success of the study, bringing together their technical knowledge and team facilitation skills to ensure a comprehensive and accurate study. But the quality of the study, especially the output, is also highly dependent on the quality of the reporting, which is the work of the HAZOP scribe.

Below, we have pooled the experience of some of our scribes in the Risktec Houston business to give you our top tips for successful HAZOP recording.

1. Be prepared

As with all workshops, the success of a HAZOP depends on good planning and preparation by the facilitator and scribe. As well as obvious things like arranging a suitable venue, testing laptops and projectors, defining HAZOP nodes and guidewords, and having drawings and other technical information available, it is good practice to provide a briefing note in advance so that attendees are up to speed. Coming armed with an attendance sheet and name cards for delegates can add another touch of professionalism to proceedings.

2. Anticipate issues

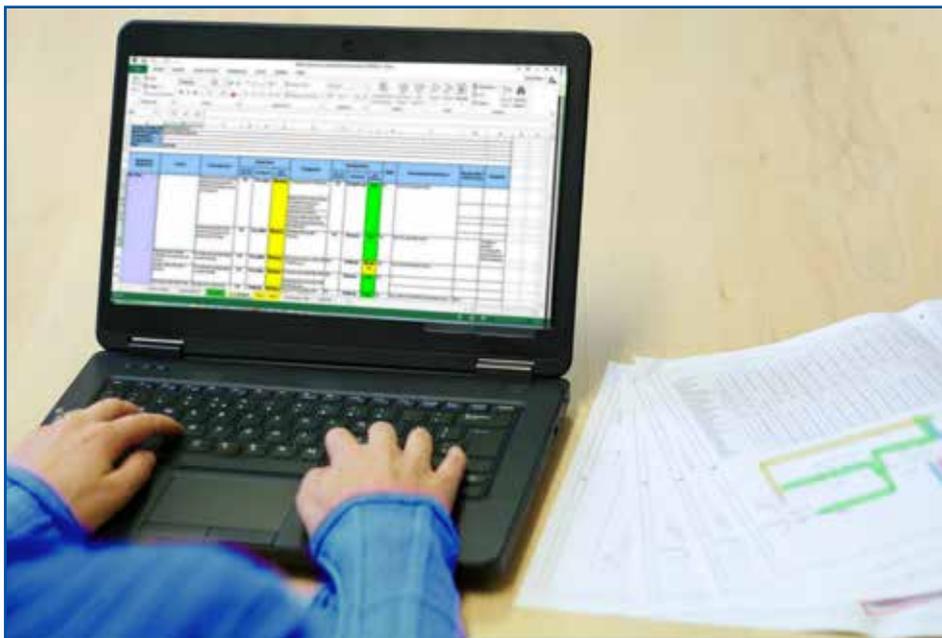
It is worth considering beforehand what the main talking points might be and anticipating what further information might be needed to address any issues, provided of course this can be achieved quickly. A broader solution is to copy the entire electronic project file onto your laptop so that you're ready for any eventuality. If it's a follow-on HAZOP, make sure you have the previous reports in case related questions arise.

3. Manage expectations

If you're meeting for the first time, it is a good idea to run through the recording process with the team, so that everyone knows what to expect and how information will be structured, both on the day and in the final report. Remember that some might be new to the HAZOP process or the method of recording, e.g. proprietary software. The HAZOP facilitator might choose to do this as part of the introduction or may look to the scribe. Agree beforehand who does what so that it all goes smoothly.

4. Consider pre-populating

HAZOP studies can be expensive endeavours, both in time and resources. Whilst an effective facilitator can be instrumental in speeding the process up, progress can be accelerated by pre-populating the HAZOP record with information. For example, for each node the



potential causes of a hazard can be pre-loaded in readiness, and suitably tailored as you go. Developing a standard approach to hazard recording also helps because this allows a high degree of smart copying and pasting.

5. Stay focused

Being a scribe is more than speedy typing. You need the mental stamina to remain alert and engaged with the exchange between engineers, operators, process and design leads. Whilst strong coffee and a good night's sleep can help, the key is to stay focused and interested in the subject matter, and not be concerned that every keystroke is projected on a big screen, mistakes and all. A good facilitator makes all the difference in how the day goes, but it is up to the scribe to ensure that scenarios are documented thoroughly and accurately.

6. Look ahead

After a while, a good scribe will be able to see where a discussion is leading, anticipate the outcome and start typing early. Taking the initiative as hazards become clear can serve to bring discussion to a head and promote agreement. Not only does this speed things up, but it also makes the facilitator's job much easier.

7. Clarify and confirm

For even the most experienced scribe there will be times when an issue seems confused or ambiguous. Rather than just launching into type, it is wiser to take a moment to clarify. More generally, blind alleys can easily be avoided if you confirm your understanding of complex issues before committing to electronic ink.

8. Adapt to different styles

The more a facilitator and scribe work together, the more effective they are as a team. Each facilitator has a certain style and set of preferences, as does the client. Some studies can be high level and fast-paced, others require a more detailed, methodical approach. Many need recording using proprietary software, some may simply use a Word table or Excel worksheet. Simply recognising this fact and remaining flexible is the first step to being a great scribe.

Conclusion

Facilitators tend to grab the limelight of a HAZOP study. But it is the ability of the scribe to work seamlessly with the facilitator and accurately record the team's views that also ensures the quality of the documented HAZOP.

Contact: Annette Kyle (Houston)
annette.kyle@risktec.com

With thanks to Terri Carpenter, Michael LaCour, Tamera Krieter, Evan Sattlem, Nathan Scott and Tracy Wilson



Introduction to RAM Modelling

Reliability, Availability and Maintainability (RAM) are system design attributes that can have a substantial impact on the lifecycle cost and performance of an engineered system. In RAM modelling, **Reliability** is the probability of zero failures over a defined time interval. **Availability** is the percentage of time a system is considered ready to use when tasked. **Maintainability** is a measure of the ease with which a system can be restored to operational status following a failure.

Whilst the word reliability can be traced back as early as 1816 to poet Samuel Coleridge, it was not until 1941 that German aircraft designer Robert Lusser recognised the need for a separate reliability engineering discipline. It has since become commonplace throughout all engineering-based industries, including oil and gas, nuclear, manufacturing, defence and transport.

Why conduct RAM studies?

The aim of a RAM study is to identify any significant causes of loss of operational availability or issues that may limit the production throughput and then propose improvements to the design or maintenance regime that enable RAM targets to be met.

Ideally, a RAM study (supported by a Failure Mode, Effects and Criticality Analysis, FMECA), would be conducted in the early stages of a project. This can then be reviewed and updated as the project progresses, with minimal disruption and cost to a project.

How are RAM studies conducted?

Normally a “bottom-up” approach to RAM modelling is taken. This starts with the system components and examines the design to determine the effects of individual component failure, often using a Reliability Block Diagram (RBD). The components making up the RBD are linked using reliability logic rather than their physical relationship.

Equipment failure data are applied to each component in the system. These data can be obtained from several sources such as manufacturing data, design specifications or operational experience. The key to a successful and accurate study is the quality of the failure data. In cases where failure data specific to the actual component are not available, generic, industry standard sources are normally used, e.g. OREDA 2009.



Using specialised RAM software, operational availability can be predicted and analysed. The software may be industry standard packages such as MAROS or Reliability/Availability Workbench, or in-house developed spreadsheets. The main advantage of the software is that it enables the rapid evaluation of design options and the sensitivity of the results to changes in the underlying data. Quantitative results provide not only headline RAM figures, but also allow the identification of critical components.

Some of the more common pitfalls to avoid when conducting RAM modelling are highlighted in Box 1.

Box 1 – Common Pitfalls of RAM

- Setting unrealistic RAM targets
- Using inappropriate failure data
- Manipulating the model to justify a desired decision
- Linking models based on physical interfaces rather than reliability logic
- Modelling contractual boundaries rather than the system
- Conducting the modelling as a theoretical backroom exercise instead of engaging with designers, operators and maintainers
- Neglecting preventive maintenance programmes

Key questions

Once the baseline RAM of the system is established, the following considerations should be addressed:

- Has the design met all the RAM requirements and targets?
- Can the design or operation be modified to increase the availability of the system?

- Can the maintenance strategy be revised to reduce downtime in the event of failure?

For availability - critical equipment, a targeted preventive maintenance programme should also be instigated, which may include monitoring to detect changes in performance or deviations from normal operating ranges.

Benefits

RAM modelling identifies areas of vulnerability which can affect operational availability and quantifies which assets and associated maintenance activities dominate downtime. Knowing this, the system design can be optimised, including its configuration, level of redundancy, component selection and supporting maintenance strategy. As well as suggesting tangible improvements, a RAM programme can provide confidence that the system will meet its operational targets and support wider project decision-making.

Conclusion

RAM modelling has a long history in engineering sectors. Used appropriately, RAM modelling is an effective tool for assessing system reliability, availability and maintainability, and is crucial to support the through-life viability of a project.

Contact: Paul Laughlin (London)
paul.laughlin@risktec.com

Safe and Secure? The Integration of Safety and Security

The emerging terrorism threat worldwide, and in particular, the threat from the well-informed insider wanting to do harm and willing to die for the cause, is challenging conventional security practice at high hazard sites and public places. To counter this threat, industry has responded with discrete security enhancements which can often result in conflict with safety requirements. This is well illustrated by the recent Germanwings tragedy, where enhanced cockpit security measures enabled the pilot to deliberately crash the plane.

Common goals

Developing effective security requires an ever greater understanding of the operations within a high hazard site in which critical assets are identified and proportional security measures are applied for their protection against a range of credible attack scenarios. This is akin to the approach followed in safety cases in assessing and mitigating the risk across the range of major accident scenarios.

Since security and safety share the common aim of protecting people, safety-critical assets tend to be security-critical assets. Hence, having a common approach to security and safety would introduce consistency and, if integrated, would naturally identify and manage conflicts, as well as realising efficiency savings.

The concept of integrated security and safety has been around for some time, and it is interesting to note the lead taken by the UK's Office for Nuclear Regulation recently in the integration of its safety and security regulatory organisation. However, the delivery of integrated safety and security by industry has been slow, predominantly because of the different approaches taken

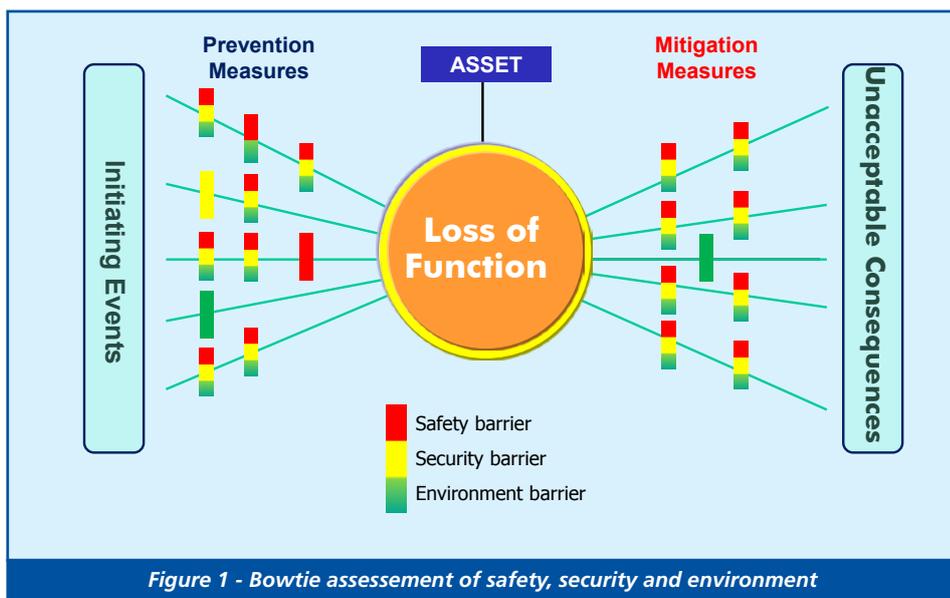


Figure 1 - Bowtie assesment of safety, security and environment

by the two sets of practitioners, and the higher levels of security clearance required for some of the more sensitive activities. Furthermore, security has tended to be more prescriptive than the risk-based practice of safety and also communication around security tends to be on a need-to-know basis whereas safety emphasises widespread, open communication.

Bowtie analysis

Recognising these differences, a workshop-based approach can form an effective basis for the delivery of an integrated safety and security solution. This is illustrated in Figure 1 using the bowtie approach in which safety and security is also integrated with environmental protection.

Attended by safety, security and environmental practitioners, as well as designers and operators, the workshop would establish potential initiators that could start a chain of events leading

to unacceptable consequences, the preventive and mitigative barriers and their functional requirements. For barriers delivering multi-functions, any conflict between safety, security and environmental functions is readily identified and can be deconflicted by the assembled team.

The bowtie approach facilitates a greater understanding of the operations and hazards, enabling the development of proportional, asset-specific security management arrangements to protect against credible attack scenarios, including the well-informed insider. This, and the interface between security and safety, also support future security reviews and ensure that meaningful, safety-informed, security enhancements are delivered.

This philosophy of integration can be extended to put in place an integrated operational management system, as illustrated in Figure 2, noting that the barriers may be plant, processes or people. An integrated management system would have the clear benefit of avoiding ambiguity and delivering efficiency savings for those barriers that deliver a combination of safety, security and environmental (SSE) functions.

Conclusion

In a world where security threats appear to be constantly evolving and resources are becoming more and more stretched, the integration of safety and security makes sense on a number of levels, from improving understanding to the effective and efficient provision of security measures.

Contact: Keilson Foote (London)
keilson.foote@risktec.com

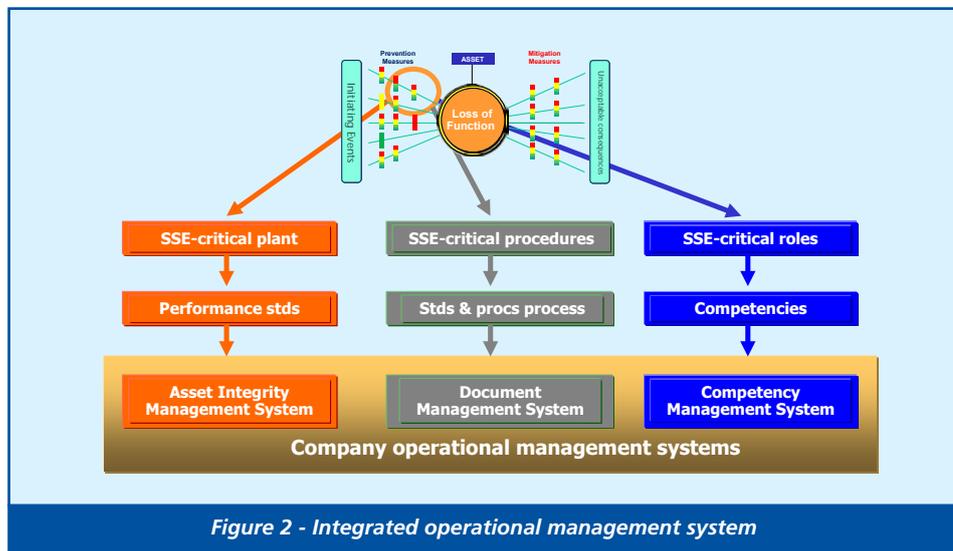


Figure 2 - Integrated operational management system

Improving Efficiency in Safety in a Cost-Conscious World

Every industry cycles through periods of favourable and unfavourable economic conditions. The petroleum industry, for example, having enjoyed several years of high oil prices, is today reeling from the impact of prices not seen for six years and at levels that are lower than the breakeven cost of many ventures. The inevitable response is to cut operating costs and delay investment in new projects, which all makes for gloomy headlines and the harsh reality of people losing their jobs. But with the gloom comes the opportunity to improve the efficiency of operations, something that is rarely a top priority when budgets are plentiful and there is huge programme pressure.

This article highlights some examples where more innovative approaches to safety and risk management can contribute to improving efficiency and performance.

Maximise recycling

Whilst it is true that no two technical safety studies are ever precisely the same, there are often many similarities. Significant time can be saved by basing a new study on the most recent and relevant good practice elsewhere rather than attempting to reinvent the wheel. Moreover, putting in a little effort upfront to standardise approaches can save considerable effort in the long run, for instance by using proven templates for hazard registers, bowtie models and HAZOP reports, as well as adopting streamlined QRA methods and standardised models.

Enable with software

Use of technical software is common in safety risk analysis to solve complex numerical problems in an efficient way. But many of the well-established products do not link well with each other. For example, CFD explosion analysis software does not automatically produce results in a form that can be used by QRA software. Developing in-house tools to pre- and post-process data such that it can be readily used between different software not only saves costs by improving efficiency, but also improves the quality of the results and value of the findings.

Challenge nice-to-haves

When more and more preferential requirements are added into standards by well-intentioned technical authorities, the standards can lead to gold-plated engineered solutions. In fact, the safety



risk may even be higher than a simpler, cheaper solution based on inherent safety thinking. A robust ALARP (As Low As Reasonably Practicable) process enables a transparent challenge to nice-to-have requirements so that the design focuses on what is necessary rather than what is preferential. What is essential here is highly experienced expert judgement during option studies and ALARP assessment, which focuses on delivering a proportionate risk-based design.

Tap into graduate potential

Many companies underestimate the capabilities of graduates and assume that, until they have completed the traditional two year graduate training scheme, they are a burden on the organisation. But given the right opportunity and support, graduates can be a very cost-effective resource. One example is to ring fence two or three graduates to work at a facility to concentrate on improvements in equipment reliability and maintenance. Experience has shown that their cost will be repaid many times over due to reducing equipment maintenance backlog by eliminating unnecessary work, introducing more advanced inspection techniques and increasing equipment reliability.

Learn by distance

Training budgets are amongst the first to be scrutinised during hard times. However, technical training is rarely optimised and often simply involves a selection of courses to travel to and sit in a classroom. E-learning has some clear cost saving advantages in that people can learn from wherever they have internet access and at times that best suit them. Furthermore, e-learning allows

measuring of progress using standardised tests which can be difficult to achieve by an instructor alone. Not everything can be taught using e-learning, such as HAZOP facilitation skills, which require live interaction with other people, but most technical safety skills lend themselves very well to online learning.

Package consultancy support

During the busy times it is common for projects to ramp up resource with large numbers of individual contractors. This is generally easy to organise and secures resources quickly. However, this approach has considerable hidden costs: the capability is limited to the skills of the individuals and if delays occur the costs are still incurred. Furthermore, when the end of the project is in sight the resource moves on and knowledge is no longer available. A more cost-effective and delivery focused approach is packaged consultancy support. Here, a scope of work is clearly defined with specific deliverables and prices. The consultancy draws upon its people with the required skills and largely conducts the work from its own premises with close contact with the client throughout. The client is always in control, the consultancy only works when the client has a need, and cost savings are realised.

Conclusion

Unfavourable economic conditions necessitate that organisations cut costs and delay investment. This provides safety professionals the opportunity to improve efficiency and performance of operations (whilst maintaining standards), something that is not always so easy when the industry is booming.

Contact: Steve Lewis (Warrington)
steve.lewis@risktec.com

