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Risk assessment—an insurer's perspective

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Abstract

With the current emphasis upon the use of quantitative risk assessment (QRA) for meeting legislative requirements, and the implementation of the Control of Major Accident Hazards (COMAH) directive in the UK, the author will aim to highlight in this article the numerous advantages of using qualitative risk assessment methodologies and the importance of understanding the impact of risk perception in such assessments.

Keywords: Risk assessment; Risk improvement; Insurer

1. Introduction

Those who create risks need to control them, either out of self interest because society forces them to do so, or because risk transfer mechanisms are too expensive or leave unacceptable residual risks. They are not likely to invest in risk improvements simply because an insurer asks, unless there is some benefit such as reduced premium or other spin off. Risk makers need to identify their risks, analyse and prioritise them, and develop risk improvement plans to satisfy their corporate strategies. They can do so by seeking outside help, have advice thrust upon them by regulatory agencies, or go it alone.

The first and second option can be expensive (for a number of reasons), and because they involve on-site consultations often involving third parties, are likely to result in weak commitment or even scepticism by line management.

The third option tends to be continuous and proactive, and requires in-house skills, time and commitment, and because it involves on-site expertise, is more likely to contain high validity results and gain commitment from line management.

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The UK Control of Major Accident Hazards (COMAH) regulations Article 9 para 1b [1] require that major accident hazards are identified and that the necessary measures are taken to prevent or mitigate such accidents, thus limiting their consequences for man and the environment.

Article 3 requires that the risk assessment captures all and every operation within the site boundary, not just processes, and that consequences beyond site boundaries are considered. Thus hazards identified for processes have to be assessed and prioritised along with, e.g. warehouses, unloading quays/jetties, for safety, health, environmental and other consequences, both within and beyond the site boundary. The ideal is that this be done with a single 360° hazard analysis methodology. The practice to date falls somewhat short of this ideal.

From our experience with personal misjudgements and technological surprises—clearly we can't size up all threats on an equal basis. Some can be assessed on actuarially, such as employee injuries or road accidents. Even so, individuals may not be aware of this data and understand their significance or be able to grasp what the numbers really mean or how they compare with other risk numbers. It is clear that little or no data or information exists to enable assessment of risks at the other extreme, e.g. as yet unknown long-term effects of some chemicals, or electromagnetic fields.

The bottom line is that whatever method is used to estimate risk, whether by scientists or lay people, it cannot escape the element of subjectivity which is involved in the defining of questions, designing of experiments, and assembling evidence.

In addition, there is the political aspect to consider. A complaint often registered by (smaller) companies is that regulation is enforced too stringently. However a current positive trend is that on all sides attempts are being made to simplify and deregulate where possible. COMAH is one example of legislation which generically categorises vs. the more typical piecemeal approach.

2. The traditional insurance survey—why it is outdated

From an insurance coverage perspective, COMAH captures and is not limited to, property damage and business interruption (PD/BI), general liability (GL), employer's liability (EL), and director's and officers (D&O) liability.

However, traditional insurance surveyors (and there are still some out there) will tend to concentrate on one coverage, primarily property damage and business interruption. Their recommendations can conflict with that provided by a surveyor from the liability insurers, e.g. storage of hazardous materials at an adequate distance from production building, vs. the requirement to store those same materials well away from the site boundary and from prying eyes or indeed vandals. Insurance reports based along these lines cannot claim to complement a customer's risk management processes, since the advice given is based on partial data, or a very limited view of the risk.

However, the picture does not end there. All too often one hears of only safety, health and environment (SHE) hazards in the chemical industry. What about product liability? The pharmaceutical industry, heavily regulated and relying upon trained and untrained intermediaries to ensure efficacy of their products, understand this well. Warning, labels and instructions regarding their products are very important.

In the chemical industry this could translate into inadequate information on a material safety data sheet (MSDS), or indeed on a label on a drum or bag container, resulting in incorrect storage (the operator may have handled the material entirely correctly based on the information he has seen) and subsequent fire/explosion.

Failures on sites, systems, procedures, instructions, whether they result in near-misses, accidents or major incidents, are really failures to manage, and thus the organisational structure and management systems are at least as important as types of buildings, equipment and process hazards. Zurich's risk engineering department concentrates upon assessment of management systems, and conclusions regarding the standard of the whole site will depend upon whether we believe the controls are adequate for the loss potentials present.

There is considerable parallel between those areas requiring assessment in the Zurich risk engineering property damage and business interruption, (PD/BI) and general liability (GL) assessment reports, and those areas which require consideration under COMAH, as listed in Annexes II, III IV, V (marked with *), as indicated in Table 1 below.

Table 1
Comparison between COMAH and Zurich PD/BI and GL reports—areas requiring assessment (items marked * appear in COMAH)

Property damage and business interruption	General liability
Business description (construction,	Access control *
occupation, protection, exposure) *	Safety of non-employees *
Site layout *	Contractors *
Fire division	Physical impact
Construction	Fire spread *
Tank storage *	Chemical releases *
Other storage *	Biological releases *
Processes *	Water damage *
Vapour cloud/BLEVE *	Physical emissions
Electrical systems *	Work-away coverage assessments
Utilities	Pollution (air, water, soil pathways) *
Maintenance *	Biological releases *
Contractor control *	Environmental impact *
Smoking controls *	Design/development (incl. MOC) *
Housekeeping *	Quality control
Emergency response *	Warnings/labels
Fire defection and alarms *	Instruction manual
Fire extinguishing *	Sales/marketing
Fire brigade response *	After sales service
Exposures *	Customer complaints handling
Intrusion/arson *	Document control *
Natural perils *	Customer control
Business interruption assessments	Life cycle *
Loss investigation *	Wholesale/distributor dealers

3. COMAH and the requirement for a 360° risk assessment

The success of any registered site meeting the COMAH requirement heavily depends upon the thoroughness of the hazard analysis methodology in use. Ideally the methodology needs to be (truly) holistic, forming the basis for the site or corporation risk management, easily understood by non-engineers and non-scientists whilst still being scientifically correct, time- and cost-effective, and highly visible in the way identified risks are addressed and prioritised.

Before we plunge headlong into meeting COMAH requirements, we should ask ourselves why we are carrying out these risk assessments, what the associated problems are, and consider how the results should be put across.

Failure of large technological systems tend to fall into the low probability but high consequence category. Quantified analysis of these is based on known or inferred failure rates of components, which are then combined to form subsystems. Add to this localised effects such as location, weather, type of service, competence of the workforce, maintenance, and we have a recipe with a high level of subjectivity [2].

The most coldly analytical methods are likely to be inaccurate due to deficiencies in data base or method itself. This is not to say that quantified risk analysis (QRA) is not useful, but it should be recognised that the accuracy is limited.

Risk assessors in any field need to consider measures of level of risk that society is willing to accept. Formal risk assessment can help clarify questions, make underlying assumptions more explicit, and describe options and trade-offs. Within this process, one must consider ‘goings and givens’, for example: the right of an individual to smoke, and the responsibility of manufacturing firms to protect their employees.

Whilst risk assessment has come very much to the fore in the last decade, hazard or risk analyses are not new to mankind. There is documentary evidence that as early as 3000 BC, Mesopotamians consulted experts or Asipu (conjurer) to help them reach risky, uncertain or difficult decisions. The Asipu would approach this task in a structured manner, collecting data from the gods, and totalling the pluses and minuses against certain parameters to come up with an overall positive or negative on a proposed solution and its alternatives [3].

Today these conjurers have been replaced by engineers and scientists, the pluses and minuses replace by apparently exact numbers e.g. 5.476×10^{-7}. However, the perception that many have is that the world of magic and gobbledegook is still very much with us.

There are therefore two broad categories of risk assessment; observation and calculation of the actual risk of process/project, and judgement of those assessing the risk. There also exists an issue regarding the nomenclature; objective and subjective, or an arrogant alternative; real and imagined. Technical experts tend to use the first, but the second dominates thinking and actions of most individuals. These differences in thinking create difficulties for decision makers and regulators, erode trust between experts and the rest of the public (BSE, Gulf War Syndrome, chemical industry). The two methods seldom appear to agree [4].

Studies by Slovic et al. [5] on societal perceptions of risk indicate that the extent to which risk is faced voluntarily, the potential for large catastrophic effects, as well as the *conception* of risk, determines the level accepted. Nuclear power was introduced to people in the form of Hiroshima—peoples' perceptions are shaped by first impressions, which tend to remain. Consider the petroleum industry; if society's initial knowledge was the use of Napalm in Vietnam and its hideous associations, as opposed to a cosy fire, perhaps individuals would not still be happy to drive down the road sitting on top of a 20-gal tank of gasoline. Refer to Fig. 1 and Table 2 below.

If this is not complicated enough, society is both risk aversive and risk embracing—it is extremely critical if an airplane falls out of the sky, but at the same time participates in hang-gliding, potholing or skiing [6].

Even so, experts still tend to try and alter public to their own view—this is futile. A lot of time and energy has been and will continue to be wasted on this approach instead of making real progress towards solutions [7].

The problems of distrust between experts and the rest of the public are exaggerated in case of industrial scientists and engineers. This is exacerbated further because people tend (not always with good reason) to look with suspicion on motivations of industry. Another issue is that experts begin to doubt rationality of public and criticise emotionalism—resulting in occasional confrontation.

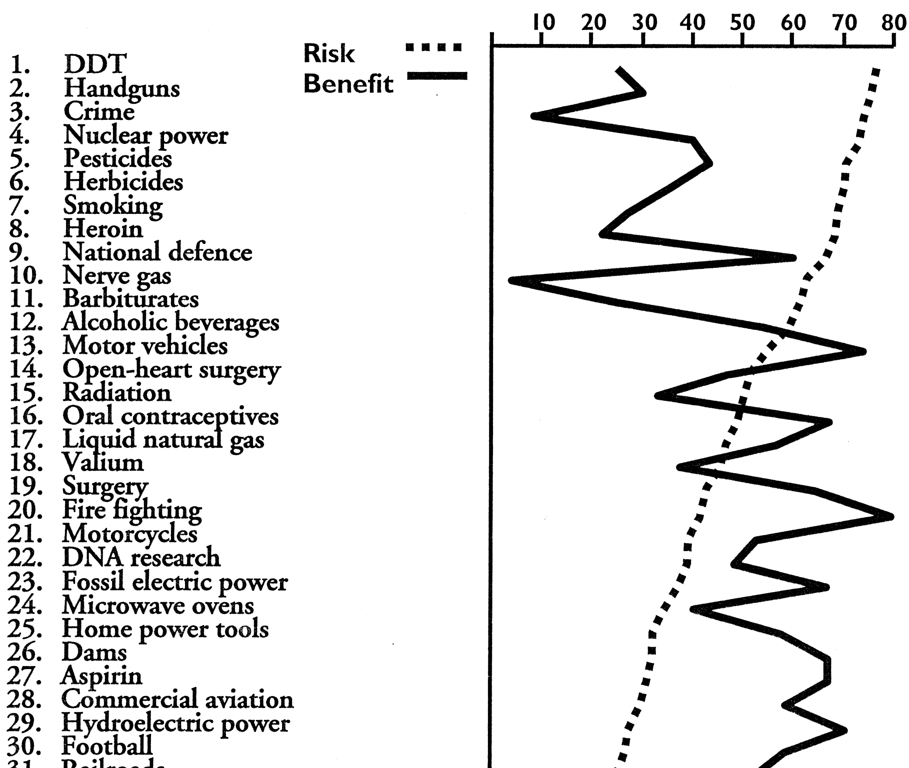

Fig. 1. Societal Risk Assessment, How safe is safe enough? ''Facts and Fears'' by P. Slovic, B. Fischof, S. Liechtenstein, Decision Research, Eugene, OR, Plenum Press, New York, 1980.

Table 2
Sixteen qualitative risk characteristics used in the factor analysis of Slovic et al. [5]

1. Uncontrollable	Controllable
2. Dread	Non-dread
3. Global catastrophic	Not Global catastrophic
4. Consequences fatal	Consequences non-fatal
5. Not equitable	Equitable
6. Catastrophic	Individual
7. High risk to future generations.	Low risk to future generations
8. Not easily reduced	Easily reduced
9. Risk increasing	Risk decreasing
10. Involuntary	Voluntary
11. Affects me	Does not affect me
12. Not observable	Observable
13. Unknown to those exposed	Known to those exposed
14. Effect delayed	Effect immediate
15. New risk	Old risk
16. Risks unknown to science	Risks known to science.

On the other hand, legislators who are popularly elected every few years are tending to show more concern for perceptions of risk than do regulators who are shielded from public accountability. Under the COMAH permissioning regime, the UK Health and Safety Executive (HSE) will be more directly accountable.

So—the gap between experts and public can't be narrowed by forced change of public opinion alone. Experts need to work at reversing the image that society has of them as being self-serving self-ruling enemies, and they need to understand the importance of the public's perceptions and their inclusion in decision-making processes.

4. The way forward—a team approach to industrial and environmental safety

Zurich Risk Engineering believes that only the company itself has the necessary knowledge about their processes and sites, and therefore should not leave the task of risk analysis to an external group of consultants. The consultants role should be to lead team of the company's line managers through the risk analysis, provided of course he knows one of the proven hazard analysis methodologies. The Zurich Hazard Analysis (ZHA), a form of gross hazard analysis, works along these lines.

5. Zurich Hazard Analysis (ZHA)—a panacea

How many line managers in industry appreciate or care about insurers' distinctions? They work with risks, know why they exist, and have the authority to change or demand change in the risks they perceive as unacceptable. What is needed is a systematic method for managing those risks instead of just common sense, intuition and individual experience.

ZHA can be applied to all kinds of risk, in all industrial and commercial situations; from the maintenance workshop to boardroom, from laboratory to warehouse, from pilot to process plant, and from domestic appliance to pharmaceuticals.

The origins of ZHA can be traced to the US military system safety concepts. These required that safety be built into airplanes just as performance, stability and structural integrity, to replace the 'fly–fix–fly' approach.

Each designer, manager, engineer assumed portion of responsibility for safety. This principle was used in the design of the Inter-Continental Ballistic Missiles and resulted, in 1969, in the US MIL-STD-882 'System Safety Program for System and Associated Subsystems and equipment: Requirements for'.

ZHA has parallels with, and complements HAZOP, developed by ICI in the 1970s, introducing the team approach instead of using one-man shows by safety or risk management professionals. It recognises the importance of bringing together a team of company experts (who may, it should be noted, still be 'lay people' with respect to risk assessment techniques), and the way the team interacts when stimulated to think openly and laterally about what can go wrong.

While HAZOP uses six or seven guide words or phrases to identify deviations which may result in hazards, ZHA uses a sequence of 'brain ticklers' such as chemical characteristics, structural malfunction, and untimely operation to stimulate thought in a controlled brainstorming process to identify hazards which do not fall within the scope of HAZOP, e.g., non-process. Both methods require an experienced team leader and aim to identify hazards, risks and those scenarios in a logical systematic manner.

For the reasons mentioned earlier, ZHA requires a *qualitative* assessment of risks; rating each in a relative sense for probability and severity. No attempt is made at quantification of risks, because this takes far too long, and is not necessary at the level of analysis performed. Subsequent detailed analysis of particular risks may require numbers, prompted by conclusions of the team analysis. QRA need not concern the full team. Similarly, the insurance industry has standard methodologies for assessing financial risks.

An agreed acceptance level or protection level drawn on this profile is used to distinguish acceptable risks from unacceptable ones. Priority is given on the basis of severity. This stage can take some time to resolve, as subjective assessments come into the fore. However, this should not be discounted as it is a very realistic reflection on how society perceives risks.

Risk mitigation measures are considered for each risk in turn according to the sequence eliminate/prevent, reduce, guard/protect, warn/instruct, transfer (via insurance etc.). The results are documented in a similar format to HAZOP; hazard–cause–effect–corrective action.

By the end of the analysis, the team have identified the problems and devised solutions. They can sell their ideas more easily to non-engineers and non-scientists by illustrating the effects on the risk profile, and because the methodology enables incorporation of non-SHE type consequences, alongside or part of a hazard–cause–effect scenario, this can often increase the justification of a safety measure which has no apparent financial return, to those decision makers with financial/non-technical backgrounds.

6. Conclusion

Risk assessment should be at the heart of company operational strategies, to evaluate the adequacy of process and management system activities. A company might decide that the best achievable may not be good enough for some enterprises it wants to pursue, so it can avoid the risk altogether, but it cannot achieve this without carrying out a risk assessment first, as the following demonstrates:

unconscious incompetence—when a company does not know it has a problem
conscious incompetence—at the hazard identification stage of the risk management process
conscious competence—implementing corrective actions
unconscious competence—continuous improvement.

Users and practitioners of risk assessment methodologies should recognise their essentially political nature, and the requirement to listen to those members of the public, who should not be excluded from the decision-making processes regarding risks amidst our society.

In addition society requires legislators to ensure adequate information, open exchange regarding choices available in a timely fashion, and to manage technological risk. Industry requires that legislators forecast their requirements clearly, are flexible in accepting and understanding risk management techniques, and provide feedback for continuous improvement. In meeting society's and industry's need, this in turn will meet insurer's needs for risk management. COMAH appears to be a step in the right direction.

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