Hazards forum

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VIEWPOINT

SYSTEM RECOVERY ANALYSIS: FOR SAFER HAZARD SITES?

by Dr Frank K Groszmann

1. INTRODUCTION.

ACCIDENT/FAILURE INVESTIGATION APPROACHES.

The necessity to ask questions after every accident is well recognised: we want to prevent a repetition. First, we want to know what happened, next we want to find out and to understand what went wrong. The questioning and the understanding are both very important in the process of seeking prevention, though in themselves they are not sufficient to achieve it, even if we are satisfied that we have asked the right questions and that we have obtained appropriate, useful and helpful answers.

When we are concerned with hazardous industrial plant where the stakes are high and events on a very large scale can occur, we go to great lengths and expense to ask our questions in a formal framework backed and supported by authority. Our search for answers to the question "what went wrong?" will be thorough; will involve investigation on location and elsewhere. It will draw on wide-ranging studies and analyses, in the hope that better understanding of the causes of an event will give us a better chance to avoid a repeat in the future.

To assist our investigations and analyses, a whole armoury of techniques and methodologies has become available, based mostly on our past experience with 'failure' and its prediction or prevention. Fault Trees, Failure Mode and Effect Analysis (FMEA), Hazard Operability (HAZOP), Hazard Analysis (HAZAN) and the like became widely used by the latter half of the 20th Century. They went through very rapid progress and came to be supported increasingly by appropriate software and the products of information technology.

Whereas the plant itself remained at the focus of investigations in most of the 20th Century, a gradual shift started from the 1970s. This was towards the recognition of the role of the 'human operator' and, increasingly, the critical importance of human performance, human concerns and in particular, management systems. The shift of emphasis was evident in the spreading use in the 1980s of a formalised scheme for investigations known as MORT (Management Oversight and Risk Tree).

Towards the end of the century the questions asked were no longer simply about how events had followed one another at the plant; formal recognition came to be given to thinking in terms of a wider range of 'sequentially timed events'. The presence of the human operator and the kind of management system within which the human operator functions, came into focus. What it is that the operator observes, how the operator interprets the observation and not only how but also when the operator's information will be acted on and by whom, emerge as essential and crucial questions.

In recent years, formal accident investigations have come to be expected to give Human Performance the attention this aspect deserves. The aim generally, is to identify the 'root causes' of accidents and adverse events, commonly a mixture of plant/equipment and human behaviour. This approach to investigations and analysis, is supported by a number of guidance publications, for example Human Performance Investigation Process (HPIP, from the US Nuclear Regulatory Commission) and software facilities, for example CERCA. Proprietary systems, such as those devised by the International Loss Control Institute, ILCI, have gone in this direction too.

Decisions about what range and measure of resources get allocated to an investigation (expertise, time-input, facilities and expenditure), are a matter of discretion, balance and judgment. To make the expenditure worthwhile, the lessons from investigations need to be taken on board, not only by the site-operator at the location of the incident but also by others in the industry operating comparable installations.

Failure investigations, of course, deal with past events and situations. When significant changes in technology are introduced, when the scale and complexity of an operation increases, when systems of general or technical management are modified, or if operating procedures no longer match real circumstances, measures well beyond investigating past failures are needed.

The very definition of failures and in particular the distinction between test-failures and in-service failures, can be a crucial issue. Typically, when failure-rates are needed for calculating estimates of risk, their derivation can depend significantly not only on the quality of data but also on the requisite skill of interpretation.

In general, failure-based analysis and methodology is currently behind most approaches to industrial hazards. To expose weaknesses and system inadequacies, these require recognisable signs/symptoms from past failure experience.

2. SYSTEM RECOVERY AS A PRINCIPLE

Instead of focusing on 'failures', in plant /equipment, organisation or human actions, one can concentrate on what is necessary to bring back, if possible, the particular unit or the whole entity involved, to normal operation, or otherwise safely shut it down. The term 'system recovery' is suggested for this approach.

If we define 'systems' as entities which follow rules to serve a desired purpose, then plant and equipment, designed according to rules for their **intended purpose**, are always parts of a system. In an incident, circumstances are clearly other than the intended purpose.

If we take as a starting point, the intended purpose for which the plant and the system in which it operates have been designed, those will be the circumstances with which all others during the life of the plant can be compared. The '**design condition**' will therefore serve as the primary reference condition. Whatever the system, if the design is sound for the original purpose intended, there will exist a '**safe domain**' within which the system can be operated with confidence. The nature and extent of such a 'safe domain' can be described by its characteristics, in terms which are both qualitative and quantitative: ie **measurable parameters**.

For every discreet part of a system a range of interrelated measurable parameters will define first the 'safe domain', as mentioned above, followed by other related ranges corresponding, for example, to **close monitoring**, **warning**, **tested limits** and **emergency**.

In order to achieve safe operation, the primary objective of 'system recovery' will be to ensure that all the means which are necessary to bring back the system within the safe domain are in place and are functioning. **SYSTEM RECOVERY ANALYSIS** (SRA) is proposed as a formal procedure for implementing 'system recovery' in practice.

System Recovery Analysis (SRA) requires measurable parameters to be identified first. Ranges of these parameters will characterise the normal operation of the plant in the 'safe domain', within design conditions. Temperatures, pressures and quantity of contents in a defined, identified part of the plant are typical such parameters.

Deviations in these parameters may be anticipated under various foreseeable circumstances, not only while the plant is being operated but also during commissioning, maintenance, repair, modification and decommissioning, as well as either accidental or intentional/malicious damage. Approximate quantified estimates of the deviations are to be linked with specified controls and actions, including relevant time constraints, which can bring back the plant to the 'safe domain', provided that such recovery is both possible and desirable. Safe shut-down may be a preference in some circumstances.

Temporary shut-downs, repairs and modifications are also to be taken into account in terms of their real-time effects on the measurable parameters associated with the plant.
Deviations beyond recovery are to be assigned stand-by, emergency and mitigation measures respectively, commensurate with an estimated committed-response to the circumstances which can arise. In this way the necessary measures can be identified in advance, listed, assessed and costed.

SRA is applicable to any size, any scale of significant process or event where the plant item involved can be defined and measurable parameters can be assigned.

3. EXAMPLE OF POTENTIAL APPLICATION

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As an example of how system recovery principles might have been applied and how they may relate to petrochemicals plant now or in the future, one might reflect on lessons learnt from the March 2005 BP America, Texas City Refinery Plant explosion.

An explosion when air hydrocarbon vapours ignited, resulted in 15 fatalities and injuries to more than 170 people. The source of hydrocarbons was liquid overflow from a blowdown stack, when overfilling and overheating of a Raffinate Splitter tower's contents caused the overpressure protection system to operate.

The quantity of liquid present in vessels and other discreet parts of the system is one of the key measurable parameters in this type of plant. What the best way may be to provide instrumentation and to measure quantity of liquid as a parameter, is a separate issue, but the process operators need a clear indication of how this quantity relates to system capacity at any one time. It may be useful to regard the quantity-of-content/ capacity ratio as an SRA parameter in its own right.

Level indicators or alarms alone do not provide the necessary information, nor is it immediately clear to the operator what action must be taken. SRA would readily identify any gaps in the necessary instrumentation. Real-time SRA would also inform both operators and management at an appropriate level, about the availability of, or lack of, devices together with relevant instructions to enable them respectively to take time-critical action.

Temperature and pressure at selected identified locations, are two further obvious parameters.

The process control system may take full account of the relationship between temperatures and pressures measured at different parts of the system, but this may not be familiar to the operator who has to take critical decision, especially in an emergency.

The application of SRA can help to formulate clear, immediately identifiable operator-action prompts next to instruments rather than relying on the operators' memory. SRA may further demonstrate the value of providing reliable feedback to the operator on the true, not virtual, outcome of every safety-critical actuation.

4. CONCLUSION

This article has a limited purpose only. First, it is to introduce 'system recovery' as a concept relevant to hazard sites, in order to generate further discussion and debate, with a view to its consideration for practical application.

Second, it is to propose System Recovery Analysis (SRA) as a practical means of applying the principle to actual plant at hazard sites. SRA has the potential to be presented as a methodology and as a suite or family of software packages to suit the plant, site or organisation in question. To get there, a great deal of research, much detailed development and considerable amount of local input will be necessary. There are similarities to HAZOP, but for plant of limited complexity or if a rapid overview is sought, SRA may well prove to be less cumbersome and less costly, yet go much further. SRA takes on board time-constrained actions and can link these with quantified parameters; important features which will warrant detailed exploration in practice.

Third, this article seeks to bring to the attention of safety professionals dealing with hazardous plant, the scope and potential of the 'system recovery' approach. It is its future application in real-time that holds the greatest promise for cost-effective reduction in the number of all adverse events.

It is to be hoped that arrangements for a pilot practical application in industry and its evaluation can soon proceed.

John Lee

The Secretary, John Lee, is to retire at the end of March, on the grounds of ill-health. A new Secretary will be appointed shortly, and there will be more on this in the next issue of the Newsletter.

John Lee writes:

"It is with much regret that I have to give up my post as Secretary of the Hazards Forum.

It doesn't seem like eight years ago that, with some anxiety, I took over the job from Ian Lawrenson and was introduced to the then Chairman, Stuart Mustow. I suspect that Brian Neale, who takes over from me from the 1st April, has similar concerns. However, I need not have worried and neither should he. I thoroughly enjoyed those years, meeting a succession of splendid helpful and supportive people, including those who have been at one time or another members of the Executive or Activities Committee all of whom, without exception, I consider to be my friends as well as colleagues.

I am fortunate that my faith assures me of 'a sure and certain hope' for the future, I hope that the future of the Hazards Forum is equally assured, I have every confidence that Den Davies, the Chairman, and Executive Committee members, together with Brian, will make sure that it is. With my grateful thanks to you all."

17th AR2TS (Advances in Risk and Reliability Technology Symposium)

The 17th Symposium on Advances in Risk and Reliability Technology (AR2TS) is to be held between 17-19 April 2007 at Burleigh Court Conference Centre, Loughborough University.

The 17th AR2TS will be an international forum for presenting and discussing recent advances made in the general area of reliablity, risk, availability and maintainability. Contributions will be provided from both the university sector and from industry. It will be of benefit to both practitioners and academics involved in this field who want to keep in touch with the latest developments and perhaps, through discussion, influence the future direction of research.

For further details and to register on line see: www.lboro.ac.uk/arts or contact A.Green@lboro.ac.uk.

J-value: a Universal Scale for Health and Safety Spending

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A common yardstick against which to judge spending on health and safety across all sectors of the economy is needed if resources are not to be diverted away from areas of greater need. It is argued that the J-value is an objective, absolute and universal scale that fulfils that need. Previous judgments on the value for human life are reproduced, but the J-value demonstrates that significant differences exist currently in the regulatory standards for different industries. Case studies show that very different levels of health and safety spend have been demanded in practice in those industries.

Recent risk stories such as conkers being banned from school[1,2] and horse-chestnut trees being felled[3] suggest that responses to risks to health and safety may be arbitrary and often disproportionate. But such managerial reactions are not confined to the school-yard. In the absence of generally accepted figures relating tolerable risk to the cost of abatement, common across all industries, there is a good chance that higher-than-warranted safety expenditure will be embarked upon in certain industries perceived to be 'high-risk'. This may be either as a result of one-off Government action or else through unilateral action on the part of the company concerned, perhaps because of perceived public pressure. Meanwhile those industries seen as 'low-risk' may underspend significantly, so that markedly different costs and standards of safety may pertain in different industrial plants and economic sectors. While some variation has to be expected, especially given the uncertainties involved in quantifying risk, too great a variation would suggest that the country as a whole was diverting resources away from areas of greater need, as Government has recognised[4].

There have been some glaring examples of the use of very large resources to reduce risks that were already small. For example, the speed restrictions imposed on the whole of the UK's railway system following the Hatfield train crash cost the rail companies hundreds of millions of pounds and may well have increased the risks to the travelling public[5]. Then the spending of billions of pounds on BSE countermeasures after 1996 when the threat was all but over has been calculated to have saved around 10 lives at most[6]. In the nuclear industry, BNFL's Enhanced Actinide Removal and Site Ion-Exchange Encapsulation plants cost together[7] about £800M and may save one or two lives over their lifetimes. In November 2003, the police closed Tower Bridge for several days after a fathers' rights protester ("Spiderman") climbed a nearby crane and refused to come down. The police were worried that he might fall and be blown onto the bridge, but the cost of the resultant traffic disruption was estimated at £5M per day[8].

But while we may feel that the expenditures mentioned above were out of proportion, the task of achieving a consistent and proportionate response to any given risk has been hampered by the lack of a universal scale against which such a response could be measured. Previous attempts were either industry-specific, such as the IAEA's International Nuclear Event Scale, or were purely economic, based on a market analysis which might value some people's lives more than others', or else were founded on opinion, opening them up to the charge of subjectivity, even if a large number of people had been polled. This article discusses the new Judgment- or J-value technique, which provides an objective, absolute and universal scale against which health-and-safety spend in any sector may be measured, providing an explicit judgment on whether the plan or scheme under consideration is reasonable.

The life-quality index

The first step to deriving the J-value is to find a suitable measure for the quality of life. It may be postulated that the fundamental factors influencing the quality of life for any given individual are first how long he can expect to live from now on and secondly how much he will have available to spend, both on life's necessities and on its luxuries. Given these two postulates, it may be shown[9,10] that an appropriate measure is given by the index, Q_0, where:

$$Q_0 = G^q X \qquad (1)$$

in which X is the life expectancy of the average individual in years, G (£/y) is the average, annual earnings (which may be taken as the GDP per person), while the exponent, q, is the work-life balance, *viz.* the ratio of the time spent working to the time remaining. Each of G, q and X, is an objective variable; a reasonable value for q has been deduced to be about 1/7, while G and X are available from national statistics and actuarial tables respectively.

Furthermore the term, G^q, for the inevitably low, fractional values of work-life balance, *q*, that will occur, has the form of a utility function, where initial earnings, essential for food and clothing, are valued more highly than later increments of earnings, which are used to pay for luxuries. Figure 1 gives an illustrative example of such a utility function, with $q = 0.35$. Thus it may be seen that the term, G^q, emerges as the utility of personal earnings per year, as judged by the average individual in the nation. This allows the intuitively attractive interpretation that the life-quality index is simply the sum of all the annual utilities for the years remaining to the average individual.

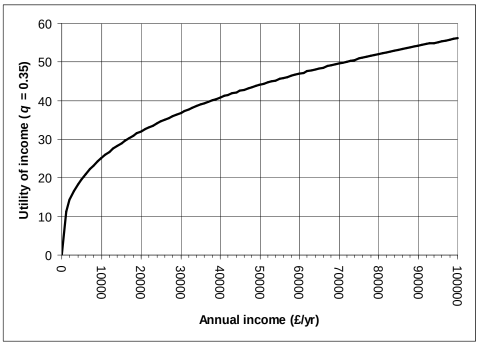

Figure 1: Utility of annual income

The last stage comes from noting that goods and services that an individual can use today are more valuable than goods for which he must wait before enjoying, and this can be allowed for by replacing the life expectancy, X, by a discounted life expectancy, X_d, where, of course, $X_d \rightarrow X$ as the discount rate tends to zero. Thus the final version of the life-quality index is:

$$Q = G^q X_d \qquad (2)$$

The rate of time preference should be appropriate to the long periods over which health and safety effects are likely to be seen, as a result of both the long operational life of safety equipment and the long period over which health effects can show up. Low discount rates are standard in such cases, in the range 1 – 4 %[5]. This range covers, for instance, the discount factors used by BNFL (2.5% pa) and British Energy (3% pa) in assessing their nuclear decommissioning liabilities.

As an aside, it may be noted that the discounting life expectancy has the interesting effect of reducing the lowering of life expectancy with age. Thus whereas an infant has a life expectancy of nearly 80 years, his 4%-discounted life expectancy will be only ~24 years; the corresponding figures for a 40-year-old are ~40 years and ~20 years. Thus it may be seen that under a 4% discount rate, the time horizon by which an individual may judge the benefits or costs of his actions changes little in the first 40 years of life. This may provide a good model of and rationale for human decision-making at different ages: for example, young people tend not to plan long into the future, certainly not twice as far as a forty-year old, which consideration of their undiscounted life expectancy would prompt them to do.

The J-value

Suppose the average person in a group of people is considering spending money on a scheme that will enhance the safety of group members. The discounted life expectancy will increase, but the yearly income available to the average person will decrease. The changes in these two factors will alter the life-quality index, one in the upward and the other in the downward direction. Clearly the average person's interests will be served only if the new life-quality index is higher than it was originally.

We may carry out a small-signal analysis to relate the change in life expectancy to the changes in available income and life expectancy, and by imposing the limiting condition of no change in life quality, deduce the maximum annual income that the average person should be prepared to spend on the safety scheme in question. We may extend this figure to the group simply by multiplying by the number of people in the group, so as to achieve the maximum annual expenditure, a_{pop} (£/y), that the group as a whole should be prepared to countenance.

Large groups, such as the people living near a particular industrial plant, may normally be assumed to have the same age distribution as the national population. There will be occasions, however, when information on the age and life expectancy specific to the group needs to be used, as, for example, in considering the desirability of otherwise of treatments for women with breast cancer. The work-life balance, *q*, is normally kept at the nationally estimated figure, and, as a matter of moral principle, it is considered that the figure for average income, *G*, should be kept the same for all groups within the nation.

The Judgement- or J-value is found by dividing the actual annual expenditure being considered, $\hat{a}_{pop}$ (£/y), by the maximum that the group should be prepared to spend:

$$J = \frac{\hat{a}_{pop}}{a_{pop}} \qquad (3)$$

which should be less than or equal to unity for an acceptable safety scheme. When, as is often the case, a single, initial spend, $\hat{A}_{pop}$ (£), is dominant, then we may write conservatively[10] that:

$$J = \frac{q\hat{A}_{pop}}{NG\Delta X_d} \leq 1.0 \qquad (4)$$

where ΔX_d is the change in life expectancy averaged over the group brought about by the safety scheme in question. The change in life expectancy may be calculated taken from physicians estimates or by detailed calculations using actuarial tables. Actuarial calculations for the nuclear industry are complex because of the effects of radiation do not appear until after a long delay, typically 10 years, and are then stochastic over a period of about 30 years[11,12].

While the safety expenditure will often be met by the state (e.g. the NHS) or an industrial company, it is argued that the benefits should still be based on the willingness to pay of the benefiting group. This is fully consistent with the general principle of welfare economics that the benefits of a public programme are measured most appropriately by the aggregate willingness to pay on the part of those benefiting from the programme.[7]

Interpretation of the J-value scale

Since the J-value is the ratio of the actual spend to the maximum reasonable spend, it follows that a safety scheme with a J-value greater than unity will cause a net disbenefit. Thus if a scheme is calculated to have a J-value of 3.0, then it is costing three times what it should, and effort should be spent in finding another way of producing similar safety benefits much more cheaply.

Meanwhile, a safety scheme with a fractional J-value is acceptable. For example, a J-value of 0.2 indicates that the scheme will provide a safety benefit without using up too much resource. In fact, the scheme could be augmented and made up to five times as expensive without creating a net disbenefit (although the low J-value should not be taken to imply that spending more money is essential).

Using J-values to evaluate regulators' recommendations

A recent study[10] considered the recommendations of regulatory or quasi-regulatory bodies for road, rail, the health industry, the nuclear industry and offshore oil and gas, with corresponding regulators: the Department for Transport, the National Institute of Clinical Excellence, the National Radiological Protection Board and the Health and Safety Executive. The results are shown in Figure 2.

The values are generally of the same order, and clustered above and below the maximally risk-averse, reasonable position of J = 1.0. But NICE's general recommendations and those for road safety are well below the J = 1 line, while the J-values for offshore oil and gas stand out as high, as does the J-value for radiation workers when the rate of time preference and the loan interest rate are set at 2.5%. The large difference between the lower and upper J-values for radiation-dose safety measures reflects the long delays before health effects may be seen.

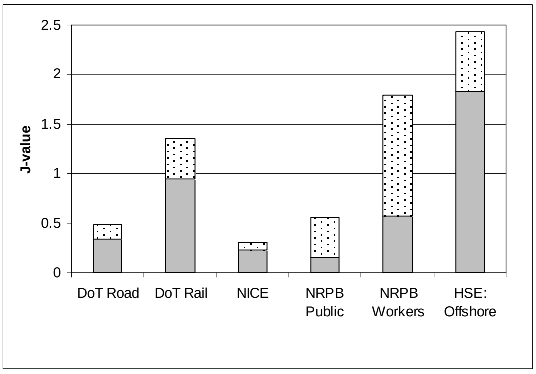

Figure 2: Regulators' J-values. The dotted shading indicates the range of values for discount rates set at 0% and 2.5% pa and for annual versus one-off safety-spends.

One reasonable way of bringing the regulators' recommendations into harmony would be to ensure equality of J-values at a discount rate of 2.5% pa. This would have the effect of reducing the required safety spend against multiple fatalities in the rail industry by about 25% but doubling the prescribed safety expenditure for road and against single deaths on the railways. At the same time, the required safety spend in the offshore industry would be more than halved. The common value of a human life would then be about £2.5M, which is very much in line with previous estimates of £2.1M[14] and £2.6 - £3.9M[15] (all 2003 £'s).

Meanwhile, the NRPB advisory figure to avert a man-Sievert for radiation workers would be reduced from £50,000 to £28,000, while the corresponding figure for the general public would rise from £20,000 to £35,000. NICE's criteria for economic acceptance of a new drug treatment would then need to be revised upwards by a factor of about 4 in order to come into line.

Case studies across industrial sectors

The study referred to above also considered actual cases[13] in a number of sectors where expenditure on safety was under consideration or was made. The results are shown in Table 1. It is clear from the very large spread of J-value that the measure of consensus apparent in the J-values for the regulators' recommendations is not mirrored in these cases.

Considering train protection systems, while the extremely expensive ERTMS has so far been rejected, TPWS has been installed, despite having a indicating poor value for money. Moving on to health, the case of imatinib demonstrates NICE's tendency to limit treatments even when the J-value is less than unity. Moreover, while NICE has recommended vinorelbine, paclitaxel, docetaxol and zanamivir, their very low J-values raise the question as to why NICE had to be consulted in the first place.

The early BSE/vCJD countermeasures[16], which had a J-value well below unity, were implemented, but so were the post-1996 countermeasures, which had an extremely high J-value. This high J-value indicates very poor cost-effectiveness, and implies that the £7 bn estimated to have been involved could have been spent much better elsewhere.

Both the BNFL clean-up plants considered have extremely high J-values, whether one considers the protection of a critical group or the protection of the UK population as a whole. One of these has been implemented by BNFL with the approval of the Environment Agency, while the other has not. The very high J-value of the installed Technetium-99 Removal Plant implies that a very large sum of money has been sanctioned to reduce an already small risk of one cancer being contracted. On the other hand, the below-unity J-value associated with the unsanctioned drug imatinib, as well as the very low J-values associated with vinorelbine, paclitaxel and docetaxol, make it clear that once a person is actually suffering from the disease, the funds available to ameliorate the illness and extend life are subject to much tighter constraints. It is difficult to understand the logic of such disparities.

The case for the installation of VOCs control measures on small petrol stations looks marginal at best, based on the J-values produced and the large uncertainties on the harm caused. This supports Government's proposal to derogate existing small petrol stations.

	Health and Safety Measure	**J-value**	**Status**
Railway protection systems	Train Protection and Warning System (TPWS)	3.8 – 11.3	Implemented
	European Rail Transport Management System (ERTMS)	38 – 132	Not implemented
NICE drug evaluation	Breast cancer drugs: Vinorelbine, Docetaxol, Paclitaxel	0.014 – 0.046	All recommended
	Zanamivir for influenza in old people	0.016	Recommended
	Imatinib for chronic myeloid leukaemia	0.68	Not recommended
Public Health: BSE/vCJD	Early, pre-1996, countermeasures	0.1 – 0.37	Implemented
	Post-1996 countermeasures	109 – 368	Implemented
BNFL effluent clean-up	Technetium-99 Removal – Critical Group	130 – 523	Implemented
	Technetium-99 Removal – UK population	296 – 1214	
	Krypton-85 Abatement – Critical Group	39,700 – 118,000	Not implemented
	Krypton-85 Abatement – UK population	256 – 1,034	
Small Petrol Service Stations	Containment of volatile organic compounds (VOCs) during underground, storage-tank filling	1.62 – 2.36	Proposed to exempt existing small petrol stations

Table 1: J-values from case studies

Conclusions

The J-value has been developed as a universal scale against which to measure and assess health and safety expenditure in all sectors of the economy. Its use in a number of diverse sectors has been demonstrated, as has its ability to produce figures for the value of a human life that coincide approximately with previous estimates based on different approaches.

Given its capability to translate a variety of cost-benefit formats onto a common, objective yardstick and its easy interpretation in terms of how much more or less than the reasonable maximum spend is being considered, the J-value is proposed for use by decision makers on health and safety in all sectors. It is suggested that its adoption could lead to more consistent and hence better targeting of health and safety expenditure in all areas of the economy.

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Report of Executive Committee Meeting, 8 January 2007

The Committee was introduced to Brian Neale who was preparing to take over the role of Secretary from John Lee whose long term illness is preventing him from continuing. Brian is a Chartered Engineer and a Fellow of both The Institution of Civil Engineers and Institution of Structural Engineers.

The Customer Satisfaction Survey was discussed and recommendations made for improvement. It was decided to issue the Survey at both the AGM and the Event which follows in addition to a questionnaire aimed principally at the Event. It is hoped that the feedback will enable the Executive Committee to focus on the needs of its members and other customers.

Three nominations had been received for the two Trustee posts that would become vacant at the AGM in March. A vote will be necessary and the letter sent out to invite members would explain the detail and hopefully encourage a good attendance.

The Learning from Accidents Working Party met on the 19th October 2006 and as a result an evening event on 'Just Culture' is being held on 19th June 2007 at the Royal Academy of Engineering. Guests, under the Chairmanship of Dr David King, Chief Inspector of Air Accidents and after a presentation from Professor James (Jim) Reason, will be able to discuss the pros and cons of whether introducing a Just Culture would assist in learning from accidents.

Other Evening Events were discussed. The Executive heard that the 'Risk Management of Critical Computer Based Systems' event had been a success but that, as with the 'Flooding' event held earlier in March, the report had been delayed awaiting the input from one of the speakers. [Secretary's Note: Both Reports have now been produced and distributed]. Future events included 'Off-site Risks from Major Hazard Sites' to be held in March 2008, 'Just Culture', mentioned above, and 'Risks Associated with the 2012 Olympics' to be held in September. Sponsors are always sought to support these events, if you would like to take this opportunity please contact the secretariat.

The rest of the meeting was devoted to examination of the past year's finances and the budget for 2007 as they affected the Annual Report. This will be presented at the Annual General Meeting on 13th March 2007 at the Institution of Chemical Engineers' London premises at Portland Place.

J F Lee 26 February 2007

Hazards Forum Evening Event
21st November 2006

Design and Risk, Design Decision-making under Uncertainty during the early Stages of Design

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This event was organised jointly with the Design & Industries Association and was held at The Design Council in Bow Street, London, the first time a Hazards Forum event had been held at this venue. The benefit of running a joint event like this was that it attracted guests from a broader spectrum of designers and engineers. The event was chaired by Mr Paul Traub, Associate Director of CCD Design and Ergonomics Ltd. and some 43 guests heard presentations from Dr Brian Thompson, one of the Directors of the Design & Industries Association; Mark Phillips, Director of the Design Futures Group of Sheffield Hallam University; and Ian Liddell CBE FREng from Buro Happold.

Dr Thompson presented a paper on 'Different Attitudes to Risks, and their Influences upon early Design Decision-Making', Mark Phillips presented views on innovation and risk in design education and design practice while Ian Liddell shared his experience of design decision-making for large-scale civil engineering projects which had included the design of the Millennium Dome.

Guests heard that whether designing an innovative new chair, motor car or building, designers would be faced, in the early stages of design, with formulating different design options and choosing which of them would produce the best overall solution. This was seldom easy because at this stage of the design there will be uncertainties about the consequences of making design decisions. Education, from university through to continuing professional development, can provide the platform for designers to tackle such problems within their own specialism. The joint event was also held because it was believed that there would be considerable benefits for both the engineering and design communities from discussing and sharing their approaches and experiences of making these design decisions and it is hoped that those who attended agreed that this event had provided that opportunity.

A report is being produced and will be sent to all those who attended. The Hazards Forum would like to take this opportunity to thank the Design & Industries Association and The Design Council for sponsoring the event and would like to thank in particular Dr Brian Thompson for his part in its organisation.

J F Lee 27 February 2007

Sharing Lessons learned from Accidents- a 'Just Culture' Approach

A Hazards Forum evening event on this topic will be held at the Royal Academy of engineering, Great Peter Street, London SW1P 3LW on Tuesday 19th June 2007, starting at 17.30. The meeting will be chaired by Dr David King, Chief Inspector of Air Accidents and Head of the Air Accidents Investigation Bureau, and there will be a presentation by Professor Jim Reason, Emeritus Professor of Psychology, University of Manchester, and the author of many renowned books including 'Human Error' and 'Managing the Risks of Organisational Management'

After every accident someone will say 'this must not be allowed to happen again we must learn the lesson.' The only way to do this effectively is to share the lessons learned widely both within and outside a company. This is because companies do not have a corporate memory, employees retire and lessons are forgotten unless they have been shared widely. Companies often feel that they need to heavily sanitise information of this kind to avoid criticism say from litigation lawyers, regulators, media, etc. But need this be so? Why can we not share information freely between companies on a confidential basis so that accidents can be reduced? There appear to be three requirements to solve this problem:

- replace behavioural error litigation. (The Prime Minister has already suggested that there have been some accidents which should not carry any blame, but will the new Corporate Manslaughter and Corporate Homicide Bill increase litigation and restrict sharing?)
- recognise that human error is normal and operational work must take this into account in design and risk assessment work. (This requires leadership from the top of the organisation.)
- recognise that accident or incident investigation should be solely directed towards establishing the causes and not to lay blame or liability. (The Investigation Boards for the transport industries have this as a specific objective but not the Health and Safety Executive.)

The civil aviation industry, with their 'Just Culture' approach, has made a significant contribution in this approach and shares all information. The improvement in safety has been remarkable and the meeting will hear about this from the Chairman. Other industries have recognised the value of the approach and are investigating its use and we hope guests will take the opportunity, within an extended discussion session, to share ideas with each other. To focus the debate Professor Reason will make the formal presentation.

As with all the Hazards Forum's evening events, attendance will be invitation. If you would like to attend this meeting, please contact the Secretariat.

Online GIS for Natural Hazard Information

Lucy Stanbrough from the University of Hertfordshire, England, is conducting research into the use of online Graphical Information Systems (GIS) for natural hazard information, and is looking for users and content providers to complete a short survey.

To date there have been no studies that that aim to identify and compare content providers assessment and provision of user needs against actual user needs on a global multi-hazard level, which could provide a valuable piece of research in this burgeoning field.

Online GIS applications can include anything ranging from complex applications like ESRI web services to more simple services such as Google Maps or Google Earth, which many of you have come across during research or general browsing for hazard knowledge.

The survey can be found at this address: www.the-online-gis-survey.co.uk

New Holistic Masters Programme in London

A new MSc degree in Earthquake Engineering with Disaster Management is being offered by the University College London beginning September 2007. The programme will embrace a holistic approach to the field, imparting a combination of specialist earthquake engineering knowledge and an understanding of the social, economic, and political impacts of earthquake events in order to prepare engineers who can provide holistic design solutions and be able to work in both engineering and disaster management roles. Graduates of the programme will be able to:

- understand the roles and interactions between seismology, soil dynamics, and structural dynamics;
- apply both current seismic codes and novel methodologies of seismic design, repair, and assessment;
- understand the national and worldwide social, economic, and political consequences of earthquakes;
- select and assess the adequacy, economic viability, and life-saving effectiveness of pre-event risk mitigation and post-event risk management solutions when applied to different contexts.

The programme consists of eight taught modules and a major research project (which professionals can do in their current workplaces), and has been developed in collaboration with civil engineering and nuclear industry professionals, disaster managers, re-insurers, academics, and non-governmental organizations. There will be part-time study options, and a Disaster Risk Management short course will also be available.

For more information, see ww.civeng.ucl.ac.uk

Calendar of Events

Date	Event	Venue	Contact/further information
2007			
MARCH			
29-30	'Facilitating Knowledge Transfer: Science to practice in Disaster Management' organised by the SPIDER Network	Coventry University	t Mitchell e: t.mitchell@ids.ac.uk www.spidernetwork.org
APRIL			
4	'Risk Education for Engineers' seminar by the Safety and Reliability Group of the IMechE	IMechE 1 Birdcage Walk London SW1	t: Michelle O'Brien 020 7973 1309 e: m_obrien@imeche.org
17-19	17th AR2TS (Advances in Risk and Reliabilty Technology Symposium)	Loughborough University	e: J A.Green@lboro.ac.uk www.lboro.ac.uk/arts
17-20	'HAZOP Study for the Offshore Oil and Gas Industry' Short course from the Institution of Chemical Engineers (IChemE)	Hilton Treetops Aberdeen	Rachel Robinson, IChemE t: 01788 534458 e: courses@icheme.org www.icheme.org/hazopstudy
MAY			
16-17	'Layer of Protection Analysis (LOPA)' Short course from the Institution of Chemical Engineers (IChemE)	Staff House Conference Centre University of Manchester	Rachel Robinson, IChemE t: 01788 534458 e: courses@icheme.org www.icheme.org/lopa
JUNE			
14-15	'Communication especially during Volcanic Emergencies' organised by the SPIDER Network	University of Portsmouth School of Earth & EnvironmentalSciences	E: Richard.Teeuw@port.ac.uk
18-20	'HAZOP Study, Leadership and Management' Short course from the Institution of Chemical Engineers (IChemE)	Ramada Parkway Leeds	Rachel Robinson, IChemE t: 01788 534458 e: courses@icheme.org www.icheme.org/hazopstudy
19	'Learning from Accidents – a Just Culture Approach', evening event organised by the Hazards Forum	Royal Academy of Engineering	T: 0207 665 2230 e: hazards.forum@ice.org.uk
SEPTEMBER			
25	**'Managing the Risks re London 2012 Olympics', organised by the Hazards Forum**	**TBA**	**t: 0207 665 2230** **e: hazards.forum@ice.org.uk**
17-19	'Applied Hazard and Operability (HAZOP) Study' Short course from the Institution of Chemical Engineers (IChemE)	Ramada Parkway Leeds	Rachel Robinson, IChemE t: 01788 534458 e: courses@icheme.org www.icheme.org/AppliedHazard
25-26	'Layer of Protection Analysis (LOPA)' Short course from the Institution of Chemical Engineers (IChemE)	Staff House Conference Centre University of Manchester	Rachel Robinson, IChemE t: 01788 534458 e: courses@icheme.org www.icheme.org/lopa
NOVEMBER			
TBA	**'Business Risk and Continuity Planning', seminar organised by the the management Group of the IMechE, co-sponsored by the IMechE and the Hazards Forum**	**IMechE** **1 Birdcage Walk** **London SW1**	**t: Rachel Croshaw** **e: r_croshaw@imeche.org**
6-9	'HAZOP Study for Team Leaders and Team Members' Short course from the Institution of Chemical Engineers (IChemE)	Staff House Conference Centre, University of Manchester	Rachel Robinson, IChemE t: 01788 534458 e: courses@icheme.org www.icheme.org/HazopTeam

Membership of the Hazards Forum 2007

Distinguished Members

Professor P A Bennett, FREng
Professor Sir Bernard Crossland, CBE FRS FREng
Dr S N Mustow, CBE FREng
Dr A C Patterson, CBE FREng
Professor P O Wolf, FREng
Professor Sir Frederick Warner, FRS FREng

Institutional, Corporate and Individual Members include:

British Computer Society
British Hydrological Society
British Psychological Society
City University
Ergonomics Society
Eurogears Ltd
Geological Society
Institute of Measurement and Control
Institution of Chemical Engineers
Institution of Civil Engineers
Institution of Engineering and Technology
Institution of Mechanical Engineers
Institution of Materials, Minerals and Mining
Institution of Occupational Safety and Health
Institution of Structural Engineers
Lancaster University
Met Office
National Health and Safety Groups Council
Risk Management Solutions Ltd
Risk Support Ltd
Royal Academy of Engineering
Royal Society of Chemistry
Safety and Reliability Society
Society of Industrial Emergency Service Officers
University of Nottingham
University of York

BP plc
Corus Group
CSE International Ltd
DSTL
Health and Safety Executive
Lloyd’s Register
NEBOSH
Rail and Safety Standards Board
Shell UK Ltd
United Utilities

Mr Ade Adeyemo
Dr John Bond
Mrs Patricia Bond
Mr Iain Carter
Mr Nigel Cheetham
Mr Frank Crawley
Mr Graham Dalzell
Dr Chris Elliott
Mr David Eves CB
Mr Robert Foster
Mr Robert Gilchrist
Dr Frank Groszmann
Mr John Lee
Mr Brian Neale
Mr Peter Livock
Dr J McQuaid CB
Mr Mark Paradies
Mr Fred Pell
Mr Michael Selfe
Mr Ed Spence
Mr Brian G J Thompson
Mr Simon Turner
Professor John Uff CBE QC FREng