



# **Understanding and responding to societal concerns**

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# Understanding and responding to societal concerns

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The term 'societal concerns,' as commonly used, embraces numerous disparate entities. It is important that this be recognised because the sine qua non for the appropriate handling of societal concerns is to fully understand their nature and the motivations of groups which express them. As this report demonstrates, these may range from worries about the risk associated with some hazard, to concern over other (non-risk) factors entrained by the hazard, conflicts over values, failures of process, and, by no means the least, self-interest of one kind or another. Societal concerns do not, as is often implied, originate or remain in the limelight solely because of public pressures. They originate from and are sustained by many different sectors of society for any and all of the motives listed above.

Various theoretical models have been developed of the societal response to risk. Although distinct, they share much common ground, notable of which is that society is plural in its beliefs and values and that these are at least as important as 'the facts' in risk decisions. However, the responses to this situation vary widely, with some still arguing that facts alone should shape risk management decisions and others believing that there are no such things as facts in these circumstances and that all perceptions are of equal validity. We advise caution in picking a way through this minefield. For reasons given, we also do not recommend that quantitative techniques, or the search for facts, be abandoned, as some would urge, though their more thoughtful use should be encouraged.

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## **EXECUTIVE SUMMARY**

### **AIMS**

The purpose of this report is to provide a sounder footing for the understanding and hence management of societal concerns.

### **METHODOLOGY**

A multi-disciplinary approach is taken. The methodology is two fold. On the one hand, based on the authors' experience, societal concerns are characterised according to the motivations which are likely to underpin them. Secondly, a number of theoretical models of risk perception are described. From this a number of common strands and conclusions are drawn.

### **ISSUES**

*The origins of societal concerns:*

- societal concerns are generated by many different groups within society and not simply the undifferentiated 'public'
- societal concerns are motivated by numerous factors besides 'pure' risk. These include matters of ethical belief, values, political beliefs, and procedural issues, plus political, commercial, social and professional self-interests and ways of working.

*Theoretical models:*

- sociologists, philosophers and other disciplines have provided a number of theories (behavioural paradigms of risk analysis) of how society perceives and prioritises risk issues. Some theorists believe that they have found the ultimate model, but most consider that no model is supreme, that all have something to offer and all have shortcomings (e.g. some are as reductionist as scientific models). We share the latter view, since all models are a simplification of a far more complex reality, and because model choice is influenced by the worldview and interest of the individual
- a general conclusion of most models is that individual or group decision making about risk is comprised of consideration of values plus consideration of evidence, with the emphasis on the former. This applies both to professionals and non-professionals. This leads some theorists to the conclusion that risk is entirely socially-constructed, which contrasts sharply with the stereo-typical 'natural science' perspective that risks are quantifiable. Termed 'cultural-relativists' at one end of this spectrum, and 'naive-positivists' at the other, most people, academics included, lie somewhere between

*Decision Making and Bias:*

- it is to be expected that, because we live in a plural and evolving society with multiple values, beliefs, motivations and ways of working, that risk management preferences will be equally diverse. Democratic decision making requires that these different positions be heard. Ultimately, however, choices must be made, and this necessarily implies the introduction of bias. A risk management strategy cannot be

promoted without a belief that one way of life, or one way of sharing risks and costs, is better than another

- one technique, based on rational field theory, offers the prospect of elucidating beliefs, values and other factors active in decision making, and may provide a novel approach to understanding and dealing with alternative preferences

## **CONCLUSIONS**

- the existence of frequent debate over societal concerns is not in the least regrettable, but the quality and meaningfulness of debates could be improved by a variety of means including paying more attention to risk management decision processes and on what basis choices are actually being made
- in deciding how to handle societal concerns in the best interests of society it is necessary to be aware of the underlying motivations of all stakeholder groups
- one should also be aware of the relative capacity of stakeholder groups to lobby the political system
- the HSE should take a broad view of the relative attributes of the various theoretical models on offer rather than signing up to any particular model
- the HSE should be aware that there is a spectrum of belief about the extent to which risks are either socially-constructed or objective. Most people occupy middle ground
- in a plural society, plural preferences on risk must be anticipated. In a democratic society, all of these preferences should be heard and encouraged to be heard
- dealing with societal concerns often has major societal implications which should be assessed by whatever means are available. Numbered amongst these concerns is the effective and efficient use of resources. Therefore, despite the known limitations of techniques like QRA and CBA, we do not support their wholesale elimination in the absence of anything better
- ultimately, risk management decisions are based on some form of prejudice or preference for one choice over another. Such preferences should be open to inspection and malleable in the face of convincing arguments

# 1 INTRODUCTION

## 1.1 WHAT ARE SOCIETAL CONCERNS?

‘Societal concerns’ is a nebulous term difficult to endow with concrete meaning and which, it has to be acknowledged, signifies different things to different people. In the HSE’s publication ‘Reducing risks, protecting people,’ ‘societal concerns’ are described as follows:

“...the risks or threats from hazards which impact on society and which, if realised, could have adverse repercussions for the institutions responsible for putting in place the provisions and arrangements for protecting people, e.g. Parliament or the Government of the day. This type of concern is often associated with hazards that give rise to risks which, were they to materialise, could provoke a socio-political response, e.g. risk of events causing widespread or large scale detriment or the occurrence of multiple fatalities in a single event. Typical examples relate to nuclear power generation, railway travel, or the genetic modification of organisms. Societal concerns due to the occurrence of multiple fatalities in a single event is known as ‘societal risk.’ Societal risk is therefore a subset of societal concerns.” (HSE, 2001)

We ourselves are familiar with HSE’s definition of societal concerns and accept that ‘societal risk,’ that is, the risk associated with major hazards which could conceivably give rise to multiple fatalities, can be considered as one subset, though no more, of societal concerns. Earlier we have reported on risk criteria for societal risks of this kind (Ball and Floyd, 1998; Floyd and Ball, 2000). Here, however, the net is broadened immensely to take on board all manner of other societal concerns which are somehow related to risk or danger, and which are expressed or acknowledged by the ‘public,’<sup>1</sup> or their representatives or would-be representatives, as important and in need of serious attention.<sup>2</sup> In these circumstances, even things like commercial competition become a factor in risk perception (Boehmer-Christiansen, 1990 & 1994a).

A feature of many hazards or hazardous activities that generate these kinds of societal concerns, or are said to do so, is that they are not necessarily of similar concern to experts or, if they are, the concern may be tied to different aspects of the same hazard. Thus, while the reason for public concern over the MMR vaccine is generally considered to be parental anxiety about the risk it poses to their own children, experts are more worried about the ability of the general population to withstand an epidemic if vaccination numbers fall below a certain proportion of the population. In this report we therefore spend some time analysing the risk perceptions and behaviour of experts as well as the public. It will emerge that there are important reasons for doing this besides the one given here.

Recent examples of societal concerns which spring to mind are truly numerous and range from such things as the integrity of the nation’s gas mains, to the future of nuclear power, global warming, control of terrorism, safety of adventure sports, child safety, disposal of off-shore structures (e.g. Brent Spar), control of foot and mouth disease, railways, provision of aids for the

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<sup>1</sup> The term ‘public’ is hard to relinquish but potentially misleading. We see the ‘public’ as a diverse entity holding many contrasting views, often for good although different reasons. This applies wherever we use this collective noun in this report.

<sup>2</sup> According to Sandman (1995), apathy is a more normal state of affairs, although we ourselves suspect this may be because the regulatory system and those who maintain it are more trusted than is commonly supposed.



disabled, and so on. The sheer number of expressions of societal concern that are continually emerging has led some commentators to question the healthy functioning of our society. A proliferation of studies of such things as ‘the public understanding of science’ has been one response, but in our view this itself already shows signs of bias because it bears the implications that the problem is, firstly, of the public, and, secondly, attributable to ignorance. We would not wish to prejudge this issue.

Furthermore, it is our view that the number of issues giving rise to societal concerns is in no way surprising, for the fundamental reason that there is a plethora of factors which can give rise to them. We consider that for an understanding of ‘genuine’ societal concerns and, so far as possible or desirable, any attempt at their resolution, it is crucially important that they not all be assigned to the same pigeon-hole as if one such concern were akin, or even comparable, to another. For one thing, concerns are not of equal weight, significance or distribution. Furthermore, from a regulatory perspective, it is a fundamental necessity to be cognisant of the disparate motivations which may underlie societal concerns, for it is essential for wise governance that their social legitimacy is somehow judged. Analysis of the root causes of societal concerns, whatever they may be, is therefore an imperative.

## **1.2 OBJECTIVES**

The project has the aim of providing a sounder footing for the characterisation of societal concerns and, from there, the management requirements which are appropriate to address wider public concerns in a cost-effective way.

## **1.3 APPROACH AND STRUCTURE**

Because of their disparate nature and origins, not to mention their importance in shaping society, we believe that societal concerns are best examined from whatever perspectives, sociological or otherwise, that can enlighten so that maximum insight may be gained. We are not convinced that any single discipline or theory describes fully the nature of societal concerns, and even if it did, we would consider it wasteful to disregard other work which made a valid contribution. In the context of societal concerns, too much is at stake to leave leaves unturned. Furthermore, all theories have their supporters and detractors, and we do not wish our recommendations to be seen as anchored exclusively to any particular theoretical approach. To do so would simply invite a further round of pointless and arcane debate, deflecting attention from what in our view is needed, which is a set of practical recommendations. Indeed, we believe that our recommendations can be arrived at by any of a number of approaches and that this gives them all the more strength and credibility.<sup>3</sup>

Our report is structured as follows:

Chapter 2 describes the emergence of risk-based approaches to safety management and how this alone may have led to the generation of some societal concerns. It notes that controversies (societal concerns) over risk have various origins – they are by no means just about the public’s so-called irrationality. Many tend to have origins in ‘fears’ not unrelated to mainstream ideologies, such as environmentalism or globalisation, or simply emerge from *zeitgeist*, such as

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<sup>3</sup> For instance, Renn (1998) describes sociological risk analysis as a ‘patchwork of conceptual approaches,’ *all of which* have a significant role to play in the enlightenment of risk managers. The search for a single “unified” theory, he says, may be elusive and is perhaps not even desirable.

the desire to live risk-free forever, or from major commercial or professional battles fought with reference to fundamental beliefs.

Chapter 3 analyses societal concerns and produces a novel classification identifying, in this case, four main types with twelve sub-groups. What distinguishes these variants is that they are underpinned by different motivations. The relevance is that regulatory strategies for responding to societal concerns need to be assessed in relation to the specific factors giving rise to that concern.

Chapter 4 describes alternative theoretical models of how risks are perceived. These are drawn from sociology, psychology and philosophy. Although there are differences of opinion at the expert level, a number of common themes emerge which have salience regarding official responses to societal concerns. This Chapter also introduces ‘rational field theory’ – a potentially valuable instrument for the analysis of societal concerns and risk management decisions in general.

Chapter 5 continues the discussion and Chapter 6 makes recommendations.

Appendix 1 elaborates upon one of a number of ways in which professional bias, intentional or otherwise, may intrude into risk management decision making, a phenomenon which itself can give rise to societal concern.

Appendix 2 describes a methodology devised by Renn and colleagues at the Centre for Technology Assessment in Stuttgart for defining risk management strategies for global environmental hazards. In the context of this report, it is of interest that this work also proceeds by first characterising hazards, just as we set out here to characterise societal concerns. The purpose of their report is on the whole different from this one – the existence of societal concerns as assessed by the political system is taken as given - but so far as overlaps occur, is not incompatible.

Appendix 3 describes prototype tools for probing ‘rational fields.’

Appendix 4 makes the point (important) that the wise use of resources, including money, is also a societal concern.



## **2 THE EMERGENCE OF SOCIETAL CONCERNS ON THE POLICY AGENDA**

### **2.1 FROM PRESCRIPTION TO RISK MANAGEMENT**

As noted in Chapter 1, there should be no surprise that the issue of societal concerns, as with risk itself, has risen high on the political agenda. This was inevitable following in particular the passage of the 1974 UK Health and Safety at Work Act (HSWA), in which an overt move was made towards risk-based regulation (McQuaid, 1998).<sup>4</sup> Prior to that, most safety legislation had been prescriptive, if also piecemeal and patchy. A good illustration of the spirit of prescription can be found in s. 28 of the Factories Act 1961 where it is stated that “For every staircase in a building ..... a substantial handrail shall be provided and maintained” (quoted by Farmer, 1989).

The important thing about the prescriptive approach to risk management is that, superficially at least, it left comparatively little room for either doubt or controversy (except, perhaps, in the hands of a barrister). Activities were, by implication or assertion, either safe or not (HSE 1999). However, with the passage of the HSWA, itself, it should not be forgotten, achieved only after protracted Parliamentary debate, the revolutionary concept of ‘so far as is reasonably practicable’ was introduced. Crucially, this connoted a long step away from the absolute. ‘Reasonable practicability’ remains a complex judgement entailing a weighing-up of the risk reduction benefits of a safety intervention and the cost and difficulty of its implementation (for additional factors which the HSE has identified as potentially relevant see Table 1). It now became the principle yardstick for ‘measuring’ how far it was necessary to go to comply with safety law. No single metric was involved, but a complex mix of criteria, the balancing of which was left, significantly, to the discretion of duty holders, regulatory officials and their advisers.

This Act, since followed by other risk-based legislation including notably the 1987 EU Framework Directive on Health and Safety in the Workplace and the UK’s Management of Health and Safety at Work Regulations 1999, turned out to be a harbinger of a worldwide shift towards risk-based regulation. This trend is not confined to occupational safety but is manifest in many fields beyond, for example, consumer safety, environmental protection, medicine, food safety and forensic psychiatry. While one of the primary motivations for this shift was to improve health and safety by the promotion of goal-setting over reliance upon prescriptive standards and codes of practice, in some cases at least it also required duty holders, those responsible for hazards, to assume the responsibility for deciding how safe was safe enough, based upon their own interpretation of reasonable practicability.<sup>5</sup> Common sense and responsibility were assumed. This approach, however, is intellectually demanding, all the more so in a litigious society engaged in political integration with larger bodies such as the EU. Litigation itself is becoming a serious source of income for some and has its own implications in generating demands for regulation of societal concerns.

### **2.2 DECISION MAKING ITSELF AS A SOURCE OF CONTROVERSY**

We consider that the above, by no means simple matter, constitutes another of the fundamental causes of the continuing controversies over existing hazards and future threats, particularly when

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<sup>4</sup> The emphasis here is on workplace safety, accidents and major hazards, but there are close parallels in the environmental arena which has seen a growth of ‘environmental alarmism’ (Lomborg, 2001), the introduction of new concepts such as ‘precaution’ (Boehmer-Christiansen 1994b) and the equivalent of ALARP, that is, the ‘best practicable environmental option.’

<sup>5</sup> For instance, see the Piper Alpha Inquiry report (Cullen 1990).

coupled with the contemporaneous shift towards greater transparency in decision making. For, it can readily be imagined, and as will be discussed in some detail in Chapter 4 and Appendix 1, decision makers and recipients of the consequences of decisions, operate according to a variety of beliefs, values, and traditional ways of doing things. Therein lies much scope for inconsistency which, in the absence of a suitable justification, could look all too much like management in disarray, inevitably leading to dissatisfaction. In our view more scrutiny should be afforded to who is required to make these complex judgements and the decision procedures actually employed.

### 2.3 THE PROFESSIONAL-PUBLIC DIVIDE - ONE OF MANY CONFLICTS

Furthermore, risk decisions are clearly of interest to many parties besides the general public, that is, all those affected by the decisions irrespective of whether they are directly involved in the decision process or not. This is hardly surprising, since it has been estimated that as much as ten per cent of a typical industrial nation's resource is spent on safety-related matters. Apart from the natural interest of those who initially foot the bill, and those who ultimately pay for it (consumers/taxpayers), many groups actually make their living out of safety. As these groups increase in number and influence it has to be anticipated that 'societal concerns' will figure ever more prominently on the agenda.

In view of the significance of safety investment as part of the economy, a number of authors have consequently been prompted to analyse risk-based decisions in terms of their apparent cost-effectiveness. Generally, these investigations have found huge disparities between different programmes in terms of the amount invested per unit of risk reduction gained (e.g. Belzer, 1992; Fernandes-Russell et al., 1988; Tengs et al., 1995; Travis, Richter, Pack and Fisher, 1987; Viscusi, 1992). This apparent discrepancy has often been taken as implying that, within society, resources may have been seriously misallocated. For example, in the energy policy realm it is often alleged that if all energy industries were regulated to the same standard of health and safety as is the nuclear industry, we would have no such industries.

For some theorists, it has been a short step to attribute these discrepancies to pressures arising from public perceptions (societal concerns) of risk. This in turn has encouraged extensive research into the nature of risk perception. As remarked by Paul Slovic in 1999, in defence of the public:

“These critics draw a sharp dichotomy between the experts and the public. Experts are seen as purveying risk assessments, characterised as objective, analytic, wise, and rational – based on *real risks*. In contrast, the public is often seen to rely on *perceptions of risk* that are subjective, often hypothetical, emotional, foolish, and irrational.” (Slovic, 1992)

While not everyone is so critical of the public (itself a vague and flexible term),<sup>1</sup> scathing indictment of public rationality nonetheless is a seemingly deeply entrenched phenomenon in some quarters. Ample evidence of elite concerns about the supposed irrationality of the public as decision makers can be inferred from the number of research programmes mounted in the UK in recent years whose themes have been broadly described as 'The public understanding of science (or risk).' These have tended to imply that ignorance and misperception were widespread, and accounted for the aforementioned discrepancies. Yet, other studies have shown, even from the early days of research into perception of risk, that the public's perceptions of risk and their

understanding of things like probability, while imperfect, are in most cases far better (though obviously not perfect)<sup>6</sup> than this group apparently supposes, and far from irrational (Slovic, 1992; Fischhoff, 1995; Frewer et al., 1998; Houghton et al., 1999). Brian Wynne has suggested an alternative motivation for the re-emergence of the public understanding of science as an issue:

“(this) can be seen as part of the scientific establishment’s anxious response to a legitimation vacuum which threatened the well-being and social standing of science.” (Wynne 1992)

Provocative though Wynne’s message may be, there are many commentators who would lend it some credibility, ourselves included, while also noting that this phenomenon is primarily British and is not considered important on the Continent with its generally more scientifically-educated ‘public.’ This has not deterred ‘rationality of science’ lobbyists in some countries from maintaining an enduring, and some say desperate, search for salvation through yet another field, namely, that of

**Table 1** Factors to be weighed in risk decisions (HSE, 1989)

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***Summary of factors affecting compliance with ALARP***

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***Economic***  
 Questions of reasonable practicability: can relatively cheap modifications significantly reduce risk?  
 What proportion of those exposed get a livelihood from the hazard source?  
 What other benefits does the source provide to the community?

***Psychological and ethical***

- Does the hazard present a continuous or catastrophic risk?
- Is it natural or man-made?
- Is there a possibility of harm to future generations?
- Is potential harm immediate or delayed?
- Uncertainties in risk magnitude and consequence
- Are vulnerable groups of the public exposed?
- Is it a familiar or novel hazard?
- Is the harm reversible?
- Is the risk voluntary?

***Alternatives and benefits***

- What are the available alternatives and implications?
- What is the perception of associated benefits?
- What is the importance to the nation of the project, including economic and other benefits?

***Ends***

- What are the political objectives at national and local levels?

***Management competence***

- Does the public have confidence in the independence and quality of expert advice?
- What is known about the quality of project management?
- Could emergency services cope with incidents?

***Process***

- Does the public believe that all views have been heard and all alternatives considered?
- Does the public have confidence in the independence and fairness of regulatory authorities?

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<sup>6</sup> We cannot agree with some commentators who appear to assume that the public is always well informed, or, for that matter, experts.

risk communication. They remain concerned over public attitudes to hazards of various kinds, and the public's apparent failure to heed messages emanating from technical assessments. Thus, beginning in the 1980s, and continuing to this day, there has been much emphasis on risk communication. However, the fact is that apart from a few local successes, it has largely failed to either stem dissatisfaction or reduce conflicts (Slovic, 1999; Fernandes-Russell et al., 1988).<sup>7</sup> Indeed, it is not uncommon, and perhaps, on reflection, not surprising either, that communication efforts can exacerbate public concern. As Fischhoff has said:

“The best-case scenario for risk communication (and, indeed, risk management) is having fewer, but better conflicts. Some conflicts would be avoided by preventing needless misunderstandings, others by forestalling (or redesigning) unacceptable projects. Those that remain would be better focused on real issues.” (Fischhoff, 1995)

## 2.4 SOME INITIAL CONCLUSIONS

Our initial conclusions and observations here are hardly surprising. Risk issues are controversial because, on the one hand, of the comparative novelty of the risk-based approach in society and the fact that risk-based decision making involves choices which are substantially value-based. Secondly, risk issues provide ‘opportunities,’ political or economic, to those who promise abatement. Such choices are still treated in some quarters as if they are open to solution by ‘rational thinking.’<sup>8</sup>

Although debate over risk is in many ways a sign of a healthy society, we feel much concern about the level of the debate which has tended to polarise in some arenas (as in the case of the expert-public dichotomy), while barely leaving the starting blocks in terms of quality in others (e.g. over ‘global warming’). In order to take things further, in the next Chapter we examine much more closely the nature of societal concerns, and attempt a classification.

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<sup>7</sup> Although the failure of risk communication as a means of assuaging public concern is clearly observable, in some quarters hope still abounds. It is tempting to suppose that this may be because an influential sector of the risk community has strongly-held beliefs in this area. It is well known from studies of risk perception that women generally judge risks to be larger and more problematic than men. Various hypotheses have been put forward to explain this based upon biology and social experience. However, a more detailed study of male-female and white-non-white perceptions of risk in the USA (Slovic 1999) indicated that the gender difference in risk perception was traceable firstly to white males rather than black males, and then to a particular sub-group of white males who produced risk perception ratings that were consistently lower than for the other three groups and for the majority of white males themselves. This sub-group of white males was found to be characterised by higher incomes, higher education and political conservatism, by trust in institutions and authorities, and by anti-egalitarian attitudes, including a disinclination to yield decision-making power to ordinary citizens in areas of risk management. It does not take much of a stretch of the imagination to conceive of people with characteristics such as these, being successful, and hence influential, in hierarchical agencies in both the public and private sectors, including those with responsibilities for risk management.

<sup>8</sup> Rational thinkers of this type are often imposing their own view of rationality on others.

## 3 AN ANALYSIS OF THE CAUSES OF SOCIETAL CONCERNS

### 3.1 THE APPROACH

In our experience societal concerns, although superficially about risk-related issues, are frequently about other things besides, or even instead. If evidence were needed, this was amply provided by the December 2001 HSC/Policy Studies Institute conference in London aptly entitled ‘Trade-offs in risk: are we getting it right?’ The main case studies described at this gathering included gas pipelines and train safety. It soon became clear that societal concerns could be viewed differently from each of the perspectives of the many different stakeholders present, not excluding their exploitation as a means of furthering colossal investment programmes. In some of these cases it is difficult to determine if the real interest is the societal concern of the public which matters, or the furtherance of commercial, professional, institutional or personal interests. We are of the opinion that it is crucially important for the regulator to be as fully cognisant as possible of the social legitimacy of those hazards impugned as ‘societal concerns’ in deciding which action to pursue. For this reason we attempt in this Chapter to set out a typology of motivations giving rise to or otherwise promoting societal concerns, including some which we consider to be of dubious legitimacy.

Our system of approach is based on that used by Granger Morgan and Max Henrion in 1990. Morgan and Henrion’s interest was policy analysis. They observed that, although it is frequently assumed that policy analysis is undertaken to provide better insight and understanding of a

**Table 2** Summary of some of the motivations of people and organisations for carrying out policy-focused research (based on Morgan and Henrion, 1990)

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#### *Types of motivation*

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##### *Substance-focused motivations*

1. To obtain an “answer” to a specific policy question prior to implementation
2. To develop insight for policymakers
3. To illuminate a policy area for a variety of interested parties

##### *Position-focused motivations*

4. To provide arguments in support of one’s already established position
5. To generate an answer to justify an action

##### *Process-focused motivations*

6. To persuade others that one has things under control and can be trusted
7. Because of legal requirements (e.g. to carry out a risk assessment)
8. Because other people expect it
9. Because it is not obvious what else to do and political reality requires that something be done

##### *Analyst-focused motivations*

10. To derive enjoyment, professional recognition and rewards
  11. To use a specific problem to demonstrate one’s analytical tools
  12. Because it is the analyst’s job
  13. Because it is the only thing the analyst knows how to do
- 

problem, this is not necessarily the case. Their analysis, reproduced in simplified tabular form in Table 2, highlighted the controversial conclusion that research of this kind is conducted for a



host of reasons besides the prima facie reason, that is, to answer a specific policy question. No proof is offered of the authenticity of the items included in Table 2, but conventional wisdom and experience lead one to grant it a certain plausibility. For example, in support of item 4, Boehmer-Christiansen (1999) has described the motivations for using and misusing science, and hence risk, in policy. The implication of the Table is that motives can be characterised as being of a social, political, professional or even personal nature. Thus, bias, intentional or otherwise, usurps what otherwise might have been taken for objectivity, and motives, not reason, emerge as a key driving force of human behaviour. Motives, however, tend to remain disguised, either deliberately or inadvertently, and are not therefore easily identified or made transparent. Knowledge is selected and emphasised to serve interests, including existing or desired power relationships.

The reason for introducing Table 2 here is that it might be possible to generate a similar deconstruction of motivations underpinning societal concerns. As described in Chapter 2 and above, hints of competing interests of various kinds are rife. The point of doing this would be to illuminate the possible factors leading to societal concerns and to open up the potential for discussing what these concerns are really about. We proceed along these lines in the following section, using case studies wherever we are able to illustrate the points.

### **3.2 A CLASSIFICATION OF SOCIETAL CONCERNS**

Our classification of societal concerns and factors giving rise to them is summarised in Table 3. First in the Table are what have here been termed ‘substance-derived’ concerns, the term implying that the concern is specifically associated with the hazard itself or something closely associated with it. Concerns of this kind could be attributed directly to worries over the level of risk or nature of consequences, whether real or perceived, or they might stem from some other factor associated with the issue other than safety. Within this group there are two sub-classifications, denoted as type 1 and type 2. Examples of type 1 societal concern might well include road safety, especially of children, say, but also arguably of the workforce (when compared with other workplace activities), or the concern of some health care professionals over the occurrence of injuries in the general population. It is pointed out that this second example originates from a professional concern rather than the public, but nonetheless it may still result in the expression of societal concern. Type 1 concerns are probably those which professionals, particularly those with ‘naive-positivist’ leanings,<sup>9</sup> would regard as the most ‘genuine’ forms of societal concern.

Type 2 concerns involve peripheral impacts of hazards or their methods of control. They are also quite ‘genuine’ from a stakeholders perspective, but less so from that of experts because the issues of stakeholder concern may differ substantially from the expert’s focus. An example of type 2 societal concern is provided by the recent outbreak of foot and mouth disease. Apart from the hazard of foot and mouth itself, anxiety has been generated over the method of control of the disease, the methods used in the raising of farm animals in general which were exposed by the crisis, and the knock-on effects for tourism in Britain. There is no shortage of examples within this category. The disposal of the Brent Spar off-shore oil storage vessel is another potential member. Although the dispute, between Greenpeace and Shell, was largely framed in terms of alleged environmental contamination which might result from residual chemicals in the Spar, it is plausible

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<sup>9</sup> For a discussion of naive-positivism see Chapter 5 and Shrader-Frechette (1991).

**Table 3** A summary of types of societal concern and their causes

<i>Underlying nature of a societal concern</i>	<i>Motivations and/or possible causes</i>
<b><i>Substance-derived origins</i></b>	
1. The associated risk is genuinely high or believed or predicted to be high	- specific concern over safety
2. The hazard, or the way it is controlled, impinges adversely on some other aspect of life or the common good which is valued	- specific concern over other (non-safety) factors embroiled in the issue
<b><i>Value-derived origins</i></b>	
3. The associated activity is inherently undesirable because it infringes the ethical considerations of one or more stakeholder groups	- ethical conflict
4. The hazard is not being properly handled	- failure to comply with legal requirements - does not accord with a specific group's beliefs about how hazards should be managed
5. The activity is undesirable because some believe there are more important goals	- preference for other goals
<b><i>Process-derived origins</i></b>	
6. Consultation between risk managers (duty holders) and risk bearers is inadequate	- hubris; insufficient oversight
7. Confidence of stakeholders in one another is poor	- lack of trust
8. Risk amplification has occurred	- activities of a particular group(s) give prominence to an issue
9. Lack of concern about a risk (risk attenuation)	- apathy; powerlessness (real or imagined)
10. The same ends can be achieved by alternative and better means	- preference for alternative means
11. Failure to consider risk transfers	- oversight
<b><i>Stakeholder-derived origins</i></b>	
12. A stakeholder group (not necessarily the public) has promoted an issue according to its own beliefs or needs	- because it is in accord with their philosophy or ambitions - because it is their job - because they seek the publicity

that the concern expressed by the public had more to do with the much broader issue of the overall state and exploitation by commercial interests of the marine ecosystem which had long been in the news (Ball, 1998). Brent Spar itself was purely a token of this, being one only of numerous such objects disposed of in the sea, not to mention chemical waste discharges, fisheries activities, and the like, which all exact their toll on marine life. Thus, the 'risk' in this case is really no more than a symbol for a much vaguer, unspecified future threat and as such risk perception and risk management become part of the art of political persuasion. This has not prevented Shell from being deeply affected and, apparently, more risk-averse.

The next category of societal concern listed in Table 3 is labelled 'value-derived.' Authors from a variety of disciplines, anthropology, sociology, philosophy and political science, have all described the different value systems to which people may adhere. Ultimately, although frequently overlooked, all risk management decisions are anchored in a value or belief system of one kind or another (see Chapters 4 and 5 for a discussion). The alternative impression, which is quite often given although it is erroneous, is that decisions somehow effortlessly make

themselves subject only to the provision of a ‘proper’ scientific analysis.<sup>10</sup> In the case of the BSE-CJD crisis, for example, the government stressed that the decisions on how to handle the affair should be made by the committee of appointed scientists. According to the rationale that decisions are necessarily value-based, this would have been a mistake, since the role of values in the decision process was not made transparent and was even denied.<sup>11</sup> The rationale would suggest instead that choices on how to proceed should have been made by the government itself and not the scientific community, since these decisions depend on value-based political choices. This is not intended to challenge the value of the scientific information provided by the committee as one of the inputs to the decision process.

Within the category of ‘value-derived’ societal concerns, three sub-groups have been listed. First are those driven by overt ethical conflicts (type 3). Examples are easily found and include the genetic engineering of crops, though even here we note ‘contamination’ with trade issues. No matter how many risk assessments are done of GM crop trials, there will remain a fundamental conflict between those who oppose what they see as ‘tinkering with nature,’ or playing God, and those who regard this research as essential for the survival of the human race or merely as their legitimate job or just scientific ‘progress.’ Similar arguments pertain with regard to human cloning, and the construction of dams in developing countries, the latter entailing trade-offs between development and the anticipated gradual improvement of social conditions for the many, versus the displacement of sometimes huge human populations and the destruction of natural habitats.

However, ethical positions impact in all risk management decisions to some degree or another, and not just in the more high profile examples like those cited above. For example, for some time it has been accepted that the maximum tolerable risk for those at work is higher than for the general public on the basis that workers get some benefit from their jobs and have, to some degree, a choice about which job they take. This presumption, however, reasonable though it may be from some perspectives, raises ethical questions. Why should workers be exposed to higher risk when everyone is expected by society to work? Likewise, the use of techniques like cost-benefit analysis in decision making, a widespread practice in Britain and Europe, is founded in one particular ethic - utilitarianism - and is not consistent with other perspectives such as preferential support for the weakest, or even future, members of society.

Type 4 societal concerns are also value-based, although not in the same way. In this case the values are derived from professional or institutional worldviews, codes of practice, and ways of working. For example, the Royal Society for the Prevention of Accidents (RoSPA), as its name implies, is primarily concerned with accident prevention or minimisation. Thus, RoSPA might take a different view on, say, the safety of adventure activities from that of the HSE, the latter’s fundamental philosophy, based upon the Health & Safety at Work Act 1974, being to reduce risks so far as reasonably practicable i.e. to take account of the monetary costs, opportunity costs, and difficulty of implementing control measures in comparison with the risk-reduction benefits

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<sup>10</sup> We believe, as do many others (e.g. Graham and Wiener (1995) and Seedhouse (1992)), that science is only objective within certain boundaries (constrained rationality or rational fields) which should be clearly defined. In most circumstances, an intellectual effort is needed to separate value from science, especially in science used for regulation. For example, a pollution control standard will consist of scientific evidence plus value-based assumptions about the appropriate trade-off between health and control and opportunity costs. At a deeper level, science may also have made value judgements about which pollutants to measure (often determined by measurement capability), and which dose-response functions to believe in.

<sup>11</sup> The same is likely to apply to the ‘global warming’ debate in the UK, see Boehmer-Christiansen and Kellow (2002).

of the measures, before deciding upon a risk control strategy.<sup>12</sup> In fact, as described later, many institutions and their associated professions have carved out their own specific approach to safety decision making, sometimes in isolation from other professions, and these are in many cases not consistent with each other (see Appendix 1 for further details). Inconsistencies in professional decision making are bread and butter for the media, and the subsequent public exposure of these differences may itself lead to the generation of societal concerns. In some ways the saga of Automatic Train Protection in the UK provides an illustration. British Rail and Railtrack have not sought to implement ATP, believing, probably correctly, that it is not justified on reasonable practicability grounds. Other groups, however, professional and lay, approach the matter from a different perspective and find it difficult to comprehend how the railways can avoid wishing to implement a system which is perceived to be working in some other European countries and which apparently saves lives.

A further variant of ‘value-derived’ societal concerns arises when the parties involved have a preference for different goals. This type 5 societal concern is invoked by the debate over Britain’s energy futures. For some, the determining factor should be the most competitive consumer prices and this, along with some lip service to air quality considerations, has spawned the current proliferation of gas-fired power stations. Others view this trend far less favourably because a valuable hydrocarbon resource, gas, is being consumed in what is seen as profligate fashion without much regard for future generations who will be forced to rely upon other sources to generate the numerous benefits supplied by this commodity. So in this case the goal of low prices in the short term has prevailed over the alternative goal which some would describe as the careful, long-term management of the resource (that is, to use a fashionable term, ‘sustainability’). These are not the only goals that might be considered in this context. Security of supply is also an issue which is known to give rise to societal concerns, as demonstrated by the recent power cuts in California. Until very recently, security of supply has not been much of an issue in day-to-day Britain, but as gas reserves deplete and the country becomes more reliant upon remote foreign suppliers in regions of political instability, and particularly if other sources of power such as the nuclear sector are phased out, the issue has a fair chance of re-emerging with a vengeance. Indeed, there are signs that this is already beginning to happen, with various lobbies (renewables, energy efficiency etc.) necessarily having an interest in stressing, if not exaggerating, this scenario (Laughton, 2001).

The third category of societal concerns listed in Table 3 is described as ‘process-derived.’ Broadly speaking, these societal concerns arise primarily because of the way in which hazards have been managed rather than because of the associated risk or any ethical conflict. It is well established that even very small risks can give rise to significant concern if, for whatever reason, consultation between duty holders and those exposed to a risk is inadequate, or if there is insufficient trust. We believe that a great deal, though not all, nuclear concerns still arise out of a legacy of distrust, combined with an exploitation by special interest groups (type 12 – see below).

Likewise, it could be argued that the societal concern surrounding the operation of the Rechem chemical waste incineration plant in Pontypool in the early 1990s exhibited some aspects of type 6 and 7 societal concerns. Certainly, there was a lack of trust between stakeholders such that the plant’s activities were viewed with suspicion by many members of the local community, and this prompted the Welsh Office to commission an independent survey of contamination around the

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<sup>12</sup> The HSC/E’s mission statement is “to ensure that risks to people’s health and safety from work activities are properly controlled.”

plant. The survey itself also drew attention to the main likely source of off-site contamination being, not the incinerator stack, but a shed where components were dismembered prior to incineration. This shed was directly vented to the atmosphere for the purpose of reducing operative exposure to chemical fumes, suggesting that a lack of communication or foresight by those responsible for occupational safety may have contributed to the environmental contamination which subsequently arose and the ensuing disquiet.<sup>13</sup> These types of societal concerns, it is clear, may arise because of communication barriers between any combinations of the many stakeholders involved in these issues – it is not *just* a problem of the expert-public interface.

Recently D. F. Peat (2002) has argued that one reason for loss of trust which does operate at the expert-public interface can be put down to the failure of experts to fully incorporate into their thinking the implications of chaos theory. Although the central idea of uncertainty has inveigled its way into the thinking of society as a whole, there is still a tendency among some professionals to act as if they possessed some god-like certainty about the future consequences of their actions. Yet, as Graham and Weiner (1995) and many others have pointed out, numerous safety interventions which have been implemented appear to have had no effect at all, or worse, when reviewed in the cold light of day (Jarvis et al., 1995; Scuffham and Langley, 1997; Ball, 2002).

A further cause of societal concerns is risk amplification (type 8 in Table 3). Risk amplification may occur inadvertently through the normal, though complex, operations of society in dealing with any particular issue. As the American, Sapolsky, has correctly observed, “There is no shortage of information about risks. Let a potential risk be identified and soon all possibly relevant professions, agencies, and trade groups will offer public positions in order to protect established interests or proclaim new ones. Add the news appeal of risk stories, the availability of advertising dollars to defend and promote products, and the ongoing flood of scientific reports and there is a flood of guidance for the concerned” (Sapolsky, 1990). Thus, concern if not fear is propagated throughout a society.

An illustration of this is the perennial issue of child safety in playgrounds. Although the actual risk of injury in playgrounds is, perhaps surprisingly, small, considering what goes on in these places, substantial public concern has been expressed unwaveringly over at least two decades (Ball, 2002). This can partly be attributed to the number of agencies which have declared an interest. These include play providers, mainly schools and local authorities, the private sector and charities, equipment manufacturers, playground designers, parents, play promotional agencies, standards-setting bodies, insurers, solicitors, assorted experts, the courts, regulatory bodies, advisory bodies, the health service, the media, publicity-seekers, and academics of various persuasions.<sup>14</sup> Naturally, not all of these groups are as well-informed. More importantly, they do not have the same interests and aspirations. The resulting Tower of Babel alone is capable of creating a societal concern whether or not, in the cool light of day, there is much to fight over.

The other side of the coin arises when there is insufficient concern, as judged by one or more stakeholder group, about some particular hazard. Given that, as Sandman (1995) has said, the normal public state of affairs over risks is apathy (commercial examples are of course not unknown), there are plenty of opportunities where risks may be seen to have been attenuated. In particular, this can arise where those exposed are somehow de-coupled from the reality. This can

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<sup>13</sup> It is a salutary lesson that while the shed was quietly discharging into the environment, experts were deeply engrossed in ever-more technically detailed discussions of chemical measurement, atmospheric dispersion, and statistics.

<sup>14</sup> Even HSBC has a web page on playground safety.

occur for a variety of reasons. In the case of the low uptake of MMR vaccine, for example, it is now so long since there has been an epidemic of these diseases that even most health workers are unfamiliar with them. It is therefore unsurprising that the interest of public, who are even more removed, has waned, let alone the effects of any anxiety they may have over the side effects of the vaccine itself, and it is left for concerned experts to try to generate a societal concern. In contrast, experts have often used the risk of death on the road (about 1 in 10,000 per annum), as an example of a risk which the public by and large accepts in exchange for the benefits. The apparent lack of concern in this case may, in fact, be more associated with the real difficulty of getting anything done about it, than with the supposed risk-benefit trade-off. A risk of this magnitude means that every person in the country will have a family member, relative, or friend killed or seriously injured on the roads in their lifetime. De-coupling can also occur when markets are encouraged to operate 'competitively.' Consumers, for instance, are bombarded with information on the relative prices of gas and electricity from various suppliers, and might well think it good sense to take the 'best' offer. However, the 'best' offer may entail buying from a company which has employment or environmental policies which, were the consumer fully informed, would be wholly unacceptable.

Societal concern type 10 occurs when different beliefs exist about how best to proceed. Within the injury prevention field, for example, some clearly have a strong preference for environmental modification (e.g. the provision of specific safety features like helmets, handrails, seat belts, etc.), whereas others believe that education offers the best or only chance of success (Sibert, 1991). Clashes between such 'world views' may themselves generate societal concerns, for example, the heated debate within the injury prevention community over whether or not the wearing of cycle helmets should be vigorously promoted or even mandatory. The philosopher Seedhouse (1997), as discussed later, has described how different beliefs about the goals of health care lead to confusion and stress within our public healthcare system. Boehmer-Christiansen (2001) has described how, in the case of the 'climate change' issue, alternative solutions have become a part of the debate, with proponents of some solutions standing to gain if the risk can be intensified, and others if strong ethical dimensions are invoked.

A further important, process-derived, cause of societal concern (type 11) may arise where particular safety interventions are introduced without due consideration of the possibility of risk transfers. Risk transfers may simply shift an existing risk to some other group, may transform it into a different kind of risk altogether, or may increase risk through some unanticipated behavioural response (Graham and Weiner, 1995). For example, the provision of well-marked road crossings may invite some pedestrians to cross without looking both ways, and medicine bottles with 'child-safe' caps may encourage parents to leave those bottles nearer to a child's hands or, even, not to lock the entire medicine cabinet.

The final category of societal concern listed in Table 3 (type 12) is denoted as 'stakeholder-derived,' implying the imposition of some kind of vested interest. This phenomenon is widespread.<sup>15, 16</sup> It may be deliberate or unintentional, altruistic or self-seeking, sensible or

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<sup>15</sup> The December 2001 seminar 'Trade-offs in managing risk: are we getting it right?' hosted by the HSC and the Policy Studies Institute, provided striking examples in which societal concerns were invoked, without apparently anything vaguely reminiscent of the kind of careful analysis which we recommend here, as a justification for truly colossal investment programmes. These concerned the rate of replacement of gas pipelines despite massive costs (to be passed on to consumers) and low risks and the strong possibility of risk transfer; likewise, ATP was projected to cost billions. Clearly, some agencies have huge interests in the furtherance of these programmes and extreme care should be taken in sanctioning investments of public money in ventures of this kind. The seemingly superficial invocation of 'societal concerns' provides no such justification. Another case is the building of an expensive wastewater treatment plant, the

misguided. Promoters of this kind of societal concern range from individual single interest campaigners, to wealthy corporations. Motivations range from passionate beliefs about justice, to commercial or publicity gain, or professional self-interest. In some cases, perpetrators may not be aware of their role in creating the concern, believing merely that they are doing their normal professional job. A well-known example can be found in the now recognised exaggeration of the risk posed by ‘acid rain.’ In fact, this cannot be pinned on any one group, since many sectors of society (even some industries), found one sort of benefit or another to be associated with the advocated mitigation or regulatory measures, and exploited the situation for these ends. Expressions of concern must be traced back to their sources and checked for evidence of exploitation. For instance, Boehmer-Christiansen and Kellow (2002) argue that the concern over ‘global warming’ is greatly exaggerated because of the influence of the large number of potential winners who will gain from the recommended emission reduction strategies. Although type 12 is the last type of societal concern listed in Table 3, this is probably the most pervasive. Nobody is immune, and only careful analysis can afford any hope of protection.

### **3.3 SOME CONCLUSIONS ON THE NATURE OF SOCIETAL CONCERNS**

In our opinion the preceding analysis demonstrates conclusively that ‘societal concerns’ are very much a mixed bag. Some fit the ‘purist’ vision of being about the actual risk associated with some hazard, but most are not at all of this kind, being associated with peripheral implications of hazards or their management, or with ethical concerns, or beliefs about how things should be done. Yet others arise because of procedural issues, and most pervasive of all, perhaps, are those associated with some form of self-interest (personal, professional, institutional, commercial etc.) which may be deliberate or unintentional. The decision about how to proceed clearly depends upon the type of societal concern with which one is confronted (cf. the approach by Renn et al. to global environmental threats, as in Appendix 2), and ultimately upon the resources a specific political system decides to allocate to its mitigation, reduction or eradication.

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largest in Europe, at Hull, without demonstrable environmental benefit. Cost-benefit analysis was not permitted in the legal case brought by the EU against the UK government, which rather revolved around the legal definitions of estuary and sensitive areas.

<sup>16</sup> In passing, we note the recent keen interest of Enron, formerly traders in natural gas and involved in the UK’s ‘dash for gas,’ in ‘global warming’ and the Kyoto Protocol. What was the linkage?

## 4 THEORETICAL MODELS

This Chapter is concerned with theoretical models which have been put forward to explain the way in which humans perceive and react to risk. It is not the purpose of this study to promote any particular model endowed as ‘settling’ the issue of societal concerns. For one thing, we do not believe there is any such model (although we do find significant utility in a number of models). More importantly, though, the ultimate project goal is to make recommendations and in so doing it is necessary to be aware of the extent to which these are or are not model-dependent. In the following sections we therefore describe several models, from which, as fortune has it, many common features emerge. Later we will consider their implications for the handling of societal concerns.

### 4.1 A CLASSIFICATION OF RISK CONCEPTS IN SOCIOLOGY

In 1998 Ortwin Renn presented an influential paper entitled ‘*Risk Debates in Political Arenas*’ at the World Congress of Sociology. This paper was based on an earlier analysis by the same author (Renn, 1992). It provides what we consider to be an illuminating examination and classification of sociological perspectives on risk. An important feature of Renn’s work for the present report stems from the fact that it is often inferred that one primary source of disagreement over risk lies at the natural science-social science interface (this is in addition to that at the expert-public interface).<sup>17</sup> What Renn’s work exposes is a far more complex situation – discord over risk issues also exists within sociology itself, and the same is of course true within the natural sciences and allied professions (Ball, 2000a). So what should be done? As Renn, quoting Blumer (1931), says, “There can be no scientific investigation without classification.” In this section we report Renn’s findings, based on his classification, adding views of other commentators where shown.

According to Renn (and others, e.g. Shrader-Frechette (1991)), there exists a spectrum of approaches by which one might attempt to prioritise risk management activities. At one end of the spectrum, risks are sorted according to ‘objective’ measures of probability and harm. At the other end of the spectrum, risks are seen as purely social or cultural constructions, such that priorities should reflect social values and lifestyle preferences. While the importance of social and cultural factors is not disputed by most investigators, what is felt to be missing is a clear expression of how these factors may influence social judgements. Various sociological theories have been put forward for this purpose, but using different frameworks and classification criteria. What they have in common is the notion that humans do not perceive the world with pristine eyes, but through perceptual lenses filtered by social and cultural meanings.<sup>18</sup> Beyond this, consensus on the sociological perspective on risk is described by Renn as amounting to ‘a patchwork of conceptual approaches and theories.’

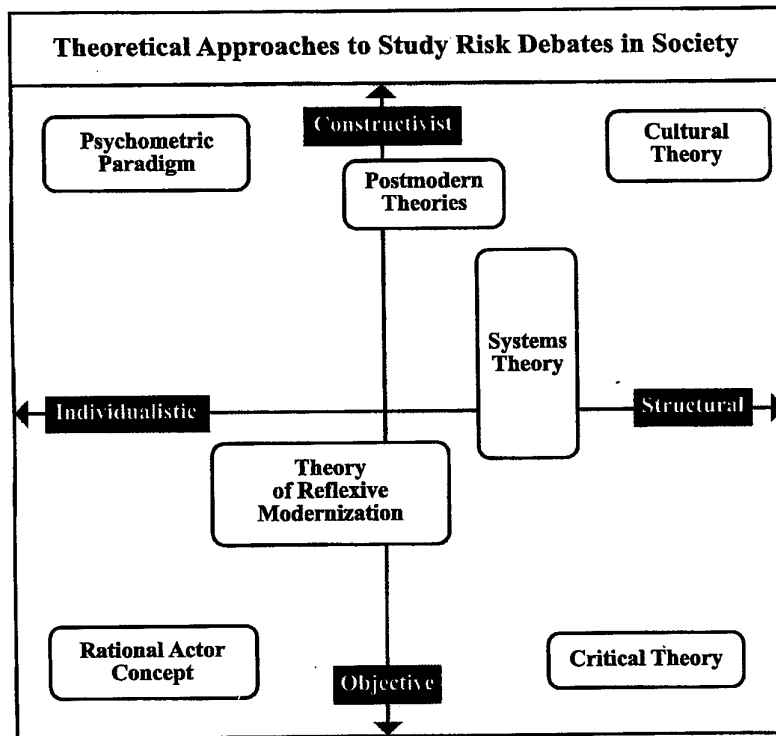
Nonetheless, criteria for prioritisation are still required. It is said that only when risks can be defined objectively is there a ‘simple’ policy response e.g. to reduce the greatest risk first. If risk is socially or culturally constructed, criteria will differ and are harder to define because contrasting social values and life-style preferences should be reflected. With the growing variety of life-styles or belief systems, modern society has become increasingly risk averse, or so it is said, and perceptions of risk are more and more fragmented. However, Renn himself is rather critical of

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<sup>17</sup> Recall, for example, the debate underlying the 1992 Royal Society Study Group report ‘Risk – analysis, perception, management.’

<sup>18</sup> Here Renn quotes Dietz.





**Figure 1** Major sociological perspectives on risk (Renn, 1998)

those who see all risk assessments as subjective and still finds utility in ‘objective risk assessment’ for that category of risks where data are available, causation is well understood, and societal concerns are non-existent or uncontested. When risks are argued about, the debates relate to assumptions about the nature of society, the individual, and the degree of objectivity possible, but here social scientists too speak in many voices. This has led Renn to set out a simple scheme which delineates the criteria used by different social science persuasions to analyse and prioritise risk. The outcome, summarised in Figure 1, warrants some explanation.

In this taxonomy, Renn orders the sociological approaches with respect to two dimensions. The abscissa represents the continuum between an individualistic and a structural (collective) focus when investigating risk debates. Structural concepts emphasise that complex social phenomena cannot be explained by individual behaviour alone, but that they rest upon interactive, often unintentional effects among individuals and between larger units, be they institutions, social groups, subcultures or a society. The ordinate, on the other hand, measures the degree to which one believes that a risk is capable of being objectively understood. At the top is the position that all knowledge about risk is socially-constructed, subjective, and unmeasurable. At the bottom is the position that all knowledge is directly experienced from physical reality accessible through a combination of data collecting and theoretical reasoning. Figure 1 indicates Renn’s view of where some major theoretical approaches to the social processing of risk might lie with respect to these axes. He goes on to describe briefly a few of these theories (descriptions of others can be found in Renn (1992):

- *The Rational Actor Paradigm (RAP)*

This model underlies traditional, number based risk assessment and requires a great deal of knowledge as distinct from speculation and guesswork or modelling of the future. Individuals and institutions are both treated as rational, self-seeking entities, aiming to balance risks with benefits. This has its roots in mainstream Western philosophy and especially economics: goal-attainment motivation, and individual choice are its themes based upon the acceptance of the possibility of knowledge about future outcomes, the predictability of human actions, and the optimisation of individual utility. This paradigm is accepted by most schools of thought as the ‘touchstone’ of current risk assessment, but it is under attack. While it is felt that the aggregate effect of these choices gives the market and institutions predictability and consistency, even in the absence of a self-conscious collective will, concern is generated over the imperialistic extension of RAP to social phenomena for which it is perceived to be unsuited.

- *Systems Theory*

A major goal of paradigms other than RAP is to try to identify and define additional classifications of social concerns which then must rely on negotiations to achieve agreed risk control strategies. Systems theory takes a collective perspective and assumes multiple rationalities. Under this scenario, uniform regulation is clearly more contentious because people are bound to disagree about risks and this will generate resentment among some groups. Systems theory is also more concerned with the effects of one individual’s actions on others, and disputes the assumptions of RAP that all individuals have enough knowledge to make rational choices. Under its assumptions, prediction of outcomes in a real and complex world is difficult if not impossible, and the claim to rationality merely an imposed ideology – that of experts (Rayner, 1987).

Judgements by groups and organisations become more important, and choice is now necessary as ‘multiple rationalities compete with each other for attention and influence.’ Uncertainty and indecisiveness may follow, with the tendency for threats to become exaggerated or suppressed. Congruence between risk takers and risk bearers is not possible. However, risk management institutions are not necessarily at fault (as Ulrich Beck might claim (Beck, 1990)), but are caught in the inevitable dilemma of regulating risks while people fear dangers which have been defined in non-objective terms. In this situation, regulators and risk creators use probabilistic reasoning for justifying their strategies, while the victims use perceptions of threat or alternative professional judgements as a justification for rejecting dangers. These two lines of reasoning are clearly incompatible, and, unsurprisingly, the political system finds it difficult to resolve the ensuing conflict (Wynne, 1992).

- *Reflexive Modernity*

This assumes that the ideological foundation of ‘*modernity*,’ with its numerical and expert based risk assessment, has lost its legitimating power. Science and technology alone are no longer the widely accepted reference for justifying collective action. The transfer of risk to third parties without their consent, typical of the traditional system, has made risk assessment highly contested and therefore politicised. Traditional technical risk assessment is rejected as simply a strategy for legitimisation via a false claim of scientific reasoning. It is argued that traditional risk assessment shifts risks elsewhere, to others, nature, or the future. Technical risk assessment

is seen as biased, as underestimating real threats, and is aimed at legitimising the ubiquitous exposure of society to incalculable risks. Beck (1992) claims that:<sup>19</sup>

- risk has replaced capital as the main consequence of capitalist expansion – by spreading risks over larger populations and externalising the unwanted consequences of production to third parties
- risk acceptability is predominantly an issue of distributive justice rather than of risk magnitude
- organisations develop routines for managing risks which de-emphasise responsibility and accountability
- technical risk assessments constitute legitimisation strategies to justify ubiquitous risk and lure people into accepting threats to their lives and livelihoods

Overcoming these weaknesses, it is said, requires change towards ‘reflexivity,’ that is, listening to many voices and negotiating outcomes rather than setting rules. Here is found a clear correspondence with cultural and critical theory (see below). All three provide ‘a consistent explanation for the confusing risk situation in modern and post-modern societies by placing the ‘risk society’ in the context of reflexive modernisation.’ They argue that successful organisations ‘need to evolve into reflexive entities that are open to manoeuvre in a chaotic sea of fast changing value systems, competing knowledge claims, and institutional constraints.’

As new risks are imposed on the public without their consent, what does Beck propose in response? Very little, according to Renn, ‘other than the rather naïve suggestion to risk management agencies to refuse licensing any technical facility that cannot insure its maximum losses.’ Some researchers doubt, however, that ‘reflexivity’ is possible for large organisations – whether they can acquire the needed flexibility and ability to adapt instead of relying on stable hierarchies and restricted communication. They may find it difficult to move beyond RAP.

- *Critical theory*

In contrast to the above, critical theory is derived from neo-Marxist political theory and as such is concerned with the emancipation of the working class at political, psychological and social levels. It is based on normative assumptions that are not shared by all sociologists but postulates ‘a common interest,’ an overarching rationality, that bridges the diversity of a pluralist society. If there is indeed a decline in universal rationality, critical theory argues, new values of this universal kind need to be created to provide for a collective orientation that does not conflict with personal aspirations. It assumes a form of societal RAP and claims that existing political structures lack legitimacy. The only viable solution for overcoming inequitable risk burden sharing, it is argued, is to create a forum for an open discourse in which all actors are given the opportunity to resolve their conflicts. The resolution of conflicts over risk without political power and pressure remains a problem, for ‘only in a powerless setting can a truly rationally motivated understanding emerge.’ Where should such open discourse take place? If inside bodies like the HSE, conflicts could be anticipated and solutions tested.

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<sup>19</sup> Of these four assertions, we would agree with the second and third.

- *Cultural Theory*<sup>20</sup>

Like critical theory, cultural theory rejects the technocratic RAP model and with the post-modernists tends to see all risk assessments as ‘socially-constructed knowledge systems amenable to criticism and deconstruction.’ In contrast, Renn argues that RAP ‘models’ remain appropriate for ensuring the most effective and efficient production and exchange of goods and services (and hence related risk management), but need auxiliary ethical norms or moral principles to distribute equitably the added value among society’s members. Social reality becomes impoverished if all actions have only one common goal - to maximise or optimise one’s own utility.

Cultural theory, like systems theory, posits the existence of cultural perspectives or basic attitudes, but goes further by attempting to provide a four-fold typology of cultural prototypes or clusters that are likely to form distinct response patterns towards risk. Renn is critical of cultural theory because he believes that all behaviour can be described as a mix of all four types<sup>21</sup> and considers it a hypothesis rather than exclusive explanation. While the emphasis on values and worldviews rather than interest and utilities is seen as a major accomplishment, the relationship between cultural prototype and organisational interest is viewed as unclear and problematic.

#### 4.2 SOME CONCLUSIONS ON SOCIOLOGICAL THEORIES OF RISK

First, Renn’s conclusions, which are several. Number one is that the technical analysis of risks provides only a narrow definition of undesirable effects. Despite this, Renn perceives some benefits, since it focuses on ‘real’ health effects and assures equal treatment for all risks under consideration. However, the price society pays for this methodological ‘rigour’ is its abstraction from the culture and context of risk-taking behaviour. On the other hand, sociological risk perspectives include contextual and cultural factors, but render the already difficult decision process even more so. Since we live in a pluralistic society with different value systems and world views, who can legitimately claim the right to select the values or preferences that should guide collective decision making?<sup>22</sup>

The ultimate remedy is seen to lie in communication processes that promote practical discourses over the integration of public values and facts into joint decision making efforts, processes built upon intensive dialogue and mutual social learning. (Shrader-Frechette (1991) argues that “objectivity requires simply the possibility of intelligible debate over the merits of rival paradigms.”) The idea is to build a common platform for members of the public, stakeholder groups, professionals and regulators. It is the aspiration that this would satisfy three primary goals (Renn, 1998):

- to include the best expertise on existing risk levels and interventions
- to ensure that the concerns and values of all those affected are part of the deliberative process
- to adjust regulations to the values and visions of those who need and want to be protected from hazards

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<sup>20</sup> For a fuller account, see Douglas and Wildavsky (1983), Schwarz and Thompson (1990), Adams (1995).

<sup>21</sup> Adams (1995) pp 202-4, also finds problems in assigning individuals to cultural types.

<sup>22</sup> Surely not the regulator, unless via delegation, but the politico-legal system.

However, having stated some of Renn's conclusions, the question arises as to how representative they are. Certainly, they do not please everyone. For example, Renn's classification of sociological perspectives on risk as in Figure 1 leads inexorably to the "...frustrations that are likely to evolve when sociologists try to classify sociological schools of thought...." (Renn, 1998). Thus, if you have striven for many years to devise an overarching framework of understanding, only to find it pigeon-holed in some far corner of a two-dimensional classification (as, for example, does the psychometric paradigm or cultural theory), there is potentially an implication that others do not perceive your work as you might think appropriate. This is unfortunate because Renn and others have many praises to sing of these theories and the light they have shed. As Renn (1998) says, "All theoretical concepts reviewed in this paper have a significant role to play in the analysis of risk behaviour and in the enlightenment of risk managers," a view echoed by Rayner (1992) – "each of the existing behavioral-science paradigms offers a plausible explanation for a different aspect of the problem." The dispute, if it exists, appears to revolve in part at least around the perceived primacy of each contending sociological theory, but so far as this study is concerned this is not the issue – it is peripheral.

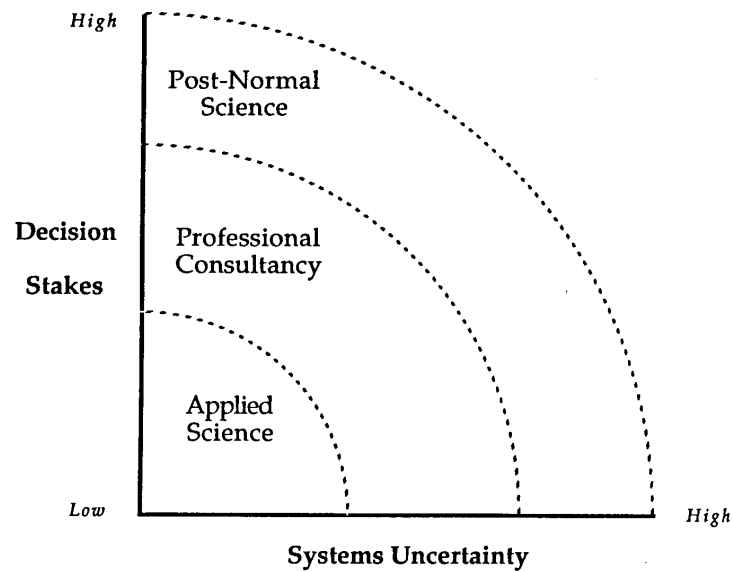
We now consider briefly some writings of a number of other authors. First we take Rayner's review of cultural theory and risk analysis (Rayner, 1992). Rayner observes that while the principles of cultural theory have been enormously influential,<sup>23</sup> its practical application has been very limited. He notes also that there are significant differences among even that small group of people who are actively working on cultural theory and are its main proponents.<sup>24</sup> It appears from this that the discord commonly associated with the public-expert interface, and the natural-social science interface, manifests itself at each level of society as you focus in, just as fractal images retain their complexity at higher and higher magnifications. However, what is important in terms of this project is, as Rayner says, that despite the many competing behavioural paradigms of risk analysis, all share the view that risk behaviour is a function of how human beings, individually and in groups, perceive their place in the world and the things that threaten it. If this at least is common ground, it does provide a basis on which to think about the types of problem-solving strategies that are needed.

Funtowicz and Ravetz (1992) also address this issue, namely, that scientific problem solving in the modern world requires awareness of both the factual and value dimensions of problems. According to their model, set out in Figure 2, the key parameters, measured on the axes, are *systems uncertainties* and *decision stakes*. Where these measures are low, traditional applied science is seen as appropriate, but at higher levels of uncertainty or decision stakes, traditional methods are inadequate. In the "wild" area, labelled 'post-normal science,' typically facts are uncertain, values in dispute, stakes high, and decisions urgent. In these circumstances the remedy is seen as something added to practice which bridges the gap between a concerned public and scientific expertise, namely, some form of dialogue among all stakeholders in a problem, regardless of their formal qualifications or affiliations.

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<sup>23</sup> Presumably a reference to 'academe,' as the influence is limited beyond.

<sup>24</sup> For example, Rayner describes those who subscribe to the 'stability hypothesis' (roughly, this states that individuals will seek to homogenise their experience of social structure in their lives i.e. individuals with hierarchist tendencies will seek hierarchist jobs) and those who adhere to the 'mobility hypothesis' (i.e. individuals may flit like butterflies from context to context changing their arguments as they do so).



**Figure 2** Three types of problem solving strategies (Funtowicz and Ravetz, 1992)

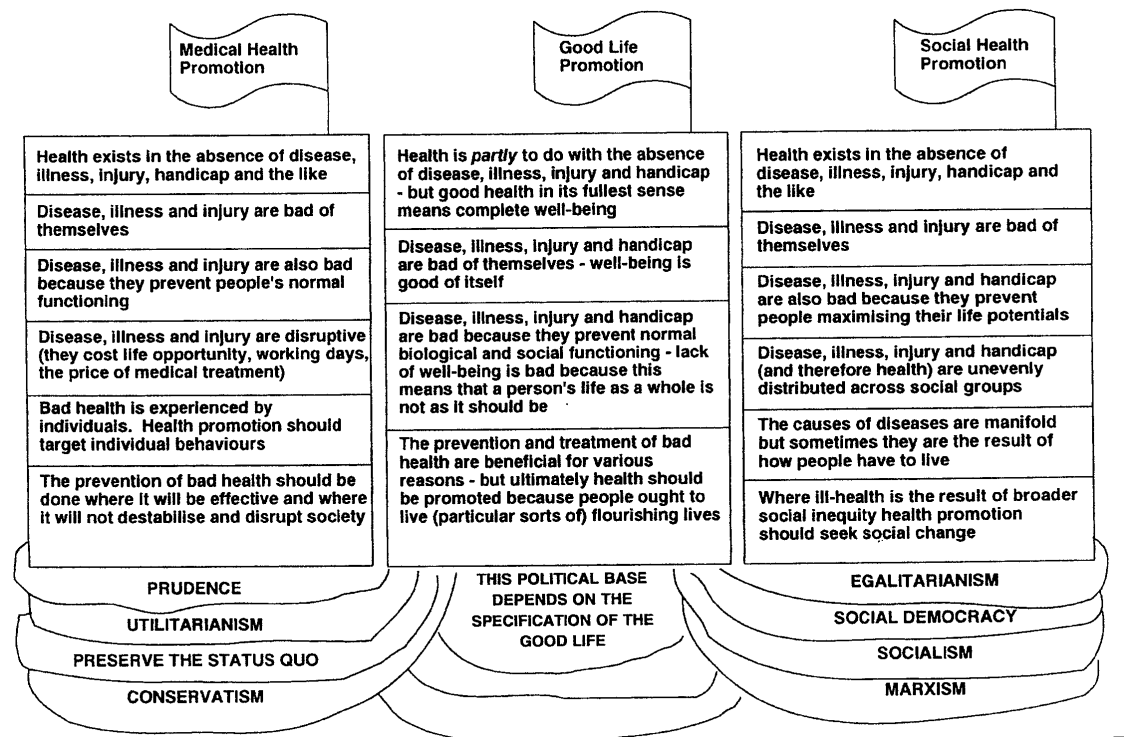
Rayner (1992) also describes the Funtowicz and Ravetz model, which he finds compatible with the framework of cultural theory, even though it was apparently first presented as a critique of this theory. All three authors observe that the most plausible opportunity for the application of a cultural relativism perspective lies in the outermost domain of ‘post-normal’ science, a term we are not particularly happy with although we recognise the difficulty. This would also fit in with Adams and Thompson’s model of three kinds of risk, that is, risk which is directly perceived, risk which is perceived through science, and ‘virtual’ risk (Adams and Thompson, 2002). Whether the world is actually as neatly compartmentalised as this is another matter, and we would certainly point out that the boundaries between these domains are anything but fixed. Certain case studies, for example, of the safety of children’s playgrounds (or climate change), seem not to fit comfortably into this mould. Concern over playground safety has been a global phenomenon for several decades, suggesting it might be regarded as one manifestation of societal concern. But in terms of the Funtowicz and Ravetz typology, it should probably lie within the ‘applied science’ zone, since the uncertainty and decision stakes are, when examined, rather low. In fact, playgrounds appear to have been on the agenda more because of the curious workings, ‘reflexivity’ perhaps, of society, than because of the characteristics of the hazard (Ball, 2002).

However, it would be unreasonable to expect perfection from any of these models of what are highly complex phenomena with all manner of feedback loops. This has not prevented them from providing numerous revealing insights and it is encouraging to observe the high degree of commonality regarding what needs to be done. These matters will be returned to later. First, though, it is worthwhile to consider the roots of societal concerns from a philosophical perspective.

#### **4.3 A PHILOSOPHICAL ANALYSIS**

A philosophical analysis of decision making described by Seedhouse (1997), although conceived in the context of health provision, is potentially highly relevant regarding the issue of societal concerns and risk management more widely. Figure 3 shows, in simplified form, one outcome of this analysis. In this Figure, three visions of health promotion – termed ‘medical health

promotion,' 'good life promotion' and 'social health promotion' – are listed. In fact, it is possible to identify a few other variants, but three are shown here for simplicity.<sup>25</sup> Of these, medical health promotion starts from the premise that health promotion should work against disease, illness and injury. Social health promotion, however, is anchored in the belief that health promotion should change the social world – it should challenge those social injustices which cause ill-health. Good life promotion, on the other hand, believes that health promotion should seek to bring about 'positive health' or 'well-being' and should thereby create 'good lives.'



**Figure 3** An elementary illustration of possible political biases of health promotion from Seedhouse (1997). On which foundation should health promotion (or risk management) be based?

Of these, medical health promotion is often considered to be objective (evidence-driven) because it aims to improve measurable aspects of people's lives – frequency of injury, illhealth, longevity etc. Social health promotion hopes to reduce health inequalities by improving the lives of the least well-off members of society. Good life promotion takes health to be more than the absence of disease, and consequently recommends activities which are not primarily about the prevention of maladies.

However, all three of these approaches are anchored in underlying political philosophies. Although there is ample room for argument about details, medical health promotion emanates from a political philosophy of prudence, utilitarianism, and the preservation of the status quo.

<sup>25</sup> In common with cultural and other theories, the number of possibilities is strictly limited because there is only a finite number of positions which can be held.

Thus, it could be said to be analogous to hierarchism as described by cultural theory. Under this philosophy, less emphasis would be assigned to things like unemployment-related illhealth and injuries caused by speeding on the road, because these things are either not measured or have not been given quantitative targets. Furthermore, medical health promotion is primarily carried out because illhealth is costly for society. Its roots lie in conservatism. While also anchored in political bias, social health promotion is perhaps more overtly so. Since the early eighties a number of movements, such as the WHO's Safe Communities initiative, have been keen to 'develop safe communities,' the belief being that health and social injustice are entwined (Ball, 2001). This concept has an egalitarian basis, with roots in the various kinds of social democracy. As for good life promotion, this strays far beyond health promotion and into the political minefield of what might constitute a 'good life' and who decides.

Without much difficulty, traces of these political biases can be observed at work in arenas for which the HSE has responsibility. The use of tools like cost-benefit analysis is, for example, just the kind of activity associated with evidence-based decision making, preservation of the status quo, and conservatism. On the other hand, the interest in organisational safety cultures and the setting of targets for injury reduction, suggest that social pressures are also at work.

Thus, Seedhouse has independently reached conclusions similar to those emerging from a number of the sociological models including, notably, cultural theory (also the more specific analysis of approaches to safety decision making described in Appendix 1). A pervading argument of Seedhouse's work is that decisions about health promotion, and by extension risk management, are always based on human values and that science in fact cannot but take a secondary informative role in the decision process. Thus:

*various pieces of evidence + various pieces of opinion = a risk management decision*  
(adapted from Seedhouse (1997))

To paraphrase Seedhouse, since what constitutes good risk management can be thought of in a number of different ways, and since risk managers subscribe to a range of political philosophies, risk management is riddled with deep theoretical tensions. Inevitably, this leads to argument, conflict even, and in turn may lead to the generation of societal concerns.

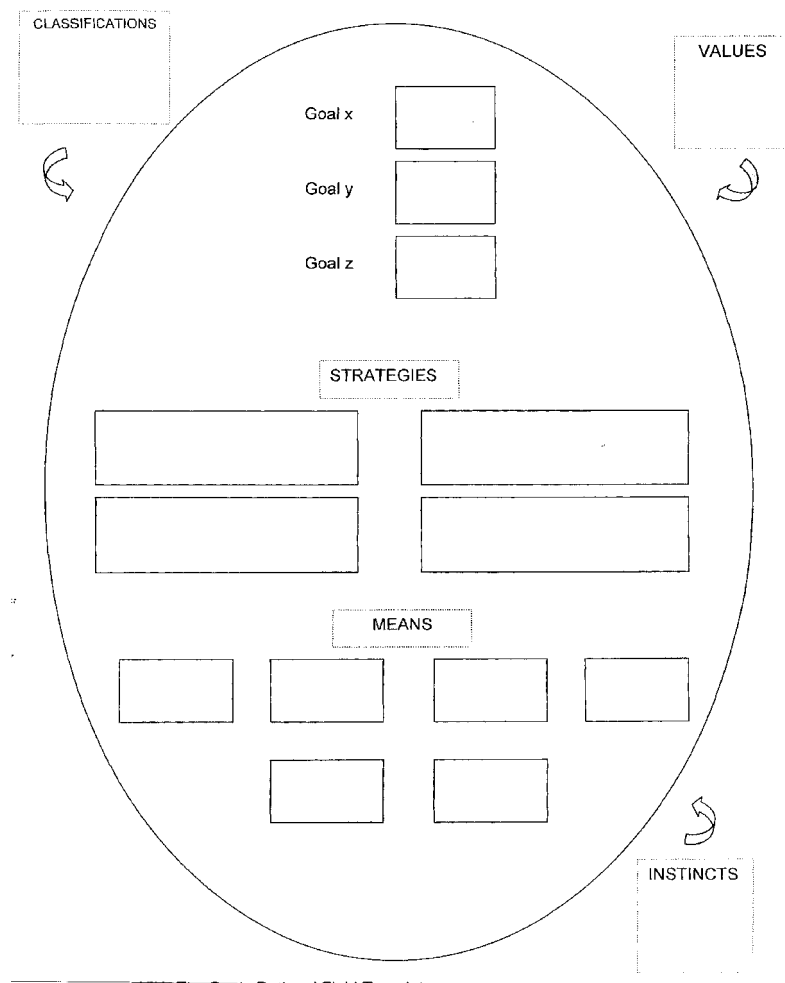
For example, if it is held that the main causes of risk are socially-derived e.g. from the type of transport infrastructure present, then most conventional road traffic safety measures could be construed as no more than tinkering at the edges if not actually perpetuating the status quo. On the other hand, taking measures to adjust the transport system at the macro level e.g. by making private car usage more difficult, immediately invokes other, including ethical and economic, considerations. Thus, what is going on in cases like this, either way, is ultimately ideological in that it is shaping people's lives. As both the sociological models and political analysis reveal, several types of outlook or 'worldview' can be identified, each with its own preferred approach to the resolution of any particular problem.

#### **4.4 RATIONAL FIELD THEORY**

In a recent extension of his work, Seedhouse (2002) applies rational field theory to decision making. We consider this a powerful approach for getting to the heart of risk management decision processes, which is where we believe many of the conflicts over societal concerns originate. The underlying premise is that we organise the world around ourselves according to



numerous conventions, or ‘rational fields.’ While this is necessary, in order to progress, one can be ensnared by rational fields if they come to be perceived as cast in stone, rather than the products of choice, which is what they are. In the context of societal concerns, one can hypothesise that these concerns are the consequence of different stakeholders acting according to different rational fields. Although rational fields help one to cope with life, they can be a problem if we are unaware of their existence. The suggestion is, therefore, that by exposing and exploring the rational fields of the various participants in a risk debate, the door is opened for constructive dialogue and understanding. Without this, opponents simply pass each other by, like the proverbial ships in the night.



**Figure 4** The rational field template (Seedhouse, 2002)

Figure 4 shows a crude but basic rational field template. Rational fields are generated by any kind of problem solving behaviour, and are formed from instincts, values and classifications. The inclusion of ‘classifications’ in this scheme is particularly interesting. This refers to the way in which individuals or organisations classify the world. For example, if a fossil-fuel power station manager classifies pollution as discharges to air (as opposed to discharges to the whole

environment), he may well elect to remove contaminants by flue gas washing, with the slurry being discharged without any qualm to the aquatic environment. From the point of view of his rational field, the boundary of which is partially determined by that particular classification, this may be logical, but it might well conflict with an alternative rational field that does not as readily sub-divide the environment into distinct compartments.<sup>26</sup>

All decisions are made against the backdrop of a rational field, so there is no shortage of examples. The decision, for example, to vent some operations of the Pontypool waste incinerator (Chapter 3) to the atmosphere in order to reduce occupational exposure to contaminants was based on a rational field which was less concerned about low-level environmental contamination. Here, one can sense that rational fields are profession-dependent. An occupational hygienist, for example, might well see the incinerator according to a different rational field than would an ecologist or, again, an environmental scientist. It is a modest step to realise that societal concerns, like those over the safety of adventure activities, the railways, or whatever, all involve clashes between different rational fields. Thus, the key, it is suggested, is to explore and define the rational fields which are operating. In so doing, this promotes to the agenda real debate, and should provide the opportunity for more meaningful decision making. This, we believe, is the primary ingredient of a sound approach to the management of societal concerns.

So how might one explore and define the rational fields operating in any given circumstance? In Appendix 3 we describe prototype tools for this purpose. Once the various rational fields associated with a concern have been identified they may be analysed by posing specific questions, for example, Seedhouse (2002) suggests the following:

- are the rational fields compatible?
- if not, is it possible to select compatible goals or to change the goals?
- are the goals realistic given the surrounding rational fields?
- are the goals desired by the subject(s) who inhabit or will inhabit the field?
- are the strategies appropriate to the achievement of the goals?
- if not, what positive goals can be achieved using these strategies?
- what beyond-the-evidence assumptions have created the rational fields?
- is the field rigid, flexible or disintegrating?<sup>27</sup>
- can the field be made more flexible?

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<sup>26</sup> In fact, this is a real example, based on the former Bankside power station in London, which for many years discharged its flue gas washing effluent into the Thames. Subsequent consideration of this practice by the Royal Commission on Environmental Pollution was the inspiration behind their formulation of the concept of Best Practicable Environmental Option (BPEO) – which can be seen as a new rational field.

<sup>27</sup> Rational fields may disintegrate if their founding classifications, values and instincts are seriously incompatible, or if they contain conflicting strategies aimed at inconsistent goals. Flexible fields may contain goals which are not completely explicit, or if they contain behaviours which are not entirely consistent.



## 5 CONCLUDING DISCUSSION

### 5.1 SOCIETAL CONCERNS – WHERE IS THE DISPUTE?

Although there is a tendency in some quarters to associate societal concerns, and risk contests in general, purely with the public, the fact is that risk disputes exist at all levels of society. They occur as much within and between the professions as between professions and the public. Rational field theory, as described in Chapter 4, exposes the value-ridden nature of all decision making processes, expert or lay, from which it follows that far more attention is required of how values and beliefs contribute to the decision processes of all parties. To paraphrase Paul Slovic, the American psychologist, speaking at the 1998 annual conference of the European Society for Risk Analysis, ‘inquiry tends to focus on risk assessment, but the real unknowns are in the realm of decision making.’

### 5.2 CONTENDING THEORIES OF RISK PERCEPTION AND BEHAVIOUR

As Renn (1992 & 1998), Rayner (1992), and others describe the situation, although a number of sociological theories have been put forward to explain risk behaviour, which in academic quarters may be seen to be in competition, the reality is that “each of the existing behavioral-science paradigms offers a plausible explanation for a different aspect of the problem” (Rayner, 1992). We therefore suggest that the HSE would be best advised to take a broad view of the theories on offer,<sup>28</sup> rather than adopting any single theory or any few. As Renn (1998) advises, there is a “... need to preserve the plurality of risk theories in the social sciences,” even though some risk managers may be keen to push for “some unified theoretical umbrella.” For the following reason, Renn (1992) concludes that it may not even be desirable to strive for such a unified theory: “...the advice of social scientists will vary considerably depending on the worldview and disciplinary background of the individuals asked,” and “Who is going to decide which social construction of reality has more validity than another competing construction?”<sup>29</sup>

The HSE, being in any case more concerned with outputs, need not get too involved in the academic debates underlying rival theories, even perhaps being well advised to steer clear of them. Furthermore, the good news from a regulatory perspective is that there is substantial unanimity over the most important points to emerge from these theories. For example:

- that “all (behavioral paradigms of risk analysis) share the view that risk behavior is a function of how human beings, individually and in groups, perceive their place in the world and the things that threaten it” (Rayner, 1992);
- that the technical analysis of risk provides society with only a narrow view of an issue which, although helpful in some circumstances, ignores the culture and context of risk-taking behaviour. The concentration of technical analyses upon probabilities and consequences is of limited use in understanding social orientation;
- that we live in a pluralist society with different values, world views and aspirations, and therefore multiple perspectives need to be heeded in decision making;
- that risk decisions, whether by experts or the laity, are driven by values and beliefs first and facts second;

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<sup>28</sup> This is tantamount to ‘rising up the insight axis,’ as recommended by Adams (1995), though in this case the resulting panorama is of contending theories rather than contending cultural solidarities defined by a single theory.

<sup>29</sup> We would add, based on experience and (political) theory, that there remains a large gap between a theory and its use (or mis-use) which is partly down to the constraints on bureaucracies (Boehmer-Christiansen, 2002).

- that this leads inexorably to the need for more inclusive discourse over values and beliefs when addressing societal concerns;
- that the social acceptability of hazards is not for professionals (including academics) to determine, and can only be arrived at following appropriate discourse with all stakeholder groups.

Adding further weight to these propositions is the fact that similar ones have been arrived at via other disciplines. To name a few, these include natural science (Shrader-Frechette, 1991); political science (Boehmer-Christiansen, 1995, 1997 & 2001), communication (Leiss and Chociolko (1994) and Fischhoff (1995)), and philosophy (Seedhouse, 1997). Thus, these conclusions would appear to be largely independent of the theoretical model used.

We add that one of the most significant variables in environmental risk debates today, is the particular ‘vision’ of the future which is held by stakeholders in risk debates and upon which expectations are predicated. These ‘visions’ lie very much in the realm of persuasion and hence politics.

### **5.3 DRIVERS OF SOCIETAL CONCERNS**

By drivers we refer to motivations and expectations. In Chapter 3, and summarised in Table 3, we set out our own classification of factors giving rise to societal concerns. This stems from our direct experiences rather than any theoretical model. These range from concerns about a level of risk associated with some hazard (this is the conventional type of societal concern that ‘experts’ would most easily recognise), to concern over some other consequence which may or may not be risk-related which is somehow entrained in the issue, to concerns about values, process, or out of some kind of self-interest (personal, institutional, professional, or commercial).

The complexity of the picture painted by the above is beyond dispute. This is compounded by the observation that some issues of societal concern entrain pretty well all of these motivations. Even in the case of the safety of children’s playgrounds, the topic of a recent study for the HSE (Ball, 2002), at least six of the twelve factors in Table 3 are active. However, we believe that this is simply a reflection of the complexity of society as it actually is, and that to try to simplify matters further is not helpful.

We are aware that some theories are based on less complex models of ‘the fray.’ Cultural theory in particular, identifies just four cultural solidarities (hierarchicalists, egalitarians, individualists and fatalists), with each of which it associates a discrete ‘myth of nature’ (Schwarz and Thompson, 1990). Armed with this model, it then sets out to explain the dynamic interactions between these diverse cultural factions, with the ultimate aim of harnessing these competing worldviews such that they may contribute to the formation of more resilient risk management solutions. These are powerful and worthy goals and the model is in many situations highly illuminating, but on the other hand it must not be overlooked that this model is “a convenient simplification – an abstraction – whose utility depends on the degree of correspondence between the two typologies” (Adams, 1995), and no doubt on other simplifications too.

For instance, it is implausible to us, based on our practical experience, that vested interest is not an important explanatory variable but, according to Rayner (1992), it is rejected by some cultural theorists as having any systematic explanatory power. Other authors, including Rayner himself, believe that self-interest is a crucial factor in many cases. Kellow and Boehmer-Christiansen

(2002) have made self-interest the focus of their analysis of the Kyoto Protocol, veiled of course by flag waving on behalf of ‘global societal concern.’

There are other difficulties too with the simple model. For instance, taking the Brent Spar case (or, equally, the international politics of global warming) as an example, superficially, according to this model, one might have supposed that Greenpeace would have slipped neatly into an egalitarian mould (protecting the environment and humanity), and Shell into that of the individualist (believing the ocean environment could be used as a dump of nigh on infinite capacity). However, our experience of this affair (membership of the Scientific Group on the Decommissioning of Offshore Structures) suggests to us that such stereotyping can be both inaccurate and unhelpful. Shell, in our view, cannot be assigned to any particular culture (it soon pulled out of the ‘sceptical’ alliance against the Kyoto protocol), nor characterised as believing the ocean could absorb whatever was thrown at it, based on observation from afar of the procedures they followed. These, in our view, were probably dictated most of all by their professional background (mainly engineering, as you might expect in offshore oil and gas), and not by their culture (even supposing Shell has a common culture or something that approximates to one). Likewise, the behaviour of Greenpeace hinted less of egalitarianism than of opportunism, the opportunity for them being massive publicity.

As Rayner says, “...because organizational interests tend to be specific to the issues being debated, a general framework to predict institutional responses to risk may prove elusive” (Rayner, 1992). This leads on to the issue of whether the combatants in risk controversies have a tendency to remain true to their cultural solidarity (the stability hypothesis), or whether they ‘flit like butterflies’ between the solidarities depending on the details of the situation encountered (mobility hypothesis). Cultural theorists, it seems, have mixed opinions about this. Our view, based on our experience, coincides with that of Rayner, namely, that ‘mobility’ is very much a force to be reckoned with – “The mobility hypothesis allows for greater creative mobility and the development of a dynamic model of risk behavior that includes other important influences on behavior, in particular the logic of *self-interest*” (Rayner, 1992: emphasis added). For such reasons we therefore consider that rational field theory, as described by Seedhouse (see Chapter 4), may be a more useful model for the HSE since it explicitly recognises that decisions which people and organisations make are functions of instincts and values and classifications, all of which are operative.

#### **5.4 WHOM TO ENGAGE IN DECISION MAKING AND WHY**

Most theorists are agreed, as are we, that we live in a pluralist society with different values, worldviews and aspirations, and therefore multiple perspectives must be heeded in decision making. Cultural theorists would, according to their theory, demand that all ‘solidarities’ be represented (Schwarz and Thompson, 1990), by which would be meant their preferred categories of hierarchists, egalitarians, individualists and fatalists. Although understanding the attraction of such simplification for theoretical modelling, these categories are not particularly useful in real world decision making. The real world is far more complex, and neither individuals nor institutions conform readily to these cultural stereotypes (particularly if you subscribe to the ‘mobility hypothesis’). As Rayner (1992) has said, cultural theory attempts to predict statistical trends in the patterns of arguments associated with particular forms of organisation, and not more than that. This is not to suggest that participants in some risk debate might not usefully be screened to see if some cultural type is under-represented. But it would seem that some other

means would need to be found for identifying stakeholders, with the crucial factor being that no significant ‘voices’ be omitted, as strongly argued by Graham and Wiener (1995).

Indeed, these authors consider ‘omitted voices’ to be a prominent source of narrow decision making as absent parties will not only be unable to get their views across, but organised interests may get a disproportionate say. They also reflect that government bodies tend to hear a subset of interests in part because there are costs to private parties in making themselves heard (see also, Boehmer-Christiansen, 2002). Thus, although an industry may have ample resources if an issue of interest to it is on the agenda, dispersed risks affecting the wider community are less likely to attract public representation because the incentives for ordinary citizens to organise and speak will be small (Graham and Wiener, 1995).

Our suggestion is that an appropriate political analysis of a societal concern should identify the relevant stakeholders. In some cases the number may be quite large. In the example of playground safety, for example, stakeholders include at least the following groups: parents, children, local authorities, schools, the play industry, the insurance sector, standards agencies (British and European), advisory bodies, inspection agencies, campaigning groups, the legal profession, government agencies, assorted professions and the HSE, and this is probably a *lesser* societal concern!<sup>30</sup>

## 5.5 THE PROBLEM OF BIAS

This report has emphasised the need to incorporate plural views into decision making, while acknowledging that these will be based substantially on beliefs, values and ways of categorising the world, rather than upon objective information. In other words, bias will unavoidably be encountered, and ultimately the question may well come down to choosing one form of bias over another.

So far, nothing has been said about this clearly important topic. The following advice, paraphrased from Seedhouse (1997), is offered:

- not all values are equal – some can be more thoroughly justified than others (moral philosophy) and some – when applied – produce better practical results than others
- it is necessary to hold some values to decide anything
- it is necessary to take the fullest possible account of the evidence to work to best effect
- risk management does not have a necessary core set of values
- risk management is essentially political – the only honest and open way forward is to admit this and embrace it

Seedhouse (1997) expands further with a typology of bias (prejudice), stating that failure to distinguish between types is a frequent cause of confusion.

*Necessary prejudice* – is any belief on which a person grounds her reasoning/actions. Prejudice, in this sense, is a prerequisite for any thoughtful action (other than instinctive or intuitive reaction). In this sense prejudice is a ‘prejudgement’ without which it is not possible to think about anything. A *necessary prejudice* may be either inescapable (heavy objects fall to ground) or chosen (the effect of exposure to low levels of ionising radiation, or dioxin, can be predicted

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<sup>30</sup> The Children’s Play Council has, in this regard, set up a broadly-based stakeholder group called the Play Safety Forum which appears to hold serious prospects of making some headway in the resolution of this particular concern.

by a linear dose-response relationship). Whatever the case, a prejudice should be considered necessary if it appears to be just not possible to act without it.

*Blinkered prejudice* – is a belief that is held by the believer to be an objective truth regardless of the strength of arguments against. Such a prejudice can be about matters of evidence, or about matters of value (e.g. trains should never crash). Blinkered prejudice can be held either knowingly or unknowingly. The ways of working of engineers, scientists, sociologists, economists etc. all show signs of inadvertent blinkered prejudice through years of being trained to think in a particular way (e.g. epidemiologists look for risk factors which they can most easily measure, rather than ones which might be most important). Blinkered prejudice may be attributable to ignorance – even the most distinguished climate scientists may know nothing of the sun or geology, areas where lie the most doubts about the ‘mainstream’ climate change hypothesis.

As Seedhouse says, what is most important is not the content of the prejudices but how they are held. Those who have open minds will hold at least some of their prejudices tentatively, while those with firmly closed minds and fixed opinions will be entirely happy with blinkered prejudice of either sort.

*Reasoned prejudice* – is a position arrived at through reflection on either evidence or values or both, is open to revision, and is a prejudice which the holder is continually prepared to question and defend if he believes it to be defensible.

Only the first and third forms of prejudice should be countenanced by risk managers. It must also be recognised that sooner or later prejudice has to enter into any risk management decision process, because decisions are not just about facts but also about beliefs and preferences. Therefore, whatever decision is made, there will *always* be grounds for dispute. A risk management strategy cannot be promoted without having an opinion that one way of life is better than another.

## **5.6 REDUCTIONISM, RELATIVISM AND PROCEDURAL RATIONALITY**

This report makes the point that risk decisions are in general driven as much by values as by evidence. Given this situation, is the science of measurement any use at all? Within the world there exists a spectrum of views. As Shrader-Frechette (1991) says, “In the debate over the rationality of science, philosophers and scientists are arrayed on a spectrum extending from pluralist or relativist views to logical-empiricist views.” At one end of the spectrum, the pluralist end, one tends to find adherents of the belief that there is no scientific method, that “anything goes,” and that no system of scientific rules and standards is ever safe. At the other end, the logical empiricists consider that there are at least some universal and fixed criteria and that these guarantee the rationality of science. Somewhere in the middle are the so-called ‘naturalists’ who maintain that theory evaluation can be rational even though there are no absolute rules for science.

According to Shrader-Frechette (1991), cultural relativists tend to inhabit the left of this spectrum, and naive positivists the right. Shrader-Frechette herself finds flaws with both positions and argues for the ‘middle ground’ – termed ‘scientific proceduralism.’ Thus, she



maintains that sociological reductionists<sup>31</sup> err in overemphasising the role of values in risk evaluation, whereas scientific reductionists err in underemphasising the role of ethical values and democratic procedures in risk evaluation.

Shrader-Frechette (1991) goes on to consider the implications for risk management. Here, the spectrum manifests itself, at the extremes, as those who decry the use of techniques such as QRA and CBA,<sup>32</sup> and those who see decisions as being *made* by such tools. However, our view coincides here with that of Shrader-Frechette, namely, that although there are many cases where these techniques have been badly used, and although they have serious limitations (e.g. Ball, 2000b, 2000c, 2002/3; Boehmer-Christiansen, 1991), there are in principle reasons for continuing to use them, albeit with considerably more insight than has traditionally been the case. Critics will of course point to the flaws in these techniques, but it is a value-judgement whether flawed techniques (providing, we hope, that the flaws are made clear) are better or worse than no techniques at all. As Shrader-Frechette says, a society pleading for policy-making based solely on expertise, intuition and wisdom, or on ‘open discourse,’ to the exclusion of what can also be learnt from QRA-CBA, “is like a starving man pleading that only steak will satisfy him.”

Shrader-Frechette is by no means alone in making a case for a ‘middle’ road. Graham (2001), in discussing alternative perspectives on the economic evaluation of injury control, considers three major philosophical traditions that have influenced political thinking in modern Western-style democracies: liberalism, utilitarianism, and communitarianism. He concludes that ““strict” liberals and communitarians, defined as those who have no interest in other perspectives, are few in both number and influence and thus there is interest throughout the world in practical tools to operationalize utilitarian thinking, *at least as a partial contribution* to public policy (emphasis added).” More succinctly, Seedhouse (1997) avers that while “the evidence does not speak for itself but neither is it mute.”

In Appendix 4 we provide evidence that the public also are much concerned by practical and economic aspects of societal concerns as well as the entrained values. We consider it imperative that practical and economic factors in societal decision making be fully explored by whatever techniques are available.

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<sup>31</sup> Interestingly, Shrader-Frechette finds *both* cultural relativists and naive positivists to err in being reductionist, the one by attempting to reduce risk to a sociological construct which underestimates or even dismisses science, and the other attempting to reduce risk to a pure scientific reality, underestimating its ethical components.

<sup>32</sup> Quantitative risk assessment and cost-benefit analysis.

## 6 CONCLUSIONS AND RECOMMENDATIONS

### 6.1 THE ORIGINS OF SOCIETAL CONCERNS

Societal concerns have disparate origins and motivations. These owe as much to political, commercial, social and professional self-interests, beliefs and ways of working, as they do to objective circumstances and conditions. To categorise ‘societal concerns’ under a single heading is not helpful for their resolution.

**Recommendation 1:** *The diversity of the origins of societal concerns should be fully recognised. In cases where societal concerns arise which have significant policy implications they should be subjected to a thorough political analysis in order to reveal the nature of the underlying motivations.*

### 6.2 THE EXPLOITATION OF SOCIETAL CONCERNS

In some situations societal concerns may be generated or made use of in order to further political, commercial or professional interests which are not necessarily synonymous with the interests of the wider public.

**Recommendation 2:** *The HSE needs to be aware of the multiple motivations underlying societal concerns and to guard against their exploitation by interest groups, be these commercial, political or non-governmental.*

### 6.3 THEORETICAL PARADIGMS

Various academic disciplines have put forward models of risk perception and behaviour. Our view, shared by other commentators, is that all of these models have something to offer and none warrants hegemony.

**Recommendation 3:** *The HSE should keep a watching brief over the models of risk perception and behaviour which are available but should refrain from becoming overly-committed to any particular one.*

### 6.4 COMMON GROUND

What is most important about theoretical models of risk perception and behaviour from the regulatory perspective is their ‘outputs,’ their recommendations for action. In fact, common outputs emerge from many of the models which have been proposed, whether sociological, philosophical or of some other discipline. Recommendations that can be shown to have roots in a variety of models are more likely to be accepted as sound and helpful. The main, common, conclusions drawn by models are as follows:

- risk behaviour is in part at least a function of how human beings, individually and in groups, perceive the world
- risk choices, whether by experts or non-experts, are driven by values and beliefs as much as by facts

- the technical analysis of risk provides a narrow view of an issue which, while useful in some circumstances, ignores the culture and context of risk taking behaviour
- we live in a pluralist society with different values, world views and aspirations, and therefore these need to be heeded in democratic decision making
- the above points inexorably to the need for more inclusive discourse over values and beliefs when addressing issues of societal concern
- that the social acceptability of specific hazards can only be determined following appropriate stakeholder discourse

## 6.5 ABSENT VOICES

Given any societal concern, the preferred means of its resolution can be expected to be different depending upon the world view - sociological, cultural, institutional or political - of the observer. In order to obtain a balanced view, it may be necessary to encourage representatives of those positions that are absent from any particular debate to come forward. It appears to be a fact of life that stakeholder fora tend to exclude the weaker members of society, that is, those needing most protection from risks.

**Recommendation 4:** *The HSE should try to ensure that all voices pertinent to the debate about a particular societal concern are represented, particularly those groups who will have to pay.*

## 6.6 DEALING WITH UNAVOIDABLE BIAS

As political and sociological theory explain, all positions are based on some form of political or cultural belief and are therefore prejudiced. All views based on clearly considered positions and linked to coherent value systems or beliefs are, in the first instance at least, to be regarded as on an equal footing. In those cases where just individual and voluntary risk is concerned, the role of the regulator is probably limited to little more than the provision of information. Where societal concerns come into play, the regulator may well have to choose, particularly if compromise cannot be reached. The choice, however, will depend upon the regulator's own competence, philosophy and prejudices. In these cases it would seem essential to understand one's own prejudices as well as those of the stakeholder groups in order to explore and attempt to justify them to others (this means being explicit about them – see also Recommendation 9), and to remain open to the possibility that one's prejudices might have to change.

**Recommendation 5:** *Other than in those cases where societal concerns are generated by self-gain, the right to hold different perspectives should be respected. If compromise is not possible, the regulator may have to choose between perspectives. This should involve the regulator making clear his own biases, justifying them, and being prepared to modify them in the face of a sufficient reasoned argument.*

## 6.7 REDUCTIONISM VERSUS RELATIVISM

Within the professions a spectrum of beliefs exist over the rationality of science including perhaps especially science as applied to matters of societal concern. Views extend from those who believe absolutely in 'scientific rationality' (termed 'naive-positivists') to those who see everything as relative (cultural relativists). So far as this axis actually exists, most commentators

lie somewhere along it, avoiding the extremes, but being aware of the messages which derive from them. We advise the HSE to be aware of this debate and to adopt the same strategy.

In particular, we do not subscribe to the view that techniques like risk assessment, cost benefit analysis, and other quantitative tools should be abandoned, even though we have had reservations, sometimes serious, about their limitations and manner of use on many occasions. Indeed, we suspect that most people, of whatever persuasion, expect resources to be managed sensibly and that the cost and benefits of societal interventions should be examined by whatever means are available.

**Recommendation 6:** *The HSE should avoid the naive-positivist assumption that experts' quantitative techniques are completely value-free and the erroneous relativist assumption that these techniques are not objective in any sense.*

**Recommendation 7:** *The HSE should not abandon quantitative techniques but should continue to ensure that users are aware of their limitations.*

**Recommendation 8:** *The decoupling of issues invoking societal concerns from considerations of cost and practicality should be avoided. Invoking of a 'societal concern' to support, for example, some massive investment of resource or major change in public policy, without strong supporting arguments, should not be a sufficient justification for disregarding otherwise routine assessment procedures.*

## **6.8 COMPREHENDING DECISION MAKING**

It is our view that the process of risk management decision making lies at the heart of many societal concerns. Nonetheless, it remains a comparatively under-investigated topic.

**Recommendation 9:** *The HSE should consider the methods available for elucidating how stakeholders in decisions involving consideration of societal concerns use evidence and values to arrive at choices and the role of prejudice in this process.*



## APPENDIX 1 PROFESSIONAL BIASES IN SAFETY DECISIONS

In section 3.2 of this report, in describing problems arising at the risk management decision stage (societal concern type 4), we referred to difficulties arising at the inter-professional level over the choice of safety criteria, issues of how safe things should be, and the problems which could arise were these decision makers themselves to have a diversity of perspectives. When public controversy arises, attention is usually focused upon the risk assessment and/or public perceptual factors, but seldom on the usually more value-ridden, and therefore contentious, risk management decision process itself. However, a recent review based on practical experience of approaches to safety in a field directly pertinent to the interests of HSE, injury prevention, has examined professional rather than public biases towards decision making on safety (Ball, 2000a).

This identifies no less than eight different concepts of ‘safety’, a number of which are associated with particular professions (e.g. absolute risk as a measure of safety is associated with actuarial science and risk factors are associated with epidemiologists) and some with politically-motivated initiatives (e.g. safety targets) – for a summary see Table A1.1. It is apparent from this table that those who seek to influence or make safety decisions do not speak with a single voice. Even among professionals, perhaps especially there, one finds jurisdictional competitions or “turf wars.” A resulting difficulty is that these professional and institutional preferences are by no means necessarily consistent. This can lead to misunderstandings and conflict unless the professionals involved are themselves clear about what they are doing and why, and also communicate very well with one another and those other stakeholders who have an interest in the decision. If these conditions are not met, and in those cases where public scrutiny follows, the stimulation or amplification of societal concerns is a strong possibility. The debate over Automatic Train Protection systems provides one example in which different concepts of ‘safety’ are held by different stakeholders. The issue of playground safety is another (Ball, 2002).

In general, all of these concepts of ‘safety’ can be witnessed in action in present day society with different groups tending to adhere to their own perspectives. It requires little imagination to contemplate the kind of effect which such a diversity of decision criteria and decision processes may have upon the public, particularly given the propensity of the media for rooting out and highlighting inconsistencies. However, it would be incorrect to lay the blame for this at the door of either the media or the public. The problem lies with the inadequate attention paid to crucial and underlying philosophical issues about how far we want to go in implementing safety measures, what we are prepared to sacrifice in achieving certain goals, and how we should choose. In many cases these issues are mysteriously not addressed at all and may even be avoided. The consequence is that the system by which we choose contains a substantial element of chaos, for unless these matters are openly discussed, one can never quite be sure which set of rules or procedures will dominate in the end in any particular situation. Neither is it only the public who are affected. The net effect upon duty holders - those with responsibilities for safety - can also be nigh on disastrous.

The task of breaking down these barriers is far from easy, indeed, it is argued that the very creation of professions was in order to protect particular ways of thinking and working from alien influences. However, failure to take up this matter would signify a willingness to accept an artefactual degradation of our decision making processes. Instead of enfranchising the public and professionals alike by recognising the crucial steps in safety decision making, and willingly embracing them as legitimate choices, we would appear to prefer those choices to continue to be made by a process containing disturbing elements of randomness.

**Table A1.1** Eight different concepts of ‘safety’ with an indication of their origins and predominant professional affiliations (Ball, 2000a). An attempt has been made to present these as a spectrum, with more politically sensitive or value-driven approaches on the left, with more science-based approaches in the centre, and with more pragmatic hybrids to the right. These divisions are not, however, clear-cut.

<i>Safety criterion</i>	<i>Zero risk</i>	<i>Safety targets</i>	<i>Standards, CoPs and guidance</i>	<i>Absolute risk</i>	<i>Risk factors</i>	<i>Risk assessment</i>	<i>Cost-benefit analysis</i>	<i>Risk tolerability and ALARP</i>
Typical adherents	Pressure groups	National and international agencies. Major industries	Traditional industries, lower courts, accident investigators	Actuaries and natural scientists	Epidemiologists and health scientists	Safety engineers and applied scientists	Economists	Higher courts, regulatory bodies, international agencies and major industries
Basis of approach	Commitment	Political desire	Expert judgement	Historical data	Evidence	Scientific simulation	Utility theory	Case law (in the UK)
Strengths	Simplicity, single-mindedness	Clarity of overall policy goal	Should reflect a broad swathe of expert opinion. Tested over time	Enables insurance companies to set premia	Scientific basis	Analytical tool. Ability to forecast the unknown	Considers both costs and benefits of safety measures	Considers wider implications of safety measures including cost, practicality etc
Limitations	Associated benefits foregone. Cost of control disregarded	Top down approach which may be inconsistent with the sum total of individual safety interventions	Validity and motivation of judgements unclear. A bottom up approach which may be inconsistent with policy goals	Other social priorities are disregarded	Uncertainties, causality, and the question of ‘how safe is safe enough?’	Uncertainties in assumptions, probabilities and dose-response functions	Anchored in a particular philosophy. Hidden assumptions and methodological problems, particularly in valuing benefits	Difficulty of striking a balance between competing attributes of a decision
Examples	‘Vision Zero’, hand gun control, machinery guards, food additives	Injury targets. Air quality guidelines. Sustainability	Product safety standards. Workplace CoPs. Numerous personal injury court cases	Simple comparison of risks from different activities	Public exposure to radon and air pollution, playground safety	Occupational safety assessment	Railway and offshore safety investment decisions and major hazard control	Major hazard control, strategic planning applications

## **APPENDIX 2 THE REPORT BY THE GERMAN SCIENTIFIC ADVISORY COUNCIL ON GLOBAL ENVIRONMENTAL CHANGE**

Aside from the UK, Germany has probably given more consideration to the specific issue of societal concerns than most other European countries. This section outlines a major report to the German government which analyses global environmental risks and recommends coping strategies. This includes a thought-provoking classification of risk types, from which follows a suite of what are considered to be appropriate response strategies for each risk category. Although these risks are not entirely synonymous with societal concerns, some parallels can be observed.

In Germany, large-scale risks, especially about the future environment, tend to be seen as stimulants for state regulation, research, confidence building and rules of insurance, most of these measures having the aim of reducing risk and promoting technological innovation (sometimes referred to as ecological modernisation). The advisers we have consulted see societal concerns as requiring complex, politically-defined assessment processes coupled with research and technology directed specifically at risk reduction, but also communication, confidence building, and attempts to enhance the acceptability of certain risks.

An implication of this approach for a body like HSE is that efforts made to classify complex risks and enquire into their socially-constructed dimensions might strengthen the regulator in negotiations with government, risk takers and the public. In this regard, the German approach has similarities with that which we recommend in this report, specifically in our attempt to analyse societal concerns as described in Chapter 3.

The 1998 ‘short’ version (in German) of the Report to the Bonn Government has been used here.<sup>33</sup> It was drafted by Renn and his colleagues at the Centre for Technology Assessment in Stuttgart and is divided into three sections dealing with:

- the special nature of global change risks
- the classification of risks into normal, borderline and prohibited realms,<sup>34</sup> followed by a classification of hazards into six categories (these are beguilingly named Damocles, Cyclops, Pythia, Pandora, Cassandra and Medusa, according to how they match up against a list of selected criteria ) and
- to link both established and innovative risk management strategies and corresponding risk management tools to these classes in order to define management priorities

This Report is based on three primary claims. Firstly, that human impact on nature is now so global in extent that the global risk potential and its interaction with the social, economic and ecological worlds is ‘a challenge to the international community.’ Global risk assessment becomes a justification not only for national regulatory intervention in health, population growth,

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<sup>33</sup> *Welt im Wandel: Strategien zur Bewältigung globaler Umweltrisiken* (lit: World in Transformation: Strategies for the conquest of global environmental risks), Bonn, 1998. (See: [http://www.wbgu.de/wbgu\\_jgl1998\\_kurz.html](http://www.wbgu.de/wbgu_jgl1998_kurz.html)). In German, translated by Boehmer-Christiansen.

<sup>34</sup> There are some parallel's with HSE's classification of risk into three zones of intolerable, tolerable and broadly acceptable (HSE, 2001).



environment and consumption, but also for international (above all, EU) ‘governance.’ The long tradition in Germany for pro-active government policies on risk is described elsewhere.<sup>35</sup>

Secondly, there is the view that global risks require a new scientific method for their assessment, namely, a retreat from empirical science and its principle of ‘trial and error,’ as the consequence of error might lead to unacceptable damage. Hence we find science moving in the direction of global models based on scientific hypotheses and earth systems modelling.<sup>36</sup>

Thirdly, there is the assertion that the prescription of ‘wait and see,’ and combatting damage as it becomes apparent (a reactive policy), is no longer ethically responsible and needs to be replaced by precaution. This is because catastrophes can quickly assume global scale so that ‘early counter-strategies’ are required. The more widespread the possible consequences, and the fewer the possibilities for compensation, the more important it is to adopt a risk policy that is oriented on the prescription of precaution.

Thus the jump from principles to action is made. Strategies of regulatory intervention on what are to be considered global risks as predicted by global models can then follow. Responses to such risks are drafted by the Environment Ministry in Potsdam,<sup>37</sup> but require broad political support. With respect to solutions to these types of global risks, the German model is directed towards risk reduction via technological solutions and research, not regulation per se. The German Advisory Council also calls for risk assessments that reflect a balance between costs and benefits, the main benefit being technical innovation. Expertise is needed to:

- contribute to the objectification/rationality (*Versachlichung*) of the risk debate and
- give society greater confidence in its own management capacity

Precaution and innovation are clearly seen as ‘opposites that need balancing by an intelligent state or bureaucracy, the correct middle way needing to be found between daring and caution.’ The middle way is not easily found, however, ‘because the empirically oriented research lacks the ability to prove the consequences of global environmental risk experimentally or even to predict it.’ The state has to act in an integrated fashion even though plural visions and fears make effective management difficult. So plural visions do not apply to society only, but to risk assessment itself. The responses require a wise combination of permits, official regulation, and liability rules, as well as the application of precaution to research and institutional preparations. The state has to act in an integrated fashion.

The global risks which this process tries to confront are cross-cutting and interwoven: climate change, biodiversity loss, soil degradation and food insecurity, as well as population growth, migration and poverty, are all mentioned. Taking anthropogenic emissions as an example, the science is said to be dependent on analogy and computer simulations (largely ignoring complexity and non-linearity) and the results are typically highly uncertain and ambivalent, with

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<sup>35</sup> S. Boehmer-Christiansen, in *Interpreting the Precautionary Principle*, 1994, O’Riordan and Cameron, eds., London, Cameron May, pp.203-228.

<sup>36</sup> The danger here is that the selected scientific hypotheses may be ideologically or commercially biased towards finding, or not finding, evidence for harm.

<sup>37</sup> *Environmental Change and Security*, edited by Alexander Carus (Ecologic) and Kurt M. Lietzmann (German Federal Ministry for the Environment), Ecologic and Springer Verlag, Berlin, Heidelberg, New York, 2000, Foreword by Jürgen Trittin, and Hans-Joachim Schellnhuber’s, a member of WBGU, see ‘Earth Systems Analysis and the Second Copernican Revolution’, *Nature*, 2.12.1999 Supplement to vol. 402, 19-25.)

limited potential for improvement. There is therefore no way of avoiding the necessity for a risk policy that searches for a sound and expertise-based, as well as ethically responsible path, amongst uncertainty, ignorance and indeterminacy.

The Advisory Council therefore recommends that global risks at least should ‘be tackled as close as possible to the individual agents of their causation,’ presumably at the local or regional level. The Council therefore welcomed a management philosophy that supported the liability principle, that is, that industry be financially liable for any damage it may cause in the future. It advises governments to adopt a combination of tools for dealing appropriately with various risk types and proposes a practicable procedure by which ‘they can tackle global risks...with precaution’ without endangering the capacity for action by the community of states and their power of innovation, or worse, fossilise states in an unproductive posture of caution’.

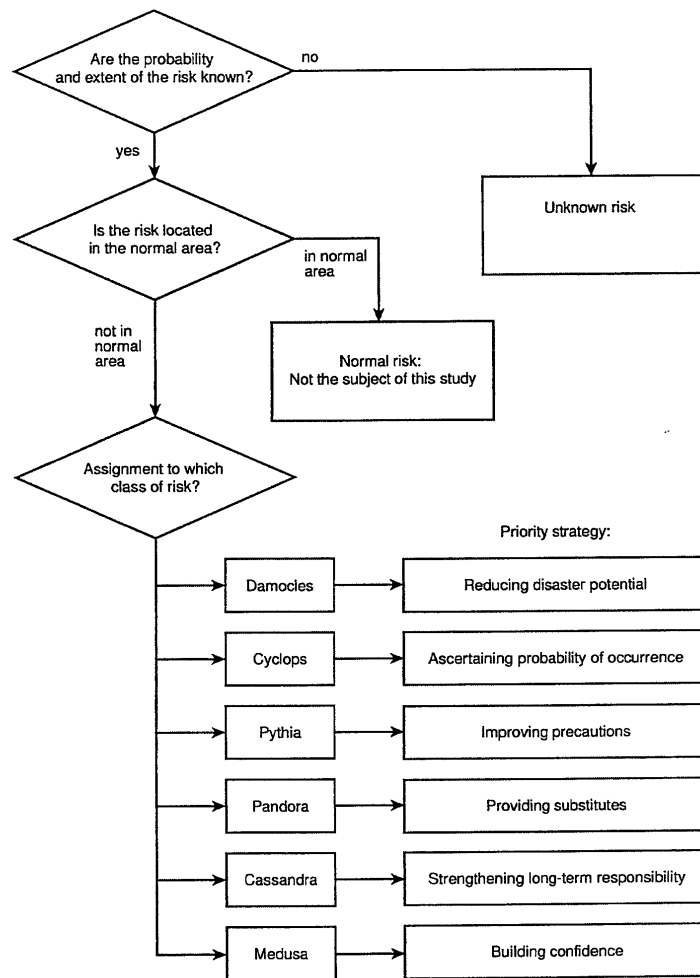
The objective for regulators as members of the state bureaucracy is therefore to search for the middle way between spotting opportunities arising from risk reduction and limitations imposed on business by regulation. If risks are completely or largely unknown, the classical precautionary strategy is to continue the development of the risk generating activities with care, but to simultaneously reduce these risks by strengthening the resilience of the affected systems. More research may be required so that the risks can be classified more accurately in future. The institutionalisation of an early warning system for research on these risks is needed, indeed a global early warning system was recommended.

### ***The Identification of a Risk Typology and Related Response Strategies***

As outlined above, the first stage of the process devised by the German Advisory Council on Global Change was the categorisation of the multitude of risks under consideration into a more manageable number of sub-groups. Categorisation is guided by the ‘basic concern to develop class-specific procedures and management rules that permit handling risks in a way appropriate to the individual risk and commensurate to the need for risk containment.’

The procedure for categorising hazards is summarised in the decision tree (Figure A2.1). If an operator or regulator wishes to assess a hazard, the tree is entered at the top, the first question being whether the risk is sufficiently known for a clear causal link to be established, and whether the probability and consequences are reliably known. If the answers are negative, then precautionary strategies are recommended. However, if informed answers are available, then the next issue is whether the hazard lies in the ‘normal,’ ‘transitional,’ or ‘prohibited’ area. Where a hazard falls in respect of these areas is determined by comparison with certain criteria, as listed in Table A2.1.

For risks falling in the ‘normal’ area (these areas can be seen in Figure A2.2), e.g. landfill sites and hydroelectric facilities, routine and accepted procedures of risk management generally suffice. However, the report is mainly concerned with hazards of the transitional (e.g. dams or hazardous waste repositories) or prohibited (e.g. flip-over of ocean circulation or nuclear winter) types. In these cases more cautious policies are required, and the next question in the decision tree is then addressed in order to further classify the hazard into one of six types. In outline, these have been defined as follows:



**Figure A2.1** Decision tree for classifying the hazards of global change (WBGU, 1998)

*Damocles*: these risks have a low probability (P) but the extent of damage is very high, as are benefits - nuclear power, large technical plant, and dams are mentioned as examples. This type of risk calls for the priority strategy: reduction of the ‘potential for catastrophe’.

*Cyclops*: P is uncertain and damage high and there is little benefit - floods, volcanic eruption, aids, massive development of GMO influenced species. Here the priority strategy is research to determine the probability.

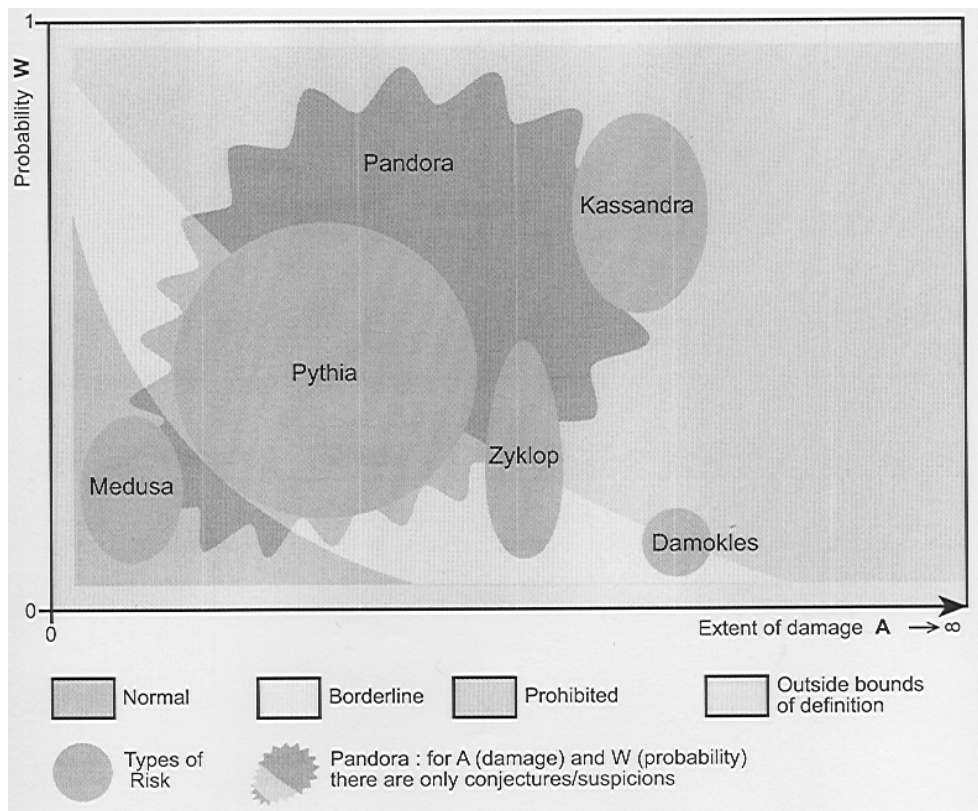
*Pythia*: with P uncertain and the reliability of estimates low, damage remains uncertain but potentially high - climate surprises, CJD/BSE, some gene technology, instability of West-Antarctic ice sheet. Here the recommendation is to improve precautionary responses.

*Pandora*: the probability and the damage estimates remain uncertain, as for persistent organic compounds, endocrine active substances. The strategy should be to prepare substitutes.

*Cassandra*: here delayed effects are important, probability is on high side but of low reliability, damage is also likely to be high but difficult to estimate. Examples are anthropogenic climate

change, destabilising terrestrial eco-systems, and the proposed strategy is to strengthen long-term liability, that is, to require private actors, especially industry, to become liable for any future damage. Industry is expected to adopt the precautionary approach and acquire insurance cover.

*Medusa*: P and damage are on the low side, but the ‘mobilisation’ (concern) potential is high, e.g. electromagnetic fields. Here the recommended strategy is to improve trust in the ‘risky’ technology.



**Figure A2.2** Types of hazard according to ‘normal,’ ‘borderline’ and ‘prohibited’ realms.<sup>38</sup>

**Table A2.1** Hazard classification criteria (WBGU, 1998)

<sup>38</sup> The general risk management approaches for the three risk zones are as follows:

Zone 1. The potential for social conflict and mobilisation (against the risk initiator) are judged to be low, that is, protests against government need not be feared because there is no clear discrepancy in the evaluation of risks between the bearers of risk and those reaping the rewards from risk taking. In this case, it is argued, technical means for risk management exist. Normal risks can be dealt with routinely and are well regulated by European law. There is no need for national and international action. Rather, deregulation should be considered.

Zone 2. In borderline cases risk assessment is most difficult. The conflict/mobilisation potential is higher because of distribution of justice issues and other sociological or psychological factors. This is the most difficult area: ubiquity, irreversibility, and fear among the public are likely. There is also the danger of risk being ignored because the damage is likely to occur only in the future. Unacceptable risk may exist but may not be perceived politically or socially.

Zone 3. Risk in the prohibited realm calls for prohibitions or the immediate reduction of risks. The probability times damage function is high. High risks are accompanied by low utility.

Normal	Transitional
Low uncertainty regarding the probability distribution of damage	Uncertainty distribution is high
Small catastrophic potential	High damage potential
Low to medium uncertainty about probability of occurrence and magnitude	The probability of damage is high
Statistical confidence intervals with respect to probability and magnitude of damage are tight	Confidence intervals are wide
Low levels of persistency and ubiquity	Persistency and ubiquity are high
High prospect of damage reversibility	Irreversibility looms
Low potential for social conflict and concern	Because of perceived distributional injustice or other psycho-social factors, conflict can be expected

Once characterised, each hazard is linked to a risk management strategy (as in Table A2.2) and given a mobilisation potential, for which might be read, ‘societal concern.’ To reduce the latter, the recommended response is that of enhancing confidence in the feared technology and trust in the regulator. All categories are subject to revision as knowledge and perceptions change.

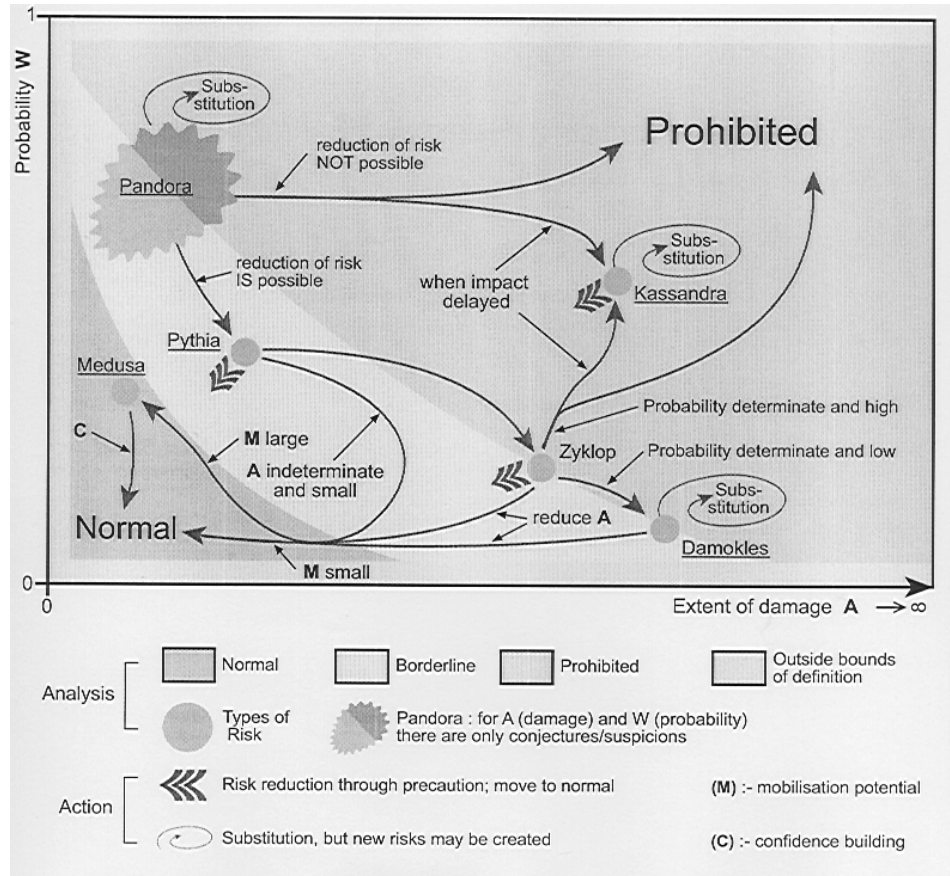
**Table A2.2** Suggested strategies for managing each hazard category

Hazard category	Strategies		
Damocles	Reduce disaster potential	Strengthen resilience	Emergency management
Cyclops	Research on probability	Prevent surprises	Emergency management
Pythia	Improve precautions and mitigating effects	Improve knowledge	Emergency management
Pandora	Develop substitutes	Enforce restrictions	Emergency management
Cassandra	Strengthen long term responsibility	Encourage reduction	Contingency management
Medusa	Build confidence	Improve knowledge	Communicate risks

Overall, the Advisory Council argues that the general response strategy should be to move risks from the prohibited region towards the normal realm (as in Figure A2.3) by improvements in knowledge i.e. research into the critical values defining each type (probability, extent of damage, reversibility, persistence, delayed effects, and mobilisation potential). Societal concern is covered only under ‘mobilisation potential’ and this is to be prevented by early regulatory action and the development of trust in the regulator.

The central recommendation is for the development of insurance against liability (*Gefährdungshaftung*), not the strengthening of regulation or regulatory agencies. At the international level the definition by experts of what is a ‘safe’ or ‘sustainable’ development path is seen as unrealistic because, inter alia, of different interests and appetites for risk taking

(*Risikofreudigkeit*) prevailing in different societies. Large knowledge deficits are also mentioned. Hence continuous innovation and learning systems with incentives for risk reduction are needed.



reflexivity of society to risk interventions (for this reason, the report recommends that these risks of global change be tackled as close as possible to individual risk generators). In common with other commentators (e.g. Funtowicz and Ravetz, 1992), traditional applied science is seen as appropriate largely in areas of low decision uncertainty and low decision stakes, and less so elsewhere. Overall, the WGBU report is directed at different issues.

## APPENDIX 3 TOOLS FOR ANALYSING RATIONAL FIELDS

Within the healthcare sector, David Seedhouse (1991, 2000) has developed and documented a range of decision-making tools for health professionals for the purpose of analysing decision choices and improving decision-making. These tools, we believe, have potential for the analysis of decisions of all kinds, including those relating to societal concerns. In so doing, they would go a significant step beyond the point reached by typical sociological theories of risk. There are several tools, but here we focus on those known as the Ethical Grid and the Rings of Uncertainty.

These tools - and particularly the Ethical Grid - are used on courses and in health care decision-making around the world. A recent development is to make them computer-based, so that graphical images of risk decisions can be manipulated and recorded. In addition, contextual expert guidance on the use of the tools is provided, along with analytical options to identify patterns of reasoning. This provides a unique method for health carers and patients to reflect comprehensively on any health intervention. Currently, health care decision-making relies almost entirely on clinical evidence, cost assessment and vaguely expressed personal judgement. By contrast, this method:

- 1) Makes implicit values explicit - visually and in writing
- 2) Allows decision-makers to understand other people's thoughts visually
- 3) Uses no technical language
- 4) Offers a pictorial and written record of deliberations
- 5) Enables health workers to fully involve all competent patients in decisions about their treatment.

The screenshot displays the 'Health Care Analysis Tools' web application. The interface includes a navigation menu with options like 'Home', 'Handbook', 'Casebook', 'Resources', 'Participants', 'Search', and 'Help'. A 'Save' button is present. The main content area shows a 'Case: Test Case 1' with a 'Tile: Risk' window listing various risk factors such as 'Financial', 'Life and death', 'Pain', 'Injury', 'Emotional', 'Reputation', 'Social solidarity', and 'Other'. A 'Comments:' text area is also visible. To the right, a large 'Ethical Grid' diagram is shown, featuring a central blue square with 'Respect Persons Equally' and 'Respect autonomy', surrounded by a red square with 'Care personally', 'Promote dignity', 'Create autonomy', and 'Keep promises'. This is further enclosed by a green square with 'Most beneficial outcome for the individual' (top), 'Most beneficial outcome for a particular group' (bottom), 'Serve needs first' (left), and 'Tell the truth' (right). The outermost layer is a grey square with 'Resources available' (top), 'Cultural norms' (top-right), 'Codes of practice' (right), 'History' (bottom-right), 'Degree of certainty of evidence' (bottom), 'Effectiveness and efficiency of action' (bottom-left), 'The risk' (left), and 'The law' (top-left).



**Fig A3.1** The Ethical Grid – prototype (Seedhouse, 2000)

It is our view that these tools could be adapted for the analysis of decisions in other sectors, including safety, so providing the same benefits. As an indication of the nature of these tools, we provide the following brief descriptions:

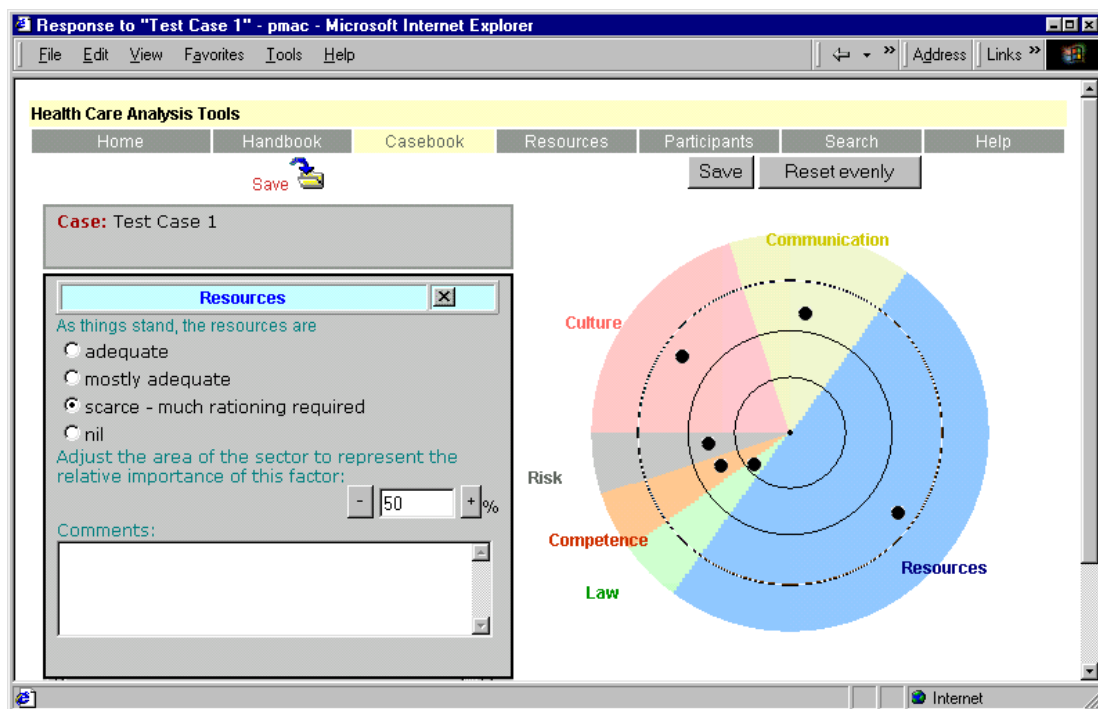
*The Ethical Grid*

The ethical grid consists of a set of 20 tiles, arranged in 4 concentric rectangular rings of different colour. Each tile represents a particular view or issue within a category represented by the ring (colour). The outer (black) ring represents practical considerations, the next (green) consequences and priorities, then duties (red) and finally the inner four tiles (blue) represent health care purpose.

While the grid may be used in a variety of ways, use of the tool essentially involves working as an individual or group to examine a specific issue or hypothesis by removing (or adding) tiles, until the fundamental aspects of the issue are represented by a few key tiles.

*Rings of Uncertainty*

The Rings of Uncertainty present a graphic model for users to reflect upon possible roles and interventions, and to collaborate to reach a common understanding of positions. The concentric rings represent varying levels of uncertainty, with uncertainty increasing with distance from the centre. The rings are divided into sectors, representing the different factors of culture, communication, resources, law, technical competence and risk. The position of the dot within a sector represents the level of uncertainty associated with that factor. The area of each sector may also be adjusted to represent the relative importance assigned to that factor.



**Fig A3.2** The Rings of Uncertainty – prototype (Seedhouse, 2000)

## APPENDIX 4 COST IS ALSO A SOCIETAL CONCERN

It often appears inappropriate or insensitive when dealing with issues classified as societal concerns, to consider overtly the cost of interventions. In bringing up the issue of cost, let alone value for money, one is exposed to criticisms of putting money before values, or even money before life. In addressing societal concerns, therefore, there is a tendency, even exhibited by governments, to shy away from or decouple cost considerations from other aspects of the issue, such as safety. This is very unwise as it is also known that democracies elect their representatives very much on the grounds that they will safeguard ‘value for (tax payers’) money.’

We would argue that although there may be some justification in this reluctance to mention money, costs, as one measure of value, cannot be disregarded, especially when responding to those societal concerns involving significant contributions from the public purse, or which place major new obligations on bodies such as schools which have little or no surplus cash. While distrust of monetary valuations is sometimes justified (e.g. Ball, 2000b & 2000c), and more so for societal concerns with value-derived origins, it is never entirely the case. *In fact, cost is itself a societal concern.* Deep unease has already been expressed about the cost of rail travel this year (2002), the price of petrol and DERV recently caused a rash of demonstrations which almost brought the country to a standstill, and politicians hesitate to increase income tax by one penny in the pound even when it could be specifically earmarked for widely-acclaimed and valued services like health and education. Modern government is expected to account for spending, especially in the context of societal concerns where privilege tends to masquerade as champion of the poor.

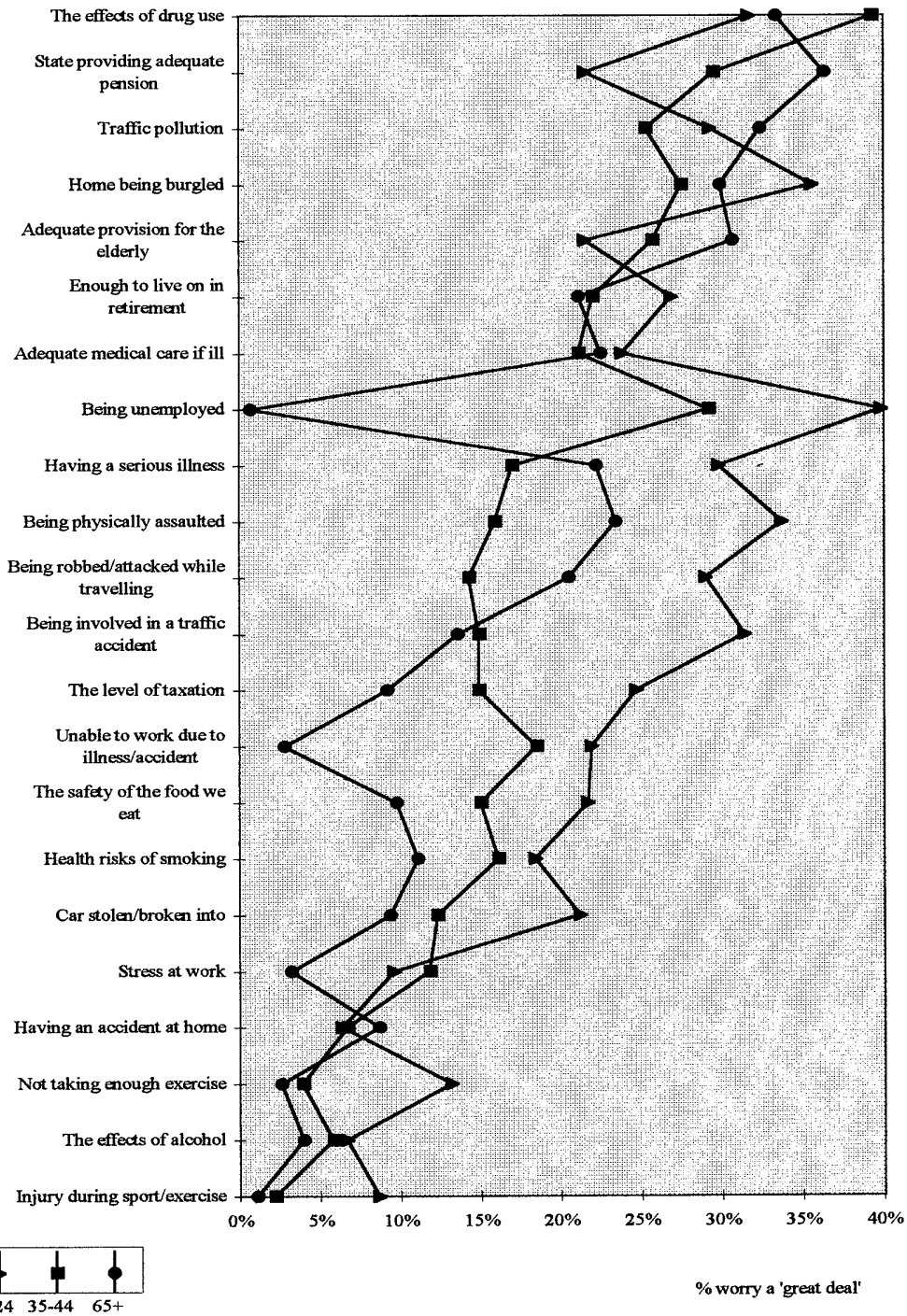
In 1997 a national survey of the British public’s worries was conducted to find what were the main concerns across a very broad spectrum of hazards (Houghton et al., 1999). One reason for this study was to probe the hypothesis that many academic surveys inject their own biases by focusing upon certain enviro-technological hazards,<sup>39</sup> possibly with the effect of giving these an exalted, undeserved status (MacGregor, 1991; Fischer et al., 1991; Boehmer-Christiansen, 1990 & 1995). This is an important issue because the regulatory actions of government agencies are strongly influenced by what bureaucracies define as public perceptions (Slovic, 1992) – perceptions which de facto often emerge from academe and, in particular, research lobbies. To redress this imbalance, if it existed, the 1997 survey included not just the conventional techno-environmental issues but also risks related to ‘lifestyle’, social welfare, finance and personal safety.

The findings of the survey were indeed that the risk issues having most immediacy for the general public differed from those engaging the attention of most technical experts. High in the rankings of public concern came issues of personal finance, employment and education. It is obvious that these matters have far-reaching implications both at the level of the individual and the level of society (see Figure A3.1). We would argue strongly, therefore, that issues of cost, and precisely who would be required to pay, should not be sidelined in debates about societal concerns and the measures deemed necessary to tackle them.

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<sup>39</sup> We suggest that if you repeatedly ask any group of people if they are worried about e.g. nuclear waste, melting glaciers, Brand X washing powder, or maple syrup, every year for many years, a societal concern may well be generated where none existed before.

There is another reason why the cost of safety interventions needs to be considered. This is because high cost interventions invariably are met with a societal readjustment (society is 'reflexive,' to use a Beckian term), which may result in the risk being shifted or transformed rather than reduced or eliminated. As in the case of children's playgrounds, it is believed that the high cost of some safety measures has resulted in a loss of provision that deprives children of a needed resource and potentially displaces them to riskier surroundings (Ball, 2002). Graham and Wiener (1995) provide many other examples of risk transfer.



**Figure A4.1** Things that the British public 'worry about,' based on a national survey in 1997 (Houghton et al., 1999).<sup>40</sup>

<sup>40</sup> Note the high ranking afforded to money-related issues like pensions.



## REFERENCES

- Adams, J. (1995) 'Risk,' UCL Press.
- Adams, J. and Thompson, M. (2002) 'Taking account of societal concerns about risk: framing the problem,' Report to the HSE.
- Ball, D. J. (1998) 'Risk management and the decommissioning of off-shore structures,' Society for Risk Analysis annual conference, Paris.
- Ball, D. J. (2000a) 'Ships in the night and the quest for safety,' *Injury Control and Safety Promotion*, 7(2), 83-96.
- Ball, D. J. (2000b) 'Consumer Affairs and the Valuation of Safety,' *Accident Analysis and Prevention*, 32(3), 337-343.
- Ball, D. J. (2000c) 'Some Philosophical and Practical Issues Related to the Costing of Injuries,' *J Injury Control & Safety Promotion*, 2, 68-69.
- Ball, D. J. (2001) 'Cost Calculation and Injury Prevention: Issues of Science, Rationality and Ethics,' Proc. of Ist WHO Safe Community Conference on cost calculation and cost-effectiveness in injury prevention and safety promotion, Viborg County, Denmark, 30 September 2001, 76-80.
- Ball, D. J. (2002) 'Playgrounds: risks, benefits and choices,' Contract Report No. CRR 2002/426, HSE Books.
- Ball D. J. (2002/3) 'Environmental risk assessment and the intrusion of bias,' *Environment International*, in press.
- Ball, D. J. and Floyd P. J. (1998) 'Societal risk,' Crown Copyright, available from Health & Safety Executive, Risk Assessment Policy Unit, 2 Southwark Bridge, London SE1 9HS.
- Beck U. (1990) 'Vom Überleben in der Risikogesellschaft.' In: M. Schuz, 'Risiko und Wagnis,' 12-31.
- Beck U. (1992) 'Risk society: toward a new modernity,' Sage, London.
- Belzer, R. (1992) 'The use of risk assessment and cost-benefit analysis in US risk-management decision making', International conference on risk assessment, QEII Conference Centre, London.
- Blumer. H. (1931) 'Science without concepts,' *American J. Sociology*, 36: 515-533.
- Boehmer-Christiansen, S.A., with Kellow A. (2002), 'International Environmental Policy: Interests and the Failure of the Kyoto Process,' Edward Elgar Publishing, London.
- Boehmer-Christiansen, S. A. (2002) 'The geo-politics of sustainable development: bureaucracies and politicians in search of the holy grail,' *Geoforum*, forthcoming 2002.

Boehmer-Christiansen, S.A. (2001) 'Global warming: science as a legitimator of politics and trade?' In: Ecology, uncertainty and policy: Managing ecosystems for sustainability,' J. W. Handmer and S. R. Dovers (eds.).Pearson.

Boehmer-Christiansen, S.A. (1999) 'Epilogue: Scientific Advice in the world of power politics,' final chapter (10), In Pim Martens & Jan Rotmans (eds.), Climate Change: An Integrated Approach. (Advances in Global Change Research), Kluwer Academic Publishers, Dordrecht.

Boehmer-Christiansen, S.A. (1997) 'A winning coalition of advocacy: climate research, bureaucracy and 'alternative' fuels,' Energy Policy, 25: 439-44.

Boehmer-Christiansen, S.A. (1996) 'Political pressure in the formation of scientific consensus,' In John Emsley (ed.), The Global Warming Debate, The Report of the European Science and Environment Forum, London.

Boehmer-Christiansen, S.A. (1995) 'Britain and the Intergovernmental Panel on Climate Change,' Environmental Management and Health, 6: 14-25.

Boehmer-Christiansen, S.A. (1994a) 'Scientific uncertainty and power politics: the Framework Convention on Climate Change and the role of scientific advice.' In: G Sjostedt, B Spector and I W Zartman (eds.), Negotiating International Regimes: Lessons Learned from the United Nations Conference on Environment and Development (UNCED); London: Graham and Trotman.

Boehmer-Christiansen, S.A. (1994b) "The precautionary principle in Germany - enabling Government.' In: O'Riordan T, Cameron J (eds.) Interpreting the Precautionary Principle; London: Cameron May.

Boehmer-Christiansen, S.A. ( 1991) '*Acid Politics: Environmental and Energy Policies in Britain and Germany*, with J F Skea, Belhaven Press, London/New York.(Paperback April 1993).

Boehmer-Christiansen, S.A. (1990) 'Energy Policy and Public Opinion: The manipulation of environmental threats by vested interests in Britain and Germany,' Energy Policy, Vol. 18, No 9.

Cullen, L. (1990) 'The Public Inquiry into the Piper Alpha Disaster,' Department of Energy, HMSO.

Douglas M. and Wildavsky A. (1983) 'Risk and culture,' University of California Press.

Farmer, D. (1989) 'So Far as Reasonably Practicable,' Croner Publications.

Fernandes-Russell, D., Bentham, G. , Haynes, R., Kemp, R., & Roberts, L. (1988) 'The economic valuation of statistical life from safety assessment,' Environmental Risk Assessment Unit, University of East Anglia, 5.

Fischer G. W., Morgan, M. G.,Fischhoff, B., Nair I. and Lave, L. B. (1991) 'What risks are people concerned about?' Risk analysis, 11, 303-314.

Fischhoff, B. (1995) 'Risk perception and communication unplugged: twenty years of process,' Risk Analysis, 15(2), 137-145.

Floyd P. J. and Ball D. J., 'Societal risk criteria – possible futures.' In: Foresight and Precaution, Cottam, Harvey, Pape and Tait (eds.), Balkema, Rotterdam (pubs.), 183-190, 2000. ISBN 90 5809 140 6.

Frewer, L., Howard, C., & Shepherd, R. (1998) 'The importance of initial attitudes on responses to communication about genetic engineering in food production,' *Agriculture and Human Values*, 15(2), 15-30.

Graham J. D. (2001) 'Economic evaluation of injury control: alternative perspectives,' Proc. 3<sup>rd</sup> international conference on 'Measuring the burden of injury,' Baltimore, 12-17.

Graham J. D. and Weiner J. B. (1995) 'Risk versus risk, tradeoffs in protecting health and the environment,' Harvard University Press.

Houghton J. R., Murray E. and Ball D. J. (1999) 'Risk ranking by the British public: a survey of worry about a broad spectrum of issues,' *J. Human and Ecological Research*, 5(3), 509-526.

HSE (1989) 'Quantified risk assessment: its input to decision making,' HMSO.

HSE (2001) 'Reducing risks, protecting people,' HSE Books.

Jarvis S., Towner E. and Walsh S. (1995) In: 'The health of our children: decennial supplement,' ed. B. Botting, 95-112, HMSO.

Laughton, M. (ed.) (2001) 'Turning point? An independent review of UK energy policy,' British Energy (pub.).

Leiss W. (1996) 'Three phases in risk communication practice.' In: H. Kunreuther, 'Challenges in risk assessment and management,' Sage, 85-94.

Leiss W. and Chociolko C. (1994) 'Risk and responsibility,' McGill-Queen's University Press.

Lomborg, B. (2001), 'The skeptical environmentalist,' Cambridge University Press.

MacGregor D. (1991) 'Worry over technological activities and life concerns,' *Risk Analysis*, 11, 315-324.

McQuaid, J. (1998) 'The future of risk research,' *Journal of Risk Research*, 1(1), 3-6.

Morgan, M. G. and Henrion, M. (1990) 'Uncertainty: a guide to dealing with uncertainty in qualitative risk and policy analysis,' Cambridge University Press.

Peat, D. F. (2002) 'From certainty to uncertainty,' Joseph Henry Press.

Rayner S. (1992) 'Cultural theory and risk analysis,' In: Krinsky and Golding, 'Social theories of risk,' Praeger, 83-115.



- Rayner, S. (1987) 'Risk and relativism in science for policy.' In V. T. Covello, 'The social and cultural construction of risk,' Reidel, 5-23.
- Renn, O. (1992) 'Concepts of risk – a classification.' In: Krinsky and Golding, 'Social theories of risk,' Praeger, 53-79.
- Renn, O. (1998) 'Risk debates in political arenas – the contributions of competing social theories,' Paper to World Congress of Sociology, Montreal.
- Sandman, P. (1995) 'Formula for effective risk communication,' American Industrial Hygiene Association.
- Sapolsky, H. M. (1990) 'The politics of risk,' *Daedalus*, 119 (4), 83-96.
- Schwarz M. and Thompson. M. (1990) 'Divided we stand,' *Harvester Wheatsheaf*.
- Scuffham P. A. and Langley J. D. (1997) 'Trends in cycle injury in New Zealand under voluntary helmet use,' *Accident Analysis and Prevention*, 29(1), 1-9.
- Seedhouse, D. F. (1991) 'Liberating medicine,' Wiley.
- Seedhouse, D. F. (1997) 'Health Promotion: Philosophy, Prejudice and Practice,' Wiley.
- Seedhouse, D. F. (2000) 'Ethics: The heart of health care,' Wiley, 1998.
- Seedhouse D. F. (2002) 'Total health promotion – mental health, rational fields and the quest for autonomy,' Wiley, in press.
- Shrader-Frechette K. S. (1984) 'Risk-cost-benefit methodology and equal protection.' In: V. T. Covello, 'Risk evaluation and management,' Plenum, 275-296.
- Shrader-Frechette K. S. (1991) 'Risk and rationality,' University of California Press.
- Sibert, J. R. (1991) 'Accidents to children: the doctor's role. Education or environmental change?' *Archives of Disease in Childhood*, 66, 890-893.
- Slovic, P. (1999) 'Trust, emotion,sex, politics,and science: surveying the risk assessment battlefield,' *Risk Analysis*, 19(4), 689-701.
- Slovic, P. (1992), 'Perception of risk,' In *Social theories of risk*, by S. Krinsky and D. Golding, ch. 5, 117-152, Praeger.
- Tengs, T., Adams, M., Pliskin, J., & Safran, D. (1995) 'Five hundred life-saving interventions and their cost-effectiveness", *Risk Analysis*, 15, 369-390.
- Travis, C., Richter Pack, S., & Fisher, A. (1987) 'Cost-effectiveness as a factor in cancer risk management,' *Environment International*, 13, 469-474.
- Viscusi, W. (1992) 'Fatal tradeoffs - Public and private responsibilities for risk,' Oxford University Press, Oxford.

WBGU (1998) see Renn (1998).

Wynne, B. (1992) 'Public understanding of science research: new horizons, or a hall of mirrors.'

Wynne, B. (1992) 'Risk and social learning: reification to engagement.' In: Krimsky and Golding, 'Social theories of risk,' Praeger, 275-297.





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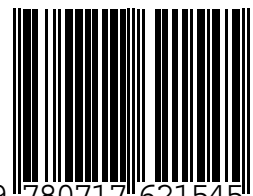
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