The UK regulatory approach to the management of risks

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" This paper expresses the personal views of the author and does not necessarily reflect that of the UK Health and Safety Executive."

1. Introduction

In the regulation of risks to health and safety at work, the Health and Safety Executive (HSE) starts with the premise that suitable controls must be in place to address all significant hazards and that these controls, at a minimum, must implement authoritative good practice irrespective of situation based risk estimates.

Where there is no reliable base of good practice, it is necessary to undertake a risk assessment and evaluation to decide on the extent to which the risk should be controlled. This concept is a central feature of much of the Health and Safety legislation in Great Britain.

For reaching decisions on control, HSE adopts a framework which ensures that there is a bias towards health and safety to take account of uncertainty, i.e. a precautionary approach. HSE is conscious that its decisions can have widespread implications through society and that to gain the trust of the public and acceptance of our decisions, what we do must reflect society's values at large. HSE can only do this if it is open about what it does to ensure consistency and coherence in its approach to undertaking its regulatory functions.

2. Background to UK Approach

The UK has had a multi-factoral approach to the regulation of risk since the Roben's Committee in 1972, which was set up to review safety, health and welfare at work. Its recommendations, (which led to the formation of the Health and Safety Commission (HSC) and the HSE), were influenced by social pressures for the explanation of and involvement in the basis of decisions about health and safety. Their recommendations particularly took account of pressure relating to representation of the different interests at the highest level of decision making, consultation with stakeholders and to the involvement of safety representatives and safety committees in the workplace. This process was taken a stage further by the 1986 report of the public inquiry into the Sizewell B Nuclear Power Station. The Inquiry Inspector, Sir Frank Layfield asked that HSE should "formulate and publish guidelines on the tolerable levels of individual and societal risk to workers and the public from nuclear power stations". The resulting document, (Tolerability of Risk from Nuclear Power Stations or ToR), published by HSE in 1988 specifically addressed the need to advance from the premise that things were either safe or not safe.

The document, reissued in 1992 following public consultations, and its underlying philosophy has since gained considerable acceptance by other regulators and industries as having wider applicability beyond nuclear power. In particular, it is now widely accepted that a properly informed balancing act between risks and benefits is central to decisions on which risks are tolerable.

The UK equivalent of ALARA is ALARP, (as low as reasonably practicable) or so far is reasonably practicable. The phrase, usually relating to controlling risk, has been in widespread use in UK health and safety legislation for many decades and has helped to bring a uniform approach to the regulation of all workplace risks, both radiological and non-radiological. British case law has established that "reasonably practicable" is a narrower term than "physically possible". In particular, that where the term "so far as is reasonably practicable" (sfairp), is used then a computation must be made in which the quantum of risk is placed on a scale and the sacrifice, whether in money, time or trouble, involved in the measures to avert the risk is placed on the other and that there should be a comparison of the two. The HSC has taken such issues into account and has established a policy that:

" When the law requires that risks should be controlled so far as is reasonably practicable, enforcing authorities considering protective measures taken by duty holders should always take account of cost as well as the degree of risk. The authorities may legitimately expect that the relevant good practice will be followed and where relevant good practice in particular cases is not clearly established, health and safety law effectively requires duty holders to assess the significance of the risks (both their extent and likelihood) to determine what action needs to be taken. Some irreducible risks may be so serious that they can't be permitted irrespective of the economic

consequences. At the other extreme, some risks may be so trivial that it is not worth spending more to reduce them any further."

Indeed, rather than activities being black and white / safe and unsafe, the use of the word risk implies that there are degrees of safety. As developed in the ToR framework, there is also the implication that risks might be classified as unacceptable, tolerable or broadly acceptable and that this is applicable across the whole spectrum of risks whether or not they are quantifiable.

The risk of suffering harm is an inescapable aspect of life. Intuitively, we all realise that personal and collective safety must in some way be balanced against the benefits that we would otherwise forego. Society may also wish to ensure the control of risks that offend against society's collective sense of equity and fairness, e.g. public reaction to a major disaster or a perceived but unknown or not understood threat, e.g. genetically modified organisms (GMO's). Thus the Tolerability of Risk Document has been developed into an HSE Consultative Document "Reducing Risks, Protecting People", (R2P2). This acknowledges, among other things, that "proper regulation of risk requires that both the individual risks and societal concerns engendered by a hazard must be addressed."

In addition, greater prosperity and increased standards of living have been accompanied by greater public demand for healthier workplaces, a cleaner environment, better housing, safer food etc.., etc.. A major challenge for the regulator and government is an apparent aspiration for a society free of involuntary risks, underpinned by a belief that the State has a duty to insulate people from harm. This is together with increasing demand for explanations of how protection is to be provided and that these explanations should be transparent and comprehensible so that the public can play its part in influencing these decisions.

Yet another factor in the application of the SFAIRP principle is that progress in good practice and technology may lead to progressive improvements in health and safety standards. This is also in line with the UK regulatory approach which operates against the background that the Health and Safety at Work Act 1974, (HSW Act), and Regulations made under it, is intended to maintain or improve standards of health and safety.

3. Risk Assessment

An assessment of the risks is at the heart of HSE's approach to regulating and managing risks. A fundamental principle of the Health, Safety and Welfare (HSW) Act is that those who create risks from work activity are responsible for protecting workers and the public from their consequences. Thus, broad general duties are explicitly placed on those who are best placed to do something about preventing or controlling the risks. These broad, general duties, which are generally "goalsetting" are supplemented by specific regulations. Some of these place absolute duties on duty holders. An example is the duty to ensure that employees do not receive doses of ionising radiations which exceed dose limits. Others, like the broad general duties are qualified by SFAIRP, in order not to impose duties that none can fulfil and to ensure that preventative and protective actions are commensurate with the risks. The requirement for risk assessment applies across the whole spectrum of activities. The Management of Health and Safety at Work Regulations 1999 place a number of obligations on employers and others including at Regulations 3(1):

"every employer shall make a suitable and sufficient risk assessment of: "

a) risks to the health and safety of his employees to which they are exposed whilst they are at work; and

b) risks to the health and safety of persons not in his employment arising out of or in connection with the conduct by him of his undertaking for the purpose of identifying the measures he needs to take to comply with.....relevant statutory provisions.

This applies to all employers, (and self employed), and all risks. Specific Regulations referring to chemicals, noise, ionising radiation etcetera, have all contained similar provisions. Thus whatever the hazard, the same approach to decision making is required.

It is HSE's view that there is overwhelming evidence that, when properly used, the results of a risk assessment often provide an essential ingredient in reaching decisions on the management of risk. The results of the assessment should be used to inform rather than dictate decisions and be only one of many factors taken into account in reaching a decision.

4. Risk v Hazard

Hazard and risk are part of everyday vocabulary. When people say they are prepared to take a risk, they are willing to incur the chance of adverse consequences in the expectations of a positive benefit. Intrinsic in that

definition is that risk should reflect both the likelihood of harm occurring and a measure of the consequence. Traditionally, hazard has been described as an intrinsic property of something to cause harm and risk as the chance of the harm being realised. Thus HSE often requires the hazards to be identified, the risks they give rise to be assessed and control measures to be implemented to control risks; thus taking account of the circumstances in which people and management interact with the hazard.

There will be cases where the distinction between hazard and risk is blurred in practice. HSE, for example, might attach a different weighting to the likelihood that harm will occur from the weighting attached to the consequences. The more weighting placed on the consequences, the more the distinction between hazard and risk becomes blurred. If we choose to concentrate solely on the consequences, the distinction disappears, the possibility of consequences taking complete priority over chance. In some areas, particularly those of high hazard, HSE operates a "permissioning" regime which requires operators to submit detailed information on their proposals and a risk assessment. Examples are nuclear power, GMO's and the offshore oil industry. In some cases, licensing by HSE is required in others, the opportunity for HSE to seek further information and/or stop the operation.

A risk assessment may show that the risks are such that individuals may not be unduly concerned because of the familiarity of the risks and/or that the expectation of harm to any one individual is low. Nevertheless, the activity giving rise to the risks may need to be controlled further because of the possible consequence on society. It is important to properly characterise the risks for the effective application of the preferred risk control hierarchy. At the top of the hierarchy is the consideration of measures or alternatives that will avoid the hazard in the first place. This might involve substitution or adopting a process which is designed to be inherently safe. Lower down the hierarchy are consideration of measures that will reduce the risks. An implicit presumption underlying the hierarchy is that it is not the case that any activity can be pursued simply because measures are available to control the risk it entails. This would be particularly true for activities where there are considerable uncertainties in the estimates of risk attached to them, and where hazard rather than risk is the dominant consideration. An example of an activity where there is considerable uncertainty on the nature and scale of the risks that they give rise to is in some aspects of work with genetically modified organisms, (GMO's).

5. Risk Assessment

In the UK, our risk assessment and risk management procedures have a number of safeguards to ensure that our approach is in line with the Precautionary Principle, i.e. to rule out the lack of certainty as a reason for not taking preventative action. The Precautionary Principle describes the philosophy that should be adopted for addressing risks subject to high uncertainty, particularly in the environmental field.

Thus, as a rule, our risk assessment procedures;

- require that assumptions to fill gaps in knowledge be tested through recognised methods, e.g. sensitivity analysis;
- attach more weight to consequences for those hazards giving rise to irreversible and potentially severe detriment, e.g. cancer;
- give more weight to the consequences of a risk being realised than to its likelihood, where there is great uncertainty about the latter. For example, by assuming that working with genetically modified organisms entails a very high degree of risk and must therefore be subject to a very stringent control regime;
- build safety factors in the assessment process where appropriate, e.g. in assessing toxic substances, safety factors are used depending on the quality of data, severity of effect, and whether data from animals or *in vitro* experiments are being extrapolated to humans;
- consider worst case scenarios, the greater the uncertainty about consequences. These can span from a 'most likely' worst case to a 'worst case possible' depending on the degree of uncertainty, societal concerns and, again, attributes such as irreversibility of realised consequences or potential for affecting future generations;
- make use of comparative risk assessment for novel hazards that bear a similarity with existing hazards requiring a stringent control regime for reducing risks to tolerable levels.

In managing risks we would be particularly interested in examining:

- what constitutes good practice, or the merits of good practice that apply in comparable circumstances;
- whether the option is technically feasible and whether it will improve or at least maintain standards of health, safety and welfare;
- ensuring that another type of risk is not created e.g., banning a particular solvent may increase the use of a more hazardous one; reducing airborne concentrations of substances in the workplace by exhaust ventilation may increase risk in the community or vice versa.

- how much uncertainty is attached to the issue and as a consequence the precautionary approach that should be adopted.

6. Decision Making

HSE adopts a framework for reaching decisions which intrinsically ensures that while there is a bias towards health and safety to take account of uncertainty, bias reflects a proper judgement of the degree of caution needed in the circumstances of the decision. The framework achieves this by ensuring that, as the degree of uncertainty increases, there is an increasing shift towards requiring more stringent measures to mitigate the risks. In cases where the benefits cannot justify the risks, the framework requires that consideration is given to banning whatever gives rise to the hazard.

In reaching and adopting a decision, a crucial factor in success is in ensuring as far as possible, that interested parties are content with the process for reaching decisions and, ideally, the decisions themselves. In particular, they will need to be satisfied about:

- the way uncertainty has been addressed and the plausibility of the assumptions made; and
- how other relevant factors such as economic, technological and political considerations have been integrated into the decision making process.

"Getting it right" depends to a large extent on the criteria adopted for deciding whether a risk is unacceptable, tolerable or broadly acceptable. Research has shown that the criteria adopted by regulators in the health and safety and environmental field can be classified according to three "pure" criteria:

- an equity based criterion, which starts with the premise that all individuals have unconditional rights to certain levels of protection. This leads to standards, applicable to all, held to be usually acceptable in normal life.This may in practice lead to fixing some sort of limit to represent the maximum level of risk above which no individual can be exposed, whatever the benefits.
- a utility based criterion which applies to the comparison between the incremental benefits of the measures to prevent the risk of injury or detriment and the cost of the measures. The balance can be deliberately skewed towards benefits by ensuring that there is gross disproportion between the costs and benefits.
- a technology based criterion which essentially reflects the idea that a satisfactory level of risk prevention is attained when "state of the art" technology is employed to control risks whatever the circumstances.

All the above must, of course, be tempered with reality and common sense e.g. not using worst case scenarios bearing little semblance to reality, or imposing unnecessarily high technological standards such as requiring wood furniture manufacturers to adopt state of the art technology developed for keeping clinically clean pharmaceutical facilities or electronic chip manufacture.

HSE's approach to the tolerability of risk (ToR) framework accommodates all three criteria whilst avoiding their disadvantages. The main tests applied under ToR are very similar to those that apply in everyday life. Thus in real life, there are risks that people ignore and others that they refuse to entertain. There are also many other risks that people are prepared to take by operating a trade-off between the benefits of taking the risks and the precautions we all have to take to mitigate their undesirable effects.

The ToR framework is shown in figure 1.

7. Developments Influencing HSE's Decision Making Process

The Robens Committee's diagnosis of the issues at stake when regulating for health and safety still holds good, namely that:

- health and safety at work can not be ensured by an ever-expanding body of legal regulations enforced by an ever increasing army of inspectors.
- primary responsibility for ensuring health and safety should be with those who create risks and those who work with them;
- the law should provide a statement of principles and definitions of general duties with regulations setting more specific goals or standards.

However, our approach on the management and regulation of risks has evolved to take into account developments that have arisen over the last 25 years or so. In particular:

- we have a better understanding of how people view risks;

- changes have taken place in the regulatory environment and on the industrial scene;
- there have been marked shifts in the preference, values and expectations of our society.

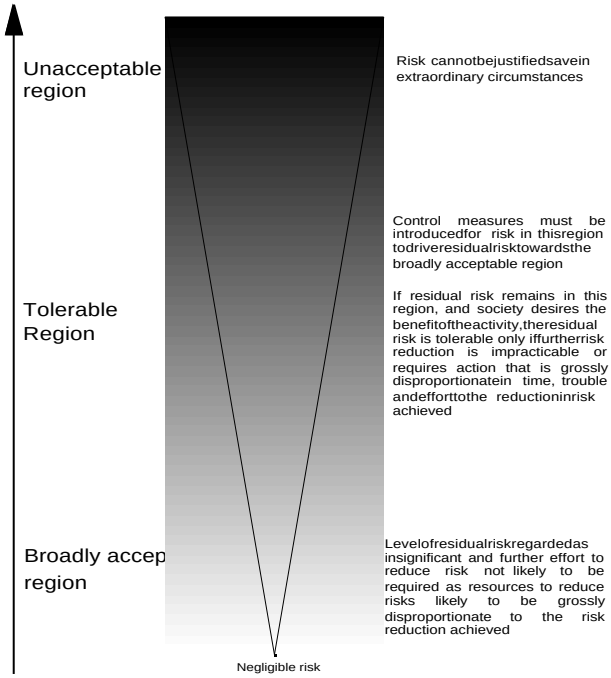

Figure 1. HSE criteria for the tolerability of risk

8. Perception of Risk

How people view risks and apply value judgements is perhaps the most challenging factor to take into account when developing an approach to the regulation of risk not least because these views and value judgements are not static but change according to circumstances.

We all recognise that we are surrounded by hazards. Less apparent is that whatever we do, however we occupy our time or even if we "do nothing", we are taking some kind of risk. Every day, consciously or unconsciously, we all view hazards and evaluate their risk to determine which ones we choose to notice, ignore, or perhaps do something about. The way we treat risks generally depends on our perception of how they relate to us and things we value.

The characteristics and types of hazards that give rise to "societal concerns" have been intensely studied by social scientists. Three factors in particular appear to be closely associated with how society at large perceive risks:

- how well the process, (giving rise to the hazard), is understood;
- an event's degree of dreadfulness, e.g. because they give rise to risks which can be catastrophic, are inequitably distributed and where individuals cannot control their exposure or assume the risk voluntarily;
- the number of people exposed and likely to be killed in one incident.

Public response to a particular incident can also be amplified or attenuated depending on how the risk interacts with psychological, social and ethical considerations. Another factor is the degree of trust in the ability of those creating the risk (or in the regulator) in ensuring that adequate preventative and protective measures are in place for controlling the risks or mitigating the circumstances.

Even where the best data is available to make an assessment, people who do not share judgmental values implicit in assumptions on, e.g. relative values of risk and benefits, may see the outcome of the exercise as invalid or even not pertinent to the problem. An example of this was the controversy which surrounded the proposal to dispose of the Brent Spar oil platform in the middle of the ocean, following an assessment by the company showing the potential harm to the environment to be low.

In general, hazards give rise to concerns which can be placed in two categories:

- **Individual** concerns or how individuals see the risk from the hazard affecting them and the things they value personally. They may be prepared to engage voluntarily in activities that entail high risks but are far less tolerant of risks imposed on them and over which they have little control.
- **Societal** concerns: this type of concern may be associated with risks which if realised could lead to widespread or large scale detriment, e.g. nuclear power generation, rail travel or the genetic modification of organisms.

People are likely to be more averse to risks:

- which could cause multiple fatalities;
- where it is difficult to intuitively estimate the actual threat;
- where the risks and benefits are unevenly distributed either between groups of people or over time, e.g. more risk borne by future generation.

On the other hand, familiar hazards, often taken voluntarily for a benefit will not, generally give rise to societal concerns.

9. Changes in the Regulatory Environment

Marked changes that have taken place in the regulatory environment since Robens are:

- *Internationalisation of regulation* - increasingly being undertaken at European or international level in the form of legally binding instruments, particularly in the wake of the creation of new global markets and new technologies. This requires innovative forms of regulatory co-operation, mutual recognition of standards, removal of barriers to trade.
- *Increased complexity of risk* - whilst the obvious and well understood risks have generally been tackled, new and less visible hazards have emerged and gained prominence, e.g. biotechnology and processes emitting gases which give rise to global warming and ozone depletion. Where processes are only partly understood, regulatory decisions are often made on limited data and considerable scientific and

technological uncertainties. The control measures required by regulators should reflect the nature of the uncertainties and err on the side of health and safety.

10. Changes on the Industrial Scene

Two major factors over recent years have been:

- Changes of patterns of employment;
- Different approaches and needs of small and large firms.

There is an increasing trend in industry and elsewhere to "out source" work, (and hence risks), with consequential changes in employment patterns and fragmentation of large companies into autonomous smaller organisations. Examples are:

- dramatic increases in self employment and home working;
- small and medium sized firms are a major force in creating jobs;
- British Rail - a monolithic railway organisation - has become a series of separate companies with different responsibilities for operating the track, the rolling stock and the networks.

Some of the changes have blurred legal responsibilities for occupational health and safety traditionally placed on those who create the risks or those best situated to take steps to control the risks. In certain industries it is often no longer clear who is in such a position. Much legislation now has requirements for employers to cooperate where necessary to secure health and safety, (e.g. "Management of Health and Safety Regulations"). In many sectors the above factors undoubtedly make it more difficult to co-ordinate the adoption of risk control measures.

Another outcome is that there are many more players often with little access to expertise. This has led to a growing demand by small firms for a reversion to prescriptive regulations, running counter to HSE's self-regulatory approach. Large firms are, of course, resistant to such moves as they do not face the same problems and are very much at ease with the self regulatory approach. As a result, HSE places great emphasis on the need for clarity of the status and content of the guidance which it produces. It also makes particular efforts to ensure that the needs of small firms are taken into account when developing strategies and initiatives and that communication channels, (both ways), are straightforward and easily understood.

11. Changes in the preferences, values and expectations of society

In its work on strategic initiatives, HSE has adopted the following as key drivers for health and safety issues:

- Novel technology, IT & communications;
- Changing patterns of work and lifestyle;
- Environmental issues, (global warming, sustainable development);
- Political and economic climate
- Public opinion, (ethics, special interest groups, media);
- International legislation and programmes of work;

Many of these directly impact on shifts in expectations:

- It makes it easier for people to have information on issues that may affect them or society. The explosion in information technology has, for example, resulted in greater awareness of issues such as the Chernobyl incident, the toll of asbestos related deaths, the threats to the ozone layer. Unfortunately information about risks is frequently passed on in isolated bits by the mass media and without any critical examination or peer review - often resulting in the public getting confused or in some risks being amplified and others attenuated.
- the increased pace in exploiting advances in scientific and technical knowledge, leading to an increased focus on technological risks.
- greater affluence in society. The acceptance of industrial activity to gain increased standards of living is no longer as readily given as when the fight against hunger and poverty overshadowed everything else.

These shifts have led to:

a) *A growing perception that risks should be justified*. There is a growing propensity to scrutinise benefits brought about by industrial activity against potential undesirable side effects. This is particularly true for risks:

- which may have catastrophic consequences,
- where the consequences may be irreversible, e.g. release of GMOs.
- which led to inequalities because they affect some people more than others, such as those arising from the siting of a chemical plant or an incinerator.
- which could pose a threat to future generations, e.g. radioactive waste.

b) *An increasing reliance by the public on regulators that they trust*. A heightened perception of risk has been accompanied by a recognition that it is virtually no longer possible for individuals to:

- avoid risks that they would prefer not to incur, e.g. employment or promotion opportunities may be restricted for those averse to air travel or driving a car.
- assess for themselves the risks posed by many new hazards arising from industrialisation. This may be because the risk is not obvious, e.g. new substances where there may be a long delay between first exposure and manifestation of effect. People must instead rely on the opinion of experts. However, the trust placed in such experts as a source of reassurance is being eroded particularly for issues where the media seek to exploit controversies which surround them. Increasingly, therefore people are having to rely on authoritative bodies such as HSC/E as a source of reassurance. To be effective this, however, requires HSE to earn the trust of those seeking its view. This is far from easy. There is often pressure on regulators (and industry) to act quickly and decisively in a climate easily influenced by perceptions of harm often based on graphic imagery. Regulating slavishly on such occasions is not the answer.

c) *Calls for greater openness and involvement in the decision making process.* One of the most dramatic shifts has been the pressure on regulators for greater clarity and explanation of their approaches to regulatory risk. In the UK, the "Better Regulation Task Force" have produced principles of good regulation which require:

- the targeting of action: focusing on the most serious risks or where hazards are less well controlled;
- consistency: adopting a similar approach in similar circumstances to achieve similar ends;
- proportionality: requiring action that is commensurate with the risks;
- transparency: being open on how decisions were arrived at - what are their implications; and
- accountability: making clear, for all to see, who are accountable when things go wrong but without resorting to unfair retribution.

All these are entirely consistent with the Robens Committee's conclusion that real progress on health and safety is not possible without the agreement of those affected and the co-operation and commitment of those playing a role in implementing decisions.

A key feature of the practical implementation by HSE of its role in ensuring that appropriate standards are met is the fact that its inspectors have discretionary powers in their application/targeting of relevant sections of the law to achieve optimum effect. Thus inspectors will try to maximise the effectiveness of time spent on premises by focusing on the most important issues, and to ensure that control measures being requested are commensurate with the risk. HSE also makes significant use of formal audits and assessment of management safety structure and systems. We find, (in general), that those companies which are generally well structured and managed also demonstrate a better performance over the whole range of health and safety issues.

12. Common issues across the range of hazards

There is an increasing realisation in the radiation protection community that the risks that they control cannot stand alone and apart from other workplace and environmental agents and that general principles of responsible risk management and control are equally applicable.

The factors and issues described lead to the inescapable conclusion that in health and safety there are no special cases which fall outside the framework. The science of radiation is complex - but then so is microbiology, (germs can also spread by infection). Exposure to radiation can cause acute, chronic and long term effects - so can some chemicals. There may be stochastic and non-stochastic effects - cf. chemicals. There is a dose-effect relationship in aspects of radiation - there is in noise and vibration.
There is a "dread factor" with radiation - there is with GMOs. There is a potential for environmental damage - there is with GMO and pesticides. The bottom line is that exposure should be prevented/controlled taking account of:

- risk assessment
- cost benefit
- societal acceptability/tolerance

The means of prevention/control of exposure include enclosure/containment shielding, airflow gradients, training, competence and supervision. Indeed, identification of potential exposure in real time is relatively easy for radiation compared to e.g. pathogens, chemicals, vibration. There is great scope for demystifying the topic and the application of principles of protection/regulation used in many other fields. There is also a need to be realistic and pragmatic about the resource required to protect people from harm, in terms of standards applied, (EU standards, OECD, ICRP), being commensurate with the problem and resources required by regulator and operator in the implementation of the standards.

13. Recent developments in UK regulatory approach

Finally, the UK government has recently issued a document called "Revitalising Health and Safety", which has had a fresh look at standards of health and safety in the workplace against the backdrop of much of the foregoing. There are five main messages:

- a fair, decent and safe society depends on good regulations and that, where necessary, the law must bite to keep workers and the public safe.
- more is expected of public policy than simply protecting from manifest harm. We need to promote better working environments to promote productivity and competitiveness.
- achieving minimum legal standards is not a sufficient goal. We must strive for a culture that can achieve continuous improvements in health and safety standards;
- whatever improvements have been achieved to date, we do not accept that the toll of death, injury and work related illness cannot be reduced further;
- Ministers, the HSC and the HSE are fully committed to achieving a step change in health and safety.

  (You may ask where radiation fits into this. In terms of standards, have we done enough already compared to other existing and emerging problems?)

The government have set a number of targets for reduction of:

- working days lost per 100,000 workers from work-related injury and ill health by 30% by 2010;
- reduce the incidence rate of fatal and major injury accidents by 10% by 2010;
- reduce the incidence rate of cases of work-related ill health by 20% by 2010; and
- achieve half the incidence of each target by 2004.

It is again interesting to consider where exposure to radiation figures in this context.

A ten point strategy to achieve these goals has been developed:
- The health and safety system should shift from minimum standards to best practice. (Do we already do this in radiation?) In doing so, the HSE make an active contribution to the wider government agenda of competitiveness, sustainability, public health and social inclusion;
- The health and safety system must complement the government's vision for a competitive, knowledge driven economy. We must recognise and promote the contribution of a work force which is "happy, healthy and here" to productivity and competitiveness;

- **Occupational health** must remain a top priority, including better compliance with health law, innovative arrangements to secure continuous improvement, and having the right knowledge and skills available with appropriate occupational health support;
- There is a need for **positive engagement of small firms**, by demonstrating the benefits of effective health and safety management. We need to simplify law that is overcomplicated with their needs in mind, without compromising standards and ensure that small firms are encouraged to seek advice without fear of the regulator. Pressure for improvements in standards should be sought through the supply chain;
- The compensation, benefits and insurance system must **motivate employers** to improve their health and safety performance;
- A more deeply engrained **culture of self regulation** needs to be cultivated, most crucially in the 3.7 million businesses with less than 250 employees. By demonstrating the business benefits of effective health and safety management and:
- providing financial incentives which motivate; and
- change the law to secure penalties which deliver. Together with the full integration of health and safety within general management systems.
- The full potential of Roben's vision for worker participation in individual workplaces has yet to be realised. **Effective partnerships between all stakeholders in the health and safety system**, including central, devolved and local governments are crucial.
- **Government must lead by example**. All public bodies must demonstrate best practice in health and safety management, including procurement and promoting best practice through the supply chain;
- Most health and safety failures are due to poor management and ignorance of good practice rather than direct malicious intent. **Education** at every level, starting in primary schools, in health and safety skills and risk management is the key. Coverage of risks issues in engineering, design and general management education remains weak;
- The best way to protect workers' health and safety is to "**design it in**" to processes and products, particularly where there is heavy reliance on contracting.

This paper has been deliberately general, (as requested). I believe, however, that it does raise a number of questions for the radiation community:

14. Radiation Issues for the Future

- Radiation is undoubtedly a hazard, but where does it lie in terms of risk to people which has not already been significantly addressed and compared to other risks to health and safety and well being?
- What opportunities exist for adopting a common approach, (not specific measures), for further controlling exposure to radiation vis-à-vis other agents?
- What information do we have on the extent to which radiation actually causes harm to people at work, as opposed to a statistical approach. How can we obtain better information?
- Are we doing sufficient to address society's concerns, (real or imagined), regarding radiation issues? Do we have a vested interest in keeping society concerned?
- To what extent do eminent and authoritative bodies such as ICRP understand the real world of everyday life?
- How much energy and resources should be devoted by standards making bodies, regulators and users/generators of radiation into small reductions of levels of risk beyond an already low level, (relatively speaking)?
- Where is science and technology leading and is the current regulating framework fit for the purpose for the future?

I do not attempt to answer any of the above questions, merely to stimulate a constructive debate.