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Risk communication and professional engineers

A paper provided by the **Joint Institution Group on Safety Risk - JIGSR**

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Joint Institution Group on Safety Risk

The mission of the group is to work together by consensus to promote action and enhance awareness and knowledge of health and safety risk issues in the interests of the engineering profession.

The aims of the group are:

- To raise awareness of health and safety risk issues of interest to the profession - in particular acting as a forum for the exchange of information between members
- To promote and support more widely initiatives and activities originating in member organisations where engineering benefits the wider community
- To promote joint action on agreed topics of mutual concern and interest where there are agreed benefits to the wider engineering community

This group was formally know as the Inter-Instutional Group on Health and Safety.

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Cover images (clockwise from top left)

- Train accident, Gramatneusiedl, Austria
- Nuclear power station
- Power lines damaged in bad weather
- Hertfordshire Oil Storage Terminal, Buncefield by courtesy of Hertfordshire Constabulary

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1. Background and Objectives

This paper arose from discussions at a Workshop between members of the Inter-Institutional Group on Health and Safety (IIG) and the HSE in November 2011. The IIG subsequently set up a working group to produce the paper (with HSE input). It was agreed that it would have the following objectives:

- identify the key issues for professional engineers in risk communication in the context of health and safety risk management;
- summarise recent developments in the area being carried out by professional and government bodies;
- identify where further action might be appropriate; and
- make recommendations on what more might be done to promote appropriate action to improve risk communication.

The members of the working group are listed in Annexe 1.

2. Introduction

Public understanding of risk and effective communication of risk issues by experts and policy makers is vital if health and safety outcomes are to be optimised. Public underestimation of risk can lead to failure to take appropriate precautions to ensure protection against harm in a variety of important ways, whilst overestimation of risks can lead to opposition to potentially important technological developments and can also lead to public demands for inappropriate legislation and regulation. It is entirely appropriate that there should be public debate about requirements for health and safety provisions and about technological developments with health and safety implications, and that public perception and socio-political issues should be an important consideration in decision making. To inform this debate, it is vital that engineers and others responsible for communicating risk issues do so in ways which are accurate, trustworthy, credible, proportionate, and which recognise valid concerns.

In order to express the issues relevant to particular risks to the wider public, engineers have to bridge a potentially wide culture gap. In many cases, engineers regard the need to address risk satisfactorily as primarily an issue of meeting 'objective' criteria often expressed in statistical terms. This process of risk assessment and optimisation provides an important basis in trying to ensure that scarce resources are employed cost effectively in minimising the risks to which individuals and society are exposed and it is important that this 'objective' element in risk management is not neglected. However, society generally does not see the issues as simply as this. Unless engineers understand what lies behind the sometimes complex public attitudes and perceptions and take account of them, they will be unable to communicate effectively with the wider public about the issues involved in identifying, assessing and managing risks. As a result there is a danger that they will not be able to gain acceptance for important technological advances or improvements in our capability to minimise the risks to which we are exposed.

This paper examines what is being done to ensure that the subject is understood by the key stakeholders and that appropriate action is being taken to develop thinking on this issue and to improve mutual understanding. Whilst the primary focus of the paper is on health and safety risks (in line with the objectives of the IIG), it is necessary to see these in the context of wider issues of risk communication and management, and how risk is regulated. Health and safety risk management issues constitute a very important part of the range of risks which have to be addressed by professional engineers and they also constitute an important element in the ethical requirements placed upon them. In developing the skills to handle risks relating to health and safety effectively, engineers develop competencies which will have direct application to the handling of the broader spectrum of risks which they have to manage.

3. Key Issues

This document does not provide an exhaustive review of the extensive research that has been carried out on risk communication. However, a short bibliography of research is included in Annexe 2. This not only deals with research into aspects of risk communication addressed in this paper, but also with associated issues such as how perceptions of risk are formed, social amplification of risk, the response of different 'personality types' to risk and the development of effective processes to involve stakeholders and to generate trust and improved understanding.

A key issue identified in the research carried out on the subject relates to the issue of trust. Where the public or those affected perceive something to be of high risk, trust in those responsible for introducing the risk and those controlling it, can help to mitigate concerns. Conversely, a lack of trust can lead people to oppose a development even where scientific evidence indicates that the risks are relatively low[1].

Research has suggested that to achieve trust, five characteristics are required:

- competence (those communicating know what they are talking about);
- objectivity (this frequently means a view that the source of information is independent);
- consistency (a track record in dealing competently with similar matters);
- openness (a willingness to disclose information and not to appear secretive); and
- empathy (willingness to accept the validity of concerns and to listen and consult).

Concerns are usually greater and trust is more difficult to build where:

- experts disagree or appear to disagree about the risks involved;
- exposure to the risk is involuntary (i.e. it is imposed by others) and is perceived to be out of the control of those subject to the risk;

- it is perceived as 'artificial' rather than naturally occurring;
- the risk is unfamiliar or poorly understood (e.g. it appears to be new with potentially unknown consequences);
- the consequences are dreaded, hidden, irreversible or particularly memorable (e.g. it could lead to cancer, or genetic effects, or it is perceived to be associated with a technology that has had a major and memorable impact on society such as nuclear weapons);
- there is doubt about the benefit from accepting the risk - particularly where benefits and risks appear to be distributed unevenly. For example, ethical concerns arise where there is perceived to be a greater impact on a vulnerable group (e.g. children, future generations or the elderly);
- the risk is catastrophic (i.e. it is likely to affect a large number of people at one time);
- similar developments have led to unpredicted or underestimated consequences (e.g. consequences of concern have arisen from technology which is perceived to be similar); and
- those creating the risk are perceived as obtaining a particular advantage (e.g. a commercial incentive to underplay the risks) and, particularly, where the organisation or individuals involved have a history of being perceived as uncaring.

In a recent paper to the Institution of Mechanical Engineers[2], the Chair of the HSE, Judith Hackitt CBE, emphasised the importance of building public confidence and made the point that this will not come from telling people that 'we know best'. What will help to deliver it is:

- acknowledging justifiable fear or apprehension of the new and unknown;
- explaining innovations in terms of benefits and risks;
- being honest about what can be done to reduce but not eliminate risk; and
- constantly reminding people that inaction is itself, not risk free.

4. Developments of Relevance to the Discussion

Issues arising from understanding and communicating about risk, particularly in the context of safety, have been the subject of debate among engineers and scientists for many years. For example, The Royal Society initiated major discussions in the 1980s and 1990s which were instrumental in beginning the process of broadening the purely scientific interpretation of risk among the scientific and engineering communities to take account of the views of social scientists[3,4]. The need for wider considerations to be explicitly considered in decision making was heightened by major public inquiries such as that for Sizewell B, where quantitative risk assessment began to be considered in the context of societal considerations and led the Nuclear Installations Inspectorate (NII)/HSE, together with the nuclear industry, to set out criteria which attempted to frame risks in a wider 'socio-political' context in such publications as 'The Tolerability of Risk of Nuclear Power'[5] and subsequently, in a broader context, 'Reducing Risk, Protecting People'[6].

The topic of risk communication has recently received much attention from government departments, regulatory bodies and from the professional engineering and safety community. This section introduces several of the major studies and reports of relevance to this paper and summarises some of the key conclusions and recommendations. For convenience, the discussion is broken into two parts - **developments relating to the engineering profession**, and consideration of handling risk-related issues in a wider context **within government**. The latter is important because it can both determine the response to technological developments and will impact on their development and use through regulation. Both are important issues for the engineering profession.

In reviewing and discussing developments, material has been selected with the purpose of contributing to the objectives set out in Section 1 above.

Developments in the Engineering Profession

Royal Academy of Engineering Report on 'The Societal Aspects of Risk'

The Royal Academy of Engineering has facilitated a continuing debate among professional engineers on risk-related issues informed by input from social science research. Publications from this 'risk project' included the proceedings of a debate entitled 'Trust me, I'm an engineer'[7] and a particularly relevant report on 'The Societal Aspects of Risk'[8].

The latter report made the point that one of the reasons that the subject of risk is so complicated and important is that it brings together technical issues with social ones and that both of these must be addressed. It summarised the role of experts, drawing out many of the issues identified in Section 3, above, as being of importance in achieving public trust in communications on risk. Following a discussion of key issues, illustrated by examples of success and failure, it concluded that: "....The conventional separation between the technical (the province of engineers) and the social (the province of managers, politicians and the public) cannot survive scrutiny. Engineering decisions are inevitably shot through with social considerations, just as many apparently political decisions depend on technical judgements. Indeed it is often hard to tell just where the 'technical' ends and the 'social' begins". Given this, it concluded that "Engineers need to be as adept at functioning in a wider political environment as they are in a technical one". It recommended that the following guidelines should be considered in all engineering activities:

- at an early stage, identify the interest groups that might have a stake in the project;
- define the boundaries of the system under consideration and ensure that decisions about the appropriate boundaries are understood and accepted by interest groups;
- aim to quantify the risks with as much precision as is relevant and achievable;
- do not attribute a greater degree of precision to risk assessments than deserved;

- recognise the social, political and economic implications in any risk assessment and acknowledge them publicly;
- stimulate public debate on the perceived risks and benefits; and
- establish a consultation and feedback process about risks with stakeholders, including the public and local community.

Engineering Council 'Guidance on Risk for the Engineering Profession'

This important document published in March 2011[9] sets out the key principles underpinning the role of professional engineers and technicians in dealing with risk, and their responsibilities to society. It highlights eight important outcomes arising from the effective management of risk and in a short pamphlet (and associated 'wallet card'), lists six principles (each with associated practical advice on how these might be achieved) to guide and motivate professional engineers and technicians in identifying, managing and communicating about risk. The Guidance points out that the control of risk will depend both upon the support of those inside the organisation and the agreement of those outside, and that the engineer will thus need to pay attention to human and cultural perspectives as well as purely technical aspects.

The six principles are:
i. apply professional and responsible judgement and take a leadership role;
ii. adopt a systematic and holistic approach to risk identification, assessment and management;
iii. comply with legislation and codes, but be prepared to seek further improvements;
iv. ensure good communication with others involved;
v. ensure that lasting systems for oversight and scrutiny are in place; and
vi. contribute to public awareness of risk.

The fourth and sixth principles are particularly relevant to the current discussion. It is emphasised that within an organisation, risk management should be communicated as a core value and that there is a requirement for strong, honest and effective two-way communication; where appropriate, the establishment of a consultation and feedback process about risks with all stakeholders; a clear expression of the balance of risk and benefit; and, the encouragement of 'open reporting' within a culture of learning and questioning. In raising awareness and understanding about the real levels of risk and benefit and in helping to prevent misperceptions, it is suggested that engineers should be prepared to engage in public debate on perceived risks and benefits, ensure that risk and its management (along with the interdependency of risk factors) is brought out in discussion with the public, and that concepts of 'risk and reward' are communicated. They should recognise the social, political and economic implications and acknowledge them publicly, explain quantitative aspects of risk clearly and with the use of supporting evidence, be honest about uncertainties, and challenge misrepresentations.

Other Recent Developments

The Institution of Occupational Safety and Health (IOSH) has championed 'creating a risk intelligent society'. The proposed approach is explained in IOSH evidence to the Löfstedt Review[10]. The IOSH initiative aims, among other things, to work towards health and safety issues being part of national, vocational and professional education and training. This will help people to develop risk management skills which will be valuable in all aspects of life, inform decision-making and improve the quality of people's lives. It will also help business, because having a 'risk intelligent' workforce will help protect and grow their skill base, encourage sensible and safe behaviours, prevent accidents and ill-health, and cut down absences and losses. Furthermore, IOSH point out that it will ultimately benefit society, as better risk management will help reduce the massive costs, both human and financial, from health and safety failures.

In response to a consultation on science in a review of the National Curriculum being carried out by the Department for Education, the Royal Society for the Prevention of Accidents (RoSPA) has made suggestions as to how understanding in schools about health and safety and risk issues might be strengthened[11]. RoSPA pointed out that in the context of risk being poorly understood and applied by the lay public (including teachers), and in the need to prepare pupils for adult life, '....The science curriculum is an ideal context in which to teach the concept of risk, the language of risk and the process of risk assessment'.

Several professional bodies have carried out work more recently to try to make risk management and communication a higher priority through raising awareness and providing training materials. The IIG, with HSE/HSL support, developed during 2006-2008 an outline of core material ('a common vocabulary') for undergraduate engineers[12,13] and produced a sample CD showing how health and safety and related risk issues might be taught on a common basis to all engineers in an interesting and engaging way using e-learning techniques. The feedback from this pilot, following wide consultation, was very positive and in 2010, IOSH commissioned a report[14] to examine how this material could be used more broadly and what steps needed to be taken to move it forward. Recently, the HSE have provided initial funding for the project to be taken to its next phase, led by the Health and Safety Laboratory (HSL). Representatives from the IIG/professional bodies, industry and academe are offering input and advice on how this can be best achieved. In addition to teaching basic concepts to undergraduate engineers, underpinned by the Engineering Council Guidance discussed above, the teaching material could potentially provide input to the creation of a better understanding of health and safety risk issues more widely - such as in schools, further education and industry.

More recently, the Hazards Forum in collaboration with the Engineering Council, the Royal Academy of Engineering, and industry sponsors, has initiated a programme of discussion meetings on risk communication for engineers. Accounts of these meetings will be published in Hazards Forum Newsletters[15].

Developments in Government

Since the late 1990s, there has been a growing appreciation that handling risk effectively - both in terms of opportunity and threat - is increasingly central to government in its role as a regulator, steward and manager of risks at the strategic, programme and project/operational levels. In particular, that the accelerating pace of change in science and technology and greater societal connectedness are creating new responsibilities and demands on government. This section provides a summary 'time-line' of the key developments and initiatives. It shows that a very large number of initiatives have taken place in recent years within government to provide guidance on risk- related issues and emphasises the importance and topicality of the subject as a concern of government. Recently, health and safety regulation has received particularly intense and repeated scrutiny, with a large number of actions being taken by the HSE to address concerns - many of which appear to stem less from the nature of regulation than public (and media) perceptions of risks and the application of regulations in a risk averse context. Some of the items in the 'time-line' relate more generally to the management of risk and its regulation and go beyond risk communication in a safety context. However, they draw out points which have relevance to this discussion. Others are specific to health and safety and relate to attempts to address potential concerns and, where appropriate, to simplify regulation.
The key developments are:

- **1996** - Establishment of the UK Interdepartmental Liaison Group on Risk Assessment (ILGRA) as an informal committee of senior policy makers on risk issues to help ensure coherence and consistency in governmental risk assessments and to advance good practice. It established a sub-group on risk communication. ILGRA ended its work in 2002.
- **1997** - Formation of the Better Regulation Task Force. In 1998, it published 'Principles of Good Regulation'. This contained five tests of whether regulations are fit for purpose which are now widely recognised and used: proportionality, accountability, consistency, transparency and targeting.
- **2002** - The Cabinet Office published its Report entitled 'Risk: Improving Government's Capability to Handle Risk and Uncertainty'. This recommended a comprehensive programme of change to improve risk management across government[16].
- **2005** - The Better Regulation Executive (BRE) was set up within the Department for Business, Innovation and Skills to co-ordinate the government's approach to regulatory reform.
- **2006** - Establishment of the Better Regulation Commission (BRC) - a non-departmental public body under the oversight of the Department for Business, Enterprise and Regulatory Reform. The BRC was set up to provide independent oversight of the BRE and provide a strategic focus on risk-based regulation.
- **2008** - The BRC was replaced by the Risk and Regulation Advisory Council (RRAC), an independent advisory panel with a mandate to focus on risk-based management of regulation.
- **2009** - A summary was published of the RRAC's work entitled 'Response with Responsibility – Policy-making for Public Risk in the 21st Century'[17].
- **2009** - The Regulatory Policy Committee was established to provide independent scrutiny of proposed regulatory measures put forward by government and to challenge where proposals are not supported by robust evidence and analysis.
- **June 2010** - Lord Young's Review of health and safety legislation and the compensation culture was initiated, with publication in October 2010 of the Report: 'Common Sense, Common Safety'[18].
- **April 2011** - The 'Red Tape Challenge' was established. This cross-Whitehall programme seeks to put a 'spotlight' on different areas of regulation by inviting comments on a website. The intention is thus to provide a clearer picture of which regulations should stay, which should go and which should change. The presumption is that all burdensome regulations will go unless government departments can justify why they are needed. Health and Safety legislation had its 'spotlight' period in July 2011 and underwent a 'Star Chamber' process in 2012. Comments were taken into account by the Löfstedt Review.
- **May 2011** - The Löfstedt Review was established[19]. This was set up to look into the scope for reducing the burden of health and safety legislation on business while maintaining the progress that had been made on health and safety outcomes. Professor Löfstedt's final Report - 'Reclaiming Health and Safety for all' and the government response was published in November 2011.
- **January 2012** - Independent Regulatory Challenge Panels were initiated to deal with disputes over specific advice given by HSE or local authority regulators to duty holders where there is no existing appeals mechanism.
- **April 2012** - The HSE 'Myth Busters Challenge Panel'[20] began work to look into complaints regarding the advice given by non-regulators such as public bodies, insurance companies, health and safety consultants and employers, and to provide an assessment as to whether a sensible and proportionate decision has been made.
- **September 2012** - An informal working group on risk-based policy making was set up within the European Parliament to influence legislation.

Three of these developments are of particular relevance to the subject of this report:

Cabinet Office Report 'Risk: Improving Government's Capability to Handle Risk and Uncertainty'

This Report[16] emphasised the importance of ensuring that governmental decisions include consideration of risks; that tools and methods of risk management are established and applied; that responsibility for handling risk is kept with those who can best manage them; and that those involved in decision making have the skills to give due weight to risk issues and have recourse to professional expertise. In discussing the handling and communication of risks to the public, the issue of trust was again emphasised with six points being stressed:

i. clarity about objectives and values;
ii. openness and transparency around decisions;
iii. decisions to be clearly grounded in evidence;
iv. public values and concerns to be clearly taken into account in making decisions;

v. provision of sufficient information for individuals to make balanced judgements; and
vi. mistakes to be quickly acknowledged and acted upon.

These points were embedded in five principles for managing risks to the public:
1. openness and transparency
2. engagement
3. proportionality and precaution
4. evidence
5. responsibility

The Report concluded with a set of recommendations on how government might improve its handling of risk more generally.

The Risk and Regulation Advisory Council

The RRAC produced a number of reports, guides and tools to help policy-makers and the public tackle public risk before its 'Offensive against the poor handing of public risk' ended in 2009. Three of these are of particular relevance:

'A Practical Guide to Public Risk Communication'[21] again recognised the importance of developing trust - as exemplified by the Bovine Spongiform Encephalopathy (BSE) and Mumps Measles Rubella (MMR) vaccine controversies which occurred around the time of its publication. The document provides a short, practical guide to help government get its risk messages across effectively, based on five elements:
- assembling the evidence - demonstrating a credible basis for the position;
- acknowledgement of public perspectives - considering how those affected understand the risk;
- analysis of options - considering the broad range of options and their trade-offs;
- authority in charge - defining the nature of involvement; and
- interacting with the audience - identifying the audiences and the appropriate methods for communicating with them.

For each of these, the document provides a series of 'prompts' that might enable policy makers to consider whether they had considered each of these issues in sufficient depth.

It was suggested that the guide should be used in conjunction with a further RRAC document - 'A Worrier's Guide to Risk'[22]. This sets out questions that recipients of risk communication messages can ask to help them understand and assess how the messages relate to their own circumstances.

At the end of the RRAC 'offensive', 'Response with Responsibility - Policy-making for Public Risk in the 21st Century'[17] was published in May 2009. This summarised the results of the RRAC's work and made recommendations. The report concluded that there were five trends that contribute to breakdowns in the appropriateness and effectiveness of policy making and which require strong leadership from government to counter and achieve robust and appropriate policies.

These were:
- risk 'actors' who shape perceptions and responses to public risk - here, a small subset were seen as active 'risk-mongers' who wilfully distort perceptions and can endanger the policy making process;
- streams of data, information and opinion which can distort perceptions of risk and scare people away from managing risks themselves;
- intolerance of failure which leads to more red tape and restrictions on people's behaviour;
- pressure on government to act hastily; and
- the risk of removing responsibility from individuals - with the potential consequence of reducing community resilience.

The Council developed an approach which it believed would help government and the public to deal with these issues. This involves taking a step back from the immediate concern, recognising the wide range of groups that can combine to influence responses to a risk, and incorporating them actively into the policy-making process. In particular, the Council placed an emphasis on three key disciplines:
- understanding the risk in context - how perceptions of the risk have been shaped, including using a process developed for mapping the landscape around the risk;
- engaging with a broad community - using the map of the risk landscape to develop a common understanding of the issues and to explore together how the issues can be tackled; and
- effective communication - quickly restoring focus to the underlying nature of any given risk and provoking public debate about interventions and trade-offs.

The Council recommended that government should establish an independent Public Risk Commission, which among other things, should communicate with and challenge risk actors and risk-mongers when there is evidence of unhelpful behaviour, and champion as an independent voice, the need for individuals, businesses and organisations to take back responsibility for the management of risks that they can understand and control. This, it was concluded, would provide a foundation for different policy solutions and more societal resilience.

Whilst welcoming the work of the RRAC, the recommendation to create a Public Risk Commission was not taken up; the view

being taken that the proposed functions could be carried out by existing institutions, including the newly established Regulatory Policy Committee.

The Löfstedt Review

In addition to reviewing current health and safety regulations and guidance, the Löfstedt Review[19] made important observations and recommendations regarding improving the understanding of risk. The HSE's 'Principles of Sensible Risk Management'[23], together with the 'Myth of the Month' series were welcomed as attempts to dispel health and safety myths in response to media stories. Löfstedt also mentioned the importance of 'Reducing Risks, Protecting People'[6] in providing an overview of risk and risk management and welcomed the work of IOSH (see above) in attempting to create a 'risk intelligent society' and its website for schools and colleges. It also recognised the contribution of the HSE's risk education programme, RoSPA's safety information programme, and the British Safety Council's qualifications for school children. It again emphasised that consideration of risk requires an inclusion of the 'social context' and a recognition that the public, stakeholders and regulators perceive risks differently and that risk communication techniques need to recognise that traditional practices are no longer effective in 'post trust' environments. It therefore concluded that there needs to be a wider debate within society about risk.

In particular, the Report concluded that there needs to be a shared understanding of risk and how it should be regulated, and that a mechanism is needed to bring together Parliament, policy makers, academics and the public to achieve this. It concluded that this should be broader than just occupational health and safety and encompass other areas such as public health and environmental issues. Professor Löfstedt therefore made two specific recommendations in this context:

- 'The House of Lords be invited to set up a Select Committee on Risk or establish a sub-committee of the Science and Technology Committee to examine this issue and consider how to engage society in a discussion about risk', and
- 'That the Government asks the Chief Scientific Advisor to convene an expert group aimed at addressing this challenge. The outcomes need to be disseminated widely across Parliament, policy makers, academics and the public.'

It is clear from the wide range of initiatives launched by Government in this area, that the subject is regarded as important in policy formation and in ensuring that the UK is competitive and takes advantage of technological developments. It is also clear from the above summary, that many ideas have been generated which may have a significant impact on the engineering profession. The next section of the paper discusses some of the actions that might be taken by the profession to move these forward and to engage in the continuing debate.

5. Summary of the Key Issues Emerging from the Discussions

There are several issues emerging from this paper which professional engineers and their professional bodies may wish to consider further and act upon:

1. Providing scientific and technical data is necessary but not sufficient if risks are to be successfully managed. It is important that benefits and dis-benefits are objectively and transparently assessed in order to ensure that resources are used as effectively as possible in minimising risks, but it is also vital that 'socio-political' concerns are addressed and transparently weighed in decision making. A suitable balance has to be struck between understanding and using engineering, scientific and economic analysis and taking proper account of societal perceptions and concerns.
2. There is a need to examine what the barriers are for engineers and engineering organisations to communicate more effectively about risks and how these can be overcome. For example, do they recognise and accept the importance of managing and communicating about risk; are they aware of the guidance and tools which exist and the conclusions of research from the social sciences; and are they sufficiently encouraged and supported to communicate about risk and challenge 'bad science'?
3. Engineers and scientists may need help to become more aware that if they do not pay attention to - and develop expertise in - building trust and meeting the needs of stakeholders, they are unlikely to be successful in gaining acceptance for developments and, indeed, trust in the profession may be degraded. It is therefore vital that the current thinking and recommended good practices, many of which have been summarised in the discussion above, become better embedded in the training and continued professional development of engineers at all levels. This does not imply that all engineers should engage in risk communication as some may not find it easy to engage with the subjective judgement involved. However, it is important that the need is understood by both individual engineers and the organisations in which they practice, and that those with the necessary skills are encouraged to participate in wider stakeholder communication where this is judged necessary and appropriate.
4. The public are faced with increasing challenges in judging the relative importance of the risks they face. Their understanding is not always helped by poor communication and potential bias from those creating the risk, from pressure groups with a particular 'angle' on an issue, and by some parts of the media, which may on occasions exaggerate risks or scare people in order to provide 'a story'. It is thus important that a more 'risk intelligent' society is created and that sources of information are developed which are seen by those with interest and/or concerns about issues to be sources of objective and trusted information. This also reflects the conclusions of the Löfstedt Report that there needs to be a wider debate in society about risk.

As will be seen from the discussion above, there have been a very wide range of government and regulatory initiatives, reflecting the importance of better risk management and communication and ensuring that it is translated into fit-for-purpose, better understood, and proportionate regulation. Engineers are at the fore-front of addressing many of these issues and in shaping perceptions in business and among the public. It is thus important that they play a pivotal role in shaping the on-going debate.

6. Recommendations

In response to these issues, three broad recommendations are made:

- It is apparent from the review of initiatives such as the Engineering Council Guidance on Risk and the work of bodies such as the Royal Academy of Engineering and the Risk and Regulation Advisory Council, that there already exists much material which should enable engineers and safety professionals better to understand and take appropriate action to improve risk communication in the context of health and safety (and more widely). They will frequently be best able to make judgements based on technical and economic considerations about the cost effectiveness of reducing health and safety risks and will understand the uncertainties and potential systems-related 'knock-on' effects of decisions.

  In listening to and taking account of broader stakeholder concerns and perceptions, it is important that decisions continue to take account of these technical conclusions and that an appropriate balance is struck.

  It is suggested that guidance be developed which takes account of the issues summarised in Section 3, above, and many of the good practices which have been identified in Section 4, and in other published work. This would draw together the principles and tools which are available and put them in the context of real examples of the types of decisions which engineers might be expected to influence - particularly in a health and safety context, but also more widely - thus providing a 'compendium' of good practice. This could include examples of how technical/economic judgements can be developed, the need to take a 'systems' approach considering the full life cycle of an engineering undertaking taking account of issues such as the design process and ergonomics, but most importantly in the context of this paper, how broader societal concerns might be transparently presented and communicated to facilitate an improved decision making process, and when it is appropriate for this to take place.

  Recommendation 1: A group representing professional bodies is established to provide good practice guidelines to engineers and safety professionals to improve awareness, facilitate improved analysis of the issues and improve communication. This could draw on existing material whilst promoting the development of any further tools which may be required. It could include advice on the circumstances in which wider communication about risks might be appropriate.

- The need to provide new and engaging teaching materials to provide a basic understanding of the principles of risk management (and in particular health and safety risk) to undergraduate engineers has been identified as important by the professional bodies and the HSE, and progress is being made in developing these. Issues relating to understanding risk and putting it into context, together with risk communication, have been identified as a component of this. The Engineering Council Guidance[9] is an important new development and it is suggested that this should provide the basis for underpinning and encouraging take-up of the new material as it is developed.

  In a further report, sponsored by IOSH, which reviewed the earlier work in this area, it was concluded that some of the basic messages about health and safety risks contained in the proposed material and presented in a thought provoking and engaging way, could also potentially be used in further education, in schools and for improved training in industry. The development of teaching materials for schools has been the subject of initiatives by several of the bodies involved in trying to improve understanding of health and safety risks. If developing a more risk intelligent society is to be achieved, it is suggested that the various initiatives and existing materials (including the current HSE/HSL and IIG initiative) should be drawn together as far as is possible, to provide a coherent approach with the aim of developing a broad portfolio of engaging material, which can be used not only in the context of the teaching of undergraduate engineers, but more widely.

  Recommendation 2: Initiatives to develop innovative and engaging teaching material (such as the HSE/IIG work to teach risk concepts to undergraduate engineers in a health and safety context) should continue to be endorsed and supported by the professional bodies and used, where appropriate, in ensuring that such issues receive due attention in accreditation. As a broader objective, support should be given to drawing together current developments and sharing of good practice to provide a portfolio of materials which can be presented to a wider audience in education, industry and potentially more broadly as an input to developing a more risk intelligent society.

- It is important that 'third parties', who are likely to be trusted by a broad range of stakeholders, act to provide clear advice on risks based on the scientific/engineering evidence, looking at issues in a 'systems' context and providing balanced judgements which take account of the important issues drawn out in this paper. Engineering and safety professionals have a critical role in this and professional bodies might consider how they could play a stronger role - building, where possible, on existing work including that of the Royal Academy of Engineering, Engineering Council and other engineering- and science- related bodies concerned with communication and public understanding of risk.

  This relates strongly to the need to challenge lack of objectivity/bias in claims which under- or over-estimate risk. It should be recognised, however, that effective and constructive 'challenge' sometimes has to take place in an environment which deters individuals from raising issues, and this is professionally difficult for them. It is suggested that consideration be given to how further support can be given where required.

  The recommendations of the RRAC and the Löfstedt Report about wider consideration of risk issues and how society might be encouraged better to engage with the issues should be addressed and it is important that the engineering institutions and

other bodies ensure that the engineering profession is fully engaged in this - demonstrating and emphasising the important role that engineers are able to play and working more closely with government to facilitate this.

Recommendation 3: The professional bodies, both individually and collectively, should further consider how they can play a role in the wider debate on risk issues which has been proposed in the Löfstedt Report and elsewhere. In particular, they may wish to consider whether the engineering and safety community can be more effective in challenging claims which are at odds with the evidence and, where appropriate, in supporting those in the engineering community who attempt to challenge such claims.

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Annexe 1

Members of the Working Group

Richard Taylor (Chairman)	Chairman of the Inter-Institutional Group on Health and Safety
Beverley Bishop	Principal Research Officer, Economic and Social Analysis Unit, Health and Safety Executive
Andrew Petrie	Chairman of the Institution of Engineering and Technology Policy Panel on Health and Safety
Nicola Stacey	Member, Safety and Reliability Group, Institution of Mechanical Engineers and Health and Safety Laboratory
Paul Thomas	Chairman of the Hazards Forum
Luise Vassie	Director of Policy, Institution of Occupational Safety and Health
Graham Barber	Secretariat, Institution of Engineering and Technology

Annexe 2

Bibliography

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Annexe 3

About the IIG and the context of this paper

The Inter-Institutional Group on Health and Safety Risk (IIG) currently has representation from eleven engineering and other professional bodies with a strong commitment to improving risk management in the context of health and safety. The HSE and Engineering Council are also represented at the IIG meetings. Its objective is to work together by consensus to promote action and enhance awareness and knowledge of health and safety risk issues in the interest of the engineering profession.

This paper arose from discussions at a joint workshop between the IIG and the HSE held in November 2011. It has been produced by an expert group nominated by the IIG and with input from the HSE. The paper, along with two others produced in the same context, have been produced to stimulate debate and potentially to promote action in areas of interest and concern. The views expressed, and the conclusions reached, do not necessarily represent those of all the member professional bodies of the IIG, or those of the HSE.

The Group reports regularly on its activities to the Professional Engineering Forum of the Engineering Institutions which has endorsed its objectives and aims.

The **Joint Institution Group on Safety Risk - JIGSR** (formally known as the Inter-Institutional Group on Health and Safety) is made up of representatives (members and staff) from the following organisations:

- Hazards Forum
- Institute of Ergonomics and Human Factors
- Institute of Marine Engineering Science and Technology
- Institution of Chemical Engineers
- Institution of Civil Engineers
- Institution of Engineering and Technology
- Institution of Mechanical Engineers
- Institution of Occupational Safety and Health
- Institution of Structural Engineers
- Royal Institute of British Architects
- Royal Institution of Naval Architects
- Safety and Reliability Society
- Health and Safety Executive
- Engineering Council

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