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In Terms of Risk

Report of a seminar to help define important terms used in communicating about risk to the public

Radiation, Risk and Society Advisory Group

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Working in partnership with the Health Protection Agency

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Radiation, Risk and Society Advisory Group

CHAIRMAN: PROFESSOR SIR KENNETH CALMAN

This report from the Radiation, Risk and Society Advisory Group reflects the understanding of the science and the views of the R,RSAG members and seminar attendees.

Radiation, Risk and Society Advisory Group as at 2002

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Professor Sir Kenneth Calman
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Dr Michael Murphy
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Dr Hilary Walker
Department of Health
was invited to attend

SECRETARIAT

Dr Roy Hamlet
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Dr Jill Meara
National Radiological Protection Board, Chilton

INTRODUCTION

1 The Radiation, Risk and Society Advisory Group (R,RSAG) was set up in 2001 as an advisory group to the Board of NRPB. Sir Kenneth Calman, Vice-chancellor of the University of Durham, chairs it. Members are drawn from a wide range of disciplines that have interest and expertise in communicating about risk to the public, recognise the importance of radiation risks in this context and are keen to help NRPB. The aim of R,RSAG is to assess what the public wants to know about radiation and risk and how society will be affected by such issues. As well as preparing this paper, R,RSAG work has included:

(a) evaluating a meeting held by NRPB to hear public views about the health effects of power transmission and making recommendations to NRPB,
(b) doing a survey of 13/14-year-old children to find out how they define risk and radiation and what risks they feel they face in everyday life,
(c) auditing NRPB press releases and other documents to ensure that public messages are delivered effectively.

2 R,RSAG aims to ensure that NRPB has the tools and evidence to inform, advise and explain risks to the public in the most effective way.

3 In July 2002, R,RSAG hosted a seminar amongst professionals to help develop a common understanding of the terms used to describe risk and present it to the public. Attendees included R,RSAG members, National Radiological Protection Board (NRPB) members and staff, representatives from government departments and from organisations that will be joining with NRPB in the Health Protection Agency (HPA). Also present were guests from ILGRA (the Interdepartmental Liaison Group on Risk Assessment), the Hazards Forum, RWMAC (the Radioactive Waste Management Advisory Committee), ESRC (the Economic and Social Research Council), and COPUS (the Committee for the Public Understanding of Science).

4 Draft definitions of the terms were circulated to participants in advance. People worked in small groups to refine the definitions. This paper was developed from the initial definitions as amended by the proceedings on the day.

PRECAUTION

5 *Precaution* is 'care beforehand: a preventive measure: something done beforehand to ward off evil or secure good'. Taking precautions is commonplace in personal life and is usually determined by intuition, experience, behaviour of role models, personal values, etc. The decision on what to do will be based on balancing the effectiveness of the practical precautionary measures against the sacrifices involved in adopting them. The decision should seek to ensure that the effort is proportional to the threat and that the end effect sought is proportional to the means to secure it. Taking precautions is the attitude of mind behind the traditional risk-based approach. It is not new. In the scientific domain, the anticipation of evil or good is based on evidence, precedence or reasoned conjecture.

Carrying an umbrella – precaution in action

Many people carry an umbrella as a precaution against getting wet. They balance the inconvenience, extra weight to be carried and the risk of losing the umbrella against the benefits of keeping dry if it rains. The weather forecast could help improve the accuracy of predicting rain, but not everyone uses it. Some people do not mind getting wet or have other ways to protect themselves.

6 A *precautionary approach* and the *precautionary principle* as regulatory actions are often used interchangeably or in non-specific ways that overlap with the lay definition of being cautious or taking precautions. It would be better to reserve these terms for their more specific meanings in the disciplines of science and politics, respectively.

Precautionary approach

7 The precautionary approach is a scientific term used to describe the cautious process that scientists use when converting experimental data into advice on acceptable levels of public or occupational exposure to any agent. If the necessary information is uncertain or inferred (for example, from animals to humans), additional safety factors are included when deciding acceptable levels for public or occupational exposure. It is often ignored in media discussions about safety levels and risk factors. The very act of carrying out a risk assessment is a practical demonstration of a precautionary approach. The objective of a risk assessment is to characterise and if possible quantify the risk, ie the probability of occurrence of an adverse effect. The process of carrying out a risk assessment imposes discipline and structure on the exercise of precaution. It facilitates scrutiny and probing of the judgements that are involved. The dialogue that it fosters about precaution may be more valuable than the outcome in terms of an estimate of the likelihood of occurrence of an adverse effect.

Safe levels of chemicals in food and the air – the precautionary approach in action

Toxicity information may only be available from animal experiments. In this case, the scientific convention is to set the acceptable level at one-hundredth of the dose found to have no deleterious effects in the animals. Two cautious ten-fold factors are used, one to take account of possible species differences and one to account for the natural variation within humans.

Where data cannot provide a reliable estimate, it is customary to use the most pessimistic estimate of the risk when setting standards. Risks are inferred from direct experimental data, logical biological mechanisms and similarities to analogous situations.

Precautionary principle

8 The precautionary principle is, by contrast, a political term. It defines the way to decide on preventive action if the scientific evidence is not clear enough for a reasonably accurate assessment of the risk. If the level of harm and likelihood of its

occurrence are well enough known, then a precautionary principle is not needed because the harm can be calculated directly and the government or public can make evidence-based decisions. If the level and likelihood of the risk are not certain then the role of the scientific community is to:

(a) advise on the hazards,
(b) summarise the strength of the available evidence in a critical way,
(c) take part in the political discussions about whether and how to apply the precautionary principle,
(d) do research to enable a more accurate assessment of the risks.

9 Politicians should make decisions based on the science but adding explicitly public and societal factors. The science should not be 'stretched' beyond what is known or knowable, in order to justify a political decision.

10 There is no single agreed definition of the precautionary principle but four influential reports do provide insights about where the precautionary principle should be used.

> 'In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.'
>
> (UNEP, 1992)

> 'The true application of the precautionary principle is in cases where there is reason to think there may be an effect, but no evidence has yet been obtained for its existence or the evidence is inconclusive.' (RCEP, 1998, paragraph 4.47)

The most recent UK interpretation of the precautionary principle has been published by ILGRA in 2002. It states that the precautionary principle should be invoked when:

> '(i) there is good reason, based on empirical evidence or plausible causal hypothesis, to believe that harmful effects might occur, even if the likelihood of harm is remote, and
>
> '(ii) a scientific evaluation of the consequences and likelihoods reveals such uncertainty that it is impossible to assess the risk with sufficient confidence to inform decision making.' (ILGRA, 2002)

> 'Use should be made of the precautionary principle where the possibility of harmful effects on health or the environment has been identified and preliminary scientific evaluation proves inconclusive for assessing the level of risk;
>
> 'Measures must observe the principle of proportionality, taking account of short-term and long-term risks; must not be applied in a way resulting in arbitrary or unwarranted discrimination; and should be consistent with measures already adopted in similar circumstances or following similar approaches;
>
> 'Measures adopted presuppose examination of the benefits and costs and of the public acceptability of the different options possible.' (EC, 2000).

Nut allergy – subverting the precautionary principle to counter a threat of litigation

Precautionary action does not always have the desired effect. Consider the labelling of foods that contain nuts. People who are allergic to nuts need to know that a product may contain nuts. However, an increasing proportion of manufactured food now contains the warning 'may contain nuts'. Some of the products are unlikely to have been produced in factories where nuts are routinely used; however, manufacturers may use the warning to deflect litigation. The logical conclusion is that all manufactured foods will carry the warning and a person with a nut allergy will not know which foods really contain nuts and which do not.

When to use the precautionary principle

11 The precautionary principle does not dictate the decision but says the lack of certainty should not be given as a reason to avoid making a decision. The precautionary principle allows a decision, but does not force one. It avoids stultification of progress (either in protection or in exploitation) through attempts to use lack of evidence as the clinching argument.

12 The precautionary principle is often said to be 'invoked' when uncertainty prevails about the potential risk even when all the available evidence is taken into account. This is sometimes called a 'theoretical risk' by public bodies because the risk exists in theory but has yet to be demonstrated in practice. The precautionary principle could be seen as a last card, to be played by objectors against an agent that poses a possible threat. This poker game approach should be substituted by an open approach and regular dialogue with all stakeholders. The term 'invoke' does not describe well the process of a political decision, based on social, economic and other factors, when science cannot yet offer enough information to quantify a possible risk.

13 The cautious approach used by scientists when they carry out quality assessments of the scientific literature, interpret their own work or suggest safety standards is a necessary and often sufficient mechanism for controlling a hazard without needing recourse to the precautionary principle. The discipline and rigour of the approach should be given more publicity. The need for the precautionary principle is a political judgement that should be carried out by policy makers in consultation with all other stakeholders. If action is judged to be needed, it has to be based on the characteristics of the hazard. This includes definition of what would constitute significant harm to the public in terms of the number of people affected, how badly they would be affected and whether the possible effect was particularly feared by the public.

RISK

14 Choosing to accept 'no risk' is simply not possible. A 'no risk' option brings with it a denial of the benefits that come from toleration of some risk. Scientists have begun to foster a better understanding by declining to say that anything is safe, but offering instead to explain the technical measures in place to estimate the risk, to be open about the uncertainties and to reduce the risk.

Explosive coal dust – a missed opportunity to use the precautionary principle?

Michael Faraday investigated an explosion at Haswell colliery, County Durham, in September 1844. The explosion killed 95 miners. The accepted hypothesis at the time was that great explosions resulted from the sudden and unpredictable emission of firedamp (consisting mostly of methane), easily ignited by the candles used for illumination. There was no way of knowing afterwards whether there had been such an emission; it was just assumed as the obvious explanation, and accepted as an unfortunate act of God inseparable from mining coal.

Faraday questioned the hypothesis and advanced the alternative proposition that the burning of coal dust was a factor. He subsequently developed his argument, suggesting that a quantity of firedamp, much smaller than supposed, could start the explosion. However, coal dust would then take over as the fuel and the explosion would propagate through the mine since coal dust was deposited everywhere. This was an uncomfortable assertion. Whereas the coal mine owners argued that measures against an act of God were impractical, coal dust deposits could be controlled, although it might be expensive. Faraday's alternative hypothesis was not acted upon because of the failure of every attempt in the laboratory to propagate an explosion through coal dust alone. The evidence was thus that a coal dust explosion could not sustain itself in the absence of firedamp. Many thousands of miners died because of the difficulty of countering this evidence, on which the owners could rest their case.

A mining engineer, William Galloway, produced strong, indirect evidence, although stopping short of certainty. He found that great explosions only occurred in dry and dusty mines, never in a wet mine. Cold weather could change a wet mine into a dry one – and great explosions were more prevalent in winter. But still the 'certainty' provided by the laboratory evidence held sway for many years. Galloway eventually clinched the argument by conducting experiments at a much larger scale than hitherto and immediately found that a coal dust explosion could propagate at the larger scale in the absence of firedamp. This turned the tide of opinion and Parliament acted to require the simple precaution of watering the coal dust, half a century after Faraday had first advanced his hypothesis. Would the application of the precautionary principle have changed matters? The answer must be 'yes', whatever the precise wording or interpretation.

15 The Health and Safety Executive distinguishes risk from hazard, noting that these terms are often used interchangeably in everyday life (HSE, 2001): 'Hazard is the potential for harm arising from an intrinsic property or disposition of something to cause detriment. Risk is the chance that someone or something that is valued is adversely affected'.

16 Pencheon et al (2001) in the *Oxford Handbook of Public Health Practice* (quoting the Royal Society Study Group, *Risk, Analysis Perception and Management,* 1992) define *risk* as 'the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge. It can never be reduced to zero'.

17 In the public arena, risk has a number of meanings and sometimes substitutes for words or phrases with definitions that are more specific – for example, source of hazard, consequence or type of hazard. Both 'expert' and 'lay' groups modify the meaning of the word over time and according to the specific situation in which the term is used.

SAFE

18 Safe is even more problematic to define than risk, despite its common usage in everyday speech. Chambers Dictionary defines it as 'unharmed, free from danger, secure, sound, certain, reliable, cautious'. Recent official communications in the UK have avoided the use of 'safe' in favour of terms that describe a risk as very low or acceptable compared to other risks in society. A scan of internet sites reached by searching for the definition of safe led to results ranging from a complete absence of risk through to exhortations that individuals or communities should take responsibility to decrease local risks. Any definition of safe is relative to the messenger, audience, situation and over time.

Possible definitions of safe

Safe means no risk at all.

Safe means no evidence of risk.

Safe means no current evidence of risk, but risk cannot be excluded.

Safe means no need to worry about the risk

Safe is when no 'reasonable' person would intervene.

Safe means 'safe enough' in the context of other risks commonly encountered.

Safe means that there is no hazard present.

19 Just like risk, safe has both a public and private dimension and perceptions of safety are influenced by well-described factors (DH, 1998), including:

(a) likelihood of adverse consequences,
(b) 'dread' associated with those consequences,
(c) degree of control exercised by individuals, organisations and society,
(d) degree of trust/distrust invested in others (ie risk managers and regulators) who are able or required to exercise control on people's behalf.

How safe is safe enough?

20 There is no absolute level of safety and this needs to be acknowledged more readily by scientists, professionals and politicians. Safety measures impose costs as well as benefits and a balance must be struck.

Costs and benefits of safety – the example of road traffic safety

The private use of roads constitutes a substantial risk to those who use them. This risk is larger than for other forms of transport. However, the consensus is that the benefits of maintaining and even expanding the road network are worth the risks.

Consensus has allowed governments to introduce legislation to make the roads safer – speed restrictions, drink-driving laws, compulsory seat belts, and restrictions on the use of mobile phones, etc. Here the benefits of greater safety have generally been acknowledged to outweigh the costs involved. This may cease to be the case if further reductions in risk have too great a cost.

EVIDENCE OF ABSENCE VERSUS ABSENCE OF EVIDENCE

21 There is an important distinction between evidence of no effect versus no evidence of effects. While the former might form one part of a scientific definition of what it is to be 'safe', it is important not to confuse the two situations and overemphasise the reassurance provided by the latter. Public messages must acknowledge the scientific uncertainties surrounding any particular safety issues and the evidence that is available to allow risks to be calculated. While expert opinion may have a collective view about the risks attached to a particular source of potential harm, it should reveal the degree of and reasons for the conviction attached to that view.

ROLE OF SCIENTISTS AND EXPERTS

22 The public's degree of conviction and trust in probabilistic estimates of risk depends partly upon the information available. Scientific knowledge and expert opinion clearly help to increase the conviction in the nature (probabilities) of the risk being faced. Where such knowledge is credible – if, for example, scientific research reaches consistent and robust conclusions – there will be greater consensus among the public regarding the risks being faced. Expert opinion does not always reach consensus. Specialists in geopolitics, for example, may differ greatly in their assessment of the risk (likelihood) of a nuclear war and much less public consensus can be expected. Where there are gaps in scientific knowledge it may be reasonable to err on the side of caution. However, caution can work both ways depending on the defensive/offensive stance taken and may be interpreted by some as executing the first strike.

ROLE OF AUTHORITIES

'Risk management – getting the right balance between innovation and change on the one hand, and avoidance of shocks and crises on the other – is now central to the business of good government.' (Foreword by the Prime Minister to *Risk: Improving Government's Capability to Handle Risk and Uncertainty*, Cabinet Office, 2002)

23 The systematic consideration of risk should be an important part of the business of any public or private organisation. All decisions should be the result of an explicit

appraisal of uncertainties, estimation of the risk and calculation of the costs and benefits to society and to individuals.

24 Authorities need to take note of other important factors that determine the acceptability of hazards and risks in society. These are well described elsewhere (Fischhoff et al, 1981; Kasperson et al, 1988; Kasperson and Stallen, 1991; Morgan, 1993; Slovic, 1987; Viscusi, 1998; Wilson, 1979). People distinguish between risks that they choose to take (eg a decision to smoke) and public or collective risk (where a decision to reduce the budget for the armed forces impacts upon the safety of the whole community). Cellular telephony is a good example of both. Individuals expect to be able to make an informed choice about whether to use a mobile phone, but the public are all exposed to the risks attached to mobile phone base stations. In general, the public are more averse to imposed risks than risks they feel they control (Covello et al, 1988; Covello, 1991; Roth et al, 1990).

25 The significance of 'risk' to ordinary people depends not just on the probability of an adverse event but also on the consequences of the event itself. The public are more averse to risks with catastrophic consequences such as major nuclear accidents (DH, 1998).

TRANSPARENCY, OPENNESS AND IMPARTIALITY

26 There are a number of definitions, from recent reports, that point to what the concepts of transparency, openness and impartiality mean and how organisations should act.

> 'An organisation operates in a *transparent* way if there is full publicity for its existence, its terms of reference, the decisions that it takes and the reasons for those decisions. The data justifying decisions should be freely accessible. There is no panacea: whilst *transparency* is necessary, it is no guarantee that materially good decisions will result. The manner in which communication is undertaken can convey its own message: appearing to disclose information only under pressure does not enhance credibility. Once an agency has become mistrusted, any information from that source will tend to be disregarded.
>
> 'An *open* organisation is one where there is adequate opportunity for those outside the institution, especially those with a particular interest in the given decision, to contribute fully to the decision making process. The nature of the contribution … will vary according to circumstances. For scientific input, the use of peer review and open publication of evidence will be major factors. Both policy makers and the public must be able to recognise and take into account the impact of vested interests in the process and the balance struck in the ultimate outcome. All analyses should also be subject to peer review and scrutiny. Greater *openness* and more scrupulous attention to accountability also provide a formal means of exposing the misuse of science by politicians. It may provide a means of clarifying the level of uncertainty in scientific assessments and the assumptions underlying scientific and economic analysis. There is a difficult line to tread between openness and scaremongering. Careful, but not unduly simplistic, explanation is one of the means of avoiding reactions of panic to a half-understood story.' (RCEP, 1998, paragraphs 8.63 and 8.66)

27 The BSE Inquiry (Phillips, 2000) also recommended an open and transparent approach, specifically when dealing with scientific uncertainty. To quote from Volume 1 of the report (paragraph 1301):

> 'Our experience over this lengthy Inquiry has led us to the firm conclusion that a policy of *openness* is the correct approach. When responding to public or media demand for advice, the Government must resist the temptation of attempting to appear to have all the answers in a situation of uncertainty. We believe that food scares and vaccine scares thrive on a belief that the Government is withholding information. If doubts are openly expressed and publicly explored, the public are capable of responding rationally and are more likely to accept reassurance and advice if and when it comes. We note, by way of example, that SEAC and MAFF have made public the fact that an investigation is being carried out into the question of whether BSE has passed into sheep. We do not understand that this has led to a boycott of lamb.'

28 *Impartiality* in the context of scientific advice or policy making means listening to all points of view and giving equal weight to evidence of equal rigour. An organisation can be impartial in its work despite being dependent (or rather not independent) on other bodies for support, funding, etc. Impartial scientific advice reflects the scientific consensus, although not necessarily the views of the scientist giving that advice.

29 It may be difficult to maintain impartiality and be perceived as impartial if:

(a) the balance of media reporting favours one point of view,
(b) the argument is between evidence – however substantial – of no effect and evidence – however slight and disputable – that there is an effect,
(c) an organisation is perceived as dependent (financially or in other ways) on another 'vested interest' (the government, industry or a pressure group).

30 Scientific impartiality implies a willingness to change opinion if the evidence suggests. It also assumes that the scientist discovers and declares the possible biases in the work. 'Partial' science could be defined as work where the reader can work out what the conclusion will be by knowing the author 's identity.

Why should organisations be open, transparent and impartial?

> 'Bodies like the Food Standards Agency, the Human Genetics Commission and the Monetary Policy Committee have shown that more open processes, based on evidence, are more effective at handling risk and winning public confidence than secrecy.' (Foreword by the Prime Minister to *Risk: Improving Government's Capability to Handle Risk and Uncertainty*, Cabinet Office, 2002)

31 The Department of Health describes openness (defined to include both avoiding secrecy and willingness to listen) as the single most important factor in building trust by the public of the decisions of authorities (DH, 1998). Trust benefits any scientific organisation that wishes to inform the public about the risks they face in an efficient and effective way. The public want to be engaged and to have confidence that the organisation is doing the right things. The organisation needs to work on confidence building, not fall back on 'trust us'!

Practical ways for an organisation to be open

32 The consultation document (DH/WO, 2002) on setting up the new Health Protection Agency quotes government policy as set out in *Quangos: Opening the Doors* that 'public bodies should be open. As a minimum they need to hold an annual open meeting and publish minutes and agendas of meetings wherever practicable and reasonable' (Cabinet Office, 1998). It recommends the code of practice adopted by the Food Standards Agency as a good model for an open organisation.

33 Does openness and transparency require every conversation, corridor meeting and e-mail to be open to scrutiny? That is stretching the meaning of openness and transparency much too far. An organisation should be open about the considerations, criteria and values that it brings into play in making decisions.

34 Onora O'Neill, in the 2002 Reith Lectures, entitled *A Question of Trust*, said:

> 'Plants don't flourish when we pull them up too often to check how their roots are growing: political institutional and professional life too may not go well if we constantly uproot them to demonstrate that everything is transparent and trustworthy.
>
> 'If we want to restore trust we need to reduce deception and lies rather than secrecy. Some sorts of secrecy indeed support deception, others do not. Transparency and openness may not be the unconditional goods that they are fashionably supposed to be. By the same token, secrecy and lack of transparency may not be the enemies of trust.'

35 Calman (2002) draws an analogy between consent for clinical procedures and community consent. He defines a number of explicit ways that public views could be incorporated into political decisions. All these mechanisms require the public to trust the outcome. Trust in both clinical and societal contexts involves two elements: recognising that an individual cannot make the decision alone and willingness to depend on the decision of others.

36 In practice, openness should reflect how easily external, and possibly antagonistic organisations and members of the general public can get their views considered and their questions and concerns answered within the work of the organisation. Although scientific organisations may not have the responsibility for making decisions about controlling risks, they need to incorporate the views of a wide range of people into their work. This will help them to ask the right scientific questions, to assemble evidence that addresses all these questions and to explain the reasoning behind their advice in a logical and understandable way. Many organisations find it difficult to portray the balance of scientific opinion in a way that does not devalue alternative views.

37 An open, transparent and impartial organisation will also define how it makes its decisions, what evidence it uses and why. It publicises what sorts of evidence it gives most weight to when making decisions about risk. It explains the need to synthesise and evaluate different types of evidence. It acknowledges that scientific advice may be based on judgement and opinion (which can in themselves be interrogated for their quality) as well as the results of scientific experiments.

Openness helps an organisation to get its message across

38 There is a virtuous cycle of building trust, as well as a vicious cycle that can destroy it. Now organisations aspire to have the open approach of the Food Standards Agency (FSA, 2001).

Approaches used by the Food Standards Agency to build public trust

FSA acts independently and has the power to publish its advice without the need to consult ministers.

FSA ensures that policies are based on the best available scientific evidence, which is made fully available. This includes openly acknowledging areas of uncertainly.

FSA involves all stakeholders including consumers, minority groups and others in policy development and encourages debate on key issues.

FSA ensures that decisions are proportional to the assessed risk, recognising the need for precaution due to uncertainties.

FSA communicates its decisions in an open and honest way in appropriate language.

39 Openness, transparency and impartiality are not sufficient if the advice produced is *impenetrable. Good communication,* whether listening and hearing other opinions and getting the message across clearly and understandably, are also important.

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