

DEBATE SUMMARY

The challenge of communicating the uncertainty in risk estimates to decision makers

Held at The Royal Society on 5th February, 2014

The Foundation is grateful to Lloyd's Register, Risk Solutions Ltd, RPS Energy, The Michael John Trust, and the Willis Research Network for supporting this debate.

The hash tag for this debate is #fstriskcomm .

Chair: **The Earl of Selborne GBE FRS**
Chairman, The Foundation for Science and Technology

Speakers: **Sir Mark Walport FRS FMedSci**
Government Chief Scientific Adviser, Government Office for Science
Tom Bolt
Director, Performance Management, Lloyd's of London
Judith Hackitt CBE FEng
Chair, Health and Safety Executive

Panellist: **Dr Michelle Harrison**
CEO, Government and Public Sector Practice, WPP

SIR MARK WALPORT said that assessing, managing and communicating risk was central to his work as the Government Chief Scientific Adviser. The communication challenges were to distinguish between risk and hazard; recognize uncertainty and devise techniques for dealing with it; understand the different values and viewpoints of decision makers and stakeholders; and communicate the results as clearly as possible in straightforward language.

Uncertainty of risk estimates was inherent in both natural and human-made disasters. The process of preparing the National Risk Register¹ was key to communicating risks to the UK. The NRR helped to guide the question of what the quantum of expenditure should be on prevention, mitigation, management and post-disaster response.

Hazard, the amount of loss from a given scenario, was straightforward to estimate, but risk estimates are a combination of the hazard, the likelihood of an event, and the vulnerability of those exposed to that event.

An example was the control of the use of pesticides. Yes they could be a hazard to beneficial insects but properly applied and used in appropriate field conditions the risk was small compared with the benefit gained from reduction of disease, etc. Regulation should always be based on risk analysis, not hazard estimates, and it should balance the benefits of using new technologies against possible downsides. Regulation often suffers from asymmetry - benefits are ignored and hazards exaggerated. Misunderstanding of the precautionary principle increased the danger of this asymmetry.

It was crucial to be open about uncertainty and to recognize that opponents to a course of action will have values that are based on more than the scientific evidence - failure to understand this led to stalemate in the GMO debate, and could well hinder the use of hydraulic fracturing to develop shale gas. The scientific evidence about earth tremors events and potential fugitive emissions were neither here nor there to the environmental, anti-energy industry, and NIMBY concerns of those who opposed fracking.

¹ www.gov.uk/government/publications/national-risk-register-for-civil-emergencies-2013-edition

Innovation was central to our future prosperity; it involved risk. Later in the year

the Government Office of Science will publish a report with the title "Innovation: managing not ducking risk" to explore the question of this debate further.

TOM BOLT said that the function of the insurance industry was to allow businesses or governments to manage and often limit their risk exposures. The insurance industry would participate in a risk transfer for a premium, but only with a thorough understanding of the uncertainty involved in a risk - whether it is an "Act of God" type of natural disaster such as a flood or earthquake, a "jump risk" - actuarial miscalculations, or wrong decisions taken because of inappropriate behavioural mind-sets.

Lloyd's of London is a vital part of the global industry - with 1.7% of the global insurance market in 2013. Lloyd's received more than £25 billion in premium income and received claims for £16.8 billion. It worked through a network of cover holders and brokers under a general supervisory authority, one of whose fundamental roles was to ensure that the capital backing for the underwritten policies was adequate. The simple formula which established the price at which policies were offered (average claims history plus a third (or other factor) of the standard deviation of the claims plus expenses plus an element for the return on capital held) hid a multitude of analysis dealing with the uncertainties surrounding claims and expenses. Not only could model selection or accuracy be an issue, but also the input data may be uncertain or there may be contingencies that have not been allowed for.

Risk modelling was much more widely used in underwriting compared to ten years ago. Some argued that instinct and experience was enough, but this was simplistic. Models provided for a framework for an analysis of the risk and a way to communicate the uncertainties of the risk estimates to the underwriters. Models were analogous to a human skeleton. To complete the body they needed to be supplemented by experience and judgement.

But, there was always the problem of conveying what the model output meant to the decision maker - the underwriter or senior management. Simplified, but not dumbed-down language was needed to make sure the information was understood.

JUDITH HACKITT said she would focus as an example on the role that the Health and

Safety Executive (the HSE) plays in land use planning. The HSE is a statutory consultant for planning applications around major hazard sites. Its aim is to mitigate the effects of a major accident on the population around the site. But it was aware that the chemical industry provides major benefits from its operations. It would be wrong to fail to consider these benefits in its regulatory role. We all know of the risk of major industrial accidents - for example the 1974 Flixborough explosion².

Ideally hazardous sites should be sited well away from populated areas. But this is unrealistic. Houses, schools, hospitals, are often in close proximity to plants containing large quantities of hazardous substances - and often the plants are the source of employment. So safety is only one of a number of issues that planning authorities have to consider when an application is made for development. They must strike a balance between the needs of industry, the community and the environment, now and in the future. The HSE must be consulted, and it may advise against a development. The authority has to consider that advice, but the authority takes the decision as to whether to grant permission to go ahead or not. The HSE recognizes the right of the authority to take decisions and only very rarely asks the Secretary of State to call the application in.

The HSE should present its advice on the nature of the risk in such a way that benefits from the application can still take place. It should also be able to explain its views to those with different perspectives - given the uncertainties involved about whether accidents could occur and what the effects might be. Increases in population around the site, or new processes may mean what was acceptable in the past is no longer applicable. What happens if an accident does occur? Did HSE explain its procedures well? Should HSE continue to watch the site even if its advice has been rejected? How does HSE inform newcomers?

Two examples were quoted of advice about planning applications; a project at the Oval cricket ground which is adjacent to a gas holder where advice was rejected after the application was called in, and Wandsworth, where a satisfactory solution was found. The difference was that in Wandsworth there was early and wide consultation with developers and others and by amending early plans, consent could be given with acceptable safety

² www.catastrophic-events.com/docs/Flixborough.pdf

considerations. The lessons were to communicate early, deal with all stakeholders, seek to find a solution, not engage in a standoff. This means that the HSE must act as a "risk educator"; it advises on the applications to ensure results which satisfy everyone. It should avoid polarization; not, for example, rely exclusively on such tools as Quantitative Risk Assessment (QRA), which few understand, but seek to understand the concerns that all participants may have.

A central theme in the ensuing discussion was the relation between scientific evidence and advice tendered to decision makers through trusted advisers. It was not a question of either/or, but rather that decision makers needed to consider all aspects of policy changes, which may well range outside the scientific base, and they may need to act very quickly when the scientific evidence is not complete and there are still areas of uncertainty. Mere uncertainty is no grounds for refusing to consider scientific advice (uncertainty applied to other areas as well, such as public opinion, the attitude of the courts, and foreign reaction). What was important was to find language for the decision maker which indicated the range of uncertainty - was it fundamental, or did it apply only to certain less important features?

A trusted expert adviser would be trained to consider all the risks inherent in policy changes. She or he would be using a risk register and identify who owns each risk, who will suffer and what is the likelihood and consequences of an event. She or he and the decision maker would inevitably also be affected by their own personal values. At the centre of the relationship was trust.

Some speakers were concerned that building "trust" could mean that the adviser shared too closely the ambitions of the decision maker, and was reluctant to press views which did not align with them, or became subject to "group think". This was, perhaps, more of a danger in the public service where Ministers felt bound by a manifesto and other commitments, and found advice which stood in their way as unhelpful.

The Government Office of Science had never, however, come under pressure to temper evidence to meet political considerations, and had always been aware of the need to disclose as accurately as possible any evidence, and the degree of uncertainty attaching to it, while accepting that it was for Ministers to take the decision, and that there

would be other issues other than scientific evidence which must influence them.

In both the public and private sectors, the culture surrounding the decision maker is crucial. It should support any adviser - whether "trusted" or not to convey advice in terms which can be understood, with full awareness of the time and other problems facing the decision maker.

Speakers welcomed the HSE view that the future of understanding risk and effective regulation lay in keeping discussions open by sharing information and knowledge of uncertainty, and educating the public to accept that risk is inevitable, but can be managed, and should be balanced against possible benefits. But how capable is the public in understanding such issues? Does the mere mention of uncertainty undermine the trust of the public in government? But others thought that the public accepted that the UK government operated for the benefit of the nation as a whole. The issue is not the avoidance of risk, but being able to compare risks and benefits. In the past, new technologies had often been opposed because the benefits from particular applications had not been made clear, and a campaign had developed against the whole technology, not its beneficial application. The resistance against using Genetically Modified Organisms (GMOs) was an example.

Problems arose where different perspectives applied; for example, those who lived in the Chilterns saw the HS2 project differently from those who lived in Manchester. The only way through this was to take a wider perspective and look at the project (its benefits and costs) on a national level. This required leadership essentially anticipating the risks and working from the start with interested parties to mitigate them, an understanding of different views and an ability to weigh them in accordance with evidence.

Speakers also doubted whether sufficient emphasis was being given to future unknown risks such as the effects of shipping and oil and gas developments in the Arctic. There was considerable work being done through horizon scanning to see how risk reduction can be achieved without affecting benefits. Experience internationally showed that there was a general awareness of global risks - notably the international work on climate change.

The principal points from the discussion were, first that both views from “trusted expert advisers” and scientific evidence could be of value to decision makers; they both had a role, but there were dangers if evidence was down played. Second, both the public and decision makers needed to be educated in understanding the uncertainty

inherent in risk estimates; in not thinking risk could be avoided, but how risks can be compared and assessed against benefits avoiding asymmetry. Third, that risk can be dealt with effectively through prevention, mitigation and management - given strong leadership.

Sir Geoffrey Chipperfield KCB

TED^x Talks

Professor David Spiegelhalter OBE FRS
www.youtube.com/watch?v=4LSbnEgvmG8

Dr Irwin Redlener
<https://knowrisk.com.au/videos/ted-talk-disaster-recovery>

Useful Links:

AIR Worldwide
www.air-worldwide.com

Centre for Environmental Risks and Futures, University of Cranfield
www.cranfield.ac.uk/about/people-and-resources/schools-and-departments/school-of-applied-sciences/groups-institutes-and-centres/centre-for-environmental-risks-and-futures.html

Centre for Risk Studies, University of Cambridge
www.risk.jbs.cam.ac.uk

EQECAT
www.eqecat.com

Financial Services Knowledge Transfer Network
<https://connect.innovateuk.org/web/financialservicesktn>

The Foundation for Science and Technology
www.foundation.org.uk

Government Office for Science
www.bis.gov.uk/go-science

Health and Safety Executive
www.hse.gov.uk

The Lighthill Risk Network
www.lighthillrisknetwork.org

Lloyd's of London
www.lloyds.com

Lloyd's of London – Realistic Disaster Scenarios
www.lloyds.com/the-market/tools-and-resources/research/exposure-management/realistic-disaster-scenarios

Lloyd's Register
www.lr.org

The Nimrod Review – the loss of RAF Nimrod MRL XV230 by Charles Haddon-Cave QC
www.official-documents.gov.uk/document/hc0809/hc10/1025/1025.pdf

Oasis Loss Modelling Framework

www.oasislmf.org

Professor Nick Pidgeon

<http://psych.cf.ac.uk/contactsandpeople/academics/pidgeon.php>

Research Councils

www.rcuk.ac.uk

Risk Management Solutions

www.rms.com

Risk Solutions

www.risksol.co.uk

The Royal Society

www.royalsociety.org

RPS Energy

www.rpsgroup.com/Energy

Statistical Laboratory, University of Cambridge

www.statslab.cam.ac.uk

Technology Strategy Board

www.innovateuk.org

The Lloyd's Register Foundation

www.lrfoundation.org.uk

Willis Research Network

www.willisresearchnetwork.com

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www.wpp.com

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