Science & Technology Committee: Written evidence

Risk perception and energy infrastructure

This volume contains the written evidence accepted by the Science & Technology Committee for the Risk perception and energy infrastructure inquiry.

No.	Author

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Written evidence submitted by the Department of Energy and Climate Change (Risk 00)

RISK PERCEPTION AND ENERGY/NUCLEAR INFRASTRUCTURE

This submission has been prepared for the Committee's inquiry into risk assessment, communication, perception and tolerability in relation to energy infrastructure, focusing on nuclear power by the Department of Energy and Climate Change.

Introduction

1. The Government has committed to delivering a low carbon and affordable energy mix of renewables, new nuclear and clean gas and coal which will provide continuous low carbon generation and reduce the UK's dependence on fossil fuel imports. In common with other countries, the UK faces two great risks: the prospect of dangerous climate change which will have unprecedented impacts on global security and prosperity, and challenges to energy security as our current generation of power stations closes and ensuring supplies of energy which are resilient to volatile fossil fuel prices.
2. DECC's ultimate goal is to deliver clean energy for the future and tackle dangerous climate change. In line with the priorities set out in the National Security Strategy we identify and assess risks to energy assets and networks including from terrorism, cyber attack, international military crises, and natural hazards and major accidents. Working in partnership with industry and regulators we take action to reduce vulnerabilities, and put in place plans and arrangements to respond and recover in the event of infrastructure failure.
3. We believe that nuclear power stations have a vital part in our energy strategy to help ensure a diverse mix of technology and fuel sources, increasing the resilience of the UK's energy system. Nuclear power is a proven technology able to provide continuous low carbon generation and is forecast to be the lowest cost form of low carbon generation. These potential benefits mean that new nuclear power stations have an important role to play in the UK's energy future.
4. The Department of Energy and Climate Change (DECC) has a key role to play in several aspects of the UK's civil nuclear activities. Through the establishment of nuclear regulatory bodies covering safety, security, transport and environmental protection, the Government has set in place the organisations essential to ensure the nuclear industry in the UK is appropriately regulated in compliance with European and international

requirements. The regulatory regime applies to current nuclear installations and will apply to any future installations.

5. To further enhance this regime the Government has created the Office for Nuclear Regulation, which will combine the safety, security and transport aspects of regulation for the nuclear industry. DECC, through the Nuclear Decommissioning Authority, is responsible for the decommissioning, clean-up, waste management and eventual disposal of the civil nuclear liabilities created during the public ownership of the nuclear industry. To facilitate new nuclear build in the UK the Government has taken a number of actions: developing the National Policy Statement on sites for new nuclear power stations; Regulatory Justification; Waste and Decommissioning finance arrangements; and Generic Design Assessment of proposed reactor systems.

6. The unprecedented events at Fukushima Dai-ichi in Japan focussed global attention on nuclear power, specifically in relation to its safety and security. Safety is and will continue to be our number one priority, both in relation to existing facilities and potential future plants. Some countries such as Germany, Italy and Switzerland have decided to phase out nuclear power. Alongside other countries such as France, Finland, China and the US, the UK Government has decided to continue with our policy that nuclear has a role in the energy mix now and will continue to do so in the future.

7. Recent polls, including a populus survey conducted in August this year show that support for nuclear power in Britain has risen over the past year, despite the events at Fukushima. A recent Nuclear Industry Association (NIA) YouGov poll (November 2011) has also shown that 77% (risen from 68% in the summer) of those polled agree that "Britain needs a mix of energy sources to ensure a reliable supply of electricity, including nuclear power and renewable"[1].

8. Our response to the Committee focuses on DECC's role in communicating nuclear policy, which includes new nuclear, safety and security, non-proliferation, emergency planning, managing radioactive waste and touches on the themes of the inquiry rather than addressing the specific questions point by point.

Government's role in communicating nuclear policy

9. The role for Government is to communicate the role of nuclear in the UK as an essential part of the energy mix, and the benefits that it brings. In particular: that it is a safe and reliable low carbon technology which will help to mitigate the impacts of climate change, help to meet our ambition to be less

[1] NIA press release: http://www.niauk.org/NIA-Press-Releases/Industry-poll-shows-continuing-support-for-nuclear.html

dependent on imported fossil fuels, and help in providing UK consumers with cost-effective electricity.

10. DECC primarily communicates this through its policy statements and consultations, whether that is on the energy mix and nuclear's role, or specific nuclear policy such as the Nuclear National Policy Statement or policies on waste and decommissioning. More on this is in the section below.

11. It would be unrealistic to aim for consensus, but we believe it is important that our policy towards nuclear should win widespread understanding, confidence and respect. We aim to do this by:

    a. Communicating regularly and effectively with all our audiences through a variety of channels to reinforce messages on the role of nuclear in the energy mix, Government's commitment to new nuclear, and safety of nuclear power stations. These communications are based on factual and scientific evidence, accessible and understandable to the public and communicated by Ministers and officials;

    b. Ensuring that information on the work of the Office for Nuclear Development is accessible and transparent on the DECC website to help encourage understanding and trust in the Government's policy on nuclear;

    c. Ensuring we understand and address the needs and concerns of our stakeholders and target audiences through clear fact based messages.

12. There is an onus on the nuclear industry to build a reputation that instils trust and confidence and provides reassurance on the safety of the nuclear industry, particularly post-Fukushima. However there is a clear role for Government to ensure that the regulatory regime is fit for purpose and to engage with local communities and the public to communicate that nuclear is a reliable and safe form of energy.

13. In the case of Fukushima, it was important that we established the facts before making any decisions on policy. In this regard, the Secretary of State asked that the Chief Nuclear Inspector Dr. Mike Weightman report on the lessons learned from Fukushima and the implications for the nuclear industry and new nuclear. This was an independent report.

14. In light of this, we have re-emphasised the importance of the safety of nuclear power and the ongoing need for nuclear as part of the energy mix. Separately, Dr. Mike Weightman has presented his reports to media, key stakeholders and the public and the Secretary of State has placed these reports with Parliament.

Specific Nuclear Policy

15. The Government has conducted a number of public consultations which have provided clear facts and evidence-based information on nuclear power to raise awareness of nuclear, both the benefits and the risks. In particular the last administration conducted an extensive consultation in 2007 which led to the Government's decision in the 2008 Nuclear Power White Paper that nuclear should be part of the energy mix. Government is taking facilitative actions to enable the marketplace to come forward with nuclear energy that will help provide long-term energy security.

16. The policy of these facilitative actions and nuclear policy is communicated through a variety of mechanisms as set out below.

Regulatory Justification

17. The EU Basic Safety Standards Directive requires member states to justify new radioactive practices, that is, to assess whether their benefits outweigh the health detriment they may cause. Justifying two reactor designs, the AP1000 and EPR, was one of the facilitative actions necessary to allow new nuclear power stations to be built in the UK. The Government held three public consultations which respectively covered: the process; the application for each of these designs, submitted by industry; and the Secretary of State's proposed decisions. The application and the decision documents addressed in detail the issues around the impact of radiation on health, the operation of the regulatory regime intended to keep radiation doses received by people below certain levels, and the Secretary of State's reasons for concluding that the regulatory regime did this effectively. The Government's Responses to these consultations made clear concerns raised by the public and stakeholders on health issues related to nuclear and the Secretary of State considered these concerns at length in his decision documents.

18. The decisions were approved by the House of Commons by a majority of 520-27 for the EPR and 517 – 26 for the AP1000.

The National Policy Statements

19. The Nuclear National Policy Statement provides the primary basis for making decisions on applications to build nuclear power stations, and sets out a list of sites potentially suitable for the building of new nuclear power stations up to the end of 2025. The NPS was subject to an Appraisal of Sustainability, which analyses the environmental, social and economic impacts of its implementation. The NPS was also subject to a Habitats Regulations Assessment, which assesses the impact of the NPS on the integrity of European natural habitat sites. The NPS sets out the potential impacts of building new nuclear power stations, and the Government's assessment of the potential for mitigating these at the sites in question. The NPS and its

associated documents were the subject of a series of public consultations, which included public meetings and exhibitions at all the proposed sites, and public meetings in regional centres. These meetings gave people the opportunity to raise concerns about the impact of nuclear power stations and for officials and regulators to respond. The Government also published detailed responses to the consultations, covering all the points raised. The Nuclear NPS was approved by the House of Commons by a majority of 267 – 14.

20. The Nuclear NPS also gives planning guidance on health impacts and assesses individual sites and in doing so documents the concerns that residents raised at each site and the Government's response. This included concerns raised about risk, such as risks of flooding, or risks of health impacts. This gives clarity on how perception of risk has affected the assessment of whether individual sites are potentially suitable or not.

Managing Radioactive Waste

21. DECC is committed to delivering a solution for safe and secure disposal of higher activity radioactive waste, both for legacy and future nuclear wastes. Without credible mechanisms for long-term management of nuclear wastes, the new-build programme will be jeopardised. Government must be satisfied that effective arrangements will exist to dispose of waste from new nuclear reactors.

22. The Government's policy for dealing with higher activity waste is through geological disposal, coupled with safe and secure interim storage until a Geological Disposal Facility (GDF) is operational. DECC and the NDA's Radioactive Waste Management Directorate (RWMD) are driving forward the Managing Radioactive Waste Safely (MRWS) programme to implement this policy.

23. The principles of voluntarism and partnership are key in this, working with willing communities to find a suitable site for a GDF. The voluntarism approach involves working closely with local communities to explain the realities of geological disposal, answer questions, address concerns and tackle issues openly in order to deliver stakeholder confidence that decisions are taken for the right reasons and developments will be safe and beneficial to the local community. In particular we have been working closely with the west Cumbrian MRWS Partnership, led by local authorities who have already expressed an interest in the programme, to develop and deliver several rounds of extensive local stakeholder engagement activities, including DECC and NDA officials participation in regular open meetings and community events to explain government policy and answer stakeholder questions and concerns.

Nuclear safety

24. DECC is accountable to Parliament for safety at nuclear power stations and other licensed civil nuclear sites in the UK. The Secretary of State receives advice on nuclear safety issues from the Office of Nuclear Regulation, currently an agency of the HSE pending legislation to create a separate statutory body.

25. The operation of the UK's nuclear safety regime is delivered through the ONR who undertake licensing and the day-today regulation of nuclear sites throughout the UK. In its 2009 report on the UK system the IAEA IRRS report noted that "the UK has a mature and transparent regulatory system and advanced review process, which is backed up by highly trained, expert and experienced nuclear inspectors". The report also noted the UK's ability to effectively manage safety in the nuclear industry now and in the future, through the proposed establishment of the Office of the Nuclear Regulator, as it stated that "once again the UK are showing world leadership – an encouraging example to all in the world preparing for the challenges of the future".

26. With the move in October 2011 of the transport regulator for radioactive material from DfT to ONR, DECC has also become accountable to Parliament for the transport of radioactive material by road rail or inland waterway.

27. Through ONR's reporting and international safety standards, DECC is able to reassure the public and parliament of the UK's safe and secure nuclear industry. However, it is within ONR's remit and that of nuclear operators to ensure they are transparent and open in their policy and communicating this to the public. This is a specific recommendation in Dr. Weightman's report of the lessons learned from Fukushima.

Nuclear security

28. DECC is responsible for the overall effectiveness of the security regime for the UK's civil nuclear sites. It is crucial that all nuclear facilities and nuclear material are protected against 'extreme hazards' including criminal or malevolent acts because of the potential risk to public health and safety, and the environment. Security arrangements are kept under constant review as part of a continuous process to ensure existing arrangements are robust and effective and flexible to respond to any indication of a terrorist threat on a UK nuclear installation or nuclear material in transit. Security arrangements comply with international standards – the Convention on the Physical

Protection of Nuclear Material and the recommendations in International Atomic Energy Agency's regularly updated guidelines, especially the information circular INFCIRC225.

29. DECC works closely with the Office for Nuclear Security (part of the ONR), the independent security regulator, as well as the Civil Nuclear Police Authority and the Civil Nuclear Constabulary (a specialised armed police force), to ensure that security measures at UK civil nuclear sites and for nuclear material in transit are effective. The Nuclear Industries Security Regulations 2003 makes provision for the protection of nuclear material, both on sites and in transit, against the risks of theft and sabotage, and for the protection of sensitive nuclear information.

30. All civil nuclear operators are required to have site security plans setting out the security arrangements for the protection of nuclear sites and nuclear material on such sites. The arrangements cover, for example, physical protection features such as fencing and turnstile access, the roles of security guards and the Civil Nuclear Constabulary, the protection of proliferation-sensitive data and technologies and the trustworthiness of the individuals with access to sensitive nuclear information and material. These arrangements will apply to new nuclear build operators.

31. The UK is committed to nuclear security and to learning from others. In October, an IAEA International Physical Protection Advisory Service (IPPAS) Mission visited the UK to assess our compliance with the International Convention on the Physical Protection of Nuclear Materials and the IAEA's guidelines on nuclear security The IAEA concluded that the state of civil nuclear security arrangements was sufficiently robust; both in the context of the legal and regulatory framework and how it is implemented at the Sellafield nuclear site and the port of Barrow used for nuclear shipments. The IPPAS Mission team identified many examples of good practice and a number of valuable recommendations and suggestions. DECC is working with the nuclear regulator, Sellafield Ltd and NDA to use this 'CONFIDENTIAL' report to ensure that we continue to develop and improve our civil nuclear security regime.

Nuclear Non-Proliferation

32. DECC leads on a number of individual non-proliferation policy areas to support international measures to reduce the threat of proliferation of weapons of mass destruction, largely through its commitments as a signatory to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and those arising under the G8 Global Partnership. DECC is also the lead Department for the nuclear and radiological elements of the Global Threat Reduction

Programme (GTRP), the UK's principal programmes of co-operative overseas assistance on nuclear security and wider non-proliferation.

33. It is inevitable that any international developments regarding activities associated with actual or potential weapons of mass destruction will capture, and hold, media attention. DECC works hard with its international partners and agencies to help ensure that press releases and other information on the global efforts to promote safe and secure nuclear operations and materials, and the commitments to which states must adhere, is made fully available, and is accurate. In this regard the website of the IAEA is a major tool. Moreover both DECC's own website and that of the FCO, and the website of the Export Control Organisation (ECO) in BIS provide respectively, clear information about the UK's non-proliferation activities and guidance to firms about nuclear sensitive exports.

34. The UK's GTRP programme publishes an annual report on its activities (online at www.decc.gov.uk/gtrp). DECC's Press Office also handle one-off matters, such as the UK's ad-hoc contributions to the IAEA's Nuclear Security Fund or the signing of bilateral Nuclear Cooperation Agreements.

Emergency Planning and Radiation Monitoring

35. DECC is the lead Government Department in the response to an emergency with off-site effects from a licensed civil nuclear site in England and Wales. As such, one of its responsibilities is to ensure that information is available to the public and media regarding the implications of a nuclear emergency. DECC also contributes to the wider National Risk Assessment (NRA) process led by the Cabinet Office.

36. Under REPPIR (Radiation (Emergency Preparedness and Public Information) 2001) Regulations, nuclear site operators and carriers must share their assessments of reasonably foreseeable hazardous events relating to their work with the nuclear regulator (the Office for Nuclear Regulation). They must also provide people living or working near to nuclear sites with certain prescribed information regarding the potential risks posed by ionising radiation.

37. DECC publishes information on its website regarding the risks posed by ionising radiation. The website (www.decc.gov.uk) contains facts sheets with information on the characteristics of ionising radiation and the effects of exposure to it on human health and dose comparison data. The Health Protection Agency's website provides further, more detailed, information on the potential health implications, including cancer risks from exposure to radiation. In addition, DECC's Radiation Incident Monitoring Network (RIMNET) provides gamma monitoring data for inclusion on the publicly

accessible EURODep European Union database. DECC also plans to publish regular monitoring updates on its own website shortly.

38. Site operators provide such information in a variety of forms at regular intervals not exceeding three years, often in the form of a calendar. Site operators also make the information available to the wider public by placing copies in libraries, civil centres and other public buildings.

39. In addition, there is information with local communities through Emergency Planning Consultative Committees. These Committees provide a forum for organisations with responsibilities for preparing emergency arrangements in response to events at local licensed nuclear sites to consult, co-operate and co-ordinate these arrangements.

Department of Energy and Climate Change

December 2011

Written evidence submitted by
PCAH (Parents Concerned About Hinkley (Risk 01)

1 Key factors influencing public risk perception are experience of public health damage from exposure to nuclear site discharges into the atmosphere and seawater.

2 Public risk perceptions are disregarded and discredited in the planning process for energy infrastructure: eg PCAH response to the Justification consultation on new nuclear build; PCAH's verbal contribution to the first meeting of the Hinkley C Community forum; PCAH delegate's contribution to Hinkley Point site stakeholder group meetings since 1995.

3 Local and central Government risk assessment's continuing reliance on the ICRP risk model illustrates how their perception of risk needs to catch up with the current ECRR risk assessment model.

4 Public perceptions will not be changed by continuing exposure to nuclear industry and regulatory communications which do not reflect the reality of the public's experiences of health damage throughout their 45 years' exposure to the realities of living (and dying) close to nuclear sites.

5 The Government must work with NGOs and the numerous experts on radiation risk including in the UK: Green Audit and Dr Christopher Busby, the Nuclear Free Local Authorities, John Large Associates assessment of the EPR nuclear reactor, Greenpeace, Dr Ian Fairlie, Dr Paul Dorfmann.

6 Risk perceptions and communication issues in the UK are similar to groups in other European countries though we have yet to achieve Germany's realistic assessment of nuclear power as being an unnecessary threat to human life which cannot be justified on any criteria of risk benefit analysis.

We hope members of the Science and technology will take the time to read for themselves the items listed below all of which are available through the Stop Hinkley website and Green Audit.

HEALTH DAMAGE TO COMMUNITIES LIVING NEAR NUCLEAR SITES
Somerset Coastal Communities Downwind of Hinkley Point Nuclear Site

Published scientific research papers (see list below) and available at http://www.stophinkley.org/Health/ReadList.htm show that since 1965, when Hinkley Point nuclear reactors came on stream the following illnesses showed excess incidence:

Childhood leukaemia
Thyroid malfunction
Breast Cancer
Prostate cancer
Lung and stomach cancer
Immune system impairment
Non-Hodgkin's Lymphoma
Adult leukaemia
Endocrine disruption disorders
Pregnancy and childbirth problems
Infant and Perinatal Mortality
Heritable genetic mutations

During decommissioning, reprocessing, storage and disposal of radioactive waste after nuclear plants close down, the following additional illnesses have been recorded at Sellafield in the UK and South Carolina in America:

Heart attacks
Pleural cancer

Strokes	**Skin cancer**
Brain tumours	**Kidney cancer**
Rheumatism	**Arthritis**

The Hinkley A nuclear site has now closed down. Decommissioning and on-site reprocessing began in January 2006 releasing high level radionucleides into the atmosphere and the estuary. We are already seeing unexpected cardiovascular, kidney and skin problems among Somerset coast residents.
After 5 years of exposure to decommissioning gases from the two Hinkley A Magnox reactors, we are seeing excess incidence of central nervous system illness and fatalities including Parkinson's disease, Multiple Sclerosis and Motor Neurone Disease. Macular degeneration is also increasing.

Radioactive isotopes released from Hinkley decommissioning and waste include:

Plutonium 241 – affects skin, bone, liver. Fatal dose 3mg	**Tritium** crosses placenta; birth defects
Uranium – binds to DNA, affects kidneys	**Nickel**
Caesium 137 – affects muscle, brain	**Iron Fe-55**
Strontium 90 – displaces bone calcium, causing injuries and cancer including leukaemia	**Promethium-147**
	Cobalt 60

'The Madness of Nuclear Energy' Volume 29 No 7 November 1999 - printed copy 'The Ecologist'
on line at http://www.theecologist.org/back_archive/19701999/
Best publication on all aspects of nuclear energy including health detriment, political cover-ups, new build propaganda etc.

International Journal of Epidemiology 4 March 2008.
Westlakes Scientific Consulting: Professor Steve Jones.
This large study of 65,000 men employed at Sellafield reprocessing plant between 1946 and 2002 found the risks of death from heart attacks and strokes increased with exposure to higher levels of radiation.

American Journal of Industrial Medicine, December 2007
Authors: Dr David B Richardson, University of North Carolina.
This study is of 19,000 employees of the Savannah River Site, South Carolina which has processed nuclear materials since the 1950s. It found excess leukaemia and pleural cancers among men and elevated rates of kidney and skin cancers in women.

Infant and Perinatal Mortality and Stillbirths near Hinkley Point Nuclear Power Station 1993-2005
Authors: Chris Busby, Mireille de Messieres, Saoirse Morgan
Occasional Paper 2007/6 Publisher: Green Audit, Aberystwyth July 2007
'Cancer Mortality and Proximity to Hinkley Point Nuclear Power Station in Somerset 1995-1998
Part 1 Breast Cancer'
Authors: Chris Busby PhD, Paul Dorfman BSc, Helen Rowe BA.

'Cancer Mortality and Proximity to Oldbury Nuclear Power Station in Gloucestershire 1995-1999'
Authors: Chris Busby PhD, Paul Dorfman BSc, Helen Rowe BA, Bruce Kocjan BSc

'Cancer Mortality and Proximity to Hinkley Point Nuclear Power Station in Somerset 1995-1998 Part 3 All Malignancies, Lung and Stomach Cancer. Summary'
Authors: Chris Busby PhD, Paul Dorfman BSc, Helen Rowe BA.

'Leukaemia Incidence in Somerset with Particular Reference to Hinkley Point Nuclear Power Station.' Taunton: Somerset Health Authority: Bowie C and Ewings P C 1988
Also referred to in the above 'All Malignancies…' paper by Dr Busby.

'Incidence of Leukaemia in Young People in the Vicinity of Hinkley Point Nuclear Power Station 1959-1986' Authors: Ewings P D, Bowie C, Phillips M J, Johnson S A
British Medical Journal 1989;299(6694):289-93

'Low Levels of Ionizing Radiation May Cause Harm'
Authors: Richard R Monson, James S Cleaver
The National Academy of Sciences, BEIR VII report June 29 2005
This is one of many sources in 'Nuclear Power is not the Answer' by Helen Caldicott. It supports other publications in linking radiation exposure to heart attacks and strokes.

ISBN 0-9543081-1-5
'CERRIE Minority Report 2004' Authors: Richard Bramhall, Chris Busby, Paul Dorfman
This report provides strong biological and epidemiological evidence that current models of hazard from radioactivity inside the human body underestimate risks by at least 100 and possibly up to 1000 times.

Doses to the Embryo and Foetus from Intakes of Radionucleides by the Mother
ICRP (2001) Publication 88 Ann. ICRP 31 (1-3)

German Federal Office for Radiation Protection (BfS) 2007
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2696975/
BfS commissioned this University of Mainz study which found that between 1980-2003, 77 children developed cancer near 16 nuclear sites, against a statistical average of 48. The German Federal Minister for Environment, Sigmar Gabriel, has now asked the Radiation Protection Commission to undertake a follow up study into causalities between nuclear power plants and leukaemia in children.

'Meta-Analysis of Standardized Incidence and Mortality Rates of Childhood Leukaemia in Proximity to Nuclear Facilities 2007'
Authors: Baker P J & Hoel D G (2007) European Journal of Cancer Care 16, 355-363.
Medical University of South Carolina, Charleston, SC, USA.

Radiation and Health
Science for Democratic Action August 2009
http://www.ieer.org/sdafiles/16-1.pdf
Nuclear power plants generate tritium in the course of their operation and release it both to the atmosphere and to water bodies. Tritium releases have also occurred as a result of

malfunctions such as leaks from several nuclear power plants. One such example of leaks was at Exelon's Braidwood plant in Illinois. Many reactors have experienced leaks that have not been monitored. Further, releases of tritiated water vapor from the stacks of nuclear power plants can result in radioactive rainfall, which can contaminate surface water bodies as well as groundwater. As radioactive water, tritium can cross the placenta, posing some risk of birth defects and early pregnancy failures. Ingestion of tritiated water also increases cancer risk. In this article we will only discuss tritium in the form of radioactive water.

'Wolves of Water' by Chris Busby, 2006.
Publishers: Green Audit Books 2006, Aberystwyth, SY23 1DZ, Wales, UK.
ISBN 1-897761-26-0 Price £12.

ISBN: 1 897761
'ECRR 2003 Recommendations of the European Committee on Radiation Risk'
Health Effects of Ionising Radiation Exposure at Low Doses for Radiation Protection Purposes.
Covers the problems with using Hiroshima data to set current health risk levels now that we know internal exposure to low radiation levels by inhalation and ingestion disrupt cell replication cycles and interfere with human DNA.

ISBN: 1-897761-25-2
'ECRR Chernobyl: 20 Years On – Health Effects of the Chernobyl Accident'
Editors: C C Busby and A V Yablokov
An invaluable archive of contributions from Russian and European scientists on the true effects the Chernobyl accident had and continues to have on the exposed populations, including those in Scandinavia and the UK.

Evidence of Significant Enriched Uranium atomic fuel contamination of the Hinkley Point nuclear site in Somerset and its potential implications.
Authors: Dr Chris Busby, Cecily Collingridge
Occasional Paper 2011/1 Aberystwyth: Green Audit January 2011

ISBN-13:978-1-59558-067-2 or ISBN-10: 1-50559-067-2
'Nuclear Power is Not the Answer' by Helen Caldicott 2006
Price about £14

'Wings of Death – Nuclear Pollution and Human Health' by Dr Chris Busby 1995
Publishers: Green Audit, Aberystwyth ISBN 1-897761-03-1
This book has some eye opening ideas on nuclear pollution, the links to cancer and a very credible hypothesis about the initiation of cancers. It is a very important book.

ISBN 978 1 84668 353 4
'THE LANGUAGE OF LIFE; DNA AND THE REVOLUTION IN PERSONALIZED MEDICINE
Author: Francis Collins
Published in GB in 2010 by Profile Books Ltd *www.profilebooks.com*

EDF Proposed EPR (European Pressurised Water) New Build Mox Burning Reactor at Hinkley Point, Somerset. Go to website http://largeassociates for extracts from John Large's lecture in October 2008 to Hinkley nearby communities.

UK and European publications can be sourced from:
Green Audit, Aberystwyth, SY23 1DZ, Wales or from
The Low Level Radiation Campaign *Bramhall@llrc*

Nuclear Reading List compiled by Jo Brown , PCAH (Parents Concerned About Hinkley)
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Studies on this Nuclear Reading list are available on the Stop Hinkley website
http://www.stophinkley.org/Health/ReadList.htm

REFERENCES FOR KIKK STUDY INTO CHILDHOOD CANCERS

1. Committee on the Medical Aspects of Radiation in the Environment (COMARE): The implications of the new data on the releases from Sellafield in the 1950s for the possible increased incidence of cancer in west Cumbria. First report. London: Her Majesty's Stationery Office; 1986.
2. Committee on the Medical Aspects of Radiation in the Environment (COMARE): Investigation of the possible increased incidence of childhood cancer in young persons near the Dounreay nuclear establishment, Caithness, Scotland. Second report. London: Her Majesty's Stationery Office; 1988.
3. Committee on the Medical Aspects of Radiation in the Environment (COMARE): Report on the incidence of childhood cancer in the West Berkshire and North Hampshire area which are situated the atomic weapons research establishment, Aldermaston and Royal Ordnance Factory, Burghfield. Third report. London: Her Majesty's Stationery Office; 1989.
4. Committee on the Medical Aspects of Radiation in the Environment (COMARE): The incidence of cancer and leukemias in young people in the vicinity of the Sellafield site, West Cumbria: further studies and an update of the situation since the publication of the report of the Black Advisory Group in 1984. Fourth report. London: Department of Health; 1996.
5. Kaatsch P, Spix C, Schulze-Rath R, Schmiedel S, Blettner M: Leukemias in young children living in the vicinity of German nuclear power plants. Int J Cancer 2008, 122:721–726.
6. Spix C, Schmiedel S, Kaatsch P, Schulze-Rath R, Blettner M: Case–control study on childhood cancer in the vicinity of nuclear power plants in Germany 1980–2003. Eur J Cancer 2008,44:275–284.
7. Körblein A, Hoffmann W: Childhood Cancer in the Vicinity of German Nuclear Power Plants. Medicine & Global Survival 1999, 6(1):18-23. Available at http://www.ippnw.org/Resources/MGS/V6N1Korblein.html
8. Weiss W: Background information on the KiKK study. German Federal Office for Radiation Protection 2007, Berlin,Germany. Available in English at http://www.bfs.de/en/kerntechnik/kinderkrebs/kikk.html
9. BfS: Unanimous Statement by the Expert Group commissioned by the Bundesamt fur Strahlenschutz on the KiKK Study: German Federal Office for Radiation Protection. Berlin,Germany. 2007 Available in English at

http://www.bfs.de/de/bfs/druck/Ufoplan/4334_KIKK_Zusamm.pdf
10. Stewart A, Webb J, Hewitt D: A survey of childhood malignancies. British Medical Journal 1958, 1:1495–1508.
11. Committee on the Biological Effects of Ionizing Radiations, National Research Council. Health effects of exposure to low levels of ionizing radiations. BEIR V Report. 1990 Washington, DC: National Academy Press.
12. Preston DL, Kusumi S, Tomonaga M, et al: Cancer incidence in atomic bomb survivors. III. Leukemia, lymphoma and multiple myeloma, 1950–1987. Radiat Res 1994, 137(Suppl):S68–S97.
13. International Agency for Research on Cancer: Monographs on the evaluation of carcinogenic risks to humans. I. X- and gamma radiation, and neutrons. Ionizing radiation: volume 75. Lyon, France: IARC; 1999.
14. Forman D, Cook-Mozaffari P, Darby S, Davey G, Stratton I, Doll R, Pike M: Cancer near nuclear installations. Nature 1987, 329(6139):499-505.
15. Gardner MJ: Father's occupational exposure to radiation and the raised level of childhood leukemias near the Sellafield nuclear plant. Environ Health Perspect 1991, 94:5–7.
16. Pobel D, Viel JF: Case–control study of leukemias among young people near La Hague nuclear reprocessing plant: the environmental hypothesis revisited. BMJ 1997, 314:101–106.
17. Laurier D, Bard D: Epidemiologic studies of leukemia among persons under 25 years of age living near nuclear sites. Epidemiol Rev 1999, 21(2):188-206.
18. Guizard AV, Boutou O, Pottier D, Troussard X, Pheby D, Launoy G, Slama R, Spira A: The incidence of childhood leukemias around the La Hague nuclear waste reprocessing plant (France): a survey for the years 1978–1998. J Epidemiol Community Health 2001, 55:469-474.
19. Hoffmann W, Terschueren C, Richardson DB: Childhood leukemias in the vicinity of the Geesthacht nuclear establishments near Hamburg, Germany Environ Health Perspect 2007,115:947–952. Available at http://www.ehponline.org/members/2007/9861/9861.pdf.
20. Committee on the Medical Aspects of Radiation in the Environment (COMARE): The incidence of childhood cancer around nuclear installations in Great Britain. Tenth report. London: Health Protection Agency; 2005.
21. Committee on the Medical Aspects of Radiation in the Environment (COMARE): The distribution of childhood leukemias and other childhood cancer in Great Britain 1969–1993. Eleventh report. London: Health Protection Agency; 2006.
22. White-Koning ML, Hemon D, Laurier D, Tirmarche M, Jougla E, Goubin A, Clavel J: Incidence of childhood leukemias in the vicinity of nuclear sites in France, 1990–1998. Br J Cancer 2004, 91:916–922.
23. Laurier D, Grosche B, Hall P: Risk of childhood leukemia in the vicinity of nuclear installations--findings and recent controversies. Acta Oncol 2002, 41(1):14-24.
24. Bithell JT, Keegan TJ, Kroll ME, Murphy MFG, Vincent TJ: Childhood leukemia near British Nuclear Installations: Methodological Issues and Recent Results. Radiation Protection Dosimetry 2008, 45:1–7.
25. Laurier D, Hémon D, Clavel J: Childhood leukemia incidence below the age of 5 years near French nuclear power plants. J Radiol Prot 2008, 28:401–403.
26. Sterne JAC, Smith GD: Sifting the evidence—what's wrong with significance tests? Phys Ther 2001, 81(8):1464-1469.
27. Axelson O: Negative and non-positive epidemiological studies. Int J Occup Med Environ Health. 2004, 17:115-121.

28. Everett DC, Taylor S, Kafadar K: Fundamental Concepts in Statistics: Elucidation and Illustration. J of Applied Physiology 1998, 85(3):775-786.
29. Whitley E, Ball J: Statistics review 1: Presenting and summarising data. Crit Care 2002, 6:66-71.
30. Altman DG, Bland JM: Absence of evidence is not evidence of absence. BMJ 1995, 311:485.
31. Baker PJ, Hoel D: Meta-analysis of standardized incidence and mortality rates of childhood leukemias in proximity to nuclear facilities. Eur J Cancer Care 2007, 16:355–363.
32. Personal communication from Dr A Körblein.
33. Kaatsch, P; Spix, C; Jung, I; Blettner, M: Childhood Leukemia in the Vicinity of Nuclear Power Plants in Germany. Deutsch Arztebl Int 2008, 105(42): 725-32.
34. Laurier D, Jacob S, Bernier MO, Leuraud K, Metz C, Samson E, Laloi P: Epidemiological studies of leukaemia in children and young adults around nuclear facilities: a critical review. Radiat Prot Dosimetry 2008, 132(2):182-90.
35. Bradford Hill A: The Environment and Disease: Association or Causation? Proceedings of the Royal Society of Medicine 1965, 58:295–300.
54. Fucic A, Brunborg G, Lasan R, Jezek D, Knudsen LE, Merlo DF: Genomic damage in children accidentally exposed to ionizing radiation: a review of the literature. Mutat Res 2008, 658(1-2):111-23.
55. Baverstock K: Childhood leukemias are caused by background radiation. New Scientist January 9, 2003. 4
56. Gardner MJ, Snee MP, Hall AJ, Powell CA, Downes S, Terrell JD: Results of casecontrol study of leukemia and lymphoma among young people near Sellafield nuclear plant in West Cumbria. BMJ 1990, 300:423–429.
57. Morris JA: Leukaemia and lymphoma among young people near Sellafield. BMJ 1990, 300(6725):676–678. (letter)
58. Morris JA: A mutational theory of leukaemogenesis. J Clin Pathol 1989, 42:337-40.
59. Lord BI, Mason TM, Humphreys ER: Age-Dependent Uptake and Retention of 239Pu: Its Relationship to Hemopoietic Damage. Radiation Protection Dosimetry 1992, 41:163-167.
60. Ohtaki K, Kodama Y, Nakano M, Itoh M, Awa AA, Cologne J, Nakamura N: Human fetuses do not register chromosome damage inflicted by radiation exposure in lymphoid precursor cells except for a small but significant effect at low doses. Radiat Res 2004, 161:373–379.

Figure Legends

Figure 1. Annual averages of tritium concentrations in air measured at distances from nuclear power stations in Canada, 1985–1999

Abstracted from: Tritium in the Canadian Environment: Levels and Health Effects. Report RSP-0153-1 (2003). Prepared for the Canadian Nuclear Safety Commission under CNSC contract no. 87055-01-0184 by Ranasara Consultants and Richard Osborne. Data from Health Canada: Environmental Radioactivity in Canada. Radiological Monitoring Report. Ottawa, Canada: Government of Canada; 2001.

Figure 2. Tritium concentrations in vegetation / food moisture near Canadian nuclear power stations

Abstracted from: Tritium in the Canadian Environment: Levels and Health Effects. Report RSP-0153-1 (2003). Prepared for the Canadian Nuclear Safety Commission under CNSC contract no. 87055-01-0184 by Ranasara Consultants and Richard Osborne. Data from Health Canada: Environmental Radioactivity in Canada. Radiological Monitoring Report. Ottawa, Canada: Government of Canada; 2001.

Figure 3. Quarterly 14C air concentrations near the Neckarwestheim 2 nuclear power station in Germany
Abstracted from Jahresbericht (Annual Yearbook) 2007: Bundesamt für Strahlenschutz, Berlin, Germany.
Tables
Table 1 Leukemia mortality risks Source: Baker and Hoel, 2007[31]
Table 2 KiKK odds ratios for leukemias in children < 5 years old
1.02
Source: continuous regression model used by Kaatsch et al, 2008[5]
Table 3 Summary of Bradford Hill test results
Age Groups
0-9 0-9 0-25 0-25
Distance from reactor - km Mean distance - km
>5
5 to <10 10 to <30 30 to <50 50 to <70 >70

Jo M Brown
PCAH (Parents Concerned About Hinkley)

23 November 2011

Written evidence submitted by the National Physical Laboratory (Risk 02)

1. Summary of our key points

1.1 The National Physical Laboratory (NPL) is the UK's National Measurement Institute and our comments relate to the measurement of radionuclides in the environment and of food samples.

1.2 Measurements of radionuclides in the UK are underpinned by standards and reference materials provided by NPL, and assured through Proficiency Testing Exercises and national accreditation. These provide confidence in the data provided to the public.

1.3 However, at times of crisis the public are hungry for measurement data and the measurement infrastructure that assures the quality of data will inevitably become stretched. This can sometimes lead to data being put in the public domain that is in conflict, which risks undermining public confidence. There is an opportunity to learn from the Fukushima crisis to improve the quality of data provided to the public at a time of crisis.

2. About NPL

2.1 The National Physical Laboratory (NPL) is a leading UK research establishment with an annual turnover of £70m and a staff of 600. It is the largest science asset directly owned by BIS and occupies a unique position as the UK's *national measurement institute* (NMI) sitting at the intersection between scientific discovery and real world application. Although sponsored by BIS, NPL also undertakes work for other government departments, notably Defra, DECC, MoD and DH. Its expertise and original research underpin quality of life, innovation and competitiveness for UK citizens and business:

- NPL provides companies with access to world-leading technical expertise and scientific facilities, assuring the confidence required to realise competitive advantage from the use of new materials, techniques and technologies;
- NPL expertise and services are crucial in a wide range of social applications – helping to save lives, protect the environment and enable citizens to feel safe and secure. Support in areas such as the development of advanced medical treatments and environmental monitoring helps secure a better quality of life for all;
- NPL develops and maintains the nation's top-level measurement standards, supporting an infrastructure of traceable measurement throughout the UK and the world, to ensure accuracy and consistency.

2.2 NPL has a world-class reputation for the quality of its science and an unparalleled record in demonstrating innovation and industrial relevance (the value of its measurement work to UK GDP has been estimated at £2B pa).

2.3 Specifically NPL has capabilities in: -

- Materials development and characterisation
- Radiochemical analysis & reference standards for the nuclear industry
- Structural Health / Condition monitoring for plant life cycle management
- Instrumentation validation and optimisation

2.4 NPL is managed by Serco on behalf of BIS through a government-owned, contractor-operated contract. This contract provides significant reachback to broader nuclear capabilities within Serco, notably its in-house capabilities within Serco Energy, as well as strong links with the National Nuclear Laboratory (managed on behalf of DECC in partnership with Battelle and the University of Manchester) and the Atomic Weapons Establishment (managed on behalf of MoD in partnership with Lockheed Martin and Jacobs Engineering).

3. What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects and to what extent can public perceptions be changed by improving risk communication?

3.1 One of the key factors influencing public risk perception and tolerability of nuclear energy infrastructure facilities is the degree of public confidence in the measurement of radionuclides in environmental and food samples during a crisis situation such as Fukushima. These types of radionuclide measurements vary from relatively fast, non-destructive techniques such as gamma spectrometry for I-131, Cs-134 and Cs-137 to labour-intensive and time-consuming radiochemical techniques for strontium and plutonium isotopes with all these techniques requiring specialist knowledge and facilities.

3.2 The National Physical Laboratory (NPL), which is the UK's National Measurement Institute, provides radionuclide standards and reference materials and organises laboratory proficiency testing exercises (PTEs) needed to support the measurements of radionuclides in environmental and food samples. Measurement laboratories in the UK and overseas make use of these standards, reference materials and proficiency testing exercises to:

i. Assure quality of their work,
ii. Demonstrate traceability to primary standards held by NPL,
iii. Validate new measurement procedures
iv. Demonstrate the quality of the reported data and thus provide confidence in their measurements.

3.3 The use of traceable radionuclide standards, participation in proficiency test exercises and the use of certified reference materials are required to comply with the requirements of the international ISO 17025 standard and to obtain and/or maintain United Kingdom Accreditation Service (UKAS) accreditation. UKAS is the sole national accreditation body recognised by government to assess, against internationally agreed standards, organisations that provide certification, testing, inspection and calibration services. Japan has similar arrangements in place for routine radionuclide measurements.

3.4 In response to the Fukushima crisis, the Japanese ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Japanese ministry of Health, Labour and Welfare and the Tokyo Electric Power Company (TEPCO), the company who runs the Fukushima nuclear power plants, have been publishing numerous reports with measurement results of radionuclides in samples as diverse as seafood, rice, milk, fish, meat, tea leaves, mushrooms, tap water, seawater, soil, air, vegetation and many other matrices on their respective websites. In addition, several other initiatives including Japanese nuclear industry associations, international organisations, universities, concerned citizen groups and activist organisations have been publishing additional measurement data as well.

3.5 The amount of measurement data published by the Japanese government and TEPCO is very extensive, but it has not always resulted in its intended purpose of openness and improved risk communication. This is partly unavoidable, since a small but vocal minority of the general public, rightly or wrongly, is likely to question any official data and instead may believe in conspiracy theories and/or alleged cover-ups. Another issue is that it is practically unavoidable that in a crisis situation at times contradictory or incorrect information will be published, due to time pressure, the exceptional circumstances and uncharted territory. There have been a few instances where radionuclide data previously published by TEPCO was corrected or withdrawn. As a result, alternative hypotheses on what was/is happening during the on-going Fukushima crisis were postulated by the public and the media. Some of these hypotheses can best be described as eccentric, but others have a certain degree of credibility while deviating from the official position.

3.6 However, on the whole, the attempts by the Japanese government and TEPCO to inform the public by effective use of the Internet, considering the inherent difficulties this entails and the scale of the nuclear crisis and the destructive tsunami, are unprecedented and may serve as a blueprint for future risk communication.

Dr Arvic Harms
Environmental Radioactivity Principal Research Scientist
National Physical Laboratory

30 November 2011

Written evidence submitted by the Royal Society of Chemistry (Risk 03)

The Royal Society of Chemistry (RSC) welcomes the opportunity to make the following submission to Science and Technology Committee. The RSC's Royal Charter obliges it to serve the public interest by acting in an independent advisory capacity and we are happy for this submission to be put into the public domain.

This submission has been prepared under the aegis of the Environment, Health and Safety Committee (EHSC) of the Royal Society of Chemistry. Members of the EHSC serve the RSC as individual experts and not as representatives of their employers.

The Royal Society of Chemistry only wishes to respond to those questions which fall within its area of its experience.

1. What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?

1. The key factors influencing public risk perception of energy infrastructure facilities and projects, are fear and dread[1,2].

2. Public perception is often skewed by a fundamental lack of understanding of the difference between hazard and risk which are often used interchangeably when communicating about potentially adverse effects.

3. An examination of a number of incidents (including Chernobyl) found that:

    a. There are often psychological issues associated with disturbance and risk of future illness, and the potential for idiopathic environmental illness and mass hysteria is often significant[3,4].

    b. Keeping public perception in line with scientific opinion is very difficult - the information is not easily assimilated and often not believed. Existing scientific knowledge may be limited in some cases or be ambiguous and subject to a high degree of uncertainty. Campaigning Organisations are often perceived to be more trustworthy than Government because they often disseminate simplistic explanations that are conceptually easy to understand but which may not meet rigorous scientific evidentiary criteria. This is often confounded by so-called 'Experts' who do not have relevant expertise being interviewed by the media. Communicating Science relies on existing knowledge rather than speculation.
    c. Generally, in the absence of information people go for the 'worst case' scenario' (and often exaggerate the likely outcomes) especially at the early stages of incidents.

    d. It requires luck for the precautionary principle to work when the diagnosis is incorrect and the precaution is applied to the treatment of the wrong claimed cause.

[1] Illing, H P A (2009). Toxicology and disasters. In 'General and Applied Toxicology', 3 Ed, (editors Ballantyne, B, Marrs, T C, Syversen, T) Chichester; John Wiley. pp3043-3076.

[2]Clay, J, Illing, P and Perret, J (2007). The applicability of traditional health risk analysis and ill heal;th models in the investigation of medically unexplained physical symptoms. Toxicol Env

Health A70, 1664-1669, and the work of R Bartholomew and S Wessley on mass hysteria incidents.

[3]Lowermoor: Lowermoor incident health advisory group (1989). Water pollution at Lowermoor, North Cornwall. Truro: Cornwall and Isles of Scilly Health Authority. Lowermoor Incident advisory group (1991). Water pollution at Lowermoor, North Cornwall. Second report. London: HMSO Committee on Toxicology (2005). Sub group report on the Lowermoor Water Pollution Incident. Consultative report, January 2005.
http://cot.food.gov.uk/pdfs/lowermoorreport05.pdf

[4]Melbourne airport: Bartholomew, R E (2005). 'Mystery illness' at Melborne airport; Toxic poisoning or mass hysteria? Med J Australia 183, 564-566

Notes:

The RSC is the UK Professional Body for chemical scientists and an international Learned Society for advancing the chemical sciences. Supported by a network of over 47,000 members worldwide and an internationally acclaimed publishing business, our activities span education and training, conferences and science policy, and the promotion of the chemical sciences to the public.

The RSC's Royal Charter obliges it to serve the public interest by acting in an independent advisory capacity, and we would therefore be happy for this submission to be put into the public domain.

We hope the above comments are of assistance. Please do not hesitate to contact us should you wish us to expand on any of these points.

Royal Society of Chemistry

7 December 2011

Written evidence submitted by Professor Wade Allison (Risk 04)

My name is Wade Allison. I am Emeritus Professor of Physics at the University of Oxford and Fellow of Keble College. I believe that my knowledge and experience would be useful and of interest to the Committee.

A. Executive Summary

The public fears nuclear energy because of what the radiation might do. The safety of radiation should be distinguished from the engineering problems of reactor control -- all nuclear accidents have concerned the latter. The impact of radiation on people has been minimal. The public accepts moderate to high doses of radiation when used for health, but in other contexts the public perception has been shaped by history and politics, not science. Non-medical international safety standards have been established to appease popular concerns by specifying levels found in nature, As Low As Reasonably Achievable (ALARA). Modern biology has demonstrated that no harm comes to people from radiation levels up to 1000 times higher, As High As Relatively Safe (AHARS). The local damage to public health and the economy at Chernobyl and Fukushima by ALARA regulations has been extremely serious and without benefit of any kind. The global damage done to future prospects for nuclear power in democracies is threatening.

It is recommended that

1. public trust in nuclear energy should be built on the existing acceptance of medical radiation dose levels through a programme of open and explanatory public education in schools and other fora;

2. the UK, through academic and other channels, should bring every influence to bear on ICRP and IAEA to ensure that internationally recommended ALARA "safety" levels are replaced by real safety levels (AHARS) without delay, so as to ensure that the world does not continue to be "spooked" by the one major energy source that could support future economic stability without damage to the environment.

B. Brief Introduction and Background

1. My name is Wade Allison. I am Emeritus Professor of Physics at Oxford and Fellow of Keble College. I have researched and taught a number of courses in Medical Physics, Nuclear Physics and Radiation Physics in the past 40 years at Oxford. After writing an advanced text book "*Fundamental Physics for Probing and Imaging*" (Oxford, 2006), I became concerned about the actual safety of ionising radiation and how it related to regulations and public perceptions. In particular, misunderstandings seemed, and still seem, likely to encourage decisions on future energy supply to be made that would not be in the best interest, scientifically, climatically and economically.
2. The population at large knows little about radiation, and few in the scientific community straddle the disciplines from nuclear physics to clinical medicine. It is not in the career interest of a young scientist to enter this important area, riven by popular misconceptions and public angst. It seemed like a useful and important matter for me to take on, given my scientific background. The science is straightforward but the educational task is harder.
3. In 2009 I published a popular book, "Radiation and Reason***, The Impact of Science on a Culture of Fear***", aimed at a non-scientific audience but supported with real scientific

arguments and data so that people can understand -- that is feel some ownership of the ideas. I am told that I have succeeded. It seems that the book and the related website have attracted attention around the world.

4. Whenever invited (about once a week) I give public lectures and Q&A sessions at discussion clubs, formal lectures, schools, hospitals, professional bodies, universities, etc. I have also visited Australia for this purpose. I have written invited articles for the media (eg BBC, The European) and for professional journals (eg British Journal of Radiology).

5. Fukushima created worldwide interest in the science-based reassurance in my book. In Japan, as elsewhere, few people have any understanding of radiation and its effects, and so they are easily frightened -- and the press even more so. At the time of the accident the rush of foreign nationals to leave Japan was little short of international panic. But on 28 March I wrote of the effect of the radiation "*no-one has died - and is unlikely to*". The Japanese authorities have been blamed in the press for the way the accident has been handled, but that is not appropriate, as I explained in a video interview recorded in Japan.

6. I visited Fukushima in early October and spoke with schoolteachers, doctors and community leaders in the affected area. They confirmed what I had anticipated: that fear and distrust are having a destructive effect on communities; that food restrictions and evacuations are inflicting great stress on public health, all without apparent benefit. I gave public lectures, Q&A sessions and press interviews in Tokyo. There were no heated arguments, just opportunities for reasoned reassurance.

7. In five years of work on this subject I have reached many conclusions. Details may be found in the book. Text files and more are downloadable, including the Conclusion and Fukushima Epilogue. My invited paper due to be delivered to the British Institute of Radiology on 12 December 2011 is very relevant and includes technical data.

C. Factual points and details.

These are summarised as a series of numbered points. A more relaxed and discursive treatment is to be found in my book. (I can make a number of extra copies available on request.)

1 Nuclear safety is two separate subjects, risks to reactors and risks to people. These do not overlap although few people make the separation.

1.1 In an accident the nuclear reactor(s) usually destroy themselves, eg Windscale, Three Mile Island, Chernobyl, Fukushima. Controlling and stabilising a nuclear reactor is an engineering problem that is expensive but well regulated. It should not need to be a matter for global concern.

1.2 The direct effect of radiation on people, including site workers, is rather small, both in the immediate aftermath of an accident and in its long term impact (cancer). Except at Chernobyl where about 50 died, nuclear radiation and radioactivity from reactor accidents have caused no deaths, identifiable individually or statistically. [None are to be expected at Fukushima, even among the workers, even in the next 50 years.] Why have there been none? Modern radiobiology provides answers to this question, as I have tried to explain in simple terms.

2 Why are people worried about radiation? Two reasons:

2.1 Memories from the time of the Cold War. However, like "WMD" and "45 minutes" the scare stories do not survive proper scientific scrutiny in the 21st century. The blast, fire and immediate radiation effect of a nuclear weapon may kill many, but the "lingering radiation" kills very few survivors, as is now known from the study of survivors of Hiroshima and Nagasaki (published figures give 1 in 200 within 50 years).

2.2 Radiation and radioactivity are invisible and cannot be felt. Two answers can be given to reassure:

2.2.1 Get a simple radiation detector. Today with modern electronics a detector should be cheap and easy to use. In fact a domestic smoke detector uses a radiation detector that could be redesigned for the task. Teenage students should learn about them in school and should take them home to explain to parents. Everyone should be able to see if there is any radiation -- it's as simple as burnt toast!

2.2.2 Modern radiobiology confirms that, although we do not consciously feel radiation, the cells of our body do so -- and are able to repair the damage it causes using a number of overlapping repair kits. Responsibility for protection against radiation damage has simply been devolved to a local level. The brain should relax!

3 Radiation used in clinical medicine for personal health. The various types of ionising radiation used in health care are similar to those used in nuclear technology, or otherwise found in the environment. The only difference is that the public trusts the medical profession to use these reasonably (and the media do not create alarmist news about such uses).

3.1 The public welcome moderate radiation levels, from both internal and external sources, for medical imaging (CT, PET, SPECT scans), with a single acute dose of about 5-10 millisievert.

3.2 In radiotherapy the public are thankful for doses greater than 20,000 millisievert spread over a month inflicted on normal healthy parts of the body near the treated tumour that then recover. Everyone knows someone who has benefited from such treatment.

4 Current radiation "safety" levels for the environment

4.1 These are recommended by the International Commission on Radiological Protection (ICRP) with support from the IAEA. National regulations then follow such advice, more or less -- it is difficult for them to do otherwise without raising public ire.

4.2 To allay historic public fears of radiation, these recommendations are set As Low As Reasonably Achievable (ALARA), that is close to levels in nature, about 1 millisievert

per year. This is a level of appeasement, not safety. A recoverable peripheral radiotherapy monthly dose is more than 20,000 years of ALARA-level dose-rate!

4.3 This ALARA-based level is unreasonable as a safety level.

5 Damage to the public interest from current ALARA-based "safety" regulations

5.1 At Chernobyl, as reported by UN, WHO and others, aside from 50 deaths and the successfully treated child thyroid cancer cases, the major health effects were caused by stress as a result of evacuation, poor information and a "victim" culture.

5.2 At Fukushima the evacuation zone and clean up level has been based on 20 millisievert per year. Suicides, fatal disruption of old people, destruction of businesses and breakup of communities is the result. Two comparisons:

5.2.1 this annual dose is the same as two harmless scans in a year;

5.2.2 this annual dose is so low that it would take 1000 years to accumulate what the radiotherapy patient gets in one month -- and then says "thank you" for further years of life in most cases.

Meanwhile, fear of radiation in Japan is such that parents march in the belief that 20 millisievert per year is too high and that the Japanese Government is not to be trusted.

5.3 Food destruction based on ALARA has significant economic consequences that outweigh any possible benefit. The radiation authorities, later, publicly regretted the meat destruction in Norway and Sweden after Chernobyl. Yet the same error has been repeated at Fukushima. Specifically, it would be necessary to eat one tonne of condemned Japanese meat in 4 months to receive the same dose as a (harmless) radiation scan (this statement is based on personally checked officially published numbers).

6 Suggested new conservative radiation safety levels for the environment, in everyone's best interest

6.1 Safety of radiation should be As High As Relatively Safe (AHARS), mindful of other dangers, local and global.

6.2 Suggested conservative levels based on scientific study have four parts

6.2.1 max 100 millisievert in any single acute dose

6.2.2 max 100 millisievert total in any month, that is 200 times less than accepted by the radiotherapy patient

6.2.3 max 5000 millisievert in a lifetime

6.2.4 in the future these levels should be allowed to increase in the light of advances in radiobiology

6.3 Comment: broadly these AHARS levels are 1000 times greater than current ALARA, that is relaxed by 1000 times.

6.4 A full written scientific review has been invited by the British Institute of Radiology (BIR). Accordingly, an academic paper in support of these levels has been submitted to the British Journal of Radiology with the title "*Radiation and Public Trust; The case for a major relaxation of environmental safety levels*". It will be presented as an invited lecture at the Institute's open meeting, "Chernobyl 25 years on", on 12 Dec 2011.

7 How do people respond?

7.1 The media and public figures speak of a "nuclear debate" and the need to present both sides -- but a dialogue between fear and science should not be described in that way. Scientific understanding is not achieved through the cut and thrust of adversarial challenge. The science is not difficult to understand but changing minds on any topic is hard.

7.2 My experience from lecturing is that the public is interested and trusting when they feel that they are not being talked at. Currently, they are sensitive to whether a speaker is in the pocket of an interested or commercial party. Once reassured, they listen, ask questions and engage. The press, driven by a need to deliver copy, often do not. In 2

years of lecturing I have not encountered the strong "anti" opinions that many expect others to hold. Of course the press want to keep any confrontation alive, but any opposition is confined to:

7.2.1 the genuinely frightened (who usually listen, ask questions and respond);

7.2.2 a few dedicated frighteners (who run away when faced with real science);

7.2.3 some safety professionals (who see reputations and jobs at risk).

7.3 National reactions. These vary widely, often divided by recent national history, seldom brought together by science. Perhaps I should add that the following views are personal rather than scientific.

7.3.1 Germany is in the power of the Green vote. They suffered from being on both sides of the front line in the Cold War, so fear of radiation is deeply engrained. My contributions have been reported there as contributing positively to discussion. In 2011 there have been more than 3 times as many visitors to my website from Germany as from France. Perhaps there is more internal debate -- Germany may yet turn back to nuclear technology -- but in the meantime opportunities are available for UK PLC.

7.3.2 France. The French population at large are remarkable disengaged except for the educated elite. The opportunities for close cooperation with the UK are very positive. They need us politically and financially and we need their experience, but the lack of public interest is a concern.

7.3.3 Japan. History has given Japan a particularly fearful view of radiation. At Fukushima, the traumatised reaction to the tsunami (over which they were powerless) has been transferred, perhaps, to worries over radiation (on which they are engaged in recrimination). The UK has played a commendably constructive part in calming fears in Japan through the visit of Weightman.

7.3.4 Australia and New Zealand. Although there is a traditional opposition to nuclear technology, opinion encountered on the internet (and at lectures when I spoke in Australia in October 2010) is more positive.

7.3.5 United States. Opinion is heavily influenced by historical perceptions and rarely by understanding of the underlying science. Their concern over possible litigation often prevents them from asking the right questions. Radiation safety should be decided by science, not in the courts. US perspectives tend to carry disproportionate weight in the formation of international opinion.

8 <u>Suggestions for future action</u>

8.1 The ALARA safety regulation philosophy should be changed. The UK should make a major contribution by pressing for this through ICRP and IAEA. My review submitted to BIR ends with a warning

"*To this end world authorities, such as ICRP and IAEA, should show leadership without delay. It would be unfortunate for the prosperity of Europe, USA and Japan, if they remained victims of scientifically out-dated fears, but even more unfortunate if some nations broke ranks by treating nuclear radiation safety more realistically on their own. It would be better for the nations of the world to move forward together with agreed standards into a new beneficial nuclear age.*"

The USA has contributed to excessive alarm over Fukushima and should do some serious thinking. It has been too ready to wield fear of radiation as an out-dated weapon of cultural influence. The results have been most unfortunate. The UK is in a good position to show leadership.

8.2 Education and trust. In the UK a vigorous but sympathetic educational programme is needed, building on popular experience of the benefits of radiation in clinical medicine to establish trust. Schools and Colleges should be offering more information and courses, from open public lectures that aim to reassure, to attracting young people into the industry to rebuild the UK skills base in this area. (This can be done -- the entire

nuclear industry was built between 1940 and 1944 without any existing nuclear skills base at all.) Radiation detectors should be made available. School children should be invited to take them home with instructions to explain to their parents. Reassurance, discussed with friends or over a family meal, is the fastest word-of-mouth route to public understanding and acceptance. Visitor centres, where access is currently restricted on grounds of safety, should be more active in attracting the public. UK radiation safety education programmes that proved successful would have value worldwide as cultural exports, for example through the BBC.

8.3 New realistic safety regulations should bring large cost savings to any nuclear programme. While no corners should be cut in respect of the control of reactor stability, large parts of the cost of nuclear power would be reduced dramatically with more reasonable safety standards, whichever particular technology is used. Certainly no technology should be chosen, and no delay in the UK nuclear programme should be countenanced, purely on the grounds of the current unjustifiable safety standards.

D Declaration. I am a retired academic. I have no axe to grind and no financial or contractual connection to any interested parties. I have published the book referenced in my submission. Total sales and free distribution have been 1,600 for the English edition, so far, and I understand a similar number has been sold in the Japanese edition. My visit to Japan was at my personal initiative. In particular, no contribution to expenses was received from any Government, utility, press, industry or other interested party.

Professor Wade Allison

8 December 2011

Written evidence submitted by the British Geological Survey (Natural Environment Research Council) (Risk 05)

Submission regarding the following matters as specified in the Terms of Reference:

- What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?
- To what extent can public perceptions be changed by improving risk communication?
- How do risk perceptions and communication issues in the UK compare to those of other countries?

Key factors

1. The UK, together with many countries around the world, continues to face difficulties with all things nuclear – from building new reactors for energy generation to the geological disposal of radioactive waste. Technically speaking, both reactor construction and geological disposal are well understood and have a firm scientific basis enabling informed judgements to be made. However, particularly for the construction of repositories and disposing of waste, national programmes continually stall because of concerns and fears of the various stakeholders; indeed a significant proportion of the public still asks whether a repository or a nuclear power plant is safe.
2. Most people remain unconvinced that living next to a nuclear power station or a deep repository for radioactive waste (especially for high-level waste) is safe. Anything "nuclear" is seen as dangerous, polluting and unpredictable. Much of this anxiety is the result of decades of concerns about nuclear weapons, radioactive fallout from atmospheric bomb testing and long-term effects of exposure to radiation. Such worries are confirmed and reinforced by "incidents" (used as a neutral term in this document) at, for example, Windscale (1957), Three Mile Island (1979), Chernobyl (1986) and, of course, at Fukushima in 2011.
3. Compounding the problem of confidence in the nuclear industry is secrecy – or at least the failure to openly provide relevant and sufficient information – which has too often resulted in a feeling that "they" (the authorities and the experts) are not telling the whole truth. It could be argued that this is the current situation in the UK. Additionally, many scientists lack the necessary communication skills and are poorly equipped to present their work clearly to non-specialists – particularly when attempting to provide clear and unambiguous answers to difficult questions conveying, for example, the idea of risk. There is also the argument from anti-nuclear groups in many countries that "solving" the waste disposal problem only encourages the nuclear industry to continue its "dangerous" activities – indeed many opposition groups now use this link to block any new nuclear power stations until the waste "problem" is solved.

4. Building the confidence of non-experts in the nuclear industry in thus a crucial, but extremely difficult task that must be undertaken if both nuclear new-build and the disposal of radioactive wastes are to be achieved. Only by achieving this confidence, based on sound science and a recognition and acknowledgment of anxieties, can the nuclear industry progress. The communication of risk forms part of this building of confidence. The trick is finding effective communicators, who are also excellent scientists, who can inspire trust and confidence in all groupings.

Risk Perceptions and Experience in other countries

5. Lessons can be learnt from the communication experiences in other countries, particularly with regard to the geological disposal of radioactive waste (West and McKinley, 2007). For example, comparisons between the communication styles in Finland, France, Sweden and the UK reveal two patterns. The "Decide-Announce-Defend" (DAD) approach to site selection has been used extensively in the past in France and the UK. Unfortunately, this has not been particularly successful in its goals and has generated considerable suspicion of the nuclear industry and manifestly not improved the confidence of non-technical groups, in particular with regard to the "riskiness" of a repository. This approach is now often called DADA ("Decide-Announce-Defend-Abandon") because it is ineffectual. By contrast, the "Review-Decide" pattern currently followed in Finland and Sweden (and now used in the UK by the Nuclear Decommissioning Authority NDA and in France) is open, with plans for the disposal of waste in the public arena for scrutiny and comments.
6. Although the "Review-Decide" pattern is not without its own problems (timescales can be very long and it can be an expensive process), it is much more successful in building confidence. However, it must have a sound scientific basis. For example, the use of natural ("nature's laboratories") and archaeological analogies (so called "natural analogues") to illustrate difficult scientific concepts to non-technical parties is now widely used by many organisations and training courses (e.g. www.natural-analogues.com ; http://www.nagra.ch/g3.cms/s_page/83290/s_name/naturalanalogues ; http://www.itc-school.org/index.php/Present-Courses/Utilisation-of-Natural-and-Archaeological-Analogues-in-waste-disposal-2012.html ; Miller et al, 2000) although these must be used with care (see paragraph 9 below).
7. Examples of communication styles in other countries are also useful, particularly in Japan, which has over 50 nuclear power reactors, providing one-third of its total energy requirements. The legacy of the Hiroshima and Nagasaki bombs plus a series of nuclear incidents in Japan in the 1990s and 2000s, which were not always handled in the best and most open way by the nuclear industry, has meant that, even before the Fukushima Dai-ichi incident in March 2011, there was a serious mistrust and lack of confidence in all things nuclear in the Japanese population.
8. The releases of radioactivity from the Fukushima Dai-ichi power plant and ensuing contamination of the surrounding area, resulted in accusations that the risk associated with the site had been underestimated by the nuclear industry and by the Japanese government; and that the robustness of the older reactors at the site had been over-estimated. This criticism is certainly well founded and the fundamental problem of low-probability, high-consequence events and the experience of Fukushima had led to proposals for

improvements in many national programmes. However, the attribution of blame is continuing in Japan but what is happening, following Fukushima, painfully illustrates how societal "nuclear" memories coupled with poor communication have led to the extremely difficult position in which the Japanese nuclear industry finds itself today.

9. Additionally, Chernobyl was linked to the Fukushima incident, even in its earliest stages and generated a lot of fear in Japan. This was not a correct analogy, which technical experts understood but were unable to communicate effectively, and, as a result, the link is still powerful. This linkage illustrates the importance of using the correct analogy when attempting to explain complex issues to non-experts and having a well established, proactive and interactive communication strategy in order to rectify such errors. Indeed much can also be learnt from examining the global history of incidents at nuclear reactors to both allow Fukushima to put into context and to provide better sources of experience to help remediation efforts in Japan (McKinley et al, 2011). Such comparisons will also help the UK and other countries when addressing nuclear infrastructure projects.

Lessons for other Energy infrastructure projects

10. The capture and geological storage of carbon dioxide (CO_2) from power stations (carbon capture and storage (CCS)) is a developing technology which will help mitigate greenhouse gas emissions. The UK government is very supportive of the technology and it is likely that a major demonstration site will be built in the near future. Although it is extremely likely that UK emissions will be stored in off-shore geological formations, it is important to recognise that the 'riskiness' of injection of CO_2 into on-shore storage sites is now stopping the technology in many countries e.g. Netherlands http://www.dutchnews.nl/news/archives/2010/11/barendrecht_co2_storage_plan_h.php and Germany http://www.nytimes.com/gwire/2010/04/07/07greenwire-frightened-furious-neighbors-undermine-german-35436.html?pagewanted=all .
Again, the "DAD" pattern of communication seems to have been adopted which has stalled some projects. It is important to recognise that the communication errors made by the nuclear industry seem to be being repeated in the search for CO_2 injection sites, albeit in European on-shore sites. It is essential that the other errors in communication made by the nuclear industry are not repeated in the drive to store CO_2. There is much that can be learnt by the nuclear and CCS industries having an exchange of experiences (see article by Chapman et al, 2011 also available at http://www.geolsoc.org.uk/page10374.html).

Declaration of interests

Julia West, JP, PhD, CBiol, FSB is a Principal Scientist at the British Geological Survey (Natural Environment Research Council). Dr West has over 25 years' experience working on the geological disposal of radioactive waste in UK and overseas programmes including those in Europe (France, Sweden, Switzerland), Canada and Japan. She is not only recognised for her scientific expertise in this area but also for her advice to implementing organisations when developing communication strategies relating to nuclear issues.

References

Chapman, N A, West, J M and Bruno, J. 2011. Encounter at Meiringen – can CCS and radwaste find common ground? Geoscientist. September 2011. pp 12-17. Also at http://www.geolsoc.org.uk/page10374.html

McKinley, I G, Grogan, H A and McKinley, L E. 2011. Fukushima: an overview of relevant international experience. Journal of Nuclear Fuel Cycle and Environment, 18 pp 89-99.

Miller, W. Alexander, R, Chapman, N A, McKinley, I G and Smellie J. 2000. Geological disposal of radioactive wastes and natural analogues. Pergamon, Elsevier Science Ltd, Oxford, UK.

West, J M, and McKinley, L E. 2007. Building confidence in the safe disposal of radioactive waste. In: Deep Geological disposal of Radioactive Waste (W R Alexander and L E McKinley, Editors). Radioactivity in the Environment Vol. 9. Elsevier, Oxford, UK. pp 227-249.

Dr Julia West
British Geological Survey (Natural Environment Research Council)

12 December 2011

Written evidence submitted by Mr Fred Dawson (Risk 06)

Personal details and declaration of interests

1. Until my early retirement in 2009 I had been employed by the Ministry of Defence. My career as a health and safety specialist spans over 30 years. The earlier part of my career was spent providing advice to the Ministry Defence research establishments including Aldermarston and Porton Down. In more recent years as Assistant Director Health Physics of the Ministry of Defence Central Safety Organisation I have represented the Ministry of Defence's interests in the development of national policy, legislation and responding to Ministerial business Parliamentary Questions etc relating radiation protection.

2. Since my early retirement in 2009 I have been an independent researcher and consultant researching the legacy of past and current military activities and the impact on both man and the environment.

Education / qualifications.

- Bsc Hons Degree in Occupational Hygiene Polytechnic of the Southbank 1978.
- Chartered Radiation Protection Professional.
- Member of the Society of Radiological Protection

Statement of Evidence

What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?

3. A key factor about the public's perception of risk form the nuclear energy sector is that military origins of the civil nuclear programme. The continuing MOD' secrecy and lack of transparency in relation to nuclear safety issues and the continuing exemptions etc from civil regulation such as the Nuclear Installations Act does nothing to improve public confidence in Defence nuclear safety and more generally civil nuclear safety.

4. At a technical level the HSE/ONR do a good job in providing information about risk for use by the technically literate; but needs to more proactive in reaching out to the wider public. The difficulty with engaging with the wider public is that in my experience they only become interested when issues impact directly on them.

5. Public perceptions are to a large extent influenced by the media who tend to draw on the more sensationalist views of risk, often promoted by groups such as the low level radiation campaign and the European Committee on Radiation Risk. These views feed peoples fear and dread of contracting cancer in themselves or their children. I very rarely see media reports or these groups' views being challenged.

How are public risk perceptions taken into account in the planning process for energy infrastructure?

6. That those communities taking on a risk for the benefit of society as whole should be properly compensated for that risk and blight caused (eg reduced property prices, impaired views, noise etc). Blight being a contentious issue for proposed wind farms and pylons etc.

How effectively does local and central Government communicate risk and could it be improved?

7. The absorption of the NRPB into the HPA has lowered the public profile of radiation/nuclear safety as radiation protection is only a small part of the HPAs remit.

8. The understanding of nuclear power and risk can be improved through changes to the educational system. This could be addressed by how students are taught about climate change and the choices that have to be made; and that every form of energy production carries risks and environmental impacts.

9. When incidents happen there has been a tendency to avoid saying anything negative and to wait until the media break the story. However in my personal experience it is always better to say we got this wrong and to explain how we are putting things right. This provides an opportunity to come clean and present the issues first to the public maintaining the presentational initiative.

To what extent can public perceptions be changed by improving risk communication? (please provide examples).

10. An acceptance by the public that life is not risk free and in the end we will all die. One three of us will contract cancer. That there is far from a complete understanding of what causes cancer, but that radiation can play a part in the development of some cancers. We cannot definitely answer peoples question "what caused my cancer" as there are often many causes, each contributing to a greater or lesser extent depending on circumstances.

11. An excellent example of balanced reporting on nuclear safety was the BBC programme "Bang goes the theory" http://www.bbc.co.uk/programmes/b015t2rr

12. *"In the aftermath of the Fukushima radiation scare, the team turns its attention to nuclear power. Jem climbs into a reaction chamber to explain how a nuclear power station works and what happened in Japan. Meanwhile, Dallas investigates the clean-up operation for radioactive waste, and Liz looks at what radiation does to the human body"*

13. Encourage the Society of Radiological Protection http://www.srp-uk.org/ , the Nuclear Institute http://www.nuclearinst.com/t and the European Nuclear Society http://www.euronuclear.org/ , to actively engage with the public to play an even greater role in risk communication

    Key points to improving public confidence in those communicating about risk are

    - demonstrable independence,
    - transparency,
    - stakeholder and public engagement in decision making
    - authoritative information and knowledge
    - institutional trust

14. Good examples of stakeholder engagement which I have personally participated in include

    - Cowam http://www.cowam.com/
    - Safegrounds http://www.safegrounds.com/
    - NDA stakeholder dialogue

15. All of these initiatives used independent facilitators bringing together stakeholders, many of whom hold divergent views. The facilitated dialogue provided an excellent means of framing issues and understanding stakeholders' views on risk and to greater or lesser extent forming a consensus on various contentious issues. The process enables people to learn about other stakeholders points of view on issues such as risk. The process is also seen to directly influence decisions and because of this stakeholders are willing to put time and effort into the process.

How does and should the Government work with the private sector to understand public perceptions of risk and address them?

16. Provide better public access to nuclear facilities for tours and using those employed on the plant as guides rather that media staff. Practical demonstrations to show that we are all exposed to radiation from natural sources as well as manmade sources, this serves to put exposure and doses and risks from nuclear power stations into perspective.

17. Government needs to work with the private sector and regulators to ensure a coordinated approach to the communication of risk with both short and longer term goals.

18. Joint sponsorship of online events and websites separately targeting children, teenagers, students, adults. This should include partners such as the Science Museum Dana Centre

19. http://www.danacentre.org.uk/

20. Government needs to work with the private sector to improve communications with the media making available industry and government experts in the short timescales time needed by the media rather than putting out bland statements of reassurance lacking in credibility.

How do risk perceptions and communication issues in the UK compare to those of other countries?

21. The public's perception of risk in part differs from countries such as Sweden because the UK possesses nuclear weapons. The debacle of NIREX and the national repository served to damage public confidence with the impression that science was being used to support a decision that had already been made. The subsequent reluctance by the government to release the list of sites did little to help. This contrasted with the much more open approach in countries such as Sweden and Switzerland where central government allowed local communities a greater opportunity to participate in making decisions on the sighting of repositories.

Fred W P Dawson

12 December 2011

Written evidence submitted by
Martin J Goodfellow and Adisa Azapagic (Risk 07)

Key Points

- Scientific understanding of risk perception has improved considerably over the last 50 years. However, there is still no 'grand theory' of risk perception that can explain why individual people perceive the same risk in different ways.

- Risk communication should move beyond simply presenting people with 'facts' and attempt to engage the public in two-way discussions on perceived risks. This engagement should be endemic to planning processes.

- Government can play a role in two-way public engagement on perceived risks of energy infrastructure but it must be careful to avoid a heavy handed approach that may be perceived as an attempt to coerce the public into 'falling into line'.

Authors' Declaration of Interests

1. **Corresponding Lead Author; Martin J. Goodfellow BSc(Hons) MIET AMInstP**, Post-graduate Research Engineer, Sustainable Industrial Systems Group, School of Chemical Engineering and Analytical Science, The University of Manchester.

2. Martin is working on his doctoral thesis, ***RESearch into the Public Perception Of Nuclear Design [RESPPOND]***, co-funded by the Engineering and Physical Sciences Research Council (EPSRC) and Rolls-Royce Plc via the Dalton Nuclear Institute at the University of Manchester. At the time of writing, Martin is on a three-month EPSRC-funded Fellowship at the Parliamentary Office of Science and Technology.

3. **Co-author; Professor Adisa Azapagic FIChemE FRSC FRSA**, Head of Sustainable Industrial Systems Group, School of Chemical Engineering and Analytical Science, The University of Manchester. Further information can be found here: www.sustainable-systems.org.uk

4. Professor Azapagic is currently leading or is involved in a range of research projects, including Sustainability Assessment of Nuclear Power (SPRIng) and also supervises Martin Goodfellow's doctoral research. For further information see www.springsustainability.org.

5. The views expressed in this response are those of the authors and do not necessarily represent the views of their employing organisations, any of the funding bodies or other parties identified above or mentioned below.

Response to the Questions:

Q1. What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?

6. There is a wealth of scientific literature which has built up over the last 50 years[1] detailing the many different psychological[2], sociological and cultural influences[3] on risk perception. Some theories are better than others at predicting how individuals, or groups (large and small), will respond to any given risk, but there is no definitive theory that fully explains risk perception.

7. Factors that play a role in the level of perceived risk include[2]:

- level of control over the risk;
- how much 'dread' is associated with the risk;
- the magnitude of the consequences of the hazard;
- proximity to the risk; and
- how unknown the risk is.

8. Ongoing two-way communication involving the public and allowing them a real opportunity to feel ownership and influence projects and decisions may have some impact on the tolerability of 'risky' energy infrastructure facilities and projects. However, it can be difficult to measure the specific impact of one scheme over another, or compared to doing nothing.

9. Furthermore, it is too simplistic to consider 'the public' as a single entity. A wide range of views exist on energy infrastructure projects such as new nuclear power plants or wind farms. Even within local areas there can be significant variations in the views held by different groups of the public[4]. Therefore, it is more appropriate to refer to the 'publics' rather than the 'public'.

Q2. How are public risk perceptions taken into account in the planning process for energy infrastructure?

10. The current planning process for energy infrastructure has some positive features, such as high levels of transparency in the availability of documentation via the internet and a simplified approach that invites public involvement.

11. However, there are potential issues around when and how the public is invited to become involved. An example of this can be seen with new nuclear power stations:

- Nuclear Plant safety information is made available to the public during the Generic Design Assessment (GDA) process in its unaltered 'engineering' form. Whilst this is transparent, it is unlikely that the public will be in a position to understand the large volumes of deeply complex technical safety documents. Therefore, the government should think about the ways to provide relevant information in a format more suited for the general public.
- Following GDA approval, the local site planning process begins. Although the public can get involved at this stage, the potential exists for them to feel disenfranchised. For example, the public may feel that once the GDA has been approved, the new plant is a 'done deal' by the time the local site assessment process begins.

[1] Goodfellow M. J., H. R. Williams, and A. Azapagic (2011). Nuclear Renaissance, Public Perception and Design Criteria: An Exploratory Review. *Energy Policy* 39(10) 6199-6210

[2] Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., Combs, B., (1978). How Safe is Safe Enough? A Psychometric Study of Attitudes Towards Technological Risks and Benefits. *Policy Sciences* 9, 127-152. Slovic, P., (1987). Perception of Risk. *Science* 236. 280-285.

[3] Douglas, M., Wildavsky, A., (1982). Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers. University of California Press, Berkeley.

[4] Wynne, B., Waterton, C., Grove-White, R., (2007). Public Perceptions and the Nuclear Industry in West Cumbria. Centre for the Study of Environmental Change, Lancaster University.

Q3. How effectively does local and central Government communicate risk and could it be improved?

12. It is very difficult for large institutional organisations (such as the Government) to communicate risk to the public. This is for two reasons in particular:

- firstly, many risk issues are often described scientifically by technical and complex language that are not easily understood (however, modification or simplification of this language could also be perceived as 'airbrushing' or 'spin'); and
- secondly, it is potentially difficult for the Government to appear impartial when it has a vested interest in energy infrastructure projects succeeding.

13. With respect to the former reason, successive Governments have attempted (with varying degrees of success) to translate technical risk arguments into 'plain' language. However, there is debate within the scientific community about the success of the different methods that can be adopted to achieve this.

14. Whilst recognising that the Government must be seen to act to allay any fears caused by perceived risks, it must also be recognised that actions taken by the Government that are perceived to be biased or disingenuous may make the situation worse. This has the potential to lead to misunderstanding, sensationalisation, or further erosions of trust.

15. Increasing transparency of documentation during planning and risk assessment processes is a positive move. However, this is not a 'silver bullet', as many documents that are made publicly available are written in complex technical language that the public struggles to understand. Furthermore, it is well know that 'throwing' more and more information at the public does not make people more informed or change their views. Therefore, the government should adopt a multi-pronged approach, enabling and facilitating a real two-way engagement with the public.

4. To what extent can public perceptions be changed by improving risk communication?

16. There is a real danger in believing that people simply need to be 'shown the truth', or convinced that their perception of risk is incorrect, either through provision of facts or persuasive argument. Many perceptions of risk are based on distorted or inflated views of real risks[5]. In some circumstances presenting facts in a simple, clear and logical way can assist in reducing such distortions or inflations; but in other circumstances this may be ineffective.

17. Engagement with the public is not simply about presenting a message in an understandable (or simplified form). To really understand what the public believe, why they believe it, and what might be done to influence such beliefs, requires two-way engagement which is fully integrated into whatever infrastructure project is being considered.

18. It is not only changing a risk perception that is important. How this change is achieved, and in particular what role the public is allowed or invited to play, is often as (or more) important.

19. The timing of this public engagement is also critical. Ongoing engagement (which starts early in any given process) is likely to be more effective than presenting a final case for 'one-

[5] Pidgeon, N., Kasperson, R.E., Slovic, P. (Eds.). (2003). The Social Amplification of Risk. Cambridge University Press, Cambridge.

off' consideration (see above responses to question 2). Ongoing engagement, which starts early, has the potential to provide the public with real confidence that their views are being taken into account as decisions are made.

20. There is the caveat that on certain issues the public may not be particularly interested in engaging. This can be for a variety of reasons, for example, they may feel disenfranchised or powerless, they may not rank the issue in question as a noteworthy concern, they may have too many other issues to worry about to devote time to the issue in question, etc.

5. How does and should the Government work with the private sector to understand public perceptions of risk and address them?

21. As was described in the answer to question 3, it is very difficult for the Government to present risk information to the public and be trusted (by many) to be impartial. This situation is compounded when the Government is seen to be working with the private sector, particularly in the case of 'big business' such as the nuclear industry.

22. In terms of trust, European wide research has shown that governmental and industrial sources are not ranked highly by the public to provide impartial information on risk levels[6]. Government collaboration with industry may be perceived by some of the public as collusion.

23. The authors are currently working on research to define a new systems design framework and process for designing nuclear power plants which allows the incorporation of the views of the public at the early stages of design and beyond. This framework also includes an opportunity for other stakeholders (such as regulators and government) to provide input at this early stage. The framework is also in keeping with the private sector led, 'free-market', approach for new energy infrastructure currently taken by the UK Government. This work is due to be published in late 2012/early 2013.

6. How do risk perceptions and communication issues in the UK compare to those of other countries?

24. Some research has been carried out in this area with surveys showing the range of views on issues such as nuclear power[6] across the EU. Our most recently published research shows that 42% of the UK public are in favour of nuclear power[7]. Making international comparisons of risk perception and communication issues is very difficult because of the many different social and cultural factors at work.

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13 December 2011

[6] Eurobaromter 2007, (2007). Europeans and Nuclear Safety, European Commission.
Eurobarometer 2010, (2010). Europeans and Nuclear Safety, European Commission.
[7] Azapagic, A. et al. (2011). Assessing the sustainability of nuclear power in the UK. SPRIng report. www.springsustainability.org

Written evidence submitted by Professor Tom Horlick-Jones (Risk 08)

1. Preamble

1.1 This note responds to the House of Commons Science & Technology Committee's announcement on 9th November 2011 of an inquiry into risk perception and energy infrastructure.

1.2 It first provides a very brief commentary on the six questions set out in the inquiry announcement, which seeks to highlight what is known, and not known, about these topics, and to begin to relate these questions to matters of practical policy.

1.3 It then sets out more detailed observations relating to recent empirical evidence on the underlying character of lay worries about nuclear energy technologies.

2. Comments on the questions posed by the Committee

2.1 These questions cover a vast area of inquiry, which has been addressed by an enormous literature, drawing on ideas from sociology, psychology, economics, anthropology and other disciplines. I wonder if it would be wise for the Committee to focus on a small number of key themes, and to investigate these in more detail?

2.2 It is notable that the set of questions articulates certain themes in a slightly old-fashioned way. For example, there is a sense of 'deficit thinking' running though the questions, namely the idea that lay people would 'behave sensibly if only they knew the facts', a notion despatched rather effectively by the House of Lords Science & Technology Committee report on *Science and Society* (2000) a decade ago.

2.3 The Committee would appear to have considerable ground to cover if it really wishes to get to grips with attempts to reconcile lay sensibilities and the 'tolerability of risk', a notion first introduced by the Health & Safety Executive in connection with nuclear power stations back in 1988. This line of thinking, which seeks to ascertain appropriate levels of investment to establish given levels of risk has in recent years been elaborated perhaps most effectively in connection with the UK railway system (see discussion in Horlick-Jones (2008)). In practice, whilst such valuation exercises are useful in terms of promoting consistency across disparate industries, and in providing a basis for the legal protection of operators in the courts, they do little to provide an acceptable rationalisation for those caught up in the adverse side-effects of accidents and other failures. Ultimately, there is a need for the society in question to decide whether it can live with the possible adverse side-effects of a given technology.

2.4 Perhaps the most significant obstacle to attempts to arrive at mechanistic models of lay perceptions, and measures of tolerable risks, has been a

recognition in some quarters of the fluid and situational nature of sense-making about risk issues (see e.g. video material on themes in risk perception and risk communication at: http://www.cardiff.ac.uk/socsi/contactsandpeople/academicstaff/G-H/professor-tom-horlickjones-overview.html. Recent empirical work has demonstrated the ways in which lay people reason about risk issues changes as they learn more about the issue in question. In this way, providing more information about a risk issue, including the nature of the organisations responsible for its management may serve to reduce trust in its effective management. Lay people typically reason on the basis of what has been termed 'low information rationality', basing their views on simple cues that serve to capture the acceptability of those risks 'for all practical purposes' (Horlick-Jones, 2005; 2007; Horlick-Jones *et al*, 2007; cf. Popkin, 1994).

2.5 More recent research has begun to glimpse the significance for lay (and professional) understanding of risk issues of the complex communications ecology which an increasing proportion of the world's population inhabits, saturated as it is in a multiplicity of mediated knowledge (Horlick-Jones and Farré, 2010). This line of research poses a challenge to the established risk studies literature.

2.6 In the wake of the Fukushima incident, the contested acceptability of nuclear fission power technologies has been highlighted, with Germany for example deciding to discontinue its dependence upon such technologies. No matter how safe an industry can be made, with associated increased expenditure on safety measures, ultimately its acceptability turns of whether the society in question can live with possible failures.

2.7 In the following section I examine recent cross-cultural research that has shed new light on the nature of lay sensibilities about nuclear power technologies.

3. Recent research-based insights into the character of nuclear stigma

3.1 Here I provide an outline of recent work that I have conducted into the nature of lay practical reasoning about nuclear fusion, a technology distinct from the nuclear fission that is used in conventional power stations, and which seeks to 'capture the sun in a bottle'. Nuclear fusion is the form of power that powers the Sun and other stars, and which has long been recognised as a source of potentially safe, sustainable and essentially limitless power.

3.2 This work has been conducted in collaboration with colleagues in Spain led by Dr Ana Prades López, Head of the Socio-Technical Research Unit of the Spanish Government agency CIEMAT, which works on energy and environment issues. To date, our work has been published as a report by CIEMAT (Prades López et al, 2009) and as a paper in the international per-reviewed journal *Public Understanding of Science* (Horlick-Jones *et al*,

in press). An article is also currently in press at the *Bulletin* of the International Atomic Energy Agency (IAEA) (Horlick-Jones and Prades, in press).

3.3 We have used the term ‘nuclear stigma’, an expression coined by a number of North American scholars (e.g. Flynn *et al*, 2001), to reflect the idea that, in some sense, the ‘identity’ of the associated technology has been ‘spoiled’. People are typically alarmed at the prospect of nuclear facilities being located anywhere in their vicinity. The very word ‘nuclear’ seems to conjure up negative images of contamination and destruction. One can imagine how nuclear stigma came about. Despite the many gains associated with nuclear power, the accidents at Three mile island and Chernobyl, and the associations with nuclear weapons arguable continue to resonate in the public imagination.

3.4 Our recent work has taken a somewhat oblique approach to investigating the nature of nuclear stigma. We have been studying changes in reasoning practices among groups of lay publics as they encounter the idea of nuclear *fusion* for the first time, and begin to learn something about the technology. In a sense, we have been ‘taking a microscope’ to the processes that occur when people respond to pollsters’ questions. In other words, we were interested in the specific ways in which people make practical sense of the nature of fusion technology. We recognised that, whilst opinion polls are good at gathering large amounts of data on things with which people have some familiarity, they are not so good when people do not understand the issue in question, or perhaps have mixed feelings about it. Also when people contribute data to opinion polls, it is not possible to ‘look inside their heads’ as it were, to see what is going on. One way of addressing this latter problem is to get together groups of people to discuss the issues, and to listen very carefully to what they have to say.

3.5 We were interested in the participants’ early reactions to learning about the existence of fusion, and the fact that it is a specifically *nuclear* technology. Typically, we found talk that included disease metaphors and the figure of the Chernobyl disaster as interpretative devices. One participant spoke for many when she uttered ‘it sends shivers down your spine’. Others talked about nuclear weapons, and facilities that caused cancer in local children. All the groups displayed a great deal of reaction to the word nuclear that one might say was almost visceral in nature. Associating this technology with a nuclear label served to very powerfully communicate a rich set of ideas and images. Significantly, this was *not* a calculated response to information; indeed, it was evident that at the time these participants knew very little about fusion. Rather, the response seems to have been an instantaneous emotional sense of fear, prompted simply by learning that fusion is a nuclear technology.

3.6 As the participants came to learn more about fusion technology, and its possible role in future energy policy, we observed a noticeable degree of pragmatic support for the technology, and indeed for nuclear power

technologies more generally. Interestingly, this support tended to be rationalised not in terms of, for example, high-profile climate change-related arguments, but as a way of addressing very real concerns they felt about the cost and security of energy supplies.

3.7 So does this research suggest that if only people were encouraged to learn more about nuclear power, they would tend to become less frightened and more pragmatically supportive of these technologies? Well, our findings suggest it is not nearly as simple as that.

3.8 We made audio recordings of all the participants' conversations, and examined the talk in great detail. Our analysis revealed a number of features that were not immediately apparent at the time we ran the groups. Significantly, we found that the structure of the talk took on a characteristically *apologetic* form whenever participants said anything that might reasonably have been interpreted by fellow group members as pro-nuclear in nature. In its most explicit form, there were numerous instances when participants said 'sorry' to preface their rejection of energy sources that might be regarded as 'greener' in some respect. On other occasions, they displayed a clear need to account for the fact that they held views that might have been viewed as in tension with what one might call 'a reasonable suspicion of nuclear power'.

3.9 What is going on here? Well, these 'apologies' do not take the form of thought-out, formal, statements of regret. Rather, they seem to reflect a subconscious desire to be regarded by fellow participants as 'reasonable sort of people'. We suspect that they reflect deeply-held views about what constitutes socially-appropriate ways of behaving. As such, they suggest that the social norms and cultural formations of both Spanish and British societies possess an underlying fear of nuclear power technologies.

4. Some provisional conclusions from the research

4.1 What conclusions can one draw from the research described in section 3, above? First, there seems little doubt that the nuclear label, or 'brand' as we have come to think about it, continues to exert a powerful negative influence on the public imagination, certainly in the UK and Spain, and very likely in many countries around the world.

4.2 Second, we found what we regard as a considerable degree of pragmatic support for nuclear power technologies. Perhaps it is most significant that we found this tendency among environmentalists. This support did not simply reflect an 'absorption' of the technical debates about energy policy to be found in the media, but, more importantly, it was grounded in the everyday practical experience of our participants' rising energy bills and their worries about energy security.

4.3 Finally, and we feel, most important, there appears to be an unresolved tension between this pragmatic acceptance of nuclear power, and an underlying anxiety about these technologies that appears to operate, at

least in part, at a subconscious, culturally-embedded, level. Significantly, it is not at all clear to us *how any amount of public information would be able to address this source of anxiety*. As such, nuclear stigma seems likely to continue to pose a serious challenge for the future development of nuclear power.

References

Flynn, J., Slovic, P. and Kunreuther, H. (eds.) (2001) *Risk, Media and Stigma: Understanding Public Challenges to Modern Science and Technology*, London: Earthscan.

Horlick-Jones, T. (2005) 'Informal logics of risk: contingency and modes of practical reasoning', *Journal of Risk Research,* 8(3): 253-272.

Horlick-Jones, T. (2007) 'On the Signature of new technologies: sociality, materiality and practical reasoning' in Flynn, R. and Bellaby, P. (eds.) *Risk and the Public Acceptance of New Technologies*, Basingstoke: Palgrave Macmillan, pp.41-65.

Horlick-Jones, T. (2008) 'Reasoning about safety management policy in everyday terms: a pilot study in citizen engagement for the UK railway industry', *Journal of Risk Research*, 11(6): 679-718.

Horlick-Jones, T. and Farré, J. (eds.) (2010) *The Communicative Turn in Risk Communication: Theory and Practice*. Special issue of the *Catalan Journal of Communication & Cultural Studies*, 2(2): 127-285.

Horlick-Jones, T. and Prades, A. (in press) 'The enduring challenge of nuclear stigma', *IAEA Bulletin* (published by the International Atomic Energy Agency).

Horlick-Jones, T., Prades, A., and Espluga, J. (in press; published online in July 2010) "Investigating the degree of 'stigma' associated with nuclear energy technologies: a cross-cultural examination of the case of fusion power", *Public Understanding of Science.*

Horlick-Jones, T., Walls, J. and Kitzinger, J. (2007) '*Bricolage* in action: learning about, making sense of, and discussing issues about genetically modified crops and food', *Health, Risk & Society*, 9(1): 83-103.

House of Lords (2000) *Science and Society,* Third Report of the House of Lords Select Committee on Science and Technology, London: The Stationery Office.

Popkin, S. (1994) *The Reasoning Voter: Communication and Persuasion in Presidential Campaigns*, Second edition, Chicago: University of Chicago Press.

Prades López, A., Horlick-Jones, T., Oltra, C., and Navajas, J. (2009) *Lay Understanding and Reasoning about Fusion Energy: Results of an Empirical Study*, Madrid: CIEMAT.

Annex A: The author

Prof. Tom Horlick-Jones has a personal chair in the sociology of risk at Cardiff University's School of Social Sciences. He has research degrees in Mathematics (MSc, Wales) and Sociology (PhD, Surrey). Over a period of some thirty years he has specialised in investigating risk-related behaviour, and associated reasoning, communication and decision-making processes. This experience includes a decade spent as a senior policy adviser in public sector administration, working primarily on emergency planning issues. He previously held academic posts at the London School of Economics and the University of Surrey.

He has advised many organisations, including: Department of Business, Innovation and Skills; Environment Agency, Department of the Environment, Food and Rural Affairs, European Commission, European Fusion Development Agreement, Health & Safety Executive, H.M. Nuclear Installations Inspectorate, Home Office, Post Office Group, Railtrack, Railway Safety & Standards Board, Science Museum, Sciencewise, Welsh Assembly Government, and World Health Organization. In 1998, he was summoned to provide oral and written evidence to the House of Commons Select Committee inquiry into railway safety. In 2000, he was summoned to provide evidence to the Ladbroke Grove rail crash inquiry. During 2000-02, he acted as an adviser to the Mayor of London's strategic review of the safety of the Notting Hill Carnival. In 2001-02 he was appointed (together with a health specialist) by the Economic & Social Research Council and Medical Research Council to carry out a research review on *Risk and Health*. In 2002-04, he led the independent, and officially accredited, evaluation of the *GM Nation?* public debate on the possible commercialisation of transgenic crops in the UK.

He has produced over 100 publications, including the books *Natural Risk and Civil Protection* (lead editor, Spon, 1995), *Social Amplification of Risk: the Media and the Public* (co-author, HSE Books, 2001) and *The GM Debate: Risk, Politics and Public Engagement* (lead author, Routledge, 2007; paperback 2009).

Professor Tom Horlick-Jones
Cardiff University School of Social Sciences

December 2011

Written evidence submitted by the Royal Statistical Society (Risk 09)

1. The Royal Statistical Society (RSS) is the UK's only professional and learned society devoted to the interests of statistics and statisticians. Founded in 1834 it is also one of the most influential and prestigious statistical societies in the world. The Society has members in over 50 countries worldwide and is active in a wide range of areas both directly and indirectly pertaining to the study and application of statistics. It aims to promote public understanding of statistics and provide professional support to users of statistics and to statisticians.

Summary

2. The main points we would like to submit are as follows:

    a. The public is currently desperately ill-served by the lack of ready access to up-to-date balanced and trustworthy information on the possible risks associated with different energy sources. Those that exist appear to be either reassuring propaganda or are limited to a particular hazard.

    b. We suggest some general principles for numerical communications of risks associated with energy sources:
        i. Separate different types of hazards experienced: eg acute short-term from chronic long-term
        ii. Separate impact on individuals, society and the environment
        iii. Include both quantifiable risks and those that are important but are difficult to put numbers on
        iv. For quantifiable risks, to use clear metrics, using whole numbers preferably in comprehensible units
        v. Be clear about the uncertainty attached to numbers, which should only be given to the precision justified by the evidence
        vi. Comparisons may be made with both other sources of risks, but voluntary and involuntary risks should be clearly separated
        vii. Give multiple formats and ways of expressing risks, eg in terms of both rate and impact on a population
        viii. Provide a clear warning that the past does not necessarily predict the future, and that we should be wary of being either reassured or scared by historical events
        ix. Be clear about the extent to which risk estimates are based on scientific models, and emphasise their assumptions
        x. Acknowledge uncertainty and limitations of data and knowledge
        xi. Acknowledge any disputed science
        xii. Attempt to give a balanced view that does not seek, or appear to seek, to persuade

c. We recommend that public communication acknowledges that there are many relevant issues of concern and does not solely focus on those most easily put into numbers.

d. We recommend that a suitable trusted provider for this comparative information be identified.

Introduction

3. As statisticians, our expertise is in designing studies, evaluating quantitative evidence, and assessing and communicating uncertainty. We shall therefore focus on issue 3) in the call for submissions - *How effectively does local and central Government communicate risk and could it be improved?*

4. It is well-known that nuclear energy ticks most of the boxes for 'fright factors' that influence risk perception: for example, radiation is feared and unknown, appears out of personal control, affects the vulnerable and unborn, is complex and the information sources may be untrustworthy. These important issues of risk perception are not our main area of expertise, but will influence our comments on numerical summaries, comparison and presentation.

5. We shall concentrate on nuclear energy but emphasise that comparisons should be made with other energy sources and hazards. This is not the place to review evidence for the magnitude of the risks, so we will just use illustrative examples from the literature.

What is currently communicated to the 'public' by government?

6. A web search using popular terms does not reveal any communication from the government, or indeed anyone else, which readily permits a comparative assessment of the magnitudes of the various risks associated with different energy sources. In particular the Department of Energy and Climate Change (DECC) website does not appear to contain any readily accessible information.

7. Those communications that exist are aimed at a professional audience, and we shall focus on their use of numerical information. We note that there is not just one 'public', and a range of different stakeholders have different levels of expertise.

8. The information provided by the Health and Safety Executive (HSE) Office for Nuclear Regulation (1) is aimed at an informed audience and, as befits a regulator, is primarily concerned with explaining its framework for assessing and monitoring nuclear facilities. The HSE's *Tolerability of risks from nuclear power stations* is a classic document that, although dating from 1988-1992, provides a good explanation of the HSE's general approach. Individual and societal risk is distinguished, but no attempt is made to quantify societal total 'detriment' of multiple deaths, disaster management, public shame and outrage, land rendered unproductive and so on. Tables of typical doses of ionising radiation are given, and safety standards are expressed in terms of risks per annum: for example, "*we require that a modern plant be so designed as to be able to withstand safely all earthquakes except those of a severity whose chance of occurrence is judged to be less than 1 in 10 000 per annum*". Tables of everyday risks are provided as odds, for example

a 1 in 200 chance of death per million km driven. The safety criteria are further explained *Safety Assessment Principles for Nuclear Facilities.*

9. HSE's risk communication has been recently reviewed by Bouder and Lofstedt (2), who supported the HSE's 'consensual' approach to risk communication, but suggested that in highly contested areas it could improve by being more proactive and engaging with people's concerns, exploiting wider expertise, and focusing on becoming a trusted source which is seen as understanding the social context. The HSE's documents, although a clear exposition of their regulatory approach, do not provide the public with a basis for judging the risks.

10. The Health Protection Agency (HPA) provides popular, reassuring information on "Nuclear Emergencies" (3) with a good animation, but focuses on explaining the doses and risks from low-dose ionising radiation (4), providing a comparative table of exposures from different sources, for example a 135g bag of Brazil nuts corresponds to 0.01 mSv (milliSieverts)

What is currently communicated to the 'public' by other sources?

11. The World Nuclear Association is a producers' lobby group whose site on nuclear safety (5) discusses safety (accidents), security (terrorism) and safeguards (proliferation), and a reassuring table of accident fatality rates from different energy sources is given.

12. The International Atomic Energy Agency (IAEA) is concerned with nuclear safety and security but information about relative risks is singularly absent. FAQs from 2006 (6) include the following:

    Q: *Some nuclear power plants are built on sites subject to natural phenomena such as earthquakes or tornados, which can pose a risk for any installation. What has been done to ensure the safety of these plants?*

    A: Extensive experience has shown that this philosophy of conservative design has been sufficient to cope with all of these types of natural phenomena at all nuclear power plants,

    which perhaps should be revised after Fukushima.

13. A recent document from the Intergovernmental Panel for Climate Change (IPCC) (7) (pp 745-747) provides the most comprehensive and comprehensible comparison of the risks from serious accidents from different energy sources, derived from the ENSAD database at the Paul Scherrer Institut (8). Both fatalities per Gigawatt-year as well as maximum fatalities are given - some of their data are revisited below.

14. The best exposition is given by David Mackay (9), currently Chief Scientific Advisor to DECC, who provides an accessible comparative assessment of different energy sources, including both short-term and long-term impacts. Risks are communicated as fatalities per Gigawatt-year.

15. There are a vast range of other sources of information from academic sources, individuals and pressure groups, including a website of wind turbine deaths (10) (32 up to end of 2010), communicated as fatalities per Terawatt-hour. There are endless conflicts about the impact of Chernobyl, which is of doubtful relevance to any UK nuclear programme.

16. The public is currently desperately ill-served by the lack of ready access to up-to-date balanced and trustworthy information on the possible risks associated with different energy sources. Those that exist appear to be either reassuring propaganda or are limited to a particular hazard.

How could communication be improved?

17. We suggest some general principles for numerical communications of risks associated with energy sources:
    a. Separate different types of hazards experienced: eg acute short-term from chronic long-term
    b. Separate impact on individuals, society and the environment
    c. Include both quantifiable risks, and those that are important but where difficult to put numbers on
    d. For quantifiable risks, to use clear metrics, using whole numbers preferably in comprehensible units
    e. Be clear about the uncertainty attached to numbers, which should only be given to the precision justified by the evidence
    f. Comparisons may be made with both other sources of risks, but voluntary and involuntary risks should be clearly separated
    g. Give multiple formats and ways of expressing risks, eg in terms of both rate and impact on a population
    h. Provide a clear warning that the past does not necessarily predict the future, and that we should be wary of being either reassured or scared by historical events
    i. Be clear about the extent to which risk estimates are based on scientific models, and emphasise their assumptions
    j. Acknowledge uncertainty and limitations of data and knowledge
    k. Acknowledge any disputed science
    l. Attempt to give a balanced view that does not seek, or appear to seek, to persuade

    The systematic inadequacies in past data as a basis for future predictions means that formal statistical 'error bars' have less relevance than an open assessment of deeper uncertainties, so that identifying orders of magnitude may generally be adequate.

18. A wide range of potential hazards related to energy production can be identified that impact on individual people, society and the environment, associated, for example, with routine activities, severe accidents, disposal of waste, climate change, terrorism, proliferation and energy security. All of these enter into the public debate when discussing nuclear energy and making comparisons with other sources. Some may be quantified with greater or lesser confidence – but others are more difficult to model. We recommend that public communication acknowledges that there are many relevant issues of concern and does not solely focus on those most easily put into numbers.

19. In principle a matrix could be formed for each energy source, related to each potential hazard. It is crucial that a full picture is portrayed – in many cases a quantitative assessment would not be possible but a qualitative level of severity might be assigned. Some examples are given below.

20. **Routine activities and minor accidents**. These need to be expressed in the same units as severe accidents, separating workers from the general population exposed, for example, to pollution and radiation from traditional power plants. These risks should also be expressed in terms of the total burden on the population – fossil fuels were estimated in a National Science report to lead to 20,000 deaths in the USA each year (11), and the House of Commons Environmental Audit Committee reported that particulate matter reduced life expectancy by 7-8 months (12), which ignores the effect of low-dose ionising radiation from fossil-fuel power stations. The environmental damage from routine coal and oil extraction also needs to be considered.

21. **Severe accidents**. The IPCC report (7) estimates for EU countries the following future risks (these have been translated into fatalities per TWy in order that whole numbers are appropriate): coal (135), oil (99), hydro (85), natural gas (68), biomass (15), offshore wind (6), inshore wind (2), geothermal (2), nuclear (0.4 early deaths, 0.7 later deaths) and photo-voltaic (0.2). This does not include the possibility of ship collisions with offshore wind facilities. These 'average' figures do not address the perceived catastrophic potential of nuclear power. This scenario should be explicitly addressed and justification for the quoted risks needs to be provided. Trusted sources of information, and a continuing period of safe operation, will help this be convincing. The recent Deepwater Horizon accident suggests the vital importance of environmental damage as well as direct harm to health.

22. **Waste disposal.** For nuclear waste, quantitative risk models can be provided, emphasising their sensitivity to any discount rates given to events far in the future. Carbon capture and storage also needs to be addressed, although may be more difficult to quantify.

23. **Climate change.** The impact of alternative technologies on CO_2 production can be well-quantified, and possibly a more cautious assessment made on future climate.

24. **Terrorism, proliferation, energy security.** These are vital issues that need to be specifically addressed, and assessments of the vulnerability of say nuclear installations and oil-pipelines can be provided. Exposure to geo-political forces that deny supplies can be made explicit. However, probabilities of these occurring cannot be given with any precision.

25. To reiterate our recommendations in paragraph 12, it should be made clear when there is disputed science, and numbers should only be given to the precision justifiable by the analysis. The overall confidence in the conclusions could be scored using a qualitative scale such as the GRADE score used in medical evidence reviews (13), or the IPCC's methodology for qualifying its conclusions (14).

26. This is an area of disputed science, in which trust is vital. We recommend that a suitable trusted provider for this comparative information be identified.

References

1. ONR. HSE - Nuclear. 2010 Oct 28 [cited 2011 Dec 11];Available from: http://www.hse.gov.uk/nuclear/

2. Bouder F, Lofstedt RE. Improving health and safety:An analysis of HSE's risk communication in the 21st century . 2010;Available from: http://www.hse.gov.uk/research/rrpdf/rr785.pdf

3. Agency HP. Nuclear Emergencies . [cited 2011 Dec 11];Available from: http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/AtAGlance/Flash_NuclearEmergencies/

4. Agency HP. Dose comparisons for ionising radiation . [cited 2011 Dec 11];Available from: http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/DoseComparisonsForIonisingRadiation/

5. World Nuclear Association. Safety of Nuclear Reactors . [cited 2011 Dec 11];Available from: http://www.world-nuclear.org/info/inf06.html

6. IAEA. How Safe is Nuclear Energy? : IAEA InfoLog . [cited 2011 Dec 11];Available from: http://www.iaea.org/blog/Infolog/?page_id=23#a14

7. IPCC. Renewable Energy Sources and Climate Change Mitigation . [cited 2011 Dec 11];Available from: http://srren.ipcc-wg3.de/report

8. Paul Scherrer Institut. Comparative Risk Assessment and the ENSAD Database . [cited 2011 Dec 11];Available from: http://gabe.web.psi.ch/research/ra/

9. Mackay D. Sustainable Energy - without the hot air: Contents . [cited 2011 Dec 11];Available from: http://www.withouthotair.com/

10. Gipe P. Contemporary Mortality (Death) Rates in Wind Energy . [cited 2011 Dec 11];Available from: http://www.wind-works.org/articles/BreathLife.html

11. National Research Council. Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use . [cited 2011 Dec 13];Available from: http://www.nap.edu/catalog.php?record_id=12794

12. House of Commons - Air Quality - Environmental Audit Committee. 5th Report, 2009-10 . [cited 2011 Dec 13];Available from: http://www.publications.parliament.uk/pa/cm200910/cmselect/cmenvaud/229/22902.htm

13. Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. BMJ. 2008 Apr 26;336(7650):924–6.

14. IPCC Cross-Working Group Meeting on Consistent Treatment of Uncertainties. Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties . 2010;Available from: http://www.ipcc-wg2.gov/meetings/CGCs/Uncertainties-GN_IPCCbrochure_lo.pdf

Royal Statistical Society
12 December 2011

Written evidence submitted by Georges Mercadal (Risk 10)

Response to the inquiry on Risk perception and energy infrastructure

Questions addressed:

a. What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?
b. How are public risk perceptions taken into account in the planning process for energy infrastructure?
c. How do risk perceptions and communication issues in the UK compare to those of other countries? (indirectly addressed)

Response submitted by Georges **MERCADAL**, former Vice President of the French National Commission on Public Debate, with input by Claire **MAYS**, Research Consultant, Institut Symlog de France.

Statement of interest*: G. Mercadal is a public servant in France, engineer and researcher, who has held high national positions in urban and infrastructure planning. He has presided a number of national debates on large infrastructure projects and notably the debate on radioactive waste management policy, and has coordinated methodological development of the public debate instrument. C. Mays is an independent research consultant many of whose governance research activities have been part-funded by the European Commission R&D directorate including Euratom, with complementary funding provided by the National Institute for Radiation Protection and Nuclear Safety (IRSN). She also is employed half-time by the OECD Nuclear Energy Agency as social sciences consultant to the "Forum on Stakeholder Confidence" of the Radioactive Waste Management Committee.*

Public debate as instituted in France

Legislative background

1) Impact assessment is introduced in France by the 1976 law on the protection of nature and the 1977 law on installations classified for the protection of the environment, in such a way as to communicate to the public the analysis of environmental consequences of a given project.
2) The 1983 law democratizing the public enquiry creates the obligation to consult the population in public meetings.
3) In the late 80's-early 90s, widespread opposition to the siting of the high speed train track "TGV Méditerranée" – and creation by civil society of multiple forums for public expression and counter expertise - highlights the need to consult the public much earlier in a project sequence. A government circular in 1992 creates the right to upstream public consultation.
4) A 1995 law creates the National Commission for Public Debate (CNDP), housed in the Environment ministry and tasked with organizing and monitoring public debate, in alignment with the concept of upstream public engagement.
5) In 1999, the Conseil d'Etat proposes to constitute the CNDP as an independent administrative authority and to extend the scope of public debate to the consideration of project justification.
6) This proposal is carried out by the 2002 law on local democracy and completed by the 2009 « Grenelle 2 » environmental law which adds post-debate follow up. The transposition into

national law of the 1998 Aarhus Convention on public access to information, participation in environmental decision making, and access to justice is thus little by little reinforced, although criticisms as to its completeness remain.

7) In parallel, and in specific regard to the nuclear sector, the public debate on radioactive waste management policy is one contributing factor to the 2006 Nuclear Safety and Transparency Act. This notably creates a High Committee on Transparency and Information on Nuclear Safety, and reinforces the powers and duties of Local Information Committees, effectively instituting the right for local citizens to monitor and control risky facilities.

8) France has thus **responded by legislative means to growing awareness of the need to engage with citizens** in setting priorities and settling details of infrastructure projects with impact upon the environment, and specifically, by empowering citizens in monitoring nuclear installations.

9) This legislative trend responds well to the classical study findings by Slovic et al. which highlight that personal control and familiarity are important elements in the perception of risk and safety. Furthermore, adequate institutional control extended to citizens is similarly important: note the large survey finding that the single element that increased people's trust in nuclear plant management was that "an advisory board of local citizens and environmentalists is established to monitor the plant and is given legal authority to shut the plant down if they believe it to be unsafe" (Slovic, 1993, 2000). Such findings give a pragmatic basis to the ethical assertion of rights by e.g. the Aarhus Convention. All in all**, citizen engagement in the governance of risky installations is a right, an important factor in the tolerability of risk, and indeed a vector of actual safety** (e.g. CIP, 2010).

10) In what follows, we outline the features of France's Public Debate instrument and some insights into the conditions of technological governance gained from more than 70 debates held to date.

Structure and organization of the CNDP

11) Composition: 21 members, of which 18 designated by their respective home organizations: Elected officials (mayors, territorial council members, MPs); Environmental protection NGOs; Social partners; administrative and civil magistrates. The full time President and two Vice Presidents are named by Government.

12) Referral: The project proponent must file for each project designated as affecting the environment and worth more than 300 M€. Elected officials or associations may file optionally regarding projects worth between 150 et 300M€. The CNDP examines the referral and decides either: to organize the debate or a consultation, to direct the proponent to consult, or to make no stipulation. These decisions may be contested before the Conseil d'Etat.

13) Documents circulated to the public: The initial project dossier (presentation of the project, counter-examination if any, etc.) ; existing studies ; report of counter expertise, ordered by the Commission if that has been requested by the public, paid for by the CNDP or by the project proponent ; the Commission's report of the debate; the decision within 3 months by the proponent to go ahead or to effect modifications.

14) Process: The debate lasts 4 months ; all expenses are ordered by the Commission and paid for by the project ; the Commission must remain completely neutral, arguing neither for nor against the project in the debate report; the Commission sets up all means to facilitate participation (Internet site, thematic documents or stakeholder statements; Q&A, press relations, etc.) and organizes public meetings open to all, on general or specific themes related to the project and in appropriate localities as implied by the national and/or local character of the project.

Lessons learnt from the sum of more than 70 public debates

15) Given its organization and the sample of participants gathered by the public debate, this instrument is neither a referendum nor an opinion poll. It is a legitimate project critique performed by persons external to the project yet concerned by it, and who are aided by experts of their choice. The debate is based in both knowledge and feelings. At least 5 criteria emerge as significant in regard to guaranteeing the legitimacy of the debate:

16) Time: No public engagement is possible without time, to understand the project, to identify questions, to learn, to deliberate and to formulate judgments. A debate lasts 4 months; it must be conceived of as a moment in a longer process of guaranteed interaction between the proponents and the public.

17) Alternatives: Being able to ponder different alternatives is essential to meaningful participation and thus, to trust building. Alternatives must be presented by the proponent or designed by counter experts on behalf of the attendance.

18) Territorial sense of justice: The concern of local politicians is not the welfare of the nuclear industry on its own; rather it is the sustainable development and well-being of their community. The project must be integrated in a comprehensive and meaningful development project.

19) Openness: Patience and willingness to learn are needed on the part of the nuclear sector, which must accept to internalize the feedback from society. Engineers and scientists must take participants' suggestions as a valuable input, not discard it at once as technically irrelevant. For instance, actors of the debate may be brought to perform multidisciplinary analysis of some science and society hybrid objects (examples from the radioactive waste management field include "retrievable disposal", "perennial storage" and other apparently paradoxical concepts, but which respond to both technological and societal objectives).

20) Governance: Regular debate proceedings must be accompanied by support mechanisms and followed up by adaptation: access must be guaranteed to pluralistic expertise, and, on a day to day basis, relevant data; a follow up round table should be organized between the actors of the debate, to build compromise after the polarization of the debate; easy ways for the public to appeal on safety matters must be provided.

21) All in all the experience of public debate around large infrastructure projects in France highlights the need to create and adapt public engagement instruments. Tolerability of risky installations is not a static quality but a social construct, grounded in a shared societal and technological approach to their governance. The public debate is one instrument with a certain scope; more intensive means of constructive democracy (Lavelle et al., 2011), highlighting the strategic and heuristic empowerment of civil society, too may be sought.

References and further reading

CIP (COWAM in Practice) (2010) *European-level Guidelines for the inclusive governance of radioactive waste*. On line: www.cowam.com/IMG/pdf_CIP-EUG_version_finale_telechargeable.pdf

CNDP (2007) *Les Cahiers Méthodologiques Edition 2007*. On line : www.debatpublic.fr

Fourniau, JM. (2007) 'L'institutionnalisation du débat public', *Projet* n°297, Mars 2007. On line: http://www.ceras-projet.com/index.php?id=633

Lavelle, S., Hériard Dubreuil, G., Gadbois, S., Mays, C. & Schneider, T. (2010) Démocratie constructive et gouvernance de la technique : Les conditions de la gouvernance démocratique dans un processus technique et social complexe ; *Revue Gouvernance*, vol.

7 n° 2, Winter 2010. On line (URL published with incorrect date):
www.revuegouvernance.ca/images/content/Spring2007/lavelle_et_al.pdf

Mercadal, G. (2007) Garantir le débat, *Projet* n° 297, Mars 2007.
URL : www.cairn.info/revue-projet-2007-2-page-4.htm.

Slovic, P. (1993; 2000) Perceived risk, trust, and democracy, *Risk Analysis* vol.13 n° 6 (1993); also published in Slovic, P. (2000) *The Perception of Risk*, Earthscan, London.

Georges Mercadal, former Vice President of the French National Commission on Public Debate, with input by Claire Mays, Research Consultant, Institut Symlog de France

14 December 2011

Written evidence submitted by the Nuclear Industry Association (Risk 11)

The Nuclear Industry Association (NIA) welcomes the opportunity to provide written evidence to the Committee on this issue.

The NIA is the trade association and information and representative body for the civil nuclear industry in the UK. It represents over 270 companies operating in all aspects of the nuclear fuel cycle, including the current and prospective operators of the nuclear power stations, the international designers and vendors of nuclear power stations, and those engaged in decommissioning, waste management and nuclear liabilities management. Members also include nuclear equipment suppliers, engineering and construction firms, nuclear research organisations, and legal, financial and consultancy companies. Some of our members, particularly those participating in the UK nuclear new build programme, will be making their own detailed responses to the Committee.

The NIA cannot claim to be expert in risk perception or the tolerability of risks relating to major energy infrastructure, but would nonetheless like to make some general points which might provide some context to the issues being considered by the Committee.

First of all we would like to point out that, based on the industry's opinion research, concerns about nuclear safety do not appear to have led to significant opposition to nuclear energy in the UK and those in favour of nuclear energy continue to outnumber those against. The NIA's public opinion findings – undertaken in November and released this month – showed that over three quarters of the public continue to believe nuclear power is a necessary part of a diverse mix of energy sources to ensure the UK's future energy supplies. As Keith Parker states in the attached press notice in 2010 nuclear energy had its highest support in over a decade. Favourability fell following the accident at Fukushima, but is now again rising towards 2010 levels.

An NIA focus group undertaken at the same time shows that in unprompted responses those involved did not pick out nuclear safety as a major energy issue; although more generic issues such as pollution and building on green belt were mentioned. However polls have also shown that, despite the best efforts of industry, the majority of those questioned did not feel well informed about the industry. It is important therefore that both Government and the industry should continue to engage, inform and discuss the issues of nuclear energy with the public in an open and honest dialogue. A key issue worth highlighting in any such dialogue is that all energy sources involve risks.

It is likely that there is a much better understanding of the excellent safety record of the UK's nuclear power stations in the localities within which they are located. This is because of the public information programmes undertaken by the operators, and in the case of proposed new stations, because of the extensive preconsultations carried out as part of the planning process. Communication serves two purposes, a guide to action and also to maintain and build long term trust with stakeholders. The consultation process gives people the opportunity to raise issues, which are then dealt with in the planning process.

So far as the wider general public is concerned it is probable that even a major public information campaign is unlikely to lead to a realistic appreciation of the safety of nuclear stations. However at the end of the day policy on new nuclear developments should not be driven by the perception of risk, but by an evidence based approach that enables an appropriate level of risk to be determined. As the Committee will be aware it is the responsibility of Government and the regulators to do this, and to ensure that stringent safety and security arrangements are in place to ensure that the likelihood of significant accidents is very remote. In practice, having undertaken all the necessary studies, regulators will only allow a reactor to operate if they are convinced of its ability to do so safely.

If it has not already done so we believe that it would be worth the Committee inviting the Office for Nuclear Regulation to provide evidence to the Committee on how they approach these issues in relation to nuclear facilities.

In this context the Committee may be aware that under EU legislation the Government is required, before any new nuclear station can be built, to undertake a process of regulatory justification to demonstrate that the benefits of a new station will outweigh any potential radiological health detriments. The attached Quick Guide to the NIA's regulatory justification application in 2009[1] shows that the potential health detriment from all potential activities associated with new nuclear power stations is extremely small. This process was completed in relation to two candidate designs for deployment in the UK in November 2010, following overwhelming votes in favour in the House of Commons.

Nuclear Industry Association

14 December 2011

[1] Not printed.

Written evidence submitted by the EDF Energy (Risk 12)

About EDF Energy

1. EDF Energy is one of the UK's largest energy companies with activities throughout the energy chain. We provide 50% of the UK's low carbon generation. Our interests include nuclear, coal and gas-fired electricity generation, renewables, combined heat and power plants, and energy supply to end users. We have over five million electricity and gas customer accounts in the UK, including both residential and business users.

2. Following the events in Japan in March this year, EDF Energy understands the attention that is being given to the risks surrounding energy infrastructure, in particular nuclear power. We fully support the conclusions and recommendations of the Weightman Report, which reaffirmed that UK nuclear facilities have no fundamental safety weaknesses and praised the openness and transparency of the industry. We are committed to ensuring that this continues in the future, and will implement the report's recommendations in full.

3. EDF Energy has further enhanced this approach under a four-pillared programme to inspire our company's leaders: to engage on nuclear; involve the people at our power stations who best embody our safety culture in building public trust; impact by listening to stakeholders' and customers' concerns; and integrate others who can contribute to a better understanding of the achievements and challenges of our industry.

EDF Energy's response to your questions

Q1. What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?

4. Given the events in Japan in March this year, it is understandable why the committee has chosen to focus on nuclear power. In October 2011, the HM Chief Inspector of Nuclear Installations, Dr Mike Weightman, published his Final Report on "Japanese earthquake and tsunami: Implications for the UK nuclear industry"[1]. This examined the lessons to be learnt for the UK nuclear industry from the events and found no fundamental safety weaknesses at UK nuclear facilities. The report did make a number of recommendations for Government, regulators and industry. EDF Energy is committed to addressing these, and in doing so will continue to work with the Office for Nuclear Regulation (ONR).

5. It is important to remember, however, that all forms of energy infrastructure have some element of risk (or perceived risk), whether related to safety, security of supply, affordability, sustainability, visual impact or environmental impacts arising from emissions to air, land or sea. The UK will need to use diverse technologies to meet its energy policy objectives, namely decarbonisation of electricity generation, security of supply and affordability. Technologies will need to include nuclear, renewables and fossil fuels (with carbon capture and storage if it can be proven) as well as improving energy

[1] http://www.hse.gov.uk/nuclear/fukushima/final-report.htm

efficiency. This serves to highlight the need for all of these forms of low carbon energy. It also provides both Government and the energy industry with a fundamental challenge: how to communicate this difficult balance between differing energy sources and different risks to the public.

6. It is important to distinguish objective scientific risk assessment methodologies from risk perception, based on an individual's subjective assessment of the probability of an event, and the perceived consequences of a negative outcome. It is therefore possible for the same risk to be interpreted differently by different groups.

7. Although the energy industry has a strong track record in terms of safety, the risk is that assessments may be based on emotion rather than hard evidence, which may then in turn derail legitimate energy projects. EDF Energy believes that it is imperative that the concerns of the public are adequately addressed through open and transparent communication between policy makers, operators and the general public. This is necessary as part of the ongoing initiatives to inform the public of the need for new safe, secure and affordable low-carbon energy infrastructure, and will help promote greater transparency and build trust between the different stakeholders involved.

8. Although the public's interest and understanding of energy issues is growing, it is still relatively low and so any initiatives that improve this should be encouraged. We believe that it is important to highlight to the public the connection between power station operation, transmission lines, and the universal availability of electricity in the home, which over time has simply been taken for granted. This is one of the main reasons that EDF Energy launched its Energy Future website[2] in order to engage the public in discussion around where we get energy from and what the UK's future energy mix should be.

9. We believe that there are a number of factors that can influence public risk perception of energy infrastructure projects. These include where people live, educational background, personal experiences and values or prejudices, as well as an incomplete understanding of the nature of the risk. In some instances there is likely to be an element of distrust/scepticism of the institutions involved in the process, including the infrastructure operators and the Government and regulators, which can only be eliminated by all parties continuing to act in an open and transparent manner. Risk perception is likely to differ between the national and local level, with the latter forming views based on local knowledge – which may be either positive or negative.

10. Another key factor is the role of the media (in all its forms) and the attention it gives to an event. While media reporting can be objective, coverage tends to focus on events rather than analysis which can make it more difficult to have a genuine and productive debate of issues. Recent events (e.g. Deepwater Horizon, Fukushima) have demonstrated that concerns over events in other parts of the world can have an impact on public opinion of the energy industry in the UK.

Q2. How are public risk perceptions taken into account in the planning process for energy infrastructure?

[2] http://www.edfenergy.com/energyfuture/key-info/the-energy-gap

11. Public perception of risk from any potential development is shaped through consultation, both formal and informal, between the developer and consultees. These consultees will vary from statutory consultees as laid down by legislation to any individual or group with an interest in the development.

12. The new planning regime, brought about by the Planning Act 2008, has placed a duty on developers to consult ahead of submitting a planning application. However, in reality good developers would always aim to build a constructive relationship with consultees, particularly the most immediate community around the development, ahead of a planning application being submitted. Engaging communities during the development of proposals helps to improve people's understanding of the infrastructure, its impacts and any mitigation measures required, as well as fostering a sense of trust. Building constructive relationships with neighbours/key stakeholders throughout the planning process also helps to ensure constructive relationships later during operation and beyond.

13. As an example, prior to submitting its application for development consent for Hinkley Point C new nuclear development project, EDF Energy undertook four formal stages of consultation over a three year period. This involved engagement with some 6,500 consultees resulting in around 2,000 responses. Beyond this, we also had many informal meetings with representative groups, statutory bodies and others. All of this enabled us to identify specific issues, and develop our plans in order to mitigate, or compensate for, those issues. Much of this mitigation and compensation will be reflected in the planning conditions and obligations which will be agreed should we get development consent to construct Hinkley Point C.

14. It is important to note that the majority of issues raised during these four stages of consultation were not specific to the risk from an operating nuclear power station but were related to the impacts during construction, particularly from transport, visual impacts, and the migration of temporary workers into the area and the pressure this could bring upon housing and accommodation.

Q3. How effectively does local and central Government communicate risk and could it be improved?

15. We believe that both local and central Government have a number of responsibilities in relation to the public understanding of risk:

- consulting on and defining national policy
- ensuring that the public has access to clear and reliable information
- providing resources for world class research and for authoritative independent agencies; and
- ensuring that the school curriculum equips young people with the mathematics and science skills to help them make informed choices.

Q4. To what extent can public perceptions be changed by improving risk communication? (please provide examples)

16. Locally, all of EDF Energy's power stations (both nuclear and non-nuclear) are in regular contact with key stakeholders in the community, including councillors, media and the local population. We believe that it is important we maintain the trust of local communities. We operate openly and transparently, informing the local population of our operational issues through regular Site Stakeholder Group meetings, and receive feedback on what we

can do better. We produce newsletters, host visits, engage in community-based activities and give talks in schools.

17. However, we recognise that after the events in Fukushima we must go further. One of the key recommendations of the Weightman report was that the industry should be more open and transparent, particularly with those further from our sites.

18. We are doing more:

- We now have an open reporting website, updated daily, giving information on the operational status of our nuclear plants[3].

- We have hosted focus groups to ensure we are well positioned to respond to public concerns about our industry, and have worked with an independent panel of experts to advise us on our approach to transparency.

- We are working to reopen Visitor Centres to allow people to see what we do, and we have incorporated the design of new visitor centres into our new nuclear build plans.

- As stated above, our Energy Future website helps explain to people what choices we need to make about how we generate our energy and does so with information on the benefits and disadvantages of each technology choice.

19. Polling has shown that despite Fukushima, 61% of the public[4] believe nuclear should be part of the energy mix. In fact, the results show that support for nuclear new build has broadly held up, with 47% supporting new nuclear power stations to replace ones that are being retired (and 28% against). This compares with 52% a year ago, and 46% in March this year. We believe that such consistency of support can at be attributed in part to better risk communication and an appreciation by the public of the benefits of nuclear power as part of a diverse, low carbon energy mix.

Q5. How does and should the Government work with the private sector to understand public perceptions of risk and address them?

20. The role of the Government's regulatory bodies and other agencies, including the Health and Safety Executive, Health Protection Agency and the Environment Agency is particularly important. The public expects such bodies to undertake independent and robust scrutiny of operators of energy infrastructure on its behalf, and to provide accurate scientific information. In order to reassure the public that they are fulfilling this duty, regulators need to provide clear advice and information on operators' ability to mitigate and deal with risks, and so it is important that they communicate the reasoning and the evidence behind any action they may take.

Q6. How do risk perceptions and communication issues in the UK compare to those of other countries?

[3] www.edfenergy.com/about-us/energy-generation/nuclear-plant-status.shtml
[4] YouGov poll conducted for EDF Energy in June 2011, from a sample of 4,029 adults

21. The fundamentals of risk perception and communication are not likely to change significantly from country to country. However, differences do occur in terms of risk perception according to differences in the political, geographical and cultural make up of different regions, and the historical background. As a result, we have seen very different responses to the events at Fukushima, in terms of nuclear power policy, in different countries of the European Union, and worldwide.

22. It should be noted that in the European Union there are more Member States either maintaining or increasing their nuclear capacity than those that are not. We suggest that this demonstrates that the need for low carbon energy sources to help achieve climate change targets is considered to outweigh the risks from using nuclear power.

EDF Energy

14 December 2011

Written evidence submitted by The Society for Radiological Protection (Risk 13)

1. I am writing to you in my role as President on behalf of the Society for Radiological Protection which is the Chartered professional body that represents the radiological protection community in the UK and abroad. A summary of our objectives is attached below as a Annex 2.

The nature of our evidence

2. By a coincidence of timing, the Society held a one-day meeting on Risk Communication and Radiation at the Royal Institution on December 06 2011. I am largely drawing on the key findings and discussions of that meeting in compiling our submission which therefore comprises a collation of expert opinion.

3. Our aims and objectives may be summarised as:

- To promote science and art of radiation protection.
- To disseminate knowledge and support relevant education.
- To promote high professional standards to the public benefit.

4. As a professional body, we do not promote the use of ionising and non-ionising radiation within any particular industry or sector. However, we feel that whatever justified uses of radiation society chooses to exploit, as radiation protection professionals we can help in the provision of expert advice on radiation risk management to employers and the public via the competence of our members.

5. I want to emphasise that we are confident that (within the boundaries set by established scientific knowledge) the risks can be managed. This position is based on decades of research and experience, using sound science and internationally derived and shared philosophy, standards and technologies.

6. In view of our aims and objectives, we would like to make some observations relating to your questions 3 and 4, namely:

- How effectively does local and central Government communicate risk and could it be improved?
- To what extent can public perceptions be changed by improving risk communication? As requested, I will provide examples.

Our observations on current risk communication

7. Going back 25 years, the UK authorities learned a lot about risk communication from Chernobyl and other incidents such as Three Mile Island. Transparency has increased in the UK ever since. A recent example shows this: The adoption of a high level of transparency by UK authorities in the management of the radiological consequences of the Litvinenko case demonstrated that a radiation linked incident in our capital city can be managed effectively and within the public's view. London continued to function as a result of good communications about risk, hazards and health and safety.

8. In addition in a more recent example, we feel that the very high level of stakeholder engagement and transparency provided by the Joint Programme Office of the Office of Nuclear Regulation (ONR) and the Environment Agency represents Best Practice in stakeholder engagement for nuclear reactor new build.

9. This approach removes barriers to communication and demonstrates the commitment of regulators to high standards of safety, security and environmental protection. We suggest that the growing acceptance of the case for a mixed energy economy that includes nuclear indicates that public opinion can be swayed by transparency and honest intellectual rigour. This is the antithesis of the secrecy of the past that engendered scepticism and anxiety. It is implicit that the radiological risks are being explained better than they used to be and we feel that the relatively low level of counter lobbying by anti-nuclear groups may reflect that more people understand the risks. This is especially so as radiation risks are now compared to the environmental risks and global consequences of global warming.

10. Comparison of risks in this way is often used to provide some perspective to a particular risk, but in our experience the units of such risks are not always clear, nor consistently applied. For example, risks of harm for a number of activities are often ranked as a means of informing and influencing. But it is not always clear whether these risks are of "harm per year" or "per lifetime", or "per event". e.g. rock climbing figures may refer to a probability of death per year or per climb. In the radiation protection context, cited figures may refer to the risk of an incident happening to a vehicle carrying nuclear material in terms of risk per mile, per journey or per annum.

11. Linked to this, when comparing potential health risks, it is not always clear whether the likely outcome has been taken into account, such as whether a particular health risk is likely to be curable or may more probably result in death.

12. In communications with the public, we believe it is crucial to be open and transparent about units and likely outcomes of risks and to express them clearly. As a profession we walk a line between (on the one hand) simplifying language to assist public understanding of scientific concepts and on the other hand over-simplifying and consequentially experiencing a significant risk ourselves: that of being accused of providing misleading information or at least of patronising behaviour. We simply cannot afford to be lazy in drafting information about risk and so confusing units (and the reader) and so laying ourselves open to criticism for a perceived lack of transparency.

13. Discussing radiation risk is often done in a negative way within a particular context, and the benefits to society from the controlled use of radiation generators and radioactive materials are often overlooked. For example, benefits to society include the use of thicknessing gauges across a range of industrial sectors, and benefits to individuals include diagnosis and therapy in medicine.

14. In communications with the public, we believe it is important to be proportionate when discussing the impacts of radiation on our lives, and to clearly express and balance both benefits and detriments of the controlled use of radiation to individuals and to society. We find it curious that on the whole, uses of radiation other than military and nuclear power are virtually unrecognised by the public. Our members very rarely report any interest from the public about blood irradiation, medical supplies sterilisation, the safety gains of radiographing safety-critical welds, the quality control role of radioactive sources in paper and film manufacture and of course medical and veterinary diagnosis and treatment. We feel that there would be benefits in simply highlighting these manifestly beneficial uses of radiation so that the benefits and the risks are routinely discussed in public fora. At present, it is only the radiological risks that get an airing. It is important to also explain the benefits that come from accepting tolerable levels of radiological risk.

15. Last, but by no means least, it is obvious that there is a lack of understanding by the public of the concept of risk. In particular, the probability component of risk is very poorly understood.

Our evidence on improving risk communication and understanding

16. We regret that over recent years there seems to have been a drop in requirements for science and mathematics education in schools as this only undermines the national understanding of these important subjects. This lack of understanding of risk is founded on a number of other factors such as "dread anxiety" resulting from the history of nuclear weapon testing and use and very poorly informed media coverage of these issues

17. We note that:

a. Few newspapers have a science correspondent

b. There was minimal recognition by the media that thousands died from the Japanese Tsunami compared to the amount of coverage given to the nuclear accident at Fukushima that followed. This despite the fact that mainstream science indicates that very few if any will die as a consequence of radiation effects.

c. The media often latch on to persons who purport to be "experts" who make unfounded and sometimes uninformed statements about consequences and there are few opportunities for mainstream science to challenge these. We recognise that the Society could do more to challenge these falsehoods and exaggerations, but so could others. Our own efforts now include supporting the Science Media Centre (headquartered at Euston Road). We feel this is an important objectively-based way of resisting "quackery" and providing good quality information to the media, should they choose to use it.

18. It is difficult to change public perceptions in the short-term although experience shows that it can be done over a number of years. For example, some of the motoring campaigns have gradually improved road safety by making driving under the influence of alcohol socially unacceptable to the vast majority of people. In communications with the public, we support the education of all members of society through public awareness campaigns. However, we believe it is even more important to educate society in the longer-term about the benefits and detriments of the controlled use of radiation to individuals and to society through the education of our young people in schools and further education. In particular, we recognise and welcome the efforts of STEM Ambassadors and STEMNET in supporting Science, Technology, Engineering and Mathematics Education in the UK. We plan to increase our own connections to this network, via our membership.

19. Recently, a number of high profile and very high quality science communicators have appeared on television. It is reported that one consequence of this is that Physics has become "cool again" and university applications for Physics degrees are growing. (BBC News website 18 August 2011 http://www.bbc.co.uk/news/science-environment-14563766). This is good news and continuing investment in good quality science education and engagement with young people will assist the country as a whole as it has physics. We feel strongly that this can only help young people improve their understanding of science, and specifically the concepts of probability and risk.

We thank the Committee for this opportunity to express our views, and trust that this contribution will be of assistance to the Committee. As a Chartered Society we stand ready to assist the Committee further in any way we can. Please do not hesitate to come back to us if you feel we can do more.

Dr Chris Englefield
FSRP CRadP MCMI MIOD
President of SRP
The Society for Radiological Society

14 December 2011

Annex 1

Declaration of Interests

The Society for Radiological Protection (SRP) is a charity, learned society and professional society wholly concerned with ionising and non-ionising radiological protection (RP). Our role is to promote high professional standards in RP throughout the UK, and the world where we can have influence. As a result of our wide membership, we include within our numbers people who work within government, government agencies, the medical and veterinary professions, the nuclear industry, academia, consultancies and a wide range of other industries that use radiation for its justified beneficial uses. We share a commitment to sound science, high professional standards and dissemination of knowledge and understanding of RP.

Annex 2

The Society for Radiological Protection

(www.srp-uk.org)

Our main aim is to promote and advance the science and art of radiological protection (RP) for the public benefit. Our members (~1500 in UK; ~600 international members) include representatives of the nuclear industries, medical uses of radiation and industrial applications such as Non Destructive Testing and Process Control. Non-ionising radiations (lasers and radio-frequency hazards) are also within our scope.

The Society was founded in 1963. We have been a Registered Charity (No. 1122804) since 1973. We were granted a Royal Charter in December 2007.

In 1998 we joined the International Radiation Protection Association (IRPA). We are about to campaign to improve third world representation in IRPA and we have just produced a DVD of the history of that Association. We are now the second largest RP Society in the world, after the US Health Physics Society.

In 2008 our bid to hold IRPA13, the next international congress, in Glasgow in 2012 was successful. Our team are now heavily involved in organising this prestigious event where we hope to have some 2000 delegates from across the globe.

Since our inception we have produced newsletters and a comprehensive programme of scientific meetings for the UK and the international RP community. We provide bursaries to support nominated UK and overseas students at MSc level in RP, and we have recently created a Rising Generations Group to encourage younger RP Practitioners and other persons new to the field. We have a well respected CPD Scheme and a recruitment advert distribution service for employers.

Our "Journal of Radiation Protection" started in 1981. It is now distributed across the world and has a higher "Impact Factor" than our US sister society's publication.

We are one of three partners in a limited company called "RPA2000" that awards legally recognised Certification to Radiation Protection Advisers. The scheme is the UK process for demonstrating professional competence within the RP field.

In addition to scientific meetings and upholding the standards for radiation protection, the Society has a number of Sectoral Committees and Topic Groups whose aim is to address and represent all areas of the profession: from the medical sector to teaching to the nuclear industry.

The granting of a Royal Charter reinforced our professional standing in the public and government community. Suitably qualified and experienced members can use the post-nominal letters CRadP; MSRP (Chartered Radiation Protection Professional, Member of the Society for Radiological Protection). We can also offer Chartered status to members of our partner societies.

We started a process of strategic review in 2008, in recognition of our responsibilities as holder of a Royal Charter. As part of this we are now :

- growing the Society
- raising our profile in relevant government and employer circles, commensurate with our professional status, and
- enriching the service we give to our membership and to the public

The Society for Radiological Protection

14 December 2011

Written evidence submitted by the Applied Policy Sciences Unit, University of Central Lancashire (Risk 14)

Executive summary of the main points made in APSU's submission.

1. What may be described as a 'context effect' explains why publics in the vicinity of some nuclear facilities like Sellafield can, overall, have a favourable public opinion towards the nuclear industry - even though they are concerned about the risks associated with that facility. This context effect may create a new political geography of risk.

2. The characteristics of perceived risks associated with nuclear facilities make them particularly influential in a negative way in the formation of public opinion relating to the nuclear industry.

3. Perceived salience and proximity to the nuclear facility appear to be two key factors which significantly influence an individual's perceptions of nuclear facilities.

4. At the level of the wider, general public, and among individuals who are remote from nuclear facilities, popular culture and the mass media, influence awareness of these issues and *amplify* the impact of nuclear risk perceptions upon opinion.

5. At the local level, in the vicinity of long-term extant nuclear facilities, the nuclear issue may be seen as both salient and proximate by local publics and communities. Thus, in areas like West Cumbria, the local community context and 'Sense of place' can work to *moderate* and limit the effect of perceived risk associated with that industry in the local community and raise the apparent threshold 'tolerability' of risks associated with those facilities.

6. The planning process for energy infrastructure appears to lack a systematic understanding of the development of risk perceptions in their psychological and sociological contexts. The nuclear industry, for good scientific and technical reasons, emphasises quantitative risk assessments. However, this fails to appreciate or accommodate the constructed and contextual nature of perceived risk.

7. Evidence suggests that neither local nor central government systematically communicate risk, especially in the nuclear sphere, in the sense of synthesising scientific and technical assessments of risk with the qualitative factors associated with perceived risk embedded in cultural context and the rhythm of daily lives in communities.

8. In nuclear risk communication, science often fails to understand the public, in all its diversity and complexity and, as a consequence, the public are not given accessible means to understand science.

A brief introduction to APSU and the context of its work.

9. The Applied Policy Sciences Unit (APSU) is an independent political science research unit aligned with the Lancashire Law School at the University of Central Lancashire (UCLan) and based at the Westlakes Science and Technology Park, near Whitehaven in West Cumbria.

10. The APSU's mission is to make an original and independent contribution to policy and its implementation. This unit draws upon academic research, consultancy and dissemination in the field of applied policy and political science and applies them to current policy problems. In addition to UCLan staff involved in academic research and dissemination, the APSU also involves, as advisors, individuals who are professionally involved in politics, policy and government.

11. This submission draws upon work undertaken in applied policy sciences since the late 1980s in West Cumbria and further afield, relating to public opinion, perceived risk and the governance of the civil nuclear industry. This submission is, therefore, grounded in partnership working in the context of the earliest community partnership in Britain. This experience, which was centred on the nuclear sector at Sellafield, makes this work especially relevant to the work of this committee.

12. In West Cumbria the nuclear sector comprises nuclear power generation, decommissioning and reprocessing at the Sellafield nuclear complex, and radioactive waste management nearby. This industry has dominated the economy and communities of this area since the early 1950s. This complex nuclear cluster and the associated 'Britain's Energy Coast' policy initiative are fundamentally based upon favourable public opinion towards the nuclear industry in this community and this favourable opinion is founded upon a particular configuration of risk perceptions in the locality. These opinions and perceptions have given and continue to give the nuclear industry a special 'licence to operate' in West Cumbria. They are especially revealing about risk assessment and communication relating to energy infrastructure. They have also set the scene for expansion of new nuclear power, fuel cycle activities and discussions about the possibility of a geological disposal facility for radioactive waste in this area. However, new political geographies of risk may emerge within existing areas as new infrastructure projects develop.

13. In the vicinity of the Sellafield complex, public opinion towards the nuclear industry is positive overall even though there have been a number of significant accidents involving a release of radioactivity into the environment in this area over the years. These incidents have included the Windscale fire in 1957 and the beach incident in 1983 and in 1986 fallout from the Chernobyl accident which has resulted in still-detectable contamination of parts of the Cumbrian fells.

14. Research reveals that public opinion towards the nuclear industry in West Cumbria close to the Sellafield complex is positive overall, in contrast to public opinion at the national level. This local favourability exists notwithstanding a widespread awareness and concern about risks associated with that nuclear facility. Thus, in West Cumbria there is a widespread awareness of risk associated with the nuclear industry among members of the, generally supportive, local community. However, the relationship between the site and the community within which the local public live moderates the severity and impact of those risk perceptions, as individuals balance risks against the wider and often extrinsic benefits associated with the nuclear facility.

The submission.

- What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?

15. Our studies of perceived risk and the civil nuclear industry, which stretch back over almost two decades, reveal the vital importance of context in understanding public risk perceptions. What may be described as a 'context effect' explains why publics in the vicinity of some nuclear facilities like Sellafield can, overall, have a favourable public opinion towards the nuclear industry - even though they are concerned about the risks associated with that facility. In the West Cumbria area research reveals that the community are more risk aware yet apparently less averse, to perceived risks associated with the civil nuclear industry, than compared with the national public - even in the light of widely known accidental discharges of radioactivity into the local environment.

16. The characteristics of perceived risks associated with nuclear facilities make them particularly influential in a negative way in the formation of public opinion relating to the nuclear industry. That said, public opinion towards the nuclear industry is based upon a package of beliefs held by individuals, which may be strongly influenced by context, culture and social norms. Public opinion and risk perceptions may be only marginally influenced by official or technical reassurances or representations of risk.

17. Perceived salience and proximity to the nuclear facility appear to be two key factors which significantly influence an individual's perceptions of nuclear facilities. Generally speaking, nuclear risks have certain qualities and characteristics which give them significant weight in influencing perceptions. These include their potential scope and scale - both in terms of space and time; the invisibility of man-made radiation; the perceived lack of control over nuclear issues; and their irreversible nature. These negative qualities associated with nuclear risks are exacerbated by *perceptions* that science and technology may not be fully in control of nuclear technology and that legislation and regulation may not provide an ultimately robust defence against the risks. We would stress, though that we are talking about perceptions among the lay public in this respect.

18. The perceived risks associated with the nuclear industry are further complicated by the invisibility and contested impact of man-made nuclear radiation. These qualities open the issue of the impact of man-made radiation up to multiple and sometimes competing interpretations, which bear upon the safety and security of nuclear installations in the public domain. Moreover, for most people, the nuclear issue is neither particularly salient nor proximate to their lives. For most individuals the print and broadcast media, who are prone to sensationalise nuclear stories, are the principal source of information about nuclear matters. Nuclear issues – especially given the severe characteristics of nuclear risks - closely relate to the factors making for sensational storylines which resonate with the public – and sell media copy and airtime. At the level of the general public, and among individuals who are remote from nuclear facilities, popular culture and the mass media, influence awareness of these issues and ***amplify*** the impact of nuclear risk perceptions upon opinion.

19. In recent years, however, the risks perceived as being associated with climate change, which have been widely disseminated in the media and which have been compared with risks perceived as

being associated with the nuclear industry, have undoubtedly influenced public opinion at the national level.

20. In contrast to the above, at the local level, in the vicinity of extant nuclear facilities, the nuclear issue may be seen as both salient and proximate by local publics and communities. Thus, in localities like West Cumbria, the local community context and 'Sense of place' can work to *moderate* and limit the effect of perceived risk associated with that industry in the local community and raise the apparent threshold 'tolerability' of risks associated with those facilities. It must be recognised, though, that support for the Sellafield nuclear complex in this area is mainly for extrinsic reasons associated with its perceived role in the local community and economy.

21. In the vicinity of the Sellafield nuclear complex, the nuclear industry is embedded in the locality and is connected with most of the elements of the local community. The nuclear industry at the Sellafield nuclear complex is, and has been for decades, acknowledged as part of the local reality. It is part of the heritage of the area, part of the local sense of identity and 'place' and the facility underpins most aspects of the local economy. It is also seen as providing a future for the area and opportunities for future generations of local children. This package of beliefs associated with the nuclear industry in West Cumbria, where the nuclear industry is a proximate and salient issue for most individuals sharply contrast the majority of members of the UK public who have a more detached relationship with the industry.

22. We recommend that greater attention be paid to understanding perceived risk associated with energy infrastructure developments in their local, community context.

- How are public risk perceptions taken into account in the planning process for energy infrastructure?

23. The planning process for energy infrastructure appears to lack a systematic understanding of the development of risk perceptions in their psychological and sociological contexts. The nuclear industry, for good scientific and technical reasons emphasises quantitative risk assessments. However, this fails to appreciate or accommodate the constructed and contextual nature of perceived risk.

24. An example of this lack of accommodation is the presentation of nuclear projects in isolation from one another, and from the comprehensive backstory of engagement in the area. In West Cumbria, for example, the current public consultation document relating to the geological disposal of radioactive waste in West Cumbria does not locate a proposed waste facility in the local community, nor does it position such a facility within the local nuclear context.

25. Risk, in this context is often addressed within the confines of a safety case, which may include deterministic analysis, fault analysis, engineering substantiation, probabilistic safety analysis and consequence assessments. However, though robust in its treatment from a technical standpoint, such a process fails to address perceived risk in its cognitive, community and contextual settings.

- How effectively does local and central Government communicate risk and could it be improved?

26. Evidence suggests that neither local nor central government systematically communicate risk, especially in the nuclear sphere, in the sense of synthesising scientific and technical assessments of risk with the qualitative factors associated with perceived risk embedded in cultural context and the rhythm of daily lives in communities.

27. In West Cumbria nuclear risk perceptions and related attitudes have developed out of long term experience with a facility by the community in its area. This has been buttressed by a sense of isolation felt in many these communities which, like Sellafield and Dounreay, are otherwise remote and isolated. As a result, these communities have a unique risk awareness relating to these sites. This risk awareness is probably difficult to achieve *de novo* and this local ability to handle perceived risks should be seen as one of the principal assets of a locality.

28. A most significant issue in risk communication in the planning process is, however, communication between different levels of Government. Government is not a monolithic structure and Local Government operates through different Government departments than does other areas of policy. This may mean that voices articulating local risk perspectives may be difficult to hear as they are insulated by different levels of Government and isolated from different policy networks.

29. We recommend that greater attention be paid to communities within which existing nuclear facilities are located, like West Cumbria, in the policy process and that greater emphasis be placed on local government articulating risk perceptions to all levels of government involved in nuclear infrastructure policy and projects.

- To what extent can public perceptions be changed by improving risk communication?

30. We do not believe that, in respect of nuclear energy infrastructure projects, public perceptions of risk can be easily achieved by improving communications about the risks associated with those facilities. Clearly, the reassurance of regulatory control is of fundamental importance in the operation of these facilities, but it does not appear to account for the increased support in the vicinity of facilities like Sellafield. We would stress that this additional support is due to the embedding of the facility within the local community identity and within the rhythms and activities of daily life – the local 'zeitgeist'.

31. At the national level, we have seen in recent years some emphasis on the risks associated with climate change and, in the context of an increasing awareness of those risks, an improvement in the level of public support for nuclear energy. At the national level, it is the ranging of one risk against another that may have resulted in this change as individuals see the nuclear issue as a lesser and therefore more 'acceptable' risk than climate change.

32. Perhaps the most problematic public will be those within whom a facility may be sited *de novo*. Perceptions among this group will be entirely dependent upon technical risk perceptions and the history of nuclear facility siting and associated scientific and regulatory reassurance at sites like Druridge Bay in Northumberland in 1979 and more recently Kirksanton and Braystones in Cumbria, suggests that without this embedding of a facility into the local community which is only achieved over time, new project implementation in a greenfield site may be very difficult, and costly, to achieve. These emerging political geographies of risk may have significant implications for local government as affected communities emerge within wider political units over time.

33. The above observation again emphasises the special nature of communities like West Cumbria in which there is a high level of local community support based on a long standing relationship with the nuclear industry and a wider social and political context within which to locate the risks they perceive as being associated with it.

34. Risk perceptions may also be addressed by the more careful use of language. In communities like West Cumbria, for example, risk perceptions use a lexicon of terminologies many of which are embedded in lay local discourses and culture. Beyond such localities nuclear risk communication is often much less successful as technical terms and terminologies are used in attempts to convey complex scientific terms and concepts. In short, in nuclear risk communication, science often fails to understand the public, in all its diversity and complexity and, as a consequence, the public are not given accessible means to understand science.

- How does and should the Government work with the private sector to understand public perceptions of risk and address them?

35. Given the increasing globalisation of the nuclear sector, and the involvement of the private sector in the design, operation and siting of energy infrastructure facilities it is essential that Government work with industry to understand and address risk perceptions in localities. Of special importance will be the localisation of risk in the context of multinational consortia and the preservation of the special relationship with communities in the vicinity of existing nuclear facilities.

36. One of the problems at the national level may be traditionally lower levels of trust accorded to industry, especially non-local companies, in risk communications.

37. The nature of public sector policy is changing. Government is less dominant in policy design and implementation and is more involved with multinational companies. In policy partnerships in future infrastructure developments, Government are increasingly involved with private sector organisations and the financial sector. In these complex policy networks there will be a key role for Government to represent and articulate lay and locality risk perceptions especially in wider, global policy settings which may be detached from their local implementation.

- How do risk perceptions and communication issues in the UK compare to those of other countries?

38. We believe that the same problems apply in other countries than those mentioned above. The issues are common across countries, though in many newly industrialising countries there is little experience with nuclear facilities, or technologies in the public domain - especially long-term relationships with nuclear facilities such as in West Cumbria.

39. With many new countries seeking to adopt nuclear energy without much public experience with nuclear issues, there is clearly scope for sharing of insights from more established countries like to UK – especially in the field of risk perceptions and its relationship with public opinion.

Members of APSU and their interests

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Councillor Michael Heaslip, representing Workington St Johns Ward in Allerdale Borough Council

Jamie Reed MP, Member of Parliament for the Copeland constituency

Tony Cunningham MP, Member of Parliament for the Workington constituency

John Thurso MP, Member of Parliament for the Caithness, Sutherland and Easter Ross constituency

Applied Policy Sciences Unit, University of Central Lancashire

14 December 2011

Written evidence submitted by Sedgemoor District Council (Risk 15)

EXECUTIVE SUMMARY

1. The key points influencing risk perceptions are seen to be national media reporting and the influence of NGO's and pressure groups that take a specific position with regard to nuclear power.

2. In our experience local communities are more objective in their perception of risk. They perceive that there is a potentially high impact yet low likelihood of a catastrophic event at the power station. Whilst the issue of likelihood is acknowledged and understood by local communities to be low they are nonetheless aware of the unique and significantly high harmful impact if a catastrophic event were in fact to occur. Those implications are potentially significantly more harmful and different from the potential impacts of a catastrophic event in other forms of energy production.

3. The planning process for nuclear power infrastructure projects has no reasonable mechanism to deal with risk and the perception of risk for the communities affected. The issues of risk perception and tolerability have no outlet within this framework. Communities and those that represent them have no means of articulating or redressing these issues within the planning process. There is no arena for an objective and considered discussion of these issues or potential solutions.

4. The planning process as a regulatory function is the most easily engaged with and understood process for individuals and communities. The other technical regulatory processes for nuclear energy are less understood and more "expert" driven in a technical way. Communities are used to engaging through the planning process which

touches in one way or another many people's lives. The failure of the planning process to allow for the objective consideration of the assessment of risk, its perception and tolerability, is a significant gap that undermines the creditability and 'fitness for purpose' of the process.

5. The failure of current promoters of new nuclear development to agree a community benefit regime similar to that already in assistance for the renewable energy sector, undermines the confidence of the communities in relation to the risks associated with nuclear power stations. The availability of a negotiated community benefit fund for those local communities would increase the potential engagement of those communities in the wider consideration of risk and toleration of risks associated with nuclear power.

6. Risk to human health and wider environmental risk from a catastrophic event is not dealt with in the environmental impact assessment element of a planning application. The risk however low of adverse affects resulting from the exposure of radiation to the public or the environment is not considered.
7. The failure of the national policy statement on nuclear energy to address risk and perception of risk from the exposure to radiation is also a significant oversight that must be remedied before the new generation of nuclear power is developed. It is insufficient for this significant issue to be dealt with through the other more technical and less accessible regulatory regimes

8. Both Local and Central Government fail to communicate adequately in regard to risk, perception of risk and tolerability. To undertake an objective consideration of such issues requires technical and expert support. Local Government is in a weak position with limited resources to support communities compared with well resourced Project

Promoters such as EDF. Central Government has failed to support Local Government in their work to consider and support communities through a complex and technical process.

9. Communication from Government on the issue of risk has been weak or non-existent and the void is filled by NGO's and pressure groups who potentially have a single position of being against nuclear power per se. There are therefore inadequate resources for the communities to engage adequately in an objective and open minded manner.

10. Local authorities should act as a community resource for objective consideration of risk and tolerability of risk. Local authorities should be adequately resourced to even out the current inequalities of resources between those who promote new nuclear projects and the communities affected.

Introduction

1.1 Sedgemoor District Council is pleased to have the opportunity to submit written evidence to the Committee's inquiry on Risk Perception and Energy Infrastructure and welcomes the Committee's examination of this important issue. We would welcome an opportunity to give oral evidence to the Committee and are happy to provide additional information.

1.2 Sedgemoor District council is situated in the County of Somerset. The authority has a significant coastline along the Severn Estuary and is predominantly rural with its main town being Bridgwater. The District has good communication links along the M5.

1.3 It is proposed that Hinkley Point C (HPC) will be the first new generation nuclear power station built in Britain. The promoters EDF Energy have now submitted an application for a development consent order for a new nuclear power station which is currently before the Infrastructure Planning Commission.

1.4 West Somerset Council is the relevant local planning authority for HPC. The nature of the geography however means that the proposed new nuclear power station lies adjacent to a number of communities in Sedgemoor District Council, namely the village of Cannington and Bridgwater Town itself. The impact of the development and construction will be felt in the Sedgemoor District particularly as all communication routes will have to go through Sedgemoor and Bridgwater in order for construction to take place.

1.5 In order to progress the HPC development, West Somerset Council and Sedgemoor District Council with Somerset County Council have collaborated to set up a single team for the purposes of considering planning and other regulatory processes and impacts on the community. The Councils affected requested support from the Government in order

to support local communities through the process and to provide an objective and reasoned set of representations to the IPC. This request was refused. The Councils have however been supported through the process by a planning performance agreement funded by the promoters of the project EDF Energy. This has permitted the authorities to commission support from appropriate technical experts to assist them in representing their communities.

Evidence on risk assessments, communication perception and tolerability in regard to new nuclear development

2.1 Communities adjacent to HPC have lived with the presence of nuclear energy production since 1957 when construction began. On site there is currently Hinkley Point A, which is being decommissioned and Hinkley Point B which is still producing energy. The communities are therefore accustomed to the presence of nuclear infrastructure, which has provided jobs for those living in the adjacent communities. The current nuclear power stations have had no serious or significant events that would exacerbate the issue of risk for local communities. In fact the continued safe operation of the current sites has done much to reassure local communities about the realistic levels of risk in living adjacent or close to a nuclear power station.

2.2 The perception of risk however remains for those communities as they are aware of the implications of a catastrophic event would potentially be more significant and detrimental than a similar event at a coal fired power station, for example. The distribution of iodine tablets to local communities for use in the event of a release of radioactive material acts as a constant reminder of the additional risks that exist for a nuclear power station. The events at Fukushima (and the ongoing repercussions) in addition to other historic problems at nuclear power stations have also impacted on the perception of risk.

2.3 It is also recognised through the local authorities emergency disaster processes, that the manner in which a catastrophic event at Hinkley Point would impact on communities and individuals is more significant and greater than those for other energy facilities. Whilst communities take comfort from the long period over which the current facilities have operated without incident, it merely has the effect of emphasising the low likelihood of the risk rather than minimising the impact of the seriousness should an event take place.

Current planning process

3.1 New nuclear infrastructure projects are required to be dealt with by the Infrastructure Planning Commission. An application for a DCO is currently before the IPC for HPC.

3.2 The planning process is one which is commonly understood and actively engaged in by individuals and communities. Of all the regulatory processes it is less technical than most and the one with which communities and individuals are most accustomed to engaging. It is important from a creditability point of view that the process is seen to be open and transparent and to take into consideration all relevant matters. In the normal course of a planning application, PPS 23 “Planning and Pollution Control”, would ensure that considerations of impact, risk assessment, perception and tolerability were taken into account. PPS 23 Annex A sets out the matters for consideration when deciding individual planning applications. At the penultimate bullet point it cites the following as a relevant consideration in the planning process:

“the objective perception of unacceptable risk to health or safety of the public arising from the development”.

In these circumstances issues of risk and tolerability would potentially be a material consideration for the planning process.

3.3 The DCO process that has been instituted by the Planning Act 2008 requires the IPC to consider large infrastructure projects against the national planning statement issued by the Government. The recently issued national policy statement (NPS) on nuclear energy exhorts the IPC to consider applications based on the guidance contained therein. In dealing with risks to health, particularly in regard to releases of radioactive material, the NPS states the following at 3.12.11:

"The IPC should act on the basis that the risk of adverse effects resulting from exposure to radiation for workers, the public and the environment, will be adequately mitigated because of the need to satisfy the requirements of the UK's strict legislative and regulatory regime as well as the ONR's implementation of the government's policy on demographics."

3.4 Curiously this policy guidance suggests that the issues of risk and perception of risk in regard to exposure to radiation is one that is not appropriate for consideration within the planning process. Instead it is already one that has been resolved through other regulatory processes. This contrasts with the requirement in other areas, through PPS 23.

3.5 It is also evident that the issues of risk and perception of risk and their tolerability by local communities is not catered for within the environmental impact assessment regulations. In their scope they do not require the consideration of risk and perception of risk but are more concerned to deal with potential harm to people and the environment and how that should be mitigated or removed. This is dealt with in an extremely technical way, which has the effect of excluding the public and communities who do not have the resources or technical ability to challenge or engage in these areas. Whilst there is the requirement to produce a non-technical summary, the ability to challenge or make

representations in regard to issues of risk require technical capacity if it is to be done in a reasoned, objective and relevant way.

3.6 This leads to support for communities being offered by NGO's or pressure groups (many not themselves local) often with a single objective. In the case of those groups that are anti-nuclear, then the support and technical advice given to communities or individuals who may want to consider the issues of risk come in the main from that perspective. In terms of generating an objective and considered discussion, this does not assist and as the process does not address legitimate concerns on risk, then communities and individuals feel excluded and thus the process and final decision has diminished creditability. It is the view of Sedgemoor District Council that the consideration of risk and tolerability is best placed within the planning process as it is the process that is best understood and actively engaged in by communities and individuals. The placing of the consideration of risk and tolerability in the more technical and less familiar scientific processes of other regulatory considerations, does not adequately deal with legitimate community concerns.

3.7 This is exacerbated by the inadequate funding for local authorities to support communities and individuals in their consideration of technical matters. The key to objective consideration of risk and its ultimate tolerability lies in good communication and adequate engagement with communities and individuals in a technically complex area. The need for support for local authorities to ensure adequate technical resources are provided is key. Small Rural District Councils do not carry expertise in these areas and such expertise is both scarce and expensive.

3.8 The resources of all the Councils involved in Somerset have been dedicated to meeting the requirements of the processes set out by the Planning Act 2008 and the National

Policy Statement which have by their effect excluded the issues of risk and tolerability. The limited funding provided by the developers through the PPA has meant that the authorities have had to choose to restrict their communications, considerations and engagement with communities to those issues that are directly relevant to the planning process. It has not allowed for a wider engagement and discussion or significant communication on the issues of risk, perception of risk and tolerability. This on the face of it is a significant gap in the process.

Communication with communities and individuals and community benefit

4.1 As with the issue of risk and tolerability of risk, the provision of community benefit is a matter that currently sits outside the planning process. Community benefit is the internationally accepted form of compensation paid to communities hosting large impactful infrastructure projects, particularly nuclear power stations. Payments are made from the developer's and Energy providers into a fund that communities can access as they consider most beneficial to make the hosting of a new nuclear power station more tolerable. There are many examples of this approach internationally. Community benefit is paid in such diverse countries and USA, Japan, France, Italy, Spain as well as being in place for renewable and low carbon energy projects in the UK.

4.2 Currently community benefit, despite having been referred to once in the NPS has not been accepted by promoters of new nuclear infrastructure. There is an assertion that it may be perceived as "buying" planning consent. It seems to those authorities and communities affected by this, that there is no grounds for such a perception to arise. The decision as to whether infrastructure projects should be granted consent lies with an independent objective body the IPC and on to the Secretary of State.

4.3 Sedgemoor District Council's view is that there would be an opportunity for a more rounded discussion about risk and tolerability of risk within the context of the provision of a community benefit fund. Whilst the planning process may provide for compensation through Section 106 Agreements for direct and indirect impacts arising from the construction and operation of the new nuclear facility, there are wider issues of impact and risk that do not fall within the planning process. In particular the perception of risk from a significant catastrophic event at a nuclear power station is one that is not covered by the planning process. Nor is the greater perception of risk created by the issue of iodine tablets to the local communities. It would not be dealt with by the Section 106 Agreement as the NPS has stated that the issue of human health and risk are matters for consideration in other regulatory formats where compensation and Section 106 Agreements have no place.

4.4 The acceptance by the Government and developers of the appropriateness of community benefit for communities hosting renewable energy projects has national acceptance. The potential impact on communities of new nuclear is both greater and more significant. The provision of community benefit would seem in these circumstances more appropriate and necessary. It could also be used appropriately as a catalyst for consideration of the wider issue of risk, perception of risk and tolerability for communities. In the absence of this there is no reasonable context in which such considerations can take place alongside wider issues of risk and impact of hosting a large infrastructure project that will benefit the nation.

4.5 The Councils in Somerset have accepted that the pursuit of community benefits lies outside of the planning process and have put in place lines of responsibility which respect this issue. However, it would seem completely appropriate to run a community

benefit discussion parallel with the planning process so that risk and toleration of risk can be properly considered (along with other relevant issues). A swift move to a comprehensive agreement in this regard between government, local authorities and potential developers would have the benefit of settling this matter at an early stage.

4.6 In preference, however, it would be more appropriate to ensure that both the issues of risk, perception of risk and tolerability and payment of community benefit to communities affected by new nuclear power stations should be included within the planning process. Both these issues lie outside the consideration of the planning process currently. There is failure to communicate these issues with communities and no resources for local authorities to step in and take up these issues with those communities.

4.7 There is no reason why the Government through an amendment the NPS or through separate policy or advice could not ensure that the planning processes adequately deal with and considered risk, perception of risk and tolerability as well as appropriate direct funding to support communities affected. This could also be coupled with a proper consideration of community benefit for each project promoted through the planning process. Specifically permitting these areas to be included in the planning process would remove the alleged perception of "buying" planning permission.

4.8 This could be delivered by ensuring that community benefit is a matter for local negotiation and settlement within the planning process and a matter the IPC should ensure is adequately dealt with and provided for before considering any application before it. In any event as the IPC would not be a direct beneficiary of any community benefit they cannot be tainted in reaching their own independent and objective

conclusion. This would ensure the transparency and openness in such a process if adopted.

Sedgemoor District Council

14 December 2011

Written evidence submitted by The Geological Society of London (Risk 16)

1. The Geological Society is the national learned and professional body for geoscience, with over 10,000 Fellows (members) worldwide. The Fellowship encompasses those working in industry, academia and government, with a wide range of perspectives and views on policy-relevant geoscience, and the Society is a leading communicator of this science to government bodies and other non-technical audiences.

2. We have not attempted to address all aspects of the questions below. Given the inquiry's focus on the nuclear industry, we have directed our remarks in particular towards Government's Managing Radioactive Waste Safely (MRWS) programme – the area of nuclear energy infrastructure in which the geoscience community is most actively involved in the UK, and one in which considerable work has been done in recent years to address issues of public confidence and perception of risk. We urge the Committee, in considering nuclear energy infrastructure, to recognise challenges throughout the whole nuclear fuel cycle, including 'back end' issues such as waste disposal, decommissioning, and the 'dual use' challenge of spent fuel and associated national security implications. The Royal Society's October 2011 report 'Fuel cycle stewardship in a nuclear renaissance' is an excellent starting point for considering the whole fuel cycle, beyond the more obvious aspects of waste disposal and plant decommissioning.

3. Geoscientists also have a vital role to play in understanding the risk posed to nuclear and other energy infrastructure by natural hazards. The March 2011 earthquake and tsunami in Japan have highlighted this concern. While the UK is not vulnerable to earthquakes of such magnitude, it might be affected by tsunamis triggered by events elsewhere in the world. We can quantify tsunami effects in the recent British geological record. For instance, that which hit Scotland 8000 years ago, triggered by the Storegga landslide off Norway, was around 25 metres high, and if repeated now would inundate Torness nuclear power station. More recently, the tsunami following the Lisbon earthquake of 1755 was several metres high when it reached the southwest of England – a similar event now would affect Hinkley Point power station.

4. While it is sensible to limit the scope of the inquiry to a particular area of energy infrastructure, we have included some comments relating to other aspects of the energy system. Attempting simply to transplant approaches and methodologies from one context to another is rarely successful – but with due care and attention to the particular circumstances, there are lessons to be learned, from other countries, from other parts of our energy production system, and from past experience. Many communities in the UK have a long history of living with energy production and associated risks, and of depending on this industry for their livelihoods, especially in coal mining areas.

5. Geological disposal of radioactive waste is an example of using the subsurface, and the properties of the geosphere, as part of the infrastructure we will require to manage responsibly the entire life cycle of our energy use and its impact on the planet. Carbon Capture and Storage (CCS) will be another. This new paradigm of energy use is fundamentally different to the historical model of resource extraction, involving as it does the return of waste materials to the geosphere and the need to understand their behaviour. Geoscientists will be at the heart not only of achieving this, but of addressing and communicating to the public the associated real and perceived risks.

What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?

6. Suspicion of the nuclear industry, and its reputation for secrecy, in the 1970s, 80s and 90s was a major negative factor affecting public risk perception and acceptance of infrastructure projects. This was particularly true of attempts to establish a radioactive waste disposal programme prior to the 1997 refusal of the planning application for a Rock Characterisation Facility (RCF) at Sellafield, West Cumbria. With the failure of this planning application, Government recognised the need for a fresh start and a new approach, based on openness and transparency, a deliberative approach to decision making, and early and continuing involvement of the public in decision-making. This approach has been pretty comprehensively adopted by the nuclear industry for the last decade, and is fundamental to the work of the Radioactive Waste Management Directorate (RWMD) of the Nuclear Decommissioning Authority (NDA). This has resulted in good progress in building public confidence in the industry, and in the concept of geological disposal of radioactive waste, though considerable suspicion remains in some quarters. The lesson here is that the prevailing culture in particular industries and professional communities has a huge impact on public confidence and perceptions of risk, which in turn can dramatically affect programme outcomes, and that to win back public confidence takes a long time. There has been understandable criticism in recent years that MRWS has progressed slowly. While there may be ways in which Government and others could improve the rate of progress, it is also important that the process be allowed to develop at a pace that public confidence will allow.

7. It is easy for expert communities to see their own understanding of risk as privileged. However, this can be alienating to those who do not share the same assumptions, perspectives or expert knowledge – both the general public, and other specialist communities. Geoscientists, for instance, are used to dealing with extremely long time periods, and with incomplete evidence bases, both of which shape their perception of risk and uncertainty. These characteristics have the potential to be of great benefit both in delivering safe disposal of radioactive waste, and in inspiring public confidence in this solution, but unless the differences in assumptions and knowledge of geologists and others are

recognised and honestly addressed, they may also risk fuelling suspicion and distrust. It is important for scientists to think critically about how they communicate their work, their disciplinary understandings of risk, and their confidence in their predictions – and for the scientific community to encourage and reward the development of relevant communication skills. Working together with social scientists specialising in this area can bring considerable benefit, and enlisting social science expertise in this way is becoming standard practice in the radioactive waste community.

8. Another major factor in shaping public risk perception and acceptance of energy industry is its historical role in local communities. This was particularly true in traditional coal mining communities, where the local economy was often heavily dependent on mining, and workers and their families were often all too familiar with the associated risks. It is not surprising that the only volunteer communities in the UK so far to have expressed an interest in hosting a geological disposal facility for radioactive waste are in West Cumbria, where the nuclear industry is well-established, familiar to the local population, and economically important, despite the continuing distrust of that industry by some.

How are public risk perceptions taken into account in the planning process for energy infrastructure?

9. Public acceptance and risk perception were central to the deliberations and recommendations of the Committee on Radioactive Waste Management (CoRWM) in its original incarnation from 2003-2006. The importance accorded to these factors alongside scientific and technical considerations initially caused a degree of disquiet in some parts of the scientific community. However, Government, the NDA, Site Licensing Companies and others involved in MRWS have continued to recognise the vital importance of public confidence, and this is embedded in the MRWS process through the principles of volunteerism and community partnership. The details of the planning process for later stages of MRWS are not yet known, but the Geological Society recognises the importance of continuing to address public engagement, acceptance and risk perception as the programme develops. In so doing, it is essential that the central importance of geoscience in site selection, development of the safety case and safe implementation of radioactive waste disposal is not compromised. Geoscientific information, insights and judgments can play a central role in helping to meet public concerns about risk, and decision-making processes should be carefully designed with this in mind.

10. We have no comment on how public risk perceptions are recognised in the planning process for nuclear infrastructure beyond waste disposal.

How effectively does local and central Government communicate risk and could it be improved?

11. Regarding local government, we note that MRWS is in its early stages, and that local authorities' engagement with risk and its public perception in this context is similarly new. We applaud the work which the West Cumbria MRWS partnership is undertaking, in engaging with the NDA, British Geological Survey (BGS), the wider scientific community, other stakeholders and local communities, and in communicating a wide range of specialist advice and input to local communities and decision-makers as they consider whether to proceed with participation in the MRWS process. We also note the work which the Nuclear Legacy Advice Forum (NuLeAF) has done in supporting local authorities in addressing these issues.

12. We have no comment on the effectiveness of central Government in this respect, or on other aspects of nuclear infrastructure.

To what extent can public perceptions be changed by improving risk communication?

13. An important part of CoRWM's work from 2003-2006 was not just to recognise public perceptions in its deliberations, but to start to build public confidence in its recommendations, and to address how this might be continued. Again, this has continued to be a priority for the NDA and others. It is difficult to quantify the extent to which greater public confidence in the concept of geological disposal and the MRWS programme can be attributed to improved risk communication, rather than to greater transparency of process and engagement with the public and stakeholders more generally. Indeed, it is impossible to pick apart these closely linked considerations. But it is unlikely that the progress which has been made with MRWS would have been achieved without effective attention being paid to public risk communication and related matters. (An early priority for CoRWM was to learn lessons from other public consultation processes. A particularly salutary case was the GM Nation debate, which had just come to an end and was widely regarded as having been unconstructive. This was attributed in large part to extensive gathering of (relatively uninformed) public opinion, without engaging participants in the process. By contrast, CoRWM undertook several intensive exercises to help members of the public engage with a range of experts and stakeholders with differing perspectives, and to understand their views in that context.)

How does and should the Government work with the private sector to understand public perceptions of risk and address them?

14. Industry has a vital role in understanding and addressing public perceptions of risk. This is nowhere more clearly understood than in the hydrocarbons sector, where the long-term commercial success of infrastructure investment on a vast scale depends on building and maintaining public confidence. In recent years, considerable effort and expertise has been devoted to improving public engagement, and to understanding and seeking to address public questions and

concerns, rather than making assumptions about what the perceived risks are. We would be pleased to identify examples if this is a line the Committee wishes to pursue. There are valuable lessons to be learnt in other parts of the energy sector, and Government can play a useful role in facilitating this.

How do risk perceptions and communication issues in the UK compare to those of other countries?

15. Internationally, all successful radioactive waste disposal programmes identify the importance of public confidence, and some form of volunteerism and partnership with local communities are key elements. The need to pay careful attention to public perceptions of risk and to the communication of scientific understandings of risk is widely recognised, and within the well-established international radioactive waste management community, these matters are actively discussed alongside (and in conjunction with) scientific and technical issues. This international community is generally both sophisticated and well-informed in its understanding of the similarities and differences between national programmes and contexts, from the waste inventory and geological settings to broader cultures of citizens' relationship with authority, traditions of decision-making and legal frameworks. The number of radioactive waste management programmes worldwide is very small, the financial and institutional investment required significant, and the timescales required for implementation unprecedented compared with any historical civil engineering project. So it is essential that every opportunity for learning between programmes is taken, both regarding scientific and technical understanding and public engagement, but also that such learning is sensitive to national context.

Concluding remarks

16. We would be pleased to discuss further any of the points raised in this submission, to provide more detailed information, or to suggest oral witnesses and other specialist contacts.

The Geological Society of London

13 December 2011

Written evidence submitted by Sense About Science (Risk 17)

1. Introduction

1.1 Sense About Science is a UK-registered charity (No.1101114) to equip people to make sense of science and evidence. We work with thousands of scientists and hundreds of groups across civil society to respond to questions and challenge misleading claims about evidence.

1.2 We are unable to address all of the questions posed by the committee. We particularly address questions 3, 4 and 6 put forward by the committee in their call for submissions.

2. Question 3. How effectively does local and central Government communicate risk and could it be improved?

2.1 The House of Commons Science and Technology committee report on "Scientific Advice, Risk and Evidence Based Policy Making"[1] specifically provided recommendations on Risk Communication, the Precautionary Principle and a Common Language of Risk that could be useful across Government. We have found these recommendations to be of enduring relevance.

2.2 The recommendations included a pro-active approach to working with the media in this area and said that government guidance should encourage a more aggressive approach to correcting inaccuracies or misinterpretations in media coverage of risk. The way that risk is communicated can be compromised by government reactions to reports of events, both by adopting or changing policies as a knee-jerk response and in the way that the communication of risk is done.

2.3 We also need to consider what is happening at the European level, since EU decisions regarding risk management and the way that risks are communicated affect national perceptions. For example, the EU Physical Agents (EMF) Directive 2004/40/EC, which seeks to define safe levels for equipment operators' exposure to electromagnetic fields (EMF), puts limits on exposure for operating staff. In the Directive, European legislators adopted overly-cautious restrictions which would have had consequences for clinical magnetic resonance imaging (MRI). These might have been unintended, but threatened potentially disastrous limitations on the use of the technology despite there being no known harmful effects on staff exposed to low frequency EMF, such as is used in MRI systems. It was argued that adoption of precautionary, even unfounded, regulatory limits provides reassurance. In our experience, with radiation in particular, it is as likely to cause politicians, the media, campaign groups and thereby the public to conclude that this is evidence of danger. We can provide further information about the unintended consequences of precautionary measures on risk perception; some academic work in the UK, Germany and elsewhere has begun to look at this problem over the past four years.

3. Question 4. To what extent can public perceptions be changed by improving risk communication? (please provide examples)

3.1 At Sense About Science we monitor public debates, enquiries, science stories in the news, new science legislation and consultations. If we see an issue regularly occurring and find ourselves constantly fire-

[1] House of Commons Science and Technology Select Committee, Seventh Report 2005-06, *Scientific Advice, Risk and Evidence Based Policy Making,* HC 900

fighting, or if there are underlying assumptions that would be useful to the discussion, we address these through collaborative projects which respond to specific misconceptions. If there are areas in which public perception seems to be based on misinformation or misconceptions, we find it is helpful to start by addressing these directly instead of just setting out everything that we might know about the area.

3.2 In doing this and to be able to communicate about risk effectively we need to address uncertainty. Over the last two years, Sense About Science has seen an increase in questions from members of the public about the meaning of uncertainty and worries among scientists about its misinterpretation.

3.3 We have established a working group and will produce a guide early in 2012 to include the following points: Uncertainty is typically taken to mean `we don't know', when rather it is a statement of how confident we are. Uncertainty doesn't mean that anything goes, or that it is impossible to be certain of anything surrounding the issue under discussion. Rather, uncertainty shows that an investigation of the subject has been taken seriously.

3.4 Scientists should be able to talk about uncertainty without it being interpreted that every topic in a whole discipline is open to interpretation or that there is no consensus view.

4. Question 6. How do risk perceptions and communication issues in the UK compare to those of other countries?

4.1 This memo is concerned with the media reporting of the Tohoku Great Earthquake in Japan in March 2011 and reporting of the subsequent events at the Fukushima Daiichi nuclear plant[2]. The earthquake and ensuing tsunami led to nearly 16,000 dead and over 3,000 people missing now presumed dead. Towns were sluiced away and there was extensive damage to food and water supplies, medical services, power and communications, affecting hundreds of thousands of inhabitants.

4.2 Following the Tohoku earthquake politicians focused on the events at the Fukushima Daiichi nuclear power plant and the prospect of losing control over the nuclear reactors there. On Tuesday 15th March, the EU Commissioner for Energy Günther Oettinger said: "There is talk of an apocalypse and I think the word is particularly well chosen. Practically everything is out of control. I cannot exclude the worst in the hours and days to come."

4.3 Whilst there clearly was a serious issue that needed addressing in Japan, it is doubtful that public clarity would be achieved by referring to the situation at the Fukushima plant as the "apocalypse". It seems unlikely to help people understand the situation in order to tackle and weigh-up the specific problems in a considered and measured way, which must be a priority when policy-makers and Governments communicate risk, rather than political point-scoring.

4.4 It is likely that the way the events at Fukushima were communicated in different countries and the reaction of policy makers in different countries also affected risk perceptions.

4.5 According to the findings of the Global @dvisor Wave 20 (G@20), an Ipsos survey on *Global Citizen Reaction to the Fukushima Nuclear Plant Disaster* shows that three in five global citizens (62%) oppose the use of nuclear energy and that a quarter (26%) of those have been influenced by the recent nuclear disaster in Fukushima, Japan.

[2] The media's coverage of the Tohoku earthquake and tsunami and the events at the Fukushima Daiichi nuclear plant will be the topic of a discussion session we have organised at the AAAS conference in February 2012.

4.6 However the UK does not appear to reflect this. In his recent column "Learning the lessons of Fukushima"[3], Professor Nick Pidgeon refers to these results as well as tracking data from the Public Perceptions of Climate Change and Energy in Britain by Cardiff University. He argues that these results seem to indicate that "Fukushima has had little impact on overall UK public concern about nuclear power", in contrast to the picture globally.

4.7 In Germany, Chancellor Angela Merkel announced on 15th March an immediate three-month closure of seven of the older nuclear power reactors in the country. This was just a few days after the tsunami affected the Fukushima Daiichi plant and appears to have been a knee-jerk reaction to the media coverage rather than any reassessment of the risk that these plants posed. In May, Merkel went on to announce that all nuclear power plants would close down by the end of 2022 based on the reporting of an 'ethics committee' and following many public demonstrations against nuclear power. Germany also plans to significantly decrease carbon dioxide emissions but it has been estimated that these will increase – with an extra 300 million tonnes of carbon dioxide until 2020[4].

5. Declaration of interests

5.1 We have no competing interests to declare.

Sense About Science

12 December 2011

[3] Pidgeon N, December 2011, *Learning the lessons of Fukushima*, People and Science, pg 20. http://www.britishscienceassociation.org/NR/rdonlyres/9223A350-74E4-4D11-B7C2-5DEA7D5548C6/0/peoplesciencedec11.pdf [accessed 13 Dec 2011]

[4] Deutsche Bank, 27 May 2011, *German Power: Getting Down to the Nuclear Core*, http://www.endseurope.com/docs/110530c.pdf [accessed 14 Dec 2011]

Written evidence submitted by Greenpeace (Risk 18)

Greenpeace welcomes the opportunity to respond to this inquiry. However, we are concerned that the objective of the inquiry appears to be manage and reduce public perception of the risk of nuclear power rather than working out how the government can be an honest and impartial communicator of the facts to help the public have an accurate and appropriate perception of risk.

Public perception that nuclear brings significant risks should not be viewed as a challenge to government or parliament to change perceptions. As the disaster at Fukushima Daiichi in Japan showed, there are real and present risks inherent in certain types of energy infrastructure that cannot be obviated by simply managing how those risks are perceived. If anything, public perception of the risks of nuclear power are too low, because the government and the nuclear industry has consistently played down legitimate concerns in their desire to keep the wheels on their plans for new nuclear reactors.

Indeed, the government has all too often focused on the need to manage the perception of risk at the expense of properly recognising and minimising the risk to the public. For example, Dr. Weightman's report into the implications of the Fukushima disaster on the UK's nuclear power stations recommended several ways in which the UK's regulatory regime and knowledge base should be improved. But before these recommendations had been adopted – or Dr. Weightman had concluded his research – the Secretary of State approved the National Policy Statement on nuclear power, effectively concluding that there were no important lessons that needed to be learned.

Greenpeace is grateful for having been afforded advance sight of a forthcoming study for the European Environment Agency by Dr. Paul Dorfman, Founding Co-ordinator of Nuclear Consulting Group, and Senior Researcher, University of Warwick.[1] Our response is informed by his comments.

We have limited our responses to questions 1, 2, 3 and 5.

What are the key factors influencing public risk perception and tolerability of energy infrastructure facilities and projects?

[1] FORTHCOMING EUROPEAN ENVIRONMENT AGENCY REPORT: comprises part of Chapter (Dorfman and Fucic, forthcoming) in draft for publication in a forthcoming European Environment Agency (EEA) report, volume 2 of 'Late lessons from early warnings 1824–2011: science, precaution and politics' Volume 2, due for publication in April 2012.

Public risk perception will be influenced by several factors. First and foremost of these will be the empirical evidence that there are serious risks associated with nuclear energy. In other words, people perceive nuclear power as risky because nuclear power is risky.

The most vivid illustration of this in relation to energy infrastructure was the Fukushima disaster and the decontamination operation. We do not yet know the full cost – economic, environmental or social – of the disaster. The health impact will only become apparent over time. The cost of the clean-up operation remains uncertain – primarily because it is on-going – but it is thought to run into the hundreds of billions of dollars. But instead of taking the time to learn from the disaster and communicating the facts and the risks, government officials contacted representatives of the nuclear industry and drew up a plan to manage public perception of the scale of the disaster (see below).

Worse, the government has shown little willingness to learn the safety lessons from the disaster. It is primarily concerned with keeping its nuclear programme on track. The major contributor to the meltdown is now thought to have been the prolonged interruption of the electricity needed to maintain the supply of cooling water to the reactors, not necessarily any physical damage caused by the earthquake or tsunami.[2] Whilst the UK is not tsunami or earthquake prone, some of the sites where new reactors would be built are in “high risk” flooding areas or where off-site electricity supplies cannot be guaranteed under severe hazard conditions. In both cases, Dr. Weightman raised issues with the UK’s knowledge base at the interim-report stage and recommended ways our understanding of these site-specific challenges could be improved. But the government pre-empted these findings by approving the National Policy Statement on nuclear power, designating sites for new nuclear reactors in coastal areas before Dr. Weightman had concluded his report and his recommendations been adopted and implemented.

In addition to the very real risk of a major incident at a nuclear site, there are the financial risks associated with the construction of new reactors and the opportunity costs of investing in this energy source at the expense of another. These are not communicated to the public, so it is very difficult for the public to have an accurate perception of the risks. The Areva EPR under construction at Olkiluoto in Finland was supposed to be online by 2009 but has now been delayed until at least 2014. Its cost has doubled, from 3 billion euros to almost 6 billion; the true cost could well be higher, as Areva and TVO are involved in an acrimonious contractual dispute, with each demanding compensation or damages from the other.[3] The EPR under construction at Flamanville, France has been delayed from 2012 to 2016 and is almost 3 billion euros over budget.[4] The risk of cost overruns and delays are very significant

[2] http://www.world-nuclear.org/info/fukushima_accident_inf129.html
[3] http://www.tvo.fi/www/page/2975/
[4] http://www.bloomberg.com/news/2011-07-20/edf-delays-flamanville-to-2016-on-fukushima-deadly-accidents.html

with current plans to use EPRs in Britain too. But the government has not communicated these risks in the debate over energy choices.

In addition, the government has committed to not providing any new public subsidy for nuclear, but the market has proved decidedly unwilling to shoulder the risk. Financial analysts have warned Centrica, which owns a 20% stake in the UK's existing nuclear fleet, not to opt into nuclear new build.[5] The Energy and Climate Change committee has exposed that the government is planning a series of hidden subsidies. Primarily, to encourage investment, the government has proposed reforming the UK's electricity market to provide investors with guaranteed returns by contracting to purchase energy at a pre-determined price. This transfers risk from the private sector to the public. It may also fall foul of European Union laws regarding State Aid. Hiding these planned subsidies distorts the debate and public perceptions of the financial risks.

In committing the UK to a nuclear future the government has exposed taxpayers and energy consumers to financial risks associated with failing to meet decarbonisation and renewables targets. The UK has committed to 34% cuts in CO2 emissions from energy by 2020 (from 1990 levels), as well as to producing 30% of its energy from renewable sources. But nuclear cannot be relied up to contribute: the first new nuclear reactor could not come online until 2019 (at the proposed operator's most optimistic indicative estimate). Investment in nuclear comes at the expense of investment in renewables; by placing privately-financed nuclear at the heart of the UK's energy mix, the government risks having to spend even more of taxpayers' money in a frantic bid to build enough renewable energy to meet these targets. This opportunity cost is largely hidden from the public by the government.

How are public risk perceptions taken into account in the planning process for energy infrastructure?

Reforms to the planning process, as outlined in the Planning Act 2008, the Localism Bill, the National Policy Statement on nuclear power (NPS EN-6) and the draft National Planning Policy Framework mean that there are regrettably few opportunities for the public to have a say in the planning process. Taken together, these reforms are little less than a presumption in favour of the construction of nuclear power stations, regardless of the concerns of people living nearby. They appear to be designed to drive through decisions regardless of public concerns over risk.

How effectively does local and central Government communicate risk and could it be improved?

AND

[5] http://www.guardian.co.uk/business/2011/jul/25/centrica-nuclear-power-stations

How does and should the Government work with the private sector to understand public perceptions of risk and address them?

The risks of nuclear radiation, along with the effects of chemicals and risks to health such as BSE, have particular characteristics: they are poorly understood, invisible, and have impacts a long way from the source of the problem in time or place (or both). People are, quite reasonably, much more wary of risks that are uncertain, intergenerational, involuntary and indiscernible though conventional senses. Under these circumstances people have no choice but to rely on the institutions that create and govern them. If these institutions are seen to be an unreliable, secretive and not to be acting in the public interest then the public would, frankly, be irrational not to be risk-averse.

Instead of acting as an independent arbiter of information, the government's response is, by-and-large, to believe that the problem can be solved by more science or technical evaliuation. Far from allaying concerns, this gives the impression of collusion between government and the relevant industry. It serves merely to politicise science and further undermine public perception of what the risks are and whether they can be alleviated or reduced to acceptable levels. The public has a right to feel lied to or misled if the government is seen to be managing perceptions of risk instead of adopting a neutral position and prioritising reducing the risk to the public.

This is particularly the case for nuclear power, where the government has a repeatedly shown itself determined to play down the risks of nuclear power well before the scientific consensus has emerged. As documents obtained under the Freedom of Information Act 2000 reveal, just two days after the start of the Fukushima disaster, a civil servant at the Department for Business, Innovation and Skills sent an email to executives at Areva, EDF and Westinghouse, urging the industry to work with the government in establishing "very strong coordinated messages".[6]

"This has the potential to set the nuclear industry back globally," the email went on. "We need to ensure the anti-nuclear chaps and chapesses do not gain ground on this." Instead of biding their time and producing a calm and considered response, the UK government's position was driven by a desire to manipulate public opinion: to "occupy the territory and hold it" and to "show the safety of nuclear." Given that UK is one of the few places where the Fukushima incident has not led to a rise in concern over nuclear it is possible that the Government-Industry media manipulation has had some effect on impacting public perceptions – although generally such "successes" can be quite fragile if and when revelations about the extent of collusion becomes clear.

[6] http://www.guardian.co.uk/environment/interactive/2011/jun/30/email-nuclear-uk-government-fukushima

Greenpeace is also deeply concerned that the government passed privileged legal papers relating to its judicial review of the nuclear NPS to the nuclear industry.[7] Actions like this compound public concerns about the transparency and openness of the nuclear industry and the government's attitude to its nuclear programme.

Instead of working with the nuclear industry, the government needs to adopt a neutral, whiter-than-white approach to risk. It needs to act as an arbiter of information, rather than a proponent of nuclear power trying to shout down anyone who disagrees with it. This means being upfront about the problems and risks of nuclear power. Where it does not have all the answers, as in the immediate aftermath of Fukushima, it should be honest about it and await further information, instead of embarking upon a programme of news management.

Conclusion

There are serious economic, environmental, health and safety risks associated with nuclear power. Public concerns about these risks is not irrational, and are compounded by the legitimate distrust of the authorities responsible for managing the risks of nuclear power. If anything, the public is not concerned enough about the problems of nuclear power, because the government and the industry is doing its utmost to influence perception at the expense of managing the actual risks.

Greenpeace

15 December 2011

[7] http://www.guardian.co.uk/environment/2011/dec/05/uk-government-intelligence-nuclear-industry

Written evidence submitted by
Energy Networks Association (Risk 19)

1. Energy Networks Association - who we are and what we do

Energy Networks Association (ENA) represents the 'wires and pipes' transmission and distribution network operators for gas and electricity in the UK and Ireland. Our members control and maintain the critical national infrastructure that delivers these vital services into our homes and businesses.

ENA's overriding goals are to promote the UK and Ireland energy networks and enable our networks to be the safest, most reliable, most efficient and sustainable in the world. We aim to influence decision-makers on issues that are common to its interests. These include:

- Regulation and the wider representation in UK, Ireland and the rest of Europe.
- Cost-efficient engineering services and related businesses for the benefit of members.
- Safety, health and environment across the gas and electricity industries.

As the voice of the energy networks sector ENA acts as a strategic focus and channel of communication for the industry. We promote the interests and good standing of the industry, and provide a forum of discussion among company members.

2. Introduction

The industry works with government, the regulator and other interested parties to ensure the normal supply of natural gas and electricity as a national priority. This is considered an economic imperative and it is vital that it is carried out in a manner which ensures the safety of the public, employees and contractors.

This is achieved through the following arrangements:-

a) An Executive comprising representation from DECC, Ofgem and industry to oversee the development of emergency planning arrangements (Energy Emergencies Executive (E3))
b) An Executive Committee (E3C) with wider representation from government, Ofgem and industry to prepare for emergencies by developing, maintaining and testing emergency planning arrangements.
c) Subcommittees of E3C dealing with specific issues:

E3C and the Task Groups normally meet every two months.

E3C members are jointly engaged in developing plans and processes and undertaking training and exercises with the aim of preserving normal gas and electricity supplies.

Most supply incidents are local or regional in nature and are managed by the relevant utility company. At a national level there are a series of measures to prevent or minimise disruption. First, the commercial arrangements are designed to give participants an incentive to have sufficient supplies to meet their customers'

requirements. If supplies are disrupted then operational arrangements are in place to manage the situation. In the gas industry the Network Emergency Co-ordinator would declare an emergency under the Gas Safety (Management) Regulations and re-establish the balance between supply and demand. In electricity, the Electricity Act 1989 includes provisions for the Fuel Security Code, which sets out how to manage a shortage of generation, and the Electricity Supply Emergency Code, which describes how demand will be curtailed to meet supply whilst protecting certain priority customers. Finally, there are Black Start plans for the re-starting of the UK electricity system following a complete failure. The principle in all these circumstances is for the industry to maintain operational control, while DECC's role is to cover strategy, policy and liaison with other government departments.

http://www.decc.gov.uk/en/content/cms/meeting_energy/en_security/en_security.aspx

In an emergency, the UK Government will be responsible for overall policy and strategy, whilst industry will be responsible for the operational management of the incident. It should be noted that whilst the devolved administrations do not have responsibility for energy, Scottish Ministers do have devolved responsibilities related to managing the consequences of emergencies in Scotland and therefore their representative attends meetings of E3C.

In the event of a significant disruption, or threat of significant disruption, to gas and/or electricity supplies, the UK Government may under the Energy Act 1976 seek powers to direct appropriate aspects of the production, distribution acquisition, supply and use of gas and electricity.

In addition to these arrangements electricity and gas transmission and distribution companies have established an emergency planning forum under the auspices of the Energy Networks Association (ENA) that also meets every two months, following E3C, to ensure E3C decisions are implemented and carry out more detailed planning work.

The distribution companies also have mutual aid arrangements in place to assist in the management of localised extreme events by providing for the transfer of staff and resources between companies.

2. Winter Preparedness

2.1 National Grid Winter Outlook Report

National Grid provides information to participants in the gas and electricity markets by publishing an outlook of supply and demand prior to both the winter and summer periods. Prior to the Winter Outlook Report National Grid conducts a consultation exercise designed both to help inform the industry and also to provide National Grid with feedback to support the production of the Winter Outlook Report in September/October. This report is considered by government and E3/E3C.

The consultation is separated into two main sections, a review of last winter and a consultation on the outlook for the upcoming winter and is available on the National Grid web site at http://www.nationalgrid.com/uk/Gas/TYS/outlook/

Winter Review 2010/11 - Key Details

Weather
Coldest December on record but overall an 'average' winter due to other months being relatively 'warm'
Fuel Prices
All energy prices increased during winter 2010/11, notably oil and gas. As the relative increase in gas price was higher than that for coal, the economics within winter shifted from gas to coal as the preferred source of fuel for power generation
Gas
Highest demand 20th Dec 2010 (the 2nd highest) 465 mcm/d 2010/11 supply trends - lower UKCS, more LNG. Increased flexibility from non storage supplies
Electricity
Peak demand 7th December 2010 at 17:30 59.7 GW
Actual generator availability at the peak 80%

2.2 Other information not included in the 2010/11 review
Although there was an exceptionally long spell of snowy conditions, the electricity and gas transmission and distribution systems performed well and there were no significant weather related incidents reported.

2.3 Other information concerning 2011/12 preparedness
Gas and electricity transmission and distribution companies will be reviewing their winter preparedness when their emergency planning managers meet at the next ENA forum on 11 October.

Typical actions for companies include:
- Recommissioning circuits following summer maintenance or reinforcement/replacement work to ensure networks are as robust as possible.
- Reviewing emergency plans and ensuring that staff are briefed for their emergency roles.
- Reviewing emergency stocks of plant and equipment.
- Reviewing the availability of specialist vehicles including four wheel drive.
- Considering long range weather forecasts and constantly monitoring medium and short rang forecasts. Companies have contracts with the Met Office for the provision of specialist weather warning information including longer distance probability based forecasts. This can enable companies to put in place emergency arrangements before severe weather arrives. In some circumstance this may include cancelling routine work, establishing an emergency management team and initiating contact with other companies regarding mutual assistance.

Notes

1. ENA and its member companies have supported the Environment Agency (EA) in the development of a new flood warning system for infrastructure owners. This will automatically indicate which items of infrastructure are affected by which flood warning and will be a particular help to infrastructure owners when large numbers of their sites are affected by multiple warnings. It is expected that this system will be in commission in the late autumn and more information is available from the EA.
2. Following the severe flooding in 2007, ENA and its member companies worked with EA, Scottish Environment Protection Agency (SEPA), Met Office, Ofgem DECC and the Pitt Review Team to produce a ten year strategy for improving the resilience of electricity substations and gas infrastructure to the effects of

flooding. This programme continues to improve network resilience to flood events and is now part of the National Critical Infrastructure Resilience Programme.

3. Adaptation to Climate Change

ENA worked with its member companies in 2010/11 to develop a response to the requirements placed on them as reporting authorities by the Climate Change Act. Electricity companies are more affected by the predicted changes in climate and a "core" assessment has been prepared by a task group of electricity distribution and transmission network operators. The task group included the Department of Energy and Climate Change (DECC) and received inputs from the Office of Gas and Energy Markets (Ofgem), the Department for Environment, Food and Rural Affairs (Defra), Environment Agency (EA), the Met Office and other organisations.

The Engineering Report considers those issues that are common to electricity network companies across the UK and has been used by companies as the basis for their individual reports which will also include company specific information.

UK electricity network companies have experience in operating in a range of weather conditions and have always used the latest information when considering current threats and potential climate change impacts. For climate projections this was initially UKCP02, which was used by the Met Office in a report commissioned by energy companies and published in 2008. The report investigated the potential impact of climate change on energy companies. UKCP02 has now been superseded by UKCP09, which is used in all current research.

The EP2 report was a groundbreaking initiative that brought climate science closer to business applications. This was the first project sponsored by an entire sector to review the specific impacts of climate change on their industry. Supported by climate scientists, experts from the industry worked together to understand their precise requirements and developed practical applications and business strategies for a changing world.

Further work has recently been completed with the Met Office to build a risk model that quantifies the relationship between climate and network faults, and also the vulnerability and exposure of the network to these faults. This model can be driven with climate projections to assess how network resilience may be affected by climate change.

The ENA "core" report considers all other available evidence from a variety of sources including EA, SEPA, UK Climate Impacts Programme (UKCIP) and those involved in the National Climate Change Risk Assessment programme.

The main impacts on electricity networks from the current climate change projections are:

- Temperature—predicted increase.
- Precipitation—predicted increase in winter rainfall and summer droughts.
- Sea level rise—predicted increase.
- Storm surge—predicted increase.

At present there is no firm climate change evidence to support increased intensity of wind or ice storms both of which can cause extensive damage to overhead electricity networks.

The report considers each component of transmission and distribution systems and uses current industry techniques to calculate the effects of climate change to 2099. Individual company reports incorporating all this information and the ENA Core Report were published on the Defra web site on 10 December under the banner heading:-

“Energy firms’ climate change plans will keep Britain’s lights on.”

Energy Networks Association

14 December 2011

Written evidence submitted by Engineering the Future (Risk 20)

This response has been written in partnership by:

- The Institution of Civil Engineers
- The Institution of Chemical Engineers
- The Institution of Engineering and Technology
- The Institution of Mechanical Engineers
- The Institute of Physics
- The Royal Academy of Engineering

The *Engineering the Future* alliance has developed this response to provide some information about key projects and activities that relate to the subject matter of the inquiry.

Engineering the Future is a broad alliance of engineering institutions and bodies which represent the UK's 450,000 professional engineers.

We provide independent expert advice and promote understanding of the contribution that engineering makes to the economy, society and to the development and delivery of national policy.

1. *Engineering the Future* (EtF) is an alliance of engineering institutions and professional bodies which allows the engineering profession to speak with one voice on issues of national and international importance. The varied experience and expertise of its memberships allows the alliance to provide expert, non-biased advice to government across all engineering and related disciplines.

2. This response does not explicitly answer the individual questions posed by the House of Commons Select Committee inquiry. It does, however, outline the work which EtF is currently undertaking to address issues in one key area of energy: nuclear power.

3. *Engineering the Future* is currently scoping a project to consider how to develop an impartial source of factual answers to questions frequently asked by the public on aspects of nuclear power. Key issues raised by members of the public will be identified through discussions with relevant non-governmental organisations, expert researchers in the field of risk perception, government bodies and the nuclear industry.

4. This proposal was developed and presented to the *Engineering the Future* Strategy Group in July 2011. The Strategy Group approved the project and it is currently being developed for final approval in March 2012.

5. *Engineering the Future* is engaged in delivering this project drawing on the technical expertise of engineering professional expertise. This project will build on the organisations' experience of providing strong guidance to the public, industry and government on issues relating to the nuclear sector.

6. This project follows previous *Engineering the Future* work in the nuclear area. In 2010, EtF developed its *Nuclear Lessons Learned* document which analysed the successes and failures of nuclear new builds across the globe. The study demonstrated that despite the long interval since the last UK new build, lessons have been learnt from around the world that will significantly reduce risks and delays in future UK new build programmes. Six of the most relevant projects in recent years were examined, and the outcomes and resolution of unforeseen issues that arose were documented to identify the common lessons which should be learnt.

7. In 2011, a follow-up project developed three documents which focused on specific areas of best practice during the construction phase of nuclear new builds:

    - nuclear safety culture;
    - concrete; and
    - pipe work welding.

    Engineering the Future will continue to support this project and any subsequent 'hot topics' which are identified as potentially benefiting from guidance.

8. The *Engineering the Future* alliance greatly appreciates the opportunity to contribute to this inquiry. We would also like to extend an offer of assistance to the Select Committee in its investigations into this important topic

    which address the key issues facing the nuclear industry today. The

experience and technical engineering expertise of its membership makes *Engineering the Future* a potentially valuable resource in this area.

Engineering the Future

December 2011