THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DINNER/DISCUSSION SUMMARY

The Japanese earthquake, tsunami and nuclear accident – implications for the UK

Held at The Royal Society on 18th May, 2011
The Foundation is grateful for the support for this meeting from Arup, Costain, the Institution of Mechanical Engineers, Lloyd's and Lloyd's Register

Chair: **The Earl of Selborne GBE FRS**[1]
Chairman, The Foundation for Science and Technology

Speakers: **Sir John Beddington CMG FRS FRSE**
Government Chief Scientific Adviser, Government Office for Science
Professor Nick Pidgeon
Professor of Applied Psychology, School of Psychology, Cardiff University
Professor Laurence G Williams FREng
Former HM Chief Inspector of Nuclear Installations, Professor of Nuclear Safety, John Tyndall Institute, University of Lancashire
Dr Mike Weightman FREng
HM Chief Inspector of Nuclear Installations, Office for Nuclear Regulation (Health and Safety Executive)

The Chairman invited the meeting to rise for a minute's silence in memory of those who suffered and died on 11th March in Japan.

The meeting was privileged to have Dr Weightman to speak. He had been under great pressure as it was only today that he had published his interim report and recommendations for the Secretary of State.

SIR JOHN BEDDINGTON said that what happened in Japan was an extraordinary combination of two extreme, low probability, high impact events - the earthquake and tsunami, where a 14m to 15m wave overwhelmed 5.7m sea defences. We must remember that the nuclear incident was, compared to the appalling loss of life and destruction caused by these events in North East Japan, essentially a sideshow. The nuclear plants themselves had, in accordance with their design, shut down when the earthquake struck - but there was still hot radioactive fuel in the reactors and cooling ponds after the shutdown. Problems developed when the tsunami cut standby power supplies used to power the cooling systems. The UK government realized immediately that there could be serious consequences affecting the UK nationals from these events, and COBRA met to consider with scientific advisers what was the worst case scenario, what travel and evacuation advice should be given, what were the risks for pollution of food and seafood, and what was the likely spread and reach of the radioactive plume. Information was shared internationally; and the US and UK (but not France) agreed that the risk to Tokyo was minimal, and evacuation unnecessary. Monitoring of the plume path was done frequently to ascertain risks to children and vulnerable people. An enhanced worst case - a cascade of reactor meltdown and pond failure was also considered. The media inevitably panicked and telling the public that risk in Tokyo was minimal was a difficult sell. But open discussion of the analysis and evidence leading to the advice given meant that the message was accepted. Putting nuclear risks in the context of risks in other areas - e.g. smoking - was important in calming overreactions. Lessons for the UK from Japan were - review carefully the location and layout criteria for reactors (although we do not have tsunamis, we do have flood risks) and ensure advice is grounded on good science. He regretted, as unscientifically based, the EU advice on foods and Germany's closure of nuclear plants. He strongly supported Dr Weightman's conclusions in his interim report that there was no new risks from nuclear installations in the UK from the event at Fukushima.

PROFESSOR PIDGEON said that public opinion, whether favourable or not, inevitably affected the take up of new technologies. It was, therefore, important that scientists understood what motivated public opinion, nationally or locally and how it could change. Attitudes towards nuclear had varied markedly over the years. Nuclear had always been seen, and would probably continue to be seen, as risky, but the strong anti-nuclear emotions in the 1990s, following Chernobyl and privatisation, had notably modified by 2010. Public reactions to technology were more complex than a risk analysis would suggest. They encompassed qualitative features, such as familiarity, equity, and compulsory use, cultural issues, social features - e.g. more local employment - trust in management, and perceived benefits. Failure to understand some of these features had led to failure to implement some scientifically sound policies - e.g. the potential use of genetically modified organisms (GMOs). These features also explained why the public had more faith in renewable technologies than in nuclear. But if the case for nuclear was put in the context of global warming and energy security, the public would respond more positively. Where nuclear plants were in operation, local opinion was more favourable - the plant had become a feature of the landscape - although anxiety remained. Controversy about technology is dynamic - the social amplification of risk signals can lead to panic. Support for nuclear had not dropped markedly because of Fukushima, but it is likely to have hardened the views of consistent opponents, which could lead to resistance to new builds.

PROFESSOR WILLIAMS explained the sequence of events which led eventually to the catastrophe at Fukushima and the escape of radioactive material into the atmosphere and sea. The plant systems had operated correctly, and ceased operations when hit by the earthquake, but the effects of the tsunami were to destroy power and water supplies, and caused operators to lose instrumentation and control. The presence of residual fuel in the reactors, and spent fuel in ponds led to radioactive discharges. He emphasized the difference between the Fukushima reactor designs and those plants in operation in the UK, but there were key lessons which the UK should consider. First, were our designs robust enough for danger from external hazards; second was the site infrastructure sufficiently robust (e.g. how adequate were secondary systems, emergency water and power supplies); third how good was accident management including emergency operation of instrumentation; and fourthly, how effective was the planning and training for emergencies (e.g. how rigorous and frequent were on site and off site exercises). He was fairly confident about modern standards of design as set by the IAEA and considered our

[1] Dr Robert Hawley CBE DSc FRSE FREng, Deputy Chairman, opened the debate.

regulatory system, covering the licensing of operators, was robust and comprehensive. But continual review of procedures, equipment and better understanding of how to mitigate widespread disruption caused by an emergency was essential.

DR WEIGHTMAN said that he had been asked by the Secretary of State at the Department for Energy and Climate Change to produce an interim report and recommendations for the UK following Fukushima. He would not go through the detailed recommendations in the report, which had been circulated, but he wished to emphasize that while his report was interim, and would, no doubt, be supplemented when additional information became available, his recommendations were final and firm. There might be additions to them, but he expected confirmation from operators and others that these recommendations had been complied with by the end of June. But his principal conclusion was that there was no need to curtail existing operations, as it was not credible that the same events which destroyed Fukushima could occur in the UK. Not only were the geophysical circumstances in the UK quite different from Japan, but so was the design of our plants. But we must not be complacent, and in particular, we must consider further the risks of flooding as climate changes might occur, review equipment location (e.g. the problem of diesel generators in basements) and also, how you resupply CO_2 or other essential equipment if breakdown continues over a period. He had asked all operators to check all their systems, and he was pleased that they had done so, and held special board meetings to consider the implications of the events in Japan. They had shared the minutes of these meetings with the regulator. They must now implement his recommendations. The important element in reassuring the public was trust in the scientific analysis, and management reactions, based on transparency and distribution of information.

Opening the discussion a nuclear plant operator representative said that operating companies fully understood that they were responsible for the safe operation of their plants. He and his board welcomed the report, and will comply with the recommendations. He wished to pay tribute to the operators at Fukushima, who struggled, in appalling conditions, to regain control of the plant and minimize emissions.

A number of speakers questioned the role of the media. Public opinion could be moulded by reports and we needed to be confident that we knew how to ensure that reports were based on scientific evidence, not popular reaction. There was praise for the Science Media Centre, which had acted effectively in responding to media questions. It was noted that in Japan, the Cabinet Secretary had broadcast and the Government had been effective in placing itself at the centre of concern, even although differences between Tefco and the Government were at times evident. Crucial to the effectiveness of reassuring the public after a disaster was a clear awareness by Government of problems, and effective choice of communicators. The public did not trust politicians or anyone who could be said to have a commercial interest in the disaster. So communication must be focussed through independent experts, who must know how to put their view. But it was the independence and scientific authority with which they spoke, rather than eloquence, which would satisfy the public. The reaction of Japan to the tragedy had been notably restrained, possibly due to the cohesive nature of Japanese society, although it must always be kept in mind - as Sir John Beddington had said – that the major catastrophe for Japan was the effects of the tsunami in the North East. We needed to have more confidence that in the UK there would be similar restraint. A particular problem was evacuation: if necessary it must be organized and controlled; self evacuation could lead to many more deaths.

Speakers stressed the international reach of nuclear. It was not enough to know that UK plants were safe; what about those in Europe, or further afield? The role of the IAEA was stressed; it established standards which should be internationally followed, and it encouraged the distribution of information and best practice. But there could never be certainty that standards would be upheld, and human errors avoided. What was important was that every time an accident - such as Chernobyl, Three Mile Island or Fukushima – happened, assumptions were questioned, a full scientific analysis done and its results distributed. Speakers asked whether, in spite of what Sir John and Dr Weightman said, and the reassurances they had offered, the new nuclear building programme would be delayed. There could be no sure answer to this. In all probability the important factor in delaying or accelerating the programme would be economics - the price of gas or cost of carbon emissions. Of great importance, of course, was the commitment to carbon reduction and the cost, either to the taxpayer or consumer, of developing renewables. As had been demonstrated the public preferred renewables to nuclear, and if it appeared feasible to develop renewables rather than nuclear, ministers might falter. But all the signs were that nuclear was essential for cost effective CO_2 reduction. The reaction of NGOs will also be important; at last they were showing some signs of recognizing the strength of the nuclear case.

The overall sentiment of speakers was that Dr Weightman should be congratulated on his report, which reassured those present that Fukushima did not mean that a fundamental reassessment of nuclear operation in the UK was necessary, but that his recommendations for reviews of design, standards and operations must be implemented. It was only on this basis that accusations of complacency could be met. Risk assessment is never complete, openness and transparency must be consistently sought. Obviously, if more nuclear accidents were to happen, public opinion might change, the best safeguard against such events were Dr Weightman's recommendations that there should be continual review of designs and operations, and that the Government should approach, with others, the IAEA to ensure that timely authoritative information relevant to nuclear event was disseminated.

Sir Geoffrey Chipperfield KCB

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