of new sources of supply, possible substitutions, mitigating risks and minimising waste.

The 'View from Parliament and Government' was introduced by Adam Afriye MP, Shadow Minister for Innovation, Universities and Skills. It has been a turbulent year on many fronts and science is not unaffected by the financial crisis, economic downturn, borrowing difficulties and housing, all emphasising the need for a world-class research base to help rebalance the economy, especially in chemistry, biology, aerospace, pharmaceuticals etc. The lead we maintain in plastic electronics and nanotechnology is also important, as we are not just 'bankers and borrowers' and our universities also attract much attention from Parliament and Government. Recent departmental changes include the move from DIUS and BERR to BIS, a huge department with six Ministers in the House of Lords, restricting the ability to hold the Government to account.

If politicians claim to put science at the heart of Government, they should mean it! Scientific literacy in Parliament is vital if we wish to avoid more MMRs. It will therefore be compulsory for all incoming Conservative MPs to enrol on a scientific literacy course in future, with emphasis on statistics and scientific concepts. POST has designed a programme for all MPs in Parliament.

Current topics include the need for the independence of science from undue political influence as questions need answers. Should science spending be directed to achieve economic growth? What is the relationship between the science budget and regional development? What is the role and responsibility of the Minister? Scrutiny of scientific policy is essential although it may be the responsibility of more than one select committee. The Science and Technology Select Committee is very important and therefore science will be free to flourish under a Conservative Government lead that recognises the independence of scientific research. There is also need for a longditudinal study of young people to examine how science and society impact on their training in science.

Professor John Beddington, Government Chief Scientific Adviser and Head of the Government Office for Science, summarised in a series of illustrations the increases in current Global Security Challenges:

1. World Population Growth (increasing)
2. Urbanisation (increasing)
3. Poverty (increasing)
4. World Food Requirements (increasing)
5. World Primary Energy Demand (increasing)
6. Fresh Water Availability – 70% for Agriculture (a massive problem by 2025)
7. Climate Change – Arctic free of ice by 2030 (earlier than the IPCC prediction)
8. Ocean Acidification (sudden recent increase from pH 8.2 to pH 7.6)

These factors will combine to produce the 'perfect storm' involving energy, food and water, coastal vulnerability, mega delta flooding, increasing migration seeking food, water, energy and giving rise to global conflict, a coastal risk of flooding, and demonstrating a need for science, engineering and social and behavioural science resources on a much faster time scale and with particular reference to the increased availability of contraception for women.

Phil Willis MP, Chair, Commons Select Committee for Innovation, Universities, Science and Skills, announced that the meeting is not a wake, thanks to Brian Iddon! With the recent resurrection of the Science and Technology Select Committee, "Science is back at the heart of Government". Government is no good if not scrutinised by a committee championing science. Science is not the exclusive property of a few individuals. A wide range of topics, both local and global, and ranging from tidal power to biofuels, and the Royal input to the GM debate, many of them covered in more detail in the earlier presentations, were briefly summarised as important to the new Select Committee. However, particular reference was also made to the likely combined impact of housing and surface groundwater to water availability in the south east of England where demand for affordable housing exceeds the predicted availability of underground water in aquifers for the current population.

Mark Lancaster TD MP, Shadow Minister for International Development, closed the proceedings and thanked all the speakers.

POTENTIAL HAZARDS OF NANOTECHNOLOGY

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INTRODUCTION

Nanotechnology is a rapidly developing field of science, technology and industry that has the potential to greatly improve our lives through a diverse array of products and applications; but what is nanotechnology? Nanotechnology involves the production and manipulation of materials at the nanoscale (less than 100nm). To put this into perspective, a human hair is 80,000 nm in diameter, while a red blood cell is 7,000nm. Many of the products made by nanotechnology are nano-objects or nanoparticles, which means that they either have 2 or 3 dimensions respectively in the nanoscale. Such nanomaterials are manufactured due to their unique or enhanced properties compared to larger forms of the same material. For example, they may be lighter, stronger, conduct electricity, or more reactive, enabling industry to generate new products. These products include improved drug delivery, antimicrobial surfaces, environmental decontamination, water purification, suntan lotions, cosmetics and electronic gadgets, all of which could contribute to our quality of life and economic development. For these reasons, the UK Government has invested in the development of nanotechnology allowing industry and academia to make thousands of different types of nanomaterials, varying in their physical and chemical characteristics. Many of these nanomaterials are already being used in industry, homes and in the environment, therefore resulting in the exposure of both humans and the environment. A number of Government commissioned reports have investigated nanotechnology and potential safety implications (eg The Royal Society and The Royal Academy of Engineering, 2004). Such reports have concluded that if nanotechnology is to be safe and sustainable then we need to consider whether exposures occur, and whether they pose any risk.

PARTICLE TOXICOLOGY

The toxicology of a number of different particles has been extensively studied. For example, it has been clearly demonstrated that inhalation of asbestos can lead to cancer, while substances such as titanium dioxide are low toxicity dusts. However, in the 1990s a group in the USA, led by Gunter Oberdorster, identified that the ability of TiO_2 to cause inflammation (activation of the immune system) and toxicity to the lung was related to particle size, with nano-sized particles being more toxic than larger particles. In addition, air pollution research has demonstrated that nano-sized particles can have adverse health effects in susceptible individuals, such as enhanced asthma, bronchitis, and cardiovascular disease.

For fibres such as asbestos, there is a wealth of evidence to show that length and durability are important in determining their potential toxicity. Short fibres are easily cleared from the lungs via the body's immune system. However, if the fibres are longer than the immune cells, the fibres cannot be cleared, allowing them to persist within the lung causing disease such as asbestosis or the cancer, mesothelioma. A number of nano-objects are fibre-shaped, including carbon nanotubes, which are already manufactured in tonne quantities. Studies have already demonstrated that some nanotubes have the potential to behave like toxic asbestos fibres in the mouse body (Poland et al, 2008), and so continued research is required to investigate this risk in more detail.

NANOTOXICOLOGY

A new field of research has now developed, bringing together particle toxicology and nanotechnology, in order to address the potential hazards of the newly developed nanomaterials. This is a difficult task since the diverse array of nanoparticles available means that they are unlikely to behave as a single class of particles, instead demonstrating biological activity that is related to their diverse physical and chemical characteristics. Furthermore, while the lung has been a major focus of particle toxicology in the past, Nanotoxicology now needs to address exposure via ingestion, the skin, and direct injection. The challenge for Nanotoxicology is to identify which characteristics are associated with toxicity, following exposure via different routes, and then to try to develop predictive models in the future that will allow identification of hazard with a reduced need for toxicity testing, especially with respect to animal testing.

EXPOSURE TO NANOPARTICLES

The toxicity shown for certain types of nanoparticles will only lead to risk if people or the environment become exposed to them. Without exposure there is no risk. Information about the potential for exposure of workers or consumers, by inhalation, ingestion or through the skin is currently poor. It is clear that increased investment in research, increasing production volumes, lower costs and an increased general prevalence of these materials will lead to more nano-enabled products from which there is the potential for exposure.

UK INVESTMENT

SAFENANO (www.safenano.org) was launched in January 2008 as a venture between the Institute of Occupational Medicine (IOM) and Edinburgh Napier University. This initiative is funded by the UK and Scottish Governments and has been developed to be the Micro and Nanotechnology (MNT) UK centre for proactive risk assessment of nanoparticles, which aims to work with industry to promote responsible development of nanotechnology. SAFENANO focuses on capturing, evaluating and disseminating the emerging evidence on nanoparticle risks. In addition, SAFENANO offers state-of-the-art *in vitro* toxicology testing, occupational hygiene, training, and laboratory services related to nanotechnology risks.

Defra has funded several review activities to assess current opinions in relation to the use of reference materials in toxicity testing (REFNANO), the potential for high aspect ratio nanoparticles to behave like asbestos (HARN), and an assessment of the current status of research projects world-wide (EMERGNANO). Over the last two years there has also been an increase in the funds available via research councils to investigate the potential toxicity of nanoparticles. This will enable the UK to play a key role in assessing the potential risks of different nanomaterials over the coming years, but since the number and diversity of particles available is so vast, this is not going to be a simple problem to tackle.

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