Note of SAFESPUR Meeting

Innovation in Nuclear Decommissioning – New Technologies and Research
Royal Statistical Society, London, 9 July 2008

The format for the day was that after the chair's introduction, there were three presentations, with question and answer sessions between them, a "soapbox" session of three short presentations, and a facilitated discussion. The meeting was attended by about thirty people.

Introduction
In welcoming participants, the chair of the meeting, Trevor Jones of Nuvia Ltd, reminded us that in the early years of the UK nuclear industry there had been too little work on radioactive waste management and planning for decommissioning. The result is that the UK has a legacy of ageing facilities that will be much more difficult to decommission than they were to build and operate. The situation is not helped by under-investment in R&D, nor by the loss of knowledge as people retire. Innovation will be very important in overcoming the challenges, and we need to make good use of experience in other industries and other countries, as well as doing our own R&D. It will also be essential to make full use of innovation from the supply chain. Where necessary, procurement practices should be changed to allow this to occur.

Decontamination and Volume Reduction Techniques for Nuclear Decommissioning
The first presentation was given by George Elder of Bradtec Decon Technologies Ltd, a UK company that specialises in taking ideas from the laboratory to full-scale implementation. Bradtec works in partnership with the University of the West of England, as well as with other organisations. It has mainly overseas clients. George emphasised that a range of skills are needed for such work. In his view it is important for researchers to see whole projects and to realise that they need marketing and business skills to complement their scientific and technical knowledge.

He went on to describe a chemical "decontamination for decommissioning" (DFD) process that was developed with funding from the Electrical Power Research Institute (EPRI) in the US. Chemical decontamination is used routinely in operating LWRs in order to reduce radiation exposures during maintenance. It is now being applied to decommissioning, especially for decontamination to "free release" levels so that larger quantities of metals can be recycled. The process uses dilute fluoroboric acid, which is recycled after its radioactive content is removed on to an ion exchange material or as a precipitate. There are essentially no liquid wastes and minimal amounts of solid wastes. The plant used is mobile so it can be moved from one site to another, leaving the site with only the solid waste to dispose of.

George said that a surprisingly large proportion of radioactive wastes can be recycled but, because of stakeholder concerns, the preference is for recycling within the nuclear industry. Examples include lead, which can be recycled as shielding for transport, storage or disposal containers for radioactive wastes, and steel, which can be used for high volume products such as reinforcing bar and for waste containers. Decontamination and recycling/re-use could make a large impact on decommissioning in the UK by reducing the volumes of both LLW and ILW for disposal.

To foster innovation, it is important to focus R&D on the needs of the nuclear industry and to remember that the time between having an idea and implementing it on a large scale can be 5-20 years. There is a need to keep the supply chain involved throughout if it is to play a full part.

DIAMOND (Decommissioning, Immobilisation And Management Of Nuclear wastes for Disposal)

The second presentation was by Nick Evans of Loughborough University, which is one of the six partners in DIAMOND. The others are Leeds, Manchester and Sheffield Universities, and Imperial College and University College, London. DIAMOND began on 1st July 2008 but would not be publicly launched until September. It has £4.25 million funding over four years from the Engineering and Physical Sciences Research Council and expects to increase this by involving the nuclear industry in some, or all, of its research projects. At the time of the meeting, workshops were being arranged in the Sellafield and Warrington areas for about twenty companies, in mid-September.

There will be 35 research projects in DIAMOND, each of which will involve a researcher who will obtain a PhD or post-doctorate experience and will be employable in the nuclear industry afterwards. The projects cover three work packages:

- environment, migration and risk (led by Nick Evans) – to define processes that control the transport of key radioactive contaminants in natural and engineered environments
- decommissioning, legacy and site termination (Mike Fairweather, Leeds) – to provide new techniques and technologies in support of legacy waste management, decommissioning and monitoring of site endpoints
- materials design, development and performance (Bill Lee, Imperial College) – to provide innovation in the processing and immobilisation of problematic wastes.

There are three cross-cutting themes:

- characterisation (Francis Livens, Manchester)
- treatment and packaging (Neil Hyatt, Sheffield)
- disposal (Howard Wheater, Imperial College).

Nick gave several examples of the projects within each work package. He emphasised the need for research to understand the mechanisms involved in radioactive waste behaviour under disposal conditions and during radionuclide movement out of a geological disposal facility into the environment. Without such research it will be difficult to convince the public that geological disposal will be safe. The research is long-term and expensive but vital. DIAMOND is important because it brings universities together and will have strong links with industry. It will also have international links. The aim is for long-term relationships that develop innovative approaches to long-standing problems and provide valuable training opportunities for future nuclear industry staff.

RadBall Radiation Mapping

Steve Stanley of Nexia Solutions gave a presentation on their RadBall radiation mapping technology. This was developed in a Nexia self-funded project as part of its innovations portfolio. Other projects in the portfolio include microwave decontamination of concrete, non-electrical radiation detectors, hydrogen monitoring and visualisation of contamination.

RadBall consists of a polymer plastic hemisphere inside a lead collimation sheath. Radiation falling on the device produces tracks in the plastic and analysis of these using optical tomography produces estimates of the location of the source of the radiation and its intensity. Some of the advantages of the technology are that it can be deployed in otherwise inaccessible areas, it maps 3D space from one position and can handle very high radiation levels (kSv/h). Nexia will offer a mapping service using the device for situations including before-and-after decontamination surveys and for mapping fields in active cells, glove boxes, confined spaces and hard-to-reach parts of plant. The service includes careful positioning of the device (eg via laser scanning).

At present RadBall is not sensitive enough for radiation levels below mSv/h but Nexia may investigate using other, more sensitive polymers in future. They also hope to try the

technology in neutron fields and develop the software so that two devices can be used in one space (eg to find missing radiation sources).

Soapbox Session

Steve Tothill (Nuvia Ltd) – Innovation in Nuclear Decommissioning

Steve's presentation was about chemical decontamination and why it is not widely used in the UK. Its advantages over mechanical and electrochemical decontamination techniques are that it can reach difficult areas, it requires minimal operator contact (and hence entails lower doses), the techniques are proven, and it can be used for large areas as well as in closed circuits or baths. For large areas there are various types of foams, wet gels, dry gels and wipes that can be used, all of which are quick and efficient. Steve suggested various possible reasons why chemical decontamination is not much used in the UK but is widely employed in countries such as the US and France:

- so far, there has been little UK need
- there is not enough emphasis in the UK on decontaminating materials so as to reduce quantities of radioactive waste requiring management
- there could be a fear of secondary wastes
- there is a lack of UK expertise.

He ended by asking: are there unnecessary barriers to the use of chemical decontamination and if so how can they be overcome?

Chris Woodley (Studsvik UK Ltd) – the Studsvik Metals Recycling Facility

Chris began by stating that decontamination of metals and recycling them provides the opportunity to reduce the volumes of LLW for disposal by 90-95% and that there is a market for all the metal that can be recycled. The Studsvik UK Metals Recycling Facility (MRF) at Workington will open in late 2008. It has a nuclear site licence and an authorisation under the Radioactive Substances Act (RSA). Its capacity will be 3,000 tonnes per year. The facility will sort and size-reduce metal articles and decontaminate them by grit blasting. The metals may be sent to the Studsvik MRF in Sweden for melting and release for recycling under Swedish standards (ie the activity levels in the EU report RP 89) if it is not technically possible to make them exempt under RSA. The UK MRF has applied for authorisation under the Transfrontier Shipment Regulations to send waste to Sweden. The only requirement for UK waste producers is to have their RSA authorisation changed to allow them to send wastes to the UK MRF. Secondary wastes produced at the Swedish MRF will be returned to the UK for disposal in the LLWR. To date, customers have been found in Sweden for the recycled metals.

Bob Morley (LLWR Ltd) – Database for Best Practice in Waste Minimisation

This database was developed under the auspices of the nuclear industry's Environment Agency Requirements Working Group (EARWG), which has representatives from eleven organisations. The database is intended to help industry fulfil the standard requirement in Environment Agency RSA authorisations to provide " a detailed report of a review of national and international developments in best practice for minimising all waste disposals". It is now freely available at www.rwbestpractice.co.uk. The database contains about 120 datasheets on techniques for minimising the activity and/or volume of solid, liquid and airborne radioactive wastes. Each sheet is derived from national and international sources and is independently peer-reviewed. The whole database is updated regularly. It is structured in a tiered way and can be searched hierarchically and by keyword. It shows which EARWG members use each technique, so users of the database can contact them for information on their experience. A separate database for waste assay is being developed.

Key Points from Discussions

The following is a summary of key points from all the discussions throughout the meeting, focusing on ways to encourage innovation in decommissioning and barriers to be overcome.

Waste producers' attitudes and actions

- There is a tendency for nuclear site licensees to be very prescriptive when inviting tenders for projects. They seem reluctant to try techniques that are new to them, even if the techniques are well-proven elsewhere and demonstrably cheaper.
- Some licensees use calls for expressions of interest and invitations to tender to obtain ideas which they then develop themselves.
- In R&D there is a tendency to let contracts that are too short (a year or two) to enable innovative techniques to be brought to full scale, or to allow underlying mechanisms to be understood.
- In general, nuclear industry procurement systems are too rigid and bureaucratic.
- There is a fear of wastes that have not been encountered before (eg the secondary wastes from chemical decontamination), because it may be difficult to manage them and obtain a NDA "letter of compliance" for the conditioned waste form.

Regulators' attitude and actions

- It would be helpful if the environment agencies raised their expectations of the industry for radioactive waste management in general but especially for waste minimisation and maximising recycling.
- This could be achieved through stronger enforcement of conditions in existing RSA authorisations, and through the use of new conditions when BAT ("best available techniques") replaces BPM and BPEO ("best practicable means" and "best practicable environmental option") in England and Wales.
- It is a welcome development that some regulators are commissioning their own R&D to inform themselves about new techniques so that they can challenge waste producers.

Public and stakeholder attitudes and actions

- There is a need for the industry to understand the nature and strength of public and stakeholder concerns about issues such as recycling of decontaminated wastes.
- Waste producers should engage more with the public and stakeholders and should take on an educational role.

Commercial incentives

- Much more use should be made of commercial incentives to reduce the quantities of radioactive wastes requiring disposal.
- Through its contracts with them, the NDA should incentivise its SLCs to minimise quantities of radioactive wastes arising and requiring disposal.
- The LLWR should incentivise waste producers to send less waste to it, eg by increasing its prices substantially, by making its charging mechanisms much clearer, by abolishing "allowances" for each waste producer that have to be used or lost.

Use of existing knowledge

- Despite all the talk of "knowledge management", the industry (and its regulators and suppliers) are not good at it.
- Successive reorganisations have led to much of the documentation from the past being hidden from view (eg stacks of reports being stored in old buildings) and some being lost.
- It is unreasonable for the NDA and SLCs to expect contractors to find all the old documentation before identifying knowledge gaps.
- There is a problem of lack of awareness of techniques used outside the nuclear industry.
- There is a distrust of techniques that have not been developed in the UK and of which there is limited UK experience.
- Insufficient use is made or retirees' knowledge.

- Making the best use of existing knowledge is a key issue, given the skills shortages within the nuclear industry and its regulators.

What could SAFESPUR DO?

- Invite regulators to events.
- Invite waste producers to events.
- Start a “knowledge forum” to enable industry and its supply chain to exchange ideas, views and experiences, and to make knowledge management happen across as well as within organisations.
- Hold specialist sessions, eg on chemical decontamination.

Conclusions

Trevor Jones concluded the meeting by suggesting that the main messages to the NDA, site licensees and regulators were:

- innovation needs time, planning, resources and sustained funding
- R&D must address real needs
- the industry should use procurement methods that will encourage innovation
- there should be cost incentives to minimise radioactive waste arisings and quantities for disposal
- SLCs should not shortcut the market through inappropriate use of expressions of interest and invitations to tender
- there should be more emphasis on retrieving and building on existing knowledge.