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NUCLEAR ENERGY AGENCY
RADIOACTIVE WASTE MANAGEMENT COMMITTEE

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Working Party on Decommissioning and Dismantling (WPDD)

Proceedings of the Topical Session of the 9th Meeting of the WPDD on "Human and Organisational Factors in Decommissioning"

Held at Harwell, United Kingdom
on 7-8 November 2007

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FOREWORD

Set up by the Radioactive Waste Management Committee (RWMC), the WPDD brings together senior representatives of national organisations who have a broad overview of Decommissioning and Dismantling (D&D) issues through their work as regulators, implementers, R&D experts or policy makers. These include representatives from regulatory authorities, industrial decommissioners from the NEA Co-operative Programme on Exchange of Scientific and Technical Information on Nuclear Installation Decommissioning Projects (CPD), and cross-representation from the other NEA Committees. The European Commission is a member of the WPDD and the IAEA participates as an observer. This broad participation provides good possibilities for the co-ordination of efforts on activities in international programmes.

At its eight meeting (7-9 November 2007, at Harwell, UK), the WPDD held a topical session on "Human and Organisational Factors in Decommissioning". This report documents the topical session. The main text summarises the main points from the presentations and discussions and includes the Rapporteur's report. Appendix 1 and 2 provide the agenda of the topical session and the list of attendees respectively. Copies of the presentations made are attached to this report in the form of a CD-Rom. WPDD members are also able to access the presentations on line, via the WPDD Members' Area, on following address: http://www.nea.fr/html/rwm/welcome.html

The topical session facilitated an exchange of information and experience on the following issues in particular:

- Project management and contracting schemes being used for decommissioning projects and the benefits which may be gained from including former operational staff in decommissioning teams;
- Planning and record keeping, including the extent to which inadequate historical records need be reconstructed; and
- Approaches to workforce management, particularly in regard to safety.

Mr Luis Valencia, Forschungszentrum Karlsruhe, served as Chair of the Topical Session and Mr. Luc Noynaert, SCK•CEN, served as rapporteur.

At the end of each session time was allotted for a plenary discussion. The rapporteur reviewed the main points and the lessons learnt at the end of the Topical Session.

Acknowledgement

The WPDD wishes to express its gratitude to Mr. Valencia and to Mr. Noynaert, as well as to all those presenting papers, for their efforts in making the topical session a success.

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RAPPORTEUR'S REPORT

Luc NOYNAERT,
SCK•CEN, Belgium

Organisational arrangements

Different countries apply different approaches to allocating responsibility for decommissioning, e.g. in some countries one State-owned organisation (such as ENRESA in Spain) has overall responsibility for decommissioning nuclear installations. Here, the plant owner is required to make contributions to a fund to cover the decommissioning cost but does not have responsibility for undertaking decommissioning. In other cases, plant owners retain full responsibility for decommissioning their facilities.

This difference in the allocation of responsibilities can have implications for the organisational arrangements for decommissioning. In the former case the national decommissioning organisation is more likely to retain management control over key aspects of a decommissioning project, using sub-contractors for specialist activities. In the latter case, there appears to a greater likelihood that projects are divided into discrete packages which are then subject to competition between potential contractors. Independent peer reviews of decommissioning plans are also more likely to be used in this situation.

There are also implications for fund management, e.g. the management and use of segregated funds established to finance decommissioning activities that are undertaken by a third party (e.g. a State-owned decommissioning company) are subject to greater transparency requirements than funds retained within operator organisations. Decommissioning projects may be subject to detailed monitoring arrangements including establishing of milestones, identifying deliverables and performance indicators. These measures are necessary to ensure, for example, that moneys collected from electricity customers or otherwise provided by plant owners are well spent.

Project Management

A decommissioning project involves many different tasks that require diverse skills. Important considerations for success are:

- A clear definition of jobs and responsibilities;
- Good management of human resources, e.g. motivation, training and transfer of knowledge inside the company;
- Good recordkeeping is essential and requires active participation across job boundaries; and

- Management commitment to safety, noting that special safety challenges result from the changing work environment, increased industrial safety risks coupled with an overall decrease of radiological risk.

Planning

Planning for decommissioning should take place throughout the lifecycle of a nuclear installation, including the design phase. A dedicated Dismantling and Decommissioning team should be established at an early stage of a decommissioning project, whose responsibilities should include: (1) the management of plant records that will impact decommissioning and (2) regular updating of the decommissioning plan.

It is important to involve stakeholders early in the decommissioning planning process to obtain their views and inputs on the work to be undertaken, the final goals of decommissioning project, and the site end state. In general, it is recommended that hazardous materials be removed from the facility as soon as possible, in order to minimise overall levels of risk.

Contracting Schemes

Although virtually all decommissioning projects rely to a greater or lesser extent on the services of outside organisations with specialist decommissioning skills, there are a range of contractual approaches, from large turnkey contracts that include project management activities, to several smaller contracts for specialist tasks and with responsibility for project management being retained by the organisation responsible for the decommissioning of that plant. In either case, the licence holder for a nuclear installation under decommissioning must be an 'intelligent customer', i.e. must have a sound knowledge of the safety implications of the activities being undertaken.

A related issue is the extent to which staff from the operational phase of a nuclear installation are integrated into decommissioning teams. This is more likely to occur with the second approach to contracting, with many project management teams aiming to have a balanced mix of decommissioning specialists and operational staff, to take advantage of the latter's knowledge of the plant. Where a high level of reliance is placed on the use of contractors, it becomes extremely important to establish terms of reference for a decommissioning project that are based on a good knowledge of the levels of contamination that are likely to be present, in order to avoid future contractual disputes.

Safety Skills

The dynamic nature of a decommissioning project, coupled with the introduction of diverse groups of contractors, some of whom may not be familiar with working arrangements on a nuclear installation, necessitates close attention being given to the management of safety. The classical approach to dealing with this involves the provision of workforce training, particularly on radiological protection, industrial safety and emergency response.

In addition to providing training, a proactive approach to dealing with identified safety concerns is also recommended. The project management organisation needs to consider possible solutions to safety issues as soon as they are identified and then, having decided on a preferred course of action, to initiate discussions about the issues with the affected contractors and sub-contractors. Having agreed on a course of action, a monitoring programme needs to be established to ensure that the identified concerns are addressed.

SUMMARY OF PRESENTATIONS AND DISCUSSIONS

Patrick O'SULLIVAN
NEA Secretariat

The Topical Session comprised two sessions, the first of which focused on strategic and operational aspects of decommissioning and the second focused on project and site specific issues. The first session included four national presentations (from Canada, Italy, the Russian Federation and France) and from the IAEA. The second session focused on project and site specific aspects of decommissioning, with presentations from projects in the UK, Spain, Slovakia and Germany.

SESSION 1

STRATEGIC AND OPERATIONAL ASPECTS OF DECOMMISSIONING

Doug Metcalfe (Natural Resources Canada) described the newly-developed liabilities management strategy for Canada, which covers a period of 70 years and is expected to cost about $7 billion (Canadian), over half of which relates to Cold War activities. A Nuclear Legacy Liabilities Program (NLLP), initiated in 2006, set out a 5-year plan for beginning the clean-up of disused facilities, legacy wastes and contaminated lands at Atomic Energy of Canada Limited (AECL) sites. AECL had established a Liability Management Unit with about 35 staff, which contracted decommissioning and site remediation work to internal AECL contractors, who in turn contracted some of the work out to the private sector. The AECL clean-up activities were overseen by a team of 4-6 people in Natural Resources Canada. It was envisaged that experience gained during the first 5-year programme would be helpful in enabling the long-term strategy to be developed further.

Giuseppe Bolla (SOGIN, Italy) said that, following a Government decision in 1999 to proceed with decommissioning of Italy's disused nuclear installations, SOGIN had been given wide-ranging responsibility for undertaking decommissioning projects, including licensing, planning, engineering and operational aspects. SOGIN manages 8 nuclear sites, four of which have shutdown nuclear power plants, together with three former research installations and one former fuel fabrication plant. It relies as far as possible on in-house resources to undertake decommissioning and the retraining of former operations personnel to facilitate their participation in decommissioning activities. Progress in the implementation of decommissioning work has been severely hampered by licensing and planning delays.

Leonid Sukhanov (A.A. Bochvar Research Institute, Russian Federation) described the status and trends in decommissioning in the Russian Federation. He said that more than 40 nuclear facilities will be shut down and will require decommissioning by 2030, including: 24 nuclear power plants; 5 industrial reactors; 10 research reactors. In addition, 13 nuclear submarines were being taken over annually from the Russian Navy. A national decommissioning strategy has been approved by the Federal Atomic Energy Agency, which aims to ensure that these facilities are decommissioned during the period 2015-2030. Responsibility for implementing the national strategy will lie with Rosatom (/Rosenergoatom). Current efforts were focussed on establishing an

appropriate legal and regulatory framework for decommissioning and in putting in place the financial and staff resources needed for implementation of the national strategy.

During discussion he noted that noted that the cost of implementing the clean-up of the Russian Federation's nuclear liabilities, including the rehabilitation of contaminated land, was very large. Progress was therefore determined in part by the availability of the necessary funds.

Jean-Guy Nokhamzon (CEA, France) said that the approach followed in France by the CEA and EdF was to retain the main project management function in house, including planning, licensing, site and facility characterisation and training functions. Assistance was provided to the project teams by outside consultants chiefly in regard to cost control and ensuring safety. Where possible, both organisations made use of former operations personnel in decommissioning work where possible – with incentives and retraining being provided to key personnel. Contracts for specified dismantling activities, for which CEA does not have relevant expertise, were given to outside contractors – these costs could amount to 20% - 30% of the total decommissioning cost (including the cost of waste management). Activities undertaken prior to dismantling, in particular the characterisation of the plant, were crucial to the overall success of the project. French experience suggested that establishment of an independent review board was helpful to the overall success of the project.

During the ensuing discussion he said that risk management for decommissioning projects was helped by following a stepwise approach, especially for old facilities. Risk analysis formed part of the cost-benefit analysis undertaken to decide on decommissioning strategies. Consideration was being given to greater use of turn-key contracts for decommissioning due to the inherent problems of reallocating research staff to decommissioning activities.

Michele Laraia (IAEA) said that decommissioning was necessarily a phased process comprising the pre-decommissioning phase, during which the spent fuel is removed from the installation); a safe enclosure phase (which could be short in the event of a strategy of immediate dismantling being implemented) and the final dismantling phase (which includes final dismantling and license termination). He stressed the importance of implementing an adequate training programme for the workforce (e.g. on dealing with accident situations) and on maintaining records in formats that facilitated their later use, perhaps after a period of decades. He said that stakeholder involvement in significant decisions about decommissioning was a necessity, e.g. on issues such as the site end point, issues affecting the local economy and on approaches to dealing with environmental and safety impacts such as environmental discharges and general disruption to the community caused by demolition and waste removal activities.

Panel Discussion on Recent Developments and Key Lessons Learnt

The first session ended with a panel discussion led by the five presenters (D. Metcalfe; G. Bolla; L. Sukhanov; J.-G. Nokhamzon and M. Laraia). The panel considered the issue of the sufficiency, or otherwise, of historical records and the implications for decommissioning projects. It was argued that, ideally, records (e.g. the plant configuration) should be updated regularly during the lifetime of a nuclear installation and this process should be continued during decommissioning. The panel recognised that this ideal situation did not occur for old facilities, leading to an issue of how to determine what should be done in order to arrive at a set of 'competent' documents that provide a sound basis for decommissioning. There was agreement that, as a minimum, sufficient characterisation measurement should be carried out to provide a good understanding of the degree and distribution of contamination in the facility.

Alan Neal (UKAEA, UK) cautioned against putting too much reliance on engineering drawings for old facilities, as invariably these did not reflect the 'as built' situation. For example, existing electricity networks in old plants should be disconnected completely and temporary power supplies installed, to avoid the risk of electrocution accidents. He suggested that the necessary effort needed in order to reconstruct deficient records, e.g. at the behest of regulators, often did not justify the benefit. This aim was further complicated by the fact that the memories of retired workers were often unreliable.

There was general agreement that existing drawings should be used where possible, but their limitations should be recognised. There was also a general feeling that there were significant benefits in including in the project team for decommissioning a number of people with a good knowledge of the facility during its operational phase. It was noted also that problems caused by inadequate records occurred largely in old research facilities and prototype plants; such problems were much less prevalent in, for example, second generation nuclear reactors.

SESSION 2

PROJECT/SITE SPECIFIC ASPECTS OF DECOMMISSIONING

Alan Neal described decommissioning practices at UKAEA's sites, for which the total estimated liabilities currently stand at £7.7 billion (undiscounted). NDA, who own the site on behalf of the State, intends to hold competitions for the management of all their sites and preparations for this are currently underway, e.g. Harwell and Winfrith sites will be managed as a single cluster. Funding for decommissioning work was allocated on the basis of an analysis of residual risk levels on all NDA sites and, on this basis, greater allocations were envisaged to be made in future to the large sites at Sellafield and Dounreay, with smaller allocations to sites such as Harwell and Winfrith.

Turning to safety management activities on the sites, he said that UKAEA had introduced a 'Safety Excellence Programme', intended to help improve safety levels at its sites. Key aspects included high visibility of management commitment and a behavioural safety programme. Since the start of the programme safety incident levels had been significantly reduced, to levels of less than one incident per site per month.

Juan-Luis Santiago (ENRESA, Spain) said there was a formal transition period between operation and decommissioning of a nuclear facility, during which preparations are made for the handover of responsibility (and of the site licence) to ENRESA. For the José Cabrera plant, this period was scheduled to last three years (2006 – 2009). During the transition phase, the plant operator is required to condition operational wastes and arrange for these to be transported to disposal facilities. Likewise, spent fuel is removed from the reactor pools and placed in an interim storage facility away from the reactor building.

ENRESA operated primarily as a management organisation, with key personnel being placed in management positions at decommissioning sites, complemented by former employees from the plant and specialist sub-contractors. Key issues during decommissioning were materials management, radiological protection and industrial safety, with project activities being performed by multidisciplinary groups that including experts in these fields and in disassembly and quality assurance. A high priority was given to training, including courses in radiological protection, safety and energy planning. As regards contracting he said that ENRESA aimed to divide the work into packages, to encourage greater competition and to facilitate participation by local companies. Rates of local participation in recent projects were about 65% of the total workforce. In the area of

knowledge management, ENRESA has developed an integrated system, which links the information systems on waste management, documentation management, economic management, operations management, lessons learned and radiological protection.

Jozef Hutta (Javys, Slovak Republic) said that disused nuclear installations were owned and management by Javys on behalf of the Slovak State. Operational reactors were owned and operated by Slovenské Elektrárne, a private company. The former facilities included the Bohunice A1 NPP, a CO_2 cooled, heavy water moderated, reactor shut down in 1977 as a result of a core damage accident – this facility would shortly enter a 'safe enclosure' phase planned to last until 2033. The Bohunice V1 and V2 WWERs were being shut down (in 2006 and 2008) in accordance with the accession agreements for joining the European Union and for whose decommissioning the European Commission was providing financial support (via the EBRD), e.g. €523 million was being provided for Bohunice V1 decommissioning during the period 2004-2013. He described the spent fuel and waste management facilities operated by Javys which included the national repository for short-lived LILW at Mochovce, the Bohunice radioactive waste processing centre and the Bohunice interim spent fuel storage facility (ISFSF).

The Bohunice V1 NPP was currently in a transition phase (scheduled to last until 2011) during which spent fuel was being removed to the ISFSF; operational fluids were being removed and operational waste was being processed. An EIA process was being undertaken which included a multi-criteria comparison of different strategies for decommissioning – immediate dismantling, monitored safe enclosure; reactor safe enclosure and a 'do nothing' option. This exercise – which concluded that immediate dismantling was the best option - involved also a public hearing and an expert review of the EIA report. The process was concluded by a 'Final Statement' from the Slovak Environment Ministry, in March 2007, which accepted the conclusions.

Ralf Versemann (RWE Power) said that RWE currently had 5 disused NPPs under decommissioning, of which four were following a strategy of immediate dismantling (Mülheim-Kärlich; Kahl, Hanau and Gundremmingen A) and one (Lingen) was under a safe enclosure regime, though with ongoing treatment/ disposal of enclosed wastes. He said that the dismantling of a medium sized NPP will typically require the management of about 15 000 tons of components (metals, cables etc.) and 150 000 of building rubble (from the radioactivity controlled area). In common with other decommissioning projects in Germany, there was a strong focus on decontamination, with the aim of recycling or free release of as large a quantity of material as possible. Following this approach, only about 3% of material needed to be conditioned and packaged for disposal; about 10% could be recycled and the rest was available for unrestricted release.

The decision criteria for choosing decommissioning strategies included economic considerations, potential to use skilled staff from the operating phase, availability of interim storage capacity for spent fuel and waste and the possibility of reuse of the sites for other activities. RWE's experience suggested there was benefit in organising dismantling work into strategically-relevant sub-tasks, with consistent project management of all activities being of critical importance. Other lessons included the need to select dismantling and decontamination techniques taking account of material, geometry, radiation protection and waste treatment aspects. As regards future developments, he envisaged more flexibility in the extent to which components are segmented into smaller pieces. Less use would be made in future of partial licences, allowing more flexibility to the operator in deciding the decommissioning sequence. He also anticipated more use being made of mobile systems, e.g. for waste management rather than adaptation of existing systems.

APPENDIX 1

AGENDA OF THE TOPICAL SESSION ON HUMAN AND ORGANISATION FACTORS IN DECOMMISSIONING

7-8 NOVEMBER, 2007

7 NOVEMBER 2007 (DAY 1, PM)

Topical Session

'HUMAN AND ORGANIZATIONAL FACTORS'

Chair: Luis Valencia, FZK, Germany

14.00	**1.**	**WELCOME AND INTRODUCTION** *Chair*
	2.	**SESSION 1 STRATEGIC AND OPERATIONAL ASPECTS OF DECOMMISSIONING** **(issues such as: organisational arrangements, manning levels, planning and contracting schemes)**
14:10	**2.a**	**Strategic and Operational Issues: Canada** *Doug Metcalfe, Natural Resources Canada*
14:40	**2.b**	**Strategic and Operational Issues: Italy** *Giuseppe Bolla, SOGIN*
15:10	**2.c**	**Strategic and Operational Issues: Russian Federation** *Leonid Sukhanov, ROSATOM*
15:40		*Break*
16:00	**2.d**	**Strategic and Operational Issues: France** *Jean-Guy Nokhamzon, CEA*
16:30	**2.e**	**An IAEA Perspective on Decommissioning Management** *Michele Laraia*
16:30	**3.**	**PANEL DISCUSSION ON RECENT DEVELOPMENTS AND KEY LESSONS LEARNT** *Panellists – Doug Metcalfe, Giuseppe Bolla, Leonid Sukhanov, Jean-Guy Nokhamzon, Michele Laraia*
17:30		*Adjourn*

8 NOVEMBER 2007 (DAY 2, AM)

Topical Session

'HUMAN AND ORGANIZATIONAL FACTORS IN DECOMMISSIONING'

Chair: Luis Valencia, FZK, Germany

08:30	**4.**	**SESSION 2 PROJECT/SITE SPECIFIC ASPECTS OF DECOMMISSIONING** **(issues such as: project management and personnel aspects, e.g. training, skills assessment, safety culture and knowledge management)**
08:35:	**4.a**	**UK** *Alan Neal, UKAEA*
09:05	**4.b**	**Spain** *Juan Luis Santiago, ENRESA*
09:35	**4.c**	**Slovakia** *Jozef Hutta, Javys*
10:05	**4.d**	**Germany** *Ralf Versemann (RWE)*
10:35		*Break*
11:00	**5.**	**PANEL DISCUSSION ON RECENT DEVELOPMENTS AND KEY LESSONS LEARNT** *Panellists: Alan Neal, Jean-Luis Santiago, Jozef Hutta, Ralf Versemann*
11:45	**6.**	**SUMMING UP** Chair/Rapporteur
12:00		*Adjourn*

APPENDIX 2

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Topical Session on HUMAN AND ORGANISATION FACTORS IN DECOMMISSIONING

November 7-8, 2007

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