Unclassified **NEA/RWM/WPDD(2008)12/REV1**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **02-Feb-2009**

English - Or. English

NUCLEAR ENERGY AGENCY
RADIOACTIVE WASTE MANAGEMENT COMMITTEE

NEA/RWM/WPDD(2008)12/REV1
Unclassified

Working Party on Decommissioning and Dismantling (WPDD)

A Map of International Activities on Decommissioning and Dismantling

November 2008

This document has been prepared by the Nuclear Energy Agency's Working Party on Decommissioning and Dismantling (WPDD) in collaboration with the European Commission (DG-TREN) and the International Atomic Energy Agency.

JT03259055

English - Or. English

TABLE OF CONTENTS

GLOSSARY OF ACRONYMS 5

INTRODUCTION 7

Background 7
Organisation of this document 7

OVERVIEW 9

OECD Nuclear Energy Agency (NEA) 9
European Commission (EC) 11
International Atomic Energy Agency (IAEA) 14

DETAILED D&D MAP 17

Structure of the D&D Map 17
1. Policy 19
2. Strategy 26
3. Implementation 29
4. Stakeholder Information and Involvement 34
5. Transitional Phase 36

Appendix A: List of NEA Documents on Decommissioning and Dismantling of Nuclear Facilities 37

Appendix B: List of EC Documents onDecommissioning and Decontamination of Nuclear Facilities 42

Appendix C: List of IAEA Documents Published Since 1990 on Decommissioning and Decontamination of Nuclear Facilities 43

GLOSSARY OF ACRONYMS

CND:	Coordination Network on Decommissioning of Nuclear Installations, sponsored by the European Commission Research Directorate-General
CNRA:	Committee on Nuclear Regulatory Activities of the OECD/Nuclear Energy Agency.
CPD:	Co-operative Programme on Decommissioning reporting to the RWMC of the OECD/Nuclear Energy Agency.
CRPPH:	Committee on Radiation Protection and Public Health of the OECD/Nuclear Energy Agency.
CSNI:	Committee on Safety of Nuclear Installations of the OECD/Nuclear Energy Agency.
D&D:	Decommissioning and Dismantling.
DGENV:	Directorate General of Environment of the European Commission.
DGTREN:	Directorate General of Energy and Transport of the European Commission.
EC:	European Commission.
EGRA:	NEA/CRPPH Expert Group on the Regulatory Application of Authorisation.
EIA:	Environmental Impact Assessment.
EURATOM:	The European Atomic Energy Community, is an international organization composed of the members of the European Union established on 25 March 1957.
IAEA:	International Atomic Energy Agency.
ISBN:	International Standard Book Numbering system.
NEA:	Nuclear Energy Agency (OECD).
NDC:	Nuclear Development Committee of the OECD/Nuclear Energy Agency.
NMSS:	US Nuclear Regulatory Commission Office of Nuclear Material Safety and Safeguards.
NPP:	Nuclear Power Plant.
NRC:	Nuclear Regulatory Commission (U.S.).
PWR:	Pressurized Water Reactor.

RPV: Reactor Pressure Vessel.

RWMC: Radioactive Waste Management Committee of the OECD/Nuclear Energy Agency.

TEGDE: Technical Group on Decommissioning of the IAEA.

TGDC: Task Group on Decommissioning Costs under the Co-operative Programme on Decommissioning (CPD).

TGSC Task Group on the Safety Case under the WPDD.

TND: Thematic Network on Decommissioning sponsored by the European Commission Research Directorate-General.

USNRC: see NRC.

WGIP: Working Group on Inspection Practices under the CNRA of the OECD/Nuclear Energy Agency.

WPDD: Working Party on Decommissioning and Dismantling under the RWMC of the OECD/Nuclear Energy Agency.

WWER: Water Cooled Water Moderated Nuclear Power Reactor.

INTRODUCTION

Background

This document has been prepared by the Nuclear Energy Agency's (NEA) Working Party on Decommissioning and Dismantling (WPDD) in collaboration with the European Commission (DG-TREN) and the IAEA. It is intended to assist the dissemination of information on international nuclear decommissioning and dismantling activities. The document is updated yearly and available to the wider public through the NEA website.

Organisation of this document

Following this Introduction, the document has two further chapters. The first is an Overview that describes the current aims, organisation and activities of three international organisations with interests in the field of nuclear decommissioning and dismantling (D&D), namely:

- Nuclear Energy Agency (NEA);
- European Commission (EC); and
- International Atomic Energy Agency (IAEA).

The final chapter consists of a 'D&D Map'. This catalogues current activities but its primary function is to guide the reader to useful sources of information on every aspect of D&D from policy through to implementation. It is cumulative in that the list of sources is extended at each yearly update. The D&D Map is subdivided into five main headings concerned with:

- policy;
- strategy;
- stakeholder information and involvement;
- transition; and
- implementation.

Under each heading, the sources are listed as responses to a series of questions. For example, under the main heading of 'Policy', the first question is What are the current and planned decommissioning policies in the individual countries?; the responses then show where this information might be obtained and any relevant ongoing activities.

The document also includes three Appendices that list documents relating to D&D published by NEA, EC and IAEA. These appendices therefore present much the same information as the D&D Map, though in a different format.

OVERVIEW

OECD Nuclear Energy Agency (NEA)

Within the NEA, decommissioning is discussed within several Standing Technical Committees, namely:

- Radioactive Waste Management Committee (RWMC) - of which the WPDD forms a part.
- Committee on Nuclear Regulatory Activities (CNRA).
- Committee on Safety of Nuclear Installations (CNSI).
- Committee on Radiation Protection and Public Health (CRPPH).
- Nuclear Development Committee (NDC).

A complete list of NEA documents relating to D&D is presented in Appendix A. The NEA programme of work in the area of decommissioning includes the following:

Radioactive Waste Management Committee (RWMC)

The RWMC is an international committee made up of senior representatives from regulatory authorities, radioactive waste management agencies, policy making bodies and research and development institutions. Its purpose is to foster international co-operation in the management of radioactive waste and radioactive materials amongst the OECD member countries. RWMC's work in the field of D&D is progressed through two sub-groups:

- Working Party on Decommissioning and Dismantling (WPDD) was formed in 2001 to address the policy and regulatory aspects of decommissioning – see below. It is the only NEA Working Party that is fully concerned with decommissioning.

- The Forum on Stakeholder Confidence (FSC) was formed in 2000 and is charged with investigating and distilling the lessons that can be learnt from national and international experience regarding decision-making processes and avenues for stakeholder involvement in radioactive waste management (including D&D).

In addition, the Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects (CPD[1]) works to share industrial, project-level experience among decommissioning projects. The CPD is a Joint Undertaking sponsored by the NEA and managed by its members. It was created in 1985 and currently involves 22 organisations from 12 member countries. There are in total 46 decommissioning projects participating in the exchange programme.

1. An overview of the work of the CPD is presented in *The NEA Co-operative Programme on Decommissioning A Decade of Progress* available at http://www.nea.fr/html/rwm/reports/2006/nea6185-decommissioning.pdf.

The Working Party on Decommissioning and Dismantling (WPDD)

The Working Party on Decommissioning and Dismantling (WPDD) of the RWMC is the focus for the analysis of decommissioning policy, strategy and regulation within the NEA, including the attending issues relating to the management of materials, the release of buildings and sites from regulatory control and associated costs and funding. It tracks decommissioning developments worldwide and develops reports and position papers on emerging issues. Its overarching aim is to contribute to the development of best practice through circulation of its reports and through dialogue between policy makers, practitioners, regulators, researchers and international organisations.

Beyond policy and strategy considerations the WPDD's programme of work also addresses practical considerations for implementation such as techniques for characterisation of materials, techniques and equipment for decontamination, cutting and dismantling - with and without remote operation.

The WPDD brings together senior experts in decommissioning from 18 OECD countries and from international organisations such as the European Commission and the IAEA. Its members include policy specialists, regulators, implementers, researchers and waste management specialists. The group meets once each year, at a host location that rotates among the member countries. Each meeting normally includes a topical session on an issue of special interest and a session focusing on the framework for decommissioning in the host country. Associated with this, the host country normally arranges a visit to a local decommissioning facility.

An important role of the WPDD is to facilitate the exchange of experience amongst its members and promote the further understanding of specific aspects. This is achieved through workshops and working sessions on issues of topical interest, through projects undertaken by task teams made up of experts from the participating organisations, and through collaboration with other groups working in the field of decommissioning. The latter include the NEA's Cooperative Programme on Decommissioning (CPD) (see below), as well as decommissioning groups within the IAEA and the European Commission. WPDD also works closely with the NEA's Forum on Stakeholder Confidence (FSC), to help develop the links between decommissioning, decision-making and public confidence and acceptance, and with the RWMC Regulators' Forum on regulatory issues that are of strategic interest. The current (and recent) work programme of the group includes issues ranging from regulation of decommissioning[2], the release of materials and buildings from regulatory control[3], stakeholder involvement in decommissioning[4], as well as ongoing studies on the application of decommissioning experience to the design of new reactor systems, on R&D needs and on the optimisation of decommissioning and waste management.

Decommissioning Cost Estimation Group (DCEG)

At the beginning of 2008 the WPDD established the Decommissioning Cost Estimation Group (DCEG), a specialist sub-group to foster the exchange of information and experience on the specific topic of estimating costs for decommissioning. This group is currently working on reports on the cost drivers and reporting requirements for decommissioning and, in 2009, will begin a project aimed at updating the 1999 tri-agency report *A Proposed Standardised List of Items for Costing Purposes* (see above).

2. *Regulating the Decommissioning of Nuclear Facilities* (2008) [NEA No. 6401] (also in French).
3. *The Release of Materials and Buildings* (2008) [NEA No. 6403] (also in French).
4. *Stakeholder Issues and Involvement in Decommissioning Nuclear Facilities* (2007) [NEA No. 6320] (also in French).

Committee on Nuclear Regulatory Activities (CNRA)

The CNRA is an international committee made up of senior representatives from regulatory bodies. It was created in 1989 to guide NEA's programme concerning the regulation, licensing and inspection of nuclear installations with regard to safety. CNRA's work covers regulation of all nuclear activities including D&D.

Committee on Safety of Nuclear Installations (CNSI)

The Committee on the Safety of Nuclear Installations (CSNI) is made up of senior scientists and engineers, with broad responsibilities for safety technology and research programmes, and representatives from regulatory authorities. The CNSI was established to assist member countries in maintaining and further developing the scientific and technical knowledge base required to assess the safety of nuclear reactors and fuel cycle facilities including, of course, their decommissioning.

Committee on Radiation Protection and Public Health (CRPPH)

The CRPPH is made up of regulators and radiation protection experts, with the broad mission to provide timely identification of new and emerging issues, to analyse their possible implications and to recommend or take action to address these issues to further enhance radiation protection regulation and implementation. The regulatory and operational consensus developed by the CRPPH on these emerging issues supports policy and regulation development in Member countries, and disseminates good practice including decommissioning. The Committee’s work on the evolving system of radiological protection, independently and with the ICRP, and on stakeholder involvement in decision making are directly related to the release of sites, facilities and materials from radiological and regulatory control.

Nuclear Development Committee (NDC)

The Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle, known generally as the Nuclear Development Committee (NDC), was established in 1977. It aims to provide authoritative, reliable information on nuclear technologies, economics, strategies and resources to governments for use in policy analyses and decision making. In terms of D&D, the committee has a particular interest in the financial implications of decommissioning nuclear facilities.

European Commission (EC)

At the centre of the European energy policy, approved by the Spring Summit of the European Council in 2007, lie three criteria: competitiveness, security of supply and sustainability. Already, nuclear energy is making a substantial contribution to the EU energy policy as part of the energy mix in currently 15 EU Member States, with 146 nuclear power plants in operation.

Nuclear energy can only have a realistic chance to contribute substantially to the future energy mix in Europe if a high level of safety, the long-term management of radioactive waste and the financing of decommissioning are guaranteed.

The focus of the European Commission's activities in the field of decommissioning is fully in-line with this statement. Decommissioning has become an industrial reality and it is anticipated that approximately one third of the 146 nuclear power reactors operating within the EU will be in decommissioning by 2025.

The work of the European Commission has shifted accordingly from supporting technological R&D projects towards the financing of decommissioning and the management of the required decommissioning funds as well as the implementation of an assistance programme in three EU Member States for the decommissioning of old Soviet design reactors. Also, through the Directorate General for External Relations and European Neighbourhood Policy, the EU is supporting the decommissioning of nuclear installations in countries like Ukraine, Russia and Kazakhstan.

The Commission is committed to reporting on a regular basis to the European Parliament and the Council on the progress in the field of EU decommissioning policy and the implementation of the decommissioning assistance programme in the three EU Member States.

A list of EC documents on D&D is provided in Appendix B.

Ongoing and recently completed initiatives are described in the paragraphs that follow.

High Level Group

The EU is of the opinion that a suitable modern European legal framework for the use of nuclear energy should be created to guarantee a high level of safety, as well as ensure the disposal of radioactive waste and the safe decommissioning of nuclear energy facilities at the end of their service lifetime. To implement this idea, and following the Council Conclusion of May 2007, the EC Action Plan provides for a high-ranking group of nuclear safety experts answering these questions. A High Level Group was set up with participation of senior regulators of all 27 Member States, so including also Member States without an ongoing nuclear energy programme. The constituent meeting was held in October 2007 and three working groups were set up.

The working group dealing with the safety of the management of spent fuel and radioactive waste and decommissioning will also closely monitor the enhancement of the financing of the decommissioning and waste management. This will be undertaken notably on the basis of the monitoring of the work of the Decommissioning Funding Group (see below). It will be achieved through the proposal of methods and criteria to evaluate funding, placed in a national framework and including a comprehensive review of the adequacy, the availability and the transparent management of the funding.

Decommissioning Recommendation and 2nd Report

In the context of the EC Directive concerning the rules for the internal market in electricity[5], nuclear decommissioning funding schemes within the EU became subject to high level political discussions. Concerns were expressed as to the possible adverse effects of the misuse of financial resources earmarked for decommissioning of nuclear plants and the management of waste. An inter-institutional statement in July 2003[6] set the ground for Community action, highlighting the need for adequate financial resources for decommissioning and waste management activities to be available for the purpose for which they have been established and to be managed with full transparency. After the publication of a first report[7] by the Commission on this issue, the EC published a recommendation on

5. Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC.
6. OJ L 176, 15.7.2003.
7. Report on the use of financial resources earmarked for the decommissioning of nuclear power plants, COM(2004) 719, 26.10.2004.

the management of financial resources in 2006[8] in order to propose measures to address these concerns.

The second report[9] and its related working document[10] published at the end of 2007 goes beyond the content of the first report. It covers also research reactors as well as other fuel cycle facilities and provides more details on the management and use of financial resources earmarked for decommissioning in the EU. The second report presents information on

- funding arrangements
- decommissioning cost estimation
- adequacy of financial resources
- use of decommissioning funds
- transparency

and compares funding practices in the Member States with the Commission Recommendation. The first and second report with their corresponding working documents and the Commission Recommendation can be found on the Europa website under:
http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm.

The follow-up of the findings from the second report and the further use of the Commission Recommendation will be ensured by the EC with the support of the Decommissioning Funding Group (DFG). The DFG is an expert group with representatives from all EU Member States, created to assist the EC for the development of a commonly agreed interpretation of the Commission Recommendation and for its practical implementation.

EU Nuclear Decommissioning Assistance Programme

In addition to elaborating with the Member States a common understanding on the financing of decommissioning the EC implements the Nuclear Decommissioning Assistance Programme in three Member States. This programme provides financial support to Lithuania, Slovakia and Bulgaria based on the Treaty of Accession. The Treaty foresees early closure and subsequent decommissioning of Ignalina Unit 1&2 (Lithuania), Bohunice V1 Unit 1&2 (Slovakia) and Kozloduy Unit 1-4 (Bulgaria). Because this early closure represents exceptional financial burden not commensurate with the size of economic strength of each country, financial support of the European Union is provided. The financial support includes:

- projects for decommissioning and waste management;
- projects in the energy sector to mitigate the closure consequences (ex. replacement capacity for electricity production, energy efficiency measures …);
- projects to mitigate social consequences.

The overall financial support for the three programmes totals some € 2 530 million. This covers the support for Bulgaria until 2009 and for Lithuania and Slovakia up to 2013. Currently discussions are

8. Commission Recommendation on the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste, OJ L 330/31, 28.11.2006.
9. Second report on the use of financial resources earmarked for the decommissioning of nuclear installations, spent fuel and radioactive waste, COM(2007) 794 final, 12.12.2007
10. Commission Staff Working Document *EU Decommissioning Funding Data*, SEC(2007) 1654, 12.12.2007

ongoing in order to extend the financial assistance to Bulgaria also until 2013 as for both other countries.

Technical studies related to decommissioning

The EC has completed several technical studies related to decommissioning in support of its activities. The final reports on the following studies are also available at the above mentioned EUROPA website:

- Analysis of factors influencing the selection of strategies for decommissioning of nuclear installations.
- Inventory of best practices in the decommissioning of nuclear installations.
- Comparison among different decommissioning funds methodologies for nuclear installations.
- Analysis of environmental, economic and social issues related to the decommissioning of nuclear installations.

Research related activities on decommissioning

The research-related activities on decommissioning were carried out within the Framework Programme for the European Union's research, technological development and demonstration. These activities represented a long-standing effort in this area, started in the early Eighties. Today, two networks are still in place. The first one is the *Thematic Network on Decommissioning* – started in 2001– involving some fifty organisations and that covers all aspects specific to decommissioning, from technological to legal or strategic issues. The second one is the *Project EC Decommissioning Information Network*[11], which integrates previously created databases on decommissioning costs and tools in a single platform accessible via Internet. Both activities are part of the *Coordination Network on Decommissioning of Nuclear Installations* – see *http://ec-cnd.net* – which is sponsored by the EC.

International Atomic Energy Agency (IAEA)

The International Radioactive Waste Technical Committee (WATEC) is a working group of senior international experts in radioactive waste management, decommissioning and environmental remediation, with particular emphasis on strategies, implementation, technologies and methodologies.

WATEC advises the IAEA Secretariat on programme activities and directions related to radioactive waste management and decommissioning strategies and implementation for radioactive waste from all past and present sources and activities. WATEC also provides a forum for information and knowledge sharing on national and international programmes development in these areas.

WATEC Members come from various types of organizations having responsibilities for different aspects of radioactive waste management: waste management authorities, waste generators, research institutes, regulatory bodies, government ministries and waste disposal organizations. It is geographically diverse and contains members from countries having a range of uses of nuclear and radioactive materials for electricity generation and nuclear applications. Its members have expertise in management of wastes from their arising through disposal, including management of wastes arising from decommissioning of nuclear facilities and management of disused sealed radioactive sources.

To facilitate international coordination, representatives of the OECD Nuclear Energy Agency and the European Commission are invited to attend WATEC meetings as observers.

11. The European Thematic Network on Decommissioning of Nuclear Installations [http://www.ec-tnd.net/]

In parallel, the Waste Safety Standards Committee (WASSC) is a standing body of senior experts in the safety of radioactive waste management. WASSC advises on the overall programme for the development, review and revision of standards relating to radioactive waste safety (i.e. waste management, waste treatment and safety of disposal facilities, and decommissioning). Its objective is to achieve consensus, quality, coherence and consistency in the development of international standards for radioactive waste safety.

Safety Standards

The IAEA has a long-standing comprehensive programme of work on decommissioning and has published a number of safety standards and technical reports on various aspects of decommissioning of facilities using radioactive material. Standards recently approved are:

- Safety Guide on *Release of Sites from Regulatory Control upon Termination of Practices* (WS-G-5.1) was published in 2006.
- Safety Requirements on *Decommissioning of Facilities Using Radioactive Material* (WS-R-5) was published in 2006. To support this, the existing Safety Guides WS-G-2.1, WS-G-2.2 and WS-G-2.4 will also be revised.
- Safety Guide on *Safety Assessment for Decommissioning of Facilities Using Radioactive Material* is being printed as WS-G-5.2 (currently numbered DS376).

International Decommissioning Network (IDN)

As a 'network of networks', the IDN was formed to coordinate and build efforts aimed at assisting Member States in the sharing of practical decommissioning knowledge. Within the IDN, organizations with a demonstrated record of excellence in a wide range of areas offer to share their experience. In 2008, the IDN organized a workshop hosted by Spain on waste management and clearance, and a workshop hosted by Belgium on size reduction for decommissioning of nuclear facilities.

Other Recent and Forthcoming D&D initiatives

- In 2006, the Agency initiated the Research Reactor Decommissioning Demonstration Project to assist Member States in adequate planning and implementation of safe decommissioning of research reactors. Through this project, the Agency is providing assistance to both the operators and regulators in a number of Member States with research reactors undergoing decommissioning. The project aims to demonstrate the application and use of the Agency's safety standards and best practices during the actual decommissioning of facilities from the planning stage through to the termination of decommissioning. Experts from more than 13 Member States are participating in the project. In the current reporting period, Australia hosted a technical meeting on the transition phase of the Australian Nuclear Science and Technology Organisation's (ANSTO's) HIFAR research reactor, and Philippines hosted a technical meeting on the characterization survey of the Philippine Research Reactor (PRR). Consideration is also being given to expand the project to include the Chinese heavy water research reactor as another demonstration facility. The project commenced in June 2006 and is expected to be complete by 2012.

- The second phase of the international project on Evaluation and Demonstration of Safety of Decommissioning of Nuclear Facilities (DeSa project) was completed (http://www-ns.iaea.org/tech-areas/waste-safety/desa/start.asp). The objective of the project was to develop a harmonized approach for evaluating the safety of decommissioning activities, applying the graded approach and for reviewing safety assessment.

- In February 2006 the IAEA initiated a new project on providing technical assistance to Iraq. The objective of the project is to assist the Government of Iraq with the evaluation and decommissioning of the existing facilities that have used radioactive material in the past and were damaged by the Gulf wars. The Agency project has progressed well and continued support is being given by experts from France, Germany, Italy, UK, Ukraine and the USA. Project information and results are available on the Agency's website. A draft nuclear law has been prepared and work on the drafting of regulations covering decommissioning, radiation protection and waste management continues. The primary legislation has passed through the first stage of Iraq's legislative process, and may be expected to be enacted within a year. The project has enabled Iraqi experts to draft policy and strategy documents for the management of radioactive waste, but these have yet to be endorsed by Iraq's regulatory community. Despite the delay in consolidating the regulatory situation, independent scrutiny and challenge is occurring and work is due to start on decommissioning one of the lightly contaminated sites in line with the prioritization of decommissioning activities agreed in 2007. Support for this decommissioning was provided to Iraq via a practical training programme conducted at Pripyat, Ukraine, during June 2008.

- As part of its wider programme of technical assistance to Member States, IAEA is providing support in the planning for decommissioning of NPPs and research reactors. This assistance is organised at a regional and country specific basis. The regional assistance comprises training workshops and expert missions to advise on specific aspects or facilities. Country-specific advice is organised through national projects (http://www-tc.iaea.org/tcweb/default.asp).

- In response to increased requests from the decommissioning industry for independent technical reviews, the Agency has launched a new review service for planned and ongoing decommissioning projects. Designed to complement the Agency's OSART service, the international decommissioning review service will provide an independent review of the activities associated with the planning and implementation of decommissioning in accordance with the international safety standards, other relevant recommendations and good practice in Member States. The first review was performed at the Bradwell site (Magnox NPP) in UK in June-July 2008. The outcomes of this review were presented and discussed at a technical meeting at Agency Headquarters in November 2008.

- Since 1980, the Power Reactor Information System (PRIS) has been collecting in a computerized form detailed information on nuclear power plants worldwide, including reactor design characteristics, plant general specifications and operating experience data. In 2005 PRIS was expanded and a new module gathers online information on decommissioning data such as reasons for shutdown, decommissioning strategy and milestones, fuel and waste management, and main contractors. Brief information on PRIS is given in Annex III of TRS No. 428.

- A list of safety standards, technical reports, and other documents published by IAEA since 1990 is contained in Appendix C.

DETAILED D&D MAP

Structure of the D&D Map

Sources of D&D information are listed under five main headings in response to a series of questions, as itemised below.

1. **Policy**

- 1.1 What are the current and planned decommissioning policies in the individual countries?
- 1.2 What are the main elements of a national policy?
- 1.3 What are the ethical principles that have impact on decommissioning?
- 1.4 How is licensing structured?
  - *1.4.1 What kind of regulation is needed for decommissioning?*
- 1.5 Will all national D&D sites be returned for unrestricted (or restricted) use?
- 1.6 On which basic regulatory principles and/or approaches ought clearance and recycling of material to be handled?
- 1.7 What are the necessary funding arrangements?
  - *1.7.1 How are financial guarantees built into the D&D policy and its implementation?*
  - *1.7.2 What are funding schemes including decommissioning liabilities?*
- 1.8 How should D&D be regulated to ensure the necessary safety and environmental protection?

2. Strategy

- 2.1 When is it suitable to carry out D&D? Which decommissioning option should be used - deferred, immediate or safe enclosure?
  - *2.1.1 For how many years is safe storage suitable?*
- 2.2 How dependent is the D&D strategy on the existence of waste management policies and facilities?
  - *2.2.1 How is the D&D strategy harmonised with the long-term waste management strategy?*
  - *2.2.2 What waste disposal arrangements (especially repositories) and precautions are necessary?*
- 2.3 At what cost - also radiological - should dismantling be carried out?
- 2.4 How does one arrive at generic estimates of dismantling costs as function of D&D strategy in order to determine decommissioning funding costs?

3. Implementation

3.1 What should be the contents of an EIA for D&D?

3.2 How is a safety case set up and managed?

3.2.1 What are the elements of a D&D safety case?

3.2.2 How wide is the range of assumptions needed for accident analysis?

3.2.3 What is the experience and lessons learned that can be fed back to the process of regulating decommissioning activities including criteria for judging safety cases?

3.3 What type of organisation or implementing framework is best to carry out the D&D programme?

3.4 What are the R&D needs?

3.4.1 Decontamination and dismantling techniques

3.4.2 What R&D has been done for very radioactive reactor internals?

3.4.3 What R&D has been done for dismantling concrete and its reuse?

3.4.4 What R&D has been done for decontamination of metals?

3.4.5 What R&D has been done for dealing with 'exotic' and toxic materials (like Na, NaK, Be, Graphite...)

3.5 How can costing of individual industrial projects be estimated?

3.6 What clearance procedures should be implemented for materials?

3.7 What clearance procedures should be implemented for sites?

3.8 How to perform the release measurement for very large volumes of materials and complex geometry?

3.9 What waste treatment technologies have been found to work and what have not?

3.9.1 How are special waste items to be dealt with, e.g. large items and reactor internals?

3.9.2 Which are good practices for volume reduction?

4. Stakeholder Information and Involvement

4.1 Informing stakeholders on the safety and manageability of the D&D process

4.2 How is the general public to be involved in the EIA process?

4.3 Who are the stakeholders?

5. Transitional Phase

5.1 What are the special aspects of the transition phase from facility operation to decommissioning?

1. Policy

Decommissioning *Policy* is taken to include all aspects of a government's approach to decommissioning issues. For example, any requirements regarding the ultimate use of decommissioned sites, waste management policy, public and worker health and safety policies, environmental safety policies, policies for the clearance of materials and regional development aspects.

1.1 What are the current and planned decommissioning policies in the individual countries?

- Country profiles, including statements of policy with respect to D&D activities are accessible at [http://www.nea.fr/html/rwm/wpdd/welcome.html].

- In September 2002 the NEA/WPDD issued a booklet on *The Decommissioning and Dismantling of Nuclear Facilities: Status, Approaches, Challenges*. The booklet is freely accessible on the web and can be downloaded from: [http://www.nea.fr/html/rwm/reports/2002/3714-decommissioning.pdf].

- The NEA/NDC has released a report titled *Decommissioning Nuclear Power Plants: Policies, Strategies and Costs* ISBN**:** 92-64-10431-3. The publication can be purchased in E-book (PDF -format) at the NEA website.

- The EC has published in its Official Journal (OJ L 330/31, 28.11.2006) the Commission Recommendation on *the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste*. The recommendation can also be downloaded from the Europa website: http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm.

- The EC published in 2007 its second report to the European Parliament and the Council on *the use of financial resources earmarked for the decommissioning of nuclear installations, spent fuel and radioactive waste*. The report compares funding practices in the Member States with the Commission Recommendation. The first (from 2004) and second report with their corresponding working documents can be downloaded from the EUROPA website: http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm.

- In 2004 the IAEA published a *Status of the Decommissioning of Nuclear Facilities around the World*, see under "Other" in Appendix C.

1.2 What are the main elements of a national policy?

- The NEA WPDD and NDC publications mentioned in Section 1.1 are useful to this effect. Additionally, The NEA/RWMC has held a topical session (March 2003) on *Liabilities identification and management at a national level*. The proceedings were issued in October 2003 and is publicly available at the NEA website with document number [NEA/RWM(2003)14][12].

12. See webpage: http://www.nea.fr/html/rwm/docs/2003/rwm2003-14.pdf

- The EC completed four studies
  - *Analysis of factors influencing the selection of strategies for decommissioning of nuclear installations*.
  - *Inventory of best practices in the decommissioning of nuclear installations*.
  - *Comparison among different decommissioning funds methodologies for nuclear installations*.
  - *Analysis of environmental, economic and social issues related to the decommissioning of nuclear installations*.
  - The final report of all four studies can be downloaded from the EUROPA website: http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm.

- *Strategies, Policies and Funding in Decommissioning* is a Working Area of the CND. For more information, please consult: http://ec-cnd.net/.

- The IAEA has published a technical report (TRS No. 462, 2008) dealing *inter alia* with the dispositioning of lower level decommissioning waste and materials. It illustrates several industrial options to safely and cost-effectively manage materials and waste resulting from decommissioning.

- The IAEA has prepared a report on this issue which was published in 2005 (TECDOC-1478 *Selection of Decommissioning Strategies: Issues and Factors*) focusing on national policies and strategies as dictated by national constraints and providing examples.

- An IAEA Safety Report *Decommissioning Strategies for Facilities Using Radioactive Material* was published in 2007 (SRS No. 50). It discusses specific safety issues related to the three main decommissioning strategies – immediate dismantling, deferred dismantling and entombment.

- A Level-2 report in preparation under the IAEA Nuclear Energy Series deals with policies and strategies of decommissioning. It includes safety and non-safety-related factors such as national infrastructure and priorities, financial constraints, radiological and industrial safety.

1.3 What are the ethical principles that have impact on decommissioning?

- OECD, *The Implementation of the Polluter Pays Principle*. Recommendations by the Council on 14 November, 1974

- OECD, Recommendation of the Council concerning *the Application of the Polluter-Pays Principle to Accidental Pollution*, 7 July 1989, C(89)88/Final.

- Joint Convention on *the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*. An associated descriptive document was published by the IAEA in 2006.

- Rio Declaration 1992 on Environment and Development (Principle 16).

- *The Principles of Radioactive Waste Management*, IAEA Safety Series No. 111-F, 1995

- Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on *the assessment of the effects of certain public and private projects on the environment*.

- Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on *the assessment of the effects of certain plans and programmes on the environment*.

- European Commission Guidance on the implementation of Directive 2001/42/EC on *the assessment of the effects of certain plans and programmes on the environment*.

- Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC.

- Nuclear safety and the environment. *Environmental Impact Assessment for the Decommissioning of Nuclear Installations*. Report under EC Contract B4-3040/99/MAR/C2 by Cassiopee, University of Wales and ECA Global. EUR 2005, June 2001, Revised February 2002.

- Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC.

- Communication from the Commission to the European Parliament and the Council. Second report on the use of financial resources earmarked for the decommissioning of nuclear installations, spent fuel and radioactive waste. COM/2007/794 final; Commission Staff Working Document *EU Decommissioning Funding Data,* SEC(2007)1654.

- Commission Recommendation on *the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste*. OJ L 330/31, 28.11.2006.

- NEA/WPDD Status Report, 2006, *Decommissioning Funding: Ethics, Implementation, Uncertainties*, NEA No. 5996.

1.4 How is licensing structured?

- The NEA/WPDD information platform of national fact sheets contains relevant information (see section 1.1). Information can also be found in the RWMC information platform on the *Regulatory Control of Radioactive Waste in 18 NEA member countries*: http://www.nea.fr/html/rwm/rf/welcome.html. Additional information can be found in the CRNA document *The Regulatory Challenges of Decommissioning Nuclear Reactors* , NEA#04375, ISBN: 92-64-02120-5, available on the Web at: [http://www.nea.fr/html/nsd/reports/nea4375-decommissioning.pdf]. The issue was also discussed in Session 7 of the workshop *Safe, Efficient, and Cost-effective Decommissioning* held in Rome September 2004, see proceedings on CD-Rom published in 2005.

1.4.1 What kind of regulation is needed for decommissioning?

- IAEA has issued Safety Requirements and Safety Guides dealing with decommissioning:
  - WS-R-5 Decommissioning of Facilities Using Radioactive Material ;

  - WS-G-2.1 Decommissioning of Nuclear Power Plants and Research Reactors;
  - WS-G-2.2 Decommissioning of Medical, Industrial and Research Facilities;
  - WS-G-2.4 Decommissioning of Nuclear Fuel Cycle Facilities;
  - RS-G-1.7 Application of the Concepts of Exclusion, Exemption and Clearance;
  - WS-R-3 Remediation of Areas Contaminated by Past Activities and Accidents;
  - WS-G-5.1 Release of Sites from Regulatory Control on Termination of Practices

  - Guidance on implementation of the above-mentioned standards is given in a number of Technical and Safety Reports, and other documents published by the IAEA.

- NEA/CNRA has issued (February 2000) a report on *Regulatory Practices for Decommissioning of Nuclear Facilities with Special Regard to Regulatory Inspection Practices*. The report can be downloaded from the web: [http://www.nea.fr/html/nsd/docs/1999/cnra-r99-4.pdf].

- NEA/CNRA has issued in April 2003 a report entitled: *The Regulatory Challenges of Decommissioning Nuclear Reactors*. The report can be downloaded from the web at: [http://www.nea.fr/html/nsd/reports/nea4375-decommissioning.pdf] (in PDF format).This publication is also available in French as: *Les autorités de sûreté face au démantèlement des réacteurs nucléaires*.

- The IAEA has published a Technical Document *Planning, Managing and Organizing the Decommissioning of Nuclear facilities: Lessons Learned*, (IAEA-TECDOC-1394 [2004]) and two Technical Reports *Decommissioning of Small Medical, Industrial and Research Facilities* (TRS 414) and *Transition from Operation to Decommissioning of Nuclear Installations* (TRS 420).

- IAEA has published Safety Reports on *Safe enclosure of nuclear facilities during delayed dismantling (SRS 26)*, and *Safety considerations in the transition from operations to decommissioning of nuclear facilities* (SRS 36).

- The IAEA also published the Safety Report No. 45 *Standard Format and Content for Safety Related Decommissioning Documents.*

- The IAEA is preparing a report on *Performance Indicators for Decommissioning*, where indicators are identified and evaluated. They are intended to provide an appraisal of management and organization provisions made at decommissioning projects.

- The WPDD Topical Session *Emerging issues and trends in regulatory practices during the decommissioning and dismantling of nuclear power plants* held in Paris, October 24, 2006. Proceedings are freely available on http://www.nea.fr/documents/ok/2007/rwm/rwm-wpdd2007-3.pdf.

1.5 Will all national D&D sites be returned for unrestricted (or restricted) use?

- The NEA/WPDD and RWMC-RF references in Section 1.1 contain relevant information.

- The NEA/WPDD has held a topical Session on *Building & Site Release and Reuse* at its meeting in June 2002. The proceedings [NEA/RWM/WPDD(2002)8] are available and downloadable from the WPDD web page.

- In March 2003 the NEA/RWMC Regulators' Forum held a topical session on regulatory criteria for removal of regulatory controls. In September 2004 the Regulators' Forum issued the report *Removal of Regulatory Controls for Materials and Sites. National Regulatory Positions* with number NEA/RWM/RF(2004)6. The report can be downloaded from the webpage [http://www.nea.fr/html/rwm/regulator-forum.html].

- The NEA publication *Releasing the Sites of Nuclear Installations* ISBN 92-64-02307-0 which was printed in 2006.

- IAEA Technical Report TRS-444 (2006) *Redevelopment of Nuclear Facilities after Decommissioning* provides numerous examples of reuse/redevelopment of nuclear facilities after decommissioning. A follow-up report giving numerous practical case histories derived from either the nuclear or the non-nuclear sector is under preparation.

- The IAEA has developed guidance on *Release of Sites from Regulatory Control upon Termination of Practices* (Safety Guide WS-G-5.1). The Agency is also working on a draft Safety Report on *Monitoring for Compliance with Remediation Criteria* (DD744), which could also be applied to the release of sites at the end of decommissioning.

1.6 On which basic regulatory principles and/or approaches ought clearance and recycling of material to be handled?

- *Emerging Trends and Issues in Regulatory Practices during Decommissioning and Dismantling of Nuclear Power Plants. Proceedings of the WPDD Topical Session held on 24 October 2006* is available at http://www.nea.fr/documents/ok/2007/rwm/rwm-wpdd2007-3.pdf

- See the NEA/RWMC Regulators' Forum document: *Removal of Regulatory Controls for Materials and Sites. National Regulatory Positions* [NEA/RWM/RF(2004)6] as mentioned above.

- A NEA/CRPPH expert group on the Regulatory Application of Authorisation (EGRA) is looking at principles for authorized releases (see above).

- The NEA publication *Releasing the Sites of Nuclear Installations* ISBN 92-64-02307-0 which was printed in 2006 gives some views on the concepts for clearance and release.

- The US National Academy of Sciences /Board on Energy and Environmental Systems has issued the report: *The disposition dilemma: controlling the release of solid materials from USNRC-licensed facilities* (2002), see http://fermat.nap.edu/books/0309084172/html

- A Topical Session on *Materials Management* was organized at the WPDD meeting in Dec. 2001 [downloadable at: http://www.nea.fr/html/rwm/docs/2002/rwm-wpdd2002-7.pdf]

- *Recycle and Reuse of Materials* is a Working Area of the CND.

- EU Council Directive 96/29/EURATOM (Article 5) has requirements relating to disposal, recycling or re-use of radioactive materials.

- The IAEA has published a *Safety Guide on Application of the Concepts of Exclusion, Exemption and Clearance* (RS-G-1.7) which provides reference levels of activity concentrations for release of bulk material from regulatory control. A complementary Safety Report (No. 44) provides details on the scenarios and calculation assumption used for the derivation of the levels, recommended in RS-G-1.7.

- An international symposium on clearance of material was held in Germany in March 2006, organised by TÜV-Nord (Germany) in cooperation with EC, NEA and IAEA.

1.7 What are the necessary funding arrangements?

1.7.1 How are financial guarantees built into the D&D policy and its implementation?

- These questions are touched upon in the proceedings from the WPDD Topical Session on Funding held in Paris November 9, 2004. The proceedings can be downloaded from the NEA webpage http://www.nea.fr/html/rwm/wpdd.html.

- The NEA Status Report *Decommissioning Funding. Ethics, Implementation, Uncertainties* (NEA No. 5996) deals with this issue.

1.7.2 What are funding schemes including decommissioning liabilities?

- The NEA/RWMC has held a topical session (March 2003) on *Liabilities identification and management at a national level*. The proceedings were issued in October 2003 and are publicly available at the NEA website with document number NEA/RWM(2003)14 .The NEA/WPDD information platform of national fact sheets (See Section 1.1) has relevant information.

- The NEA Status Report *Decommissioning Funding. Ethics, Implementation, Uncertainties* (NEA No. 5996) addresses this issue.

- The NEA/NDC report *Decommissioning Nuclear Power Plants: Policies, Strategies and Costs* (2003) has relevant information.

- The EC has published in its Official Journal (OJ L 330/31, 28.11.2006) the Commission Recommendation on *the management of financial resources for the decommissioning of nuclear installations, spent fuel and radioactive waste*. The purpose of the recommendation is to ensure adequate financial resources for decommissioning and waste management activities to be available for the purpose for which they have been established and to be managed with full transparency. The recommendation can also be downloaded from the Europa website:
  http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm.

- The EC published in 2007 its second report to the European Parliament and the Council on the use of financial resources earmarked for the decommissioning of nuclear installations, spent fuel and radioactive waste. The report compares funding practices in the Member States with the Commission Recommendation. The first (from 2004) and second report

with their corresponding working documents can be downloaded from the EUROPA website: http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm.

- The TEGDE committee of the IAEA has prepared a report on this issue which was published in 2005 (TECDOC-1476, *Financial Aspects of Decommissioning*), see Appendix C.

1.8 How should D&D be regulated to ensure the necessary safety and environmental protection?

- Relevant information can be found in the NEA/CNRA report *The Regulatory Challenges of Decommissioning Nuclear Reactors*, NEA No. 4375, ISBN: 92-64-02120-5, available on the Web at: [http://www.nea.fr/html/nsd/reports/nea4375-decommissioning.pdf]. The issue was also discussed in Session 7 of the NEA workshop *Safe, Efficient, and Cost-effective Decommissioning* held in Rome September 2004.

- The WPDD has organized and documented a Topical Session on the *Safety Case for Decommissioning* in December 2001 [NEA/RWM/WPDD(2002)2]. It is downloadable at: [http://www.nea.fr/html/rwm/docs/2002/rwm-wpdd2002-2.pdf]. A status report entitled *Achieving the Goals of the Decommissioning Safety Case* was issued in April 2005 with the number [NEA/RWM/WPDD(2005)3] and is available at the NEA webpage [http://www.nea.fr/html/rwm/wpdd.html].

- The IAEA has published in 2006 a Safety Requirements document *Decommissioning of Facilities using Radioactive Material,* WS-R-5, that provides recommendations on the authorisation and regulation of decommissioning. The supporting Safety Guides WS-G-2.1, WS-G.2.2 and WS-G.2.4 also provided more specific details.

- The NEA/WPDD status report on *Regulating the Decommissioning of Nuclear Facilities: Relevant Issues and Emerging Practices* (NEA No. 6401), published in 2008, provides useful insights into current practices.

2. Strategy

Decommissioning *Strategy* is taken to include all factors that need to be considered when applying to national competent authorities for permission to decommission. For example, the time scale for safe-store, proposed site disposition and use after decommissioning, technical aspects of decommissioning activities, etc.

2.1 When is it suitable to carry out D&D? Which decommissioning option should be used - deferred, immediate or safe enclosure?

- *Approaches and Practices in Decommissioning of Facilities and Management of Radioactive Waste from Non-nuclear Fuel Cycle Related Activities: Proceedings of the Topical Session of the 40th Meeting of the RWMC* (NEA/RWM(2007)9) are available on the NEA website.

- An International Seminar on *Decommissioning Strategy Selection* was organised by the NEA/WPDD in Tarragona, Spain in September 2003. The Proceedings are available from the NEA bookshop.

- A NEA Status Report *Selecting Strategies for the Decommissioning of Nuclear Facilities* ISBN 92-64-02305-4, was issued in 2006 and deals with these issues.

- IAEA Technical Report TRS-444 (2006) *Redevelopment of Nuclear Facilities after Decommissioning* focuses *inter alia* on site redevelopment as an element affecting the decommissioning strategy.

- The IAEA Safety Report on *Decommissioning Strategies for Facilities Using Radioactive Material* (SRS-50, 2007) discusses the factors affecting safety of decommissioning when immediate dismantling, deferred dismantling or entombment is selected.

- IAEA-TECDOC 1478 *Selection of Decommissioning Strategies: Issues and Factors* also provide recommendations in this field.

- EC study on *Analysis of factors influencing the selection of strategies for decommissioning of nuclear installations*. Final report can be downloaded from the Europa website: http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm.

- EC study on *Inventory of best practices in the decommissioning of nuclear installations*. Final report can be downloaded from the Europa website: http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm.

2.1.1 For how many years is safe storage suitable?

- The IAEA has published a Technical Document *On-site disposal of nuclear facilities as a decommission strategy* [IAEA-TECDOC-1124(2000)]. The document mainly deals with the 'Entombment' strategy.

- *Strategies, Policies and Funding* is a Working Area of the CND.

- An IAEA Safety Report on *Safe enclosure of nuclear facilities during delayed dismantling* has been published (SRS 26, 2002).

- The report *The Roles of Storage in the Management of Long-lived Radioactive Waste. Practices and Potentialities in OECD Countries* (the RoST report) RWMC, ISBN 92-64-02315-1.

2.2 How dependent is the D&D strategy on the existence of waste management policies and facilities?

- An International Seminar on *Decommissioning Strategy Selection* was organised by the NEA/WPDD in Tarragona, Spain in September 2003. The Proceedings are available at the NEA bookshop.

- The 2006 NEA Status Report *Selecting Strategies for the Decommissioning of Nuclear Facilities* ISBN 92-64-02305-4, touch upon this issue.

2.2.1 How is the D&D strategy harmonised with the long-term waste management strategy?

- The IAEA has published a Technical Document *On-site disposal of nuclear facilities as a decommissioning strategy* [IAEA-TECDOC-1124(2000)]. It deals mainly with the entombment strategy.

- The 2006 NEA Status Report *Selecting Strategies for the Decommissioning of Nuclear Facilities* ISBN 92-64-02305-4, touches on this issue in Section 3.1.5 on page 19-20.

- The NEA/NDC report *Decommissioning Nuclear Power Plants: Policies, Strategies and Costs* (2003) has relevant information.

- The IAEA published TRS-441 *Management of Problematic Waste and Material Generated during the Decommissioning of Nuclear Facilities* in 2005.

- The IAEA draft Safety Guide WS-G-5.2 *Safety Assessment for Decommissioning of Facilities* using radioactive Material (currently DS376) addresses the relationship and dependence on waste management.

- The IAEA international projects on Evaluation and Demonstration of Safety during Decommissioning (DeSa) explored *inter alia* the relationship and dependence of decommissioning and waste management. WS-G.5.2 draws upon the outcomes of the DeSa project.

2.2.2 What waste disposal arrangements (especially repositories) and precautions are necessary?

- The NEA/WPDD and RWMC-RF information platforms, see Section 1.1, have relevant information.

- The NEA/NDC report *Decommissioning Nuclear Power Plants: Policies, Strategies and Costs* (2003) surveys the drivers behind national strategies, including the availability of waste disposal facilities.

- The IAEA has published a report dealing *inter alia* with the dispositioning of lower level decommissioning waste and materials. It illustrates several industrial options to safely and cost-effectively manage materials and waste resulting from decommissioning. It presents

several release modes including radioactive or conventional disposal, recycling and entombment (TRS-462, 2008).

- An IAEA-TECDOC was published illustrating the results of a *Coordinated Research Project on disposal of low and intermediate level decommissioning waste* (IAEA-TECDOC-1572, 2007).

- The IAEA has developed *Safety Requirements for Near Surface Disposal* (WS-R-1), supported by the Safety Guide on *Safety Assessment for Near Surface Disposal* (WS-G.1.1). In addition a new Safety Requirements WS-R-4 on Geological Disposal was published in 2006.

- An IAEA International Project on the *Application of the Safety Assessment Methodology* (ASAM) was completed in 2006. The report of this project also addresses consideration of heterogeneity of waste disposed in near surface facilities.

2.3 At what cost - also radiological - should dismantling be carried out?

- In 1999 the NEA jointly with IAEA and EC published a document titled *A Proposed Standardised List of Items for Costing Purposes in the Decommissioning of Nuclear Installations*, *Interim Technical Document*. The NEA Co-operative Project on Decommissioning (CPD) was instrumental in preparing this document which is freely available at the webpage http://www.nea.fr/html/rwm/reports/1999/costlist.pdf

- The 2006 NEA Status Report *Decommissioning Funding. Ethics, Implementation, Uncertainties* (NEA No. 1996) discusses this question in its Section 4.4.

- The IAEA has published *Review of selected cost drivers for decision on continued operation of older nuclear reactors* (IAEA-TECDOC-1084, 1999).

- The *Standardised Decommissioning Cost Estimating of WWER-440 Nuclear Power Plant Project*/EC is developing a Standardised Decommissioning Cost Estimate of WWER-440 reactors, based on the previously developed *Proposed Standardised List of Items for Costing Purposes*. A similar document was published by the IAEA (IAEA-TECDOC-1322, 2002)

- *Decommissioning Costs* is a Working Area of the CND.

2.4 How does one arrive at generic[13] estimates of dismantling costs as function of D&D strategy in order to determine decommissioning funding costs?

- The NEA/NDC Report *Decommissioning Nuclear Power Plants: Policies, Strategies and Costs* (2003) addresses this question.

13. This question is also linked to question 3.5.

3. Implementation

3.1 What should be the contents of an EIA for D&D?

- A study has been published in June 2001 by the EC Environment Directorate titled *Environment Impact Assessment for the Decommissioning of Nuclear Installations - Final Report* [Contract B4-3040/99/136035/MAR/C2]

- *Consolidated NMSS Decommissioning Guidance* (Sept. 2002) issued by NRC [NUREG-1757, Vol. 1] in which some chapters (15-17) deals with EIA.

- Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on *the assessment of the effects of certain public and private projects on the environment*. It specifically includes the decommissioning of nuclear installations.

- The topical session at the WPDD meeting in December 2001 has examined the safety cases decommissioning within an EIA context, see Section 1.8.

3.2 How is a safety case set up and managed?

3.2.1 What are the elements of a D&D safety case?

- Relevant information can be found in the report titled *Achieving the Goals of the Decommissioning Safety Case* in April 2005 with the number [NEA/RWM/WPDD(2005)3]. This report is freely available at the NEA webpage [http://www.nea.fr/html/rwm/wpdd.html].

- The IAEA has developed safety standards (WS-R-5) and safety guides, supported by Safety Report 45, see Appendix C, that describes the safety related documents required for authorisation, regulation and completion of decommissioning activities.

3.2.2 How wide is the range of assumptions needed for accident analysis?

- The proceedings of the WPDD Topical Session on the *Safety Case for Decommissioning* (December 2001) provides relevant information, see Section 1.8.

- *Institutional, Legal, Regulatory Aspects, Licensing and Decommissioning Plan* is a Working Area of the CND.

3.2.3 What is the experience and lessons learned that can be fed back to the process of regulating decommissioning activities including criteria for judging safety cases?

- The proceedings of the Topical WPDD Topical Session on the *Safety Case for Decommissioning* (December 2001) have covered the safety case and the management of change, see Section 1.8.

- A Safety Report on *Safety Documentation* was published by the IAEA (SRS-45. 2005). It describes the format and content of safety related documents needed for decommissioning planning and implementation. It addresses the decommissioning plan, cost estimate, environmental impact statement and safety assessment.

- The Task Group on the Safety Case (TGSC) of the NEA/WPDD issued a status report titled *Achieving the Goals of the Decommissioning Safety Case* in April 2005 with the number NEA/RWM/WPDD(2005)3. This report is freely available at the NEA webpage [http://www.nea.fr/html/rwm/wpdd.html].

- The issue was also discussed in Session 7 of the NEA workshop *Safe, Efficient, and Cost-Effective Decommissioning* held in Rome (September 2004), see proceedings on CD-Rom published in 2005.

- The IAEA Safety standards (WS-R-5, WS-G-2.1, WS-G-2.2. and WS-G-2.4., as well as the draft WS-G-5.2/DS376) address the need for feedback of lessons learned from decommissioning and periodic review of the decommissioning plans.

- The WPDD Topical session *Emerging issues and trends in regulatory practices during the decommissioning and dismantling of nuclear power plants* held in Paris, October 24, 2006. Proceedings are available from the NEA website (NEA/RWM/WPDD(2007)3).

3.3 What type of organisation or implementing framework is best to carry out the D&D programme?

- IAEA has published: TRS-399, *Management and Organisation for the Decommissioning of Large Nuclear Facilities*, 2000. A follow up document is TECDOC-1394 (2004) *Planning, Organizational and Management Aspects of Decommissioning: Lessons Learned*.

- *Project Management and Planning of Decommissioning* is a working area of the CND.

- An IAEA Technical Report on *Record Keeping for the Decommissioning of Nuclear Facilities: Guidelines and Experience* (TRS 411) has been issued in 2002. A follow up document of long term aspects of record keeping in decommissioning projects was published in 2008 (TRS 467).

3.4 What are the R&D needs?

3.4.1 Decontamination and dismantling techniques

- The CPD has published a guidance document on decontamination techniques used in decommissioning activities, 1999. See Section 3.4.4.

- The question was touched upon at the NEA workshop *Safe, Efficient, and Cost-effective Decommissioning*, held in Rome September 2004 see reference in Appendix A.

- IAEA has published: TRS-395, *State-of-the-Art Technology for Decontamination and Dismantling of Nuclear Facilities*, 1999.

- At the IAEA, outcomes of R&D work on decommissioning are typically coming up from Coordinated Research Projects (CRP) and are collected in proceedings-like TECDOCs. The following are also relevant: IAEA-TECDOC-1022, *New methods and techniques for decontamination in maintenance or decommissioning operations: Results of a CRP*, 1998; IAEA-TECDOC-1273 *Decommissioning Techniques for Research Reactors - Final report of a Co-ordinated Research Project 1997-2001*, 2002; IAEA-TECDOC-1572, *Disposal Aspects of Low and Intermediate Level Decommissioning Waste*, 2007; IAEA-TECDOC-

1602, *Innovative and Adaptive Technologies in Decommissioning of Nuclear Facilities* Final report of a Co-ordinated Research Project 2004-2008, 2008.

- The IAEA recently published the following Technical Reports *The Dismantling of Contaminated Stacks* (TRS-440); *The Decommissioning of Research Reactors: State-of-the-art, Trends and Open Issues* (TRS-446); and *The Decommissioning of Underground Structures, Systems and Components* (TRS-439). Another report on decommissioning of research reactors and other small nuclear facilities by making optimal use of constraint resources was published in 2008 (TRS-463).

- US National Academy of Sciences/National Research Council, *Research opportunities for deactivating and decommissioning DOE Facilities*, Washington, DC, 2001.

- The *Innovative Remote Dismantling Techniques (IRDIT) Project* (EC) is working on:
  - Extension of existing know-how on remote dismantling techniques.
  - Collection and evaluation of specific data on remote dismantling of the RPV and reactor components at a WWER and a western PWR reactor.
  - Comparison of different techniques applied to typical reactor types (PWR and WWER).

- An IAEA Technical Report on *Decommissioning of small medical, industrial and research facilities* (TRS 414) was issued in 2003. An IAEA handbook is currently in preparation on this subject. It aims at providing hands-on guidance to decommissioning beginners.

3.4.2 What R&D has been done for very radioactive reactor internals?

- Innovative dismantling techniques used in the five EU-funded pilot decommissioning projects are briefly described at http://www.eu-decom.be/introduction/initintroduction.htm.

3.4.3 What R&D has been done for dismantling concrete and its reuse?

- The European Commission DG-Research has published some reports on these topics; these are available for purchase. A full list together with contact details is available at: http://www.eu-decom.be/about/initabout.htm.

3.4.4 What R&D has been done for decontamination of metals?

- Relevant information can be found in the report *Decontamination Techniques Used in Decommissioning Activities* This report was prepared by the CPD Task Group on Decontamination in 1999. The report is freely available on the webpage [http://www.nea.fr/html/rwm/reports/1999/decontec.pdf].

- The European Commission DG-Research has published some reports on these topics; these are available for purchase. A full list together with contact details is available at: http://www.eu-decom.be/about/initabout.htm.

3.4.5. What R&D has been done for dealing with "exotic" and toxic materials (like Na, NaK, Be, Graphite,...)

- The IAEA Technical Report on the *Management of Problematic Waste and Material Generated during the Decommissioning of Nuclear Facilities* TRS-441, was published in

2005. IAEA-TECDOC-1521, 2006 deals with *Characterization, Treatment and Conditioning of Radioactive Graphite from Decommissioning of Nuclear Reactors*.

3.5 How can costing of individual industrial projects be estimated?

- The NEA/IAEA\EC have published a joint guidance document on cost breakdown structures for analysing and recording costs, see Appendix A.

- The EC has finalised a study on *Development of Methodologies for cost calculations and financial planning of decommissioning operations*. The final report is available, see Appendix B.

- The EC has finalised a study on *Comparison among different decommissioning funds methodologies for nuclear installations*. The final report is available, see Appendix B.

- An IAEA Working Group (TEGDE) drafted IAEA-TECDOC-1476 (2005) on *Financial Aspects of Decommissioning,* dealing both with costing methodologies and funding mechanisms for decommissioning.

- A new document intended to develop a simplified, robust costing method for the decommissioning of research reactors is in preparation at the IAEA.

3.6 What clearance procedures should be implemented for materials?

- *Radioactivity Measurements at Regulatory Release Levels: A Task Group Report* is available at http://www.nea.fr/html/rwm/reports/2006/nea6186-release.pdf

- The IAEA has issued a Safety Guide entitled *Application of the Concepts of Exclusion, Exemption and Clearance* (RS-G-1.7) which provides international guidance on this issue.

- An IAEA Technical Report (TRS-462, 2008) on *Managing Low Radioactivity Material from the Decommissioning of Nuclear Facilities* includes *inter alia* an extensive discussion on instrumentation and methods to characterize decommissioning waste and materials at levels close to clearance, and how measurements are affected by established clearance criteria.

- NUREG 1640 applies, see web page http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1640/

- The EU has issued a series of recommendations to provide the guidance foreseen in Article 5 of Council Directive 96/29/EURATOM (review of current EU guidance in progress):
  - RP 113 *Recommended Radiological Protection Criteria for the clearance of buildings and building rubble arising from the dismantling of nuclear installations* (2000).
  - RP 122 *Practical use of the concepts of clearance and exemption: Part I: Guidance on general clearance levels for practices* (2000).
  - RP 89 *Recommended Radiological Protection Criteria for the Recycling of Metal from the Dismantling of Nuclear Installations* (1998).

3.7 What clearance procedures should be implemented for sites?

- The NEA and IAEA have completed a joint study on the environmental remediation of uranium mining and milling facilities and issued a report *Environmental Remediation of Uranium Production Facilities* in Feb 2002.

- The IAEA has published a Safety Requirements document on *Remediation of areas contaminated by past activities and accidents*. A Safety Guide on *Remediation Process for Areas Affected by Past Activities and Accidents* (WS-G-3.1) was published in 2007.

- ANSI N13.12 on *Release of Sites*. See www.ans.org/pi/ps/docs/ps50.pdf

- *Site Characterisation, Remediation and Reuse* is a Working Area of the CND.

- The NEA/WPDD has published status reports 2006 *Releasing the Sites of Nuclear Installations* ISBN 92-64-02307-0 (2006) and *Release of Radioactive Materials and Buildings from Regulatory Control* ISBN 978-92-64-99061-6 (2008).

- A draft IAEA Safety Report on *Monitoring for Compliance with Remediation Criteria* is being prepared that focuses on monitoring of sites (land) for the purposes of potential release from regulatory control.

3.8 How to perform the release measurement for very large volumes of materials and complex geometry?

- Relevant information can be found in the NEA report *Nuclear Decommissioning. Recycling and Reuse of Scrap Metals*. This report was prepared by a CPD Task Group in 1999. The report is freely available on the webpage:
  [http://www.nea.fr/html/rwm/reports/1996/recycling.pdf].

- The IAEA has published a Technical Report *Radiological characterisation of shutdown nuclear reactors for decommissioning purposes*, TRS No.389 (1998).

3.9 What waste treatment technologies have been found to work and what have not?

3.9.1 How are special waste items to be dealt with, e.g. large items and reactor internals?

- Some information can be found in the Proceedings of the WPDD Topical Session on Materials Management. [http://www.nea.fr/html/rwm/docs/2002/rwm-wpdd2002-7.pdf]. See also: Topical Session on Buildings & Sites Release and Reuse, Karlsruhe, Germany, 17-18 June 2002 [NEA/RWM/WPDD(2002)8].

- TECDOC-1572 was published by the IAEA in 2007 illustrating the results of a Coordinated Research Project on *Disposal of low and intermediate level decommissioning waste*. It includes cases of special waste items.

3.9.2 Which are good practices for volume reduction?

- The IAEA has published a Technical Report on the *Minimization of Radioactive Wastes from Decontamination and Decommissioning of Nuclear Facilities*, TRS No. 401 (2001).

4. Stakeholder Information and Involvement

4.1 Informing stakeholders on the safety and manageability of the D&D process

- A compilation of papers on stakeholder involvement *What We Heard within WPDD on Stakeholder Involvement in Decommissioning, 2001-2004* is available at http://www.nea.fr/html/rwm/docs/2006/rwm-wpdd2006-6.pdf

- *Stakeholder Involvement in Decommissioning Nuclear Facilities: International Lessons Learn*t is available at http://www.nea.fr/html/rwm/reports/2007/nea6320-stakeholder.pdf

- The NEA/WPDD report (2002), see Section 1.1, reviews also stakeholder issues; See also the proceedings of the Tarragona Seminar, see Section 2.1.

- A series of reports from NEA FSC and CRPPH provide useful information on stakeholder issues generally:
  - *The Societal Aspects of Decision Making in Complex Radiological Situations,* Proceedings of an International Workshop, Villigen, Switzerland, 13-15 January 1998, OECD/NEA,1998.
  - *Better Integration of Radiation Protection in Modern Society:* Workshop Proceedings, Villigen Switzerland, 23-25 January 2001, OECD/NEA, 2001.
  - *Policy Issues in Radiological Protection Decision Making:* Summary of the 2nd Villigen (Switzerland) Workshop, January 2001, OECD/NEA 2001.
  - *The Regulator's Evolving Role and Image in Radioactive Waste Management*, NEA 2003, ISBN ISBN 92-64-02142-6
  - *Stakeholder Involvement Techniques*, NEA 2004, NEA/RWM/FSC(2004)7
  - *Stepwise Approach to Decision Making for Long-term Radioactive Waste Management*, NEA 2004, ISBN 92-64-02077-2
  - *Learning and Adapting to Societal Requirements for Radioactive Waste Managemen*t, NEA 2004, ISBN 92-64-02080-2

- WPDD and FSC held in 2005 a joint Topical session on *Stakeholder Involvement in Decommissioning Projects*. The Proceedings can be downloaded from the web-page http://www.nea.fr/html/rwm/docs/2006/rwm-wpdd2006-5.pdf.

- *Public Perception, Public Relations Aspects of Decommissioning* is a Working Area of the CND.

- An IAEA Nuclear Energy Series report on *Overview of Stakeholder Involvement in Decommissioning* was approved for publication and is expected to be published in early 2009**.**

4.2 How is the general public to be involved in the EIA process?

- Public Information, Consultation and Involvement in Radioactive Waste Management. An International Overview of Approaches and Experiences, NEA 2003, ISBN 92-64-02128-0

- Further information on public involvement can be found in the proceedings of the WPDD Topical Session on Safety Case [NEA/RWM/WPDD(2002)2] and the Status report *Achieving the Goals of the Decommissioning Safety Case* which was published in April 2005 [NEA/RWM/WPDD(2005)3]. This report is freely available at the NEA webpage [http://www.nea.fr/html/rwm/wpdd.html].

- *Environmental and Socioeconomic Aspects of Decommissioning* is a Working Area of the CND.

- The IAEA has published a document in 2008 on socio-economic implications of decommissioning (TRS-464)

- See also stakeholder involvement in the previous section

4.3 Who are the stakeholders?

- See the NEA FSC and CRPPH reports; also WPDD\FSC joint Topical session and the Brochure. All mentioned in Section 4.1.

- The NEA/WPDD report of 2002, see Section 1.1, has relevant information. See also the proceedings of the Tarragona Seminar in Section 2.1.

- The IAEA has a document in preparation focussing on stakeholders' identification. It is expected to be published in 2008.

- The IAEA, together with NEA, EC and WNA has organised an international conference on lessons learned from decommissioning and the safe termination of nuclear practices in December 2006, where social aspects and stakeholder involvement have been discussed. The Proceedings were published in 2007 (see App. C under Other)

5. Transitional Phase

5.1 What are the special aspects of the transition phase from facility operation to decommissioning?

- The CSNI Special Expert group on *Human and Organizational Factors* organized a workshop on management of change in 2001 and published in June 2004 a paper on *Managing and Regulating Organisational Change in Nuclear Installations*, CSNI Technical Opinion Papers - No. 5, NEA No. 5348, ISBN: 92-64-02069-1, available on the Web at: [http://www.nea.fr/html/nsd/reports/2004/nea5348-change.pdf]. The Special Expert Group also co-organised the session on *Management of Transition and Change throughout Decommissioning* during the Workshop on *Safe, Efficient, and Cost-effective Decommissioning* held in Rome September 2004, see proceedings on CD-Rom.

- SEGHOF discussed the transitional phase during its meeting following the NEA Rome workshop *Safe, Efficient, and Cost-effective Decommissioning* held in Rome September 2004. See Rome workshop proceedings in Appendix A.

- IAEA has published a Technical Report on *Transition from Operation to Decommissioning of Nuclear Installations* (TRS 420), as well as two Safety Reports, *Managing the Early Termination of Operation of Nuclear Power Plants (SRS-31)* and *Safety Considerations in the Transition from Operations to Decommissioning* (SRS 36).

- The IAEA Safety requirements (WS-R-2, WS-R-5) and Safety Guides (WS-G-2.1, WS-G-2.2, and WS-G-2.4) also provide recommendations on safety considerations during the transition phase from operation to decommissioning.

Appendix A

List of NEA Documents on
Decommissioning and Dismantling of Nuclear Facilities

2003

Document Type	Titles	NEA References
Report ***Free*** ***OECD/NEA/CPD, IAEA, EC*** ***1999***	A Proposed Standardised List of Items for Costing Purposes in the Decommissioning of Nuclear Installations	http://www.nea.fr/html/rwm/reports/1999/costlist.pdf
Report ***Free*** ***2002***	The Decommissioning and Dismantling of Nuclear Facilities: Status, Approaches, Challenges. Available also in French.	ISBN 92-64-18488-0 www.nea.fr/html/rwm/reports/2002/3714-decommissioning.pdf
Report ***For Sale*** Feb 2002	Environmental Remediation of Uranium Production Facilities	OECD Code: 662002041P1
Report ***Free*** ***Sep 2004***	Removal of Regulatory Controls for Materials and Sites. National Regulatory Positions	NEA/RWM/RF(2004)6 [http://www.nea.fr/html/rwm/regulator-forum.html
Report ***Free*** ***OECD/NEA/CPD***	Decontamination Techniques Used in Decommissioning Activities	http://www.nea.fr/html/rwm/reports/1999/decontec.pdf
Report ***Free*** ***OECD/NEA/CPD***	Recycling and Reuse of Scrap Metals: A Report by a Task Group of the NEA Co-operative Programme on Decommissioning	http://www.nea.fr/html/rwm/reports/1996/recycling.pdf
Report ***Free*** ***OECD/NEA/CPD***	The NEA Co-operative Programme on Decommissioning: The First Ten Years 1985-95	http://www.nea.fr/html/rwm/reports/1996/decommissioning.pdf
Report ***For Sale*** ***(NDC) 2003***	Decommissioning Nuclear Power Plants. Policies, Strategies and Costs	ISBN 92-64-10431-3 http://www.oecdbookshop.org/oecd/display.asp?TAG=X2PAO8XX5X197X286EVH6Q&CID=&LANG=EN&SF1=DI&ST1=5LMQCR2K1S6L

Report ***Free*** ***(CNRA) 2003***	The Regulatory Challenges of Decommissioning Nuclear Reactors. Also available in French.	ISBN 92-64-02120-5 www.nea.fr/html/nsd/reports/nea4375-decommissioning.pdf
Brochure ***Free*** ***2004***	Decommissioning of Nuclear Power Facilities, It can and has been done (Illustrated eight-page brochure, 2004). Available also in Italian and French	www.nea.fr/html/rwm/reports/2004/nea5728-decom.pdf
Proceedings ***Free***	Topical Session on the Decommissioning and Dismantling Safety Case, Paris, 5 December 2001	NEA/RWM/WPDD(2002)2 www.nea.fr/html/rwm/docs/2002/rwm-wpdd2002-2.pdf
Proceedings ***Free***	Topical Session on Materials Management, Paris, 6 December 2001	NEA/RWM/WPDD(2002)7 www.nea.fr/html/rwm/docs/2002/rwm-wpdd2002-7.pdf
Proceedings ***Free***	Topical Session on Buildings & Sites Release and Reuse, Karlsruhe, Germany, 7-10 June 2002	NEA/RWM/WPDD(2002)8 www.nea.fr/html/rwm/docs/2002/rwm-wpdd2002-8.pdf
Proceedings ***For Sale*** ***2004***	Strategy Selection for the Decommissioning of Nuclear Facilities. Seminar Proceedings, Tarragona, Spain, 1-4 September 2003	ISBN 92-64-01671-6 www.oecdbookshop.org/oecd/display.asp?sf1=identifiers&st1=662004091P1
Proceedings ***Free*** ***2003***	Topical Session on Liabilities Identification and Long-term Management at the National Level, Paris France, March 2003	NEA/RWM/(2003)14 www.nea.fr/html/rwm/docs/2003/rwm2003-14.pdf

2004-present

Report ***Free*** ***2004***	Managing and Regulating Organisational Change in Nuclear Installations June 2004 This publication is also available in French	CSNI Technical Opinion Papers - No. 5 http://www.nea.fr/html/nsd/reports/2004/nea5348-changements.pdf
Proceedings ***Free*** ***2005***	Safe, Efficient, and Cost-Effective Decommissioning. Proceedings from a workshop, Rome, Italy, 6-10 September 2004	Set of 5 CD-Roms *Contact NEA Secretariat*

Report ***Free*** ***2005***	Safe, Efficient, and Cost-Effective Decommissioning. Conclusions and final Stocktaking. Workshop September 6-10, 2004, Rome, Italy	NEA/RWM/WPDD(2005)6 http://www.nea.fr/html/rwm/docs/2005/rwm-wpdd2005-6.pdf
Report ***Free*** ***2005***	Achieving the Goals of the Decommissioning Safety Case. Also available in French.	ISBN 92-64-01068-8 www.nea.fr/html/rwm/docs/2005/rwm-wpdd2005-3.pdf
Report ***Free*** ***2004***	Topical Session on Funding Issues in Connection with Decommissioning of Nuclear Power Plants, Paris, France 9 November 2004	NEA/RWM/WPDD(2005)4/PROV http://www.nea.fr/html/rwm/docs/2005/rwm-wpdd2005-4.pdf
Report ***Free*** ***2006***	Selecting Strategies for the Decommissioning of Nuclear Facilities. A status report, February 8, 2006.	ISBN 92-64-02305-4 http://www.nea.fr/html/rwm/docs/2006/rwm-wpdd2006-1.pdf
Report ***Free*** ***2006***	Decommissioning Funding. Ethics, Implementation, Uncertainties. A status report, Paris Mar 2006	NEA/RWM/WPDD(2006)3/REV1 (in preparation)
Report ***Free*** ***2006***	Releasing the Sites of Nuclear Installations. A status report. A status report Mar 2006	ISBN 92-64-02307-0 http://www.nea.fr/html/rwm/docs/2006/rwm-wpdd2006-4.pdf
Report ***Free*** ***2006***	Proceedings of the Topical Session on Stakeholder involvement in Decommissioning Projects - WPDD-6 Meeting - November 14, 2005	NEA/RWM/WPDD(2006)5 http://www.nea.fr/html/rwm/docs/2006/rwm-wpdd2006-5.pdf
Report ***Free*** ***2006***	The NEA Co-operative Programme on Decommissioning A Decade of Progress	ISBN:92-64-02332-1 http://www.nea.fr/html/rwm/reports/2006/nea6185-decommissioning.pdf
Report ***Free*** ***2006***	Radioactivity Measurements at Regulatory Release Levels: A Task Group Report	ISBN:92-64-02319-4 http://www.nea.fr/html/rwm/reports/2006/nea6186-release.pdf
Proceedings 2006 ***Free***	Map of International Activities on Decommissioning and Dismantling: October 2006	NEA/RWM/WPDD(2006)10 http://www.nea.fr/html/rwm/docs/2006/rwm-wpdd2006-10.pdf
Report 2006 ***Free***	What We Heard within WPDD on Stakeholder Involvement in Decommissioning, 2001-2004: A Compilation of Papers	NEA/RWM/WPDD(2006)6 http://www.nea.fr/html/rwm/docs/2006/rwm-wpdd2006-6.pdf

Report 2006 ***Free***	Stakeholder Involvement in Decommissioning Nuclear Facilities: International Lessons Learnt	ISBN: 978-92-64-99011-1 http://www.nea.fr/html/rwm/reports/2007/nea6320-stakeholder.pdf
Proceedings GD 2007 ***Free***	Emerging Trends and Issues in Regulatory Practices during Decommissioning and Dismantling of Nuclear Power Plants. Proceedings of the WPDD Topical Session held on 24 October 2006	NEA/RWM/WPDD(2007)3 http://www.nea.fr/documents/ok/2007/rwm/rwm-wpdd2007-3.pdf
Proceedings GD 2007 ***Free***	Approaches and Practices in Decommissioning of Facilities and Management of Radioactive Waste from Non-nuclear Fuel Cycle Related Activities: Proceedings of the Topical Session at the 40th Meeting of the RWMC.	NEA/RWM(2007)9 http://www.nea.fr/documents/2007/rwm/rwm2007-9.pdf
Proceedings GD 2008 ***Free***	Risks and Uncertainties in Decommissioning Cost Estimates: Proceedings of the Topical Session at the 1st Meeting of the DCEG.	NEA/RWM/WPDD(2008)6 http://www.nea.fr/documents/2008/rwm/rwm2008-6.pdf
Proceedings GD 2008 ***Free***	Human and Organisational factors in Decommissioning: Proceedings of the Topical Session at the 8th Meeting of the WPDD.	NEA/RWM/WPDD(2008)8 http://www.nea.fr/documents/2008/rwm/rwm2008-8.pdf
Report 2008 ***Free***	Regulating the Decommissioning of Nuclear Facilities – Relevant Issues and Emerging Practices *[Also available in French]*	ISBN 978-92-64-99059-3
Report 2008 ***Free***	Release of Radioactive Materials and Buildings from Regulatory Control *[Also available in French]*	ISBN 978-92-64-99061-6

Other NEA reports of possible relevance to D&D that may be downloaded from the NEA webpage [http://www.nea.fr/html/pub/ret.cgi?div=RP].

The Evolution of the System of Radiological Protection

A Critical Review of the System of Radiation Protection: First Reflections of the OECD Nuclear Energy Agency's Committee on Radiation Protection and Public Health, OECD/NEA, 2000

The Way Forward in Radiological Protection, An Expert Group Report, OECD/NEA, 2002

Radiological Protection of the Environment: The Path Forward to a New Policy? – Workshop Proceedings Taormina, Sicily, Italy, 12 – 14 February 2002, OECD/NEA, 2003

Radiological Protection of the Environment: Summary Report of the Issues, OECD/NEA, 2003

A New Approach to Authorisation in the Field of Radiological Protection: The Road Test Report, prepared by R.V. Osborne and F.J. Turvey, OECD/NEA, 2003

Future Policy for Radiological Protection: Workshop Proceedings, Lanzarote, Spain 2 – 4 April 2003, OECD/NEA 2003

Possible Implications of Draft ICRP Recommendations, OECD/NEA, 2003

Proceedings of the Asian Regional Conference on the Evolution of the System of Radiological Protection, Tokyo, 24 – 25 October 2002, OECD/NEA 2003

Future Policy for Radiological Protection: A Stakeholder Dialogue on the Implications of the ICRP Proposals, Summary Report, Lanzarote, Spain, OECD/NEA 2004

Optimisation in Operational Radiological Protection: A Report by the Working Group on Operational Radiological Protection of the Information System on Occupational Exposure, OECD/NEA 2005

Evolution of the System of Radiological Protection, Second Asian Regional Conference, Tokyo, Japan, 28 – 29 July 2004, OECD/NEA 2005

The Process of Regulatory Authorisation: A report by the CRPPH Expert Group on the Regulatory Application of Authorisation, OECD/NEA 2006

Stakeholder Involvement in Radiation Protection Decision Making

The Societal Aspects of Decision Making in Complex Radiological Situations, Proceedings of an International Workshop, Villigen, Switzerland, 13-15 January 1998, OECD/NEA,1998.

Better Integration of Radiation Protection in Modern Society: Workshop Proceedings, Villigen Switzerland, 23-25 January 2001, OECD/NEA, 2001.

Policy Issues in Radiological Protection Decision Making: Summary of the 2nd Villigen (Switzerland) Workshop, January 2001, OECD/NEA 2001.

Other related documents are available from web-page http://www.nea.fr/html/rwm/fsc.html.

The Regulator's Evolving Role and Image in Radioactive Waste Management, NEA 2003, ISBN ISBN 92-64-02142-6

Public Information, Consultation and Involvement in Radioactive Waste Management. An International Overview of Approaches and Experiences, NEA 2003, ISBN 92-64-02128-0

Stakeholder Involvement Techniques, NEA 2004, NEA/RWM/FSC(2004)7

Stepwise Approach to Decision Making for Long-term Radioactive Waste Management , NEA 2004, ISBN 92-64-02077-2

Learning and Adapting to Societal Requirements for Radioactive Waste Management, NEA 2004, ISBN 92-64-02080-2

Appendix B

List of EC Documents on
Decommissioning and Decontamination of Nuclear Facilities

A great deal of additional documentation is readily accessible via:
http://www.eu-decom.be/introduction/initintroduction.htm

NB: all the documents listed below are in the process of being published via the link below

Document type	Title	Link
Commission Recommendation	Commission Recommendation on management of financial resources for decommissioning of nuclear installations, spent fuel and radioactive waste. OJ L 330/31, 28.11.2006;	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm
Commission Communication to the European Parliament and Council	Report on the use of financial resources earmarked for the decommissioning of nuclear power reactors COM(2004)719 final; 26.10.2004;	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm
Commission Communication to the European Parliament and Council	Second Report on the use of financial resources earmarked for decommissioning of nuclear installations, spent fuel and radioactive waste. COM(2007)794 final, 12.12.2007	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm
Commission Staff Working Document	EU Decommissioning Funding Data. SEC(2007)1654, 12.12.2007	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm
Report	Study on the development of methodology for cost calculations and financial planning of decommissioning operations.	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm
Report	Analysis of environmental, economic and social issues related to the decommissioning of nuclear installations.	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm
Report	Comparison among different decommissioning funds methodologies for nuclear installations.	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm
Report	Inventory of best practices in the decommissioning of nuclear installations.	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm
Report	Analysis of factors influencing the selection of strategies for decommissioning of nuclear installations.	http://ec.europa.eu/energy/nuclear/publications/decommissioning_en.htm

Appendix C

List of IAEA Documents Published Since 1990 on Decommissioning and Decontamination of Nuclear Facilities

See http://www-pub.iaea.org/MTCD/publications/series1.asp for published IAEA reports

Safety Series (SS)		
1.	Safety Requirements on Predisposal Management of Radioactive Waste, Including Decommissioning (superseded by next doc)	SS No. WS-R 2 (2000)
2	Safety Requirements on Decommissioning of Facilities Using Radioactive Material (draft)	SS WS-R-5
3.	Safety Guide on Decommissioning of Nuclear Power Plants and Research Reactors	SS No. WS-G-2.1 (1999)
4.	Safety Guide on Decommissioning of Medical, Industrial and Research Facilities	SS No. WS-G-2.2 (1999)
5.	Safety Guide on Decommissioning of Nuclear Fuel Cycle Facilities	SS No WS-G-2.4 (2001)
6.	Safety Guide on Application of the Concepts of Exclusion, Exemption and Clearance	SS No. RS-G-1.7 (2004)
7.	Safety Guide on Release of Sites from Regulatory Control upon Termination of Practices	WS-G-5.1 (2006)
8.	Safety Guide on Safety Assessment of Decommissioning of Facilities Using Radioactive Material	WS-G-5.2 (2008)

Safety Report Series (SR)		
1	Safe Enclosure of Nuclear Facilities During Deferred Dismantling	Safety Reports Series No.26 (2002)
2.	Managing the Early Termination of Operation of Nuclear Power Plants	Safety Reports Series No. 31 (2003)
3	Safety Considerations in the Transition from Operation to Decommissioning of Nuclear Facilities	Safety Reports Series No. 36 (2004)
4.	Derivation of Activity Concentration Values for Exclusion, Exemption and Clearance	Safety Reports Series No. 44 (2005)
5.	Standard Format and Content for Safety Related Decommissioning Documents	Safety Reports Series No. 45 (2005)
6.	Safety Assessment for Decommissioning of Nuclear Facilities (draft)	DD 741
7.	Monitoring for Compliance with Exclusion, Exemption and Clearance Values (draft)	DD740
8.	Decommissioning Strategies for Facilities Using Radioactive Material (in print)	Safety Reports Series No. 50 (2007)

Technical Reports Series (TRS)		
1.	Monitoring Programmes for Unrestricted Release Related to Decommissioning of Nuclear Facilities	TRS No. 334 (1992)
2.	Cleanup and Decommissioning of a Nuclear Reactor After a Severe Accident	TRS No. 346 (1992)
3.	Application of Remotely Operated Handling Equipment in the Decommissioning of Nuclear Facilities	TRS No. 348 (1993)
4.	Planning and Management for the Decommissioning of Research Reactors and Other Small Nuclear Facilities	TRS No. 351 (1993)
5.	Decontamination of Water Cooled Reactors	TRS No. 365 (1994)
6.	Decommissioning Techniques for Research Reactors	TRS No. 373 (1994)
7.	Safe Enclosure of Shutdown Nuclear Installations	TRS No. 375 (1995)
8.	Design and Construction of Nuclear Power Plants to Facilitate Decommissioning	TRS No. 382 (1997)
9.	Decommissioning of Nuclear Facilities Other than Reactors	TRS No. 386 (1998)
10.	Radiological Characterisation of Shutdown Nuclear Reactors for Decommissioning Purposes	TRS No. 389 (1998)
11.	State-of-the-art Technology for Decontamination and Dismantling of Nuclear Facilities	TRS No.395 (1999)
12.	Organization and Management for the Decommissioning of Large Nuclear Facilities	TRS No. 399 (2000)
13.	Minimisation of Radioactive Waste from Decontamination and Decommissioning of Nuclear Facilities	TRS No. 401 (2001)
14.	Record keeping for the Decommissioning of Nuclear Facilities: Guidelines and Experience	TRS No. 411 (2002)
15.	Decommissioning of Small Medical, Industrial and Research Facilities	TRS No. 414 (2003)
16.	The Transition from Operation to Decommissioning of Nuclear Installations	TRS No. 420 (2004)
17.	The Power Reactor Information System (PRIS) and its Extension to Non-Electrical Applications, Decommissioning and Delayed Projects Information	TRS No. 428 (2005)
18.	Dismantling of Contaminated Stacks at Nuclear Facilities	TRS No. 440 (2005)

19.	Management of Problematic Waste and Material Generated During the Decommissioning of Nuclear Facilities	TRS No. 441 (2006)
20.	The Decommissioning of Underground Structures, Systems and Components	TRS No. 439 (2006)
21.	Redevelopment of Nuclear Facilities after Decommissioning	TRS No. 444 (2006)
22.	The Decommissioning of Research Reactors; Evolution, State-of-the-art, Open Issues	TRS No.446 (2006)
23.	Considerations for Waste Minimization at the Design Stage of Nuclear Facilities	TRS No. 460 (2007)
24.	Managing Low Radioactivity Material from the Decommissioning of Nuclear Facilities	TRS No. 462 (2008)
25.	Decommissioning of Research Reactors and Other Small Nuclear Facilities by Making Optimal Use of Available Resources	TRS No. 463 (2008)
26.	Managing the Socioeconomic Impact of the Decommissioning of Nuclear Facilities	TRS No. 464 (2008)
27.	Long Term Preservation of Information for Decommissioning Projects	TRS No. 467 (2008)

Nuclear Energy Series		
1.	Decommissioning of Nuclear Facilities: Training and Human Resource Considerations	No. NG-T-2.3 (2008)

Technical Documents (TECDOC)		
1	Decontamination of Transport Casks and of Spent Fuel Storage Facilities	IAEA-TECDOC-556 (1990)
2.	Factors Relevant to the Sealing of Nuclear Facilities	IAEA-TECDOC-603 (1991)

3.	Considerations in the Safety Assessment of Sealed Nuclear Facilities	IAEA-TECDOC-606 (1991)
4.	National Policies and Regulations for Decommissioning Nuclear Facilities	IAEA-TECDOC-714 (1993)
5.	Decontamination and Decommissioning of Nuclear Facilities - Results of a CRP, ,Phase II: 1989-1993	IAEA-TECDOC-716 (1993)
6.	New Methods and Techniques for Decontamination in Maintenance or Decommissioning Operations - Results of a Co-ordination Research Programme, 1994-1998	IAEA-TECDOC-1022 (1998)
7.	Technologies for Gas Cooled Reactor Decommissioning, Fuel Storage and Waste Disposal, Proceedings of a Technical Committee Meeting held in Juelich, Germany, 8-10 September 1997	IAEA-TECDOC-1043 (1998)
8.	On-site Disposal as a Decommissioning Strategy	IAEA-TECDOC-1124 (1999)
9.	The Decommissioning of WWER-Type Nuclear Power Plants	IAEA-TECDOC-1133 (2000)
10.	Nuclear Graphite Waste Management -Technical Committee Meeting , Manchester, United Kingdom, 18-20 Oct 1999	CD-ROM (2001)
11.	Decommissioning Techniques for Research Reactors- Final report of a Co-ordinated Research Project 1997-2001	IAEA-TECDOC-1273 (2002)
12.	Safe and Effective Nuclear Power Plant Life Cycle Management Towards Decommissioning	IAEA-TECDOC-1305 (2002)
13.	Decommissioning Costs of WWER-440 Nuclear Power Plants. Interim Report: Data Collection and Preliminary Evaluations	IAEA-TECDOC-1322 (2002)
14.	Planning, Organizational and Management Aspects of Decommissioning: Lessons Learned	IAEA-TECDOC-1394 (2004)
15.	Operational and Decommissioning Experience with Fast Reactors	IAEA-TECDOC-1405 (2004)

16.	Financial Aspects of Decommissioning	IAEA-TECDOC- 1476 (2005)
17.	Selection of Decommissioning Strategies: Issues and Factors	IAEA-TECDOC-1478 (2005)
18.	Characterization, Treatment and Conditioning of Radioactive Graphite from Decommissioning of Nuclear Reactors	IAEA-TECDOC-1521 (2006)
19.	Disposal Aspects of Low and Intermediate Level Decommissioning Waste –Results of a Co-ordinated Research Project 2002-2006	IAEA-TECDOC-1572 (2007)
20.	Innovative and Adaptive Technologies in Decommissioning of Nuclear Facilities- Final report of a Co-ordinated Research Project 2004-2008	IAEA-TECDOC-1602 (2008)

Other		
1.	Nuclear Data Requirements for Fission Reactor Decommissioning	INDC (NDS)-269 (1993)
2.	International Benchmark Calculations of Radioactive Inventory for Fission Reactor Decommissioning	INDC (NDS)-355 (1996)
3.	A Proposed Standardised List of Items for Costing Purposes in the Decommissioning of Nuclear Installations	OECD/NEA, Paris 1999
4.	Safe Decommissioning for Nuclear Activities, Proc. of an Int. Conf. Berlin, 14-18 Oct. 2002	IAEA, Vienna, 2003
5.	Joint NEA/IAEA/EC Workshop on the Regulatory Aspects of Decommissioning, 19-21 May, 1999, Rome	ANPA, Rome, 2000
6.	Status of the Decommissioning of Nuclear Facilities Around the World	IAEA, Vienna. 2004
7.	Joint Convention on the Safety of Spent fuel Management and on the Safety of Radioactive Waste Management	IAEA International Law Series
8.	Lessons learned from the Decommissioning of Nuclear Facilities and Safe Termination Proceedings of an International Conference, Athens 11-15 December 2006.	IAEA, Vienna (2007)