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NUCLEAR ENERGY AGENCY
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Working Party on Decommissioning and Dismantling (WPDD)

SUMMARY RECORD OF THE TOPICAL SESSION AT WPDD-10: MANAGEMENT OF LARGE COMPONENTS FROM DECOMMISSIONING TO STORAGE AND DISPOSAL, 18-19 NOVEMBER 2009

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FOREWORD

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

At its tenth meeting (17-19 November 2009, at Issy-les-Moulineaux, France), the WPDD held a topical session on *Management of Large Components from Decommissioning to Storage and Disposal*. The topical session was organised by a new task group of the WPDD that recently began work on this topic. The group is aiming to prepare a technical guide that provides a methodology to assess different management options and facilitates involvement of the different interested parties in the process of selecting the preferred management option.

Copies of the presentations made are attached to this report in the form of a CD-Rom.

Mr. Jan Carlsson, SKB, and Mr. Juan-Luis Santiago, ENRESA, served as Chairs of the Topical Session and Mr. Michel Dutzer, ANDRA, served as rapporteur.

Acknowledgement

The WPDD wishes to express its gratitude to Messrs. Carlsson, Santiago and Dutzer, as well as to all those presenting papers and participating in the discussions, for their efforts in making the topical session a success.

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Part A

MAIN OUTCOMES OF TOPICAL SESSION ON:

MANAGEMENT OF LARGE COMPONENTS FROM DECOMMISSIONING TO STORAGE AND DISPOSAL

A.1 SUMMARY OF PRESENTATIONS AND DISCUSSIONS

Jan Carlsson (SKB) opened the topical session, saying that the issue of how to manage large components from decommissioning was of great interest, both to decommissioners and to waste management agencies, as well as to regulators and other national authorities.

Michel Dutzer (ANDRA) introduced the activities of the newly-formed task group on 'Management of large components from decommissioning to storage and disposal'. He said the group would produce a technical guide that provides a methodology to assess different management options, with the aim of providing a basis for the different involved parties to evaluate different management routes, taking account of individual circumstances. The overriding objective is to assist in the overall optimisation of the downstream activities for management of these components, including aspects relating to decommissioning (removal segmentation and treatment), transportation off site, storage, recycling and disposal. He anticipated that the technical guide would be presented for approval to the WPDD-11 meeting towards the end of 2011.

Juan-Luis Santiago (ENRESA) said that the criteria to be applied to optimising the management of large components included safety, technical, waste management, socio-political, regulatory and economic issues. Overall optimisation needed to address the impact of different dismantling options (e.g. removal of components intact or in large pieces) on subsequent waste management operations. Of particular importance were aspects such as: the need to develop new waste containers (and the acceptability of these at the disposal site); egress routes for component removal, the extent of decontamination envisaged to take place (on or off site) and the number and type of transports. He said that an integrated approach to the optimisation of decommissioning and waste management was needed, involving a dialogue with the interested parties. Ultimately, regulatory approval of the chosen management route was necessary as part of the approval process for the overall decommissioning programme.

In the discussion that followed the presentation Mr. Santiago said that the time needed to gain regulatory approval of a new transport package for shipping large components was a significant constraint in moving away from a management approach based on in situ segmentation.

Michele Laraia (IAEA) described how formal decision making techniques such as multi-attribute decision analysis could be helpful by imposing discipline in the decision process and by generating an audit trail for how decision were reached. He presented a case study based on the decision process for management of slightly contaminated waste, emphasising the importance of a flexible approach to identifying options for release of the materials in question – ranging from unconditional clearance to disposal as low-level waste in engineered repositories and also including intermediate options such as restricted release, disposal as Very Low Level Waste in dedicated facilities or landfill sites, or melting..

In subsequent discussion the importance of early involvement by stakeholders in the consideration of available alternatives was emphasised

Geraldine Dandrieux (Nuclear Safety Authority) said that the French 'National Waste Management Plan on Radioactive Materials and Waste (PNGMDR)' aims to identify long-term management solutions for all radioactive waste and materials, including waste from dismantling. The Plan provides

a means of ensuring the consistency of the overall management of waste and the optimisation of individual waste management steps, including storage. She noted that, in general, reuse and recycling of waste was preferable to its disposal, and that operators were expected to follow an early dismantling strategy, subject to the availability of waste management routes. The overriding need to reduce the amounts of waste for disposal was emphasised, given the necessity of optimising the use of disposal facilities, and the need to optimise the different steps in managing the waste within an approach that has overall consistency. In France, the national waste management plan provided an important mechanism for overall optimisation of waste management. Considerations in achieving such optimisation include technical options for recycling steel and concrete, processes for decontamination, and issues surrounding the disposal of large components. Studies on these issues were currently underway and the results will be presented to the regulatory authorities at the end of 2011.

Luc Noynaert (SCK·CEN) described the strategy adopted for the management of large components during the decommissioning of the BR3 pressurised water reactor (10 MWe) in Belgium. A strategy of segmentation on site was followed for all large components. In the case of the activated components (thermal shield, pressure vessel, internals) extensive use was made of remote controlled underwater cutting (plasma arc torch), together with in-situ mechanical sawing (band saw). The large contaminated components (pressuriser, steam generator) were decontaminated using an in-loop (MEDOC) process, and then segmented using high pressure water jet cutting and diamond wire cutting. The steam generator tube bundles were segmented using a diamond wire cutting process.

During the ensuing discussion, Mr. Noynaert indicated that the reactor internals had been conditioned in a cement matrix and were now held in storage, at Belgoprocess. Eventually, the cemented packages would be placed in a geological disposal facility.

Leif Johansson (Barsebäck Kraft AB, BKAB) said that BKAB was currently examining the option of one piece removal of the reactor pressure vessel from Barsebäck and would present its conclusions to SKB in 2010. In parallel with this study, SKB is examining options for the extension of the SFR repository to accommodate decommissioning waste, including disposal of large components and interim storage of long-lived operational and decommissioning waste; relevant applications will be made to the regulatory authority (Swedish Radiation Safety Authority) in 2013. SKB was also undertaking feasibility studies for shallow disposal of VLLW and for interim surface storage of long-lived components. Amongst the issues being considered by BKAB were the implications of removing the vessel with the internals still inside, requiring additional shielding during transportation and special measures to anchor the internals. Both radiation risk and conventional risks associated with different options were important considerations. It is clear that, in the event of removing the vessel and internals as one piece, a period of interim storage would be needed prior to disposal in a future repository for long-lived waste (currently scheduled for 2045). As regards transportation, a roll-on roll-off ship would be needed for the Barsebäck vessels, and larger vessels (i.e. Oskarsham 3 and Forsmark 3) would need to be transported by barge. In either case new transport regulations would be needed for transport of the vessel including the internals.

It was subsequently noted in discussion that emplacing the reactor pressure vessel, including the internals, in a geological disposal facility would be a very expensive option. The Swedish participants confirmed that, absent the internals, the vessel itself could be placed in the SFR, though no decision will be made until the options are presented to SKB in 2013.

Bernd Rehs (BfS) said that the removal of complete (unsegmented) large components and their transport to interim storage facilities is an emerging decommissioning practice in Germany. For example, the complete (unsegmented) reactor pressure vessel of Rheinsberg NPP has been transported to the interim storage facility at Lubmin (ZLN) in October 2007. Furthermore, the complete reactor

pressure vessels of Greifswald NPP have been transported internally to nearby ZLN in November 2007 (units 1 and 2) and September 2009 (units 3 and 4). Following this approach, the components are placed in storage and radioactivity levels are allowed to decay until segmentation can largely be undertaken without using remote techniques, and there is a greater possibility that the material can be cleared and reused, rather than being sent for disposal. The need for interim storage facilities was an important factor, requiring large investment costs, and may have to remain in operation for an extended period. With regard to later segmentation of large components after storage for an appropriate period, it is to be ensured that radioactive waste that may arise from utilisation can be brought into a repository. He said that several transports of large components had been authorised in Germany in 2007 and 2008; these involved transport by road and railway, as well as by sea and inland waterway. In general two approvals are required – a special agreement under dangerous goods legislation (which is the responsibility of BfS) and a licence under radiation protection legislation (which is the responsibility of the Länder authorities or of the Federal Railway Authority).

In the subsequent discussion he said that current planning, at a conceptual stage only, was for the reactor vessels to be segmented after a longer period in storage and then emplaced in the Konrad repository in standard waste containers, because the Konrad repository is not designated for a final disposal of large components.

Boby Abu-Eid (USNRC) said that USNRC regarded large components as including reactor vessels and heads, steam generators, pressurisers, feed water heaters and turbine rotors. In general, one-piece disposal of reactor pressure vessels is the preferred management solution in the US and a number of pressure vessels had already been placed in final disposal facilities. In two cases, Shippingport and Trojan, the internals remained in the vessel, surrounded by concrete. An important regulatory issue is waste classification: USNRC does allow volumetric averaging, except in cases of intentional dilution, in determining the appropriate waste class. The issue of transport was also significant, given the very long transport distances typically involved and the involvement of different local transport authorities. In the case of the Trojan vessel transport was via rail and barge, the latter involving a journey of approximately 300 miles (500 kilometres) on the Columbia River.

The discussion that followed focused largely on the safety requirements for disposal of the Shippingport vessel. Mr. Abu-Eid said that, by concreting the internals, the risk posed from potential human intrusion was reduced and the overall waste package could avoid being classified as GTCC (Greater Than Class C). He emphasised that the internals were decontaminated prior to being concreted.

Jean-Jacques Grenouillet (EDF) described feasibility studies undertaken by EdF for the long-term management of the steam generators and of the reactor pressure vessel from the Chooz A nuclear power plant. A multi-criteria analysis technique was used. For the steam generators, a reference option involving de-categorisation from LLW to VLLW followed by one-piece disposal was compared with an option involving segmentation (thermal cutting of the walls and mechanical cutting of the tube bundles). The reference option required a greater degree of decontamination than the latter option, as well as a parallel study by ANDRA to confirm that disposal of one-piece steam generators in the VLLW repository was feasible. The reference option was selected for implementation, as it yielded significant benefits in terms of dose to the workforce, time for removal, waste volume and decommissioning cost (though this factor was balanced by an increase in disposal costs). For the pressure vessel, segmentation (except for the vessel head and vessel bottom), including interim storage of the internals, was compared with one piece removal (including the least activated internals) and interim storage of the most activated internals. The study found that transport of the vessel by boat was the most feasible option (if the one-piece disposal option were selected). Although many factors favoured one-piece disposal (as for the steam generators) the assumed level of alpha contamination in

the internals made it difficult to make a case for disposal at ANDRA's LLW repository, due to the problem of potential human intrusion. Because of the time needed to undertake more extensive characterisation of the internals, segmentation option was preferred.

In the subsequent discussion it was noted that, in certain cases, the use of lightweight concrete to surround the internals, together with arguments based on probability, can diminish the risk from future human intrusion. It should be noted, however, that the use of lightweight concrete was included in the case that was assessed by ANDRA (in terms of the impact on the long-term safety of the LLW repository) and this provision was not found sufficient because the level of residual alpha contamination exceeded the amounts acceptable for the safety case

Pascal Lecoq (ANDRA) said that ANDRA's disposal facilities already accepted a limited number of large components, e.g. PWR vessel heads at Centre de l'Aube (LLW) and heavy metallic items and concrete blocks (up to 24 tonnes in weight) at Morvilliers (VLLW). ANDRA has been working with the waste producers to estimate the numbers of large components that may require disposal over the next 20 years, arriving at estimates (in volume terms) of 2500 m^3 (LLW) and 11000 m^3 (VLLW). It is planned to seek generic authorisations from the French Safety Authority for the changes that will be needed to the facilities to facilitate the disposal of the large components, including a revised safety case for the LLW facility at Centre de l'Aube and the provision of dedicated disposal cells for large components at Morvilliers.

During discussion Mr. Lecoq said that the main issues to be addressed in order to facilitate the disposal of large components at Centre de l'Aube were the impact on the safety case (in particular in relation to the intrusion scenario), the impact on facility operation and characterisation requirements to avoid the presence of hot spots. He said that the activity limits for disposal in the facility were: 3700 Bq/g per package and 370 Bq/gr for all packages. The overall activity limit for the facility was set at 750 TBq. It was noted that, in France, the vessel head and bottom could, in principle, be disposed of as LLW though not the vessel internals -0 for which only geological disposal was possible

PANEL DISCUSSION

The panel was asked to address the following issues:

- What can be generic in the approach to management of large components?
- Does the option of disposal conflict with the objective of sustainable development?
- What are the main issues to be addressed in order to facilitate a one-piece disposal option?

The following points arose during the discussion:

- As regards the disposal of the reactor vessel and internals, a case-by-case approach should be followed, taking account of risk, e.g. although the vessel internals must normally be segmented, there were examples (in the US) where direct disposal of the vessel and internals had been achieved.
- The decommissioning plan should discuss the option proposed for management of large components, including an explanation of the reasons for the choice of the proposed option. Technical and engineering details of the management approach should be described in subsidiary documents.

- The benefits of having an integrated waste strategy for a complete site were emphasised and it was noted that recycling should play a prominent part in the overall strategy, e.g. full recycling of certain heat exchangers could be envisaged.
- Repository designers should take account of one-piece disposal options in designing repositories, as this was currently a significant impediment in several existing repositories. It was also noted that the process of revising a repository design necessarily takes a long time.
- All factors bearing on the management approach for large components should be considered from the outset, including safety and non-safety factors, and availability of infrastructure, i.e. regulatory acceptance was not the only issue to be taken into consideration. As regards safety considerations, the calculated maximum dose to a representative member of the relevant critical group was a key consideration, e.g. this would determine whether disposal of the internals in a near surface facility was possible.
- The need to optimise the entire material management system (including decommissioning aspects) was highlighted, together with the importance of exchanging experiences gained in different countries, including experience gained with non-civil components such as submarines.
- The decision process was managing large components was multi-faceted and goes beyond strictly technical considerations, e.g. one-piece removal of components from a decommissioning site for direct disposal may result in some dose burden being transferred to the disposal facility. The process of minimising doses needs to consider the entire management route and, accordingly, it is important to ensure that the decision process is transparent.
- The importance of regarding available disposal facilities as a scarce and valuable resource was highlighted. This pointed to the need to maximise the use of recycling, with this management option generally having a greater level of public acceptance than disposal.

A.2 RAPPORTEUR'S REPORT

Rapporteur: Michel Dutzer (ANDRA)

Michel Dutzer noted that the issue of the management of large components had direct implications for the decommissioning organisation, for the organisation responsible for transport and for the waste disposal organisation. These activities were often subject to different authorisation processes and therefore special arrangements might be needed to enable the overall process of managing large components to be considered by the regulatory authorities. Experience suggested that 'case-by-case' approaches had typically been applied in many countries, in view of the complex nature of the decision process. It was important that special efforts were made to ensure the overall transparency of the process.

He noted that the proposed management option for large components should be addressed in the decommissioning plan for the facility, including an explanation of why this option had been selected. In arriving at the proposed option, the decommissioning organisation would need to take into account the requirements of the repository operator, as well as those of the transporting organisation.

He highlighted the need for overall optimisation of the management process for large components, following a process which enabled public participation in the decision process. The optimisation process therefore occurs at different levels, e.g. (at a technical level) in terms of optimising the overall dose taking account of the different steps, and (more broadly) integrating the perspectives of the different players involved in the overall process, as well as the general public.

In conclusion, he said that one of the main lessons to be learnt concerned the need for good communication procedures, involving all those affected by the strategy adopted for the management of large components, and including the general public and their elected representatives.

Part B

AGENDA OF THE TOPICAL SESSION ON:

MANAGEMENT OF LARGE COMPONENTS FROM DECOMMISSIONING TO STORAGE AND DISPOSAL

18-19 NOVEMBER 2009

18 NOVEMBER 2009

Topical Session

'MANAGEMENT OF LARGE COMPONENTS FROM DECOMMISSIONING TO STORAGE TO DISPOSAL'

Co-Chairs: Jan Carlsson & Juan-Luis Santiago

SESSION 1 – INTRODUCTORY SESSION

14:00	**1.**	**INTRODUCTION TO THE TASK GROUP AND THE TOPICAL SESSION** *Session Chair* *The introductory remarks will describe the aims of the task group, and the overall aim of the topical session.*
14:10	**2.**	**INTRODUCTORY PRESENTATION** *Michel Dutzer (ANDRA), Task Group Coordinator*

SESSION 2 – OPTIMISING THE SYSTEM OF WASTE MANAGEMENT AND DECOMMISSIONING: THE ISSUES

14:35	**3.**	**PERSPECTIVE OF THE WASTE MANAGERS: SPAIN** *Jean-Luis Santiago, ENRESA*
15:00	**4.**	**INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)** *Michele Laraia, (IAEA)*
15:30		*Break*
16:00	**5.**	**REGULATORY PERSPECTIVES: FRANCE** *Géraldine Dandrieux, Autorité Sureté Nucléaire (ASN)*

SESSION 3 – 'MANAGEMENT OF LARGE COMPONENTS'

16:25	**6.**	**BELGIUM : SCK•CEN** *Luc Noynaert,(SCK•CEN)*
16:50	**7.**	**SWEDEN : SKB and BARSEBÄCK** *Jan Carlsson (SKB) / Leif Johansson (Barsebäck Kraft)*
17:30		*Adjourn*

19 NOVEMBER 2009		
09:30	**8.**	**GERMANY : BFS and BMU** *Bernd Rehs (BfS) / K-H Kölschbach (BMU)*
09:55	**9.**	**US NUCLEAR REGULATORY COMMISSION (NRC)** *Boby Abu-Eid, (USNRC)*
10:20	**10.**	**FRANCE: EDF and ANDRA** *Jean-Jacques Grenouillet (EdF) / Pascal Lecoq & Michel Dutzer (Andra)*
10:45		*Break*
11:15	**11.**	**PANEL DISCUSSION**
12:15	**12.**	**RAPPORTEUR'S REMARKS AND AUDIENCE FEEDBACK**
12:25	**13.**	**CLOSING REMARKS** *Chair*
12:30		*Lunch*

Part C

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MANAGEMENT OF LARGE COMPONENTS FROM DECOMMISSIONING TO STORAGE AND DISPOSAL

18-19 NOVEMBER 2009

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