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Organisation de Coopération et de Développement Économiques  
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**English - Or. English**

**NUCLEAR ENERGY AGENCY  
RADIOACTIVE WASTE MANAGEMENT COMMITTEE**

**Working Party on Decommissioning and Dismantling (WPDD)**

**Summary Record of the 6th Meeting of the DCEG**

**Held on 18-20 June 2013 at the NEA Offices in Issy-les-Moulineaux, France**

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## MEETING MINUTES OF THE DCEG-6

### 1. Opening of the meeting

#### *Main observations*

Björn Hedberg, the DCEG Chairman, opened the meeting and welcomed the attendees. Attendees introduced themselves.

Attendees – see Appendix.

#### *Decision*

All presentations made available at the meeting will be posted on the website (done – follow the link: <http://www.oecd-nea.org/download/wpdd/dceg/DCEG-6.html>).

### 2. Review and adoption of agenda

#### *Main observations*

No amendments.

#### *Decision*

Approved.

### 3. Approval of the DCEG-5 Summary Record (19-20 June 2012) [[NEA/RWM/WPDD\(2012\)8](#)]

#### *Main observations*

No amendments.

#### *Decision*

Approved.

### 4. Briefing on activities from the past year

#### *Main observations*

Ivan Rehak reported on RWMC/WPDD main achievements. The 13<sup>th</sup> Annual Meeting of the WPDD (November 12-14, 2012, Penrith, Cumbria, UK) held a special session on the Decommissioning Scene in the UK and a topical session on Nuclear Site Restoration, followed by a technical site visit to Sellafield. He also informed on the WPDD work plan, and on status of WPDD task groups on radiological characterization and decommissioning, and on future R&D and innovation needs for decommissioning. He briefed on current status of activities of the Co-operation Programme on Decommissioning (CPD), and its on-going task group on Site Restoration which aims to elaborate a report on technical aspects of the subject.

WPDD intends then continue working with a focus on strategic aspects of site restoration. Concerning the DCEG, the WPDD has extended the DCEG Mandate by 31 Dec 2014.

Björn Hedberg, the DCEG Chair, highlighted that DCEG aims to support all activities that may further improve decommissioning costing culture (transparency, auditability, traceability). He summarized achievements of the DCEG (identification of main cost drivers, systemization of cost items in the International Structure for Decommissioning Costing, improvement of project performance using the Earned Value Management System in decommissioning, and statement on estimation and comparability of decommissioning costs). He introduced the current work of the DCEG (practice of cost estimation for decommissioning, and a guide on international peer reviews of decommissioning cost studies), and proposed topics of future potential interest of the DCEG (to be further discussed in item 15).

Patrick O’Sullivan reported on on-going IAEA activities in decommissioning and decommissioning costing. These activities include *inter alia* the Workshop on cost estimation and financing mechanisms (IAEA, Vienna, 22-26 April 2013), project DRiMa (risk management in decommissioning), project DACCORD (data analysis and collection for research reactor decommissioning), project CERREX (MS Excel-based software for preliminary cost calculation for decommissioning of research reactors), and project CIDER (analyse and report on global status of clean-up of sites and barriers to progress in implementation of decommissioning and remediation with the aim of improving current levels of performance).

In discussion, Geoffrey Rothwell raised the question, what is/can be done in communication with public. Claudio Pescatore replied that primary NEA’s mission is to support Governments of NEA Member Countries. It is these who are ultimately in charge of informing their publics. Nevertheless, the RWMC issues plain-language flyers on different subjects are considered an effective communication tool. Fredrik De la Gardie gave examples of communication from Sweden and confirmed that the national context is very important. Patrick O’Sullivan underlined transparency as an important aspect in decommissioning costing in the light of continuously increasing figures of decommissioning cost estimates, and appreciated the ISDC document (2012) and the on-going NEA Nuclear Development Committee’s work on decommissioning costs and funding.

### ***Decision***

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## **5. The DCEG Report “The Practice of Cost Estimation for Decommissioning”**

### ***Main observations***

Claudio Pescatore introduced both ”The Practice of Cost Estimation for Decommissioning” and the “International Peer Reviews of Decommissioning Cost Studies” documents in the frame of building an international culture in decommissioning costing and on the expectation that Governments will request international peer reviews of decommissioning cost studies. The effort is further supported by the fact that the NEA has a long-term experience in organizing international peer reviews. Both documents were drafted by Thomas LaGuardia and Claudio Pescatore assuming further contribution from DCEG members.

Ivan Rehak briefly introduced the document "The Practice of Cost Estimation for Decommissioning". The document had been circulated to DCEG Members four weeks before the DCEG-6. The Secretariat had received two written comments so far.

In discussion on the document Sylvain Desecures appreciated the document and noted that: 1. Context (e.g. regulation framework, number of plants on a site, assumptions) should be more highlighted; 2. Bottom-up costing approach is described in very detail in comparison with other approaches, it should be given perhaps only as an example; 3. It should be stressed that the NRC formulae and 'a rule of thumb' are only examples. They are not best practice and there is a risk that they might be used by the readers of the document despite the limitations mentioned in the document itself.

Fredrik De la Gardie added that it should be highlighted that the proposed Table of Contents of decommissioning study report is given as a working example, since Member Countries may need to use their country specific structures. He also stressed the importance of description of assumptions and boundary conditions.

Alastair Laird confirmed that having a guide would be useful despite the sensitivity of the issue. He noted that, in the UK, the NDA prescriptive format of contracting was found helpful.

Stefano Buonarroti said that the document is a good start point, reference templates are needed, requirements on benchmarking should be described in more detail, and it should be clearly stated whether the document deals with decommissioning costing or with broader project managerial aspects.

Giuseppe Marini noted that 1. using advanced decommissioning costing approaches requires project management knowledge; 2. classification of estimation may be difficult to state since none of estimates is considered a final one; 3. despite the hands-on activities commonly define a critical path, sometime specific project managerial activities (e.g. licensing) may also have an impact on the critical path; 4. Executive Summary of the document should be structured.

Patrick O'Sullivan highlighted a need to have a document on good practice for decommissioning costing, he appreciated it in principle, however, noted that the document should not go to details (e.g. NRC formulae, WBS commented in different parts of the document).

Geoffrey Rothwell thanked authors of the draft for their work, and raised the question of application of risk analysis on contingencies and on uncertainties.

Vladimir Daniska noted that both documents reflect current decommissioning costing approach and wished to have ISDC mentioned more in comparison with frequently referred WBS. He considers ISDC an appropriate structure for implementation of risk analysis, contingencies, uncertainties, and benchmarking. Both documents ("Practice..." and "International Peer Review...") should use ISDC terms of "asset recovery" instead of "scrap and salvage". Concerning the model report format he informed that the *IAEA Safety Report Series 45 Standard Format and Content for Safety Related Decommissioning Documents* contains recommended decommissioning plan's table of content that might be a basis also for decommissioning cost report format, taking into account specifics of the cost report. He proposed to have smaller report format than currently presented.

Tom LaGuardia highlighted that cost estimate should address all decommissioning activities and should be improved when more precise information is available.

Patrick O’Sullivan noted that both documents should support broader use of the ISDC not only for estimation, but also for benchmarking, comparison of cost specific activities from different projects and risk analysis.

Simon Carroll agreed with the importance of the context (assumptions and boundary conditions, site constraints, previous experience etc.) in decommissioning costing as stated by Sylvain Desecures, and supported a risk analysis in decommissioning costing as a future DCEG topic.

It was proposed to further develop the document by a small group formed from the DCEG membership.

### **Decision**

*DCEG-6 Participants will send all their comments (including those raised in the meeting) by email by 31 August 2013. The document will be further developed, and will be finalised at the next meeting of the DCEG.*

## **6. The DCEG Report “International Peer Reviews of Decommissioning Cost Studies”**

Claudio Pescatore introduced the document “International Peer Reviews of Decommissioning Cost Studies”. The document had been circulated to DCEG Members three weeks before the DCEG-6. Peer review activities are a standard practice that is closely associated with the OECD, and is seen as an instrument for both co-operation and change. It was highlighted that NEA co-ordinated peer reviews are not meant to formally approve or disapprove a national programme, but to help the national programme do better in the future, by facilitating the self-assessment of the reviewee and/or to facilitate the assessment by the national reviewers or interested parties. The guide document itself describes methodology of performing the international peer review of decommissioning cost studies and provides check lists of questions to get the peer review started. The guide is a living document, checklists should be updated and revised as needed (e.g., upon feedback after each review).

Simon Carroll gave in a national view point some reflections on the document itself, e.g. primary focus on content of cost estimates might be followed by reviewing the quality of the estimate. Is the check-lists approach sufficient, or is it understood as a starting point to consider specific issues in depth? Is it promoting best practices or endorsing common denominators? He also made some observations based on a recent international peer review related to the post-closure safety for the Swedish spent fuel repository.

In discussion it was noted that the role Terms of References for peer reviewing should be better highlighted in the document as to describe the process of peer reviewing, input information requested and outcomes to be given.

Confidentiality of reviewed data has not been an issue up to now, since NEA has organized reviews of only publicly available documents. The focus was on processes, rather than on figures. There is still a question how detailed a peer review should be. A timeframe of reviewing process may be valuable information in the guide. Funding schemes are not peer review topics in this document (out of the DCEG mandate).

Concerning transparency of peer reviewing Claudio Pescatore gave an example of recent NEA peer review (Sweden) where the documents, videos of meeting, and questions/answers are publicly available on the NEA web.

Participants are especially invited to comment checklists in the viewpoint of their comprehensiveness.

Thomas Kirchner supported peer reviewing activities, since the EC financially supports decommissioning projects of Ignalina, Kozloduy and Bohunice NPPs and wishes to have the process as transparent as possible. This improves best practice.

Concerning current EC activities in decommissioning costing, Thomas Kirchner informed that the EU Member Countries are working to meet the *Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste*. He emphasised the importance of having a confident decommissioning funding scheme to assure moneys when they are needed. A Decommissioning Funding Group has been established comprising experts in funding nominated by Governments to share their expertise and identify best practice. Up to now there is no firm timeframe for the Group's work.

### **Decision**

*DCEG-6 Participants will send all their comments (including those raised in the meeting) by email by 31 August 2013. If comments are minor, a final version will be submitted to the WPDD-14. Otherwise, the document will be further developed, and submitted to the DCEG-7.*

## **7. Have the main cost drivers changed over the time?**

### **Main observations**

Thomas LaGuardia gave a presentation on evolution of the main cost drivers on the background of developing legal and regulatory demands and challenges of decommissioning programmes, as more complex reactors came to decommissioning and Government safety regulators expanded their influence and control over decommissioning alongside with increasing emphasis on environmental concerns and stakeholders involvement. Removal of reactor vessel and its internals as well as waste management are important cost drivers. Project management, whose role and cost were underestimated in the past, may currently rise over 50 per cent of total project costs. Availability of advanced computer hardware and software allows applying very efficient project and cost controls, the use of which is not only recommended but inevitable.

In discussion it was underlined that use of Earned Value Management System (EVMS) in decommissioning project is vital to avoid budget and time overruns. Unfortunately, EVMS is not used broadly and overruns are a common practice. This is why the US Government applies EVMS in their programmes based on their similar experience.

Concerning high project management (PM) costs Tom LaGuardia explained that PM work may include home office accounting, purchasing, procurement, hiring, and other support (non-hands on) activities and the PM work scope has to be clearly described in each cost estimation.

### **Decision**

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## **8. Session on Risk Analysis in Decommissioning Costing**

Alistair Laird, the Session Chair, introduced presentations and underlined the importance of risk analysis in decommissioning costing since extensive budget of decommissioning programmes.

### **8.a An example of uncertainty analysis in Norwegian Infrastructure projects**

#### *Main observations*

Olav Torp gave a presentation on uncertainty analysis in Norwegian infrastructure projects using the Successive Process performed in team in the following steps: definition of the objective and scope, identification of influence factors, cost breakdown structure through top-down approach, making three-point estimate for each cost item and uncertainty factor, calculation evaluation and details, and finally making conclusions to be applied in an action plan. He also gave some results from road construction projects where the approach has been applied. It is a well-tested method having been used in Norwegian infrastructure projects over 20 years (first in construction of roads, then railways and buildings), and the successful record of its implementation is well documented (see more at [www.concept.ntnu.no](http://www.concept.ntnu.no)).

### **8.b Decommissioning Barsebäck: cost estimation and uncertainty analysis**

#### *Main observations*

Ole Jonny Klakegg presented an example of cost estimation and uncertainty analysis according to methodology introduced in previous presentation (see 8.a), applied to the Barsebäck (Sweden) Decommissioning project. After an update on current status, a site visit to Barsebäck, and detailed study of analysis method, programme and structure of the cost estimate, the team (Barsebäck, SSM, and independent experts) set up a three day workshop focusing on costing review and uncertainty analysis according to prepared programme, whose steps were described in detail. Results and their uncertainties for two options (direct disposal and disposal through interim storage facility) were discussed. It was highlighted that this methodology of cost estimation and uncertainty analysis is systematically implemented in Norway and is required by the Norwegian Government for all major investment projects.

### **8.c Risk analysis in decommissioning costing studies in the UK**

#### *Main observations*

Alistair Laird introduced NDA Contract Model describing a relation between NDA, Regulator, Parent Body Organisations, Site License Companies (SLCs) and Tier 2&3 contractors. He explained rules how risk is managed in Project Cost Planning in the Management & Operations Contracts between NDA and SLCs (Tier 1), and in Tier 2's large contracts, followed by lessons learned. An example of specific project of container design / licensing and its risk was shown. The presentation was completed by presenting UK and NDA work in benchmarking to further assure costing.

### **8.d Experience of risk analysis in costing - lessons learned from US decommissioning projects**

#### *Main observations*

Thomas LaGuardia introduced evolution of risk analysis, difference between uncertainty and contingency, and basic elements of qualitative and quantitative risk analysis (risk register for both; estimate of range of variability, selection of a risk distribution and application of

Monte Carlo method for the latter). Important issue is also risk mitigation and how to implement opportunities. Qualitative risk analysis example was given with its outputs (P80/P50 risk histogram, cumulative S-curve, Tornado Chart, Spider Chart). If the risk analysis is applied on Baseline Cost Estimate without contingency, P80 (90% probability) value compared to the P50 value can be taken as a contingency. Risk analysis should be treated as an integral part of a cost estimate. If maintained as a living document and updated periodically it can provide assurance that budgets will not be overrun.

***Decision***

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**9. Summary of Day 1**

***Main observations***

Björn Hedberg, the DCEG Chair, briefly summarized Day 1 of the meeting and appreciated quality of presentations and discussions.

***Decision***

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**10. Session on Learning Curves**

Olav Thorp, the Session Chair, introduced the session presentations, which give examples from both conventional industry as well as nuclear decommissioning industry.

**10.a Learning curves on project, national programme and international levels**

***Main observations***

Clas-Otto Wene introduced three basic issues on learning curves: 1. Learning Curves work as a strategic tool for management and policy making at all levels of industrial activities; 2. Learning curves trace a stable, optimal path for the learning system; 3. Learning rate is 20% in an equilibrium market, providing no major perturbations for the learning system (e.g., new regulations, governmental R&D initiatives). He gave examples of learning curves from various industrial segments at a project, and national and international level. Learning requires physical activities, which follow thermodynamic laws. Stability is guaranteed by the theorem of minimum entropy production, and distributions of learning rates can be explained by the Cybernetic Theory.

**10.b Learning from experience in projects**

Ole Jonny Klakegg focused on learning curve in the viewpoint of knowledge management and knowledge transfer. He presented factors that facilitate learning in project-based organisations, and focused on facilitating the learning in projects and applying the learning in a decommissioning case. He analysed value, difficulty, and means of decommissioning experience transfer at the strategic level (political aspects, information and acquisition strategies, etc.), at the tactical level (technical concepts and solutions, cost estimation and time planning, sequence of operations etc.), and finally at the operational level (methods and tools for specific operations, specific materials and measurements, etc.).



### 10.c Learning curve in decommissioning within EDF

Sylvain Desecures introduced a definition of, conditions for, and impacts of learning curve. He presented a learning curve application in the EDF decommissioning programme, which is relevant due to number (58 reactors), design (all PWR Westinghouse), timing (the fleet was built over a 20-year time span), company's organization covering full energy cycle, its centralisation and feedback. He reported on fields where the learning curve is applied within EDF decommissioning program, and a methodology how to integrate a learning curve effect within decommissioning cost estimate. He gave examples of savings due to application of learning curve at company's programme level (design and investment, 80 per cent time savings against the model case design), and concerning company's productivity (50 per cent time savings against the model case). He noted that subcontractors do not usually share learning(s) from learning curve in order to maximise their benefits.

In discussion it was noted that the EDF fleet of such high number of reactors of the same type is a unique case. In most cases an operator owns various types of reactors, which are often prototypes. During contracting/procurement it is important to assure that contractor will share financial profit from learning curve with contracting body.

#### *Decision*

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### 11. Earned value management system

#### *Main observations*

Alastair Laid summarized basic principles of the Earned Value Management System (EVMS) and system's framework, including WBS, Organizational Breakdown Structure, Responsibility Assignment Matrix, Code of Accounts, forecasting estimate at completion, variance analysis, reporting cycle, and baseline change control. He underlined that EMVS is an effective system to control project work, budget, and time during whole project life cycle. He gave examples of integrated cost management systems for decommissioning performance management, and described its structure, inputs and output formats. These systems are able to perform work, time, finance, and resources control, and reporting, and are based on software applications of recognised companies.

In discussion it was highlighted that any work item should be split into measurable entities, or should have checkable milestones (deliverables). Reporting period should be at least one month to identify early a lack of performance or eventually misreporting from contractor's side. The person from licensee/contracting company responsible for checking milestones plays therefore an important role. WBS should also be split to measurable tasks and those should be unambiguously linked to specific accounts to avoid covering losses in one task with benefits from another.

#### *Decision*

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### 12. Special update on on-going decommissioning cost calculations of the Swedish NPPs

Fredrik de la Gardie informed on existing decommissioning studies for Swedish NPPs and studies' assumptions, decommissioning schedules, and overall decommissioning costs at

the first level of ISDC (costs for transportation and final disposal of waste are not included). He presented SKB's decommissioning cost calculation model, involving risk analysis using Monte Carlo simulation. He also informed on decommissioning waste management scheme including planned repositories, waste containers considered in decommissioning studies, and overall quantities of radioactive and conventional waste.

In discussion it was clarified that besides ISDC's *Chapter 05 Waste processing, storage and disposal*, part of radioactive waste management related cost are allocated also in *Chapter 08 Project management, engineering and support*. Learning curve from repeated dismantling is partly reflected in the risk analysis.

**Decision**

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**13. Nuclear development committee (NDC) - Ad-hoc group on "Costs of Decommissioning"**

***Main observations***

Geoffrey Rothwell, NDC, informed participants on on-going work of the ad-hoc group on "Cost of Decommissioning". NDC had worked on a global review of decommissioning costs based on empirical data gathered in early 2000 (*Decommissioning Nuclear Power Plants - Policies, Strategies, Costs. OECD NEA, 2003*). Currently, the main objectives of the ad-hoc group are to gather and assess country available knowledge on completed decommissioning projects, review funding mechanisms in place or under consideration, and to the extent possible, consider cost estimates for high level processes by identifying cost ranges. He highlighted challenges of the project (differences in cost estimates, commercial sensitivity of data, significant levels of uncertainty affecting the calculated outputs) and necessity for cooperation with the IAEA and EC. RWMC supports this activity. A work plan and proposed structure of the report were also presented.

In discussion it was noted that proper explanation of uncertainties is important as well as a comprehensive description of assumptions and boundary conditions of the report to avoid readers' misunderstanding in the future.

Note: *Based also on RWMC Secretariat's support, a number of members of recently established ad-hoc group are DCEG members.*

**Decision**

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**14. Brief country updates on decommissioning costing activities**

***Main observations***

Oral reports on country updates on decommissioning costing activities were given by representatives from Italy, Norway, Slovakia, Spain, and Switzerland. (Special update by Sweden was made in Item 12.)

**Decision**

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**15. Discussion and recommendations in relation to the DCEG work programme and composition of the DCEG Core Group**

*Main observations*

DCEG will continue working on reports “The Practice of Cost Estimation for Decommissioning” and “International Peer Reviews of Decommissioning Cost Studies”.

Risk analysis in decommissioning costing is a new topic of future interest. Patrick O’Sullivan supported it as a subject of possible NEA-IAEA cooperation.

Other topics such as use of the ISDC for cost comparisons of specific activities, cost of project management and other cost drivers, cost of decommissioning liabilities at national level, relations between cost estimates and bidding for contractors as part of the EVMS, and learning curve in decommissioning projects also remain of DCEG interest.

*Decisions*

*Stefano Buonarroti and Simon Carroll are new members of the DCEG Core Group.*

**16. Date and place of DCEG-7**

*Main observations*

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*Decision*

*The 7<sup>th</sup> meeting of the DCEG is likely to take place near/at Barsebäck site, Sweden, including a technical site visit. Date will be specified later.*

**17. Any other business**

*Main observations*

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*Decision*

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**18. Review of main items and decisions**

*Main observations*

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*Decisions*

As mentioned in the “Decision” sections of this Record.