Development of a Preliminary Decommissioning Plan Following the International Structure for Decommissioning Costing (ISDC) of Nuclear Installations – 13361

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ABSTRACT

The International Structure for Decommissioning Costing (ISDC) of Nuclear Installations, published by OECD/NEA, IAEA & EC is intended to provide a uniform list of cost items for decommissioning projects and provides a standard format that permits international cost estimates to be compared. Candesco and DECOM have used the ISDC format along with two costing codes, OMEGA & ISDCEX, developed from the ISDC by DECOM, in three projects: the development of a preliminary decommissioning plan for a multi-unit CANDU nuclear power station, updating the preliminary decommissioning cost estimates for a prototype CANDU nuclear power station and benchmarking the cost estimates for CANDU against the cost estimates for other reactor types. It was found that the ISDC format provides a well defined and transparent basis for decommissioning planning and cost estimating that assists in identifying gaps and weaknesses and facilitates the benchmarking against international experience. The use of the ISDC can also help build stakeholder confidence in the reliability of the plans and estimates and the adequacy of decommissioning funding.

INTRODUCTION

Risk management is a high level goal in decommissioning planning. It is essential that stakeholders have confidence in both the decommissioning and waste management plans and in the adequacy of decommissioning funding strategy. Standardization, transparency and rigorous and meaningful benchmarking all contribute to reducing risk and building confidence. Candesco and DECOM a.s. have used the International Structure for Decommissioning Costing (ISDC) of Nuclear Installations, published by OECD/NEA, IAEA & EC, along with two costing codes developed from the ISDC to perform three projects:

- the development of a preliminary decommissioning plan for a multi-unit CANDU nuclear power station;
- updating the preliminary cost estimates for a prototype CANDU nuclear power station; and

- benchmarking the cost estimates for CANDUs against the cost estimates for other reactor types (PWR, BWR, VVER, etc).

The use of the ISDC format proved to be beneficial in both achieving the risk management goals and completing the projects within budget and schedule.

ISDC, OMEGA and ISDCEX

The ISDC format provides a comprehensive structure that supports decommissioning planning and enables "bottom-up" cost estimating. Following this structure ensures that all cost elements have been considered in developing a decommissioning cost estimate and provides a basis for informative comparisons of decommissioning costs.

The costing code OMEGA, was developed by DECOM a.s. and is consistent with the structure of the ISDC [1]. It is a universal code, written in ORACLE, for nuclear facilities with any compositions of systems and structures and any radiological conditions in the facilities. The inputs include:

- Decommissioning Approach/ End State;
- Planned Activities/ Dismantling Approach;
- Inventory database & characterization; and
- Waste Management Plan

As these inputs are so interconnected, changing any of them affects the entire cost estimate. The OMEGA code has the functionality to optimize the plan to the number or availability of resources or types of resources, schedules, etc. The code allows the optimization of resource utilization (including human, technological and financial resources) and schedule and produces estimates of cost, waste volumes and exposures.

The power and flexibility of OMEGA is desirable when planning large decommissioning projects but the cost and complexity may be excessive for smaller projects. Several spreadsheet based tools following the ISDC structure, including ISDCEX developed by DECOM a.s., are also available to support decommissioning planning and costing for smaller facilities such as research reactors.

PRELIMINARY DECOMMISSIONING PLANNING AND COSTING

The OMEGA code was used during the development of a preliminary decommissioning plan of a multi-unit CANDU nuclear generating station to optimize the schedule and resource utilization and to estimate the cost of the decommissioning. The project presented many of the challenges usually encountered during decommissioning planning including developing the strategy, assembling inventory and characterization data and defining the end state.

Some unique challenges were encountered during this 'first time' application of OMEGA to a CANDU station. Foremost among these was that OMEGA generally follows a 'room' based approach but CANDUs are organized by system instead of by room. After a few failed attempts to get the inventory items organized by room, it was decided that a room based approach was not practical to use for CANDUs and a 'virtual rooms' approach, based on the Building System Index (BSI), was adopted. This approach proved to be successful.

UPDATING PRELIMINARY DECOMMISSIONING COST ESTIMATES

The ISDCEX spreadsheet was used to update the estimates of the cost of completing the decommissioning of a prototype CANDU nuclear power station. The purpose of this was twofold: to provide confidence in the previous cost estimate and to update the decommissioning cost estimate with current costs.

Detailed facility inventory data sheets – including radiological characteristics – collected during previous cost estimation work were used as an input, as were the current cost projections for ongoing storage with surveillance activities. The update of the cost estimate was completed using the ISDCEX spreadsheet.

BENCHMARKING

As cost estimates prepared following the ISDC format are transparent, this facilitates comparison of the cost elements from different cost estimates. By following the ISDC format it is possible to prepare informative comparisons of decommissioning costs.

Candesco and DECOM a.s. recently completed a benchmarking of international decommissioning costs by mapping the international decommissioning cost estimates to the ISDC format and then comparing the costs by ISDC category.

The study included estimates for various types of facilities and from different jurisdictions: CANDUs in Canada, CANDUs outside of Canada; PWRs and BWRs in the United States; PWRs, BWRs, VVERs, GCRs and HGCRs in Europe, and a few other rarer reactor examples. The available data included:

- Estimates of varying degrees of accuracy and completeness;
- Estimates developed using different approaches to estimating;
- Estimates based on different strategies, deferral periods (immediate to long-term deferral and for a few sites, estimates for more than one strategy or deferral period was available); and
- Actual decommissioning data from completed US and European projects.

The large variation in the form and quality of the available cost data required that a systematic

structure be applied to allow for meaningful comparison. The data was all mapped to the ISDC format, and was all converted to a common currency and year of estimation. The large amount of data that was produced was then graphed to provide a visual display of the information. Fig. 1 below shows a comparison of CANDU NPPs at ISDC Level 1 on a per unit basis and Fig. 2 shows the comparison on a per MWe basis.

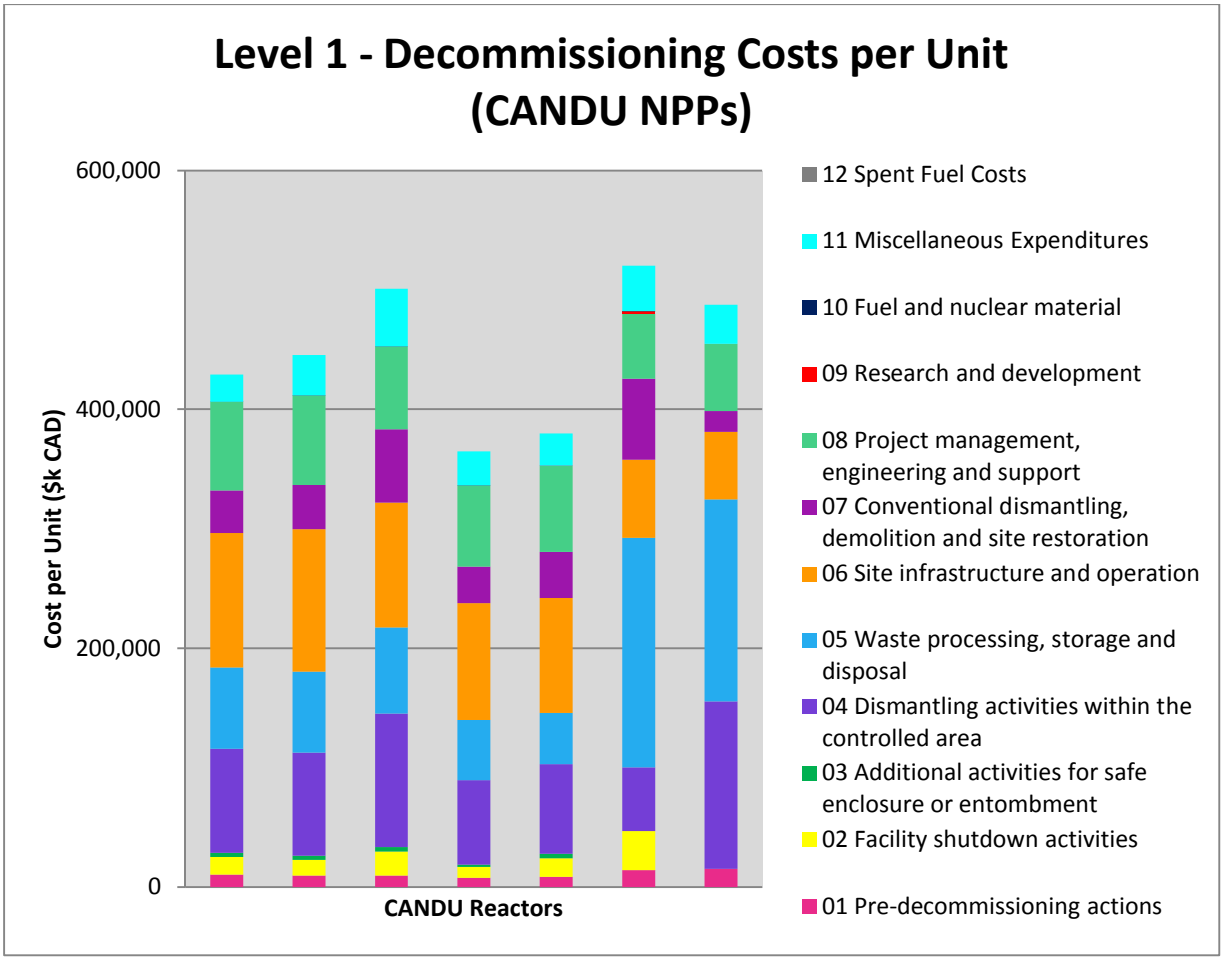

Fig. 1. ISDC Level 1 Comparison of CANDU NPP Decommissioning Costs/Unit

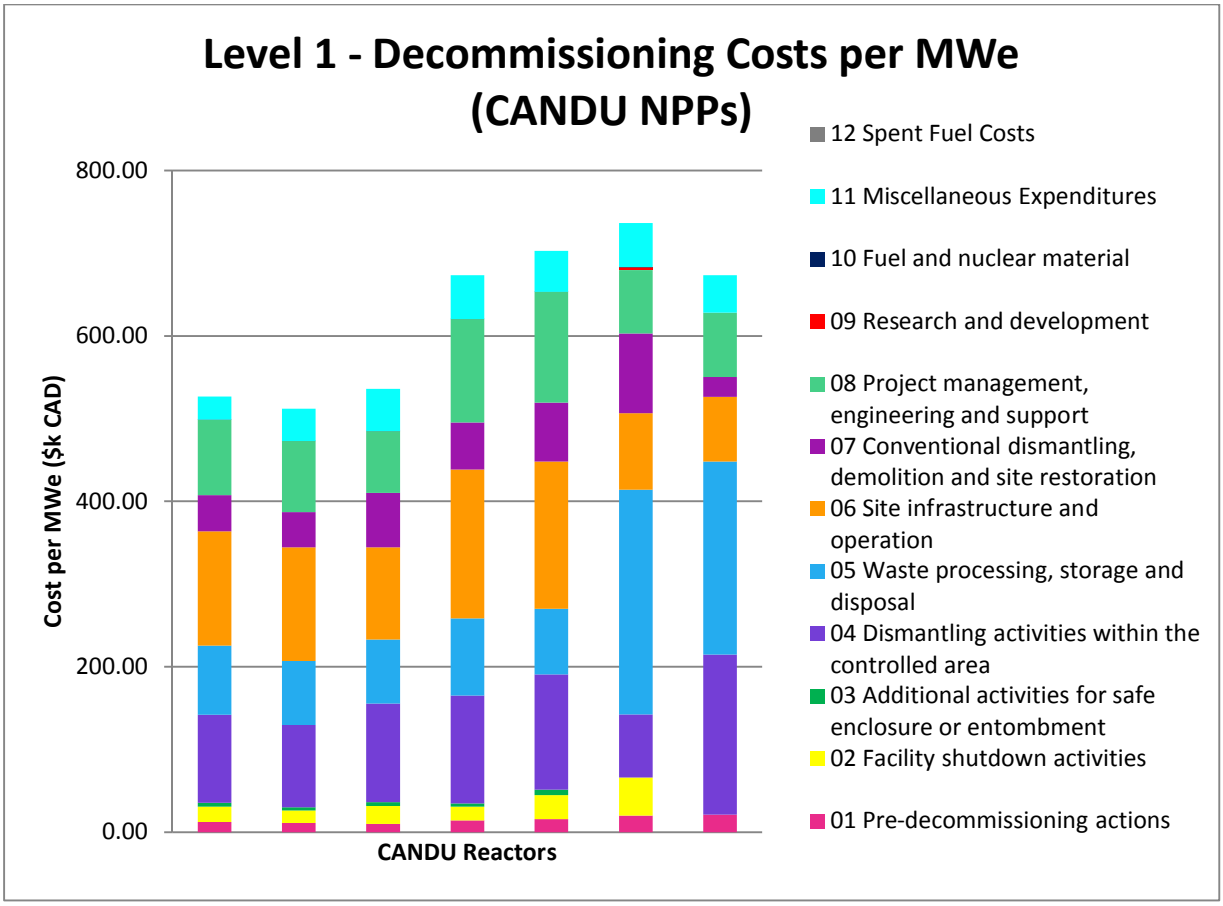

Fig. 2. ISDC Level 1 Comparison of CANDU NPP Decommissioning Costs/MWe

CONCLUSIONS

The ISDC format provides a well defined and transparent basis for decommissioning planning and cost estimating that helps build stakeholder confidence. It is an internationally accepted standard that provides assurance that all aspects of the decommissioning have been considered in both planning and cost estimating. It also provides a standard format for cost estimates that assists in identifying gaps and discrepancies. Combining the ISDC with a bottom-up approach to cost estimating based on the ISDC provides transparency and presenting the estimates in ISDC format facilitates the benchmarking against international experience, both of which enhance stakeholder confidence.

REFERENCES

1. OECD/NEA, IAEA, EC, "International Structure for Decommissioning Costing (ISDC) of Nuclear Installations" OECD/NEA No. 7088, 2012.