

## **ISDC universal costing platform eOMEGA based on internet technologies**

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### **Introduction**

The paper presents the principles of the new costing platform based on the International Structure for Decommissioning Costing (ISDC) of Nuclear Installations. The platform in development includes the decommissioning costing code and other modules related to decommissioning costing. Whole system is based on internet technologies which facilitate the work, services and communication.

### **General background for eOMEGA platform and its main features**

The International Structure for Decommissioning Costing (ISDC) of Nuclear Installations was issued in 2012 by the main international organisations OECD Nuclear Energy Agency (NEA), IAEA and European Commission to act as the standard and common platform for presenting cost estimates for decommissioning projects and to facilitate comparisons between cost estimates of decommissioning activities or groups of activities. In Europe, the ISDC is becoming nowadays the basic tool for harmonisation in decommissioning costing and benchmarking, providing the transparency and understanding the items of decommissioning cost cases; this basic role of the ISDC is also spreading worldwide.

There are many stakeholders (license holder, regulatory bodies, funding bodies, universities, public) involved in decommissioning projects who are interested in understanding the decommissioning costs and also who would like to perform the cost estimation themselves due to many reasons. Part of the data needed for costing are available in decommissioning plans; each nuclear facility should have the decommissioning plan. Other data for costing should be collected from other various sources; the ISDC platform will provide default sets of these data. Any decommissioning plan should include compulsory also the estimation of decommissioning costs which can be graded during the facility life cycle from preliminary conceptual levels up to the detail levels.

Costing software based on the ISDC available for all levels of potential users/stakeholders may facilitate these general requirements. It shall enable a flexible, graded and transparent approach for decommissioning cost estimation for any nuclear installation. At all levels of

cost estimates, the costing software should provide cost data in the ISDC format; this standard format and content of cost estimates will give greater transparency to decommissioning processes and will build regulator and stakeholder confidence in cost estimates. Recently, a new requirement appeared at managerial levels responsible for preparation of decommissioning plans and cost estimations: a costing tool is required which will enable at the managerial levels to check the costing data delivered by external providers.

As the summary, there is the demand for a costing software which is transparent, i.e. providing the results in the ISDC format, which can be graded from preliminary levels to detailed levels, which is accessible in a simple way for any levels of users/stakeholders and for which the expert support is also easy to provide.

The costing platform eOMEGA intends to provide the above requirements by merging two existing matured solutions - the existing ISDC based decommissioning costing software OMEGA [1] and the web-based internet solution. The result is the flexible, open and user friendly universal ISDC platform, the eOMEGA platform, and solutions for decommissioning costing based explicitly on the ISDC. It is assumed that the user groups will have costing backgrounds at various levels of experience. The ISDC platform eOMEGA will enable decommissioning costing at various graded levels including periodical upgrades of cost estimates according to the international recommendations in this area. Use of the eOMEGA platform will be supported by the team with the long-term experience in ISDC based decommissioning costing which also contributed significantly to developing the ISDC.

The existing OMEGA software is the pilot software which implemented in full scale the "Yellow book", the predecessor of the ISDC and later the ISDC. The code was used in numerous countries and also in IAEA projects. ISDC benchmarking approaches and translation of specific cost structures based on work breakdown structures of decommissioning projects into the ISDC were developed at the DECOM company.

eOMEGA platform will enable high level of customisation of individual cost cases by reflecting specific facility conditions, national nuclear and general frameworks and any related issues; transparency and understanding of cost cases for users and stakeholders involved is achieved by using the ISDC and by having the costing cases fully in "own hands".

Principal scheme of the eOMEGA platform is presented in the Figure 1. Except of the eOMEGA platform itself, two modules are under development as delineated by dark blue in the Figure 1. Other modules in preparation will be available in later versions of the eOMEGA platform; these modules are presented in light blue.

Potencial users from industry, R&D, universities and international organisations are indicated. The eOMEGA platform will be available at the provider as the service or as the installation at user's servers.

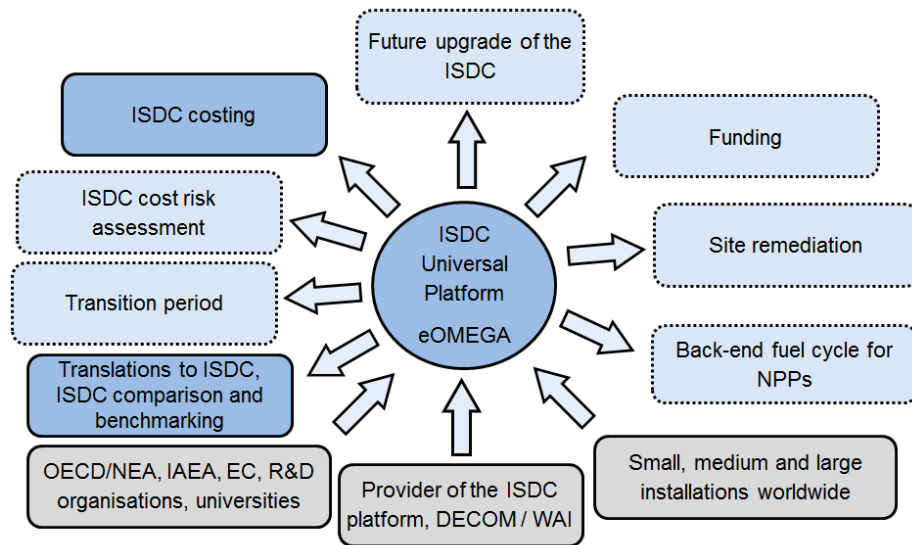


Figure 1: Principal scheme of the eOMEGA platform

### Functionalities of modules of the ISDC universal eOMEGA platform

#### eOMEGA Platform

eOMEGA Platform uses the existing proved platform based on web technologies for development of SW solutions in the cloud environment with more than 15 years of experience. Platform is operable on any server; it is the open architecture with the possibility to include ready modules and new specific modules into a customer installation and to link/arrange the modules according to customer requirements.

The web-based internet technology enables to install the eOMEGA platform at the user's servers anywhere in the world along with the remote expert support and maintenance of the platform. Only standard internet browser is needed at users; no other software is needed. High security of user's data is guaranteed, including during maintaining the software remotely.

#### ISDC Costing

ISDC costing module transforms the long-term and unique experience of the OMEGA code which is the pilot project for full implementation of the International Structure for Decommissioning Costing (ISDC) of Nuclear Installations (joint project of the OECD/NEA, IAEA, European Commission, 2012) and previously its predecessor, the so called the "Yellow Book".

The OMEGA code is the universal computer code for evaluation of decommissioning cost for any nuclear facility with any systems/structures composition and any radiological situation in the facility. ISDC is implemented as the base for cost calculation structures as the ISDC involves all typical decommissioning activities. Templates of ISDC cost calculation structures were which are used for automatic generation of cost calculation structures. Costing for waste management is based on a unique system which simulates material/radioactivity flow

in various waste scenarios. Decay of individual radio-nuclides is involved in the calculation process. Main data provided by the code are costs in ISDC format, cash flow data, manpower, exposure and waste quantities. All these features are in implementation to the eOMEGA platform.

#### Translation to ISDC, ISDC Comparison and Benchmarking

Effective comparison and benchmarking of decommissioning project cost data can be performed only if the cost data have the same format, i.e. the ISDC cost format. Transformation of cost data from any cost structure needs to be supported by set of conversion matrixes. The system of conversion matrixes is an universal one with proposed default conversion factors; the users select proper matrixes and sets of conversion factors and adapt these for its own specific case.

#### ISDC Cost Risk Assessment

ISDC costing as presented above provides standard sets of cost data in the ISDC format. There is a general trend to evaluate selected cost items by probabilistic methods, especially those with risk impact on a decommissioning project. The module will provide the possibility to evaluate selected cost data in order to include the impact of project in-scope and also project out of scope risks on decommissioning costs.

#### Transition Period

Transition period between the permanent shutdown and start of decommissioning is the complex period where the operational activities continue in sequentially reduce extent (especially related to cooling down of the spent fuel) and new activities start in facility premises and systems which are related to preparation of decommissioning. Both types of activities should be identified in details and costing for these activities should be performed; cost elements are then to be allocated to operators funding or to the decommissioning fund.

#### Funding

The funding mechanism should be established in an appropriate manner in order to have enough resources for final decommissioning of the facility. The e-Omega funding module is intended to be used as a suitable tool for calculation of funds for decommissioning taking into account the legislative background, conditions for funds collection, contributions of the license holder and revenues from the operations on the financial markets. The funding module in the universal platform will be used in relation with the decommissioning costing module i.e. the calculated decommissioning costs represents the input for decommissioning funding module and also as a separate module where the input data (decommissioning costs and/or fuel cycle costs) are defined by the user.

#### Site Remediation

Since there are many legacy waste sites, contaminated sites (e.g. mining sites contaminated by uranium tailings, oil production sites) or even few large scale areas contaminated after

accident of NPPs, it would be appropriate to extend the existing ISDC structure with more detailed activities relevant for site remediation and post closure stage or elaborate ISDC parts devoted to site remediation in more detail. Available international recommendations for site remediation and post closure issues (e.g. IAEA documentation, EURSSEM or MARSSIM) will be used. The structure may be further extend by assessing the costs necessary for remediation of sites contaminated by mixed waste or contaminated by hazardous non-radioactive waste (e.g. chemicals, heavy metals, oil products).

The Site remediation module will utilize the extended ISDC structure along with the lessons learned in the process of development of module for decommissioning costing. The same principles for cost assessment will be applied considering the specifications of activities relevant for site remediation and post closure stage.

#### Back-end Fuel Cycle for NPP's

Generally, the costs related to management of spent fuel are evaluated in parallel to costs for decommissioning of nuclear installations. An approach similar to decommissioning costing will be implemented in this module, i.e. implementing the structure of standardised fuel cycle activities and developing the costing system based on this structure of activities. A first draft of this standardised fuel cycle cost structure is already available at IAEA, as initiated and proposed by one of DECOM members.

#### **Future upgrade of the ISDC**

It is assumed that the ISDC issued in 2012 will be again updated after 10 years of its use. It will be a repetition of the process of upgrading of the "Yellow Book", the predecessor of the ISDC, the work was done in the period of 2009-2011. Existing experience at DECOM and expected experience accumulated during the use of the eOMEGA platform will contribute to future upgrading of the ISDC.

#### **Conclusions**

The eOMEGA ISDC platform intends to merge the ISDC itself, costing methodologies based on the ISDC and recent trends in decommissioning costing, fuel cycle costing, funding and other related issues into one compact and flexible working package.

#### **References**

[1] Vladimir Daniska, Matej Zachar, DECOM Experience with Decommissioning Costing; International Conference ECED 2015; Eastern and Central European Decommissioning; International Conference ECED 2015; Trnava, Slovakia, June 23 - 25, 2015