

## Basic Research on Selecting ISDC Activity for Decommissioning Costing in KRR-2 Decommissioning Project Experience Data

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### 1. Introduction

The Korea Atomic Energy Research Institute (KAERI) has carried out the decommissioning for Korea Research Reactor-2 (KRR-2), Uranium Conversion Plant (UCP). KAERI is performing research for calculation of expected time of a decommissioning work and evaluation of decommissioning cost and this research calculate a decommissioning work unit productivity based on the experience data of decommissioning activity for KRR-2.

The KAERI be used to calculate the decommissioning cost and manage the experience data from the decommissioning activity through the Decommissioning Information Management System (DECOMMIS), Decommissioning Facility Characterization DB System (DEFACS), and Decommissioning Work-unit Productivity Calculation System (DEWOCS) [1].

These efforts for decommissioning costing have been devoting a lot of effort in domestic as well as overseas. Especially, in order to estimate the decommissioning cost, OECD/NEA recommend the International Structure for Decommissioning Costing (ISDC) [2] which is consisting of 11 principal activity.

In this paper, the methodology was presented how select the ISDC activities in dismantling work procedures of a 'removal of radioactive concrete'. The reason to select the 'removal of radioactive concrete' is main key activity and generates the amount of radioactive waste. This data will take advantage of the cost estimation after the code for the selected items derived ISDC.

### 2. Dismantling Work Procedures and ISDC Activities

#### 2.1 Dismantling Work Procedures in KRR-2

The dismantling procedures of KRR-2 are created by the rules in the Nuclear Safety Commission.

This rule is 'Operator must publish the various dismantling procedures which is necessary for the dismantling of nuclear plant before beginning to dismantle'. Dismantling procedures of the KRR-2 were written by this rule. This is consists of dismantling procedure in KRR-2is as follow with 14 kinds of contents. That is Purpose, Work Scope, References,

Definitions, Responsibilities, Cautions and Limitations, Period, Utilities, Equipment, Procedures, System Recovery, Working Test, Criteria, Attachment.

#### 2.2 Section of the dismantling procedures

Section of the dismantling procedures are described as follows.

- Purpose: An approximate work procedure be described to work environment including radioactive degree of dismantling a target structure.
- Work Scope: work scope is described range of construction.
- References: References is described information on the user's guide of working tools, regulations associated with dismantling work, dismantling work, radiate waste and quality control procedures.
- Definitions: Definitions is described dismantling work related to permit surface contamination and radiation work permits.
- Responsibilities: Responsibilities is described roles and responsibilities of stakeholders such as worker, working officer, supervisors.
- Cautions and Limitations: Cautions and Limitations is described general information about major risks occur while performing the dismantling works and precautions.
- Period: Period is described contents of the dismantling work to be carried out are repeated periodically.
- Utilities: Utilities is related to the dismantling work describes the utilities used.
- Equipment: Lists the equipment used in dismantling work.
- Procedures: Procedures lists and describes detail operation procedures such as preparation, licensing, training, equipment preparation and checking, ventilation system operation verification, temporary storage facilities, ventilation, lighting installation and testing.
- System Recovery: System recovery is described technical solutions related to failure of ventilation system or electrical system during dismantling work.
- Working Test: After completion of dismantling work describes the normal action of the other strains.

Table I: Selected ISDC activities correspond with 'Removal of radioactive concrete'

level	ISDC Code	Description	level	ISDC Code	Description	level	ISDC Code	Description
L2	01.0500	Authorization	L2	05.0800	Management of decommissioning intermediate-level waste	L2	06.0400	Radiation and environmental safety monitoring
L3	01.0501	License applications and license approvals	L3	05.0807	Containers	L3	06.0401	Procurement and maintenance of equipment for radiation protection and environmental monitoring
L2	02.0400	Radiological inventory characterization to support detailed planning	L3	05.0805	Transport	L2	08.0200	Project management
L3	02.0401	Radiological inventory characterization	L2	05.0900	Management of decommissioning low-level waste	L3	08.0204	Safety and environmental analysis, ongoing studies
L2	04.0100	Procurement of equipment for decontamination and dismantling	L3	05.0907	Containers	L2	08.0300	Support services
L3	04.0101	Procurement for general site-dismantling equipment	L3	05.0905	Transport	L3	08.0305	Personnel management and training
L3	04.0102	Procurement of equipment for decontamination of personnel and tools	L2	06.0300	Operation of support systems	L2	08.0400	Health and safety
L2	04.0200	Preparations and support for dismantling	L3	06.0302	Ventilation systems	L3	08.0402	Industrial safety
L3	04.0201	Reconfiguration of existing services, facilities and site to support dismantling	L3	06.0303	Heating, steam and lighting systems			
L3	04.0203	Ongoing radiological characterization during dismantling	L3	06.0306	Compressed air/nitrogen systems			
L2	04.0700	Removal of contamination from building structures						
L3	04.0701	Removal of embedded elements in buildings						

- Criteria: Criteria is described criteria for the completed dismantling work.
- Appendix: Checklist of dismantling work is appended to the dismantling procedures

### 2.3 ISDC code associated with the dismantling work

ISDC is presented decontamination, dismantling work, as well as activities necessary to carry out the decommissioning business strategy, dismantling plans, radiation safety, site management, presented the topic for the activities needed for industrial safety and project management, and all demolition projects. Thus, this paper deriving activities for the dismantling work such as work for decontamination, decommissioning and waste management work, as well as all business activities and utilize to decommissioning costing.

ISDC is level 1, 2 and 3 is defined. Each level consist of Principal Activity, Activity Group and Typical Activity. In particular, a lot of information within 'Decommissioning activity', 'Waste treatment, storage and disposal' related to the dismantling procedures. Because the main content of the dismantling procedure to prepare the dismantling and decontamination for the dismantling object or perform the dismantling and put in storage containers, mainly management tasks. In addition, licensing, radiation and environmental monitoring, support services or else may be appropriate here.

### 2.4 ISDC code selection in dismantling procedures

In order to selecting the ISDC code, it is important to match the content of the nearest dismantling procedures with ISDC code. These code can be mainly ISDC code 'Procedure' section describing the contents subjected to actual dismantling work.

The table 1 shows the selected ISDC code. For example, before the dismantling work, there is a licensing procedure. There is sentence that 'Radiation

work permit application' within dismantling procedure and this sentence is related to 'License applications and licensing approval (01.0501)' from the ISDC. In addition, worker training is related to the 'Personal management and training (08.0305)' and 'Industrial safety (08.0402)'. Among sentences such as 'Removal of radioactive concrete around beam port' related to dismantling work activity correspond with 'Removal of embedded elements in buildings (04.0701)' from the ISDC. This is because it includes removal of buried pipe and removal of the concrete around buried pipe. And 'Sampling after removing of radioactive and nuclide analysis' activity correspond with 'Final radioactivity survey of buildings (04.0901)' from the ISDC. This is because it matches sentence isolated and managing irradiation preventing recontamination from irradiation zone for the completed section. Otherwise, 'Equipment' section temporary ventilation equipment and temporary lighting system correspond with 'Ventilation systems (06.0302)', 'Heating, steam and lighting systems (06.0303),' 'Compressed air/nitrogen systems (06.0306)' from the ISDC. In 'Cautions and Limitations' relating to 'Radiation exposure of workers' and 'Internal exposure of workers by radioactive dust' will match 'Safety and environmental analysis, ongoing studies (08.0204)' from the ISDC. It has organized a match decommissioning activities using international standards such as ISDC. As a result, if decommissioning cost estimates using the ISDC can be established a basis of international decommissioning cost estimation.

## 3. Conclusions

There are various efforts for decommissioning costing in each country. In particular, OECD/NEA recommends decommissioning cost estimation using the ISDC and IAEA provides for Cost Estimation for Research Reactors in Excel (CERREX) [3] program that anyone is easy to use the cost evaluation from a limited decommissioning experience in domestic. In the future,

for the decommissioning cost evaluation, the ISDC will be used more widely in a strong position. This paper has described a method for selecting the ISDC item from the actual dismantling work procedures. However, it is not easy to sort a lot of the dismantling procedures by manually to the ISDC items.

#### **REFERENCES**

- [1] 박승국, 조운형, 문재권, “원자력시설 해체작업에 필요한 유닛생산성 산출 시스템”, 한국정보과학회, pp. 9-12, 2011.
- [2] OECD NUCLEAR ENERGY AGENCY, INTERNATIONAL ATOMIC ENERGY AGENCY, EUROPEAN COMMISSION, ‘International Structure for Decommissioning Costing (ISDC) of Nuclear Installations’ OECD/NEA Report No. 7088, (2012).
- [3] INTERNATIONAL ATOMIC ENERGY AGENCY, Cost Estimation for Research Reactor Decommissioning, Nuclear Energy Series Report, IAEA, Vienna (2012).