A Matric System Combining NPP facilities information and decommissioning activity information

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1. Introduction

The government has been recently preparing a preparation of policy and technical development of decommissioning in order to dismantle a nuclear power plant. D&D (Decontamination & Decommissioning) research divisions have experience in dismantling the uranium conversion plant and KRR-2 (Korean Research Reactor 2, TRIGA Mark type III) of 1998-2009. Using data obtained through the dismantled KRR-2, the divisions have studied how to dismantle a commercial nuclear power plant. There are lots of problems to apply directly dismantled data of the research reactor into the dismantling of a commercial reactor.

The paper introduces a matrix system to manage a decommissioning project in preparing the dismantling of nuclear power plants as the first phase of solving the problems. The matrix, which is a system that combines the WBS code and the facility code of the nuclear power plant to be dismantled, has the decommissioning information of dismantling of the NPP.

The matrix system has an important role in the evaluation of the amount of dismantling waste and decommissioning schedule and cost in conjunction with a database system that has been developed.

2. Methods and Results

2.1 WBS (Work Breakdown Structure)

The WBS that was derived from the Work Breakdown System has emphasized the importance of WBS in conjunction with the decommissioning of an NPP. For large projects like nuclear plant decommissioning, the WBS structure used to facilitate an understanding of the major elements of the cost and schedule should be provided. In addition, it should also include a WBS dictionary, which describes the activities associated with each WBS scope of work [1].

In Sweden, the WBS was used to evaluate the preliminary dismantling costs of a nuclear power plant that will be dismantled in the future. [2]. ISDC is using the concept of a matrix and WBS to calculate the dismantling costs [3].

2.2 Facility code and WBS code

The facility code made by calculating the amount of dismantling waste includes site specific data (area, volume, and weight of the structure and types of materials) of the corresponding facilities and radiological characteristics data (surface contamination ratio and area, volume, weight of space radiation dose rate). An example of the KRR-2 is shown in Table 1.

Table 1: KRR 2nd Classification of the facility code

Object Facilities	1st Classification	2nd Classification
KRR (Research Reactor)	K1R (Reactor Hall at the KRR-1)	K1R-POL
		K1R-BSC
		K1R-SFS
		K1R-AUX
	K2R (Subsidiary build. at the KRR-2)	K2R-IEL
		K2R-LHC
		K2R-WIS
		K2R-PIT
		K2R-IEL

The WBS code made by extracting decommissioning productivity factors includes a value calculated by the equation such as labor in time, types of work in time, units of work in the time required, time of use of the equipment, and time of specific tasks depending on the types of dismantling work. The equation calculates the working time/area, the working time/volume, and the working time/weight of the device-specific in connection with the device operation. The equation also calculates the working time/area, working time/volume, and working time/weight in connection with the working time. An example that was used in the dismantling of KRR-2 is shown in Table 2.

Table 2: WBS code of the KRR-2

Work Classification	Work description	Number of WBS
Separation of Rotary Specimen Racks	Preparation	K2-4.1
	Separation	K2-4.2
	Transport	K2-4.3
	Dismantling	K2-4.4
Remove of Beam Port Liner	Remove of Nose	K2-17.1
	Drilling	K2-17.2
	Discharge	K2-17.3

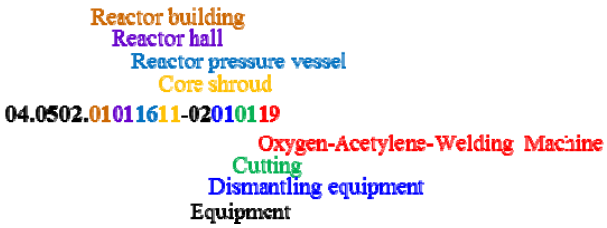
	Dismantling	K2-17.4

2.3 Matrix and structure

The facility code that will be used in the matrix was made to target the OPR1000 (South Korean designed two-loop 1000 MWe PWR Generation II nuclear reactor). The OPR1000 consist of 7 buildings: a primary auxiliary building, second auxiliary building, access control building, turbine building, nuclear fuel building, reactor containment building, and radioactive waste building. The buildings have a facility code such as a layer/area code, room code, and equipment code, and include data necessary for the calculation of the amount of dismantling waste. Information on the facility code is shown in Figure 1.

Fig. 1. Facility code of reactor containment building of the OPR1000

The WBS code to be used for the matrix is included in work productivity factor obtained from the dismantling of the research reactor. The WBS code is divided into man-power indicating the unit of work productivity factor, a technique that shows the equipment factor and device, and decommissioning management, which represents the productive factor of the workers. The matrix structure, which is a combination of WBS code and facility code, which will be used for the dismantling of a nuclear power plant, is as follows.



Here, 04 means dismantling activities within the controlled area, and 0502 means the dismantling of the reactor vessel and core components. This code provides us with information needed when trying to dismantle the core shroud of a nuclear power plant.
In other words, this code describes the fact that an oxygen-acetylene welding machine and various kinds of devices were used when dismantling the core shroud of the research reactor, and shows that it took 8 hours to dismantle the reactor core shroud.

Figure 2 shows that a matrix WBS code and facility code are coupled. This matrix has information on about 300,000 codes including the facility code and WBS code, indicating the dismantling activity as the code to be used during the dismantling of a nuclear power plant.

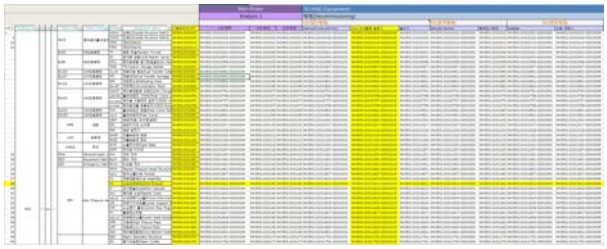


Fig. 2. The equipment code of the WBS that have the necessary information for dismantling of core shroud in the matrix

3. Conclusions

To apply the information obtained from the dismantling of the KRR-2 into NPP dismantling, a matrix system has been devised. The matrix system is configured with data related to the dismantling of the ISDC information and WBS used during the dismantling of KRR-2 and the facilities information of the NPP. The code in the matrix system has all specifications of the facility and information about the device, as well as the unit operation obtained from the research reactors. These pieces of information are intended to provide important basic data related to the requirements engineering and primary dismantling project management. It also helps evaluate the dismantling cost and schedule in advance.

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