Implementation of connectivity between facility characterization and decommissioning activity for dismantling of nuclear facilities

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1. Introduction

The dismantling of nuclear facilities should comply with the regulatory requirements for decommissioning projects, the technical requirements, and the technical criteria. The safety requirements for the dismantling nuclear facilities can be found in the IAEA safety series [1, 2]. A WBS (work breakdown structure) in connection with the dismantling of nuclear facilities was established using the PBS (physical breakdown structure) and ABS (activity breakdown structure). A matrix used to evaluate the decommissioning cost for the dismantling procedure was designed.

As a result of the verification of the designed matrix, it was confirmed that the legal regulations, the physical characterization of the structure, and the technical criteria of the dismantling can be inquired accurately when dismantling an activated structure.

2. Methods and Results

2.1 Requirements of decommissioning procedure

The decommissioning of nuclear facilities and nuclear power plants should be managed using various types of information, such as radiation safety and protection management, radioactive waste management, risk management, configuration management, quality assurance, cost and schedule management.

Because the regulation requirements and technical criteria for the dismantling of research reactor facilities and nuclear facilities have an absolute impact on dismantling strategies, the dismantling design and planning, decontamination/dismantling activities, radioactive waste treatment/disposal, and site restoration project, it is necessary to secure the connectivity with the technical elements that have been composed in the project management during the decommissioning stages.

To manage the systematic decommissioning requirements, the relationship between requirements was defined [3].

The relationship between the previously defined dismantling procedure requirements, PBS and ABS, to evaluate the reasonable dismantling cost was established (Fig. 1).

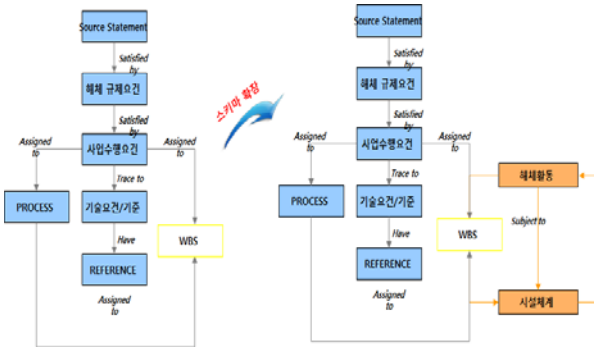

Fig. 1. Schematic diagram of relationship between decommissioning procedure requirements, PBS and ABS

2.2 PBS (Physical Breakdown Structure)

PBS has physical data such as the shape, material, specific gravity, weight, volume, and area of the nuclear facilities, as well as the structures to be dismantled.

In the decommissioning of an integrated management system project, PBS was established using OPR-1000 data, which are the same in a PWR type such as the Kori unit 1 nuclear power plant.

Table 1 shows the total number of items (2,349) input at the PBS, and the lowest number of items (1,773) for each building.

Table I: Item numbers of PBS

Building	Layer	Equipment
1. 1'st auxiliary	850	694
2. 2'nd auxiliary	251	187
3. Reactor containment	181	118
4. Access control	381	277
5. Turbine	134	105
6. Radioactive waste	419	305
7. Fuel	132	87
Total	2,349	1,773

2.3 ABS (Activity Breakdown Structure)

The standard decommissioning activities identified in the ISDC [4] are presented in a hierarchical structure (Fig. 2), with the first and second levels being

aggregations of the basic activities identified on the third level. The costs associated with each activity may be subdivided according to four cost categories.

Level 1	Principal Activity	04.0000 dismantling activities within the controlled area
Level 2	Activity group	04.0500 dismantling main process systems
Level 3	Typical Activity	04.0501 dismantling of reactor internals

Fig. 2. Hierarchical structure of the ISDC

ABS, which was established for the purpose of utilization in the dismantling activities at the Koi unit 1 NPP, additionally produced six main dismantling activities (preparation work, primary decontamination, cutting, detailed cut, secondary decontamination and loading of containers) under the typical activity (level 3).

2.4 Matrix design

A matrix function that can identify the relationship and properties between the nuclear facility classification system (PBS) and disassembly activity (ABS) as a whole was designed.

The matrix is a display method that can display data in tabular form. The data are displayed as a result of a specific query.

Figure 3 shows a matrix of the results of the nuclear facility classification system (PBS) and dismantling activity (ABS). The horizontal axis shows the dismantling activity classification system (4,435), and the vertical axis shows the facility classification system (1,773).

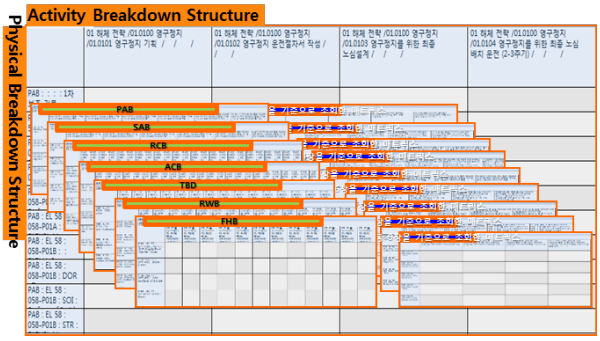

Fig. 3. Matrix structure between PBS and ABS

2.5 verification of matrix

To confirm that the designed matrix works properly, the decommissioning activity was selected as an example for the Core Support Barrel, which is a high-level activated material in a nuclear pressure vessel.

The core supporting barrel, which is a large structure and highly activated material, is assumed to perform only the cutting process and loading process without considering the decontamination or other processes.

In this case, it is assumed that the container to be used is cut into seven parts in order to charge the core supporting barrel with a 200 L standard drum.

Regulatory requirements and technical criteria related to the transport containers can be retrieved from the database of the regulatory requirements that has already implemented.

The connection between the core support barrel of the nuclear facility classification system and the dismantling activity related to the disconnection of this structure (corresponding to 05.060301), as well as the legal regulatory requirements to be considered when charging the vessel, was designed to be carried out normally in the matrix.

This provides an environment in which the nuclear facility classification system, dismantling activities, and legal dismantling regulatory requirements can be tracked during the evaluation of the decommissioning costs. (Fig. 4).

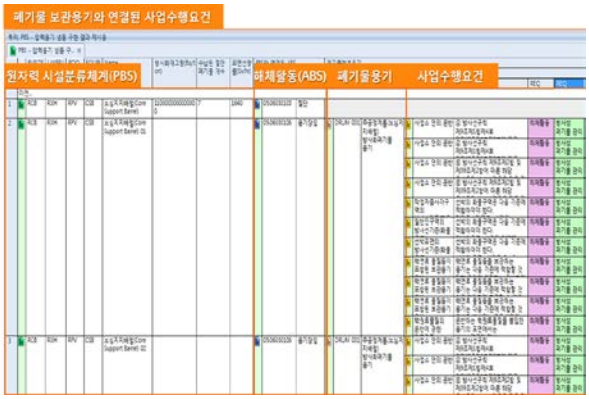

Fig. 4. Results of item survey at the cutting part of the upper most part of the core support barrel

3. Conclusions

The foundation of the dismantling WBS is secured through the combination of the nuclear facility classification system and the dismantlement activity classification system.

Using the matrix function, an environment that can inquire regarding the relationship and properties between the nuclear facility classification system (PBS) and the disassembly activity (ABS) was implemented.

As a result of verifying the designed matrix according to the selected scenario, it is possible to intuitively obtain various types of information such as the safety requirements for the operators' safety and the regulatory requirements of containers when waste generated after

cutting the activated structure in the reactor is charged to the vessel.

The combination of a nuclear facility classification system, dismantling activities, and legal dismantling regulatory requirements has created an environment in which dismantling costs can be reasonably assessed.

REFERENCES

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