

Implementation of Main Process Function on Nuclear Facilities Decommissioning Project Information

Yunjeong Hong*, Jongjin Kim, Heeseoung Park, Jeong-guk Kim
Korea Atomic Energy Research Institute, Republic of Korea
hong814@kaeri.re.kr*

1. Introduction

Decommissioning information in the various fields (decommissioning legal regulatory requirements, facility characteristics information, radiation / performance information, radioactive waste management, radiation protection, etc.) related to decommissioning is generated during decommissioning for nuclear facilities, from permanent shutdown to site restoration. Since a vast amount of information is generated and this information is used for important factors such as waste management and cost estimation, it is necessary to manage information systematically and accurately. Various management systems have been developed so far, but they are used and managed independently as various systems, which limits the complexity and information management. In order to overcome this problem, we intend to develop an integrated management system by securing the connection between existing program unit information in the current research.

In this study, main process functions are implemented to efficiently manage the necessary information in the decommissioning process of nuclear facilities based on existing conceptual design and framework design.

2. Main Process Function Design

Prior to the decommissioning of the nuclear facilities, evaluating of an appropriate cost and determining the approximate scope of the project will determine the success of the decommissioning of the nuclear facilities in the planning stage. As cost evaluation method applied to existing facilities is not considered the radiological characteristics of decommissioning wastes, it is difficult to apply them to the decommissioning of nuclear facilities requiring stability and accuracy.

At this step, based on the design of framework, we developed the estimation of the amount of decommissioning wastes with radioactive characteristics and cost evaluation methodology. And using the flexible database we can adjust this method to other nuclear facilities.

At this stage, the method of calculating the decommissioning waste amount and the cost of decommissioning cost, which considers the radiological characteristics based on the results of the framework design stage, has been developed. Based on the database which is easy to utilize and expand information,

function to be applied to various types of nuclear facilities.

2.1. Framework Design

- Based on the integrated database, the framework was built into the Client / Server environment. In addition, the data can be integrated using a common data model.
- The framework of decommissioning information integrated system is to perform the most basic and key function which evaluates decommissioning cost through calculation of decommissioning waste quantity. Therefore, in this paper, the functions necessary for calculation of decommissioning waste quantity and basic decommissioning cost are implemented.

- Development of facilities information management system for nuclear facilities
- Implementation of decommissioning waste quantity calculation program
- Implementation of decommissioning cost calculation program

- Since the decommissioning of nuclear facilities conforms to the management direction and policy of the IAEA, it is necessary to set the information management and standard of nuclear facilities by reflecting the IAEA nuclear waste management system (RWMR) the amount of decommissioning waste can be calculated.

- Decommissioning cost evaluation methodology has developed based on decommissioning waste quantity calculation and decommissioning process model.

- Development of decommissioning process modeling program
- Costing for decommissioning waste quantity
- Costing through PBS and ABS mapping

3. Results

The main process of information decommissioning of nuclear facilities is to register and manage WBS related to decommissioning facilities and decommissioning activities as a main function of decommissioning work management and to calculate the decommissioning cost.

The main function of the decommissioning facility is to classify the waste by level based on the structure of the facilities to be decommissioning and the radiation / performance measurement data, and to support the basic data structure for evaluation of the decommissioning cost.

3.1. Contents of Program Menu

For the support the cost evaluation function, we redeveloped the UI based on former prototype. The top of the system consist with key modules and illustrated in Fig 1. In order to support the core process functions on decommissioning cost evaluation, we reconstruct some functions of the UI based on the existing implemented framework prototype as follows. At the top of the system, the core functions were placed on a module-by-module basis through a ribbon-type UI.



Fig 1. The Screen of top menu on decommissioning information integrated management system

Main process function details are followings.

- Decommissioning facility characteristics information; decommissioning facility information, facility history information, physical/radiological characteristic information
- Decommissioning waste information; Radioactive waste characterization information, radioactive waste determination and classification standard information
- Decommissioning cost evaluation; decommissioning facility and decommissioning process mapping, decommissioning cost analysis and reporting

3.2. Decommissioning Project Information Main Process Function

3.2.1 Decommissioning facility characteristics information

The decommissioning facility characteristic function classifies the waste by level based on the structure of the

facilities to be decommissioning and the radiation/activity measurement data, and supports basic data composition for evaluation of decommissioning cost. In this paper, the waste amount calculation formula is applied to the existing prototype UI, and some UIs are reconstructed considering user convenience.

- Decommissioning facility information: The first screen of this function provides a screen that summarizes the amount of waste and workforce calculated based on decommissioning facility information as shown in Fig 2. The structure of the screen is provided in the form of Tree Greed on the left side and the calculated result is provided on the right side. If you click on a specific facility out of the summarized information, you will be able to calculate the disposal waste amount. If you choose a particular facility in the drawing, you will have the ability to calculate the amount of waste disposal. In Inventory 1 of the Inventory Information, the user inputs the measured radiation activity information (Inner cont, out cont, etc.), technical properties, and nuclide information for the target facility and presses the calculation button, and the amount of waste is automatically calculated according to the radiation level. Inventory 2 allocates according to waste classification based on the waste rate information being managed.

Inventory No.	Item type	DACR/Category	DACI No.	Calculation Y	Group	Dominant Material	Sec. Material(No.)	Total Mass
④ Site K1								
④ Bldg B103								
④ Area C101								
④ Area C015								
	방사선 측정	INV	THX	041001	Group 1			1.000
	전산용 자료	INV	THX	041003	Group 1			6
								15
④ Area C016								
	노출관리(외부)	INV	THX	041001	Group 1			1110
	노출관리(내부)	INV	THX	041001	Group 1			120
	노출관리(외부)	INV	THX	041001	Group 1			12
	노출관리(내부)	INV	THX	041001	Group 1			17
④ Area C017								
	방사선 측정	INV	THX	041001	Group 2			6
								15
④ Area C018								
④ Area C019								
	방사선 측정(방사선 C...)	INV	THX	041001	Group 1			3.127
								4.8
④ Area C020								
④ Area C021								
④ Area C022								
④ Area C023								
④ Area C024								
④ Area C025								
④ Area C026								
④ Area C027								
④ Area C028								
④ Area C029								
④ Area C030								
④ Area C031								
④ Area C032								
④ Area C033								
④ Area C034								
④ Area C035								
④ Area C036								
④ Area C037								
④ Area C038								
④ Area C039								
④ Area C040								
④ Area C041								
④ Area C042								
④ Area C043								
④ Area C044								
④ Area C045								
④ Area C046								
④ Area C047								
④ Area C048								
④ Area C049								
④ Area C050								
④ Area C051								
④ Area C052								
④ Area C053								
④ Area C054								
④ Area C055								
④ Area C056								
④ Area C057								
④ Area C058								
④ Area C059								
④ Area C060								
④ Area C061								
④ Area C062								
④ Area C063								
④ Area C064								
④ Area C065								
④ Area C066								
④ Area C067								
④ Area C068								
④ Area C069								
④ Area C070								
④ Area C071								
④ Area C072								
④ Area C073								
④ Area C074								
④ Area C075								
④ Area C076								
④ Area C077								
④ Area C078								
④ Area C079								
④ Area C080								
④ Area C081								
④ Area C082								
④ Area C083								
④ Area C084								
④ Area C085								
④ Area C086								
④ Area C087								
④ Area C088								
④ Area C089								
④ Area C090								
④ Area C091								
④ Area C092								
④ Area C093								
④ Area C094								
④ Area C095								
④ Area C096								
④ Area C097								
④ Area C098								
④ Area C099								
④ Area C100								

Fig 2. Decommissioning facility characteristics information assessment

- Decommissioning facility history information: The decommissioning facility history information is a function of managing the history information of the decommissioning facility. As shown in Fig 3, the history is provided in the form of a list, and includes history information necessary for deriving decommissioning facility information.

Equipment Code	Equipment Name	Description	Manufacturer Name	Model Part Name	Price	Installation Date	Purchase Date	Startup Date	Warranty (y)
010001	010001								
010002	010002								
010003	010003								
010004	010004								
010005	010005								
010006	010006								
010007	010007								
010008	010008								
010009	010009								
010010	010010								
010011	010011								
010012	010012								
010013	010013								
010014	010014								
010015	010015								
010016	010016								
010017	010017								
010018	010018								
010019	010019								
010020	010020								
010021	010021								
010022	010022								
010023	010023								
010024	010024								
010025	010025								
010026	010026								
010027	010027								
010028	010028								
010029	010029								
010030	010030								
010031	010031								
010032	010032								
010033	010033								
010034	010034								
010035	010035								
010036	010036								
010037	010037								
010038	010038								
010039	010039								
010040	010040								
010041	010041								
010042	010042								
010043	010043								
010044	010044								
010045	010045								
010046	010046								
010047	010047								
010048	010048								
010049	010049								
010050	010050								
010051	010051								
010052	010052								
010053	010053								
010054	010054								
010055	010055								
010056	010056								
010057	010057								
010058	010058								
010059	010059								
010060	010060								
010061	010061								
010062	010062								
010063	010063								
010064	010064								
010065	010065								
010066	010066								
010067	010067								
010068	010068								
010069	010069								
010070	010070								
010071	010071								
010072	010072								
010073	010073								
010074	010074								
010075	010075								
010076	010076								
010077	010077								
010078	010078								
010079	010079								
010080	010080								
010081	010081								
010082	010082								
010083	010083								
010084	010084								
010085	010085								
010086	010086								
010087	010087								
010088	010088								
010089	010089								
010090	010090								
010091	010091								
010092	010092								
010093	010093								
010094	010094								
010095	010095								
010096	010096								
010097	010097								
010098	010098								
010099	010099								
010100	010100								

4. Conclusions

In order to systematically and accurately manage related information generated during decommissioning of nuclear facilities, we have developed a methodology for estimating decommissioning costs based on the results of existing framework design phases.

In addition, it can be applied to various types of nuclear facilities by connecting facility characteristics information and decommissioning cost evaluation function based on database which can easily utilize and expand information with the aim of implementing the functions necessary to calculate decommissioning waste quantity and basic decommissioning cost calculation.

REFERENCES

[1] Y.J. Hong, Daejeon, S.K. Park, Daejeon, and H.S. Park, Daejeon, Requirement of Conceptual Design for Decommissioning Information Integration Management System, Korea Radioactive Waste Society, Spring, 2017.
[2] Y.J. Hong, J.S. Nam, H.S. Park, Daejeon, Framework Design for Decommissioning Information System on Nuclear Facilities, Korean Nuclear Society, Autumn, 2017

Fig 3. Implementation screen of decommissioning facility history information

- Physical/radiological characteristic information: It manages the radioactivity information of each nuclide calculated through analysis in the form of table.

Nuclide	Activity(Bq)	Percentage(%)
C-14	1.60E+016	0.000%
Co-60	3.74E+022	0.185%
Cr-51	2.54E+017	0.000%
Fa-59	2.11E+025	0.120%
Fe-59	6.00E+003	0.000%
H-3	8.45E+017	0.000%
Ni-59	1.45E+022	0.084%
Ni-63	1.51E+026	6.660%
Ni-99	3.05E+020	0.001%
Total	2.27E+025	

Fig 4. Radioactivity information by each nuclide

3.2.2 Decommissioning waste information

- Radioactive waste characteristics information: It consists of Acceptance Requirement, Waste Record, Approved Specification, Container, Supplier and Waster Generator.
- Information on radioactive waste determination and classification criteria: It is calculated the amount of waste according to the four-level classification criteria of radioactive waste by using the calculated each nuclide radioactivity information and radioactive waste limits.

Nuclide	Activity(Bq)	Percentage(%)
C-14	1.60E+016	0.000%
Co-60	3.74E+022	0.185%
Cr-51	2.54E+017	0.000%
Fa-59	2.11E+025	0.120%
Fe-59	6.00E+003	0.000%
H-3	8.45E+017	0.000%
Ni-59	1.45E+022	0.084%
Ni-63	1.51E+026	6.660%
Ni-99	3.05E+020	0.001%
Total	2.27E+025	

Fig 5. Calculation of radioactive waste quantity