

Development of Decommissioning Waste Treatment Method Optimizing System

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1. Introduction

During the decommissioning process a large amount of radioactive waste is generated in a short period of time. Also these waste types are diverse and even if their physical characteristics same their chemical or radiological conditions may differ. In this situation, decommissioning waste management effectively is one of the most important parts of the entire project.

Waste generated during decommissioning of nuclear facilities is subjected to various treatment processes such as decontamination or melting to reduce the disposal cost or to make it suitable for waste disposal. Such waste management history is required at the time of final waste disposal by regulatory agency. However the waste is not kept in its original packaging state, its steps are complicated and difficult to manage. For example it is not easy to separate or combine the information of each drum for recording reclassification status when managing the waste data in the drum unit.

Although several systems for radioactive waste management have been developed, it has been difficult to utilize the system effectively. Based on experience in decommissioning research reactor and uranium conversion plant, we realized the need for a specialized system for decommissioning waste management

Therefore, we developed the effective management system of characterization data for the entire life cycle from decommissioning planning to site release phase. In this paper, a waste history management system that is the basis of the whole system and an additional module for optimizing the waste treatment process is discussed.

2. Methods

In the research project, 'Development of Radiological Characterization Technology for the Life-Cycle of Decommissioning Nuclear Facilities', development is being carried out to establish an evaluation system that can efficiently manage various types of waste generated during decommissioning process.

Based on the waste history management system, we are designing an integrated management system by adding a process optimization module and image recognition application module.

7.1. Waste history management system

Previously DECOMMIS (DECOMMissioning Information System) has been developed in the KAERI(Korea Atomic Energy Research Institute) for managing decommissioning waste information of research reactor. [1] It was developed to produce data for reporting to WACID(Waste Comprehensive Information Database) which is a system operated by KINS(Korea Institute of Nuclear Safety). Because DECOMMIS has a database based on workers' daily report it has been it has been difficult to systematically manage waste history.

Based on the development and operation experience of DECOMMIS the lessons learned from experience system can be summarized as follows. 1) Information management based on waste history 2) Need for sub-stage concept of the drum 3) Information linkage with operation phase.

7.2. Optimization methodology of waste treatment

The waste treatment process is not terminated by a single process, but it is subjected to several process steps depending on its purpose. Because of the physical, chemical and radiological characteristics of the facility, the budget and schedule of the decommissioning project and social consensus, the multistage scenario for waste treatment has a very large number of cases.

A comparison between these scenarios is necessary for the selection of the optimal process scenarios. However it is often based on empirical data because it takes time and expense to consider the all scenarios. Depending on the characteristic of the target facilities, the process that was appropriate in certain cases may not be suitable waste from other facilities.

Therefore, in order to reduce the amount of waste through effective waste treatment process and to secure the safety of the workers, it is highly necessary to study the optimization methodology of decommissioning waste treatment.

7.1.1. Index used evaluation of waste treatment

Waste treatment scenarios are very different depending on evaluation index. Therefore, it is necessary to define the index for evaluation the profit and loss of each process. To do this, we surveyed domestic and overseas research cases and widely used documents and tried to analyze. [2]

Table I: Lithuanian Case [3]

Criteria	Selected attribute	Weight
Safety	Operator dose and radiological hazard	10
	Conventional Safety	100
Technical	Process/system robustness	50
	Waste form acceptability	50
	Interfaces	75
Environmental	Chemical discharges	50
Political/regulatory	Public acceptability	75
	Permissions	75
Economic	Lifetime costs	100
	Program	100

7.1.2. Decision making methodology

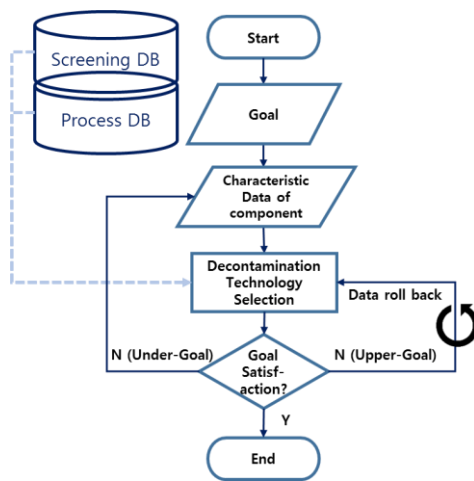


Fig. 1. Basic concept for system improvement

The factors that are considered for the selection of the treatment process are the five, 1) Safety 2) Efficiency 3) Cost effectiveness 4) Waste minimization 5) Feasibility of Industrialization, recommended by the OECD / NEA. [4] The optimization process consists of two stages. A screening step to select a process applicable to the waste and a scenario making step to consists the most preferred process among the possible processes. Safety and Feasibility of Industrialization are used in the screening phase because they are difficult to compare quantitatively.

The algorithm is structured as Fig1. First, the user inputs the target values such as total cost, total waste volume, target DF(Decontamination Factor) to be used as the boundary condition. User conducts a survey to evaluate factors to be focused on. The results of the surveys are normalized and calculated with the numerical values entered into each treatment process, and the final score is derived. Also the data of the input waste changes as this process is applied, based on these changes the process is repeated until the user boundary condition is satisfied

3. Conclusions

Based on the waste history management system we have developed a waste management system that includes the process optimization function.



Fig. 2. System screen

Data management based on drum has difficulty reflecting reclassification and repackaging situation that is almost inevitably involved in the decommissioning process. So to manage at a lower level, we introduced the concept of 'package'. It is defined a sub-stage concept of the drum that a small bundle of waste that a worker can handle in the decommissioning site.

Through the linkage of the history management system, the information of the waste can be effectively linked. It is expected to be used to bring information on the operational stage.

Currently, the function of process optimization is limited to decontamination of waste, but it will be expanded in the future to improve the function of process optimization.

Acknowledgments

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