Transactions of the Korean Nuclear Society Spring Meeting
Jeju, Korea, May 19-20, 2022

The Recycling Scenario of Concrete Clearance Wastes Generated from the Decommissioning of Nuclear Power Plants

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1. Introduction

In the process of decommissioning nuclear power plants, concrete clearance wastes are generated in large quantities. This paper reviews these concrete clearance waste recycling scenarios and presents the optimal recycling option considering the current environment status in Korea. To do this purpose various recycling scenarios that can be applied in Korea are derived by referring to the recycling cases of clearance waste. In order to derive the optimal recycling scenario, evaluation criteria are derived, and priority evaluation is conducted using the Fuzzy-AHP methodology.

2. Development of concrete clearance waste recycling scenario

Looking at the current status of concrete waste recycling abroad, these wastes that have been reduced below the clearance level through the decontamination process are mainly used for reclamation of nuclear decommissioning sites or recycled as buildings and road aggregates.[1][2]

Scenario 1. Use it as a backfill material for site restoration (restricted use)

This scenario is an option to crush the clearance concrete waste generated when decommissioning the facility and recycle it as a backfill material for restoration of the decommissioning site.

Scenario 2. Manufacture a concrete cell grouting medium in the surface disposal facility (restricted use)

This scenario is an option to crush the clearance concrete waste generated during decommissioning of nuclear power plants and recycle it to produce concrete grout to fix radioactive waste containers in surface disposal cells.

Scenario 3. Clearance concrete is pulverized and use for compaction at industrial construction sites (unrestricted use)

This scenario can be used for a variety of purposes by pulverizing clearance concrete waste generated when decommissioning a nuclear power plant and using it as a floor compaction, landfill, mixture, and roadbed material depending on the degree of crushing at the construction site.

3. Setting evaluation criteria and deriving its importance for recycling scenario evaluation

Various influencing factors are derived to analyze the priorities of clearance waste recycling scenario, which can directly or indirectly affect recycling scenario. Then, the importance of each evaluation criteria is derived using the Fuzzy-AHP methodology. A hierarchical structure is designed as shown in Fig 1. to select a concrete clearance waste recycling option.

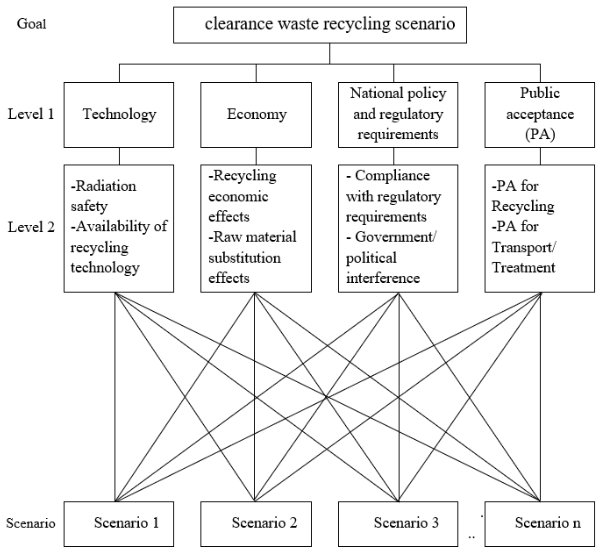

Fig 1. Fuzzy-AHP hierarchical structure of clearance waste recycling scenario

In this study, in order to evaluate the relative importance of the evaluation criteria, a survey is conducted on 21 experts who have been engaged in the nuclear or radioactive waste-related fields more than 5 to 20 years. Table 1 shows the relative importance of each evaluation criteria evaluated by Fuzzy-AHP.

Table 1. Importance of evaluation criteria

Level 1 Criteria		Level 2 Criteria	
Top factors	Importance	Sub-factors	Importance
Technology (incl safety)	0.201	Radiation safety	0.157
		Availability of	0.044

		recycling technology	
Economy	0.112	Recycling economic effects	0.062
		Raw material substitution effects	0.050
National policy and regulatory requirements	0.328	Compliance with regulatory requirements	0.202
		Government/political interference	0.126
Public acceptance (PA)	0.359	PA for Recycling	0.242
		PA for Transport/treatment	0.117
Total	1.000	Total	1.000

4. Optimal recycling scenario for concrete Clearance waste

In order to derive the optimal recycling scenario for concrete clearance waste, another survey is conducted on 10 experts who have been engaged in the nuclear power field for more than 5-20 years. Table 2 shows the results of deriving the priority of the concrete clearance waste recycling scenario using the Fuzzy-AHP methodology.

Table 2. Recycling scenario priority for concrete clearance waste.

Level 2 Criteria	Scenario 1	Scenario 2	Scenario 3
Radiation safety (0.157)	0.330	0.281	0.389
Availability of recycling technology (0.044)	0.352	0.257	0.417
Recycling economic effects (0.062)	0.274	0.294	0.431
Raw material substitution effects (0.050)	0.268	0.276	0.456
Compliance with regulatory requirements (0.202)	0.424	0.283	0.293
Government/political interference (0.126)	0.359	0.350	0.291
PA for Recycling (0.242)	0.345	0.334	0.321
PA for Transport/treatment (0.117)	0.361	0.291	0.348
Evaluation results	0.354	0.304	0.342

5. Conclusions

Through this study, the optimal recycling option of concrete clearance waste is derived by reviewing the various recycling scenario of concrete clearance waste, which generates most frequently when dismantling nuclear power plants.

The priorities of the concrete clearance waste recycling scenario are found to be relatively similar to "Scenario 1: Use it as a backfill material for site restoration (restricted use)" and " Scenario 3: Clearance concrete is pulverized and use for compaction at industrial construction sites (unrestricted use)". This means that concrete clearance waste can be recycled limited and unlimitedly.

Acknowledge

This work was supported by the Korea Institute of Energy Technology Evaluation and Planning (KETEP), granted financial resource from the Ministry of Trade, Industry and Energy (No.20203210100430), Republic of Korea.

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