Scenarios of Effective Treatment Process of Decommissioned Radioactive Metal Waste

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1. Introduction

Radioactive treatment and disposal also requires significant costs. For effective management of decommissioned radioactive waste, the quantity of radioactive waste will be diminished using several selective combinations of decontamination and treatment [1-2]. Such requirement will be fulfilled for the effective management of decommissioned waste.

In this study, the characteristics of decommissioned radioactive waste are investigated. For the safe management and effective treatment of decommissioned radioactive metal waste, selective treatment process scenarios are presented. The results of these scenarios on the decommissioning of radioactive metal waste are also discussed.

2. Scenarios of effective management of decommissioned radioactive metal waste

2.1 Characteristics of decommissioned radioactive waste

Table 1 shows the estimated quantity of decommissioned radioactive waste. Radioactive waste makes up <5% of all waste generated, and non-radioactive waste makes up >95%. According to IAEA data, the types of decommissioned radioactive waste include metal (stainless steel, carbon steel, aluminum, lead, etc.) at about 60%, and concrete (contamination, activation) at about 30%. The remaining decommissioned radioactive waste is combustible waste, waste resin, waste filter, and sludge, at about 10%. Decommissioning radioactive waste per a reactor unit is about A drums.

Table1. Estimated Quantity of Decommissioned Radioactive Waste

Nuclear Installation (country)	Reactor Type	Output Power [MWe]	Radioactive Waste Amount[t]	Non-Radioactive Waste Amount[t]
Barseback1 (Sweden)	BWR	600	5370	177310
Rinhals 3 (Sweden)	PWR	1000	5260	207860
Tokai 1 (Japan)	GCR	160	18200	174000

2.2 Scenarios of effective treatment of decommissioned radioactive metal waste

2.2.1 Estimated quantity of decommissioning metal waste. If the amount of decommissioned radioactive metal waste generated from the decommissioning of a nuclear power plant is about 0.6A(0.6 X A) drums and (A=A1+A2+A3) drums, all decommissioned metal waste is as follows to be classified according the characteristics of contamination, and shape of the decommissioned metal waste. The amount of plate type radioactive metal waste is about (0.6A1drums). The amount of curved/cracked type radioactive metal waste is about (0.6A2drums). The amount of activated type radioactive metal waste is about (0.6A3drums).

2.2.2 Scenarios of treatment process of decommissioning radioactive metal waste. Fig. 1 shows several selective treatment processes of decommissioned radioactive metal waste. By performing a surface decontamination process on plate type decommissioning radioactive metal waste, they will be reused by 0.6A1 drums according to the tolerance concentration of self-disposal under completion of surface decontamination. By conducting an ultra-high compression process on the activated decommissioning radioactive metal waste, the quantity of the activated decommissioning radioactive metal waste will be reduced by (1/7 X

0.6A3)drums. By melting the curved/cracked type decommissioning radioactive metal waste, a large ingot will be created and a small amount of slag will be created. Fig. 2 shows the scenarios of the melting process of decommissioned radioactive metal waste. When the curved/cracked type decommissioning radioactive metal waste (0.6A2drums) and additive are melted according to the melting temperature of the material, a large ingot and a small amount of slag are also created by (0.6 X 0.95A2)drums, (0.6 X 0.05A2)drums respectively [1-2].

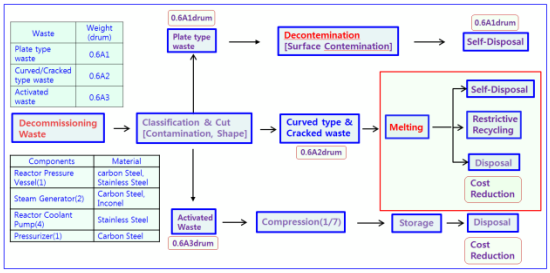

Fig. 1. Scenarios of Treatment Process of Decommissioned Radioactive Metal Waste.

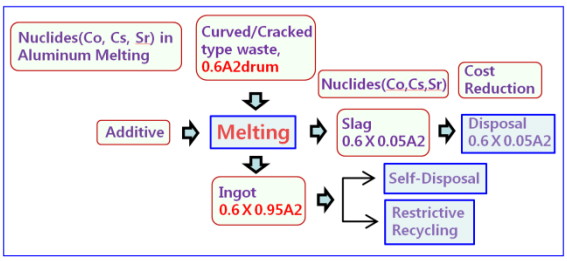

Fig. 2. Scenarios of Melting Process of Decommissioned Radioactive Metal Waste.

2.3 Result and Discussion

Table 2 shows the results of the treatment process scenarios of decommissioned radioactive metal waste. If the amount of decommissioned radioactive metal waste generated from the decommissioning of a nuclear power plant is about 0.6A drums, the amount of decommissioned radioactive metal waste is to be reduced by about (0.6 X 0.05A2+1/7 X 0.6A3)drums using several selective treatment processes. The ingot is to be reused or recycled by (0.6 X A1+0.6 X 0.95A2) drums based on the tolerance concentration of self-disposal. The slag is to be disposal of according to the disposal requirements.

Table 2. Results of the Scenarios of Treatment Process of Decommissioned Radioactive Metal Waste

Waste	Weight (Drum)	Treatment Process	Result
Plate Type Waste	0.6A1	Surface Decontamination	Self-Disposal:0.6A1*
Curved/ Cracked Type Waste	0.6A2	Melting	Ingot:0.6 X 0.95A2** Slag:0.6 X 0.05A2**
Activated Waste	0.6A3	Compression	Volume Reduction Ratio(1/7): 1/7 X 0.6A3***
Total	0.6A		Self-disposal + Restrictive Recycling:(0.6 X A1+0.6 X 0.95A2) Disposal:(0.6 X 0.05A2+1/7 X 0.6A3)

* condition: completion of surface decontamination

** ref(1), ref(2)

*** application of an ultra-high compression

3. Conclusion

Scenarios for the effective treatment of decommissioned radioactive metal waste are to be conducted and discussed. If the amount of decommissioned radioactive metal waste generated from the decommissioning of a nuclear power plant is about 0.6A drums, all decommissioned radioactive metal waste is to be reduced by about (0.6 X 0.05A2+1/7 X 0.6A3) drums using several selective treatment processes.

Acknowledgement

This work is supported by the Ministry of Science and ICT(No. 2017M2A8A5015143) of the Republic of Korea.

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