

Generation Characterization of Metal Wastes During the Decommissioning of PWR NPPs

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1. Introduction

Kori Unit 1, which was decided to be permanently shut down, will be decommissioned after approval of the final decommissioning report. During the decommissioning of nuclear power plants, various kinds of radioactive waste such as metal, concrete, and soil will be generated in a short period of time. A lot of research has been done in Korea, such as metal decontamination, which is an essential technology of nuclear power plant decommissioning. However, there is not so many researches on the utilization of metal waste that is expected to occur in large quantities during decommissioning. It is necessary to investigate the generation characterization of radioactive wastes during the decommissioning of PWR NPPs. Therefore, the status of metal wastes generated during the decommissioning of nuclear power plants will be discussed and the strategy of volume reduction of radioactive wastes during decommissioning of Kori Unit 1.

2. Status of radioactive metal wastes generated by the decommissioning

2.1 Radioactive wastes generated during the decommissioning (Foreign status)

The IAEA has predicted the amount of metal waste during decommissioning of PWR nuclear power plant (900 ~ 1,300 MWe) [1]. The amount of radioactive metal waste was generated about 58.87% of the total radioactive waste during decommissioning of NPPs.

Table 1. Estimated waste generated by decommissioning

Kinds	Generation (ton)	Share(%)
Activated metal	650	10.48
Activated concrete	300	4.84
Radioactive metal	3650	58.87
Radioactive concrete	600	9.68
Dry Active Waste	1000	16.13
Total	6200	100

In most countries, radioactive metal wastes are subject to do clearance, restricted release or disposal in accordance with national regulatory standards. The amount of radioactive metal waste generated in the US, PWR reference nuclear power plants were estimated to be 32,731 ton/ GWe for the carbon steel and 2,080 ton/GWe for the stainless steel.

The amount of radioactive waste generated by decommissioning one PWR nuclear power plant in Japan is about 2,690 to 5960 tons from 500MWe to 1100MWe. Converting these amounts into a drum, it is estimated that 12,400 ~ 31,000 drums will be generated when the weight of waste per 200 drums are assumed to be about 200 ~ 500kg. The EdF, an electric power company in France, estimates that the amount of decommissioned radioactive waste was generated about 17,100 m³ at the time of decommissioning of one nuclear power plant [2].

2.2 Estimation of radioactive metal waste generation during decommissioning of Kori Unit 1

The amount of radioactive metal waste generated in the decommissioning of Kori Unit 1 was estimated [3]. Generation of radioactive metal waste was 11,253 m³. It is assumed to be 56,265 drums (200L)

when the wastes generated are cut in suitable scale. After the melting of radioactive metal waste by induction method, the amount of radioactive waste generated can be reduced to 571 m³ which is estimated as 2855 drums (200L) as volume reduction ratio is applied to 5%.as shown in Table 2. After radiological Assessment, if some metal will be applied to unrestricted release or reuse in controlled area, the disposal amount of metal waste will be more reduced (Fig. 1).

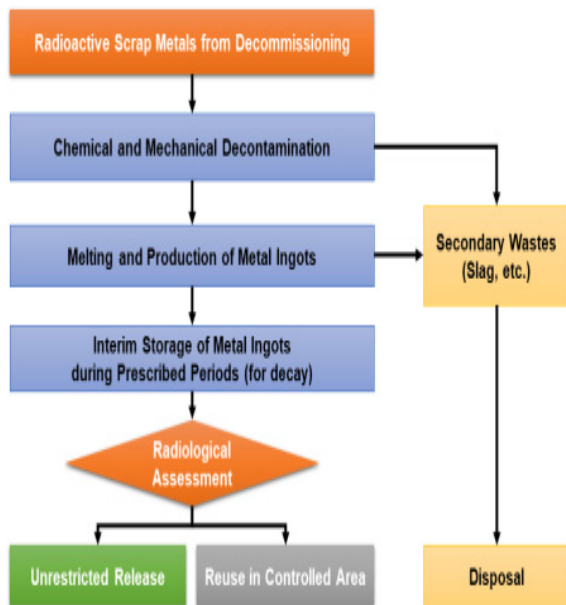


Fig. 1. VLLW and LLW radioactive metal waste treatment strategies.

Table 2. Estimation of radioactive metal waste quantity during induction heating melting and metal recycling

Level	Kinds	Waste Volume(m ³) (200 L drum EA)	
		Initial ⁽¹⁾	After melting ⁽²⁾
ILW ¹⁾	Small metals ¹⁾	8	8
	Large device	832	42
	RVI	199	10
LLW	Small metals	3,416	171
	SF storage rack	490	25
	Total	4,937	248
VLLW	Small metals	6,308	315
	Total	6,308	315
Total radioactive Waste		11,253 (56,265)	571 (2855)

1) Data from Reference [3]

2) 5% reduction of initial volume after induction melting

3. Conclusion

In the case of Kori Unit 1, the amount of metal radioactive waste was estimated to be 11,253 m³. It is expected that metal radioactive waste will be significantly reduced through decontamination and melting process. In order to achieve this, it is necessary to further investigate the melting characteristics of target metal and the distribution of the radionuclide.

REFERENCES

- [1] IAEA, Managing Low Radioactivity Material from the Decommissioning of Nuclear Facilities, Technical Report Series No. 462 (2008).
- [2] Project PENLY 3, Mieux Comprendre Les Enjeux du Nucleaire (2010).
- [3] Evaluation of Decommissioning Source Terms and Wastes for the Pressurized Water Nuclear Power Plant and Heavy Nuclear Power Plant, KEPSCO E&C Report (2016).