Management and Treatment for Decommissioned Combustible and Metallic Waste of Nuclear Research Facilities

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1. Introduction

Many nuclear facilities including NPP will be shut down and decommissioned in the near future. A commercial nuclear power plant will produce 40,000 to 50,000 tons of metal waste during decommissioning. Contaminated metallic waste represents a considerable storage volume as well as significant cost since it must be maintained and monitored indefinitely in secure storage. The high cost of either disposal or storage requires that the volume of material be minimized. In Korea, research reactors (TRIGA MARK II, III) have been decommissioned since 1997. A large amount of radioactively contaminated metal waste is currently produced, and will continue to be generated during decommissioning and available decontamination. The decommissioning project of the TRIGA MARK II and a uranium conversion plant (UCP) at KAERI has been completely finished. The decommission project of TRIGA MARK III has been under way. By the decommissioning of the TRIGA MARK II, radioactive metal waste of more than 200 tons was generated among the total 2,200 tons of waste, such as concrete waste, soil, combustible and non combustible waste. In the case of UCP radioactive metal waste, approximately 200 tons was generated during the decommissioning project [1]. A proven melting technology is currently used for low-level waste (LLW) at several facilities worldwide [2,3,4]. These facilities use melting as a means of processing LLW for unrestricted release of the metal or for recycling within the nuclear sector

2. Description of facility

2.1 Incineration facility

Fig. 1 shows the development status of incineration facility.

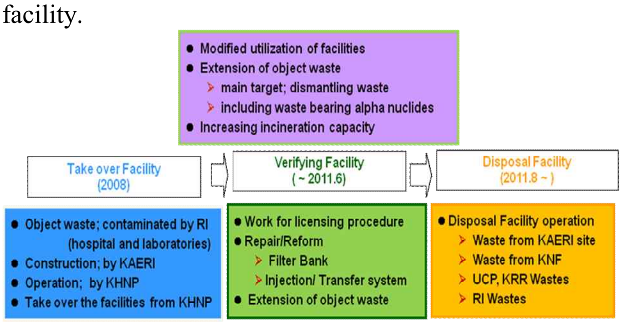

Fig. 1. Incineration facility history and status

Fig. 2 shows the schematic diagram of the oxygen-enriched incineration (OEI). The oxygen-enriched incinerator located at the KAERI. Incineration facility modified and extended to object waste including waste bearing alpha nuclide and increase incineration capacity. During the verifying facility, the filter bank, the injection and transfer system was repaired. Incineration facility consists of combustion chamber, off gas treatment process, monitoring system in stack such as carbon monoxide, Hydrogen chloride and SOx, NOx and dust. Radiation protection system and TELE Monitoring System (TMS) was installed in stack.

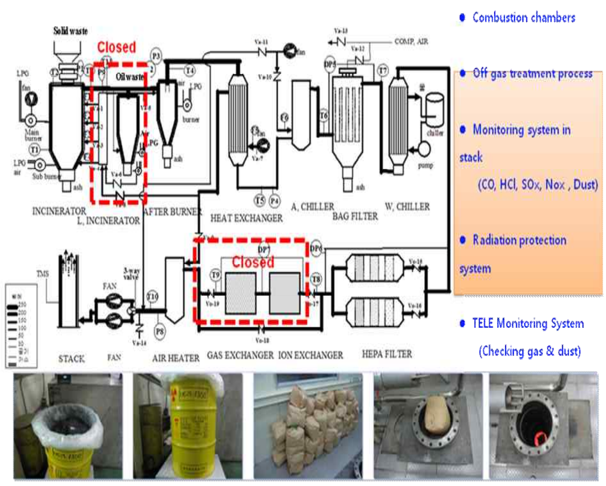

Fig. 2. Schematic diagram of the incineration facility

By last month, decommissioned combustible waste was incineration about 7 tons (166 drum). The total weight reduction ratio and volume reduction radio is 1/10, 1/50 respectively

2.2 Melting facility

The melt decontamination technology is the most effective treatment method for decommissioned metal waste. Melting for size reduction would require no prior surface decontamination and very little sorting of the waste material. Also, the recycling or volume reduction of the metallic wastes through the melt decontamination technologies has merits from the view point of an increase in resource recycling as well as a decrease in the amount of waste to be disposed of resulting in a reduction of the disposal cost and an enhancement of the disposal safety. **Fig.3** shows the development status of melt decontamination. As part of fundamental study, basic test performed with radionuclides distribution and characteristic melt decontamination. This study is concerned with the nuclides distribution into the slag, ingot and dust phase and homogeneity such as Co, Cs, Sr, and U. The bench scale facilities capacity is 10kg per batch and batch time are 2 hours. This bench scale study's purpose is verification of homogeneity, obtaining the operation skill and data for scale-up and license.

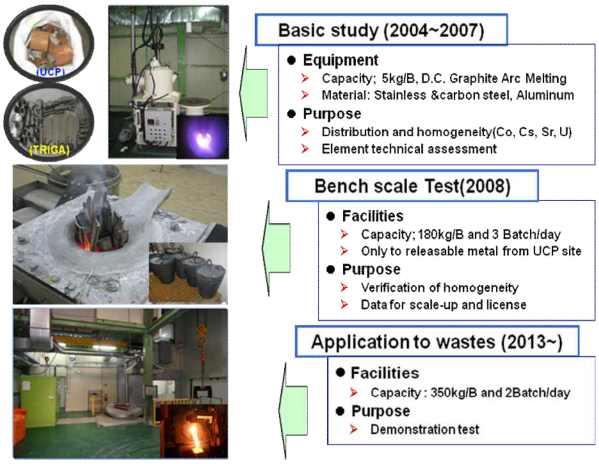

Fig. 3. Development status of melt decontamination

After this study, first, we applied to melt metal wastes generated at UCP that is only to releasable metal. Capacity is 180kg/batch and 3 batch per day. **Fig. 4** shows the homogeneity of radionuclides for 180kg/b scale.

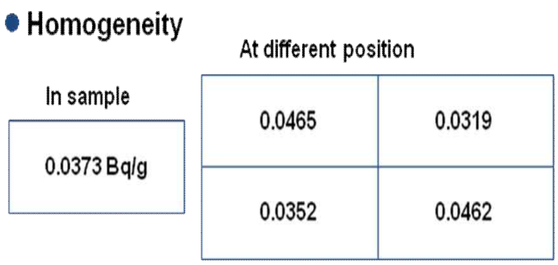

Fig. 4. Homogeneity of radionuclide (180kg/B, UCP)

Slag activity is 12 Bq/g. Radioactivity of ingot is less than 0.09 Bq/g. The radioactivity of ingot sample is 0.0373 Bq/g and different position radioactivity is 0.0465 Bq/g, 0.0319 Bq/g, 0.0352 Bq/g and 0.0462 Bq/g, respectively. This figure shows well homogeneous in ingot. The majority of radioactivity in ingot is between 0.03 Bq/g and 0.05 Bq/g. The commercial demonstration facility is remodeling of a vitrification demonstration facility and capacity is 350kg/B and 3Batch per day. From this year May, KAEI submit application for permit to KINS. Finally, KAERI achieved the permit license from KINS. **Fig. 5** shows the conceptual diagram of demonstration melting facility. The capacity is 350 kg/batch and 3batch per day. Melt facility consist of four system such as preparation system, melting system, ingot treatment, and off-gas treatment system.

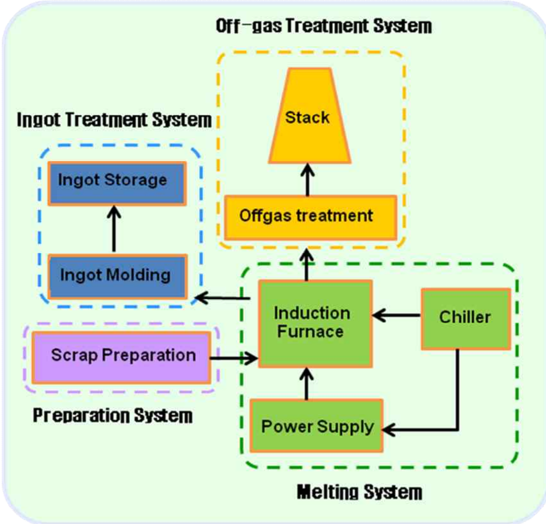

Fig. 5. Conceptual diagram of demonstration facility

3. Conclusions

The combustible waste generated from UCP has been incineration by incinerator from last year. Decommissioned combustible waste generated from KRR will be incineration. In case of KRR metal waste, we just releasable metal waste will be melt for self-disposal and volume reduction by induction furnace. Combustible wastes were treated by incinerator and ash dispose permanently site. In case of metal wastes is treated by induction furnace and slag dispose permanently site and ingot will reuse.

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