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Original

Comprehensive Comparison of Treatments and Disposal Methods of Radioactively Contaminated Materials from the Accident of Fukushima Daiichi Nuclear Power Station: Part I. Development of Evaluation Methods for the Volume Reduction Process to Incineration Residue Including Thermal Treatment and Ash Washing

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Summary

Among the waste and removed soil, which were contaminated by radio-cesium from the accident of Fukushima Daiichi Nuclear Power Station, incineration residue produced from temporary incinerators in the Special Decontamination Area is scheduled to be treated in Volume Reduction Facilities from March of 2020, where thermal treatment to evaporate and concentrate radio-cesium is performed. The main product of thermal treatment is molten slag with a limited concentration of radiation and is planned to be reused. The by-product is highly radioactive fly ash and various researches have been made for its treatment. However, since the final disposal method is not decided yet, it is necessary to compare and evaluate quantitatively the mass / volume and radioactivity of the products, in order to study the effect of further volume reduction and the suitable treatment methods.

Therefore, a calculation method for the mass balance of volume reduction process was developed and some trial calculations were made. For example, feeding 460,000 tons of incineration residue with 33,000 Bq/kg and using operation parameters obtained from literature investigation, 960 tons of disposal waste with 15 million Bq/kg was produced, which was 1/500 of mass reduction. Further mass reduction may be expected if higher performance adsorbent is used. As for lower radioactive materials, 560,000 tons of molten slag with 1,400 Bq/kg from thermal treatment, 20,000 tons of washing residue with 36,000 Bq/kg from washing treatment, and 580,000 tons of wastewater with 260 Bq/L from adsorption treatment were produced. When the target radioactivity was set as 8,000 Bq/kg to washing residue and 90 Bq/L to waste water, the required cesium elution percent and cesium adsorption percent were 99% and 99.6% respectively.

Key Words: Cesium, Incineration residue, Volume reduction, Mass balance, Thermal treatment, Adsorption