Discussion on Non-fuel Waste Treatment in Connection With Dismantlement of Kori Unit 1

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1. Introduction

The decommissioning of Kori unit 1 is approaching. In order to dismantle, not only the spent fuel stored in the spent fuel pool but also the non-fuel wastes should be managed. The non-fuel wastes refer to non-spent fuel, and waste control rods, thimble plug, in-core instruments, neutron sources, burnable poison rod assembly and other foreign materials are typically used in nuclear reactors.

Most non-fuel wastes are wastes that have been inserted into reactor internal structures and fuel assemblies during operation and replaced due to mechanical lifetimes and defects.

It is anticipated that some activation will occur during reactor output, and unlike other radioactive waste treatment before waste treatment, it is necessary to prepare the treatment method in advance.

This paper describes the characteristics of non - fuel wastes and discusses the treatment methods associated with the dismantlement of Kori unit 1

2. Non-fuel wastes

Types of the non-fuel wastes include components inserted into nuclear fuel assemblies, such as control rods, thimble plug, neutron sources, in-core instruments, burnable poison rod assembly, dummy fuels and other foreign materials.

2.1 Control rod

It is inserted into the nuclear fuel assembly to control core reactivity or to stop the reactor, and its lifetime is 10-15 EFPY (Effective Full Power Year) depending on the row type / production year.

Table 1. Control Rod's Characteristic

Division	Material	Absorber
WH type	STS304	Ag-In-Cd

2.2 Thimble plug (TP)

It serves to reduce the bypass flow of the core by blocking the control rod guide of the nuclear fuel assembly without the control rod inserted. Its lifetime is 12EFPY, and material is STS304.

2.3 Neutron Source

The neutron flux is injected into the fuel to observe the core state during low periods, and the design life is 10 years and includes Cf-252 in the source.

2.4 In-core Instrument (ICI)

The neutron flux distribution of the core is measured by moving the inside of the core or loading in into the core if necessary. It's covered with stainless steel.

2.5 Burnable Poison Rod Assembly (BPRA)

The BPRA suppresses excess reactivity and limits the excessive boron concentration. Also, the radial power distribution is flattened. B-10 is used as the neutron absorber in the BPRA.

2.6 Dummy fuel

Used for pretesting of the crane handling nuclear fuel assemblies, not a radioactive device that is not inserted into the actual core.

2.7 Other foreign material

Foreign materials are found in the primary system or in the spent fuel pool.

3. Non-fuel waste treatment

3.1 Overseas case of the Non-Fuel Waste Treatment

Abroad does not have a special disposal method. Like the rest of the country, most of the waste control rods are stored in the spent pool.

In the case of the in-core instruments, it is also stored in the spent fuel pool, or it may be partially cut and dried and stored and managed in a shielded container.

This can be considered as the availability of the storage space due to the uncertain state of the spent fuel disposal facility or the intermediate storage of spent fuel in the site.

3.2 Non-Fuel Waste Treatment Plan

Most of the non-fuel wastes are kept in the storage tank because there is no suitable radiation storage container suitable for irradiated radioactive waste. But to remove it

First, an assessment of the radioactive emissions of non-fuel wastes should be undertaken. The maximum output at the time they were inserted into the core for combustion evaluation, the fuel burn rate of the zone, and the output should be investigated. Hysterical investigation of a reliable insert will be the most basic procedure of the activation analysis.

Based on this, it is necessary to perform radioactivity and dose assessment using MCNP or McCARD computer codes.

Second, based on the evaluation results, the non-fuel wastes should be classified according to dose and nuclide.

1) Waste that is below the standard value in intermediate and low level waste disposal facilities

2) Low to intermediate level waste disposal facility waste above standard level

Third, the sorted waste is cut and packed. Packaging containers should be developed to package the remainder, except for the wastes that can be brought into the intermediate and low level waste disposal facility.

There is also a method to develop in connection with research projects related to the treatment of radioactive waste generated in the reactor vessel and reactor internal structure of Kori unit 1.

In addition, a space for intermediate storage of radioactive waste in the site should be prepared separately.

4. Conclusion

This paper briefly describes the types of the non-fuel wastes in the spent fuel pool and the treatment methods associated with the dismantlement of Kori unit 1.

Considering the dismantlement of Kori unit 1 and the point of saturation of the spent fuel pool, treatment techniques for the non-fuel wastes should be developed and studied.

We will be able to develop a safe treatment method by making good use of the dismantlement technology currently being studied.

If the developed non-fuel wastes treatment method is applied and used in the reactor, it will be possible to treat / dispose of the continuous control rod and in-core instrument, and it will become easier to manage the spent fuel pool.

REFERENCES

[1] Utilization of lecture materials in KHNP Human Resource Development Institute.[Course : Core Management General].