Phase: **Preparation**

Decommissioning Process **"Processing/Disposal/Environment Remediation (including Wastes containing Alpha Nuclides originating from Fuels)"**
Investigation Subject **"Characterization2"**
Issue **"Material accountancy"**

Needs

1. Establishing a reasonable material accountancy policy for fuel debris and nuclear fuel materials

Characterization for rational waste management：【Mid】

Desired state and reasons for it

- It is desirable to develop a technology necessary to analyze and estimate the properties of fuel debris, etc., with the aim of contributing to the development of methods for removing fuel debris and in-core structures, fuel debris storage, transfer, and storage technologies, etc.
- Since it is not possible to apply the usual material accountancy methods to fuel debris, it is desirable to have material accountancy methods suitable for fuel debris and waste, referring to past examples of similar accidents.
- It is desirable to investigate how the current methods and concepts can be rationalized, considering the data obtained from the fuel debris and waste management point of view.

Development of technologies required to understand the properties of fuel debris

- It is desirable to develop a technique to analyze fuel debris samples planned to be collected during the experimental retrieval in Unit 2 and sediment samples collected during the investigation inside the PCV by the underwater ROV in Unit 1.
- It is desirable to reduce the burden of transporting samples to the hot laboratory facility when the amount of fuel debris to be removed increases in the future.

Development of nondestructive measurement techniques for sorting

- It is important to target the amount of nuclear fuel in the fuel debris because sample analysis of fuel debris can only determine the properties of a small portion of the fuel debris extracted.
- The analysis involves the risk of contamination spread and internal exposure. Therefore, it is aimed to measure the radiation emitted or transmitted from the object while it is sealed in a container, and to determine the amount of nuclear fuel quickly without destroying the object.

Current state against ideal

Development of technologies required to understand the properties of fuel debris

- The fuel debris samples planned to be collected during the experimental removal of Unit 2 and the sediment samples collected during the PCV internal investigation by the underwater ROV of Unit 1 will be analyzed at the hot laboratory facility. There is a plan to conduct structural analysis and X-ray CT imaging using the fuel debris from the accident at Three Mile Island Nuclear Power Plant Unit 2 to confirm comparative data with the fuel debris from the Fukushima Daiichi NPP.
- Focusing on the damage to the RPV, accident progression analysis, material melting tests, and evaluation of melt migration behavior are being conducted, and a simple analysis technique is being developed to quickly confirm the presence or absence of fuel components.

Development of non-destructive measurement techniques for sorting

- Fuel debris contains a heterogeneous mixture of many nuclides and elements, including neutron absorbers, which may interfere with measurements, including voids. The effects of these impediments are being evaluated by extensive simulation analysis for fuel debris of various possible compositions. Important points are planned to be confirmed by tests using existing test equipment. Based on these results, conceptual design of equipment and sorting scenarios are being studied..

Issues to be resolved

- Since it is not practical to analyze the entire amount of fuel debris and wastes, it is necessary to have a models and measures for estimating the entire inventory, etc. from the sampling results.
- Since exposure to work during actual weighing is a critical problem, it is necessary to establish measures based on a rational judgment of safety and cost during the work.
- Quantification of α-nuclides is a very important item to be implemented when considering disposal methods, so it is necessary to develop a basic technology to support it.

Relevant Issues

- SFP-301 “SF removal”
- FDR-201 “Sorting fuel debris and radioactive waste”
- DRB-301 “Removing in-core structures and dismantling buildings”
- PDR-205 “Verification and analysis method on waste body”
- BST-003 “Measurement and analysis technology”