Phase: **Preparation**

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

Needs

1. Streamlining the downstream processes (transport, storing, processing, and disposal) considering characterization results

Desired state and reasons for it

- It is desirable to establish a method for evaluating the radioactivity concentration of previously generated rubbles, etc. (including incinerated ash and slag), and to conduct appropriate storing and management based on the concentration.
- Considering the results of characterization, it is desirable that feedback should be provided to rationalize the methods of transport, storing, processing, and disposal. In this case, it is desirable to perform comprehensive rationalization considering not only the properties of individual wastes, but also on the entire waste generated from the 1F decommissioning.
- With progress in understanding the properties of fuel debris, it is desirable to clarify issues and accumulate basic knowledge for disposal of fuel debris(fuel debris, metal debris, surrounding deposits, etc.), in correspondence with the current disposal policy.
- Of the entire management of solid waste, the flow of integrated measures for individual solid wastes, from characterization to reuse and disposal, should be evaluated, and a draft of individual waste stream option plans that are recognized to be safe and feasible should be accumulated. Subsequently, it is desirable to establish an overall waste stream by bundling all the individual waste stream option plans.

Current state against ideal

- TEPCO's storage management plan calls for the storage of secondary water treatment waste in the building, with priority given to the adsorption tower that contains large amounts of radioactive waste.
- For the secondary waste generated from contaminated water treatment, a large waste storage facility is under construction as a storage facility for adsorption towers and the like. In addition, implementation of stabilization (dehydration) process of the ALPS slurry generated from the multi-nuclide removal system, etc., which has high water content rate and is fluid, will be investigated, and the sludge from the decontamination system will be transferred to a storing facility on higher ground (collection to be started in FY2027).
- Considering the radiation effects of the slurry, the transfer of slurry from the HIC, whose integrity cannot be confirmed in the event of a fall, is being conducted with the aim of completing the transfer before the start of operation of the slurry stabilization treatment facility.
- At the Radioactive Material Analysis and Research Facility Laboratory1, a demonstration to use analytical methods to obtain data easily and quickly as a standard analytical method was completed in FY2023, with full-scale operations beginning in FY2024.

- In order to obtain analytical data on high-dose waste, adsorbent material from cesium adsorption vessel (KURION and SARRY) was collected at the Fukushima Daiichi Nuclear Power Plant site for which analysis results for some samples of the adsorbent material have been obtained.
- As a countermeasure against hydrogen generation during storage of high-dose waste, factors(hydrogen embrittlement, radiation degradation, etc.) affecting filter degradation (blockage, damage, etc.) and methods to confirm these factors have been investigated.
- In terms of treatment, the feasibility of applying low-temperature treatment technology to actual equipment has been confirmed through full-scale tests. In addition, methods for testing solidification feasibility and evaluating the stability (leaching characteristics, long-term alteration phenomena, radiation effects, etc.) of solidified products produced by various treatment technologies are being studied. In addition, in order to contribute to expansion of the technology options such as the expansion of the scope of application, for pyrolysis treatment, which is being investigated as a candidate for intermediate treatment technology, basic tests of pyrolysis have confirmed wastes with a large weight reduction rate that can be mineralized, full-scale tests have confirmed its applicability, and efforts are being made to stabilize the generated treatment residues.
- Regarding disposal, the key scenarios that could have a significant impact on the feasibility of radioactive waste disposal are being identified, and the needs for disposal concepts are being identified based on the key scenarios and other information. In addition, the establishment and improvement of draft disposal concept options is carried out as a measure to respond to these needs, using the safety assessment technology proceeded to be advanced and overseas and domestic knowledges, etc. Furthermore, the scope of these draft disposal concept options is being broadened and a draft disposal concept option that encompasses the entire radioactive waste at the Fukushima Daiichi Nuclear Power Station is investigated, and in conjunction with insights obtained in areas outside disposal—such as the precision required for characterization and the targets for waste form performance, it is proceeded to expand the draft disposal concept options and enhance the evidences indicating their feasibility.

Issues to be resolved

- It is necessary to establish analytical methods for transitioning to control of radioactivity concentration.
- It is necessary to establish a system that enables smooth sharing of information on the results of characterization and the requirements in each process so that feedback can be provided to transport, storing, processing, and disposal.
- It is necessary to clarify the specifications of containers for transport and storing and the requirements for the processing and disposal method according to each property of the waste to be characterized.
- The downstream requirements need to be organized and reflected in the characterization of the properties.
- It is necessary to investigate the installation of storage facilities for secondary waste generated from contaminated water treatment.
- It is necessary to investigate facility design and scenarios for storage in the building considering the results of characterization.
- While accumulating analytical data and improving inventory assessments, it is required to reflect waste countermeasures with a view to processing and disposal. It is also necessary to take measures according to the characteristics of various types of waste, such as rubbles, secondary waste generated from contaminated water treatment, and waste generated from fuel debris retrieval.

- Storage and management are required according to risks such as radioactivity concentration and properties. In addition, it is important to review the measurement items and timing of the monitoring of storage and management status from the viewpoint of providing feedback for understanding the properties of the waste.
- It is necessary to evaluate the characteristics of individual waste stream option plans that have been recognized as safe and feasible through repeated investigations with mutual feedback of research outcomes from each field, and to accumulate individual waste stream option plans using the properties data, etc. that are becoming clear. In addition, through these studies, it is important to identify and organize R&D issues in each field and issues related to solid waste management, etc.

2. Streamlining the upstream processes (retrieval, dismantling, sorting, etc.) considering the characterization results

Desired state and reasons for it

- Considering the characterization results, it is desirable after investigating transport, storing, processing, and disposal, the feedback should be provided to rationalize retrieval, dismantling, and sorting methods. In this case, it is desirable to conduct comprehensive rationalization considering not only the properties of individual wastes, but also the entire waste generated in the 1F decommissioning.
- As for the feedback on the streamlining of the retrieval, dismantling, and segregation methods, it is desirable to conduct investigation of clearance-based scenarios, investigation considering establishment of a measurement method, and develop a strategy for confirming the possibility of clearance and the applicability of conventional classifications.
- With progress in understanding the properties of fuel debris, it is desirable to clarify issues and accumulate basic knowledge regarding the understanding the properties of fuel debris, etc. (fuel debris, metal debris, surrounding sediments, etc.) and their sorting.
- It is desirable to comprehensively consider waste management, including fuel debris removal, whose objective is to reduce the final exposure risk to an acceptable level.

Current state against ideal

- In addition to the information on the basement floor obtained by the underwater ROV survey by FY2023 as part of the PCV internal investigation at the Unit 1, an PCV internal investigation (a section in the air) was conducted from February to March 2024, mainly in the first floor area, resulting in obtaining information on the condition of the existing structure outside and inside the pedestal, and video images related to deposits, fallen objects, etc.

Issues to be resolved

- Since the properties of the waste generated may vary and the quantity may be large, depending on the method of fuel debris retrieval, dismantling, and sorting, it is necessary to understand the properties and the quantity of the wastes.
- After understanding the properties of the waste generated depending on the method of fuel debris retrieval, dismantling, and sorting, it is necessary to rationally judge the cost and work required for the downstream processes (transport, storing, processing, and disposal) for each waste, which is feedbacked to the methods and systems of fuel debris retrieval and dismantling.

- For example, it is desirable that processing and disposal side of secondary waste generated from contaminated water treatment should provide requirements and notes to the fuel debris retrieval side.
- From a cost perspective, it is desirable to have a water treatment technology that has a proven track record (the ease of characterization and processing of secondary waste generated from contaminated water treatment) and is inexpensive.
- If necessary, information obtained from PCV internal investigation, etc., should be reflected into future investigation on a method.

Relevant Issues

- CWM-301 "Efficient and effective water treatment"
- SFP-301 "SF removal"
- FDR-201 "Sorting fuel debris and radioactive waste"
- FDR-301 "Fuel debris retrieval inside PCV"
- FDR-302 "Fuel debris retrieval inside RPV"
- DRB-301 "Removing in-core structures and dismantling buildings"
- PDR-202 "Waste conditioning method"
- PDR-203 "Establishing disposal concept"
- PDR-301 "Waste volume reduction by clearance"