Phase: **Design**

Decommissioning Process **"Processing/Disposal/Environment Remediation (including Wastes containing Alpha Nuclides originating from Fuels)"**
Investigation Subject **"Disposal concept"**
Issue **"Establishing disposal concept"**

Needs

1. Clarifying the disposal concept

Desired state and reasons for it

- In order to improve the safety, efficiency, reliability and economic efficiency of accident waste disposal, it is desirable to clarify the disposal concept of accident waste that have different properties from existing wastes.
- In order to enhance the reliability of the disposal concept, it is desired to evaluate the feasibility of the disposal concept based on the investigation of the long-term transition behavior of the disposal facility considering the characteristics of solid waste, which should be reflected into the investigation of disposal concept.

Current state against ideal

- Critical scenarios that could have a significant impact on the feasibility of radioactive waste disposal have been identified, and the needs for disposal concepts are being grasped based on the critical scenarios and other information. Additionally, 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 progress of decommissioning as well as 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.
- As a countermeasure to these needs, a disposal concept option has been established and the technology for the establishment of the disposal concept option has been advanced. Safety assessments have also been conducted to develop Waste Acceptance Criteria (WAC) to ensure the safe management and disposal of radioactive waste, though these assessments anticipate significant conservatism.

Issues to be resolved

- Radioactive wastes are disposed of by either geological disposal, intermediate depth disposal, or near surface disposal (pit or trench) and each concept of these disposal methods has been established.
- Compared with existing wastes, accident waste has features such as large amount, different nuclide compositions, uncertainties in nuclide composition, and uncertainties in waste package performance, etc. Considering them, it is necessary to clarify whether, from a technological and

economic perspective, the existing disposal concept can be applied as it is, it is necessary to add something, it is required to have a completely new disposal concept, there is a more desirable disposal concept and what it is like.

- For example, as decommissioning progresses, there are economic issues for the disposal of the massive volumes of water treatment secondary waste and rubbles due to the need for large amount of buffering materials. To establish new disposal concept, it is essential not only to verify isolation performance but also to evaluate the economic advantages relative to existing disposal concepts.
- At the same time, it is necessary to clarify issues related to the application of the current legal system and identify improvement proposals.
- In order to enhance the reliability of the disposal concept, the feasibility of the concept will be evaluated based on a study of the long-term transition behavior of the disposal facility, and reflected in the investigation of disposition concepts, including the development of the WAC. Since such evaluation will lead to the selection of treatment methods, it is necessary to assess safety under more realistic conditions to avoid overly conservative assessments that lead to the selection of excessive treatment methods.
- For example, with regard to the waste body, use of AAM or cement-based solidification materials could be considered, though the current setup is conservative since no nuclide confinement function other than sorption is considered, and furthermore, the sorption function is also a setup where considerable conservatism is anticipated. As a result, the safety assessment is based on the large contribution of easily movable nuclides such as iodine-129 and carbon-14, and a treatment method that guarantees a severe level of WAC for these nuclides has to be selected. It is necessary to investigate more realistic and reasonable safety assessment scenarios that also take into account the selection of treatment methods.
- In order to appropriately assign waste to a disposal concept that has been shown to be feasible, it is important to expand knowledge of the sensitivity structure of these scenarios and parameters to dose and to present safe and reasonable disposal option proposals through repeated trials in which the characteristics of the waste, changes in environmental conditions in and around the disposal facility, and other factors are appropriately reflected in the scenarios and parameters of dose assessment.
- Furthermore, it is necessary to broaden the scope of the waste stream to reflect this disposal option, to examine a set of disposal options that encompass the entire solid waste of the Fukushima Daiichi Nuclear Power Plant, and to contribute to the overall consideration of appropriate measures for the specific management of solid waste in conjunction with knowledge obtained in areas other than disposal, such as the accuracy required for characterization and the presentation of waste body performance targets.
- It is anticipated that an investigation of fuel debris treatment methods will be conducted in the future. Since the disposal concept of fuel debris is closely related to the treatment method, it should be investigated together with the treatment methods.

Relevant Issues

- PDR-101 “Characterization”
- PDR-102 “Waste strategy”
- PDR-201 “Reuse and volume reduction”
- PDR-202 “Waste conditioning method”
- PDR-204 “Performance assessment”
- PDR-302 “Disposal technology according to disposal concept”
- BST-006 “Risk assessment”