

**Decommissioning Process “Transport/Storing/Storage (including Wastes containing Alpha Nuclides originating from Fuels)”**Investigation Subject **“Maintaining stabilized condition”**Issue **“Understanding the behavior of hydrogen generation”**

## Needs

### 1. Managing hydrogen gas generated in the fuel debris storage canisters and controlling the corrosion resistance

Transport/Storing/Storage : [Short]

#### Desired state and reasons for it

- It is desirable to understand what physical phenomena (e.g., radiolysis of coolant) produce hydrogen in the storage canister. In addition, under complex conditions (reaction field, irradiation field) that are scientifically unexplained, a deeper scientific elucidation of the mechanism is desirable for regulatory compliance.
- It is desirable that event progression scenarios from hydrogen generation to combustion are comprehensively investigated, and management policies and facilities based on these scenarios are defined. In addition, it is desirable to have an evaluation model or experimental findings that can evaluate the effectiveness of the management policies and facilities investigated in preventing hydrogen combustion.
- In order to achieve enclosure and stable storing, measures against hydrogen generation and corrosion inside the container (canisters, etc. for storing) should be investigated to minimize the management burden and cost during storing, while eliminating venting mechanisms, etc. as much as possible.

#### Current state against ideal

- R&D of a realistic and reasonable prediction method for hydrogen generated in the storage canister is being conducted. Also, the venting mechanism for hydrogen gas release installed in the lid of the storage canister is being investigated using that prediction method, and safe transfer conditions considering the accumulation of hydrogen gas in the transfer container are also being investigated.
- For fuel debris in the form of slurry/sludge, technological issues were identified in FY2020, and from FY2021, investigations and evaluations are being conducted on the drying method of slurry/sludge fuel debris and its behavior from transfer to storing, taking into account hydrogen gas generation and release characteristics. In addition, from FY2023, considering the knowledge of the properties of the fuel debris and the conditions in the PCV, the results of the desktop study on the hydrogen gas generation and release characteristics have been confirmed by elemental tests, etc.
- In addition, since FY2023, considering the investigation in the related Government-led R&D Program on Decommissioning, Contaminated and Treated Water Management and TEPCO, and new knowledge on the properties of fuel debris and the conditions inside the PCV, the results of the desktop study on hydrogen gas generation behavior and release characteristics have been confirmed by elemental tests, etc.

## Issues to be resolved

- Since information on fuel debris (properties, source strength, etc.) is limited at this time, it is necessary to constantly incorporate the latest information on fuel debris and review hydrogen gas management and corrosion resistance management methods as necessary.
- In order to realize stable storing, technologies are required to take measures against corrosion and hydrogen generation (e.g., drying of fuel debris, recombination and absorption of hydrogen, confirmation and evaluation that hydrogen concentration can be kept below the flammable limit concentration of 4 vol%, etc.).

## 2. Advancing the radiolysis behavior evaluation

Transport/Storing/Storage : [Short]

### Desired state and reasons for it

- It is desirable that the phenomena model and parameters with large uncertainties are clarified in order to determine the priority of the advancing target. In addition, it is desirable that a deeper scientific mechanism is clarified for regulatory compliance under complex conditions (reaction field, irradiation field) that are scientifically unexplained.

### Current state against ideal

- At this stage, it is clarified which parameters affect hydrogen generation by radiolysis.
- The G-values used for the PCV and other facilities on the 1F are different from those of general wastes, and are forced to be evaluated conservatively.
- Since the test retrieval of the fuel debris began in September 2024, it is necessary to investigate using the collected fuel debris to obtain data related to treatment and disposal, such as measurements of thermophysical properties and hydrogen production from water radiolysis.

## Issues to be resolved

- It is desirable to properly evaluate G-values that are set excessively conservatively. In particular, the effects of the material and nuclide composition of the object, trace constituents in water, and water content on G-values should be developed, including basic data, to lead to appropriate G-value evaluation.

## Relevant Issues

- TSR-101 "Characterization"
- TSR-201 "Technology development to assess and manage storage container integrity"
- TSR-204 "Design of canister specifications"
- TSR-301 "Transport/storing/storage method investigation"