Phase: **Design**

Decommissioning Process **"Fuel Debris Retrieval"**
Investigation Subject **"Criticality Prevention/Cool/Hydrogen (maintaining stable conditions)"**
Issue **"Understanding hydrogen generation behavior"**

Needs

1. Predicting and measuring the amount of hydrogen generated

Fuel Debris Retrieval：【Short】

Desired state and reasons for it

- In order to prevent incidents, such as hydrogen explosion, during the fuel debris retrieval period, it is desirable to predict and measure the amount of hydrogen generated due to water radiolysis and identify the locations inside the PCV where hydrogen is likely to be retained.
- In order to predict the amount of hydrogen generated in water radiolysis, it is desirable to understand the distribution of nuclides and the dose intensity.

Current state against ideal

- Radiation from fuel debris may cause radiolysis of water, which may generate hydrogen. It should be taken into consideration that if the current nitrogen containment is not maintained, hydrogen may reach the flammable limit of 4 vol% to cause a hydrogen explosion.
- Hydrogen may stay on top of the PCV and the RPV and in the piping. Particular attention should be paid to the narrow areas such as piping, as they are prone to flame acceleration after hydrogen combustion.

Issues to be resolved

- It is necessary to formulate a method for predicting and evaluating the amount of hydrogen generated and confirm the scale and ease of generation in the event of a hydrogen explosion, in relation to the stagnant part.
- On the other hand, drying of fuel debris is important to reduce the amount of hydrogen generation. Fuel debris retrieved from the PCV is expected to be in powder and slurry／sludge form, in addition to lumps and granular. In particular, powdered and slurry／sludge fuel debris have a high water content, which is not easy to reduce. Currently, drying method by heating or other means in a storage canister is being investigated. However, investigation should also be given to drying outside the storage canister, which would enable faster drying, and to minimize the management burden and cost during storing (e.g., omitting the venting mechanism).
- When drying outside the storage canister, dust generation and its dispersal are an issue. Therefore, there is a need for a technology that can efficiently dry fuel debris in the form of powder and slurry／sludge containing moisture while controlling (or confining) dust generation and dispersal.
- In addition, to achieve stable storing, technology is required to take measures against corrosion and hydrogen generation (e.g., to confirm and evaluate drying, hydrogen recombination and absorption, keeping the hydrogen concentration below the flammable limit concentration of 4 vol%, etc.).

Relevant Issues

- FDR-101 “Understanding status of fuel debris”
- FDR-208 “Understanding status of fuels for maintaining stable conditions”