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The 7th International Forum on the Decommissioning of the Fukushima Daiichi NPS, Day 2
Pursuing the full-fledged fuel debris retrieval at1F Decommissioning with Technical Experts

Approach Toward Large-scale Fuel Debris Retrieval

August 28, 2023

Toyoshi Fuketa
Chairperson of Sub-Committee for the Evaluation of Fuel Debris Retrieval Methods

Contents

1. Background and Purpose of This Study

- **The selection of methods** for further expansion of fuel debris retrieval in scale (hereinafter referred to as "**large-scale retrieval**") to be carried out in the future **is an extremely important decision that will determine the success or failure of decommissioning over the medium-to long-term**.
- In making such a decision, not only TEPCO but also NDF, in cooperation with the government, must comprehensively examine and evaluate the feasibility of technologies based on the major premise of safety.
- For this reason, the Sub-Committee for the Evaluation of Fuel Debris Retrieval Methods (hereinafter referred to as the **sub-committee**) **has been established under the Decommissioning Strategy Committee of NDF to conduct specialized and intensive examinations and evaluations.**
- Items to be examined and evaluated by the sub-committee are as follows:
  - ✓ Clarifying issues on each retrieval method
  - ✓ Evaluation of the technical feasibility of measures for issues
  - ✓ Comparative evaluation of each retrieval method
  - ✓ Suggestions for next steps

2. Difficulties in Fuel Debris Retrieval

(1) The radiation dose inside the primary containment vessel is very high, so it is not possible for humans to enter

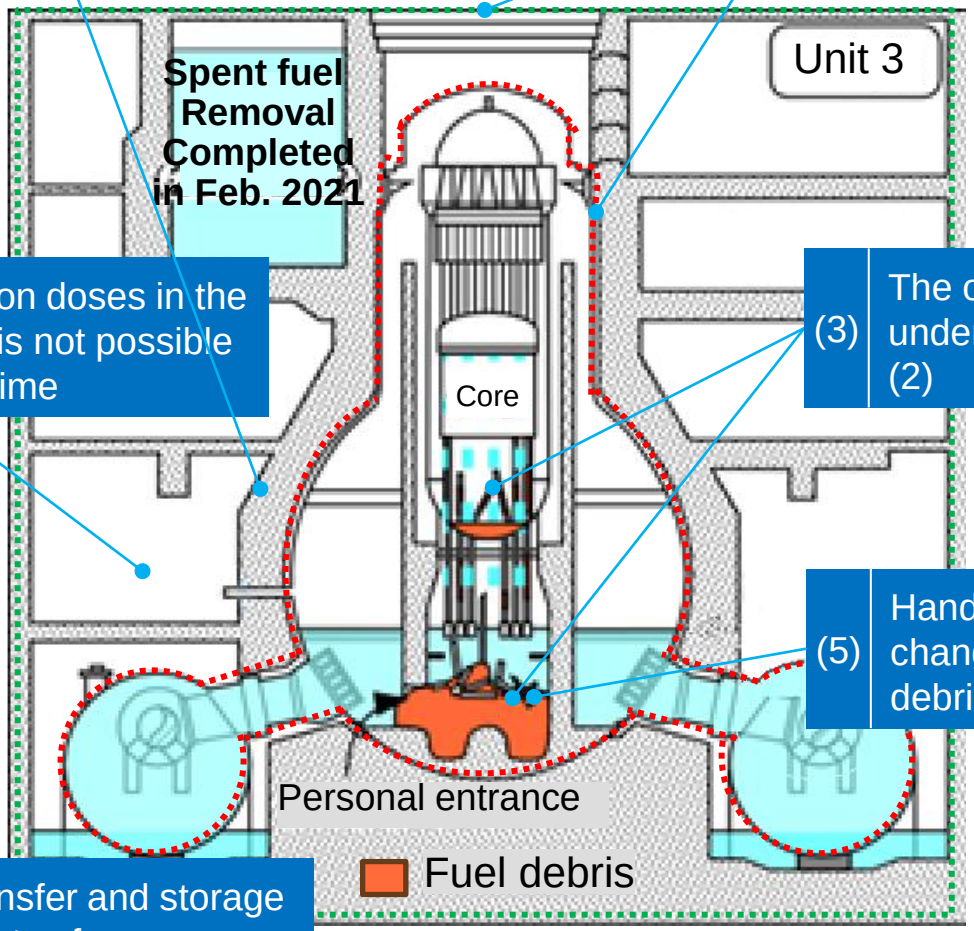
(2) Due to high radiation doses in the reactor building, it is not possible to work for a long time

(3) The on-site situation is not fully understood because of (1) and (2)

(4) The primary containment vessel must be opened while controlling the diffusion of radioactivity

(5) Handling re-criticality due to changes in the state of the fuel debris

(6) Planning for the transfer and storage of enormous amounts of contaminated structures and waste

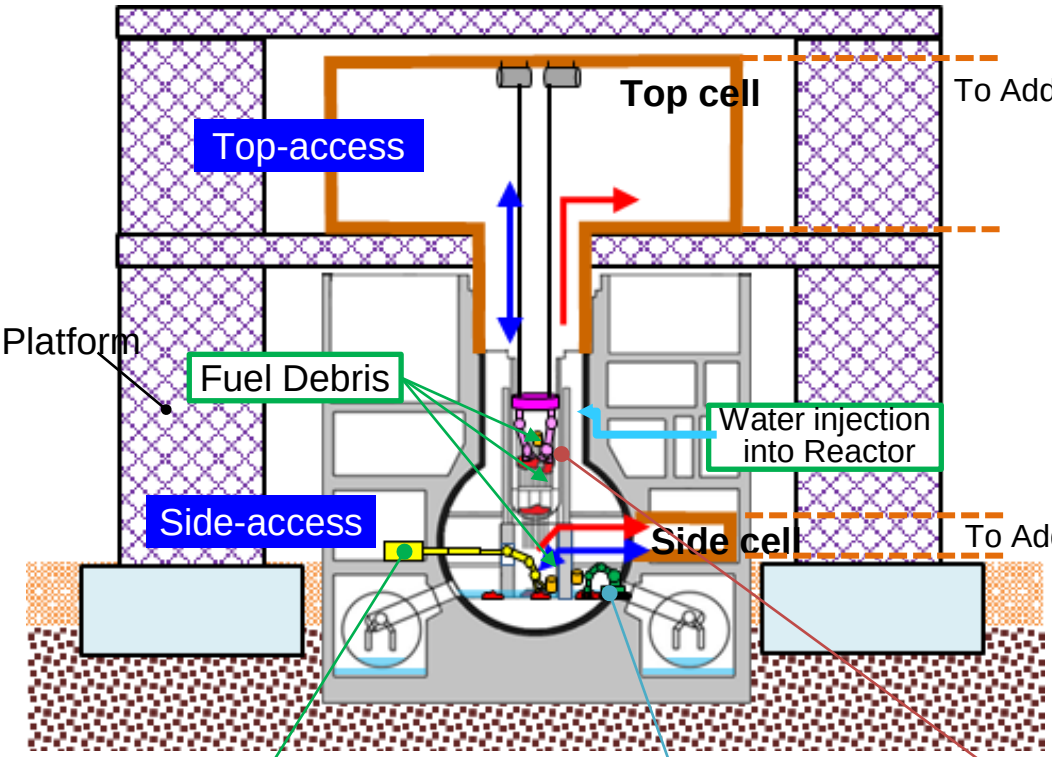


Estimation of fuel debris distribution in Unit 3

Figure provided by: Nuclear Damage Compensation and Decommissioning Facilitation Corporation

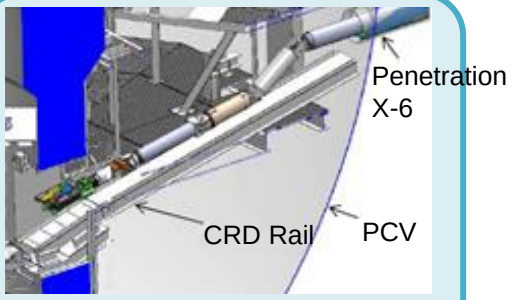
3. Methods for Retrieving Fuel Debris

3.1 Partial submersion method



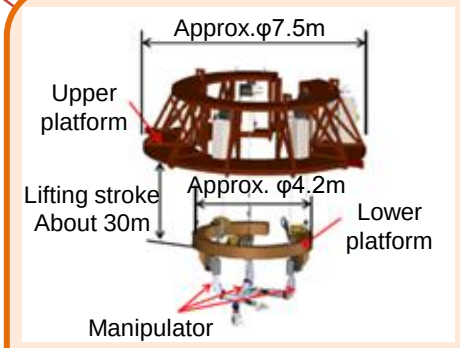
【Concept】
A method of retrieving fuel debris when it is exposed in the air, while pouring water.

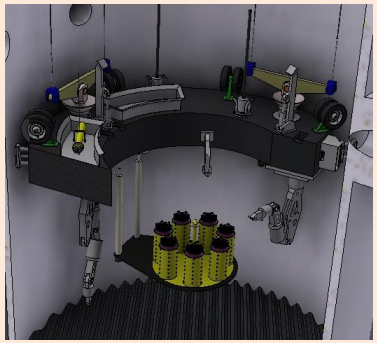
Example of remote control equipment



Example of long-arm

Example of ROV





Example of platform-type access equipment

Figure provided by: Tokyo Electric Power Company Holdings, Inc.

3. Methods for Retrieving Fuel Debris

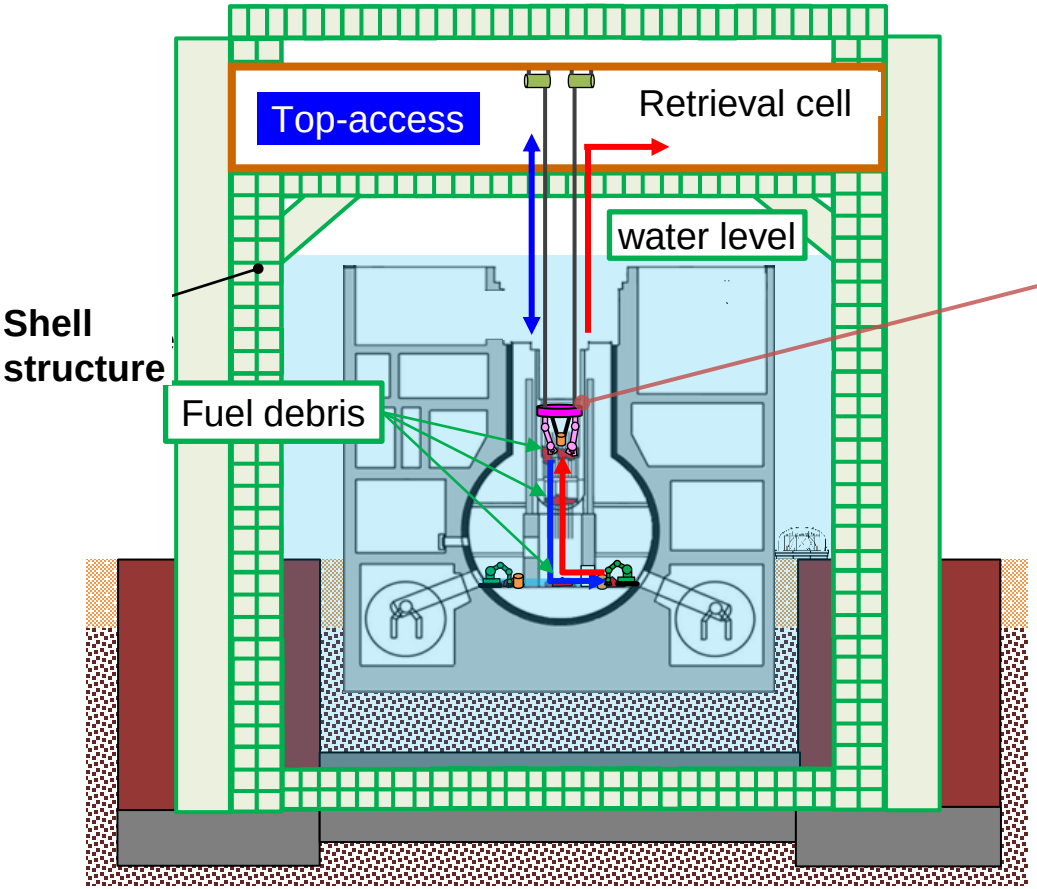
3.1 Partial submersion method

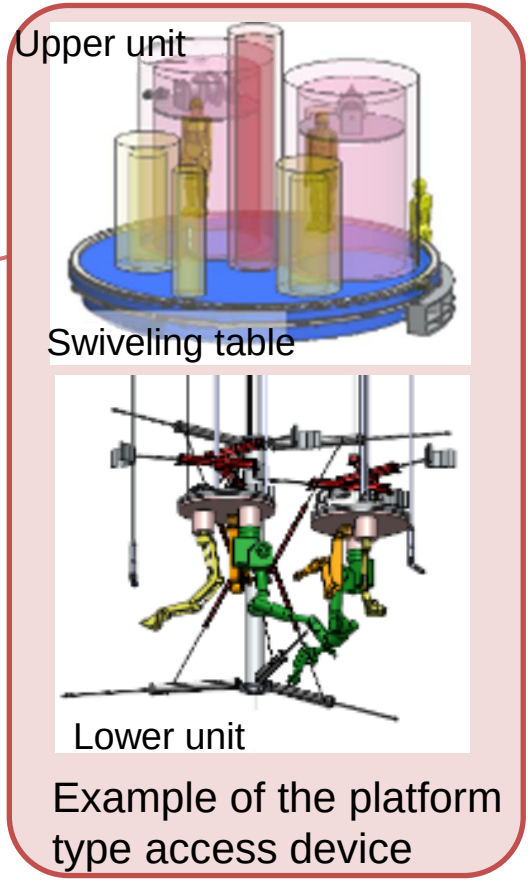
Advantages	Issues
◆Remote control equipment is used due to work being performed under high radiation doses. Contributes to improving technological capabilities. ◆Debris is retrieved as is with little change in the on-site environment, so flexible response is possible, such as changing the method. ◆Criticality control is relatively easy because there is little change in the state of the fuel debris, such as water accumulation.	◆Reliability of remote control equipment must be improved by taking measures to prevent failures, etc. ◆Structure for shielding and controlling the spread of contamination will increase in size, and the number of buildings to be removed will increase, resulting in more time required for preparation. ◆On-site surveillance will be conducted starting from when fuel debris becomes accessible, and it will take time to perform fuel debris retrieval, including improving the remote control equipment, etc.

3. Methods for Retrieving Fuel Debris

3.2 Submersion method

【Concept】
Method in which the entire reactor building is enclosed by a new structure called a shell structure as a boundary, and submerge the reactor building to retrieve fuel debris.





Example of the platform type access device

Figure provided by: Tokyo Electric Power Company Holdings, Inc.

3. Methods for Retrieving Fuel Debris

3.2 Submersion method

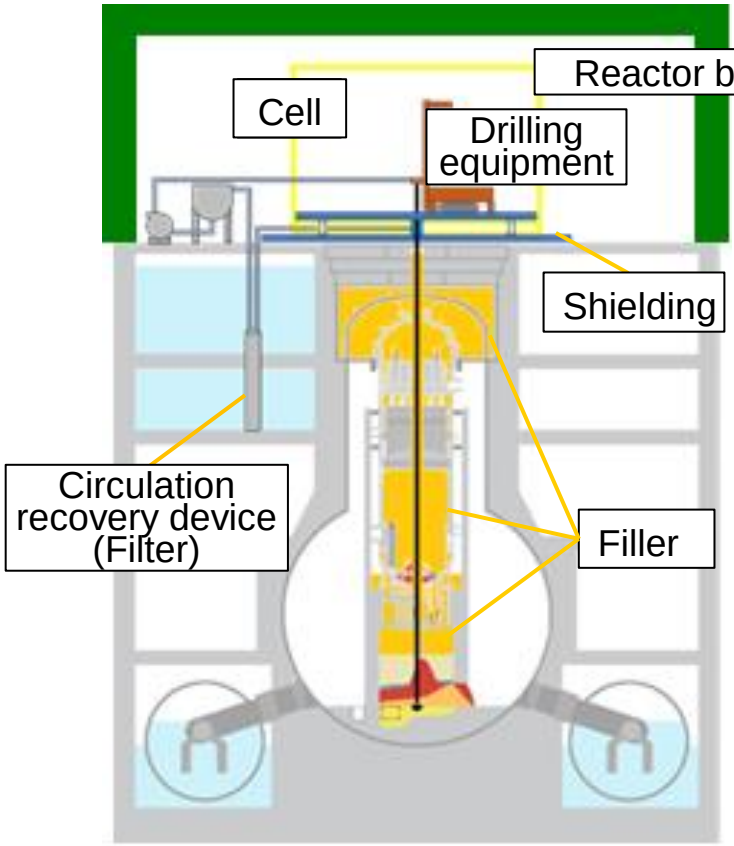
Advantages	Issues
◆ Submerging the entire reactor building enables workers to work on site. ◆ Since the reactor building is completely covered with a structure, leakage of radioactivity from the reactor building can be suppressed.	◆ Since a structure that surrounds the reactor building will be installed, the number of surrounding buildings to be removed will increase, and preparation will take time. ◆ If a tunnel is to be dug in the ground of the reactor building, construction needs to be examined based on the premise that radioactivity is present there. ◆ Since the construction of the building, including the ground of the reactor building, has no track record as to the assembly of structures, preparation will take time before the commencement of work, such as demonstration tests.

3. Methods for Retrieving Fuel Debris

3.3 Solidification method

【Concept】

Method of reducing the on-site radiation dose while stabilizing fuel debris using filler, and circulating and recovering fuel debris by grinding and fluidizing each structure and filler using drilling equipment.



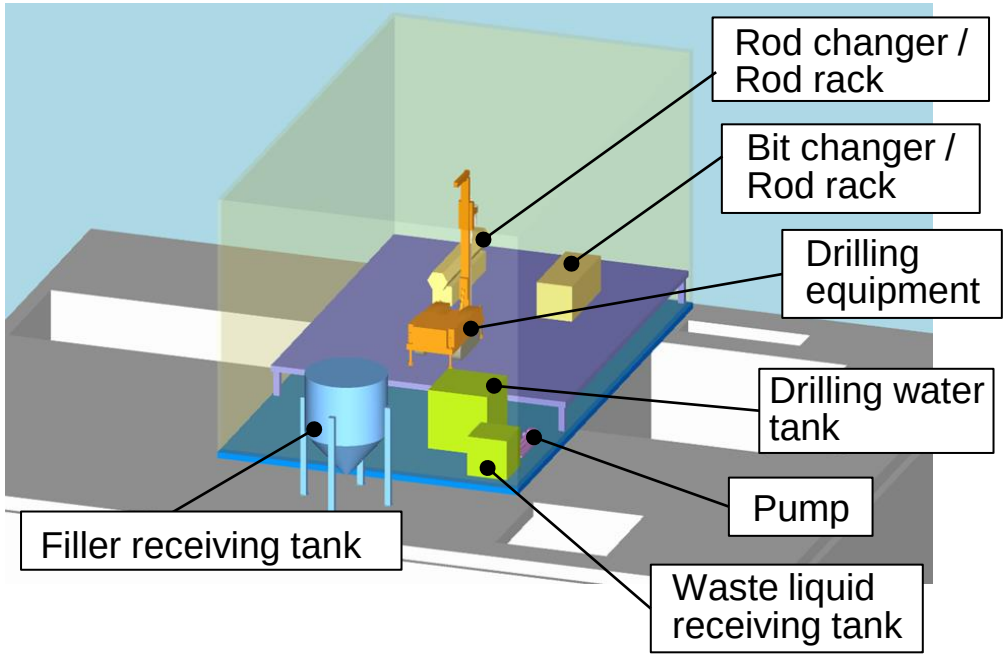


Figure provided by: Nuclear Damage Compensation and Decommissioning Facilitation Corporation

3. Methods for Retrieving Fuel Debris

3.3 Solidification method

Advantages	Issues
◆ By installing shields on the operating floor and covering the inside of the reactor with filler to allow workers to work on site. ◆ Filling and solidifying fuel debris enables diffusion to be controlled during work. ◆ Simple cells and covers will eliminate the need to remove the surrounding buildings to install the support structures.	◆ Various filling methods can be considered, such as the type of filler material and the filled range. It is necessary to examine filler material selection and the filling methods suitable for the site, as well as the retrieval method options other than drilling. ◆ Since filler materials become new waste, a filling method that minimizes waste must be examined.

4. Summary

- The methods presented here are an example, and examination and improvement will be ongoing, including for new methods.
- Future examinations may include a combination of the methods presented here.
- Safe retrieval of fuel debris is a top priority and examinations will be continued with the aim of retrieving fuel debris as quickly as possible.