Updated information about the methods of retrieval of fuel debris of the Fukushima Daiichi NPP

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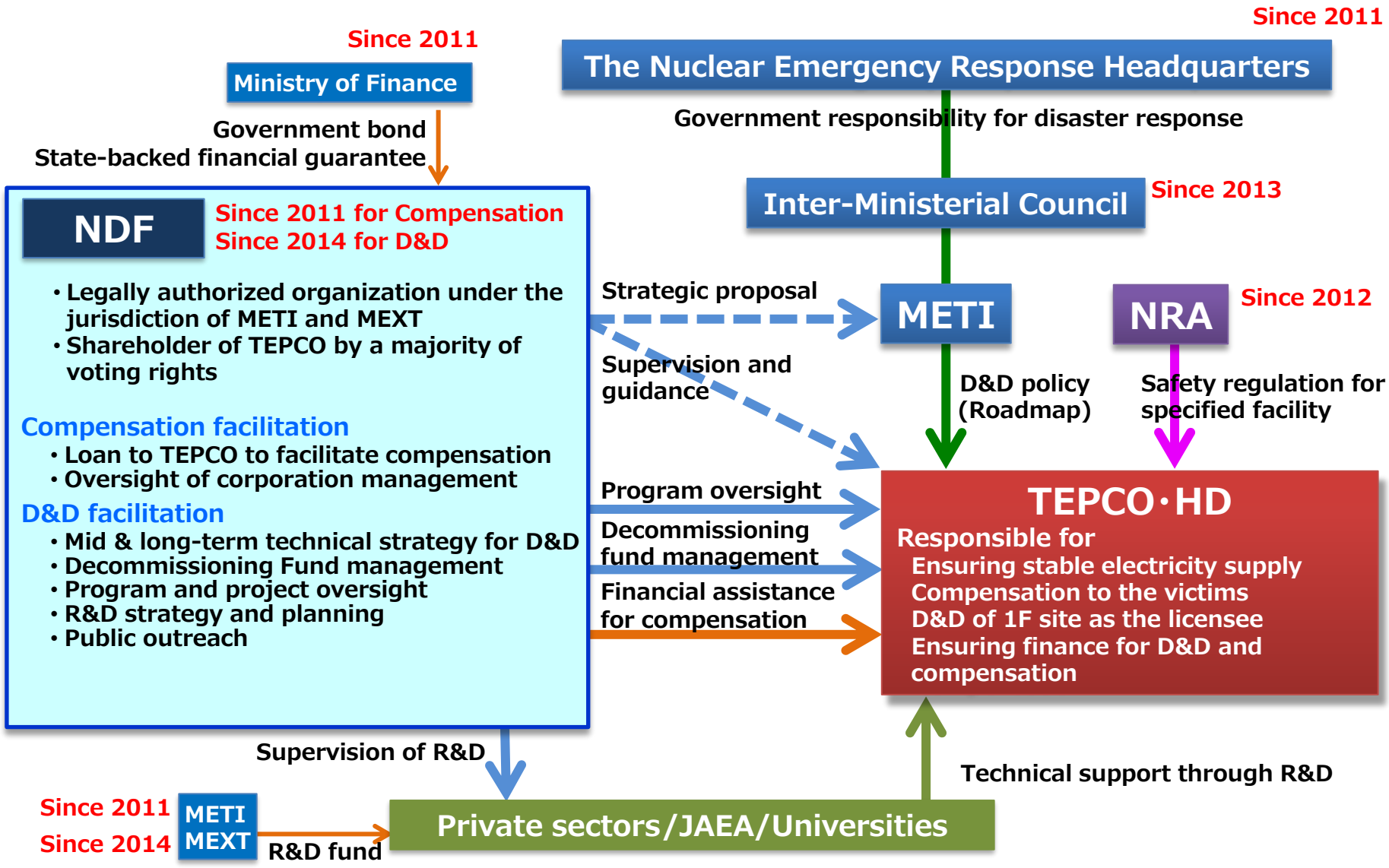
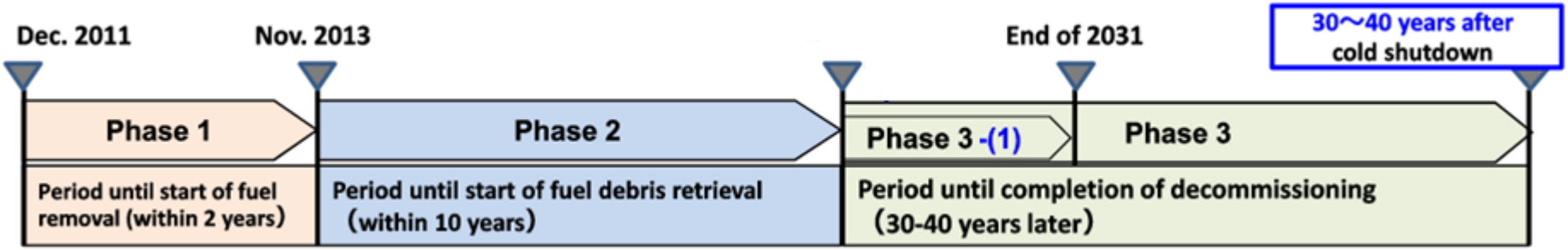
Organizational Structure for 1F Decommissioning



Mid-and-Long-Term Roadmap



Due to safety and reliability considering the impact of COVID-19 pandemic, trial fuel debris retrieval is expected to start in late FY2023.

Major milestones		Revised Roadmap	
Contaminated water management	Reduce to about 150 m^3/day	Within 2020	achieved
	Reduce to about 100m^3/day or less (Further reduction of generation)	Within 2025	NEW
Stagnant water removal / treatment •	Complete stagnant water removal / treatment in buildings* Excluding the reactor buildings of Units 1-3, Process Main Buildings, and High Temperature Incineration building.	Within 2020(*)	achieved
	Reduce the amount of stagnant water in reactor buildings to about a half of that in the end of 2020	FY2022 - 2024	NEW
Fuel removal	Complete of fuel removal from Unit 1-6	Within 2031	NEW
	Complete of installation of the large cover at Unit 1	Around FY2023	NEW
	Start fuel removal from Unit 1 (Methods have changed to ensure safety and prevent dust scattering)	FY2027 – 2028	REVISED
	Start fuel removal from Unit 2	FY2024 - 2026	REVISED
Fuel debris retrieval	Start fuel debris retrieval from the first Unit (Start from Unit 2, expanding the scale gradually)	Within 2021	*Expected to be delayed by approx. 2 years
Waste management	Technical prospects concerning the processing/disposal policies and their safety	Around FY2021	achieved
	Eliminating temporary storage areas outside for rubble and other waste	Within FY2028	NEW

1. Background and purpose of fuel debris retrieval

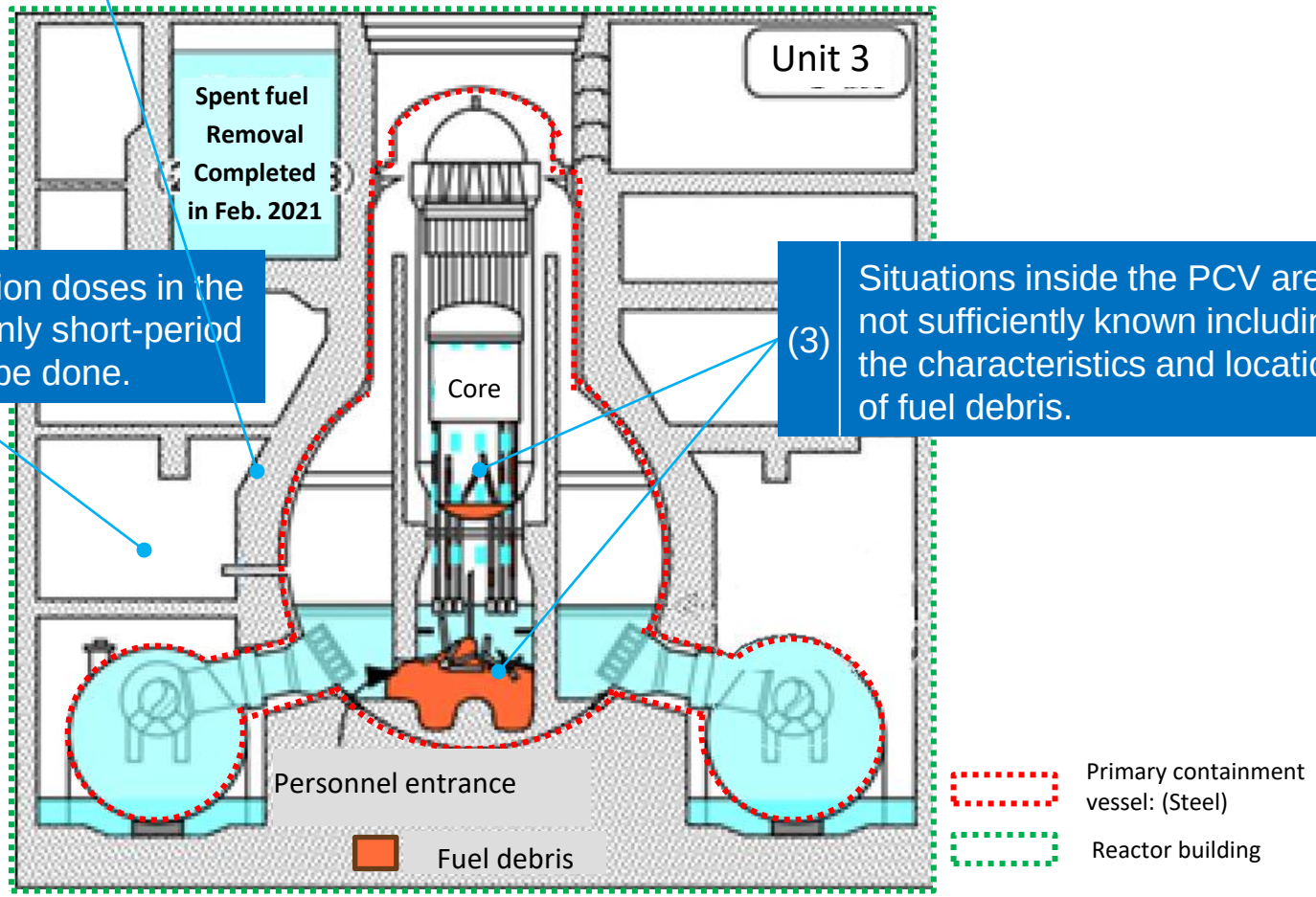
- The selection of methods for further expansion of fuel debris retrieval in scale is an important decision that will determine the success or failure of long-term decommissioning.
- In making such a decision, not only TEPCO but also the government and the NDF must be involved in the examination and evaluation.
- For this reason, **the NDF established in March 2023 the Sub-Committee for the Evaluation of Fuel Debris Retrieval Methods** under the Decommissioning Strategy Committee.
- The Sub-Committee's tasks;
  - ✓ Clarifying issues on each retrieval method
  - ✓ Evaluating technical feasibilities of measures for the problems
  - ✓ Comparative evaluation of each retrieval method
  - ✓ Suggestions for next steps

2. Difficulties in Fuel Debris Retrieval

(1) The very high radiation prevents humans from approaching the PCV. It is also a major hazard for systems and instruments.

(2) Due to high radiation doses in the reactor building, only short-period human tasks can be done.

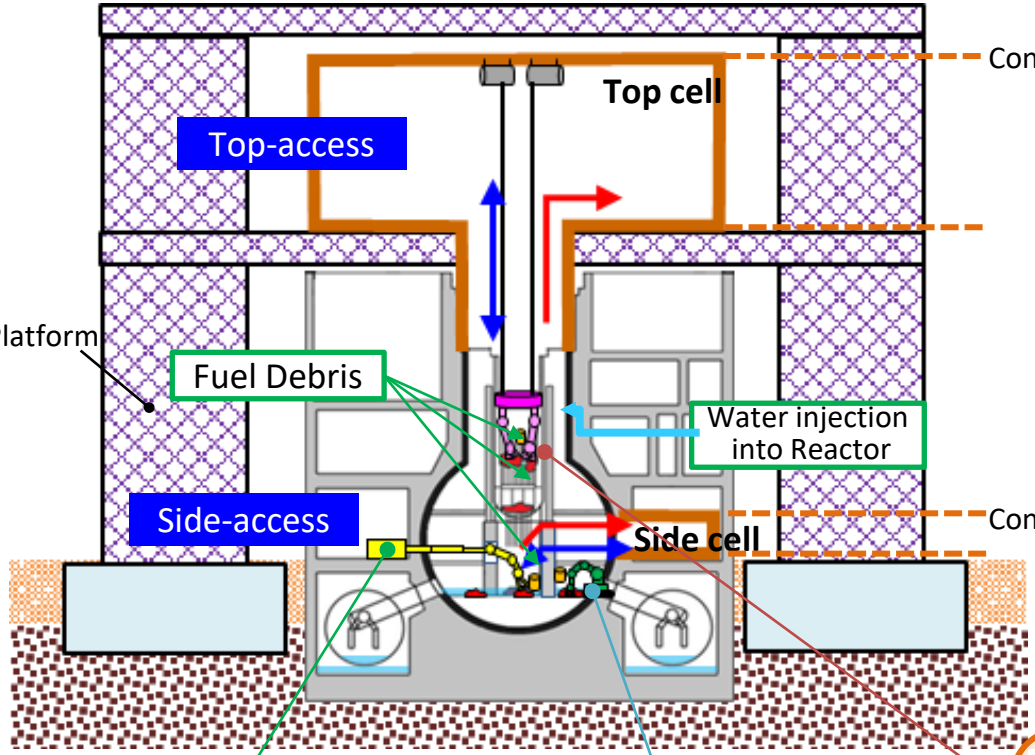
(3) Situations inside the PCV are not sufficiently known including the characteristics and location of fuel debris.



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

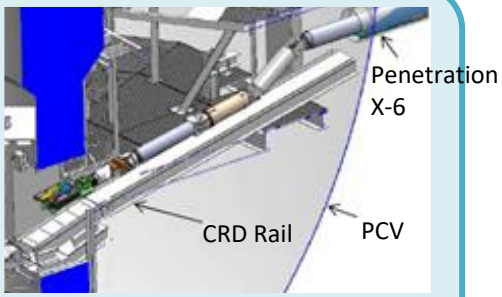


Concept

The method of retrieving fuel debris when it is exposed in the air, while pouring water

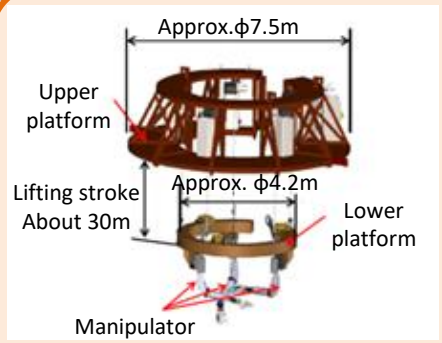
Cells: Isolated chambers that are equipped with confinement and shielding functions

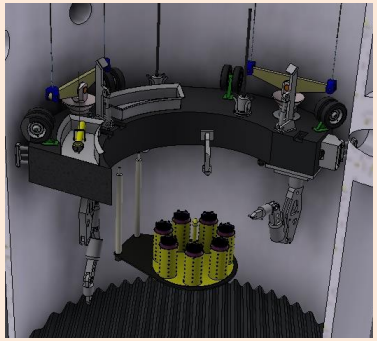
Examples of remote-control equipment



Example of long-arm

Example of ROV





Example of platform-type access equipment

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

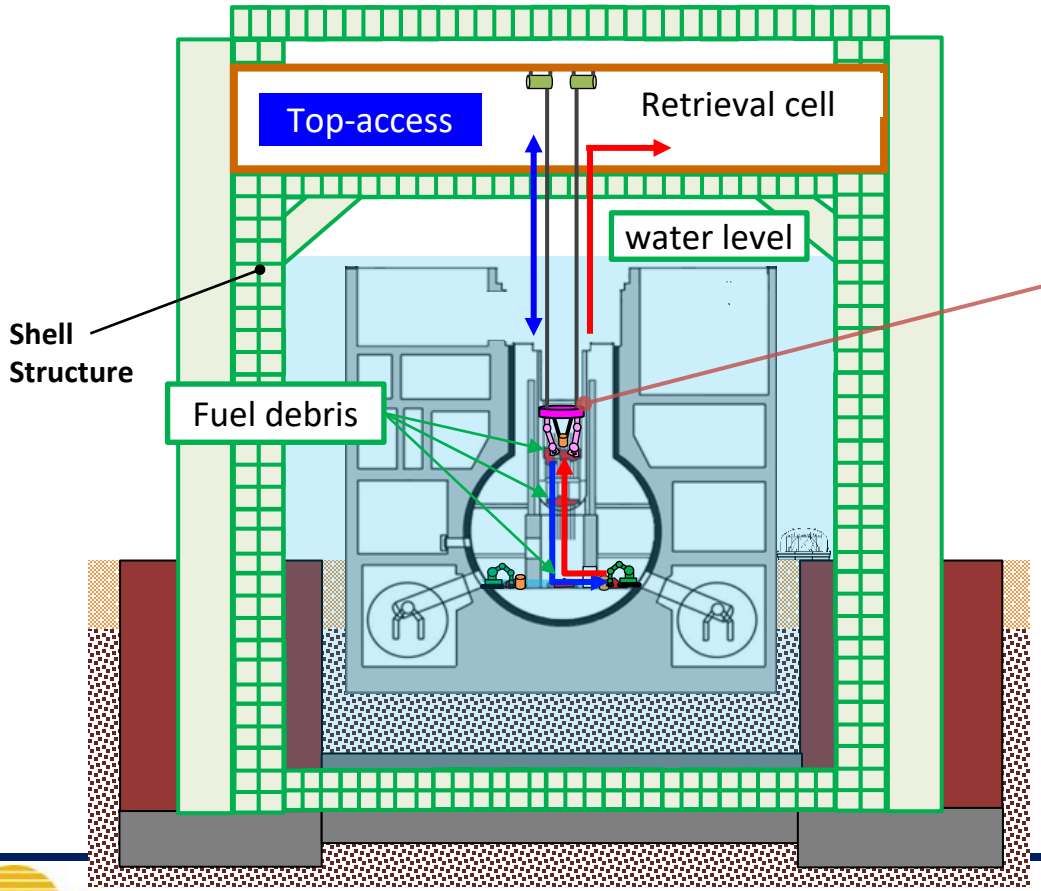
3. Methods for Retrieving Fuel Debris
3.1 Partial submersion method

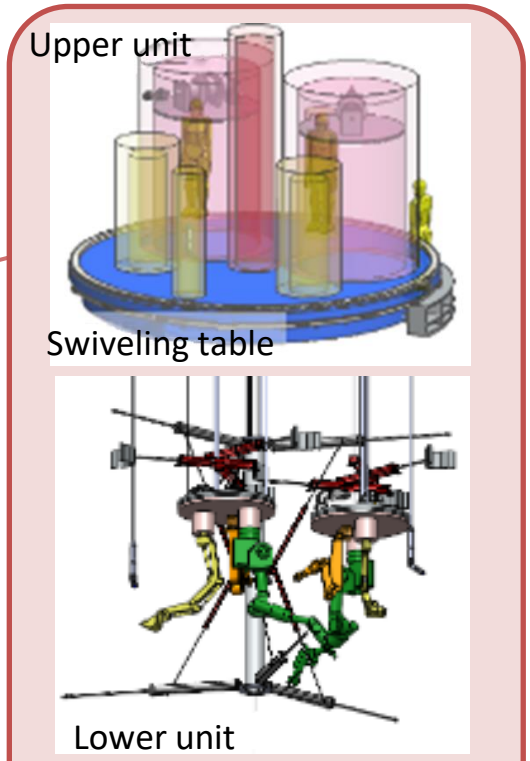
Advantages	Issues
◆ Debris is retrieved as is with little change in the on-site environment, so that flexible response is possible, such as changing the method. ◆ Criticality control is relatively easy because there is little change in the state of the fuel debris, such as water accumulation.	◆ Measures to prevent failures of remote-control equipment ◆ Constructing the structure for shielding and controlling the spread of contamination

3. Methods for Retrieving Fuel Debris
3.2 Submersion method

Concept

The method in which the entire reactor building is enclosed by a large structure called a shell structure, and submerge and cover the reactor building with water to retrieve fuel debris





Example of a platform-type access device

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

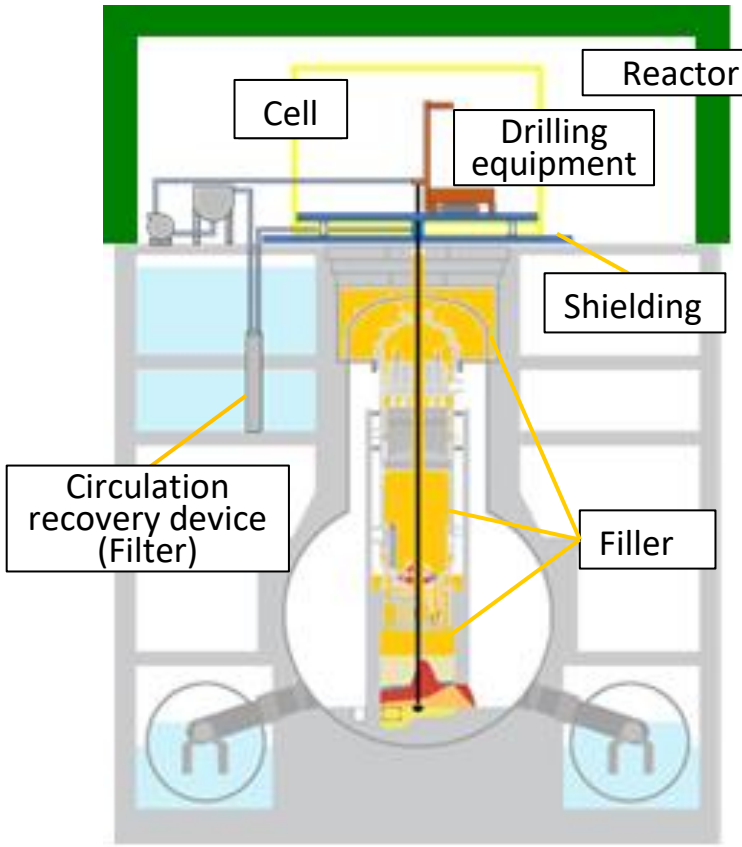
3. Methods for Retrieving Fuel Debris
3.2 Submersion method

Advantages	Issues
◆Submerging and covering the entire reactor building with water enables workers to work on the site. ◆Since the reactor building is completely covered with a large structure, leakage of radioactivity can be suppressed.	◆Taking a long period to construct the large shell structure, which makes the retrieval begin later ◆Difficult civil engineering works such as digging tunnels in the ground of the reactor building ◆Controlling the quality of water

3. Methods for Retrieving Fuel Debris
3.3 Filling and solidification method

Concept

Method of stabilizing fuel debris using filler and recovering fuel debris, structure and the filler all together by drilling and other methods



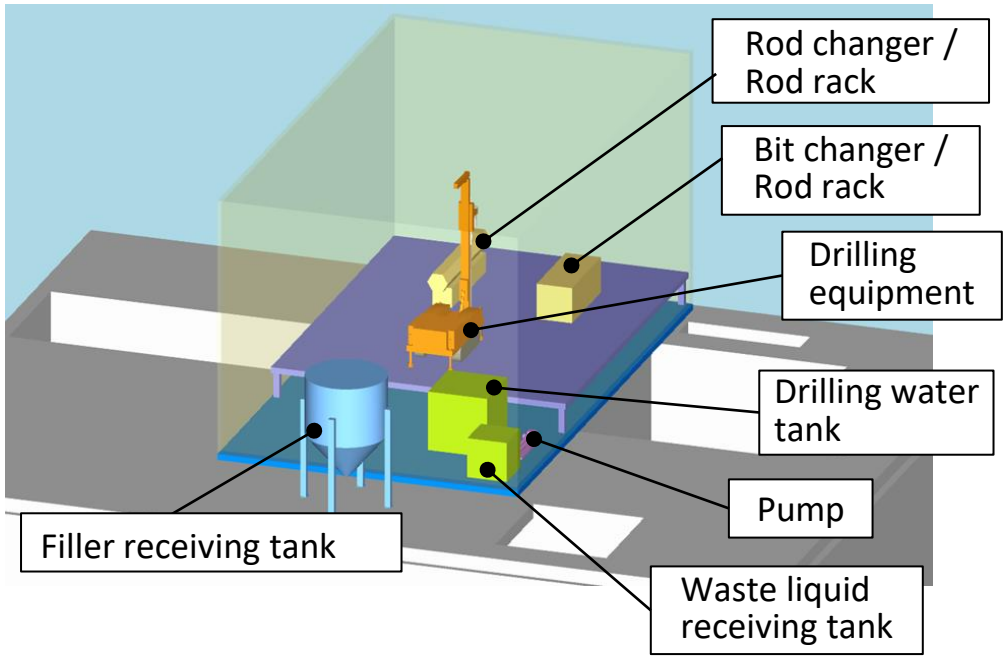


Figure provided by: Nuclear Damage Compensation and Decommissioning Facilitation Corporation

3. Methods for Retrieving Fuel Debris
3.3 Filling and solidification method

Advantages	Issues
◆The fuel debris is stabilized by the filling and solidification. ◆Filler provides a certain level of shielding function. ◆Possibility of simplifying the support structures.	◆ Various considerations are necessary including the types of filler material and the space to be filled. ◆ Considerations about the methodologies of recovery such as drilling, cutting etc. ◆ Suppression of the volume of the waste

4. Summary

- The NDF keeps examining the three methods and considering a new method as well.
- And a combination of the three methods is also taken into the consideration.
- Safety is the top priority and at the same time the NDF conducts the examinations with the aim of retrieving fuel debris as quickly as possible.

International Relations of the NDF

- The NDF is committed to promoting decommissioning in a manner that is open to the international community by gaining the trust and disseminating accurate information.
- The NDF gathers the wisdoms, maintains and enhances the international society's continuous understanding and interest through candid discussions.

Bilateral relations

NDA of UK (Sellafield etc.)
CEA France
US DOE (EM)

Regular meetings and visits and communications

Bilateral Cooperation

- **Memorandum of cooperation (NDA and CEA)**
- **Information, human resource networks**

- High-level cooperation
- Risk analysis
- Rad Waste management
- Project management

International organs

OECD/NEA

- Steering Committee
- Standing Technical Committees
  - CDLM
- Joint Programs
  - FACE
- Jointly-organized Events
  - Mentoring workshops

IAEA

- Fukushima Daiichi reviews
- IAEA GC events

International Forum

Organized annually by the NDF in Fukushima

1st Forum: 2016 April
2nd Forum: 2017 July
3rd Forum: 2018 August
4th Forum: 2019 August
5th Forum: 2021 October
6th Forum: 2022 August
7th Forum: 2023 August

Reference

For more information, the following internet sites are useful for various needs. They are regularly updated.

Ministry of Economy, Trade and Industry (METI)

- ALPS treated water web-site; https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/atw.html
- Roadmap towards the Decommissioning web-site; https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/index.html

Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF)

- Technical Strategic Plan; https://www.dd.ndf.go.jp/english/strategic-plan/
- NDF International Forum's web-site; https://ndf-forum.com/en/day2/

Tokyo Electric Power Company Holdings Inc. (TEPCO)

- Portal web-site of the Fukushima Daiichi decommissioning project; https://www.tepco.co.jp/en/hd/decommission/index-e.html
- Fukushima Daiichi nuclear power plant virtual tour web-site; Inside Fukushima Daiichi; https://www.tepco.co.jp/en/insidefukushimadaiichi/index-e.html
- Latest situation at Fukushima Daiichi nuclear power plant; video presentation (version in November 2022); https://www4.tepco.co.jp/en/news/library/archive-e.html?video_uuid=c1l1ef7y&catid=69631