

Planning for medium- and long-term On-site activities

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✓ **Introduction**

Removal of Spent Fuels from Spent Fuel Pools

Removal of core debris

Key onsite recovery actions (Stabilization phase)

1. COOLING

- ✓ *Stable cooling to low reactor temperature*

2. MINIMIZING AIRBORNE/LIQUID EFFLUENT

- ✓ *Recycling of water recovered from Tb/B through removal of radioactivity and RO: 1200 tons/day treated, of which 400 tons/day are returned to the reactors*
- ✓ *Water inventory control*
- ✓ *Installation of R/B cover*
- ✓ *Isolation of surrounding area by walls to prevent spill-over to the ocean*
- ✓ *Corrosion control of structures and components*

3. MINIMIZING RESIDUAL RISKS

- ✓ *Assure structural integrity of damaged R/B in consideration of aftershock and typhoon*
- ✓ *Assure reliability of power/water supply*
- ✓ *Control hydrogen concentration*

Beyond stabilization phase

1. *Remove SF from the SFPs*

SF remain covered by water during and after the accident: sipping analysis suggests that SF is mostly intact, though some might be damaged by falling objects due to hydrogen explosion

2. *Remove core debris from RPV and CV*

3. *Decommission*

4. *Dispose generated wastes at final disposal facilities*

AEC' committee

To discuss planning for medium- & long- term on site activities

August 3rd ~ 2011/E

15 Experts and Commissioners

- ✓ *What are the required technologies?*
- ✓ *How and who to develop?*
- ✓ *Who is going to manage the overall project?*
- ✓ *Who is going to pay?*
- ✓ *How long it will take?*
- ✓ *International project?*

.....

Anticipated key technical challenges

- ✓ *Plugging of the leaky holes (CV, R/B)*
- ✓ *Identification of the location & configuration of core debris*
 - *based on information from SA analysis, core instrument data etc.*
- ✓ *Decontamination of work place*
- ✓ *Minimization of radiation exposure to workers*
- ✓ *Management of water quality & inventory*
- ✓ *Removal of core debris from the containment (beyond RCS)*
- ✓ *Criticality control*
- ✓ *Accounting system*
- ✓ *Development of remote handling tools and robotics*
- ✓ *Disposal of Waste*

Introduction

- ✓ **Removal of Spent Fuels from Spent Fuel Pools**
Removal of core debris

[NOTE]

1) Sequence & actions described below as one reference scenario [“image”]

2) Acronyms

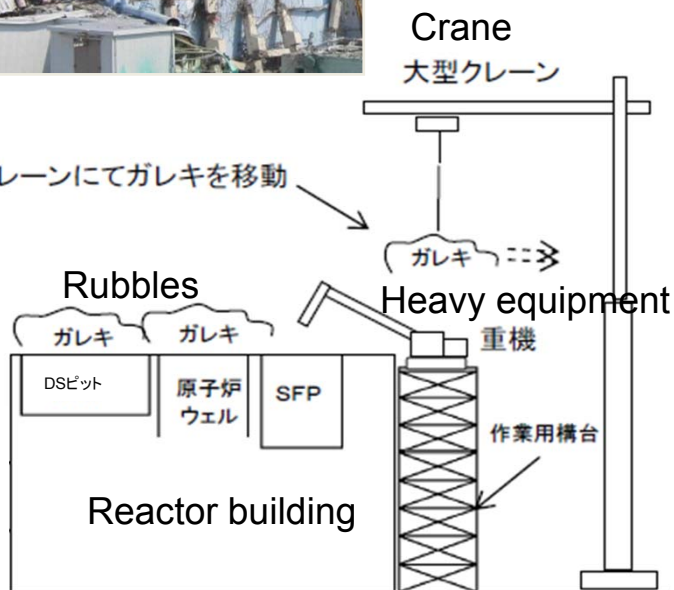
<i>HP</i>	<i>Hold Point</i>
<i>CV</i>	<i>Containment Vessel</i>
<i>RPV</i>	<i>Reactor Pressure Vessel</i>
<i>R/B</i>	<i>Reactor Building</i>
<i>T/B</i>	<i>Turbine Building</i>
<i>TD</i>	<i>Technology Development</i>

Removal of SF from SF pool

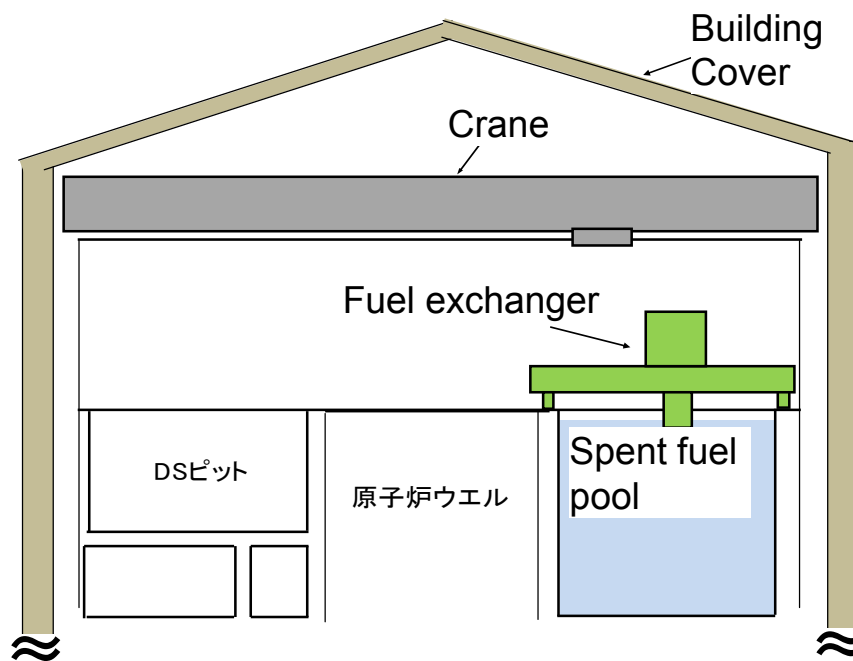
1. Remove rubbles by crane



③大型クレーンにてガレキを移動



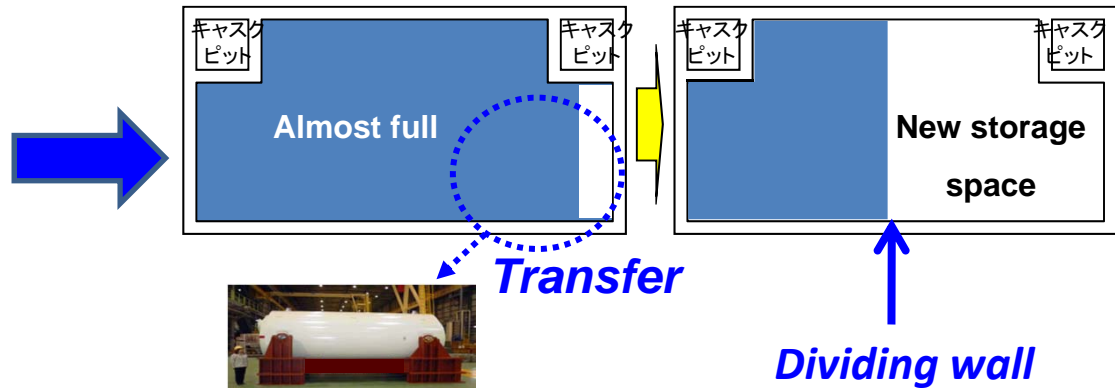
2. Install refueling machine & overhead crane



3. SF transfer by cask

Removal of SF from SF pool

4. Transfer to shared SF pool at 1F site



Challenge

Transfer of SF from shared SFP to another building

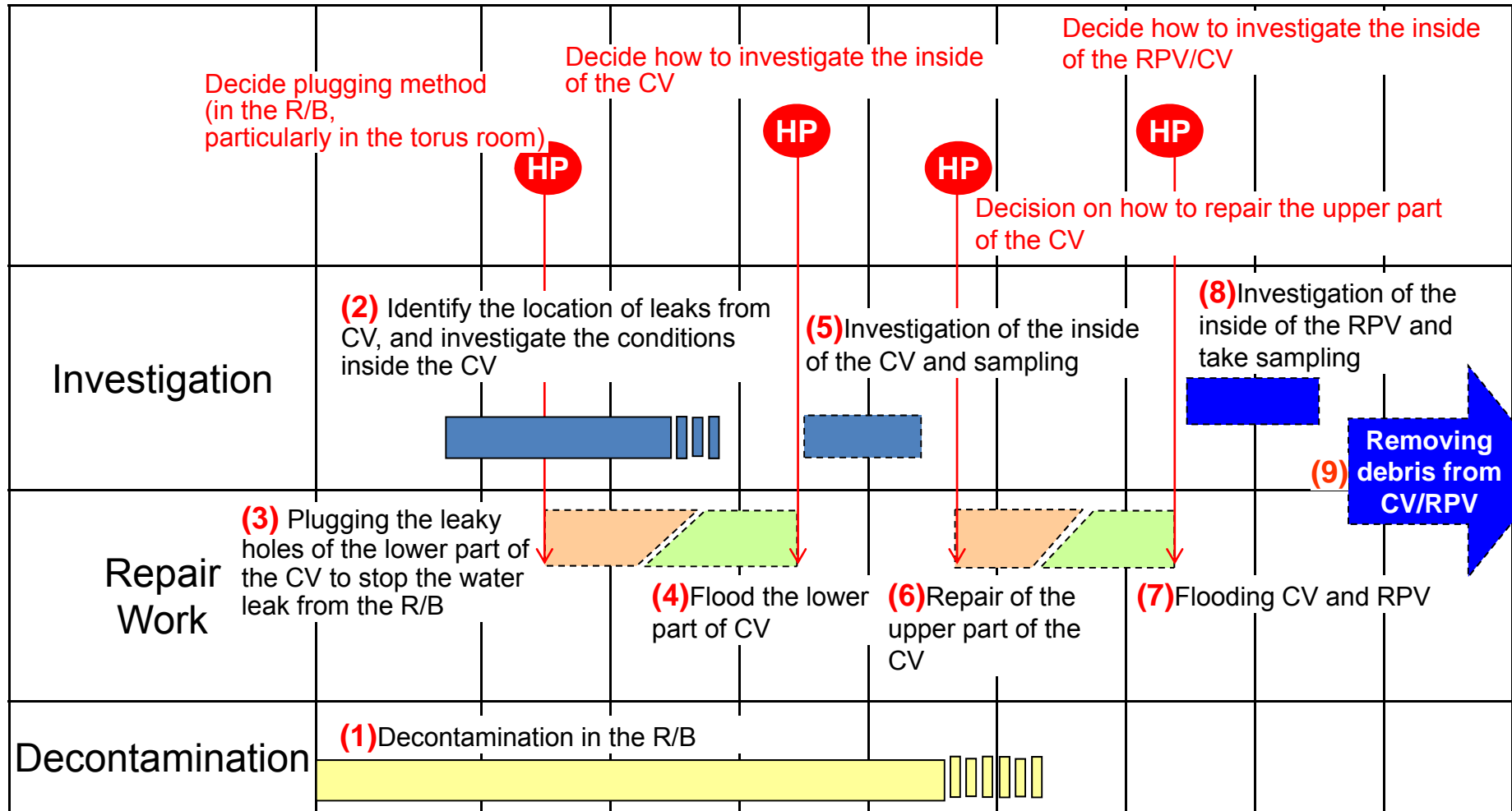
Removal of surface contamination: FP and Salt

Introduction

Removal of Spent Fuels from Spent Fuel Pools

✓ *Removal of core debris*

Removal of core debris



(1) Decontamination of R/B

Activity

Decontamination using high-pressure water, coating, surface chipping etc. to reduce exposure

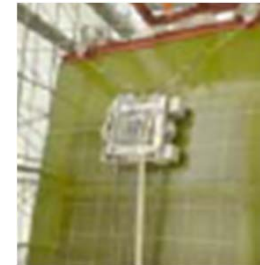
Suction equipment



CO₂ blasting

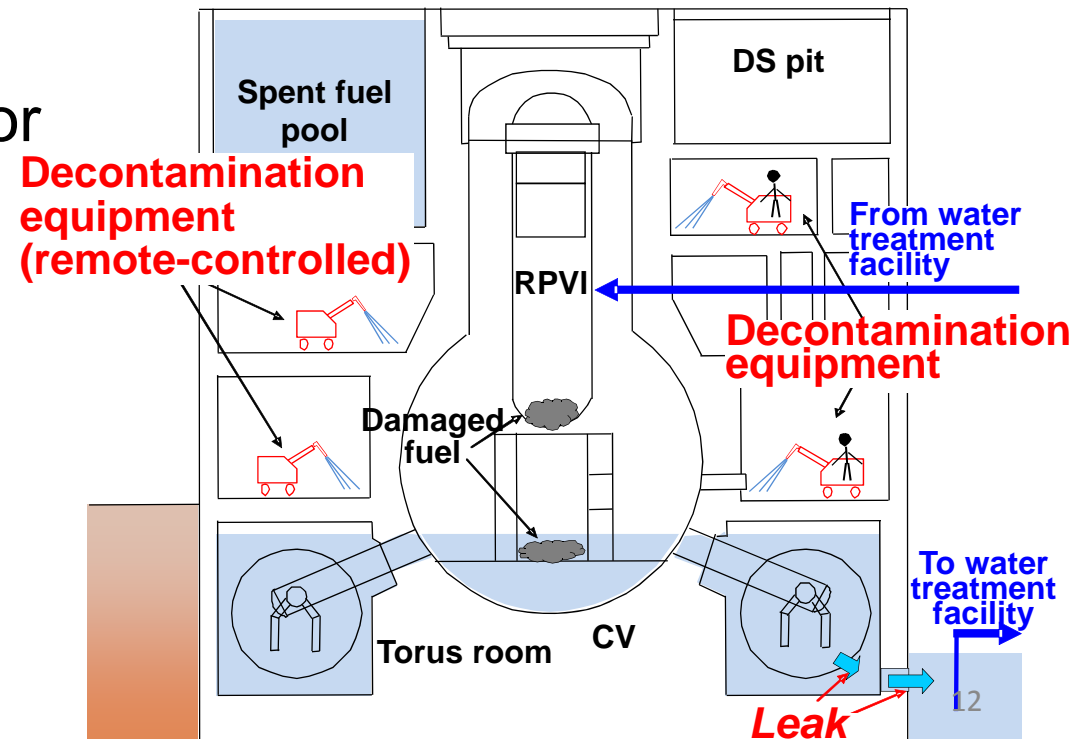


Wall surface chipping



Issues to be addressed in TD

remote decontamination or other appropriate methods for highly radioactive areas



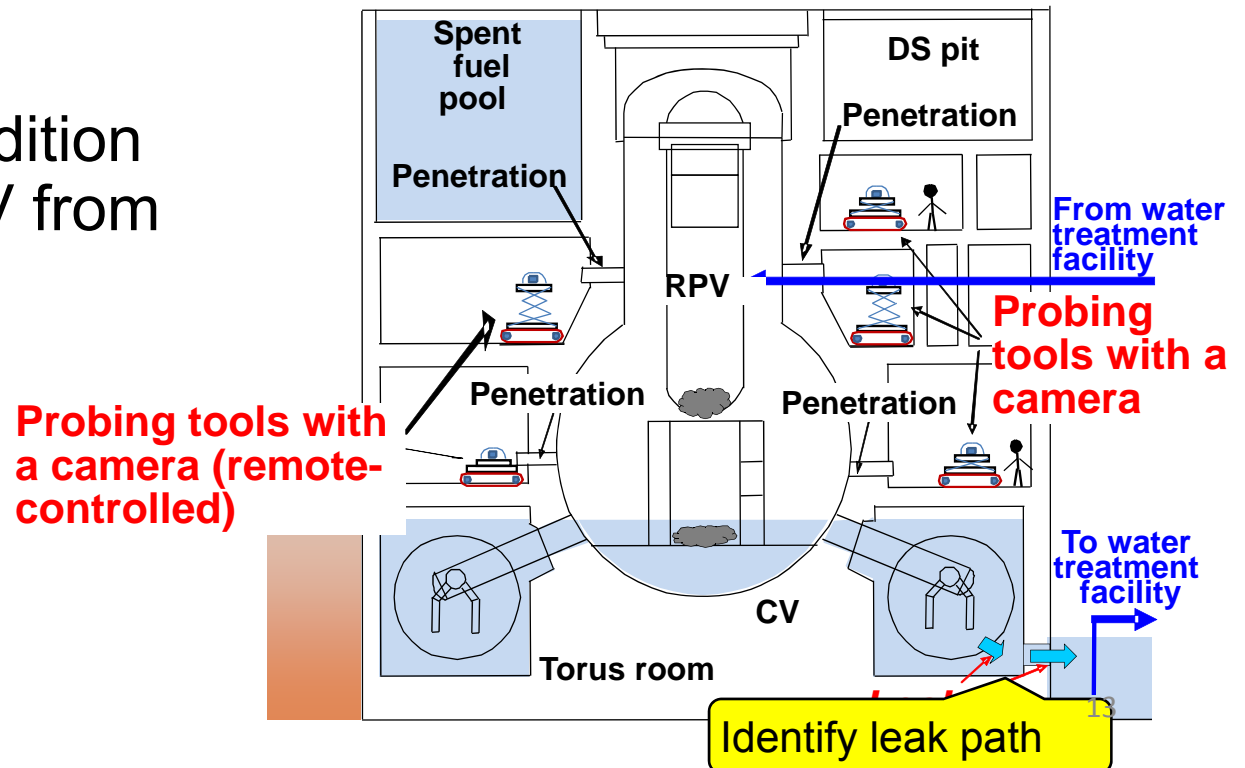
(2) Identify leak path & Estimate inside CV condition

Activity

- 1) Identify leak path using remote-controlled radiation dose measuring instruments, cameras, and other devices.
- 2) Investigate the condition of inside CV from outside by γ rays measurements, acoustic investigations, etc.

Issues to be addressed in TD

- 1) Development of methods / equipment to identify leak path
- 2) Development of methods / equipment to investigate the condition of the inside of the CV from outside



(3) Plugging the leaky holes

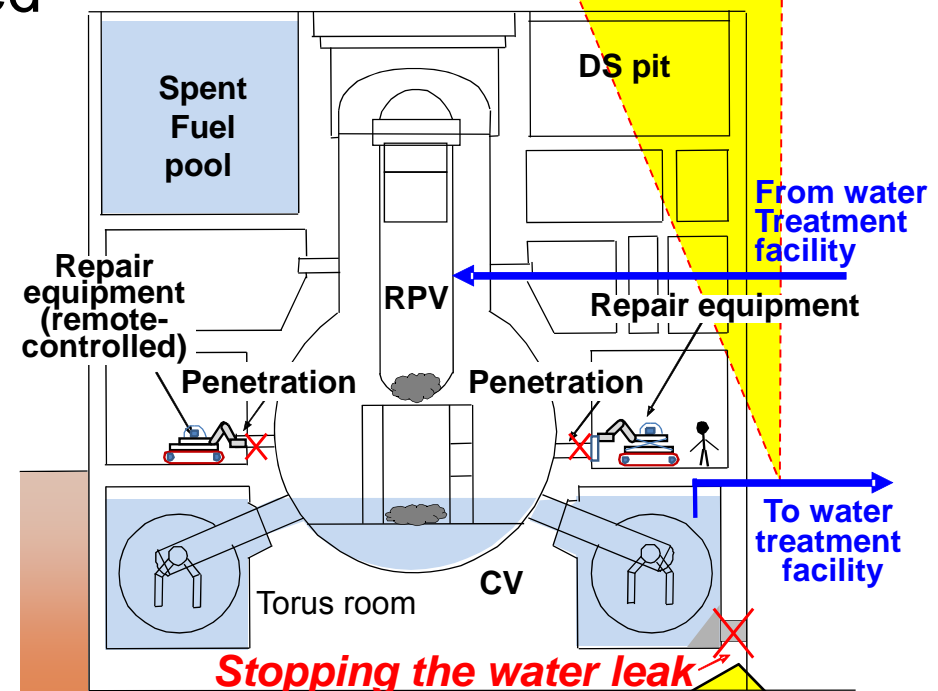
Activity

Plug the leaky holes (CV → R/B, R/B → T/B) to enable debris removal under submerged condition & to establish small recirculation loop.

Issues to be addressed in TD

Methods to stop leakage in the CV and the R/B

After plugging to leak path to T/B, small recirculation loop will be established.
RPV → CV → ~~R/B~~ → ~~T/B~~ → Treatment System → RPV



- Developments of water filling method, construction method, and instrument

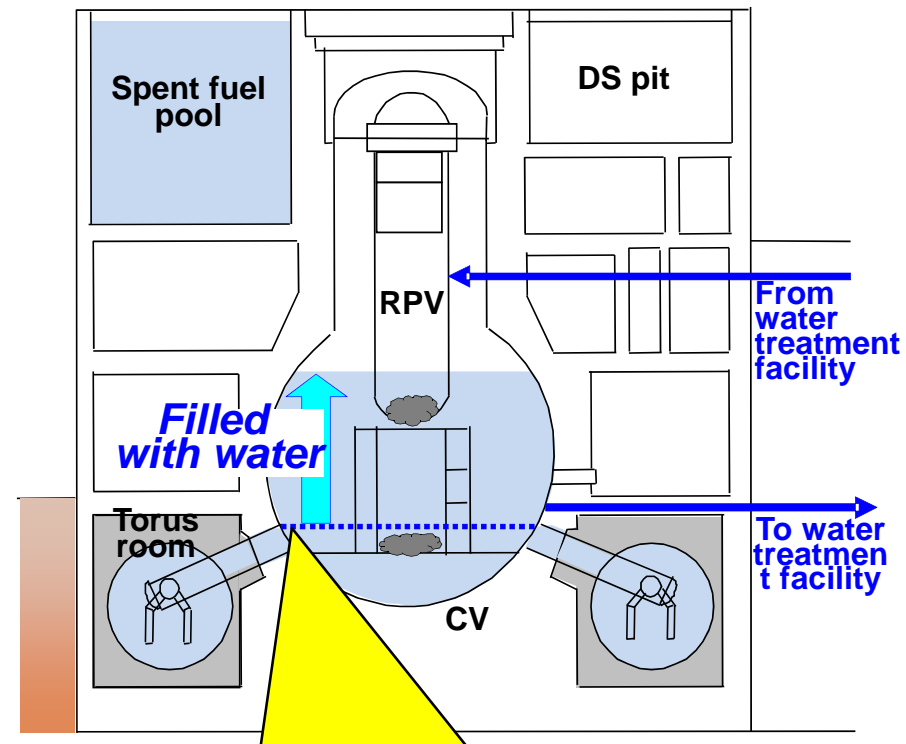
(4) Flooding the lower CV

Activity

Flood lower part of the CV with water before investigation of the inside CV starts

Issues to be addressed in TD

Methods to stop leakage from the CV and the R/B



- Developments of water filling method, construction method, and instrument

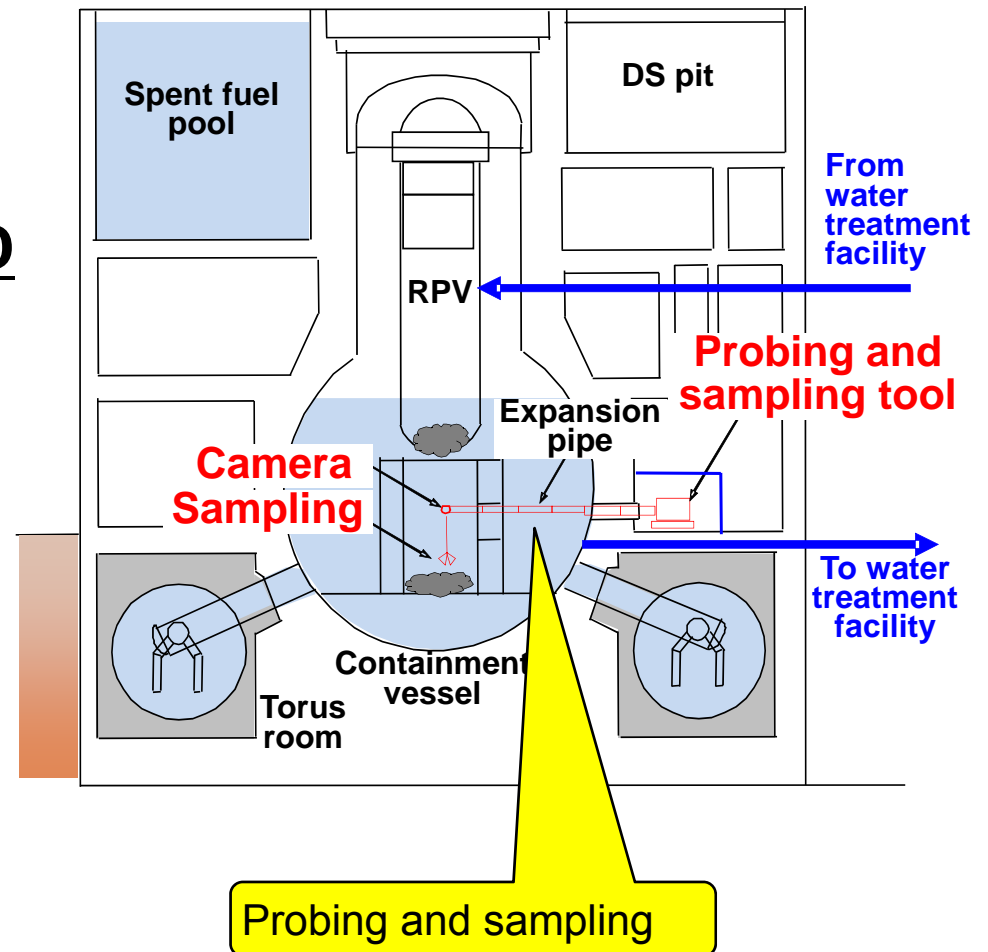
(5) Identification of location & configuration of core debris

Activity

Identify location and configuration of core debris by sampling and probing tools

Issues to be addressed in TD

Sampling and probing in high radiation environment

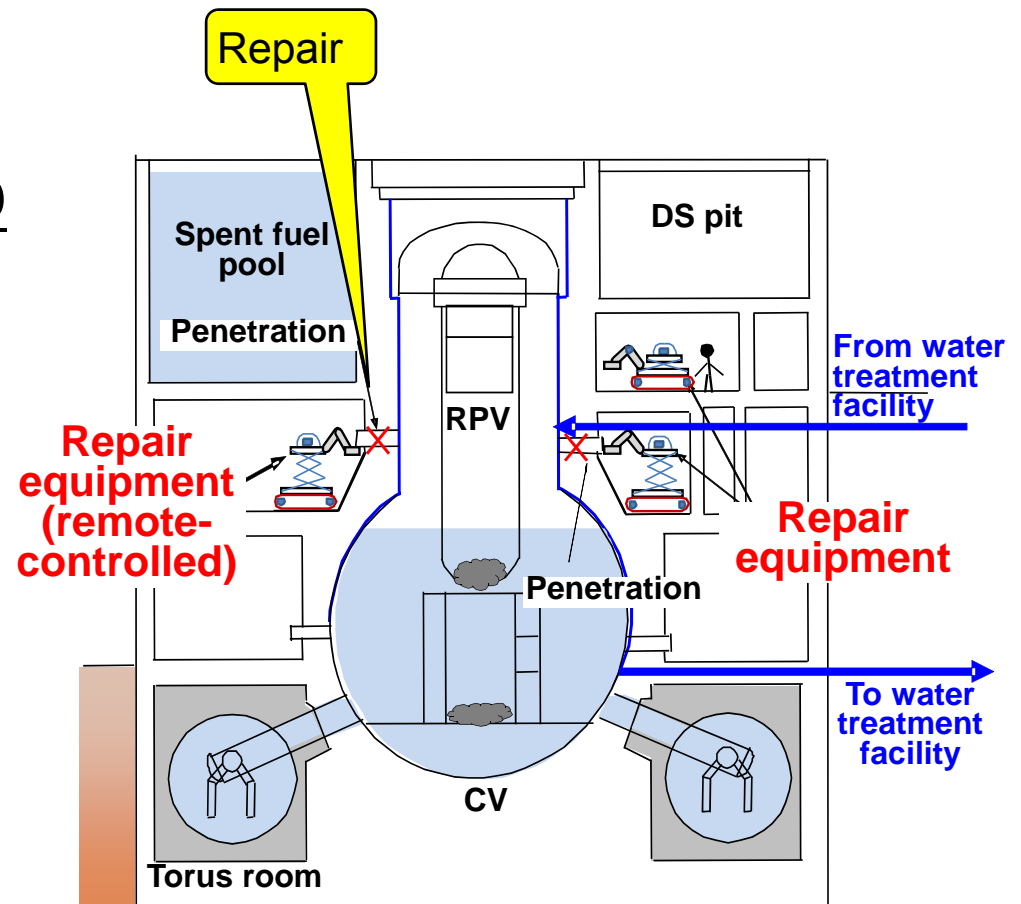


(6) Plug the leak path of the upper CV and flood

Activity

- 1) Repaired the upper CV
- 2) Flood the CV with water before investigation of the inside CV starts

Issues to be addressed in TD
same as in (3)



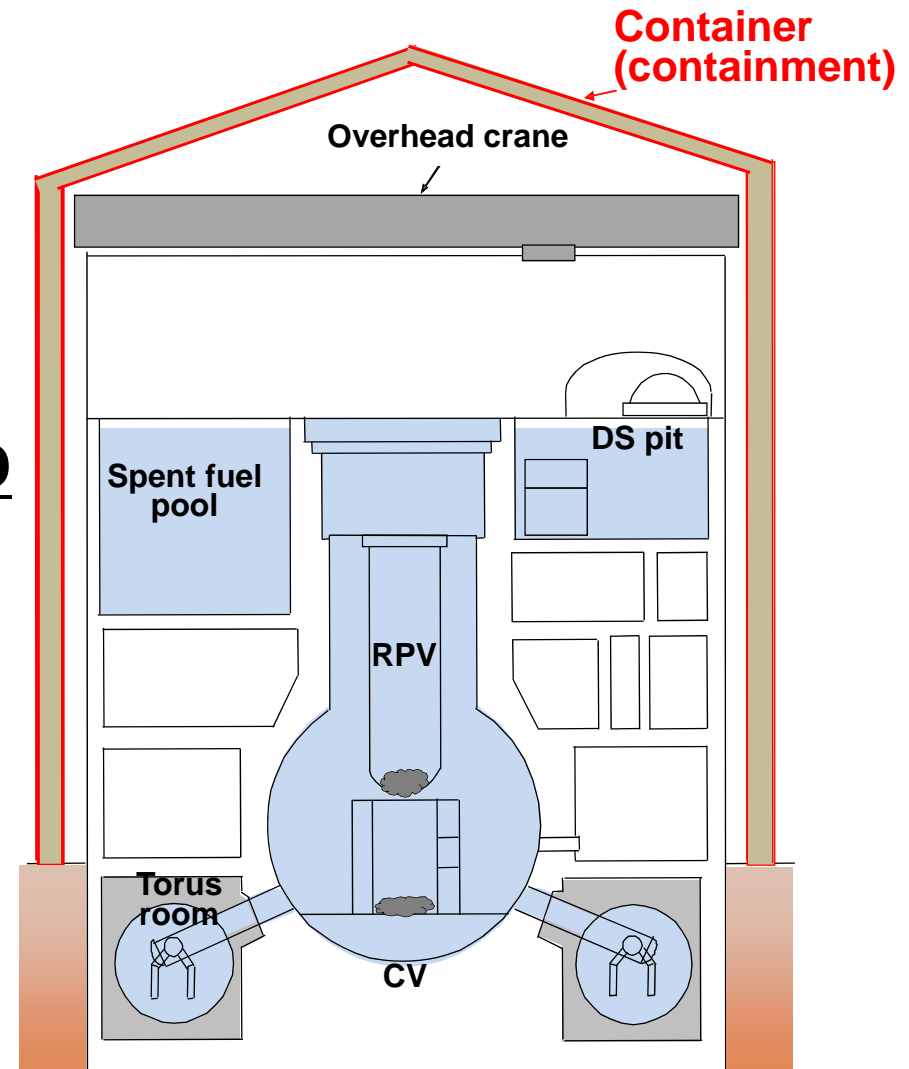
(7) Removal of CV/RPV heads

Activity

- Complete container
- After the sufficient flooding for shielding purpose, remove the upper head of the CV and then RPV

Issues to be addressed in TD

Same as in (6)



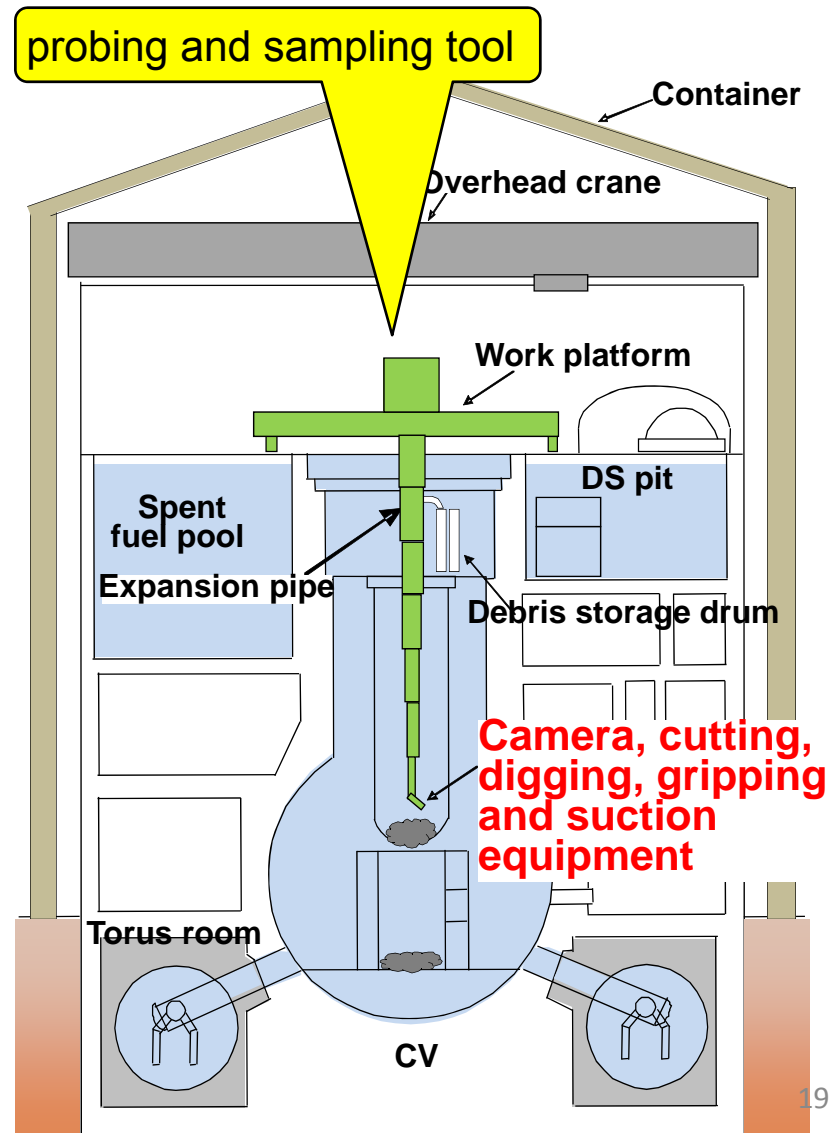
(8) Preparation for removal of core debris

Activity

Probing to the inside RPV and taking samples

Issues to be addressed in TD

Remote probing and sampling tool workable in high radiation area



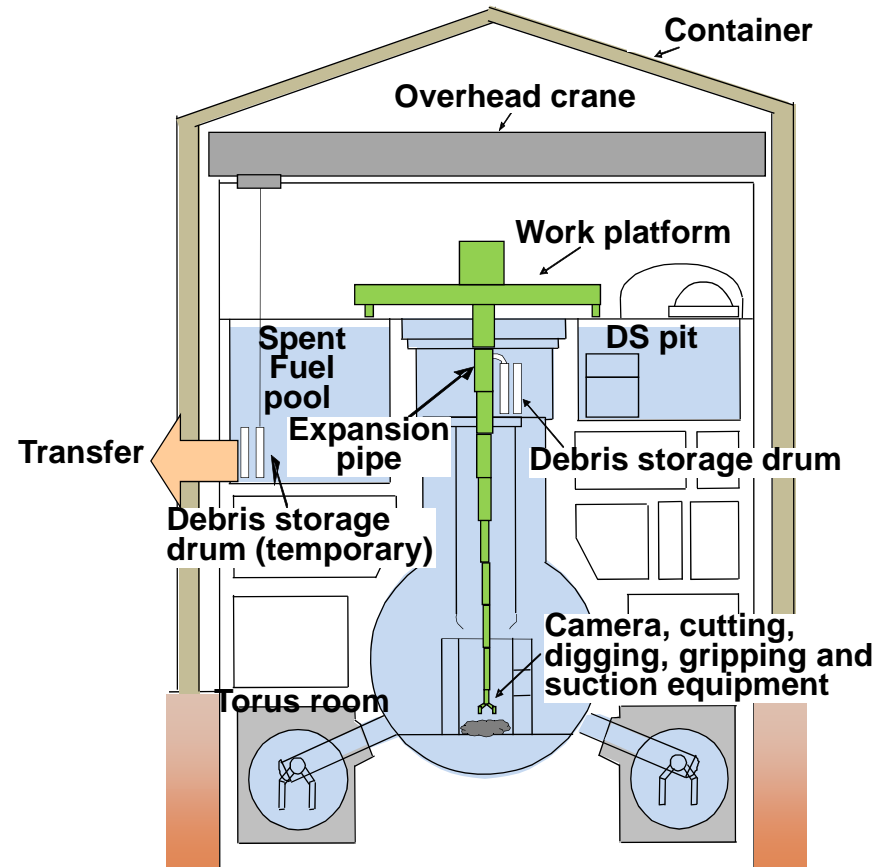
(9) Removal of debris

Activity

- ✓ Prior demonstration using simulated debris
- ✓ Core debris removal and transfer to containers

Issues to be addressed in TD

- ✓ Advanced techniques and methods for core debris removal
- ✓ Criticality control
- ✓ Storage container for debris
- ✓ Accountings system



CONCLUSION

1. Medium- and long- term on site activities;
 - ✓ Decontamination
 - ✓ Defueling
 - ✓ Decommissioning

2. AEC's Committee:
 - ✓ For deliberation of plan for medium- & long- term on site activities
 - ✓ Will identify key technical challenges using reference scenario and others