

R&D activities for Fukushima Daiichi Nuclear Power Station Decommissioning

27th October 2017

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Senior Manager

**International Research Institute for Nuclear Decommissioning
(IRID)**

This achievement is obtained from the Subsidy Project of Decommissioning and Contaminated Water Management by Ministry of Economy, Trade and Industry (METI).

Outline of IRID

1. Name

International **R**esearch **I**nstitute for Nuclear **D**ecommissioning
(IRID)

<http://www.iris.or.jp/en/>

2. Date of Establishment

August 1, 2013

3. Membership (18 organizations)

2 Research Institutes

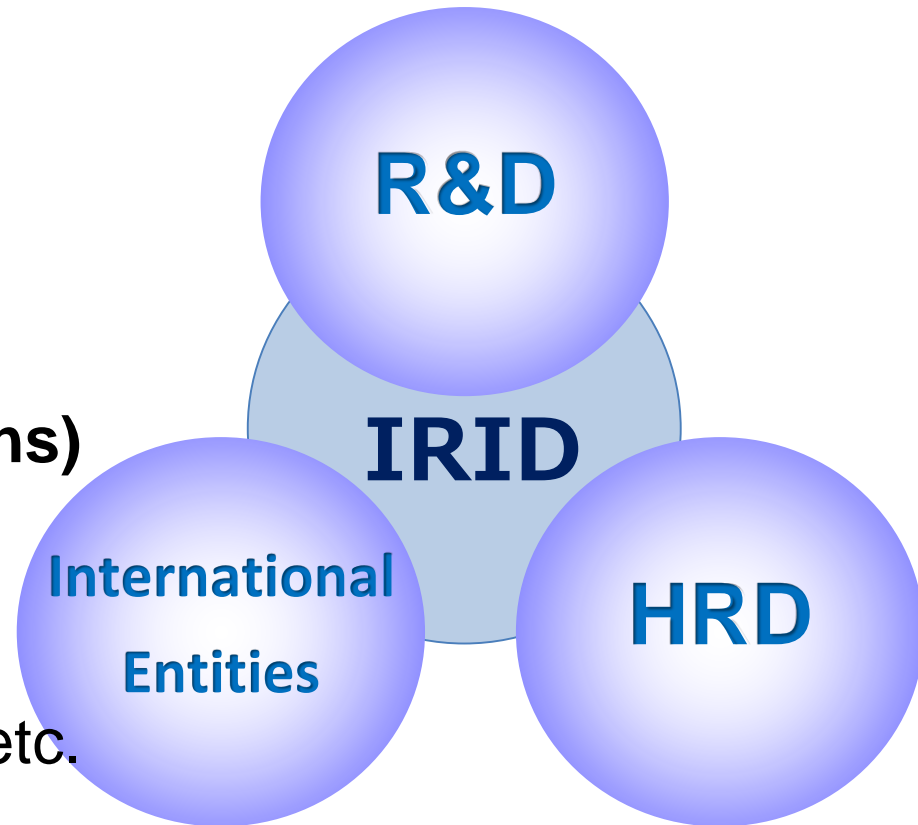
JAEA etc.

4 Manufacturers

Toshiba, Hitachi-GE, MHI etc.

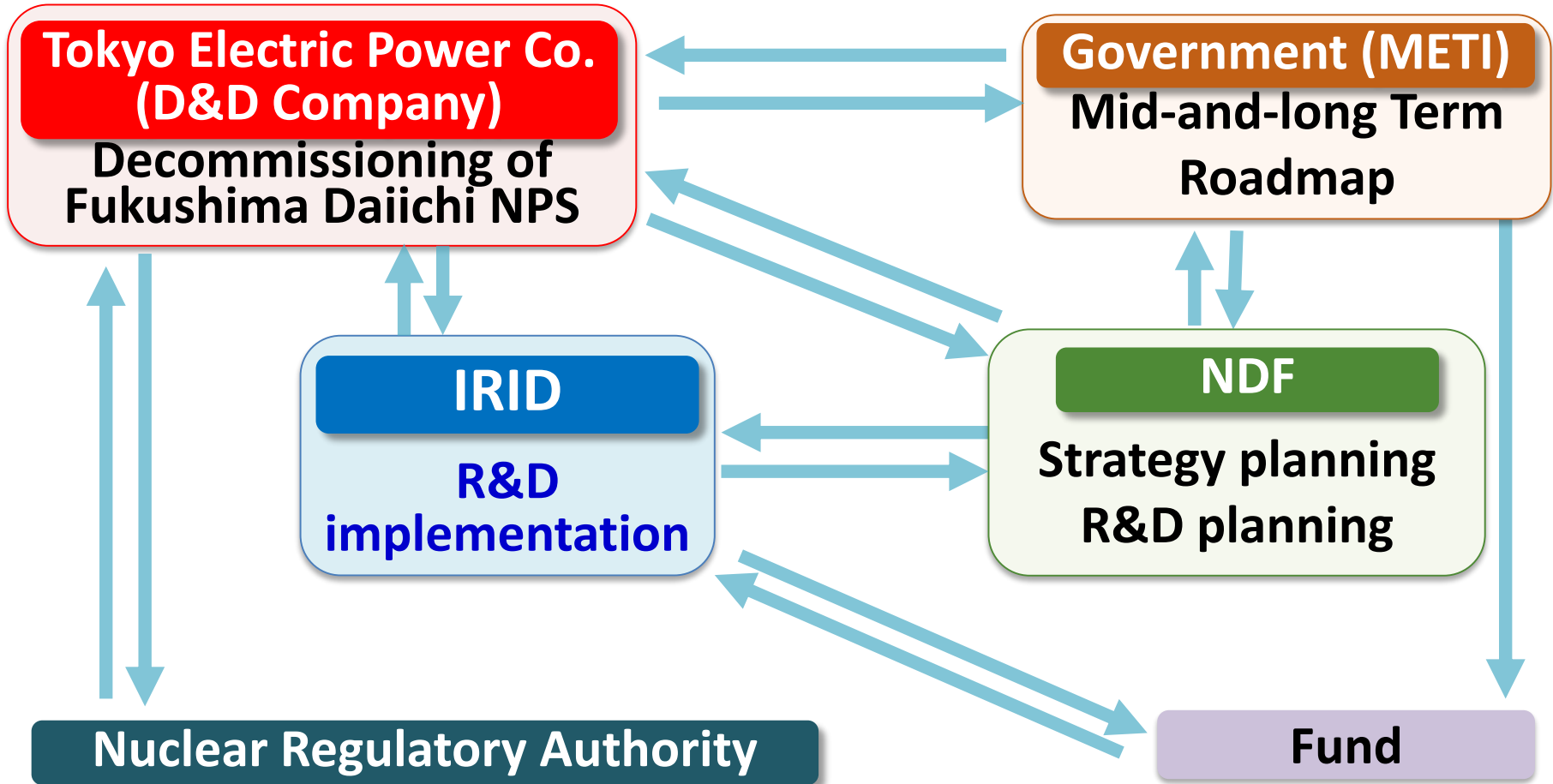
12 Electric Utilities, etc.

TEPCO etc.



Role of IRID

R&D for decommissioning of the Fukushima Daiichi NPS, with a view to strengthening the foundation of nuclear decommissioning technologies.



IRID Research and Development Projects

1. Decontamination and Dose Reduction

- Technology for **remote operation**

2. Detection of Fuel Debris

- ◎ Indirect method
 - By **analysis**
 - Using cosmic ray **MUON**
- ◎ Direct methods
 - **Inside PCV and RPV**

3,4. PCV Repair

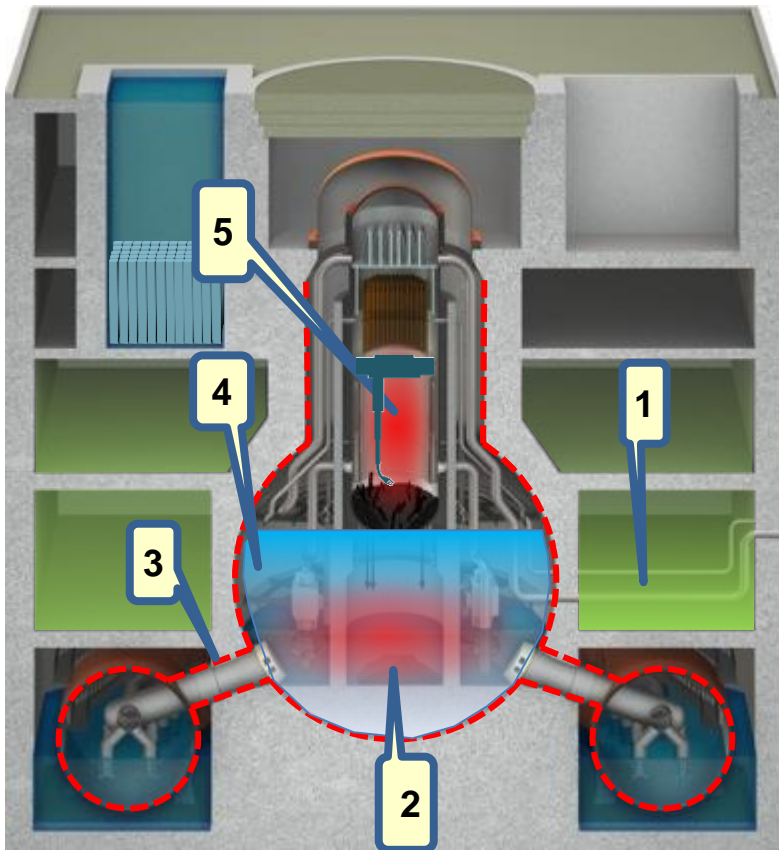
- Development of Technology
- **Full-scale test**

5. Debris Retrieval

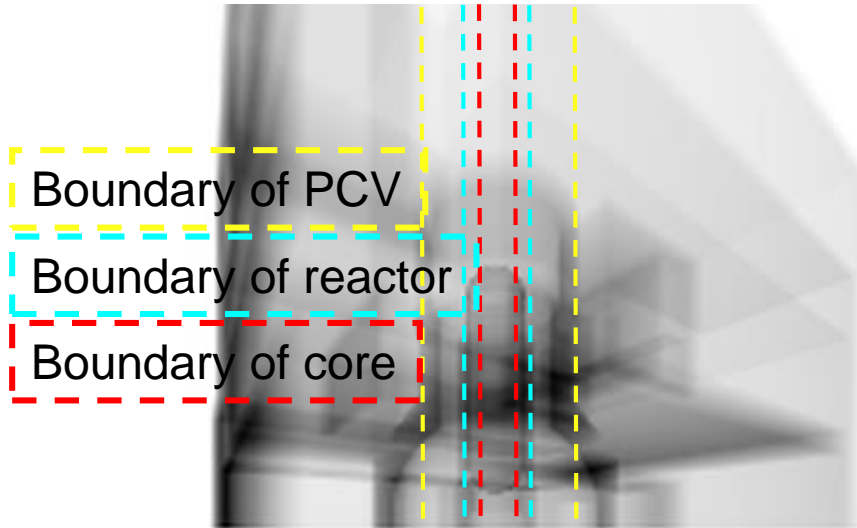
- Development of **fundamental Technology**
- Development of **access method and system**
- Development of **criticality control method**

6. Debris Transfer and Storage

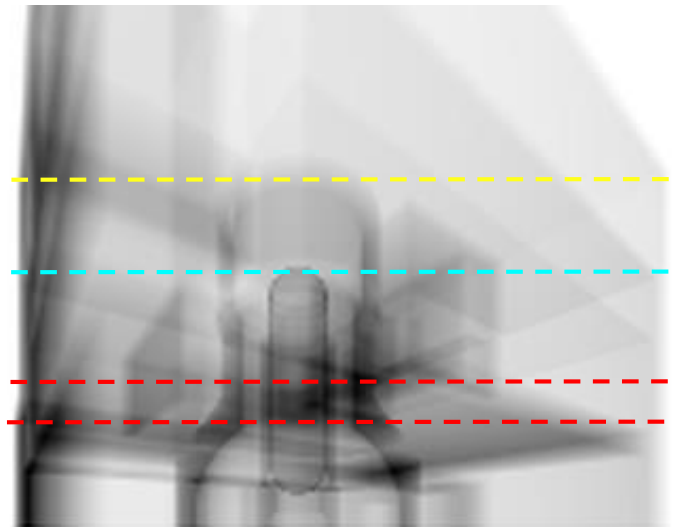
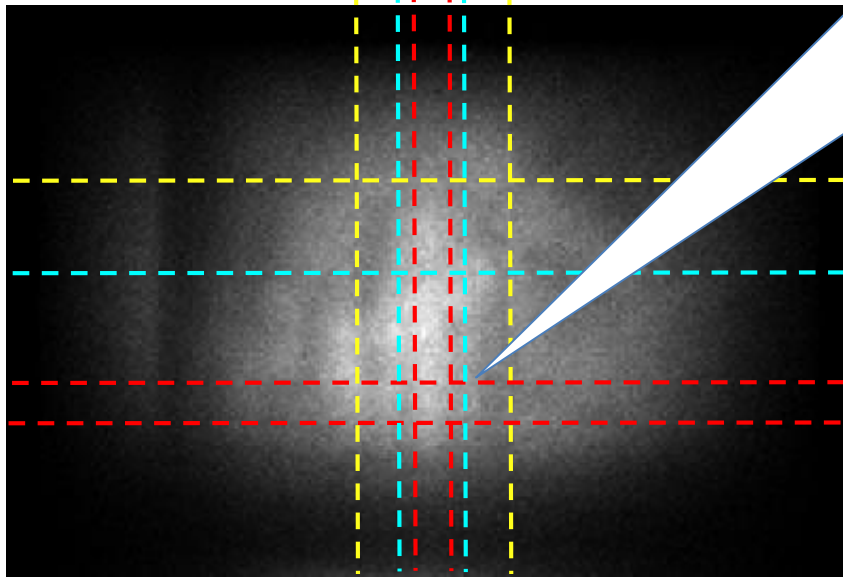
- Development of technology for **collection, transfer and storage** of debris



Detection of Fuel Debris using Cosmic Ray MUON at Unit 1

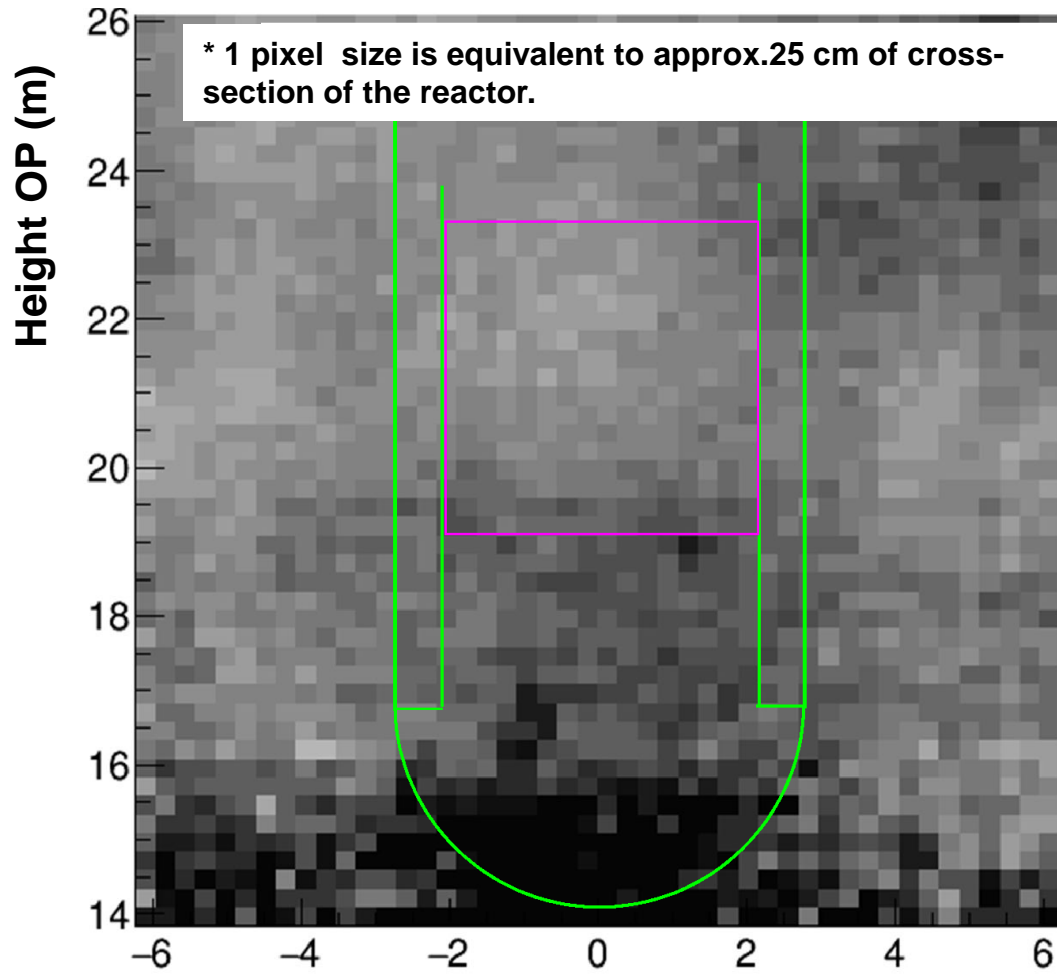


High density material (fuel) is not detected at the area where the reactor core was originally located.



Investigation using MUON at Unit 2

■ Confirming the high density material shadow that is assumed to be fuel debris at the bottom of RPV.

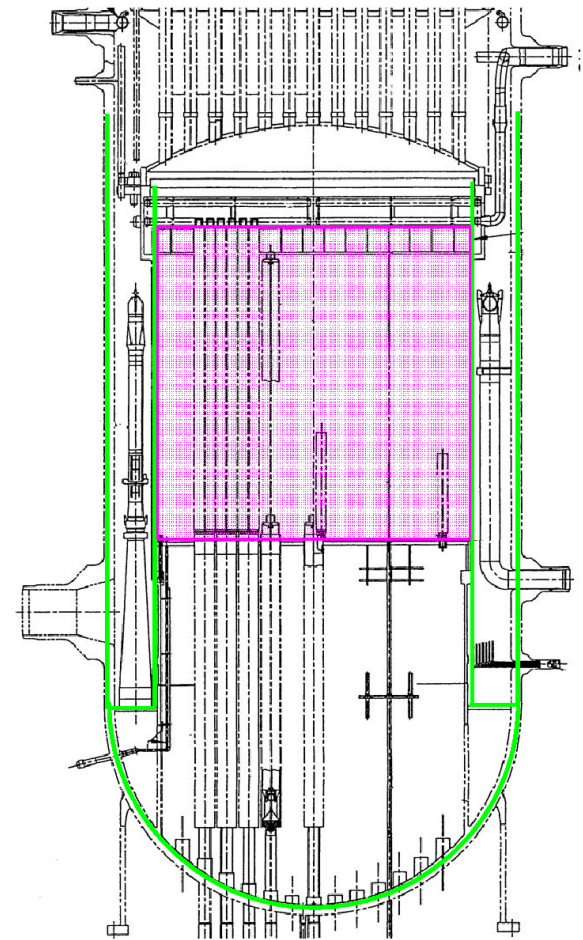


North

Horizontal distance

South

(Measurement result: as of July 22, 2016)



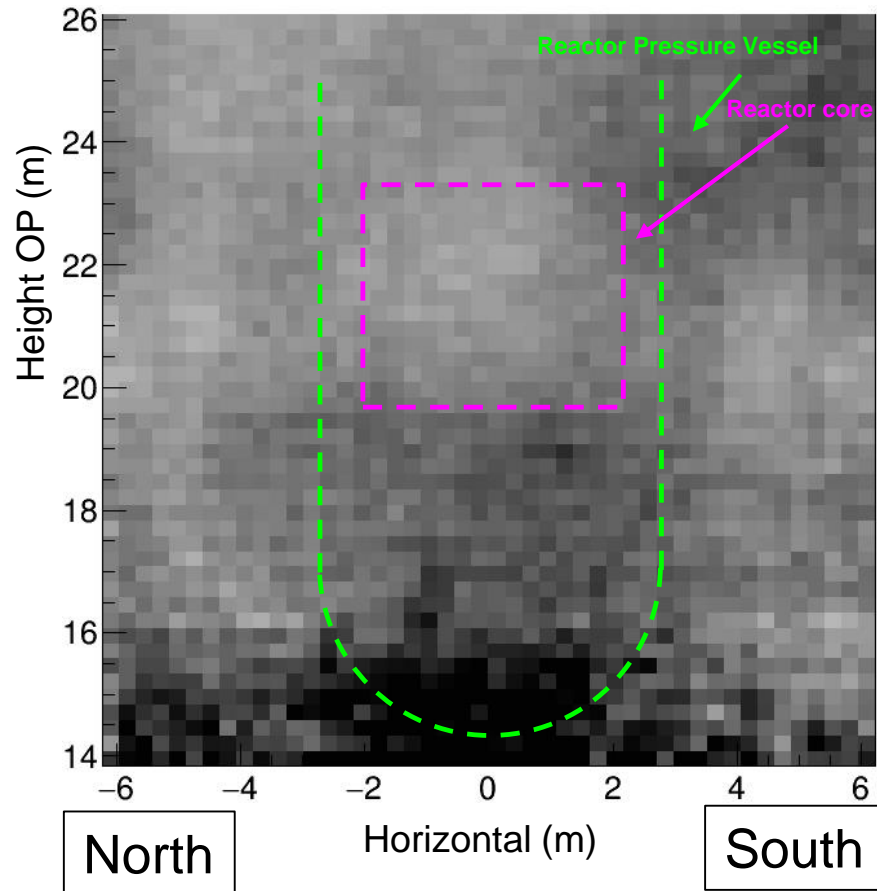
Structure of lower part of RPV

Source: Publicized results by TEPCO Holdings, July 28, 2016

Results of Muon Investigation at Unit 2 & 3

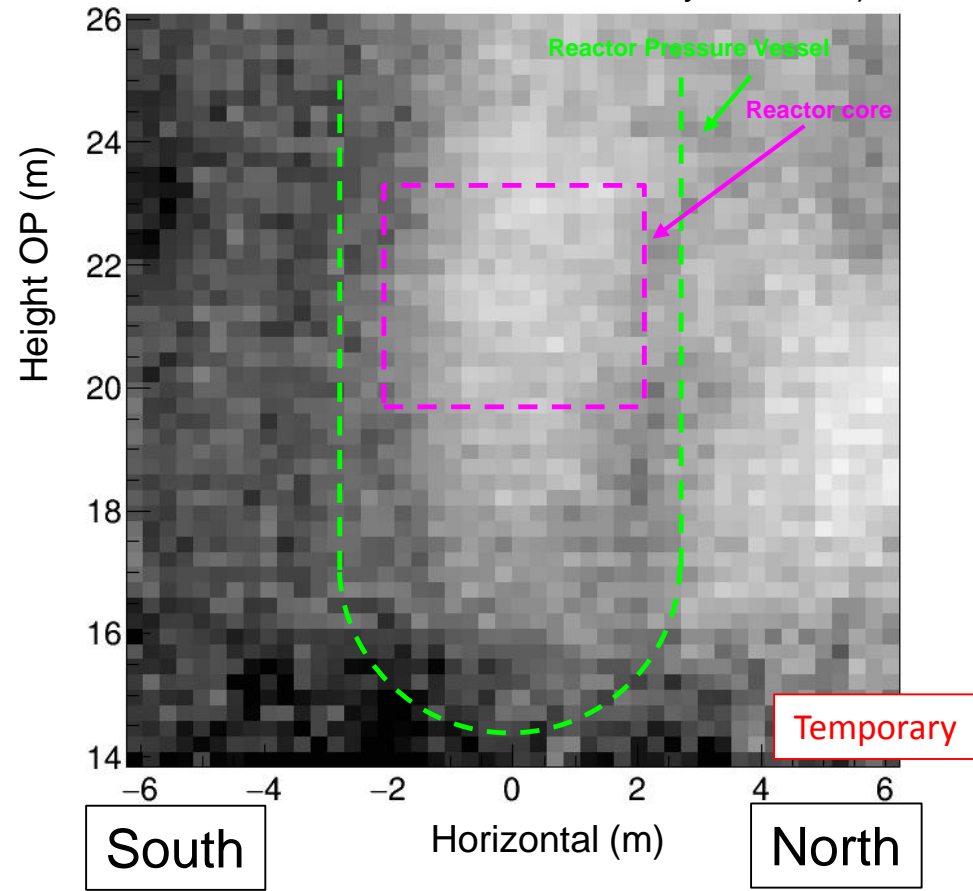
- Assuming the high density material that exists at the bottom of Unit 2 RPV.
- Not confirming the high density material at Unit 3 RPV that is assumed to exist at the Unit 2 RPV.

Unit 2



Unit 3

As of July 20, 2017)

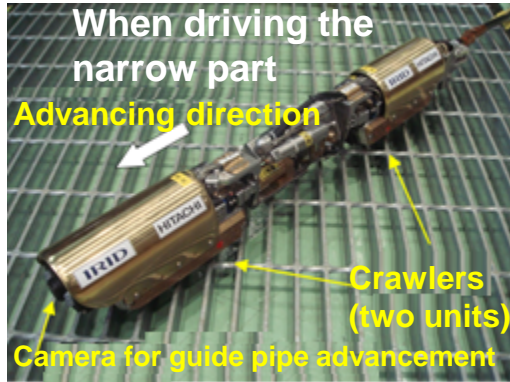


Source: Publicized results by TEPCO Holdings, July 28, 2016

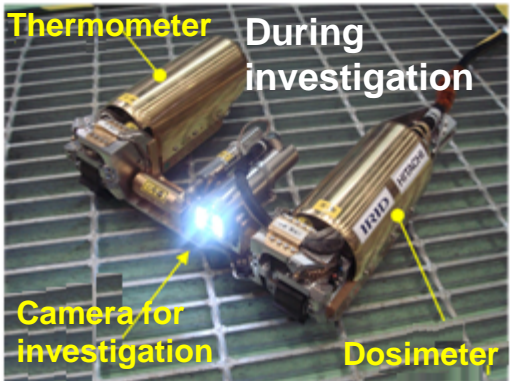
Investigation of inside the PCV using Robots

Investigation of outside the pedestal (Unit 1)

- Shape-changing robot (B1, B2 investigation)



↕ Shape changing



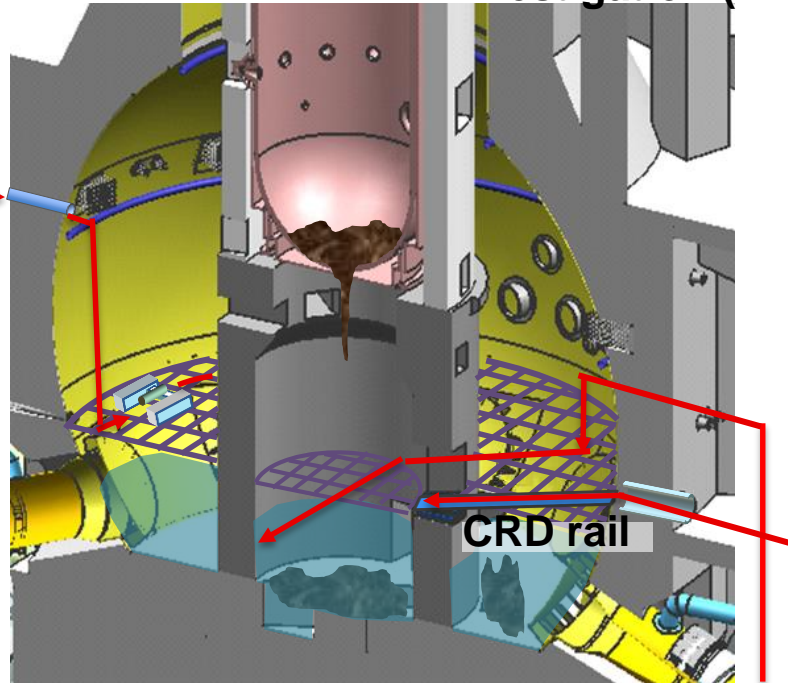
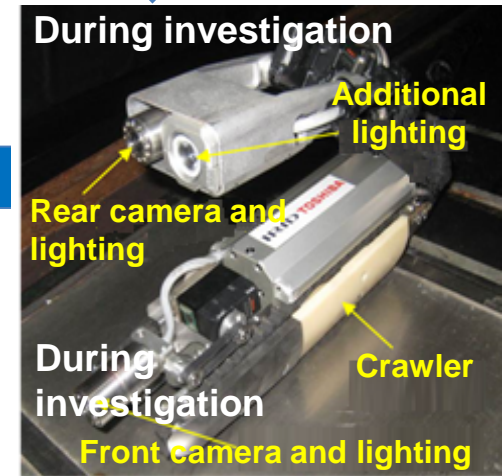
(Note) The robot for B1 investigation is shown in the above photos

Investigation of inside the pedestal (Unit 2)

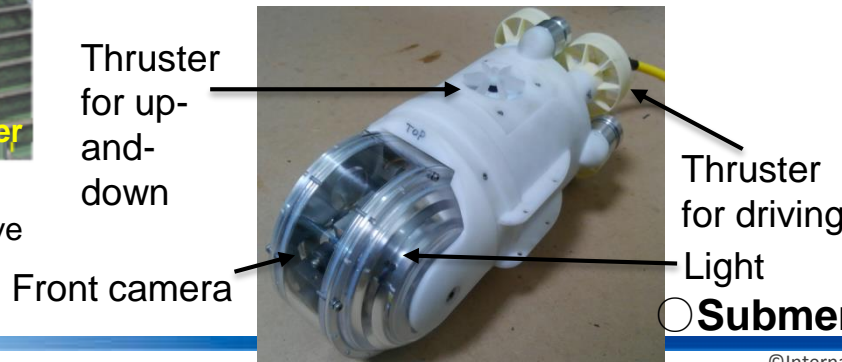
- Remotely operated crawler robot for investigation (A2 investigation)



↕ Shape changing

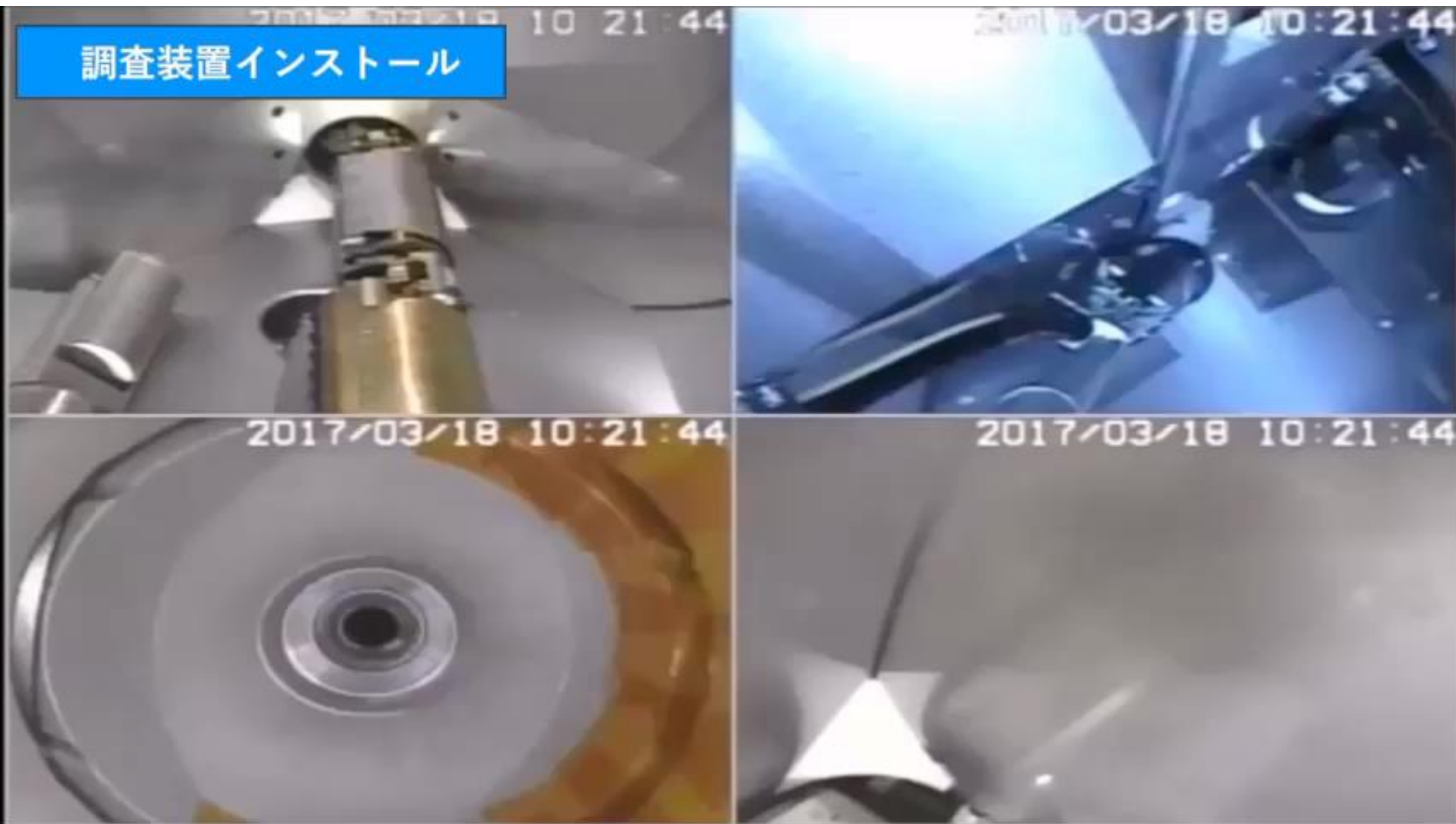


Investigation of inside the pedestal (Unit 3)



- Submersible Crawling Robot

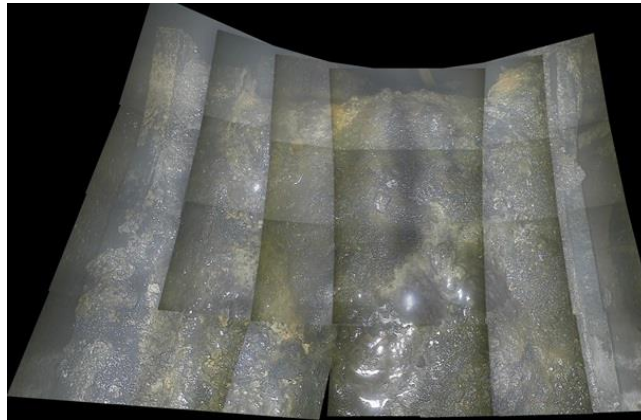
B2 Investigation at Unit 1 (Videos)



A2 Investigation at Unit 2



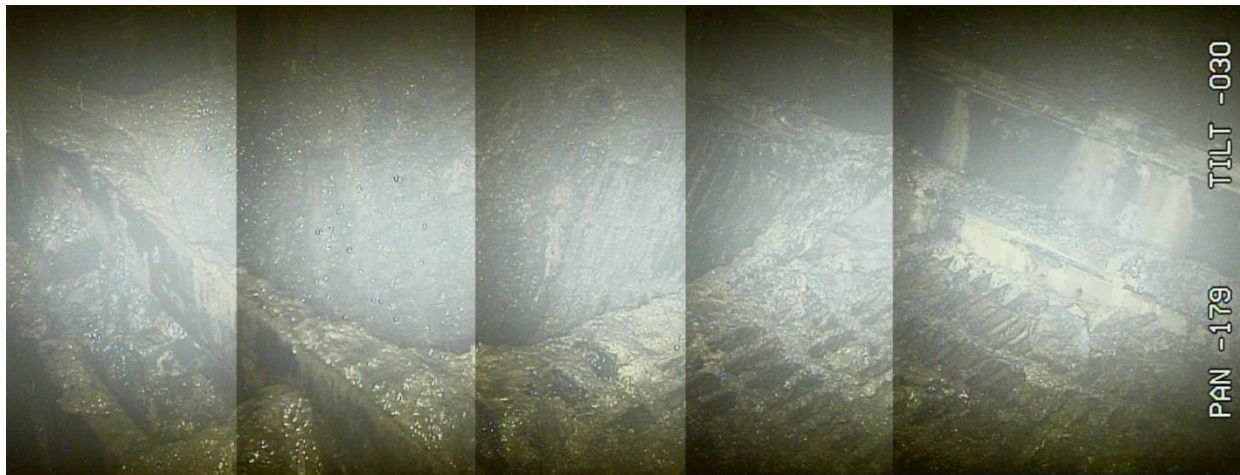
Accretion of the grating



Sediments on CRD rail



Crack of platform grating



Deformed platform



Gap between platform and CDR rail

A2 Investigation at Unit 2

Inside the pedestal (upper section of platform, middle-right side)

TIP guide pipe support (28-27)

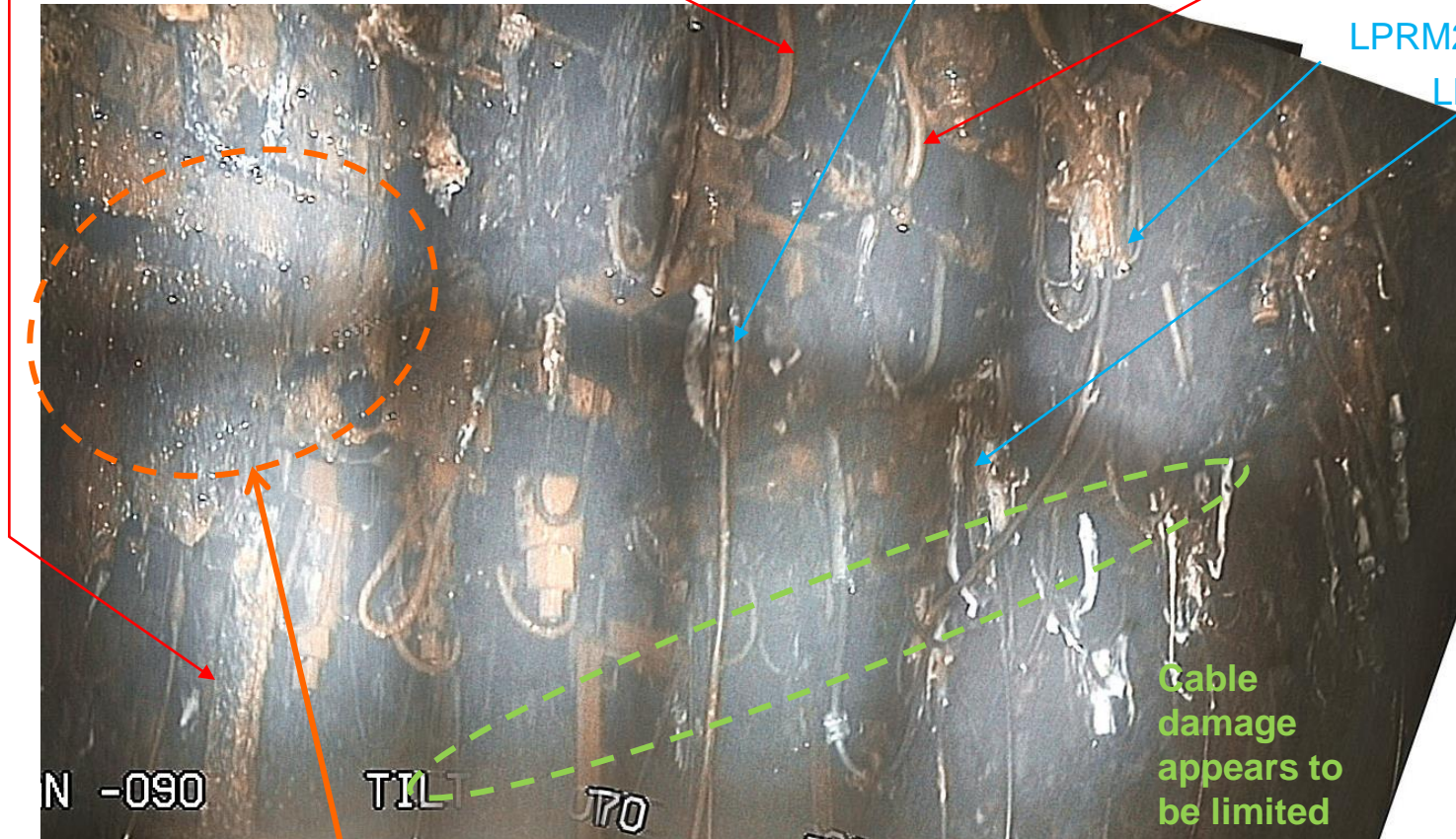
CR34-43

LPRM28-37

CR30-43

LPRM28-45

LPRM guide tube



Cable damage appears to be limited

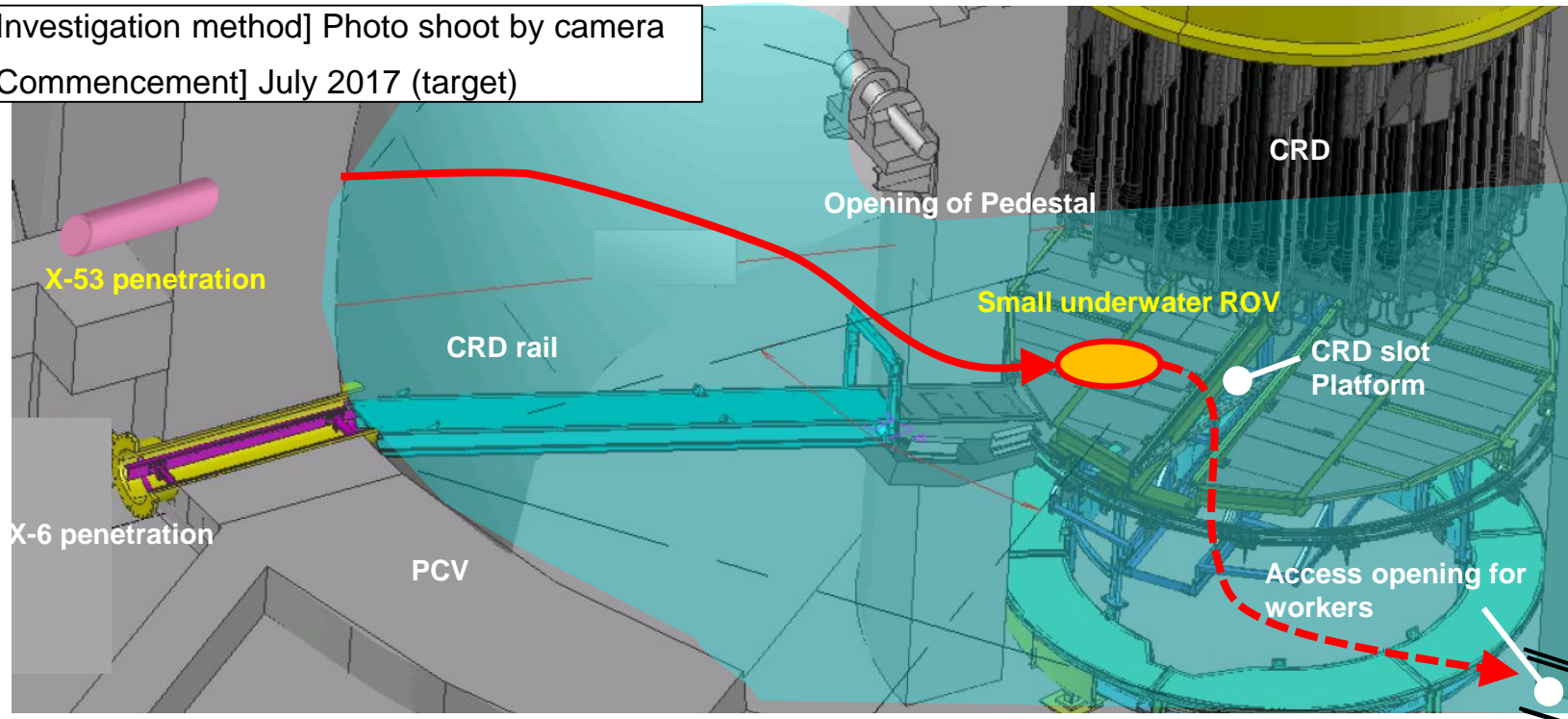
Area where PIP cables and LPRM cannot be confirmed

*Image processing: TEPCO Holdings

Investigation of the inside the pedestal at Unit 3

[Investigation method] Photo shoot by camera

[Commencement] July 2017 (target)



[Investigation route]

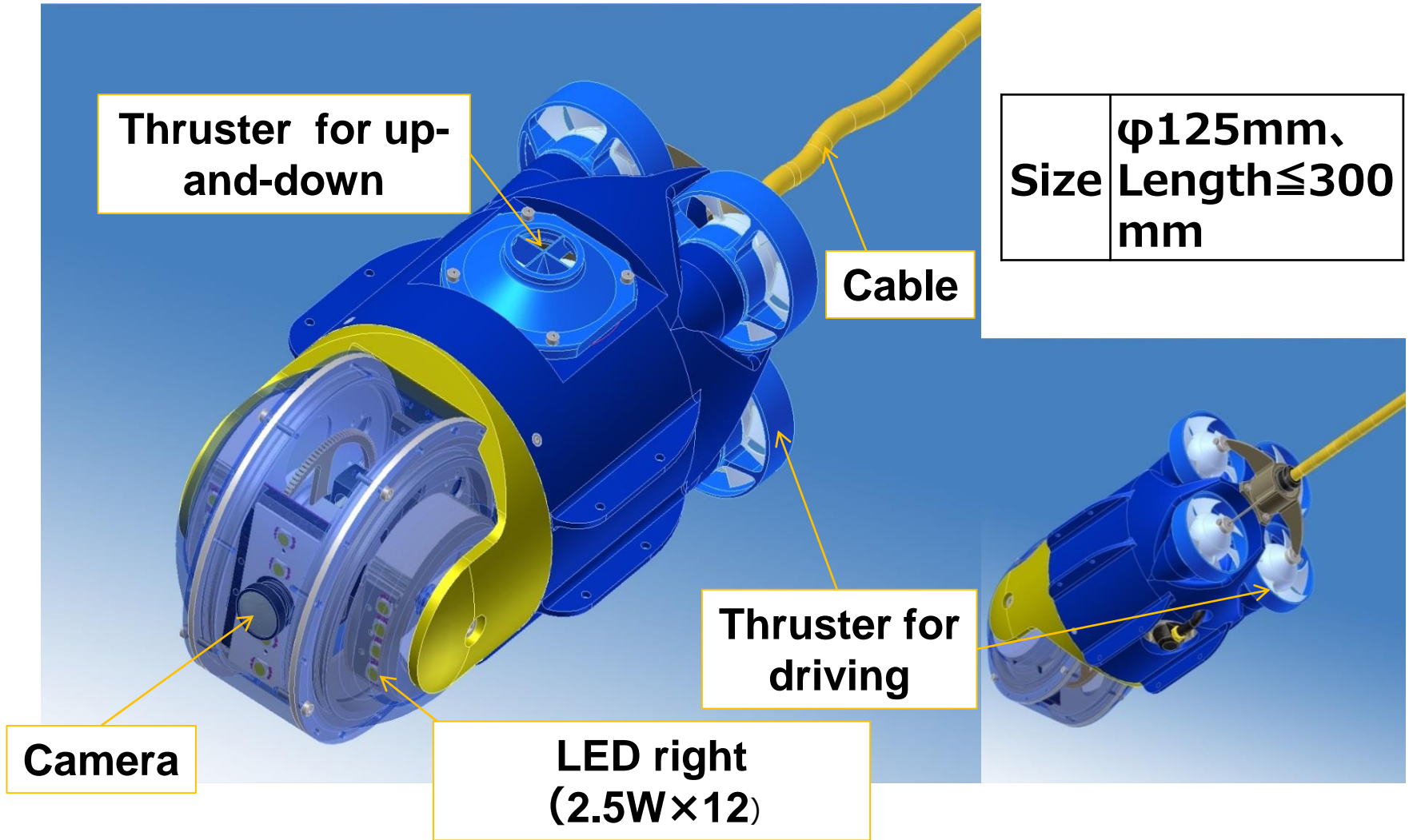
- (1) **Access from the X-53 penetration.**
- (2) Going inside the pedestal.
- (3) Checking the access route to the basement floor of pedestal.
- (4) Entering the basement floor of the pedestal.

[Investigation Items]

- (1) Status of damage **on the platform and the lower CRD.**
- (2) Presence of **obstacles at CRD slot opening.**
- (3) Conditions of **debris accumulated at the bottom of pedestal.**
- (4) Conditions **of debris** from the access opening for workers to the outside pedestal.

Investigation Device for Unit 3

Submersible Crawling Robot: "Mini-mambo"



Video images of Underwater ROV at Unit 3

隔離弁 開

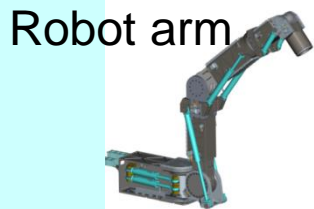
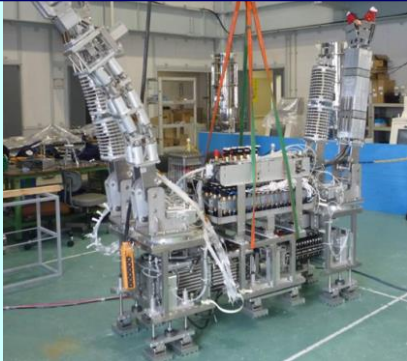


Fuel Debris Retrieval

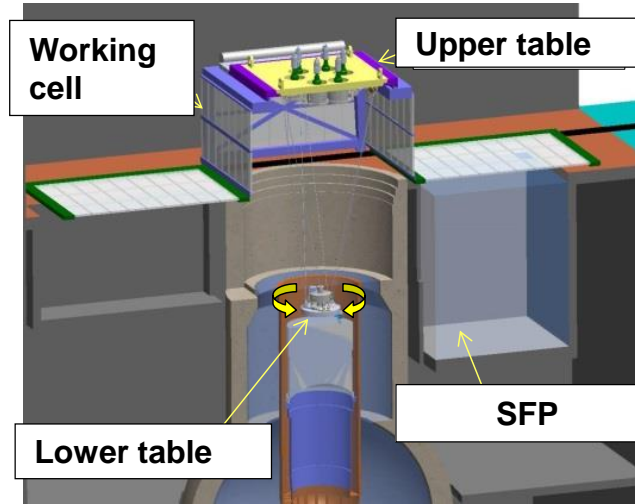
Technical issues

- **Confinement of Radioactive dust**
- **Remote Operation**
- **Reduction of radiation dose, Prevention of spreading of contamination**

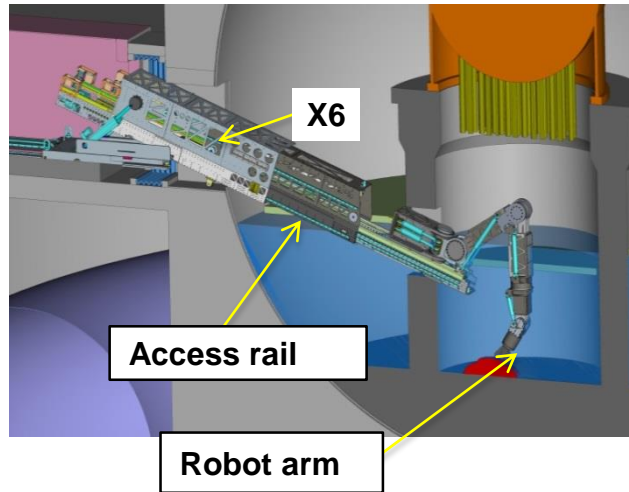
Development of key technology



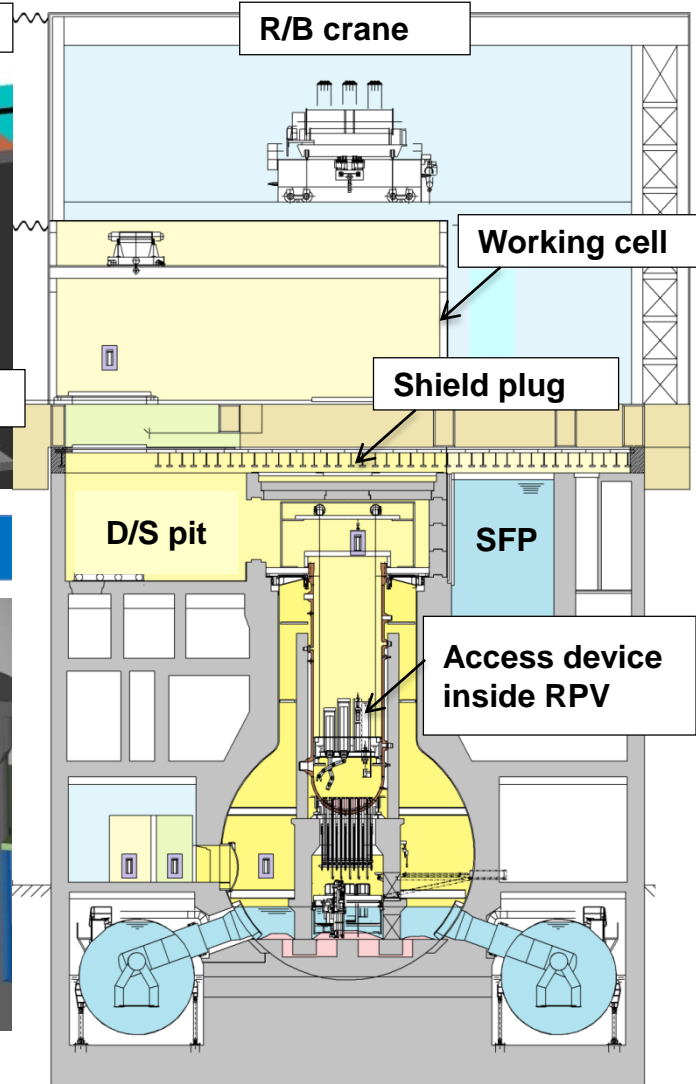
Submersion - Top entry



Dry - Side entry



Dry - Top entry



[PLAN-A] Side Entry : Access Rail Method Images of Fuel Debris retrieval (Videos)

Safety Function

Decontamination

Debris investigation

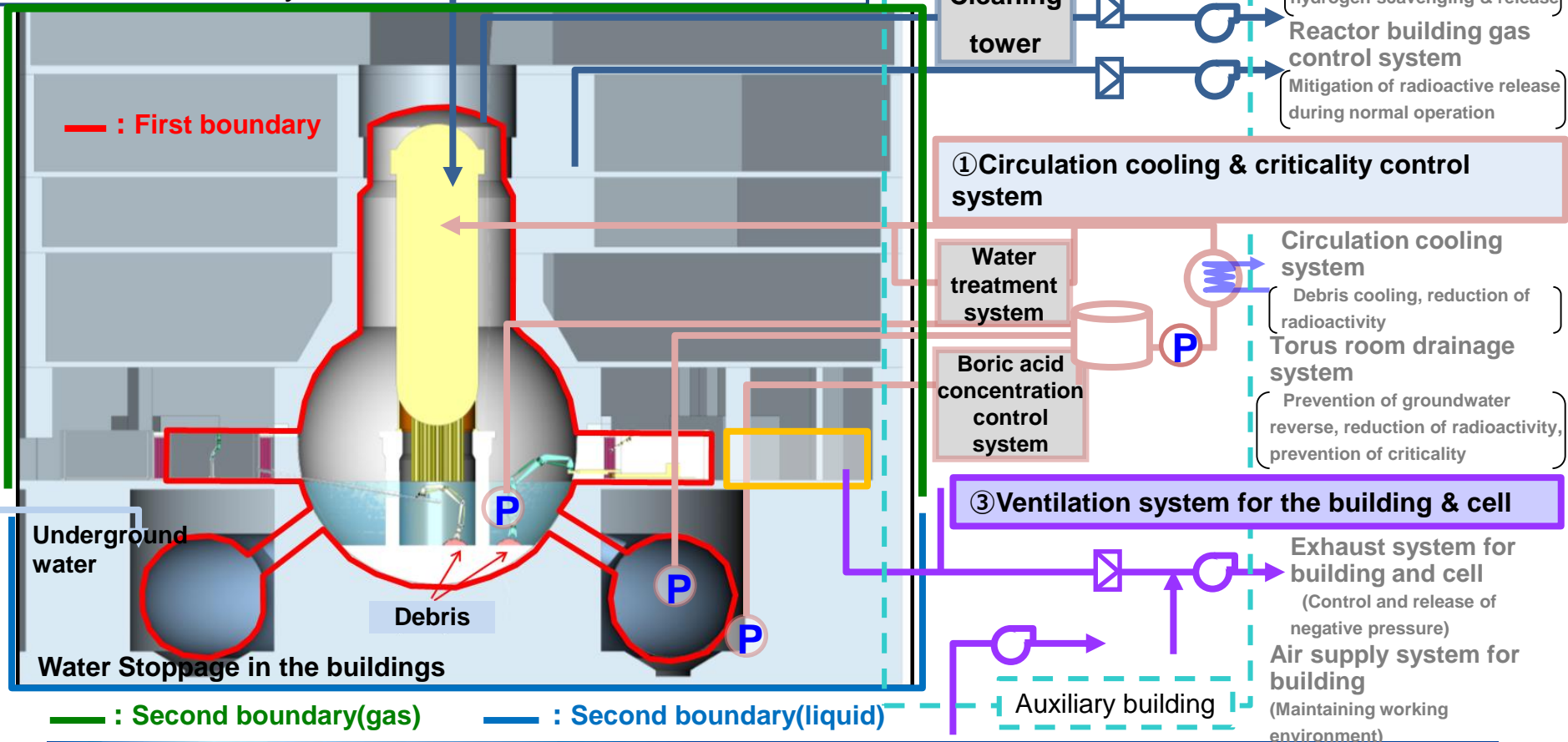
PCV repair

Debris retrieval

Collection, transfer and storage

Safety Function Requirements

1. Cooling down
2. Confinement (control of negative pressure and water level in torus room)
3. Deactivation (protection of fire and explosion)
4. Sub-criticality



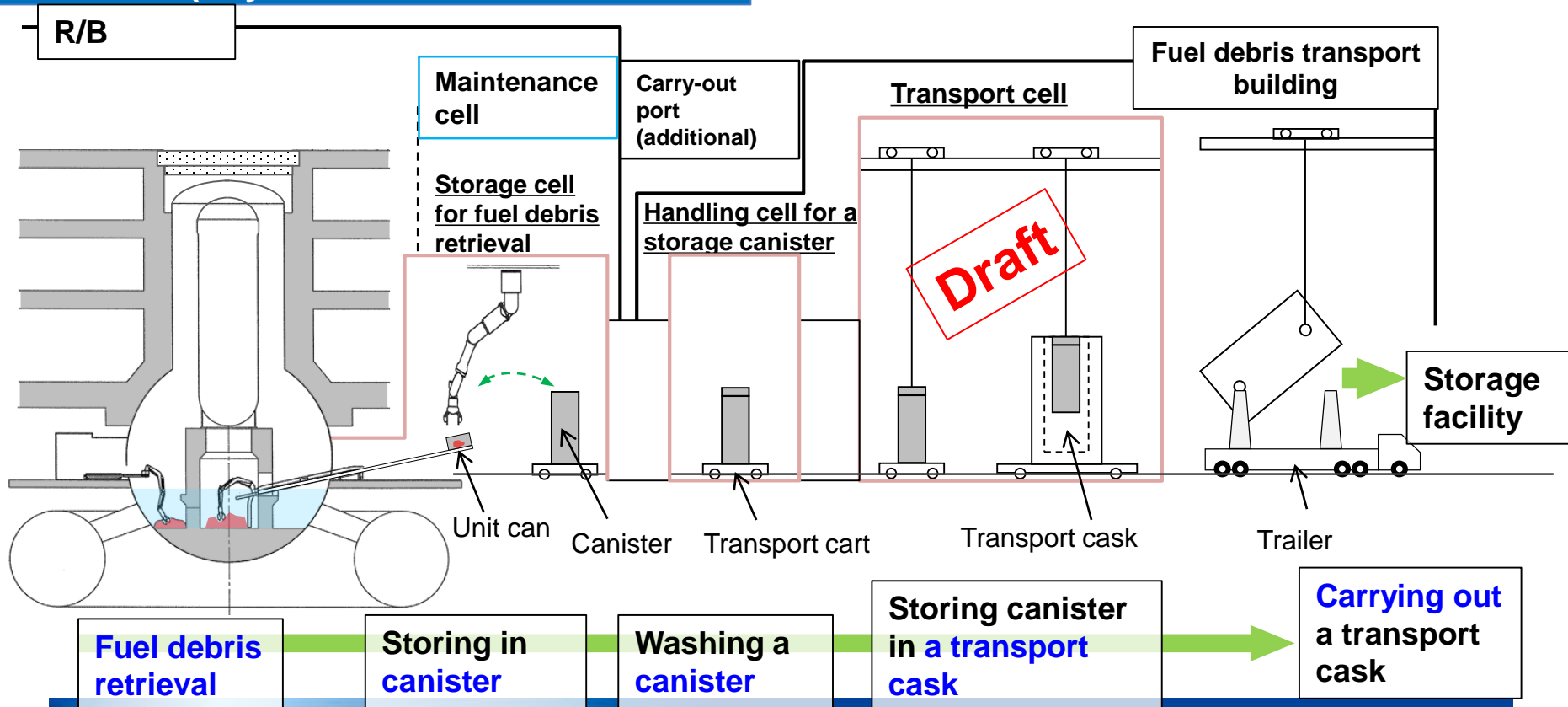
Collection, Transfer and Storage of Fuel Debris

Canister design

⇒ Response to 1F specific requirements

- High fuel exposure and enrichment → **high reactivity**
- MCCI → **hydrogen generation** caused by core concrete interaction
- Injecting sea water, melting cable → effects caused by **salt and impurities**

Transfer (Dry –side access method)



Thank you for your attention!