Japan's Side Event

Current Status of the Decommissioning at FDNPS

September 16, 2025

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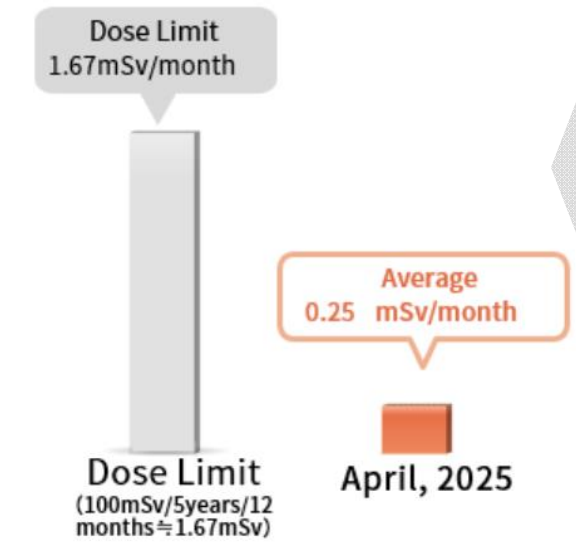
President of Fukushima Daiichi Decontamination and Decommissioning Engineering Company,
Tokyo Electric Power Company Holdings, Inc.

How significantly has Fukushima Daiichi site changed since accident in 2011?

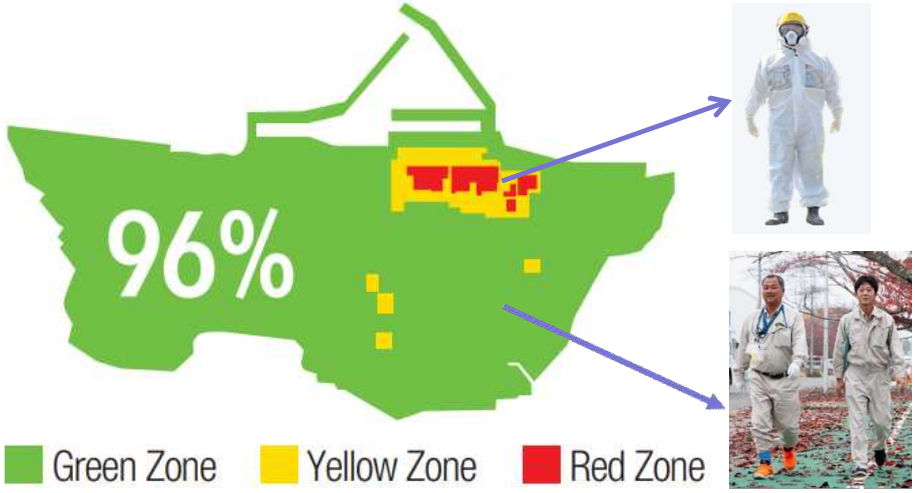
Improvement of on-site environment

The average exposure dose in April, 2025 is low enough, compared with the dose limit of 1.67mSv/month.



- ✓ Removal of rubble
- ✓ Removal of plants and soils
- ✓ Ground pavement

Zoning and lighter protective gear for workers since 2018



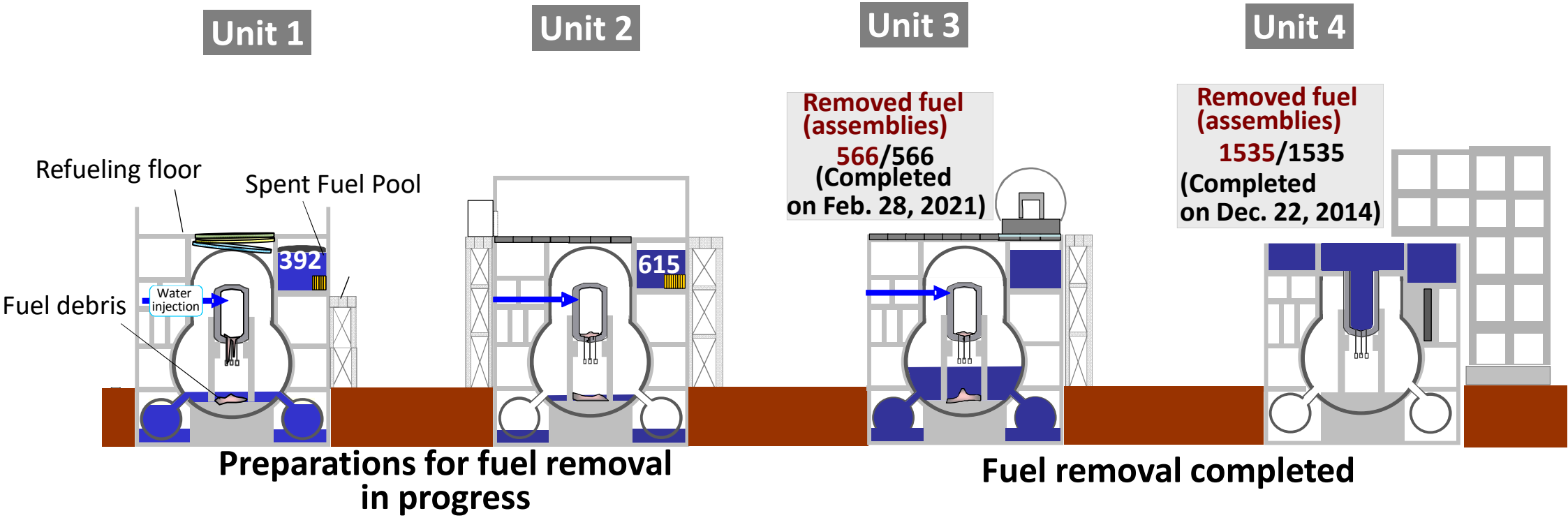
Well-being of workers

Large rest center featuring convenience store & cafeteria completed in 2015

Administrative building completed in 2016

Spent Fuel Removal from Pools

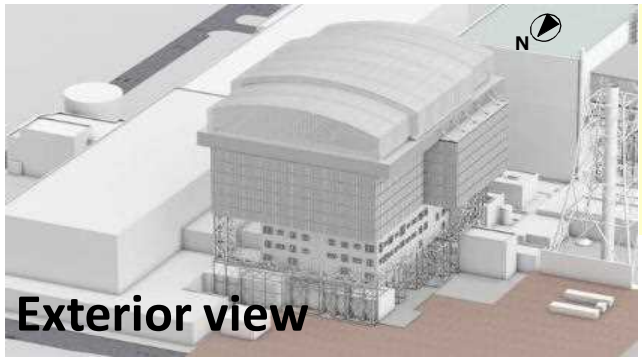
What is spent fuel removal?



-At the upper part of the each reactor building lie spent fuel pools, storing fuel assemblies etc. that were used for power generation.

-To reduce the risk associated with spent fuel, fuel removal operations from the damaged reactor buildings and the associated preparation tasks have been conducted.

Fuel removal strategy for Unit 1

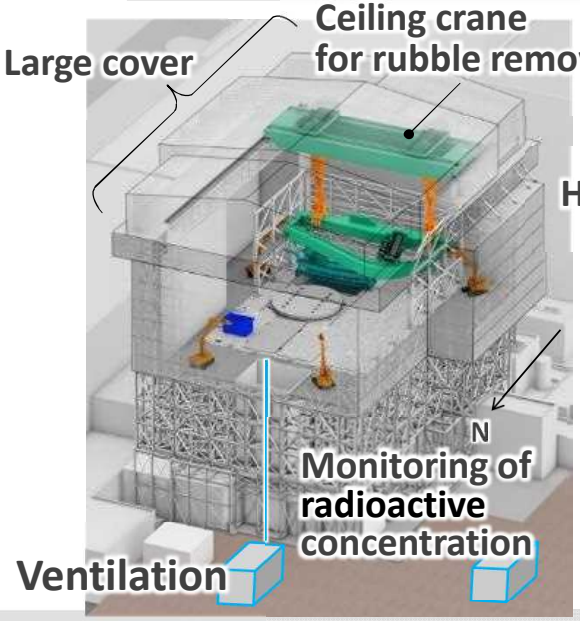


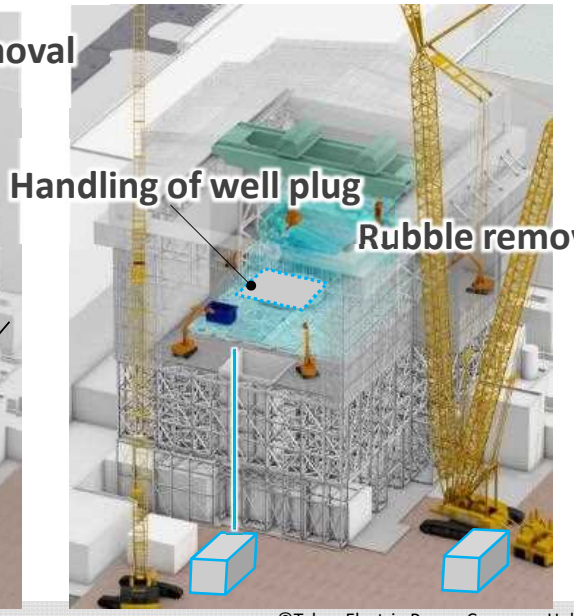
- We've decided to install a large cover over the upper part of the building in advance to prevent radioactive dust from spreading.
- After the installation, rubble removal, radiation reduction and FHM installation are to follow in preparation for fuel removal.

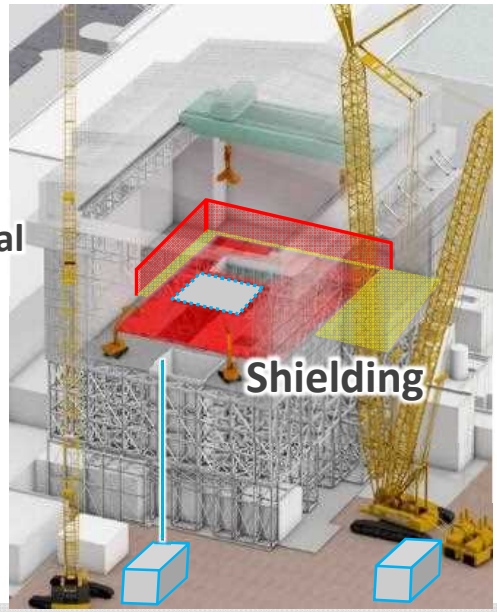
▼ Completion of large cover installation (FY2025)

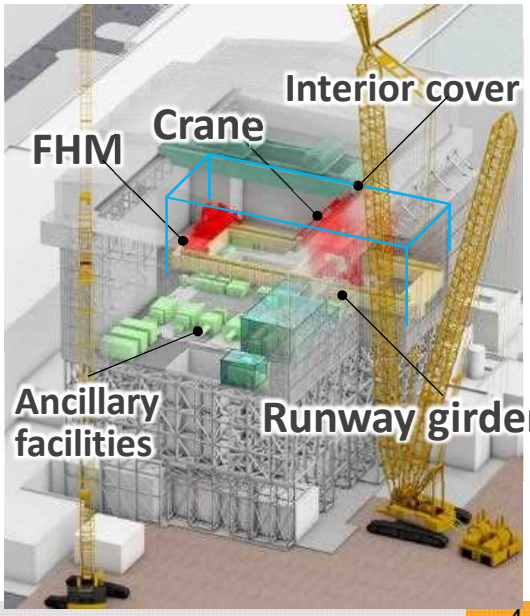
▼ Start removal (FY2027 to 2028)

STEP 1 (currently)	STEP 2	STEP 3	STEP 4	STEP 5
Install large cover	Remove rubble	Decontamination/ shielding	Install fuel handling machine	Start removing fuel





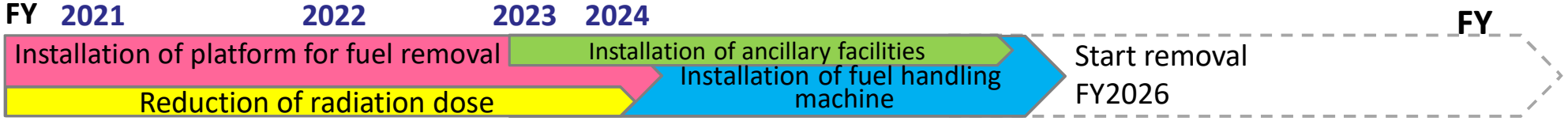


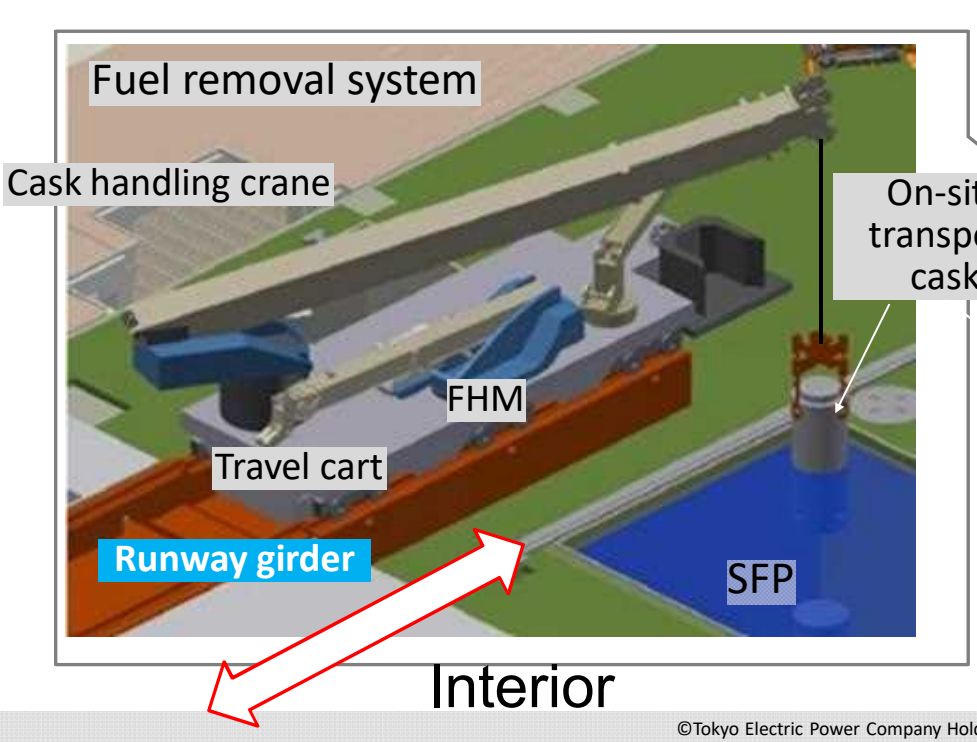


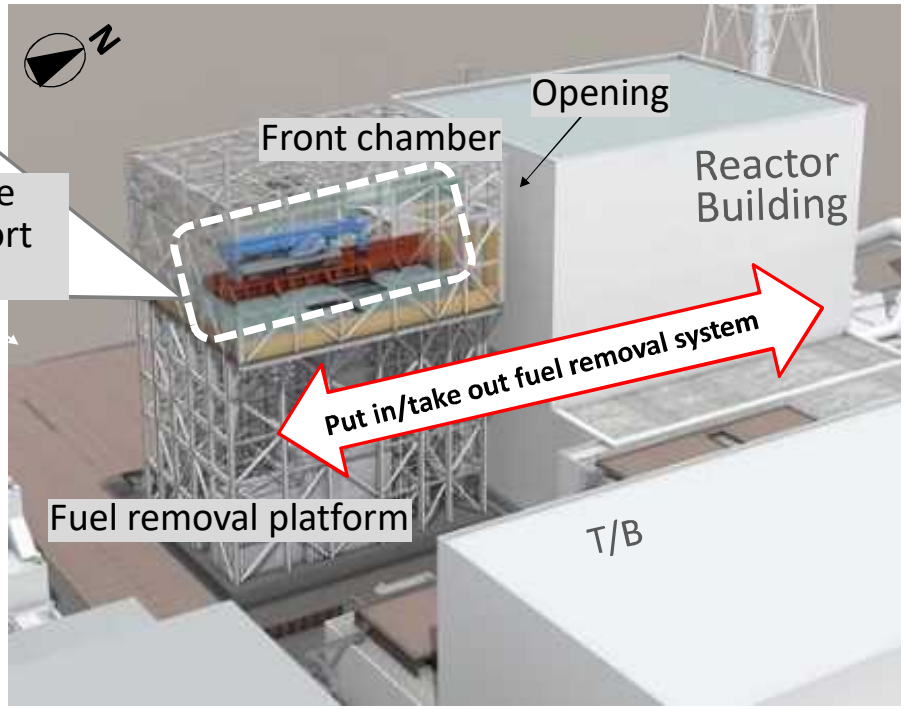
Fuel removal strategy for Unit 2

- Capitalize on existing building and make a minimal wall opening, and then put in and take out fuel removal system through a wall opening: Prevent contamination spread.
- Install fuel removal system after decontamination and shielding, and then remove fuel remotely : Reduce exposure.

<Work Process>



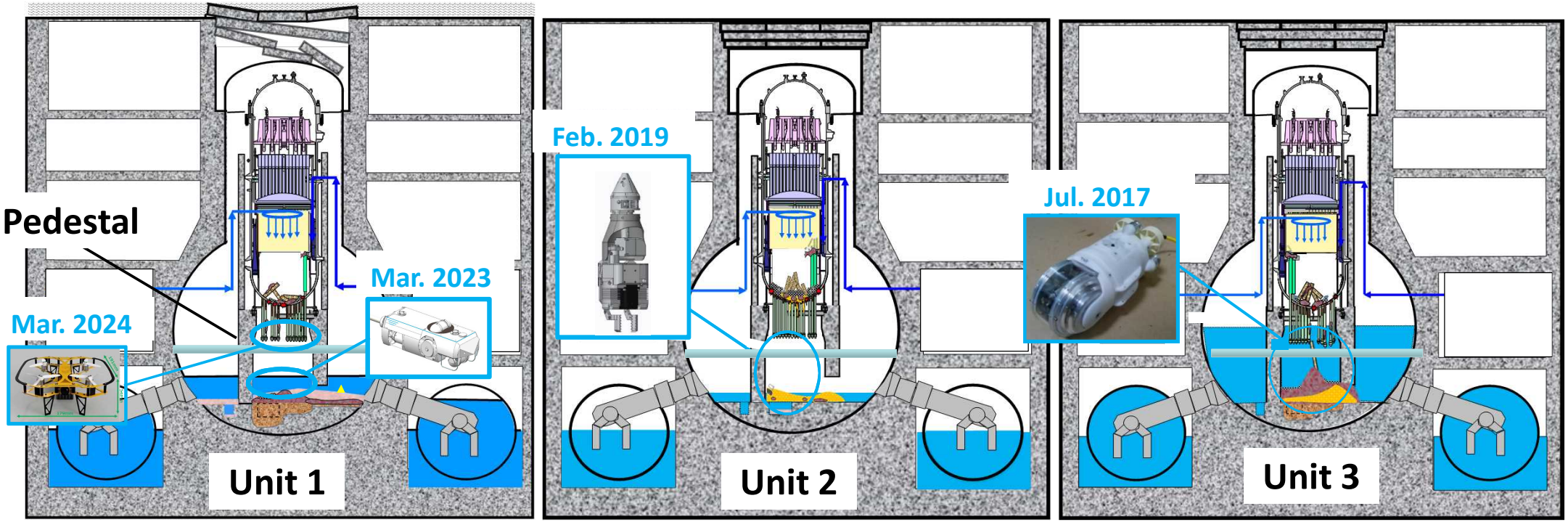





Fuel Debris Retrieval
IRID has contributed to some work shown here

Assumed distribution of fuel debris

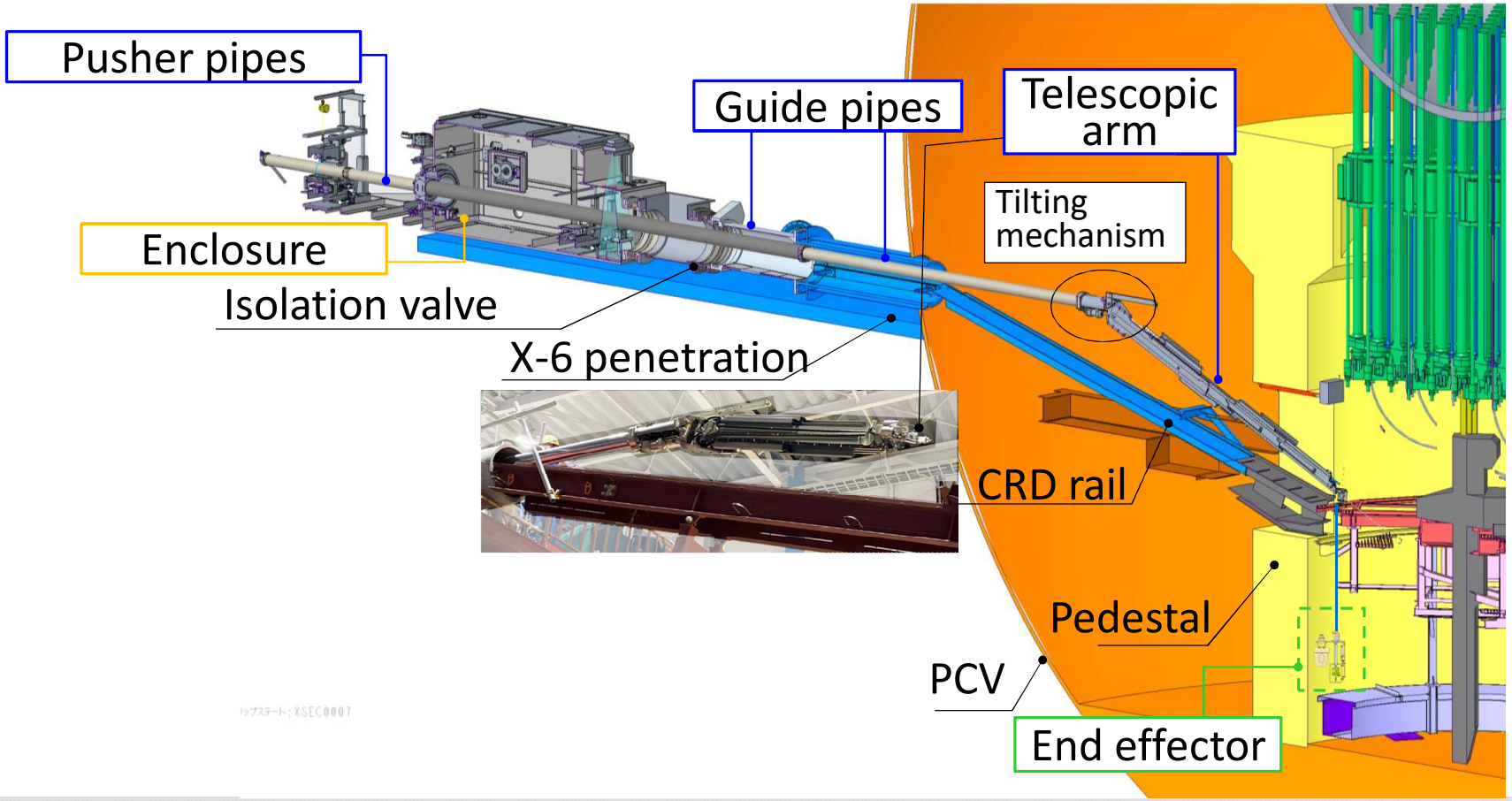
Robotic exploration | **Analysis of accident progression** | **Muon Survey**



Trial retrieval was conducted at Unit 2

Telescopic equipment for trial fuel debris retrieval

- The pusher pipes help the guide pipes move in, and then the telescopic arm, manipulated by the tilting mechanism, goes inside the pedestal.
- The end effector, lowered from the telescopic arm, works to sample the fuel debris.



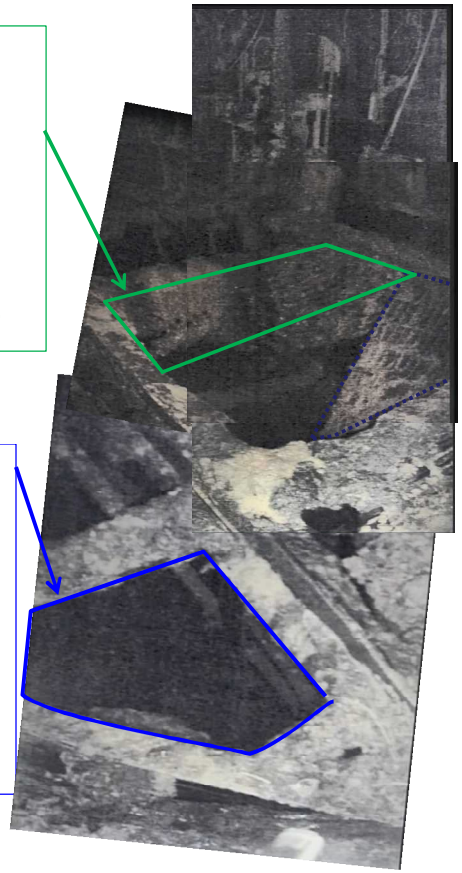
Trial fuel debris retrieval conducted twice

■To expand our knowledge about fuel debris, two trial retrievals were conducted using the different access routes.

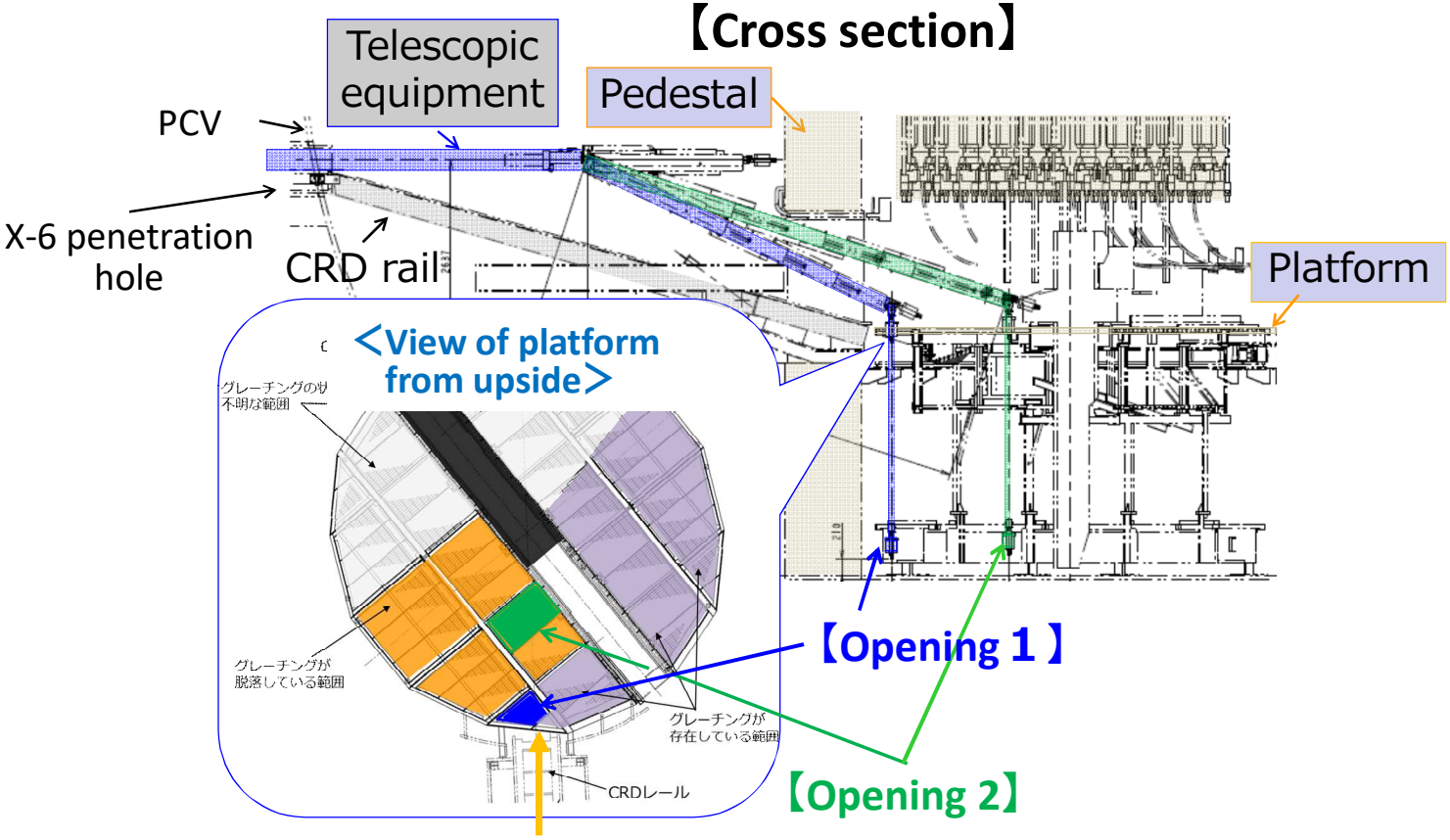
【Routes for trial retrieval】

【Opening 2】
Used in the second trial retrieval in Apr. 2025

【Opening 1】
Used in the first trial retrieval from Sep. to Nov. 2024



【Cross section】

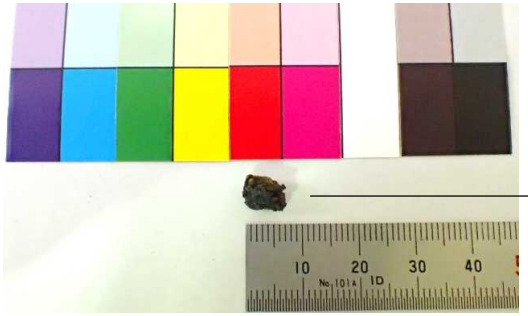


Route for telescopic equipment from outside (X-6 penetration hole)

Fuel debris obtained from the first and second trial retrieval

■Non-destructive analyses of the retrieved fuel debris have been conducted at the Oarai Nuclear Engineering Institute of JAEA.

Fuel debris obtained from the first trial retrieval

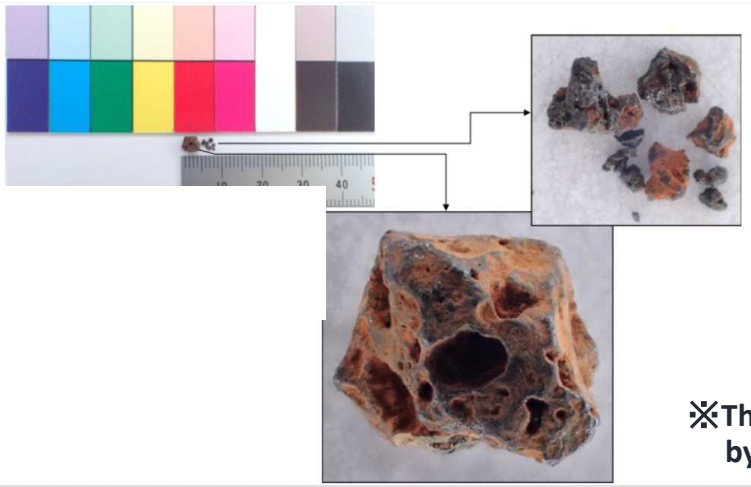


●Scale：
Approx.9mm×Approx.7mm

●Weight：Approx. 0.69g

●Dose rate※（γ ray）：
Approx. 8mSv/h

Fuel debris obtained from the second trial retrieval



●Scale of largest piece：
Approx.5mm×Approx.4mm

●Weight：
Approx.0.187g (all pieces included)

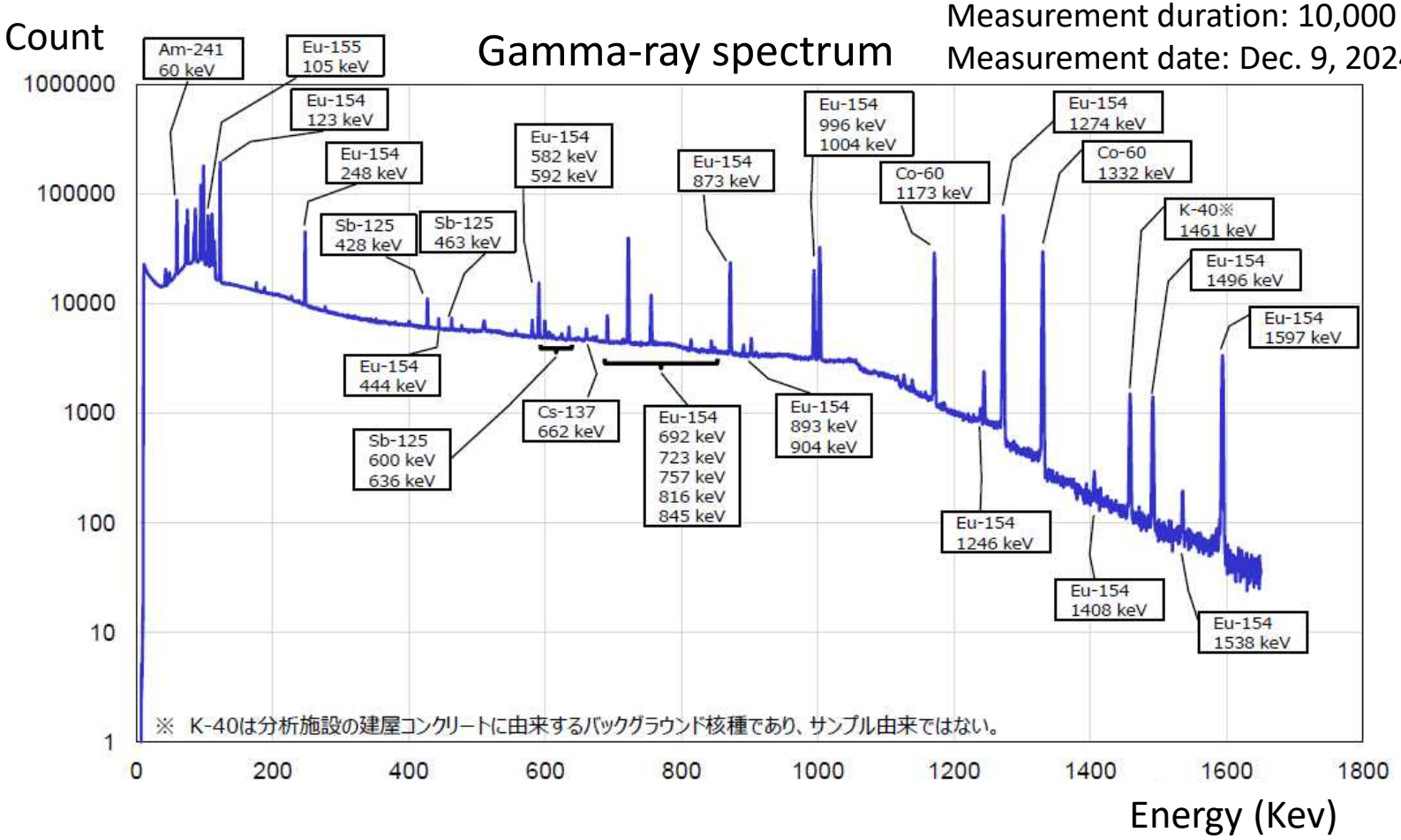
●Dose rate※（γ ray）：
Approx. 0.3mSv/h

※The sample placed in a polypropylene container was measured by an ionization chamber (1 to 2 cm away)

Result of gamma-ray spectrometry measurement of fuel debris obtained in the first retrieval

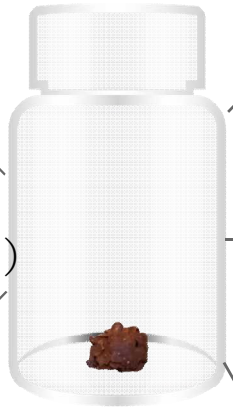
Eu-154, along with Am-241 generated from U-238 through reactions involving neutron capture, was detected, confirming that the fuel component is present in the retrieved fuel debris.

Measurement duration: 10,000 seconds
Measurement date: Dec. 9, 2024



Detailed analyses after non-destructive analyses

After initial non-destructive analyses, detailed analyses including both solid and solution analyses are underway at several research institutions



●Oarai Nuclear Engineering Institute, JAEA

Solid analysis (Assessment of elemental composition of fuel, Uranium isotope ratio, element and compound distribution)
Chemical analysis (Assessment of Radioactivity Concentration)

●Nuclear Science Research Institute, JAEA

Chemical analysis (Assessment of composition of major elements, uranium isotope ratio, radioactivity concentration)

●Nippon Nuclear Fuel Development Co., Ltd (NFD)

Solid analysis (Assessment of Uranium crystal structure, composition, element distribution)

●MHI NUCLEAR DEVELOPMENT (NDC)

Chemical analysis (Assessment of composition of major elements, composition of trace elements, uranium isotope ratio)

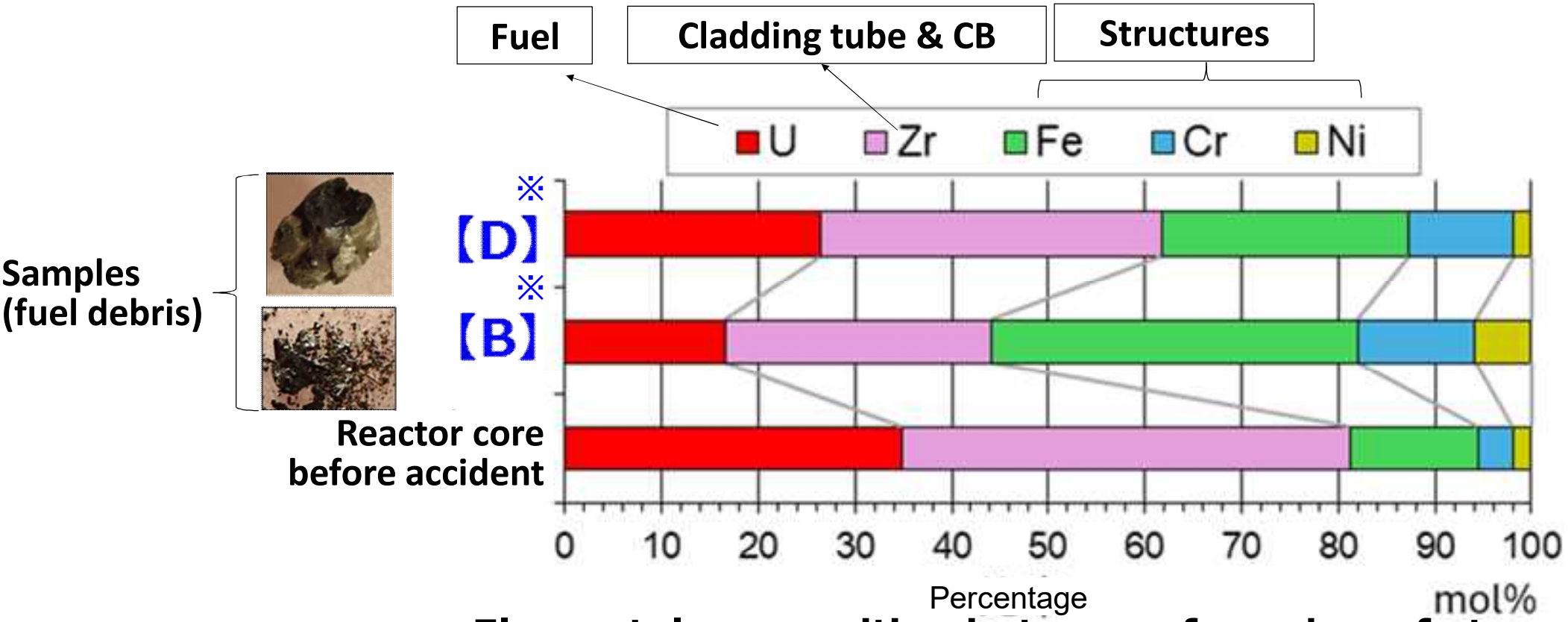
●Spring 8 (Harima Super Photon Ring-8 Gev), JAEA

Solid analysis (Assessment of microcrystalline structure. uranium valence)

Ref.
-Non-destructive analysis of fuel debris obtained in the second retrieval:
https://www.tepco.co.jp/en/hd/decommission/information/newsrelease/reference/pdf/2025/reference_20250529_02-e.pdf
-Detailed analysis of fuel debris obtained in the first retrieval:
https://www.tepco.co.jp/decommission/information/committee/roadmap_progress/pdf/2025/d250731_25-j.pdf

Example of detailed analysis of fuel debris obtained in the first retrieval (Elemental composition)

■The analysis result has shown that fuel and cladding tube incorporated various surrounding materials during its meltdown process, when fuel debris was generated.



Elemental composition in terms of number of atoms

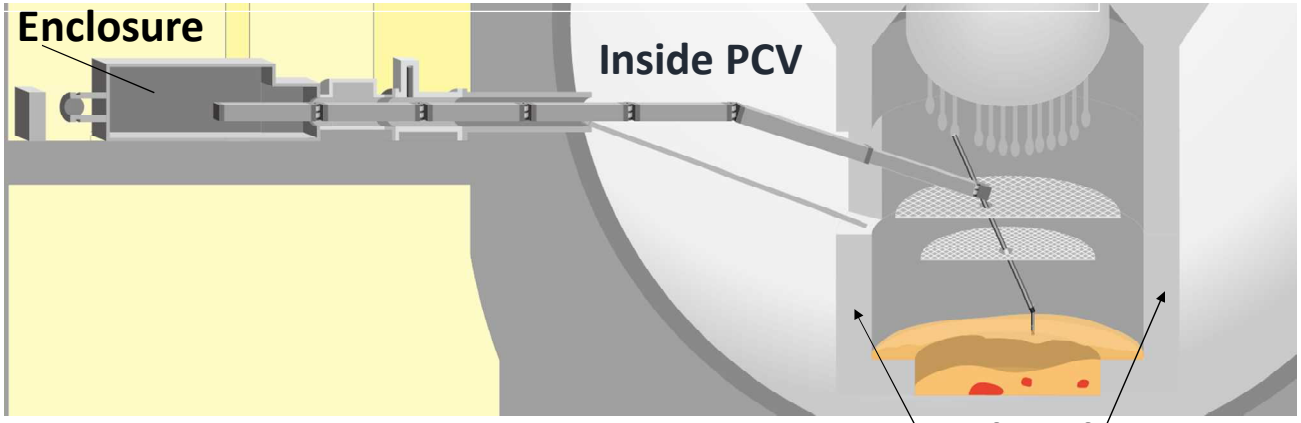
※【D】【B】:Analysis institutions:
D stands for MHI NUCLEAR DEVELOPMENT
B stands for Nuclear Science Research Institute, JAEA

Robotic arm and related equipment for trial retrieval at Unit 2

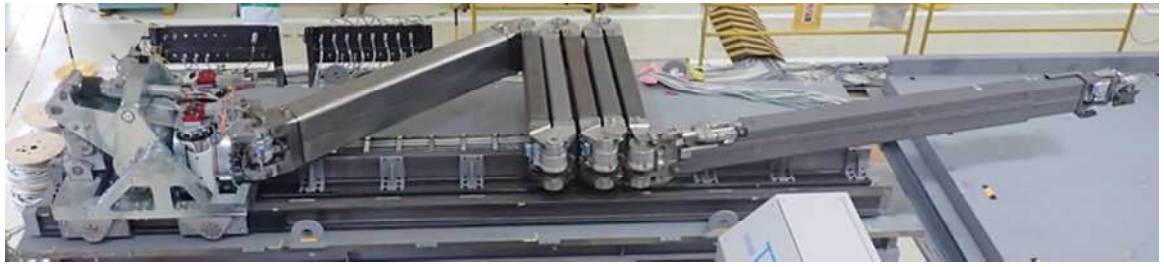
- The equipment has a foldable structure with sophisticated controllability, allowing it to pass through narrow spaces such as the X-6 penetration hole.
- A remote-controlled dual-arm manipulator, which will be installed in the enclosure, is responsible for tasks such as placing the retrieved fuel debris into a container.

Robotic arm

Extended into the pedestal (22m in length)

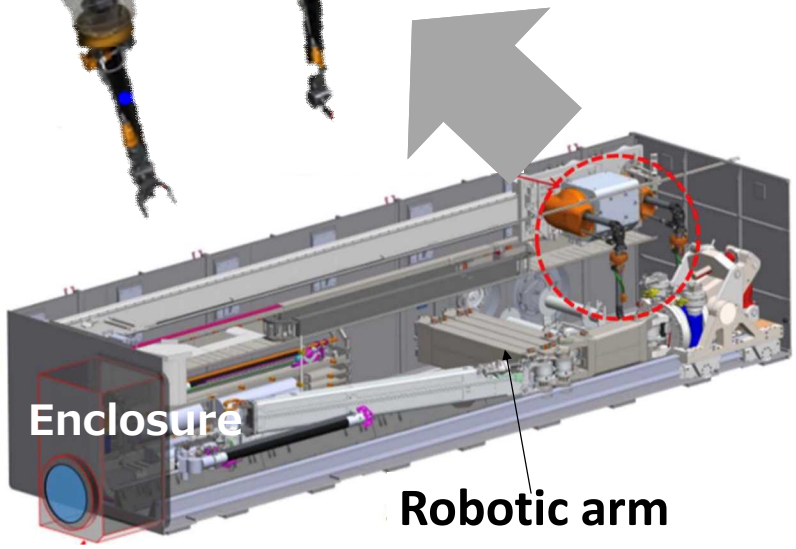


Folded in the enclosure



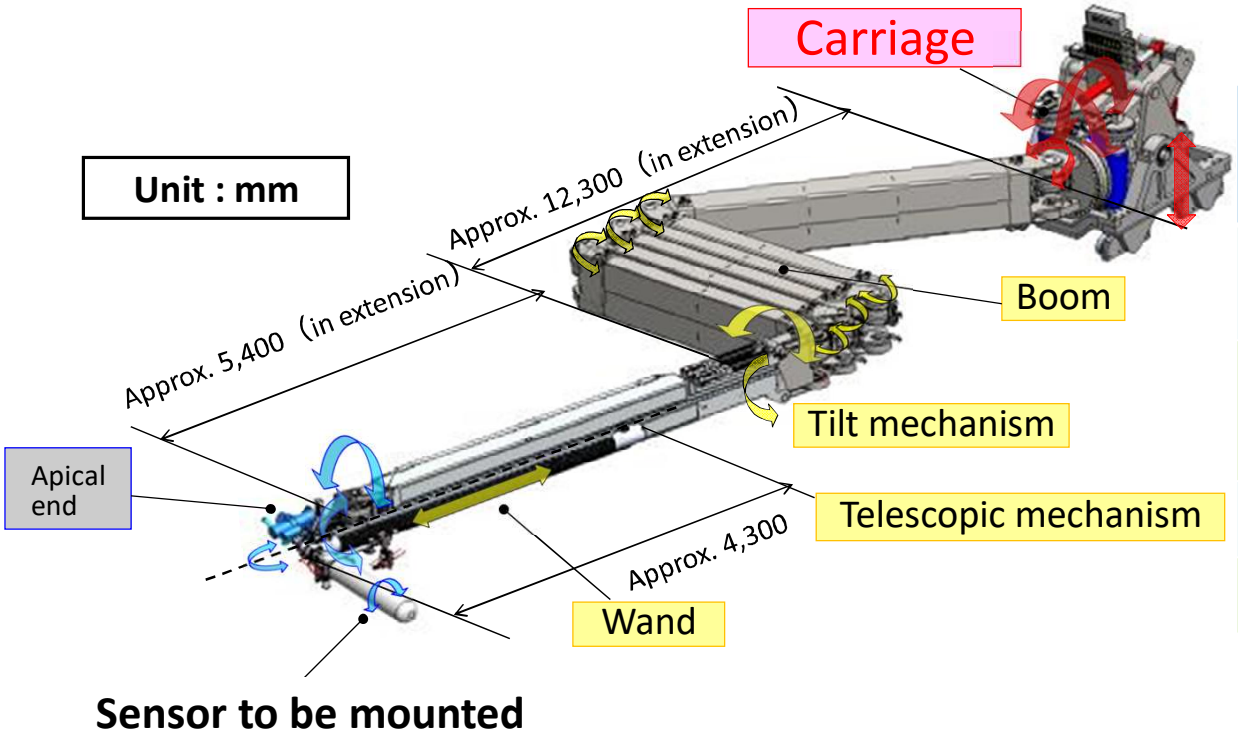
Dual-arm manipulator

Installed in the enclosure & remotely-operated by on-site workers

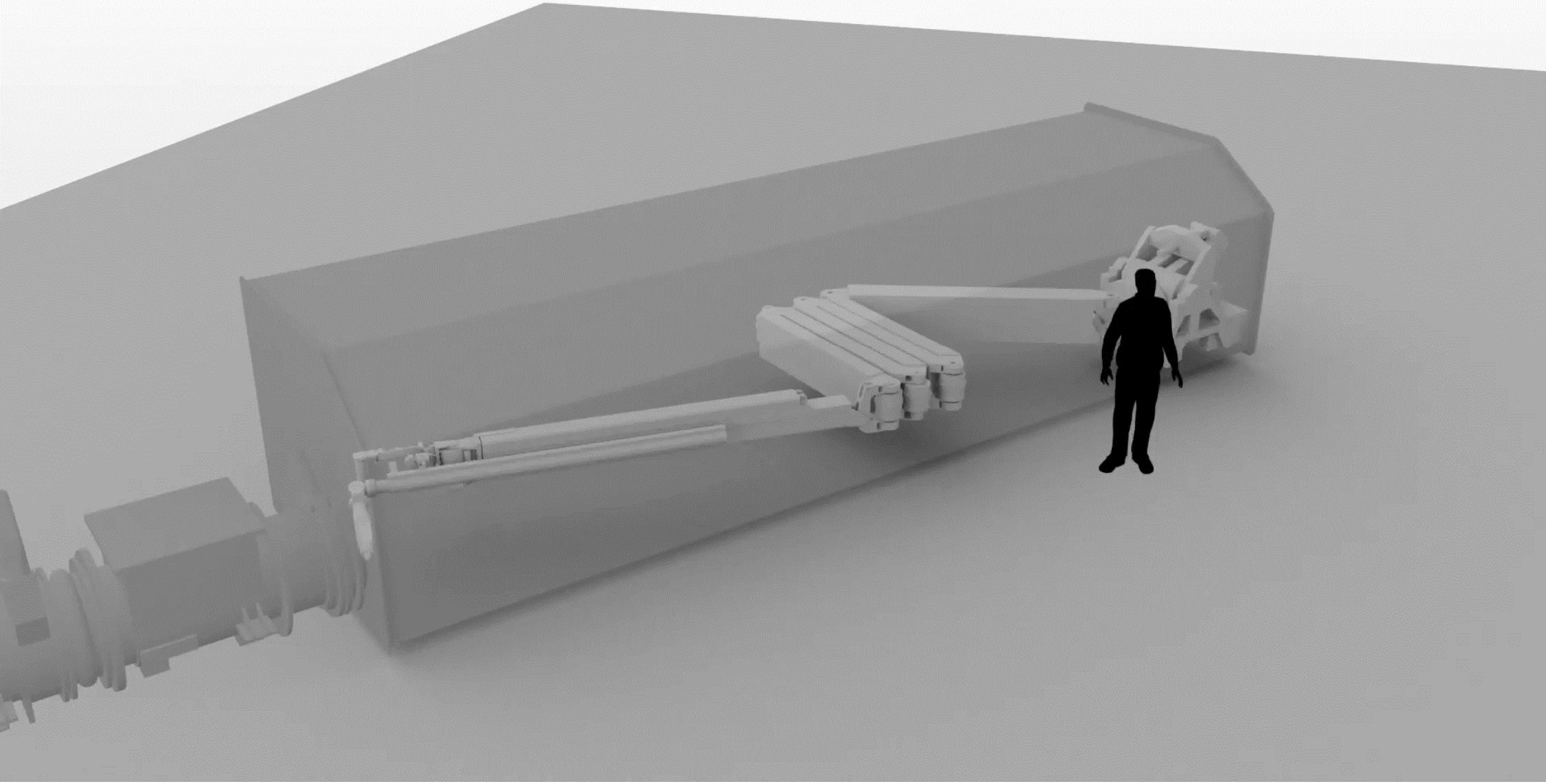


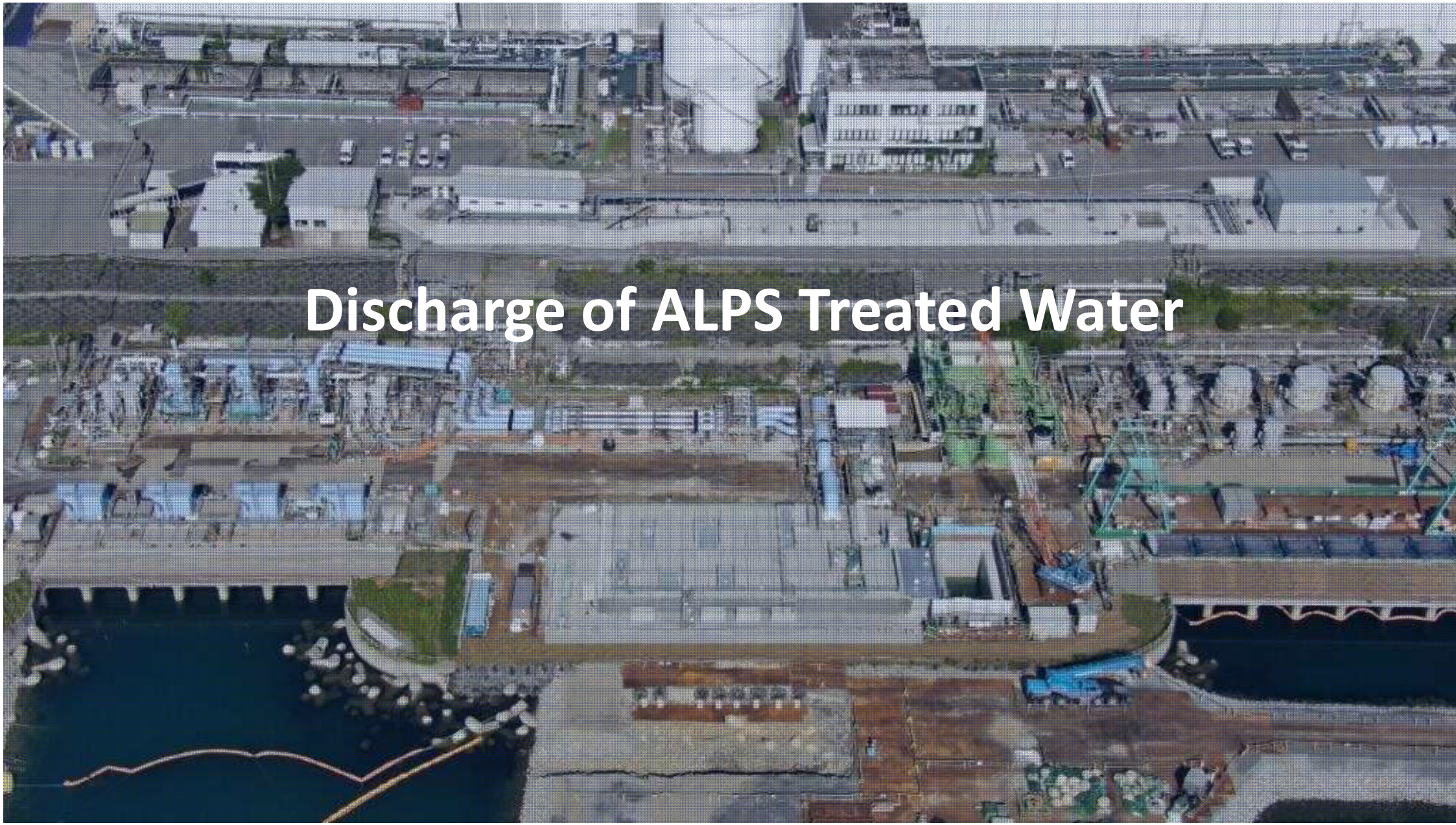
Internal investigations of Unit 2 using robotic arm

- By using robotic arm, we also aim to understand the distribution and properties of fuel debris inside the pedestal as well as the interior structure.
- Measuring devices and sampling tools will be attached to the wand.

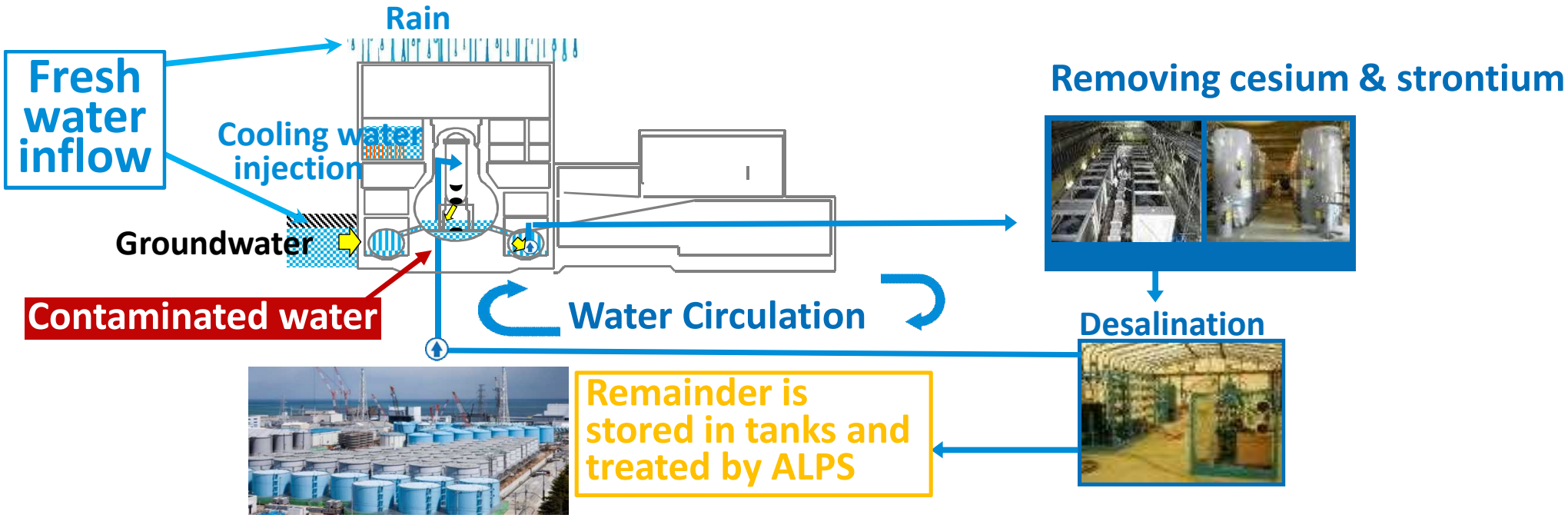


Investigation Item	Measuring devices to be mounted
Detailed vision	Pan-tilt camera
3D shape inside pedestal	Laser rangefinder
Gamma ray dose rate	Gamma camera
Neutron flux	Neutron detector




Discharge of ALPS Treated Water

Mechanism of contaminated water generation and its reduction

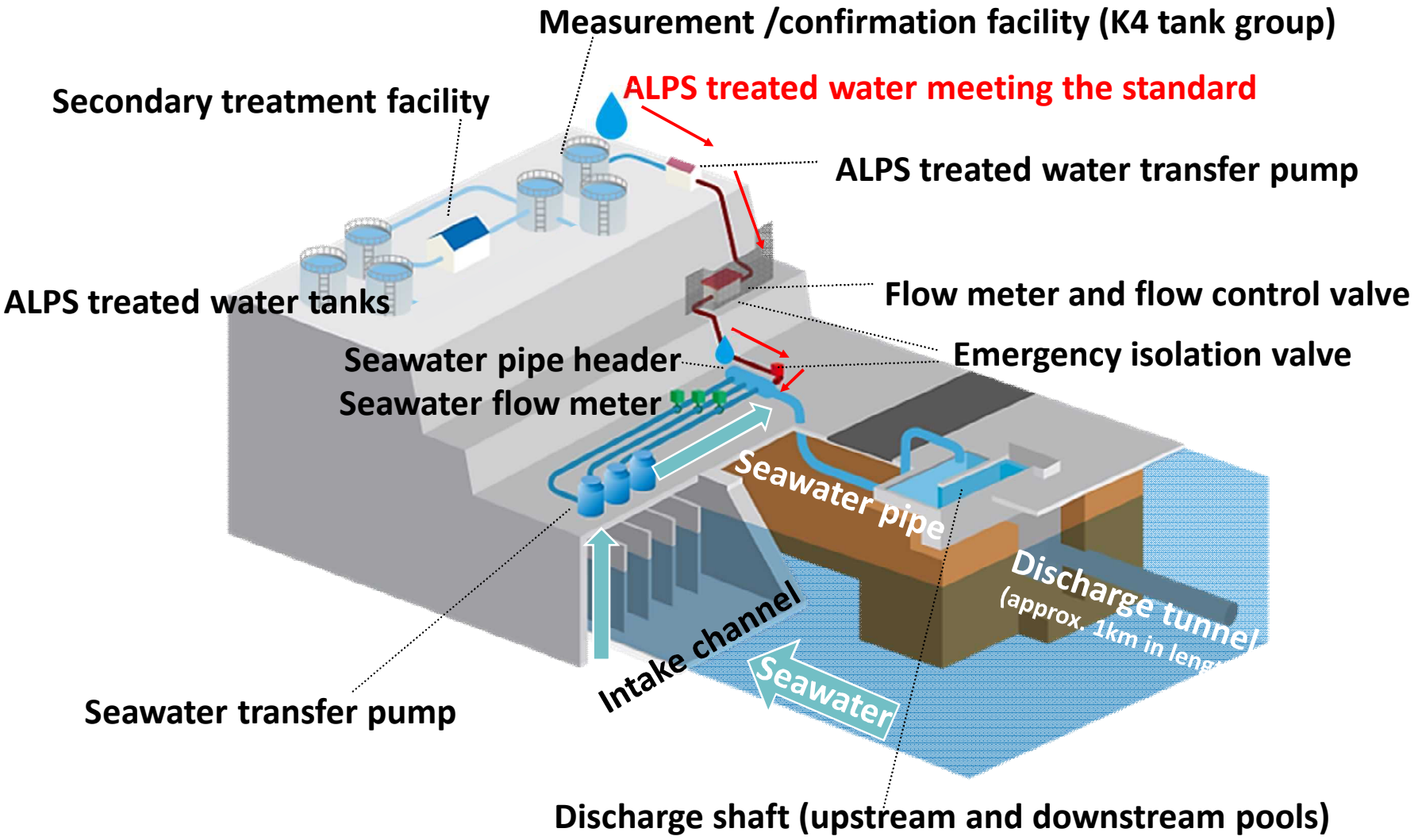


Generation rate of contaminated water （m^3/Day）

- ✓ Frozen soil wall
- ✓ Ground pavement
- ✓ Repairing top roof of turbine buildings etc.

470 m^3/Day in FY2014 → **70 m^3/Day** in FY2024

Flow of discharge of ALPS treated water into sea



Outline of discharge since its commencement in August 2023

Batch	Analysis results before dilution		Particulars of discharge				
	Tritium concentration	Concentrations of nuclides other than tritium Reference value*	Start	Completion	Tritium concentration after dilution	Discharged amount of water (before dilution)	Tritium amount
1st	140,000Bq/L	0.28	2023.8.24	2023.9.11	MAX 220Bq/L	7,788m^3	1.1trillion Bq
2nd	140,000Bq/L	0.25	2023.10.5	2023.10.23	MAX 189Bq/L	7,810m^3	1.1trillion Bq
3rd	130,000Bq/L	0.25	2023.11.2	2023.11.20	MAX 200Bq/L	7,753m^3	1.0trillion Bq
4th	170,000Bq/L	0.34	2024.2.28	2024.3.17	MAX 254Bq/L	7,794m^3	1.3 trillion Bq
5th	190,000Bq/L	0.31	2024.4.19	2024.5.7	MAX 266Bq/L	7,851m^3	1.5 trillion Bq
6th	170,000Bq/L	0.17	2024.5.17	2024.6.4	MAX 234Bq/L	7,892m^3	1.3 trillion Bq
7th	170,000Bq/L	0.18	2024.6.28	2024.7.16	MAX 276Bq/L	7,846m^3	1.3 trillion Bq
8th	200,000Bq/L	0.12	2024.8.7	2024.8.25	MAX 267Bq/L	7,897m^3	1.6 trillion Bq
9th	280,000Bq/L	0.078	2024.9.26	2024.10.14	MAX 405Bq/L	7,817m^3	2.2 trillion Bq
10th	310,000Bq/L	0.083	2024.10.17	2024.11.4	MAX 436Bq/L	7,837m^3	2.4 trillion Bq
11th	310,000Bq/L	0.076	2025.3.12	2025.3.30	MAX 403Bq/L	7,859m^3	2.4 trillion Bq
12th	370,000Bq/L	0.083	2025.4.10	2025.4.28	MAX 489Bq/L	7,853m^3	2.9 trillion Bq
13th	250,000Bq/L	0.11	2025.7.14	2025.8.3	MAX 351Bq/L	7,873m^3	2.0 trillion Bq
14th	380,000Bq/L	0.12	2025.8.7	2025.8.25	MAX 500Bq/L	7,908m^3	3.0 trillion Bq

FY2023: 4.5 Trillion Bq

FY2024: 12.7 Trillion Bq

*If the value is less than 1, it indicates that the concentrations meet the Japanese regulatory standard.

Sea area monitoring for Tritium

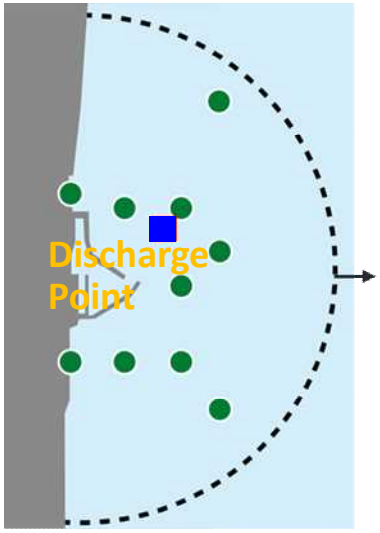
- **Tritium concentration measurements at each point are well below the related thresholds.**
  - **Japanese regulatory discharge standard: 60,000Bq/L**
  - **WHO's guideline for drinking water: 10,000Bq/L**
  - **TEPCO's discharge suspension level within 3km of the site: 700Bq/L**
  - **TEPCO's discharge suspension level within 10km by 10km area around the site: 30Bq/L**

Tritium concentration (Bq/L) through quick measurement method

10 monitoring points within 3km of the site

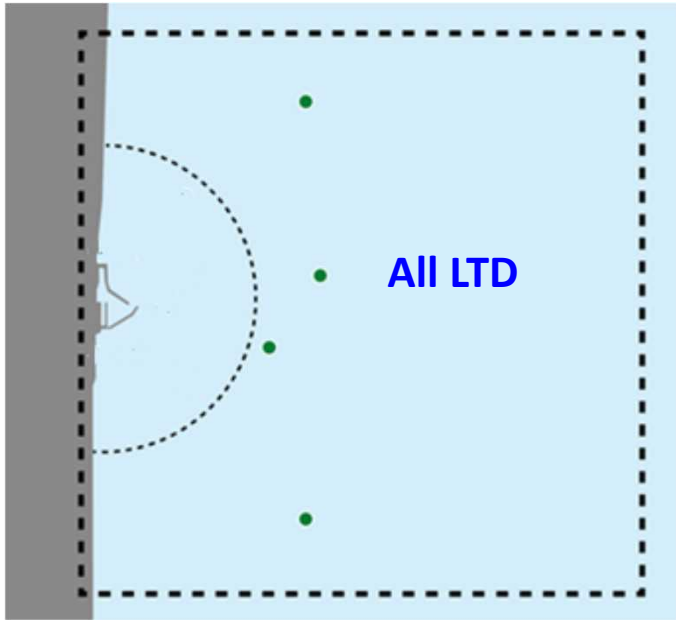
(**LTD**: less than detection)

4 monitoring points within a 10 km by 10 km area around the site



TEPCO's discharge suspension level :700Bq/L

FY2023 (4 batches)	**From LTD to a max of 22**
FY2024 (7 batches)	**From LTD to a max of 56**
FY2025 (7 batches planned)	**1st :From LTD to a max of 27** **2nd:From LTD to a max of 31** **3rd:From LTD to a max of 61**



TEPCO's discharge suspension level :30Bq/L

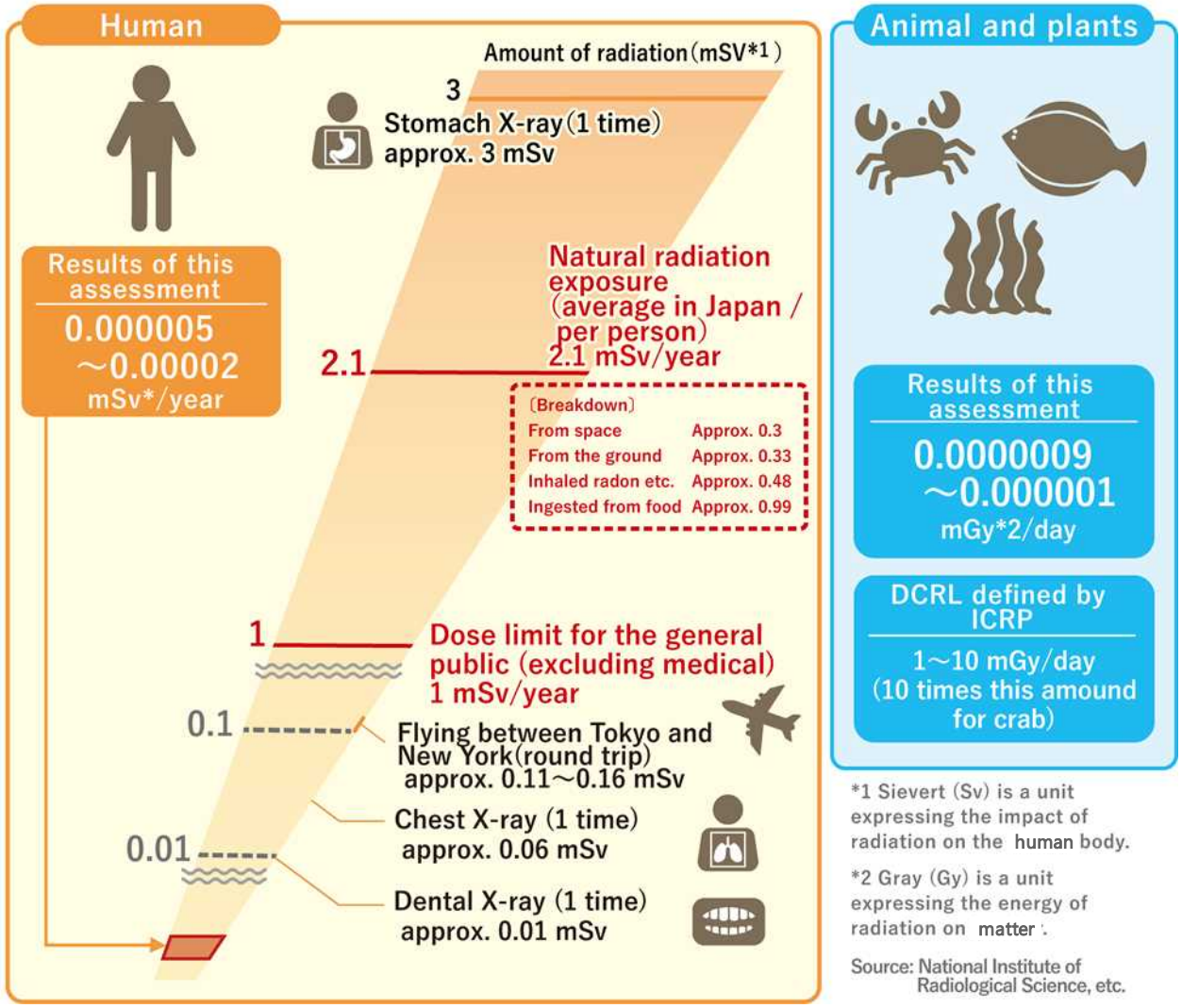
Assessment of radiological impact on public and environment

Impact on humans

Even for those living near the discharging outlet, the assessment of the exposure dose is approx. 1/50,000 of the dose limit for the general public (1 mSv/year).

Impact on animals and plants

The levels are extremely low, ranging from approx. 1/1 million (for flatfish and brown seaweed) to approx. 1/11 million (for crab) of the lower limit of Derived Consideration Reference Level (DCRL).



*1 Sievert (Sv) is a unit expressing the impact of radiation on the human body.

*2 Gray (Gy) is a unit expressing the energy of radiation on matter.

Source: National Institute of Radiological Science, etc.

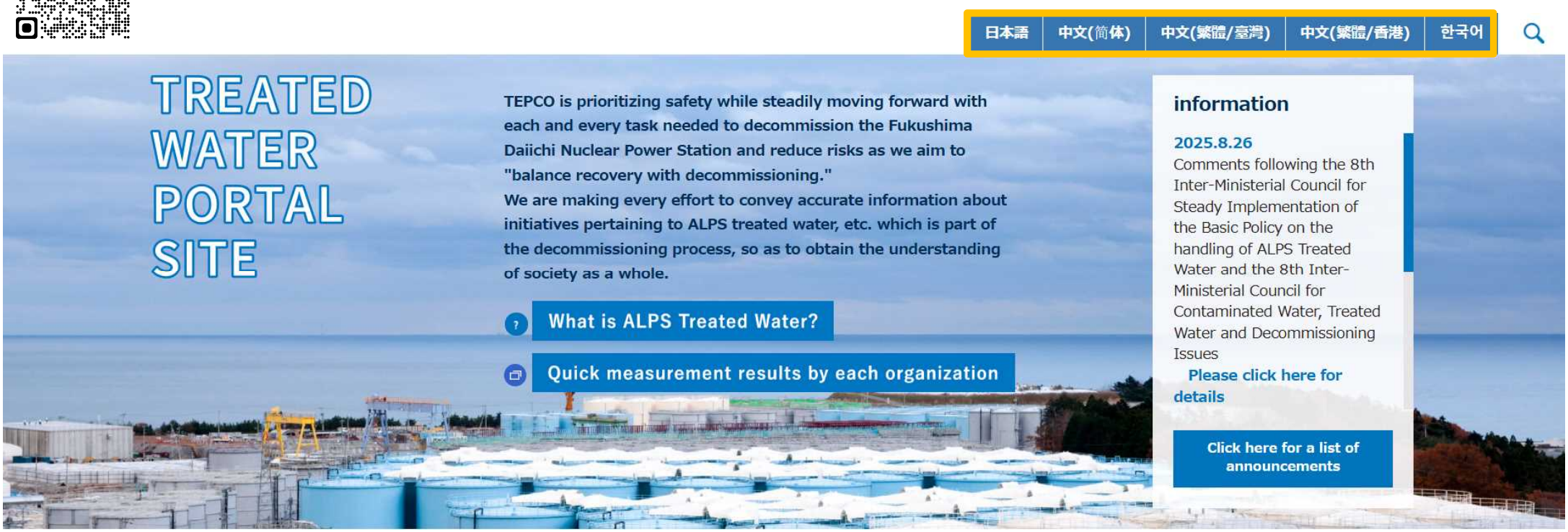
Dismantlement of welded tanks for treated water storage

- Tanks that are no longer needed due to the discharge of ALPS treated water are scheduled to be dismantled to secure space for the decommissioning.
- As part of this initiative, a total of 21 welded tanks in the J8 and J9 areas are planned to be dismantled, with work in the J9 area having been completed as of early September.

Dismantlement of all tanks completed in J9 Area on September 3

TEPCO's ALPS Treated Water Portal Site

- The status of each facility and the monitoring data for sea areas are easily accessible.
- Foreign language versions, including English, Chinese, and Korean, are available.



Summary

1. Spent Fuel Removal

- Preparatory work underway toward removal at Units 1 and 2

2. Fuel Debris Retrieval

- Trial Retrieval at Unit 2
  - Trial retrieval using telescopic equipment was conducted twice, followed by various analyses.
  - Trial retrieval and internal investigation using robotic arm planned

3. Discharge of ALPS treated water

- Concentrations of all radioactive materials including tritium have met Japanese and international safety standards
- More than 10 rounds of discharges conducted so far with minimal impact on humans & environment
- Timely and abundant information in multiple languages


Thank you for your kind attention
消防水利
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TEPCO