

Fukushima Daiichi Nuclear Power Station Unit 2 PCV Internal Investigation/ Preparation Status of Fuel Debris Trial Retrieval

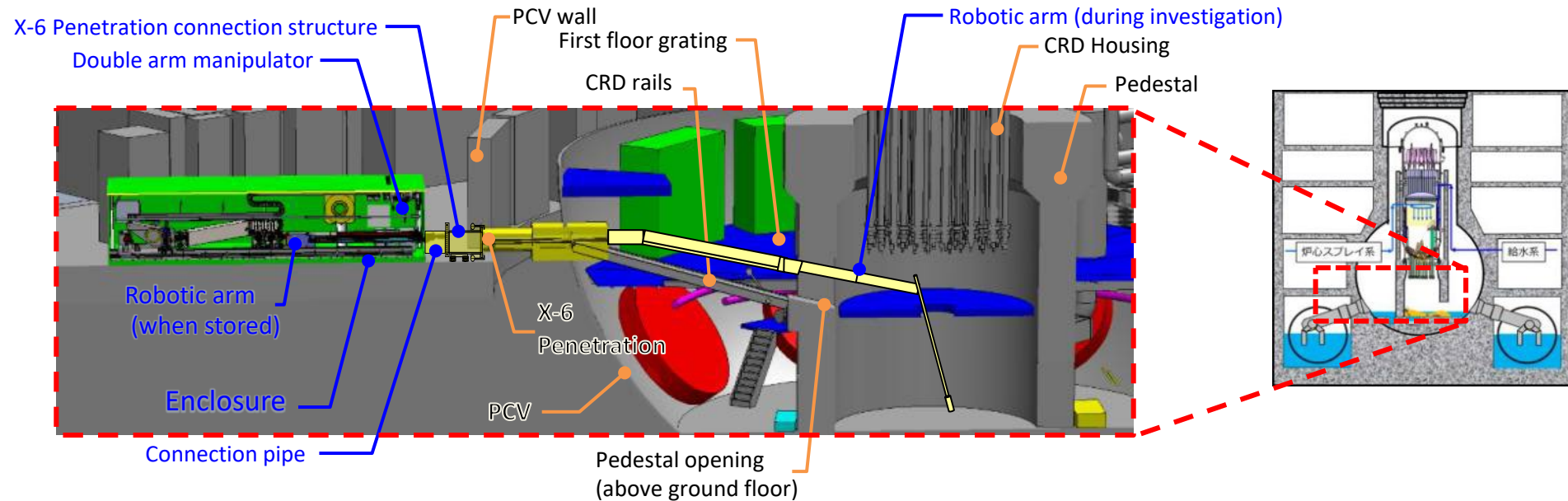
June 27, 2024



International Research Institute for Nuclear Decommissioning
Tokyo Electric Power Company Holdings, Inc.

1. PCV internal investigation and trial retrieval plan overview

- In order to guarantee work safety and prevent the spread of contamination, the following equipment will be installed at the penetration to the Unit 2 primary containment vessel (hereinafter referred to as, "X-6 penetration") that will be used for the PCV internal investigation and also as a preparatory stage of trial retrieval.
 - The X-6 Penetration connection structure isolates the inside of the PCV from the outside
 - The connection pipe shields radiation
 - A metal box that contains the telescopic device and the robotic arm (enclosure)
- After installation of the aforementioned equipment, the robotic arm shall be fed into the PCV through the X-6 penetration to remove obstacles inside the PCV while also conducting internal investigations and moving forward with the trial retrieval of fuel debris.



Unit 2 internal investigation/trial retrieval plan overview

2-1. Field Preparation Work Progress

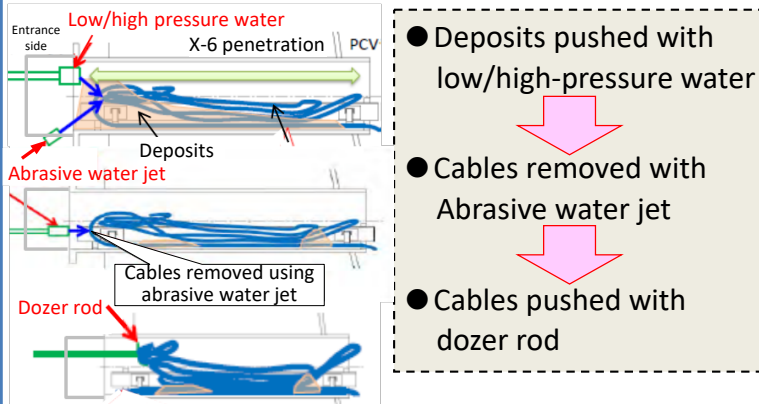
Primary Steps of the Fuel Debris Trial Retrieval (Internal Investigations/Debris Sampling)

1. Isolation chamber installation

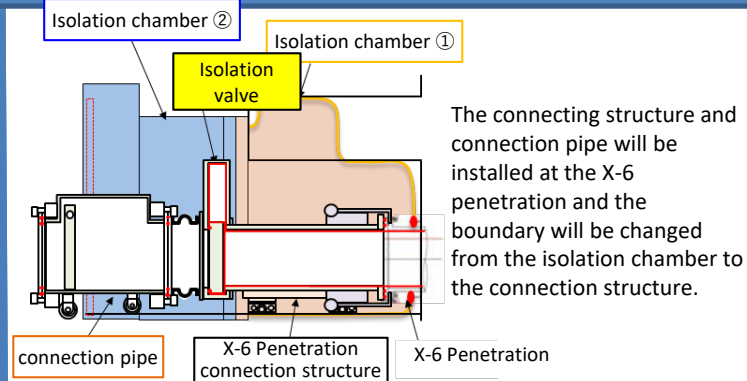
2. Opening of the X-6 penetration hatch

3. Removal of deposits from inside the X-6 penetration

Removing deposits/cables from inside the X-6 penetration

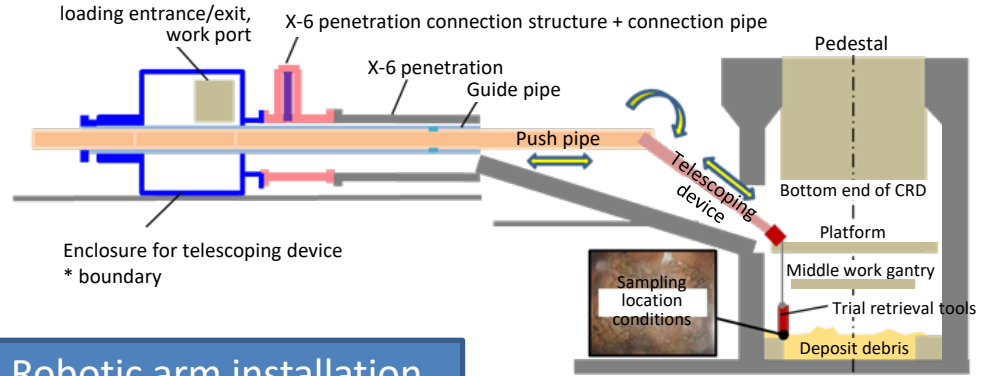


4. Installation of X-6 penetration connection structure and connection pipe

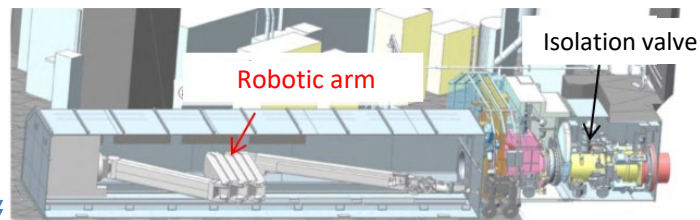


5. Installation of telescopic device

6. Trial retrieval (debris sampling using telescopic device)

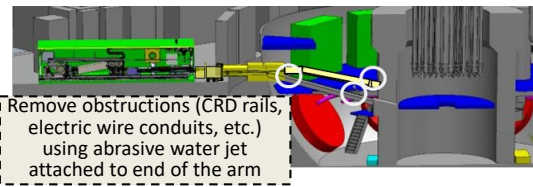


7. Robotic arm installation



8. Internal investigation/debris sampling using robotic arm

① Internal investigation

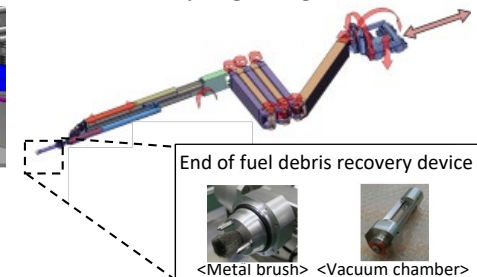


(Note)

Isolation valve: Valve installed to separate the inside of the PCV from the outside

Abrasive Water Jet: Combines high pressure water with an abrasive to improve cutting ability

② debris sampling using robotic arm

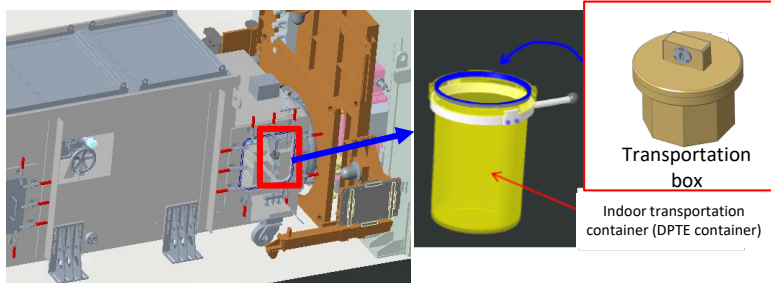


2-2. Field Preparation Work Progress

Primary Steps of the Fuel Debris Trial Retrieval (Internal Investigations/Debris Sampling)

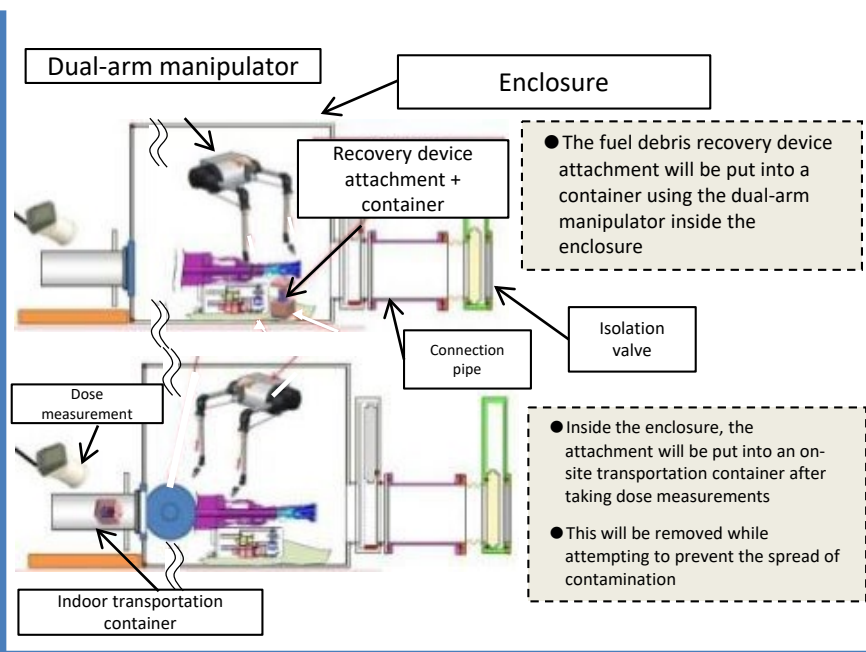
↓(From Step 6 on the previous slide)

9-1. Collection of fuel debris

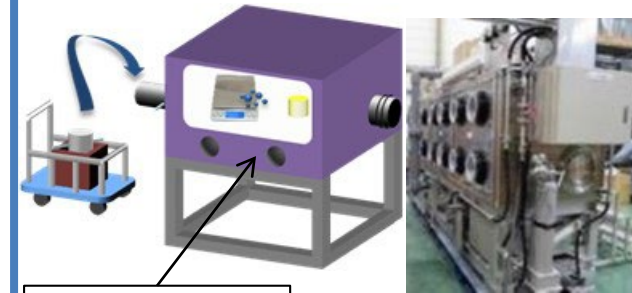


↓(From Step 8 on the previous slide)

9-2. Inserting the fuel debris recovery device attachment into a container, Inserting into an on-site transportation container/Dose measurements



10. Insertion into glovebox/Measurement

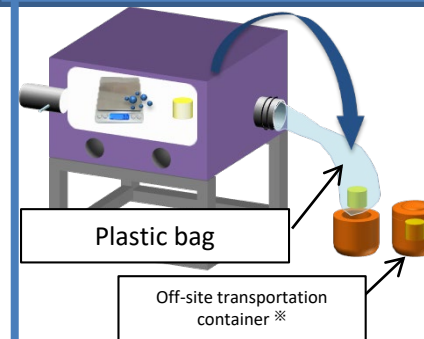


Glovebox

<Exterior view of glovebox>

- The collected sample will be put into a negative pressure glovebox
- The samples will be subjected to various measurements inside the glovebox and then put into a container

11. Container removal/Insertion into transportation container /Removal from premises



- The container will be removed from the glovebox while preventing the spread of contamination by using a plastic bag
- The container will then be inserted into an off-site transportation container and loaded onto a transport vehicle

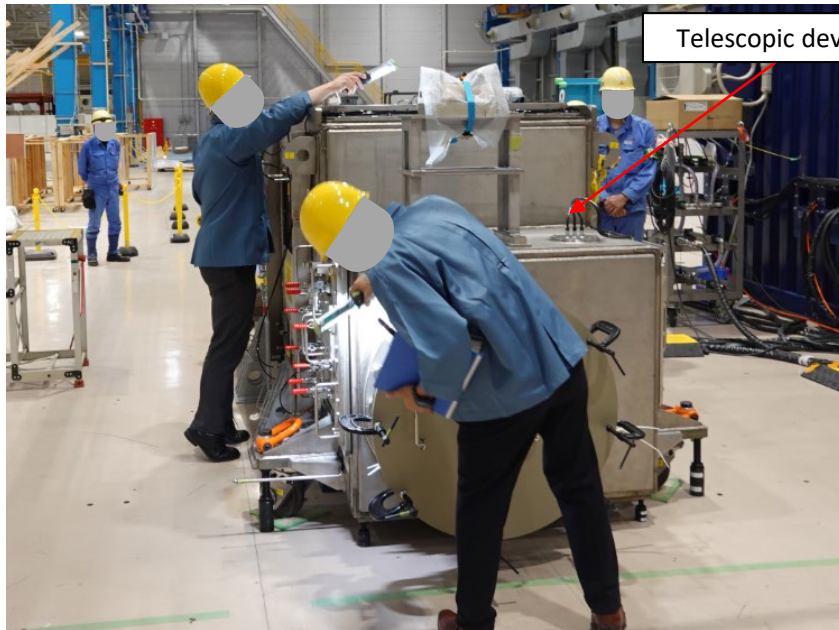
※ Prior to transport, the surface dose/contamination density, etc. of the container shall be measured to ensure that it meets legal requirements

Carried to transport vehicle

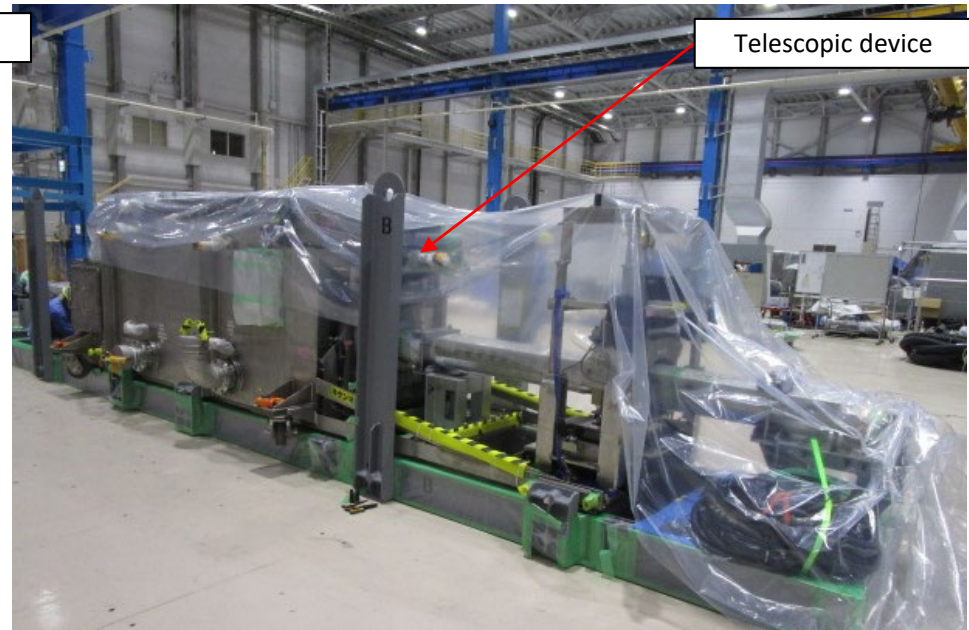
12. Off-site transport and off-site analysis

3. Telescopic Trial Retrieval Equipment Status

- The telescopic trial retrieval equipment was subject to pre-use inspections (pressure resistance check) at the manufacturer's factory on June 18, and was given "good" marks.
- Preparations for transport to the Fukushima Daiichi Nuclear Power Station are underway.



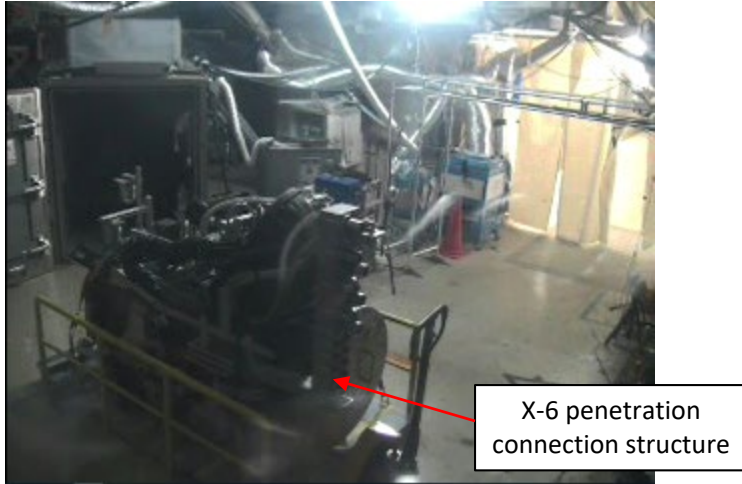
Pressure resistance check
(in-house inspection)



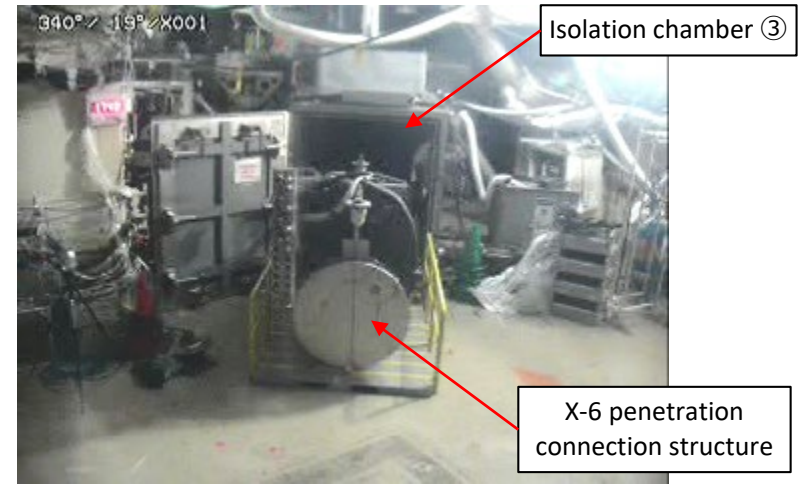
Preparations for transport

4-1. Field Work Progress Status (installation of X-6 penetration connection structure)

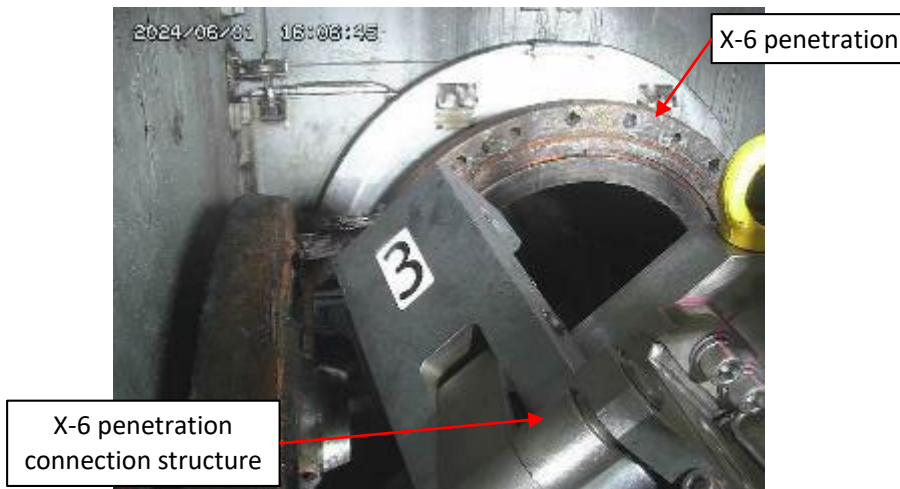
- The X-6 penetration connection structure (isolation valve) has been connected (docking) to the X-6 penetration flange. After connecting the structure, a pressure test was performed on the double flange seal and it was confirmed that there are no problems.
※ The PCV boundary was changed from the isolation chamber to the X-6 penetration connection structure



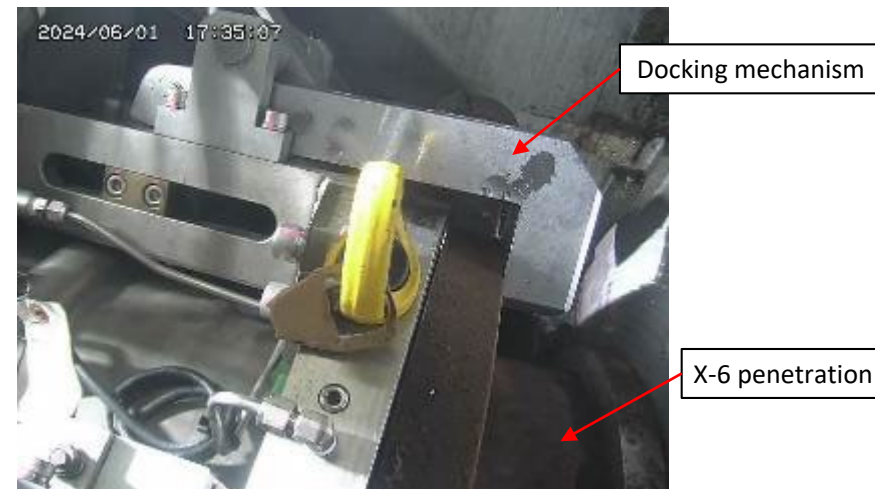
Transporting the X-6 penetration connection structure to the R/B northwest area



Carrying the X-6 penetration connection structure into the isolation chamber③



Connecting the X-6 penetration connection structure to the X-6 penetration



Connecting the X-6 penetration connection structure to the X-6 penetration

4-2. Field Work Progress Status

(Isolation chamber③, Connection pipe installation)

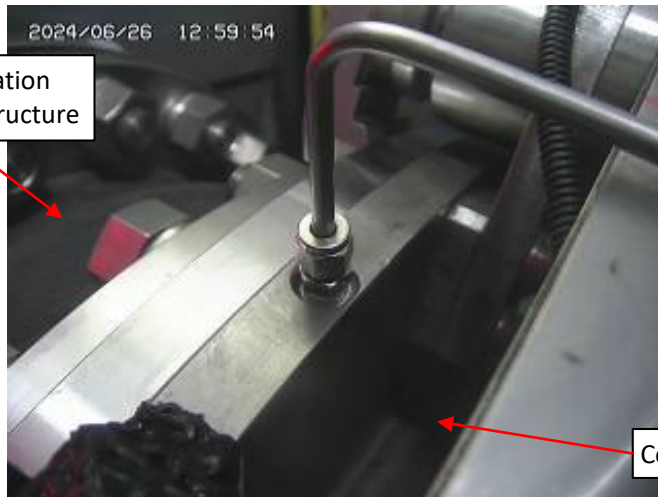
- After installation of the X-6 penetration connection structure, the isolation chamber ③ was removed and carried out of the reactor building.
- The connection pipe was installed and connected (docked) to the flange at the back of the X-6 penetration connection structure after which a pressure test of the double flange seal was conducted and it was confirmed that there are no problems.



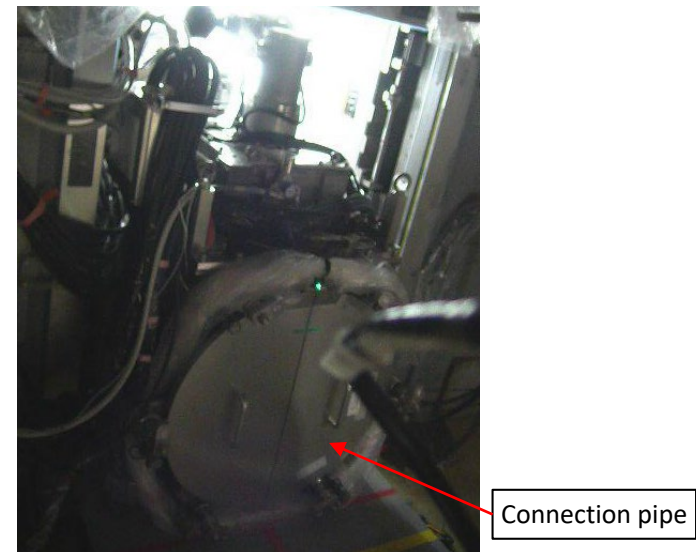
Removing the isolation chamber③



Carrying the isolation chamber ③ to the large freight entrance



Connecting the connection pipe to the X-6 penetration connection structure



Connecting the connection pipe to the X-6 penetration connection structure

4-3. Field Work Progress Status (glove box installation)

- A glove box is being installed inside the Unit 2 reactor building



Glove box installation status

5. Schedule

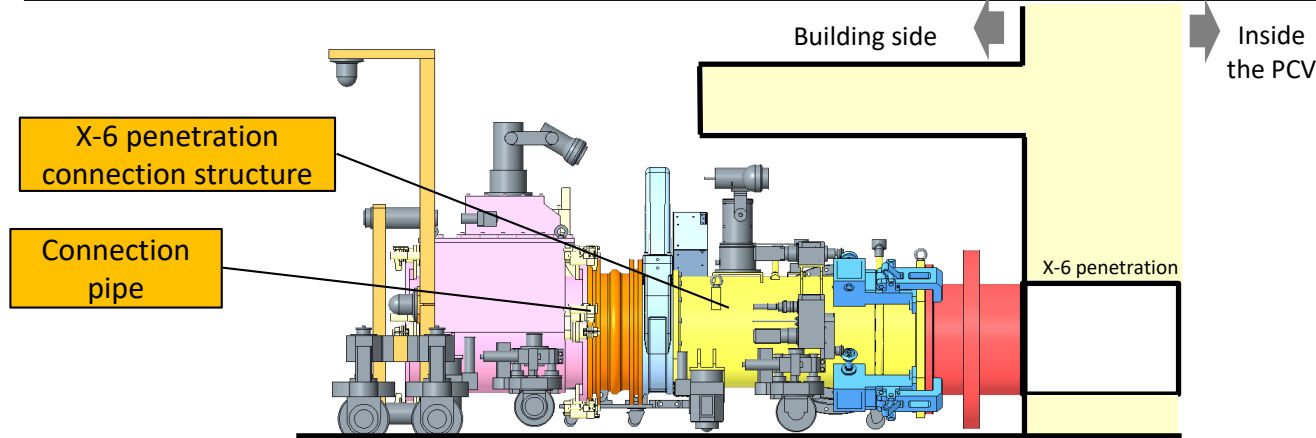
- The telescopic device was subject to pre-use inspections (pressure resistance check) at the manufacturer's factory on June 18, and was given "good" marks. Preparations for transport to the Fukushima Daiichi Nuclear Power Station are underway.
- In the field, the connection structure and the connection pipe have been connected to the X-6 penetration, and the PCV boundary has been changed from the isolation chamber to the X-6 penetration connection structure. We will proceed with preparations to install the telescopic device inside the reactor building.
- We are planning to begin the trial retrieval of fuel debris at some point between August and October 2024.
- We will continue to steadily move forward and prioritize safety during the trial retrieval of fuel debris.

	FY2023	FY2024				FY2025
	4Q	1Q	2Q	3Q	4Q	
Deposit removal						
Telescopic device manufacturing/installation preparations						
Trial retrieval (fuel debris sampling using the telescopic device)						
Robotic arm testing, additional development as required by testing results						
Robotic arm installation preparations/robotic arm access route construction						
Use of robotic arm for internal investigations/fuel debris sampling						

Reference. X-6 penetration connection structure and connection pipe

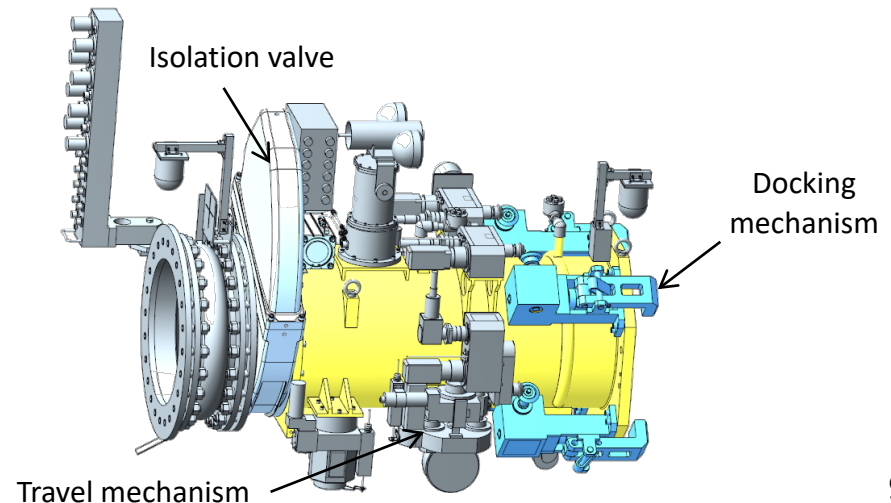
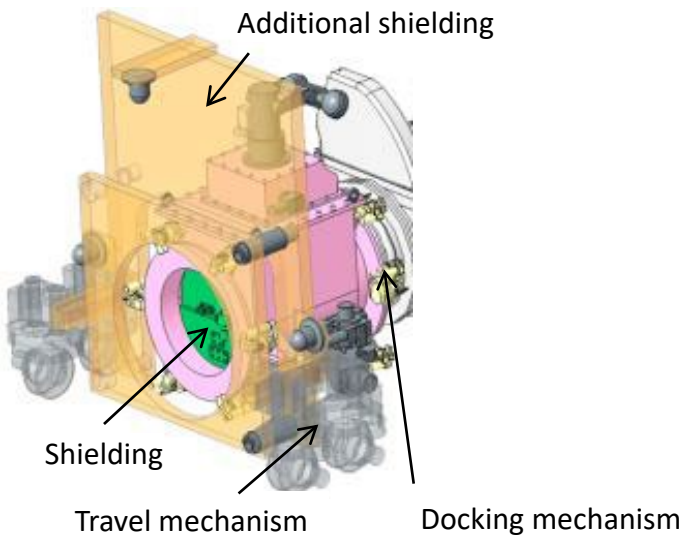
The following mechanism is being installed in order to construct an access route for trial retrieval and to create a PCV boundary

- X-6 penetration connection structure: Connected to the X-6 penetration in order to create a PCV boundary by using an isolation valve to isolate the PCV
- Connection pipe: Used to shield radiation from inside the PCV and reduce dose levels in front of the X-6 penetration



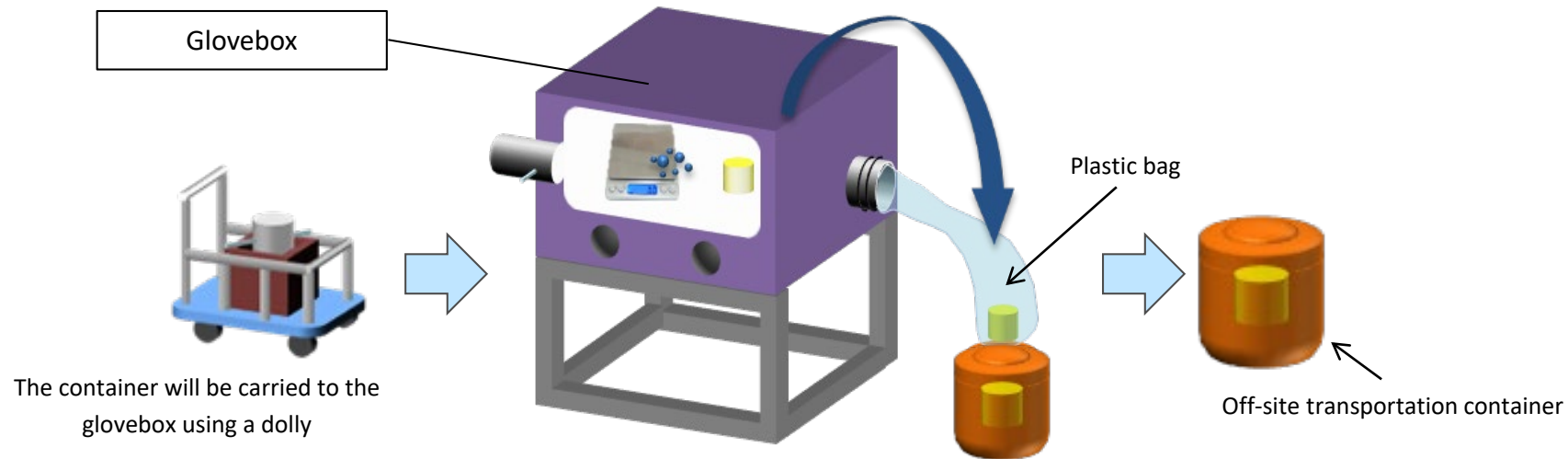
➤ Connection pipe

➤ X-6 penetration connection structure



Reference. Glovebox

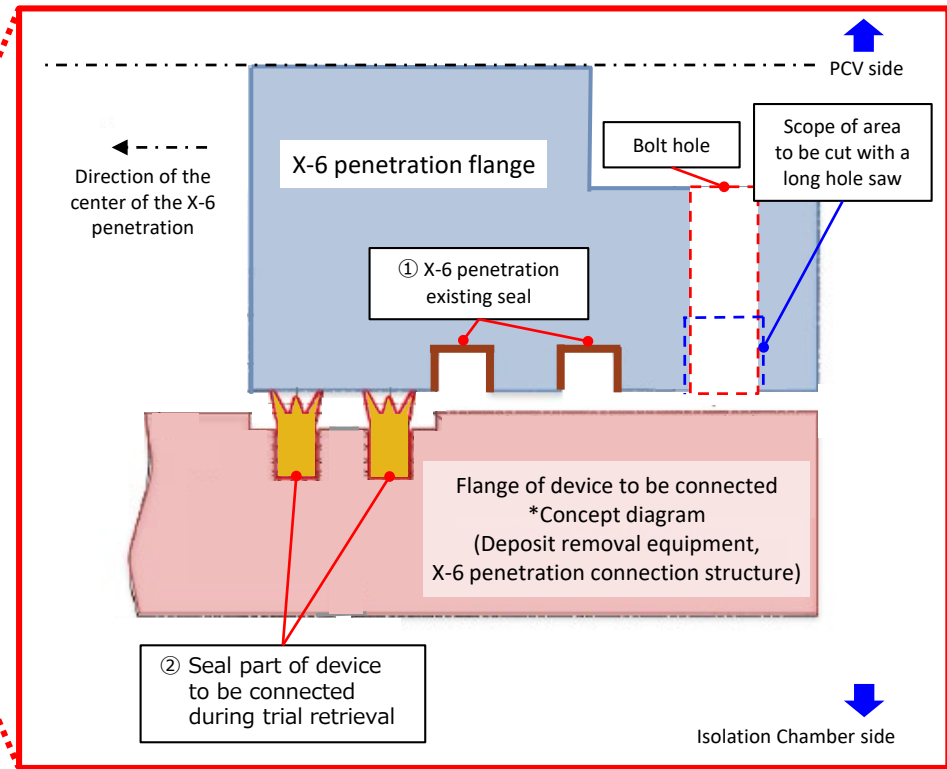
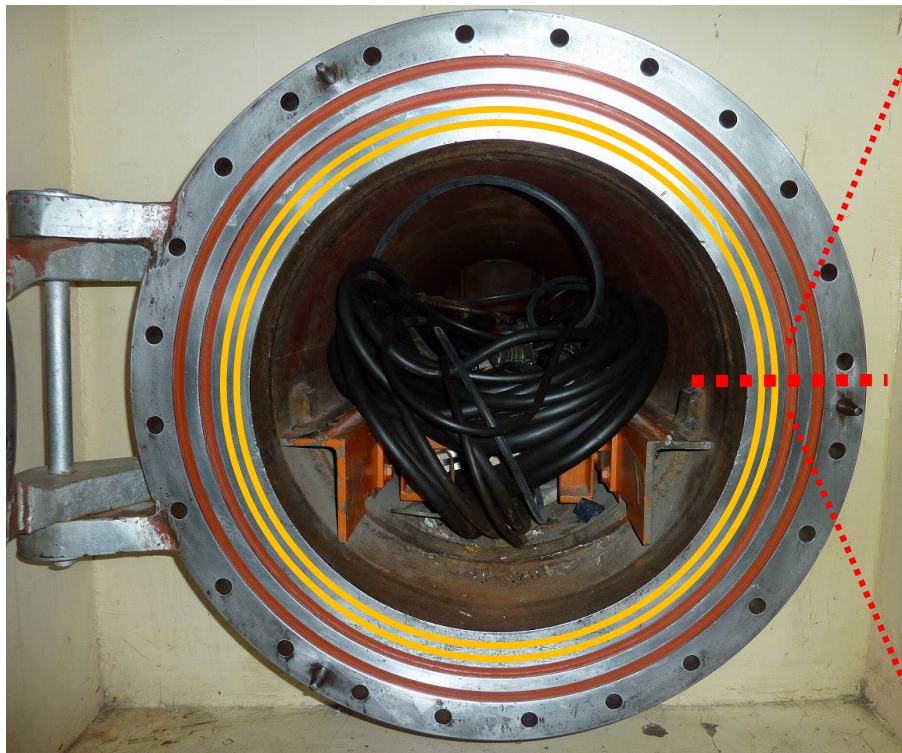
- The sampled fuel debris will be subjected to dose measurements when it is taken out from the enclosure of the telescopic device or the robotic arm, and then transported to a glovebox inside the reactor building where it will be subjected to various measurements. After measurements have been taken, measures to prevent the spread of contamination shall be implemented and it will be transported off-site



- The collected samples will be put into a negative pressure glovebox
- The samples will be subjected to various measurements inside the glovebox and then put into a container
- The container will be removed from the glovebox while preventing the spread of contamination by using a plastic bag
- The container will then be inserted into an off-site transportation container and loaded onto a transport vehicle

Reference. Sealing of the Device Connected to the X-6 Penetration

- A deposit removal equipment and X-6 penetration connection structure will be connected to the hatch flange after it is opened



X-6 penetration hatch prior to the accident (open)

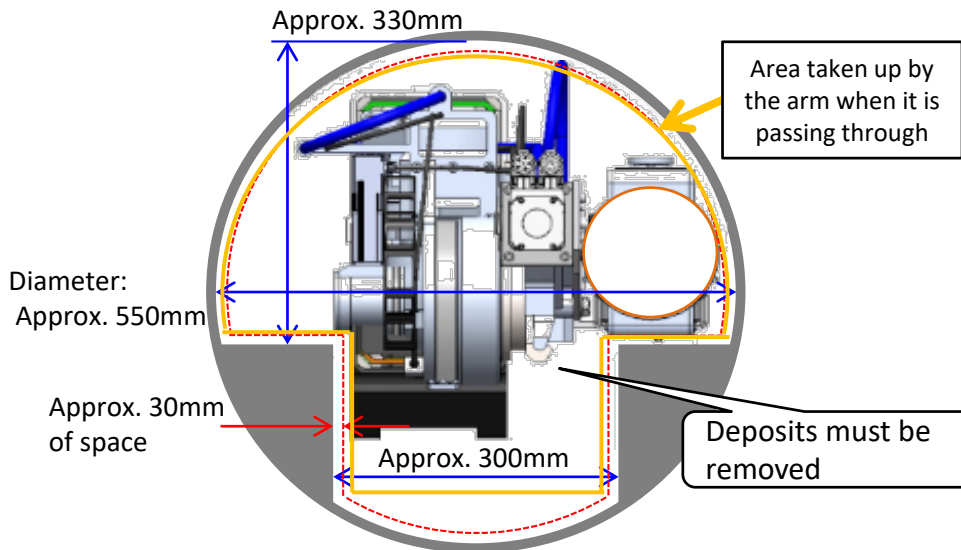
Location of seals when connecting devices to the X-6 penetration (as seen from above)

- : ① X-6 penetration existing seal
 - : ② Seal of the devices connected to during trial retrieval
- * Deposit removal equipment, X-6 penetration connection structure

Reference. Robotic arm and telescopic arm when passing through the X-6 penetration

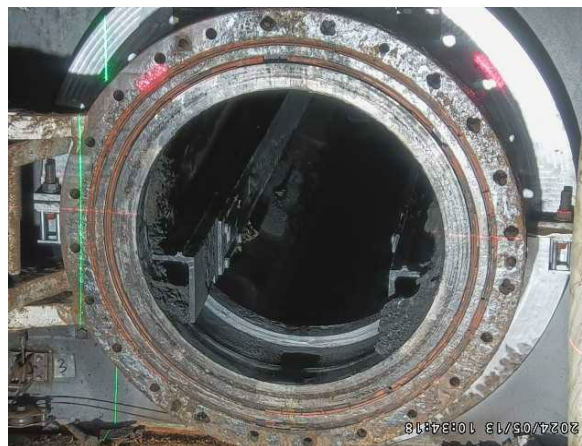
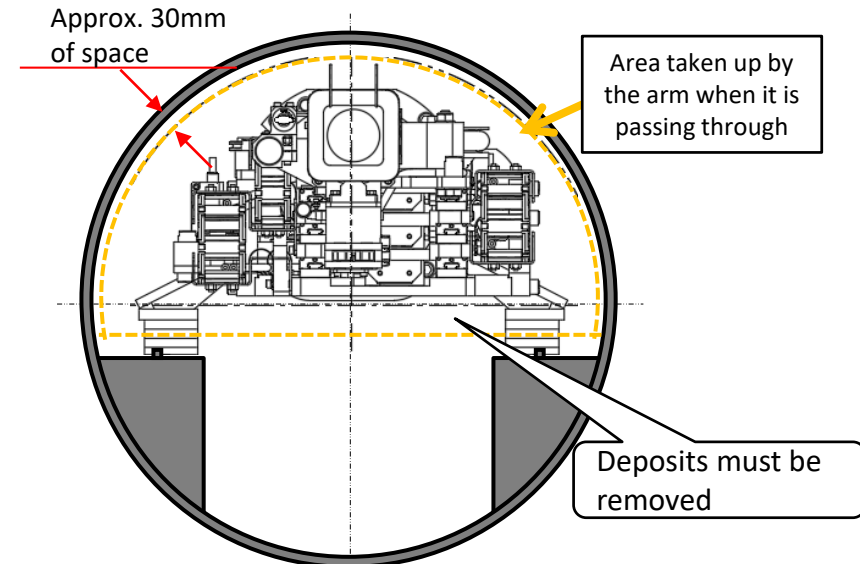
Robotic arm

(cross-section of the X-6 penetration when the arm is passing through)



Telescopic arm

(cross-section of the X-6 penetration when the arm is passing through)



X-6 penetration after the removal of deposits

Reference. Environmental Impact (1/2)

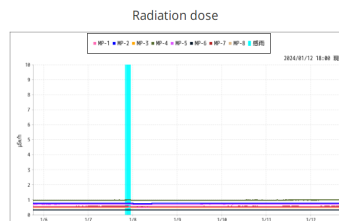
- The removal of deposits from inside the Unit 2 X-6 penetration has been ongoing since January 10, and we have **not seen any radiological impact on the surrounding environment.**
- During investigations, **gases from inside the primary containment vessel have been prevented from leaking to the outside environment through the construction of a boundary.**
- There have been no significant fluctuations in data from monitoring posts or dust monitors neither prior to or after work.
- Data from monitoring posts/dust monitors near site borders can be found on TEPCO's website
Reference URL: https://www.tepco.co.jp/en/hd/decommission/data/monitoring/monitoring_post/index-e.html
<https://www.tepco.co.jp/en/hd/decommission/data/monitoring/dustmonitor/index-e.html>

Radiation Dose measured at Monitoring Post of Fukushima Daiichi Nuclear Power Station

The following is the radiation doses of the air measured by the monitoring posts (MP1-8) at Fukushima Daiichi Nuclear Power Station.

Monitoring post (MP1 - MP8)

Monitoring points



MP Unit : μSv/h Wind Velocity Unit : m/s
○ Measurement value (2024/01/12 18:00)

MP-1	MP-2	MP-3	MP-4	MP-5	MP-6	MP-7	MP-8	風向	風速	備考
0.317	0.783	0.490	0.987	0.703	0.315	0.566	0.530	北東風	1.4	晴

Radioactive Concentration measured at Dust Monitors near the Site Boundary of Fukushima Daiichi Nuclear Power Station

The following are radioactive concentrations in the air measured near the monitoring posts (MP1-8) at the site boundary of Fukushima Daiichi Nuclear Power Station.

Monitoring points



Radiation concentration



Radioactive Particles Monitor Unit : Bq/cm³ Wind Velocity Unit : m/s
■ Measurement value (2024/01/25 09:50)

nearMP1	nearMP2	nearMP3	nearMP4	nearMP5	nearMP6	nearMP7	nearMP8	Wind Direction	Wind Velocity
1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	1.0E-06	northwest	4.4

Reference. Environmental Impact (2/2)

- The removal of deposits from inside the Unit 2 X-6 penetration has been ongoing since January 10, and during investigations plant parameters are continuously monitored. We have seen **no significant fluctuations in primary containment vessel temperature neither prior to or after work**, and there's been **no change in the status of cold shutdown state**.

- Primary containment vessel temperature data can be found on TEPCO's website.

Reference URL: https://www.tepco.co.jp/en/hd/decommission/data/plant_data/unit2/pcv_index-e.html

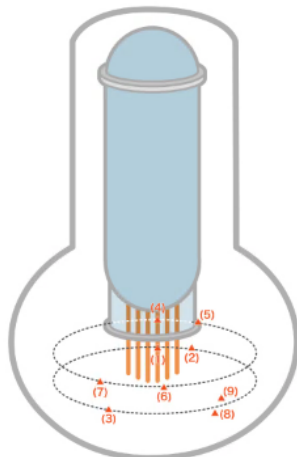
[Reference] Screen image of our website

Temperatures measured inside the Unit 2 Primary Containment Vessel at Fukushima Daiichi Nuclear Power Station

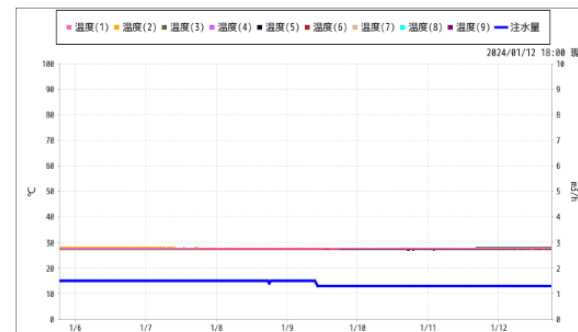
Here are the measurement results of temperatures inside the Unit 2 Primary Containment Vessel at Fukushima Daiichi Nuclear Power Station.

Monitoring points

Unit 2 reactor containment vessel



Temperature



Temperature Unit: °C. Water Injection Unit: m³/h

○ Measurement value (2024/01/12 18:00)

温度(1)	温度(2)	温度(3)	温度(4)	温度(5)	温度(6)	温度(7)	温度(8)	温度(9)	注水量
27.5	27.8	27.9	27.7	27.4	27.3	27.2	-	-	1.3