Reference
March 9, 2017
Tokyo Electric Power Company Holdings, Inc.

Unit 1 Primary Containment Vessel (PCV) Investigation at Fukushima Daiichi Nuclear Power Station

IRID TEPCO

Tokyo Electric Power Company Holdings, Inc.

1. Work steps for Unit 1 PCV investigation

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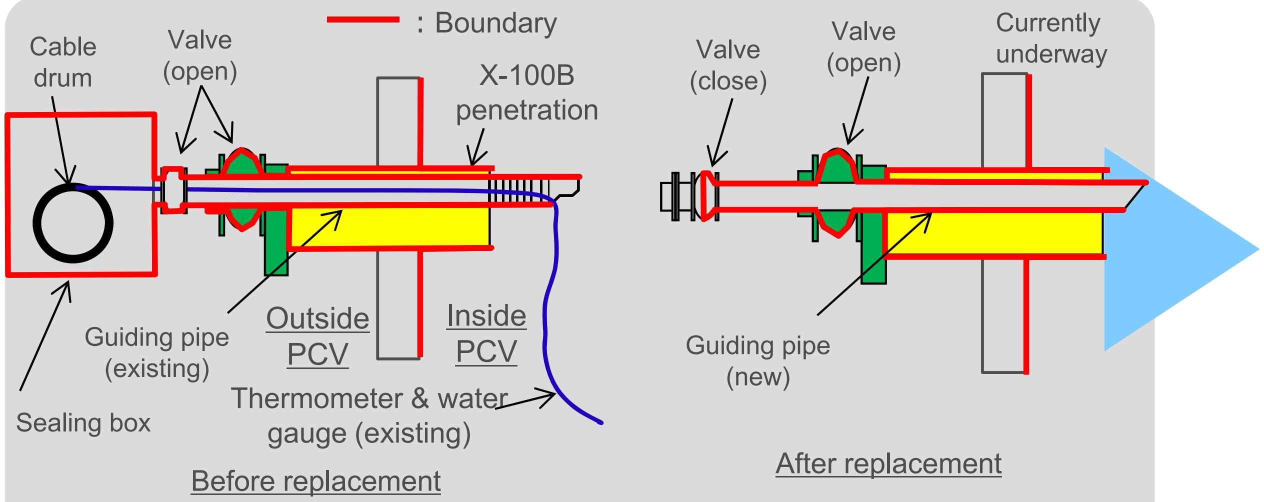
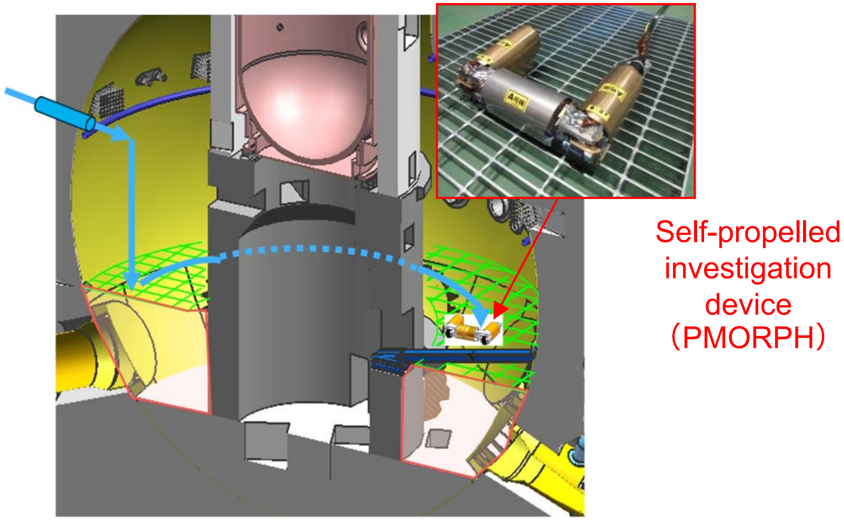
STEP1. Removal of a thermometer and water gauge and replacement of a guiding pipe

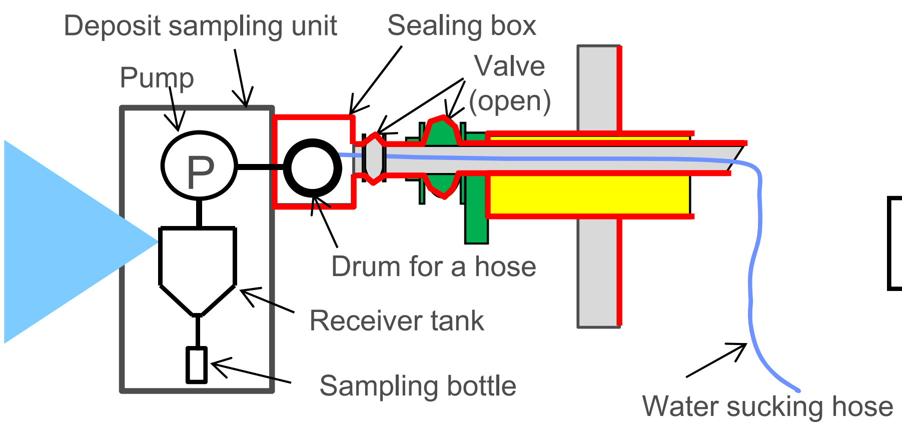


A guiding pipe will be replaced after a thermometer and water gauge is removed by the cable drum.

STEP2. PCV investigation using a self-propelled device



STEP3. Deposit sampling and re-installation of a thermometer and water gauge



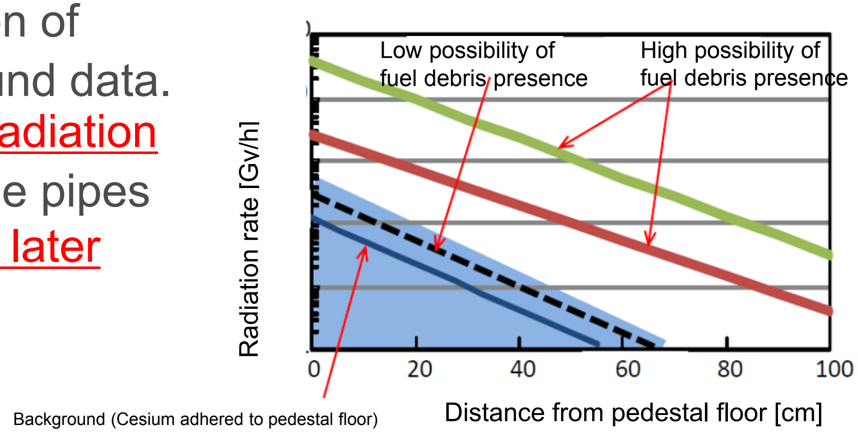
A deposit sampling unit will be installed and deposits inside PCV will be sampled using a pump.

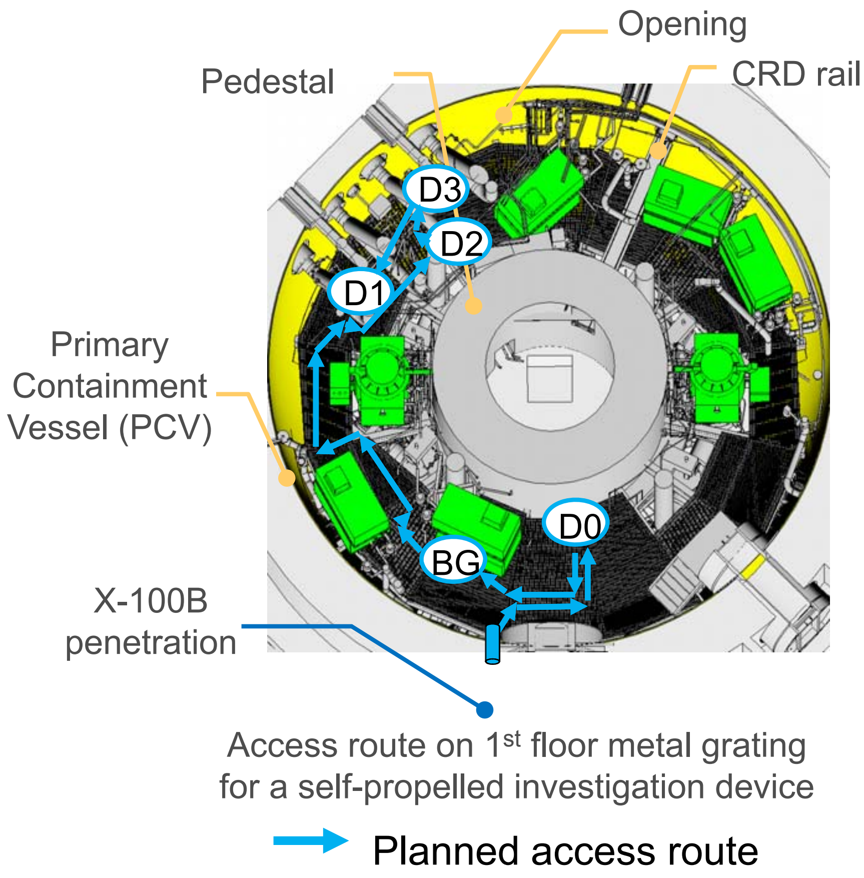
*Deposit: floating materials within the retained water and their precipitate

2. Step 2: Overview of PCV investigation using a self-propelled device (1/4)

■ **Presence of fuel debris will be estimated from the comparison and evaluation of measurement results.**

- Presence of fuel debris will be estimated from the comparison of radiation doses and distances subtracted from the background data.
- It is necessary to compare and evaluate digital images and radiation data because radiation levels can increase locally around the pipes connected to the reactor. Evaluation results will be provided later after organizing the data.





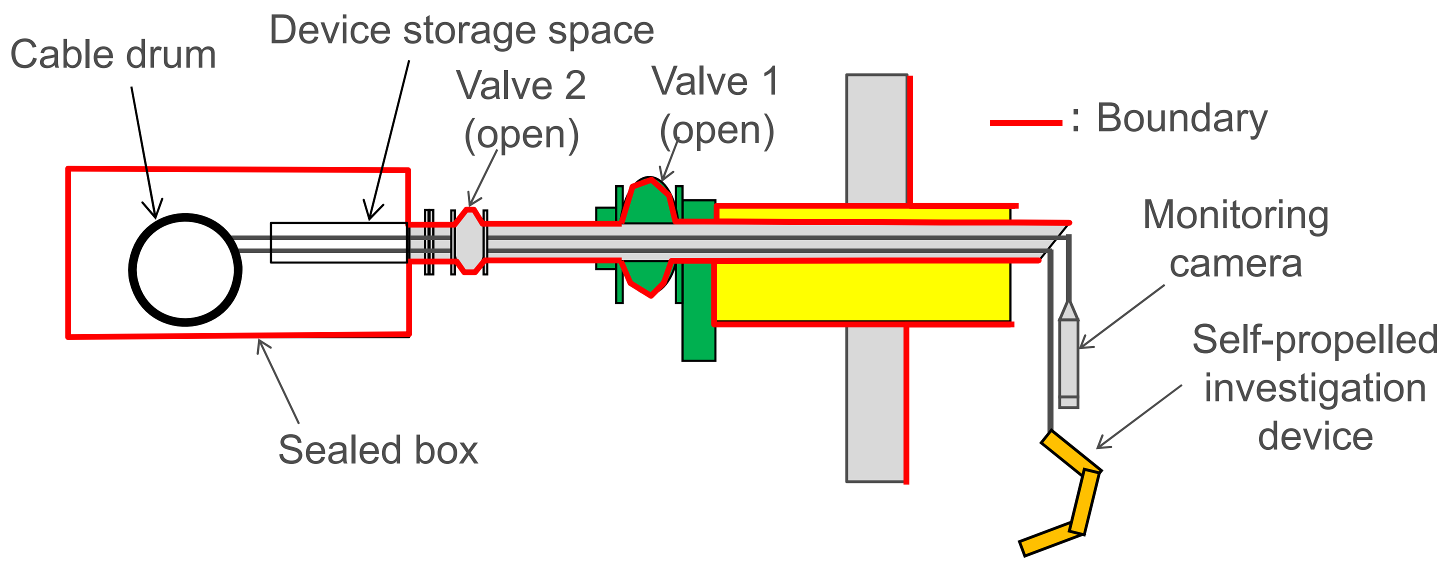
■ Measurement items: digital images and radiation doses

Measurement points	Estimation
D0	Spreading of fuel debris from drain sump
BG	Background levels against D0-D3 measurements
D1, D2	Spreading of fuel debris from opening
D3	Possibility of fuel debris reaching to PCV shell

■ Investigation plan

Day 1: D0 ⇒ Day 2: BG ⇒ Day 3: D2, D3 ⇒ Day 4 : D1

- Investigation with a self-propelled device will be conducted without influencing the surrounding environment with leakage of air from PCV. A boundary will be created by installing a sealed box with a self-propelled device to a guiding pipe and then inserting the device into the PCV.
- To check the air leakage, dust concentrations will be monitored with a dust sampler during the investigation.



Boundary created for PCV investigation with a self-propelled device

2. Step 2: Overview of PCV investigation using a self-propelled device 3/4)

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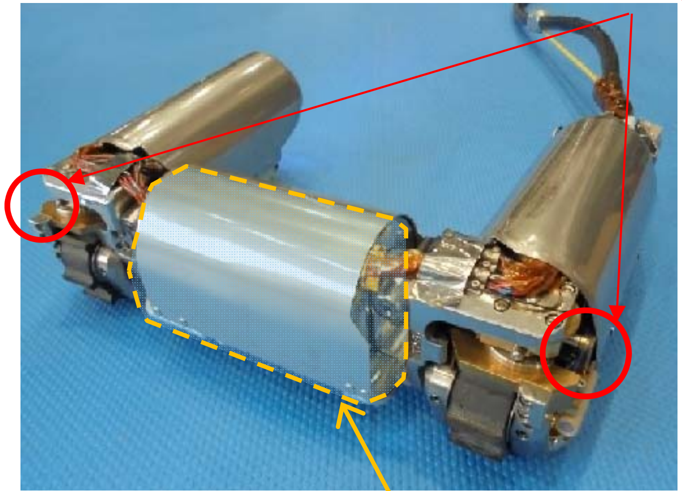
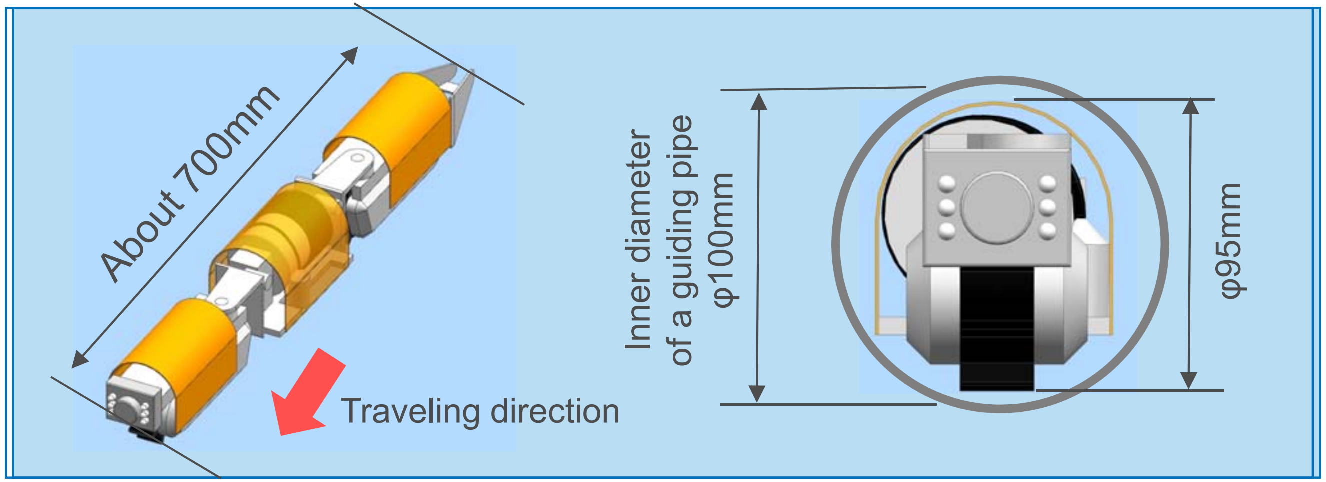
Appearance of a self-propelled investigation device

Laser guide



Storage space for a camera and dosimeter

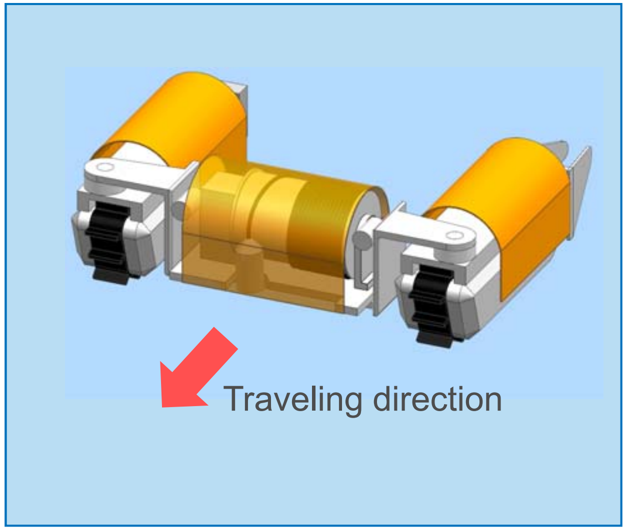
When inserted into a guiding pipe

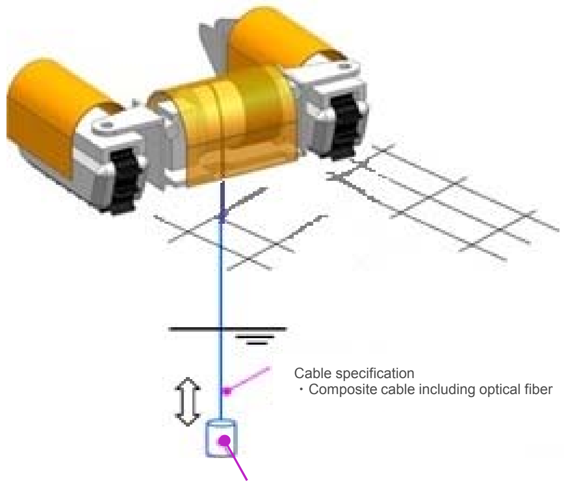


When capturing digital images and measuring radiation doses

Sensor unit integrating a camera and dosimeter

When traveling on 1st floor metal grating inside PCV





Measurement unit (dosimeter & underwater camera)
・About Φ20mm×about 40mm

Dosimeter measurement range: 1×10^{-1}～1×10^{4}Gy/h
Underwater camera: 350,000 pixel
Radiation resistance: 1000Gy

2. Step 2: Overview of PCV investigation using a self-propelled device (4/4)

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Challenge and response based on the investigation results in April 2015

Unit 1 PCV investigation (conducted in April 2015)	Challenge	Things reflected to this investigation
The device got stuck in the grating ditch and could not move any more.	Information about the conditions of the floor was not enough.	・Laser guides will be installed in front of the device to improve the spatial ability as well as to enable the device to travel while checking obstacles and openings.
Camera screen could not be checked any more because it was affected by radiation.	Measures against radioactive degradation were not enough.	・When the investigation is not conducted, the monitoring camera will be retrieved into the guiding pipe.

Other challenge and response

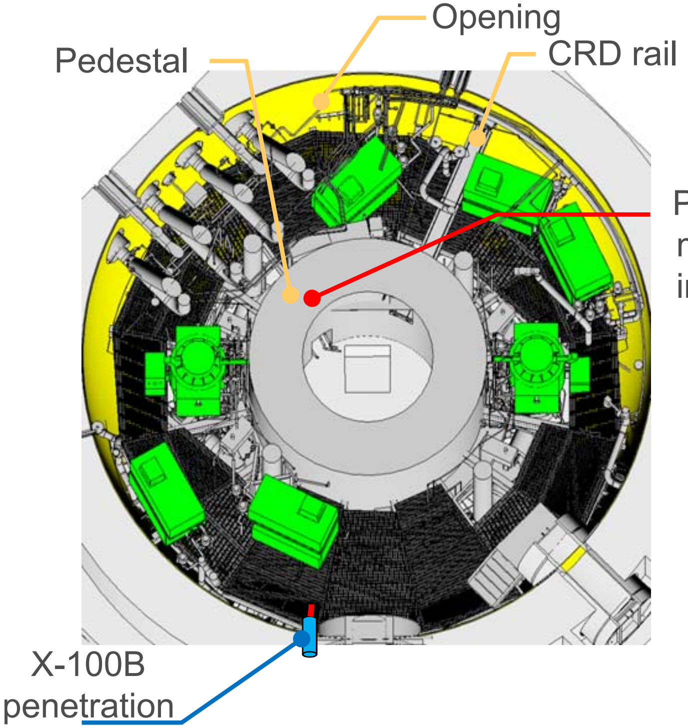
Challenge	Things reflected to this investigation
There are many structures within the retained water, such as scaffolds and pipes, which can pose obstacles to the device.	The measurement unit will be hung down and pulled up carefully.
Visibility within the retained water could be poor because it was observed in the previous investigation (B1) that floating deposits flew up in the retained water.	The measurement unit will be hung down carefully no to let floating deposits fly up.
When floating deposits in the retained water adhere to the measurement unit, radiation doses may not be measured accurately.	The measurement unit will be hung down carefully no to touch the bottom of the basement floor..

✓ To prioritize the acquisition of site data, such as conditions of the pedestal opening of the basement floor and radiation doses, for the eventual removal of fuel debris, it will be determined whether to retrieve the device depending on the situation.

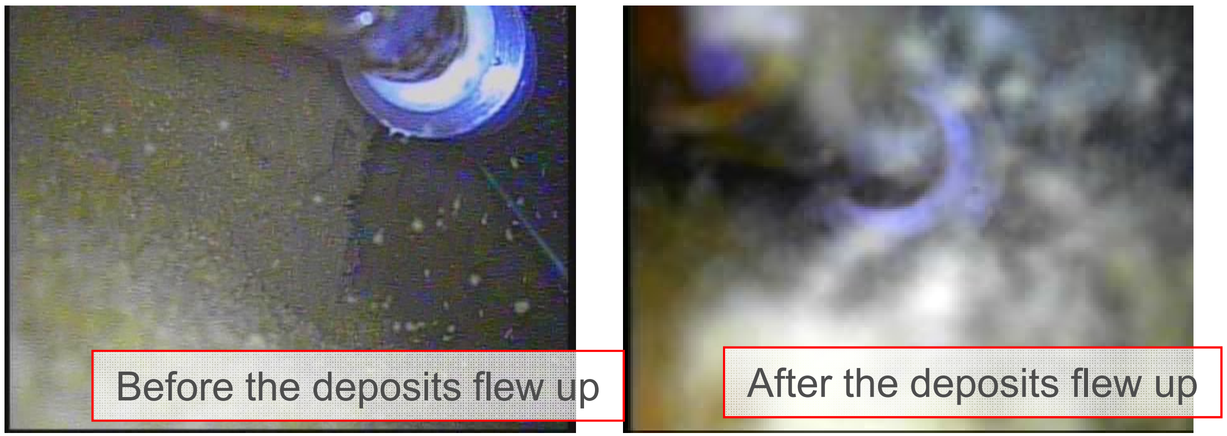
3. Step 3: Overview of deposit sampling (1/3)

- It was observed that floating deposits flew up within the PCV retained water when a permanent monitoring instrument was reinstalled after the previous investigation (April 2015).
- Sampling of the deposits at the bottom of PCV will be conducted to identify them and determine how to remove and treat them because they can pose obstacles to the future investigation and fuel debris removal.
- The sampled deposits will be analyzed with the simple X-ray fluorescence in a glove box to find the component.

*When the amount of the sampled deposits is large and radiation level is too high to deal with, a part of the deposits will be returned into the PCV.



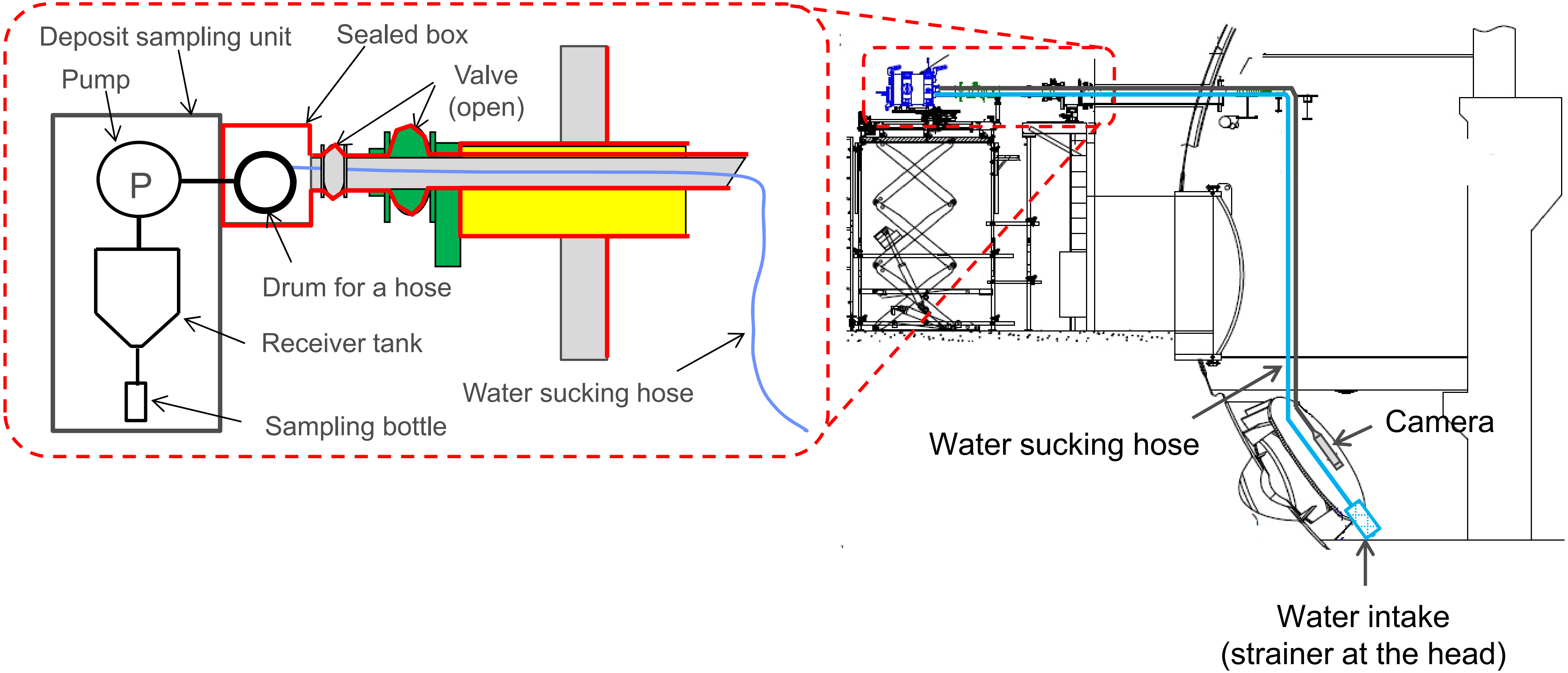
Location of a permanent monitoring instrument reinstalled



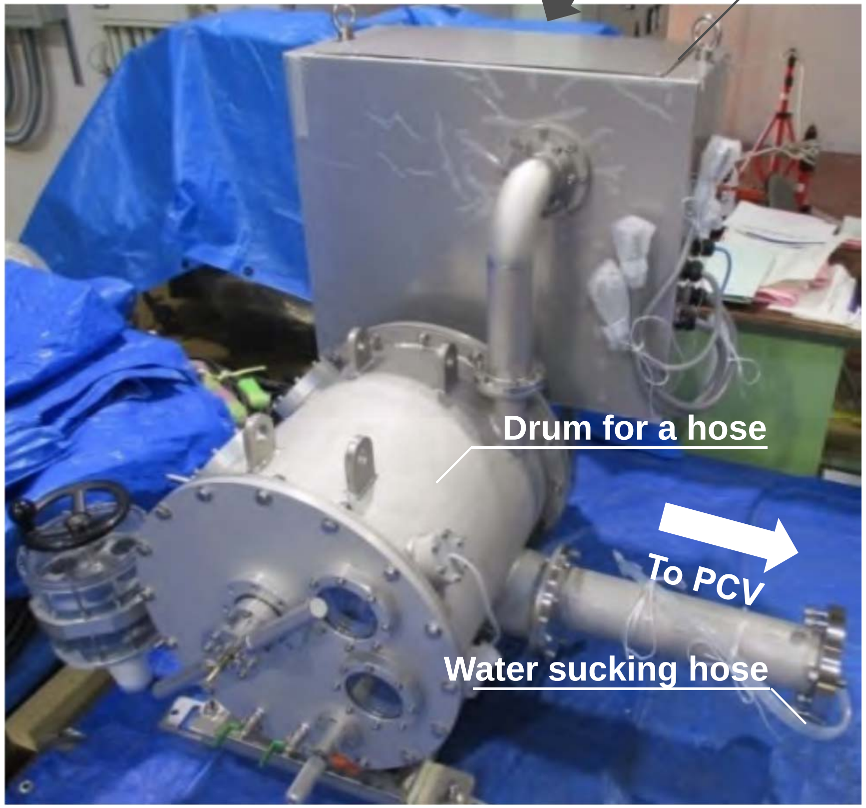
Conditions of deposits when reinstalling a permanent monitoring instrument (announced in January 2016)

3. Step 3: Overview of deposit sampling (2/3)

- Deposits near the X-100B penetration will be sampled with the retained water after a boundary is created by attaching a sealed box with a deposit sampling unit to a guiding pipe, so that the surrounding environment will not be affected with air leakage from the PCV.
- To check the leakage, dust concentrations will be monitored with a dust sampler during the investigation.
- After the sampling, a thermometer and dosimeter will be reinstalled inside the PCV.



3. Step 3: Overview of deposit sampling (3/3)

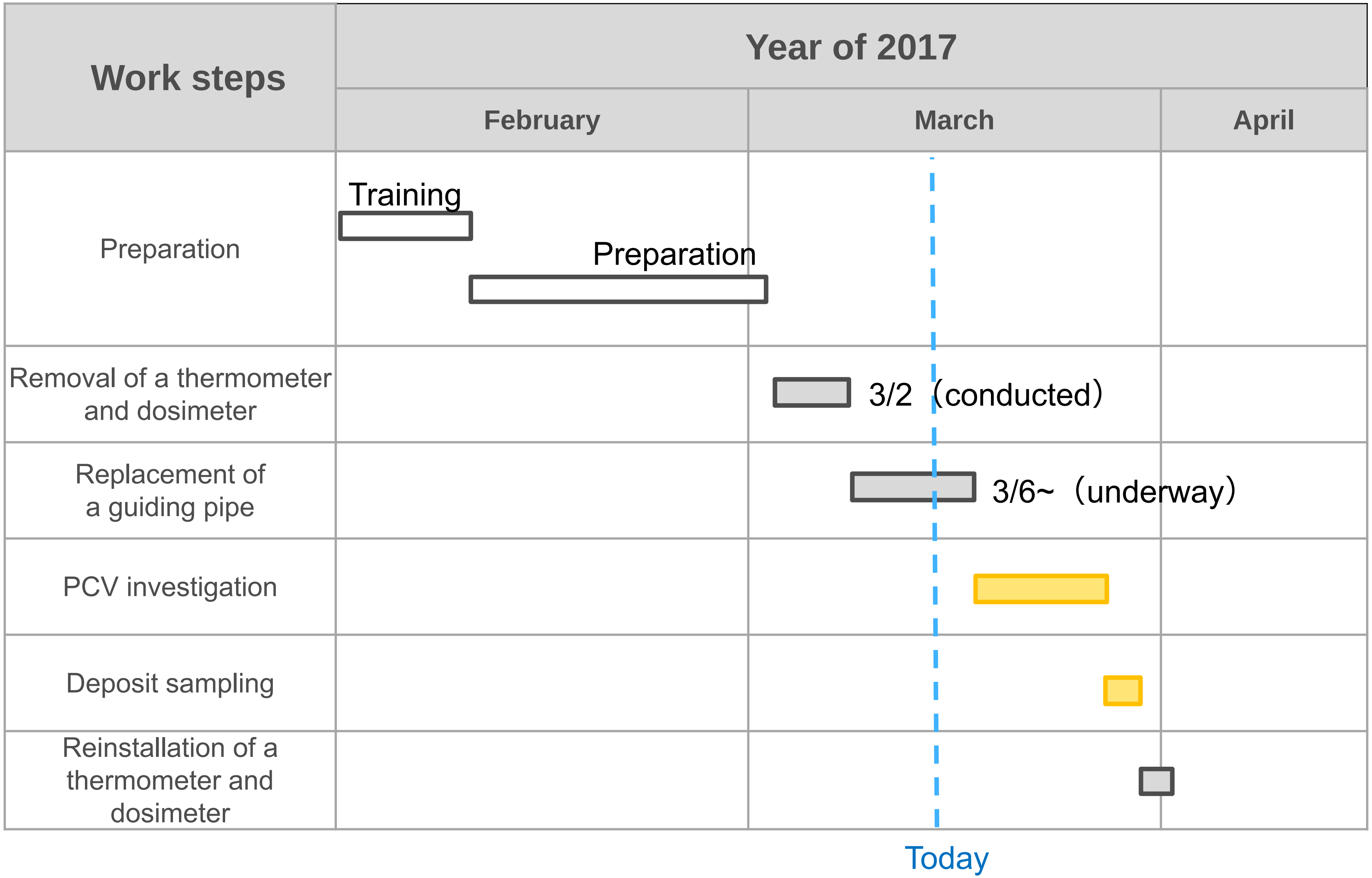


Drum for a hose and deposit sampling unit

View from A direction

Deposit sampling unit

4. Schedule (tentative)



5. Impact to the surrounding environment

- **Relatively high radiation may be measured** due to the proximity to fuel debris expected to exist at the bottom of PCV.
- In the case of measuring radiation levels more than several hundreds of Sievert per hour in the PCV, **the levels will be reduced** by the shielding of PCV concrete walls and steels.
- **A boundary will be created during the investigation not to let the air from the PCV leak to the outside.**
- Real-time data of monitoring posts and dust monitors along the site boundary are available on the website.

  http://www.tepco.co.jp/en/nu/fukushima-np/f1/index-e.html

  http://www.tepco.co.jp/en/nu/fukushima-np/f1/dustmonitor/index-e.html

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

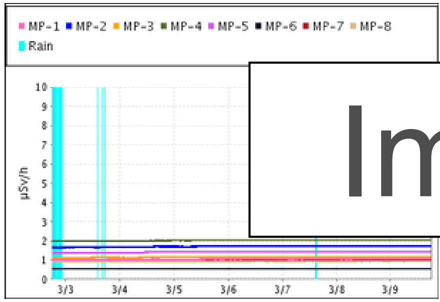
The following is the radiation doses of the air measured by the monitoring posts (MP1-8), portable monitoring posts and monitoring cars on the premises of Fukushima Daiichi Nuclear Power Station.

Monitoring post (MP1 - MP8)

| Monitoring points

・Expansion

| Radiation dose



・Expansion

▫Measurement value (2017/03/09 18:00)

MP Unit: μSv/h Wind Velocity Unit: m/s

MP-1	MP-2	MP-3	MP-4	MP-5	MP-6	MP-7	MP-8	Wind Direction	Wind Velocity	Rain
1.064	1.745	1.184	2.071	1.446	0.561	1.027	0.950	west-northwest	6.2	No

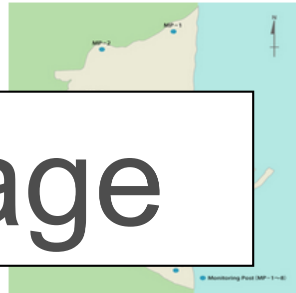
※There are some cases that wind direction and speed at the exhaust stacks cannot be measured properly due to storm.

Image

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

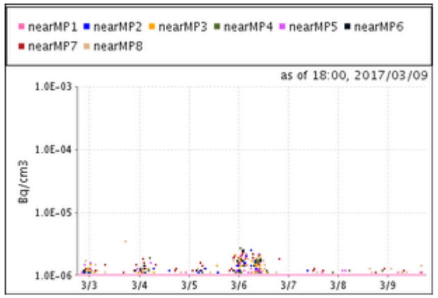
The following are radioactive concentrations in the air measured near the monitoring posts (MP1-8) at the site boundary of Fukushima Daiichi Nuclear Power Station.

| Monitoring points



・Expansion

| Radiation concentration



・Expansion

▫Measurement value (2017/03/09 18:00)

Radioactive Particles Monitor Unit: Bq/cm3 Wind Velocity Unit: m/s

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	west	1.2

※"－": the wind velocity is below 0.5 m/s

※Wind direction and speed are measured by a meteorological observation instrument, installed on the west side of the Seismic Isolation Building, at 10m above ground level.

6. Monitoring of the plant parameters

- In the case of measuring radiation levels more than several hundreds of Sievert per hour in the PCV, **it does not mean that a new event has occurred but rather the area that has not been investigated since the March 2011 accident was investigated for the first time**.
- Plant parameters are monitored all the time during the investigation.
- Temperature data inside the PCV are available on the website.

http://www.tepco.co.jp/en/nu/fukushima-np/f1/pla/index-e.html