Reference
February 15, 2017
Tokyo Electric Power Company Holdings, Inc.

Unit 2 Primary Containment Vessel Investigation at Fukushima Daiichi Nuclear Power Station (By the self-propelled investigation device)

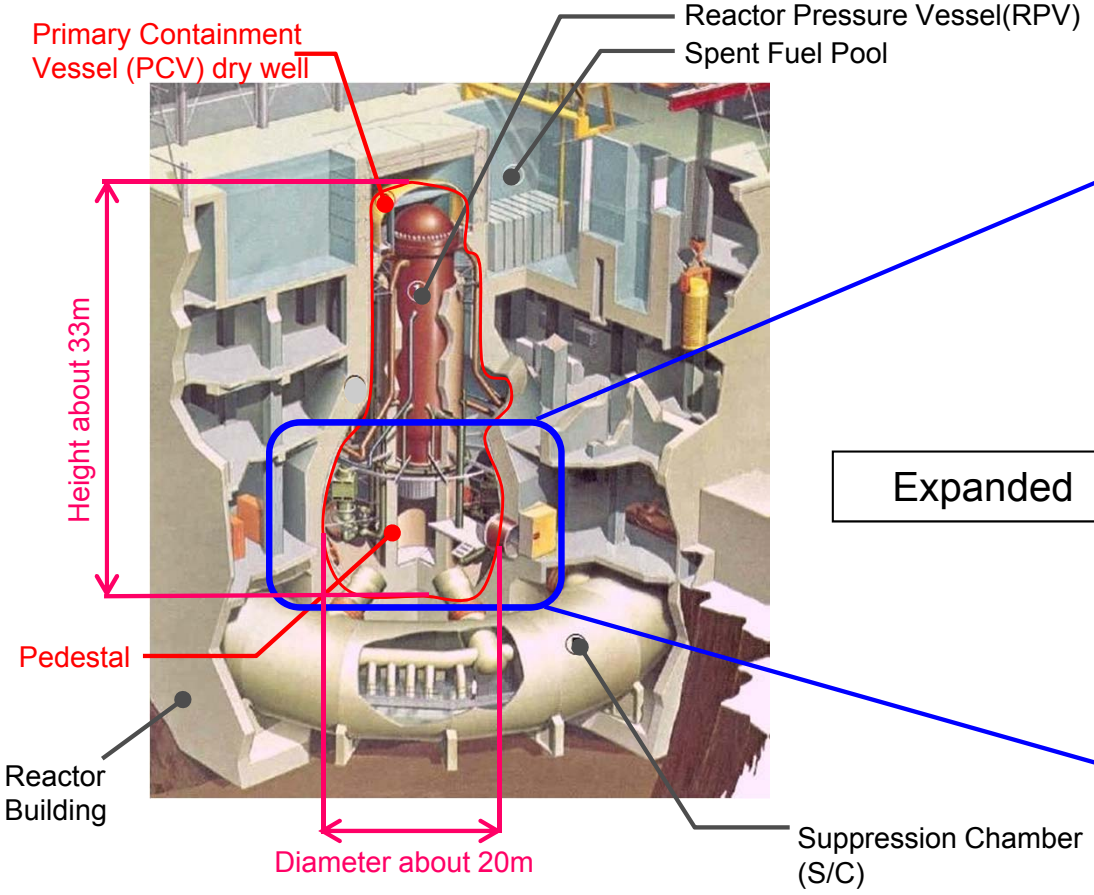
IRID TEPCO

Tokyo Electric Power Company Holdings, Inc.

1. Current conditions of Unit 2 Primary Containment Vessel (PCV)

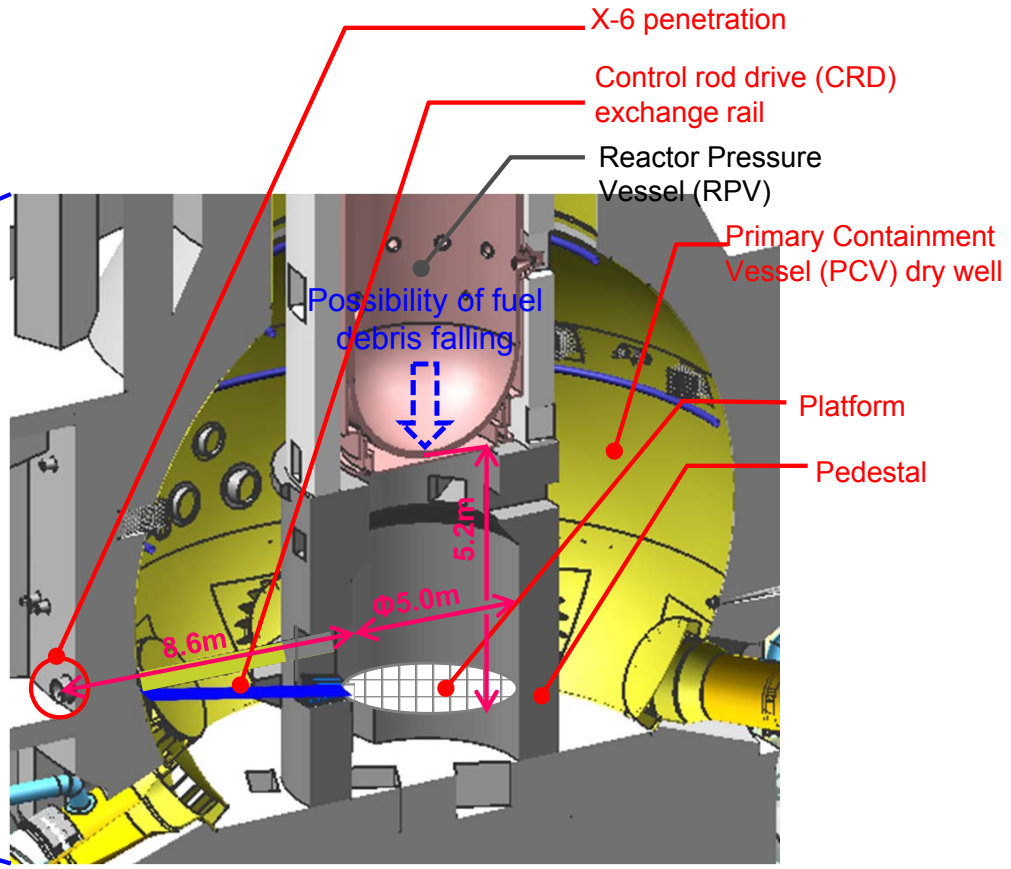
- Nuclear fuel in the Primary Containment vessel (PCV) was exposed to the air and melted from the impact of March 2011 Great Earthquake.
- As a result of the accident analysis, it was found that a portion of melted nuclear fuel might have been fallen inside the pedestal.

- To remove fuel debris, it is necessary to investigate the PCV and clarify the conditions of debris and surrounding structures.



Cross section of Reactor Building

Expanded

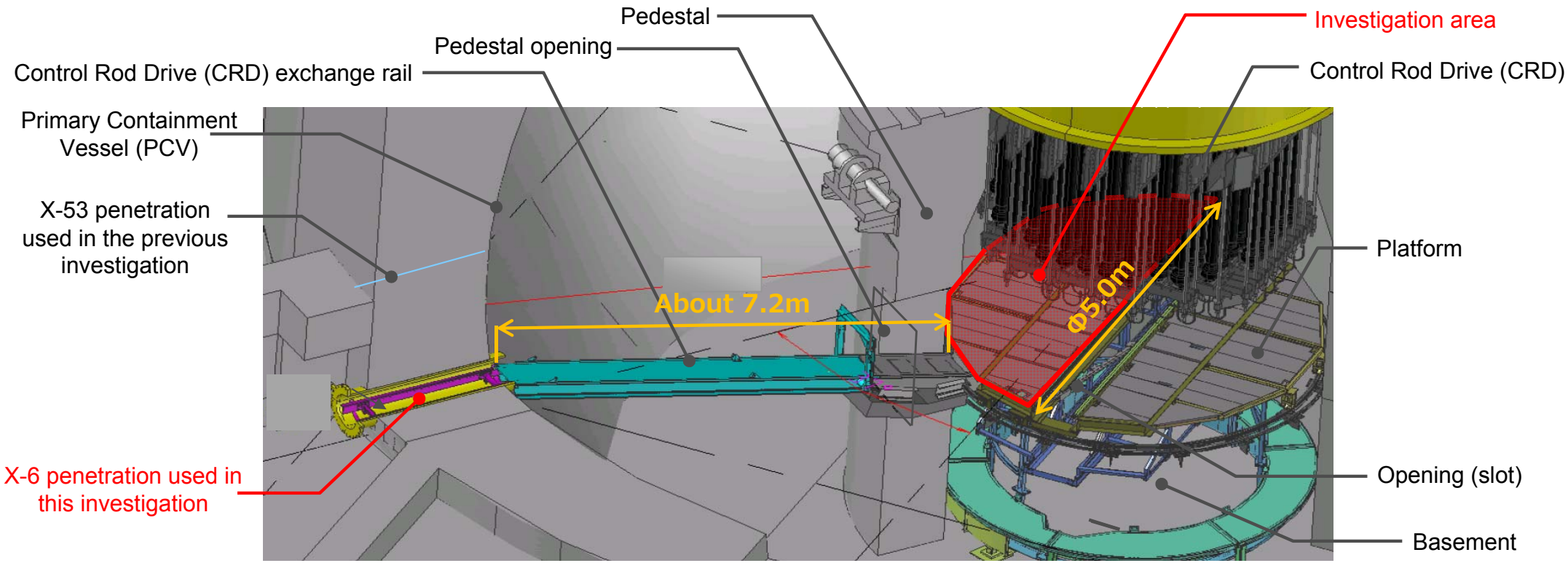


Cross section of the bottom of Primary Containment Vessel

2. Outline of Unit 2 PCV investigation

[Purpose]: ① To obtain feedback information (deformation of platform, etc.) for the design and development of next investigation devices inside the pedestal
② To inspect conditions on the platform inside pedestal, fuel debris fallen to the CRD housing, and conditions of structures inside pedestal.

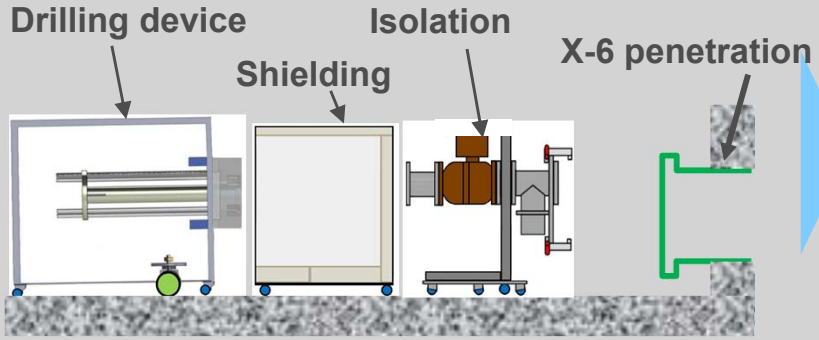
[Investigation point]: Platform and Control Rod Drive (CRD) will be investigated from the platform inside pedestal



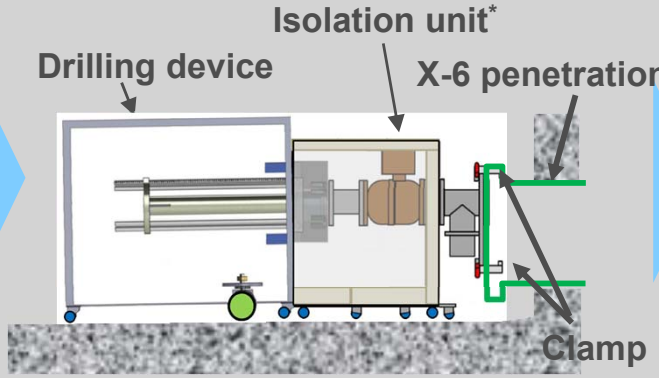
Investigation area inside the pedestal

3. Work steps for Unit 2 PCV investigation

Step 1. Drilling device carried in

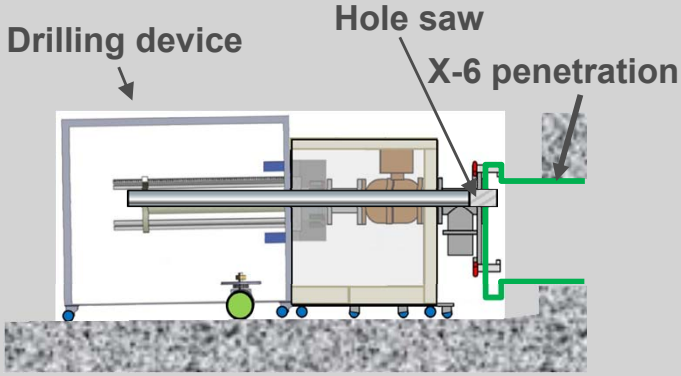


Step 2. Drilling device set up

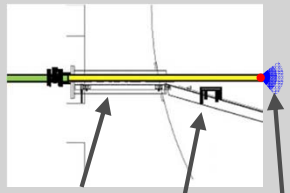


*Combination of isolation and shielding

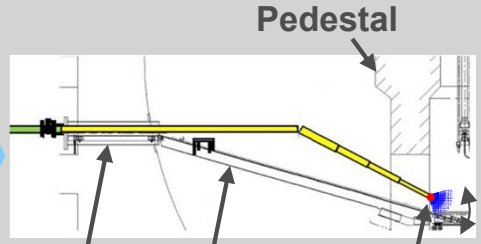
Step 3. Drilling on X-6 penetration



Step 4. Pre-investigation of X-6 penetration and CRD rail using guide pipe

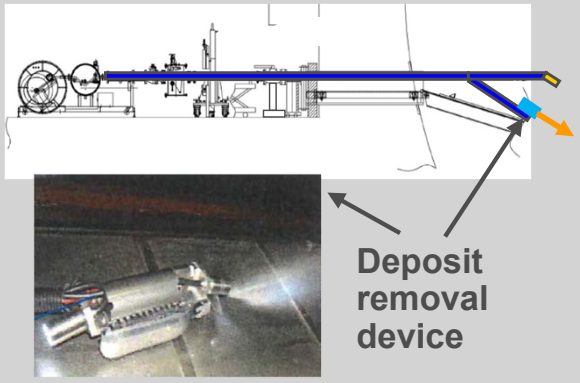


Step 5. Pre-investigation inside pedestal using guide pipe

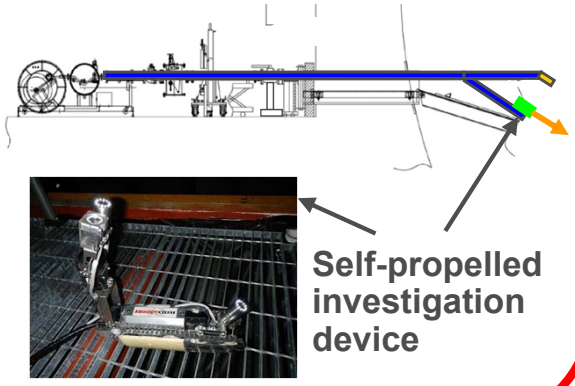


Step 6. Obstacle removal device inserted*

*The device may not be inserted depending on the obstacle conditions.

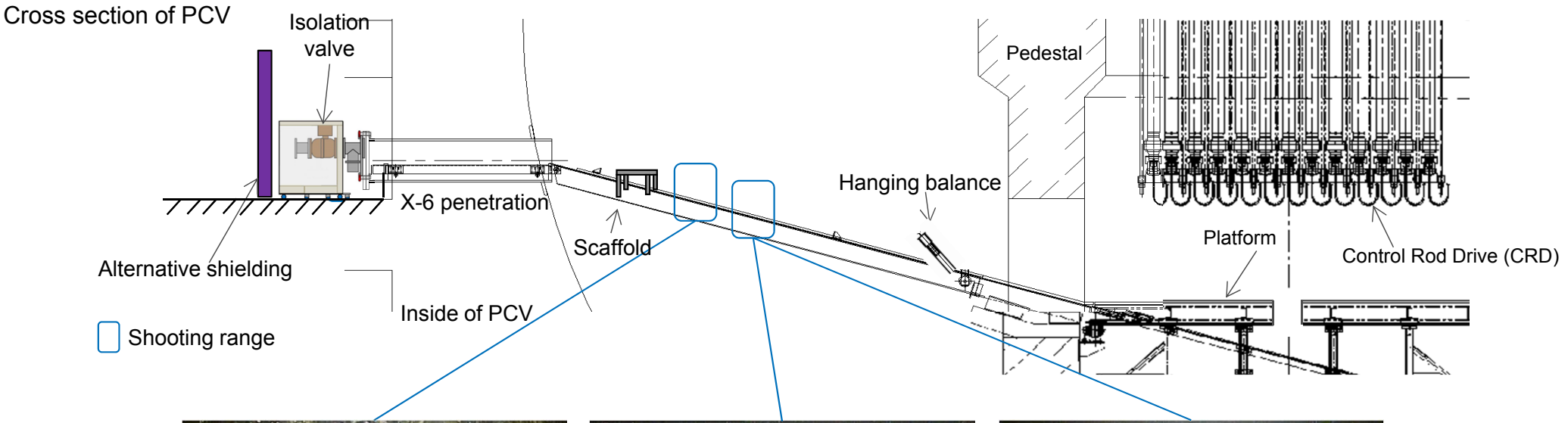


Step 7. Investigation using self-propelled investigation device



Images provided from International Research Institute for Nuclear Decommissioning (IRID)

4. Preparatory investigation results from X-6 penetration to CRD rail



Images from guiding pipe camera

Images from front camera attached to the deposit removal device

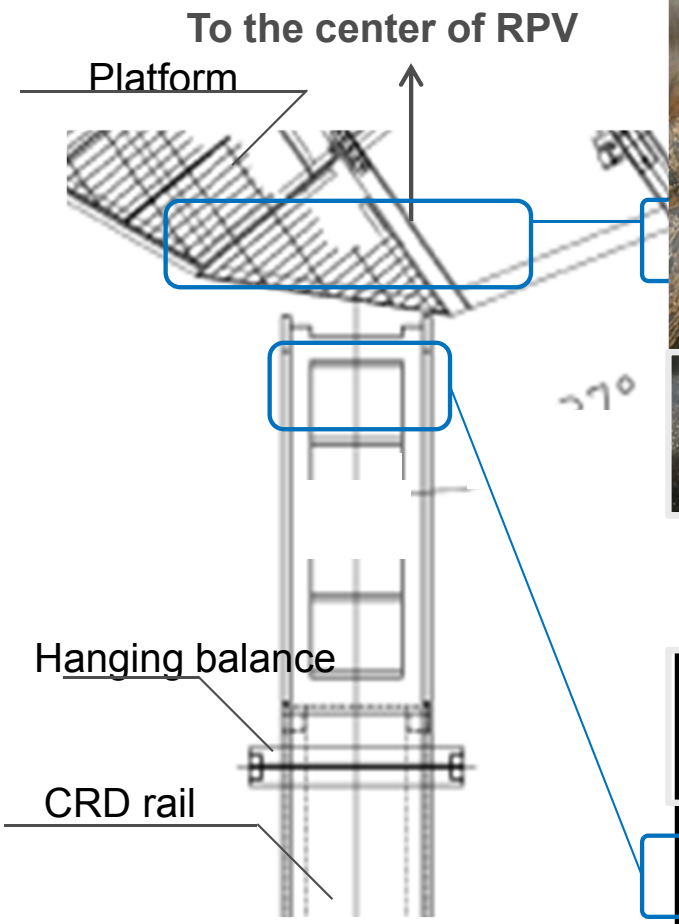
Images from guiding pipe camera

- The deposits on the CRD rail was the mixture of black paste and thin pieces of or gravel-sized materials.
- The deposits on the upper part of the CRD rail was soft but it adhered more to the lower part of the rail.
- The deposit removal device could get on the deposits but could not run on them for some parts.

Images provided from International Research Institute for Nuclear Decommissioning (IRID)

4. Preparatory investigation results at the entrance of pedestal area

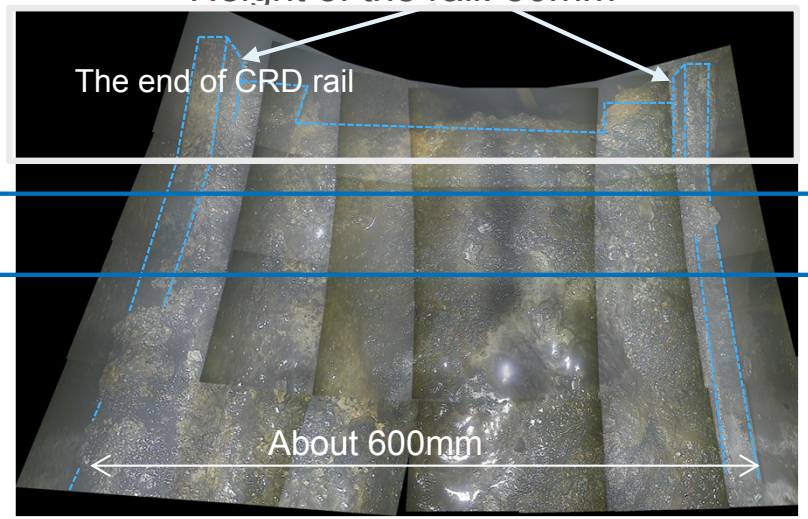
Plan view of PCV



- There was a gap (about 150 to 40mm) between the CRD rail and platform as expected.
- There were some deposits on the platform.

The same part as the picture below

Height of the rail: 30mm

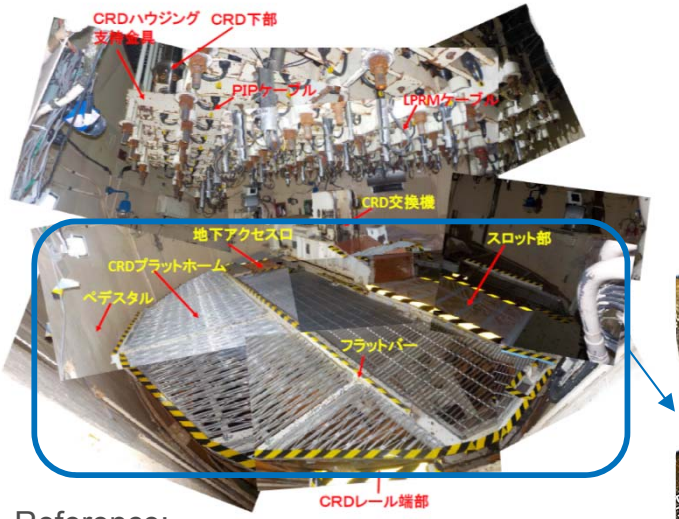


The same part as the above picture

- There were deposits all over the end of CRD rail.
- A part of the deposits was climbing over the edges of CRD rail.

Images provided from International Research Institute for Nuclear Decommissioning (IRID)

4. Preparatory investigation results of pedestal area



Reference:
Inside the Unit 5 pedestal

Metal grating fallen in

Slot opening

Metal grating sunk in

Flat bar

About 280mm

Gap between CRD rail and platform (about 150 to 40 mm)

Assumed route when trying to access to the platform inside the pedestal

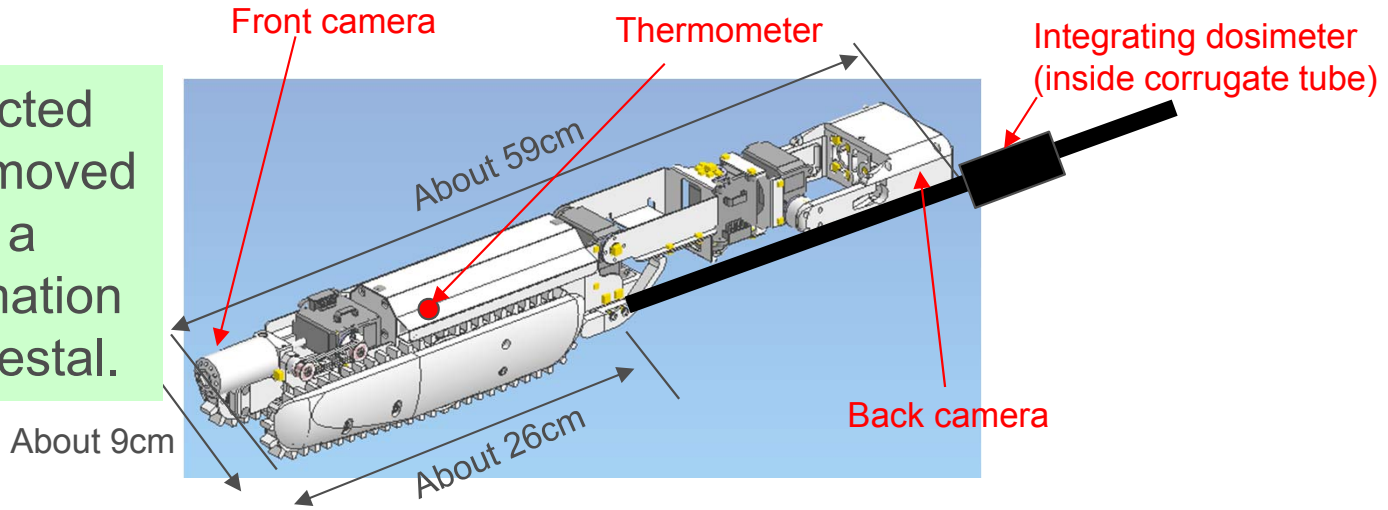
End of CRD rail

Digital image of Unit 2 pedestal area obtained from preparatory investigations

Images provided from International Research Institute for Nuclear Decommissioning (IRID)

5. Additional results expected from the self-propelled investigation device

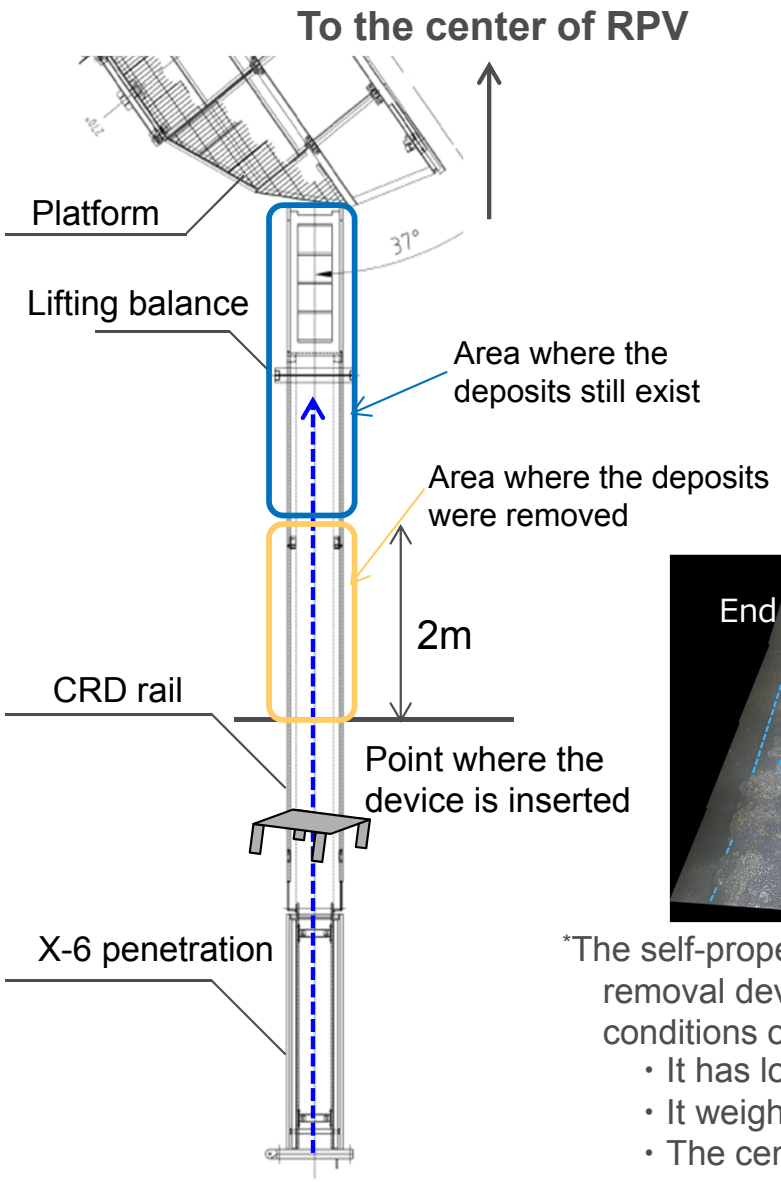
The investigation will be conducted for the area further than the removed deposits because these will be a possibility that additional information can be obtained inside the pedestal.



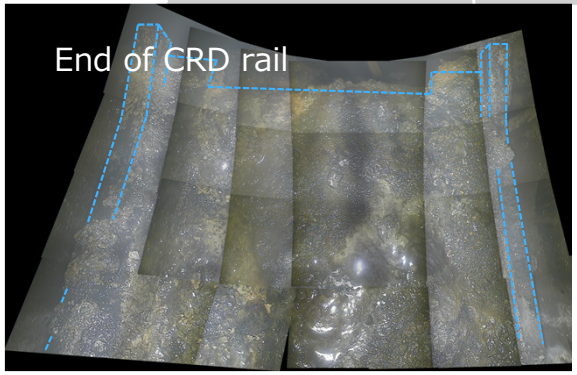
Digital images*1	• Halation will not be likely to occur because cameras and lighting are far away from each other. • The space can be recognized with two cameras of both front and back. • Radiation levels can be estimated from noise images on the camera screens (marginal error of ±30%).
Temperature	• Temperatures are measured by thermocouple.
Radiation levels	• Radiation levels are measured with an integrating dosimeter, not the estimation from noise images (marginal error of ±20%) • The dosimeter may be affected by the deposits because it is attached to the connection cable (or touches the floor surface). There is a possibility that the measurement data does not indicate ambient radiation.

*1 If the device can reach to the end of CRD rail, it can view the inside of the pedestal from different angles and find the conditions of interior structures and deposits.

6. Investigation by the self-propelled investigation device to the end of CRD rail



Investigation area	Investigation items	Information expected to be obtained
・On CRD rail ・Entrance to the pedestal area	Visual observation	The conditions of interior structures and deposits can be revealed by visually observing the pedestal area from low angles.
	Temperature measurement	Temperatures can be measured up to the vicinity of the pedestal, which will be used for later analysis.
	Radiation measurement	Radiation levels can be measured up to the vicinity of the pedestal. *The dosimeter may be affected by the deposits because it is attached to the connection cable (or touches the floor surface). There is a possibility that the measurement data does not indicate ambient radiation.



■ Access of the device

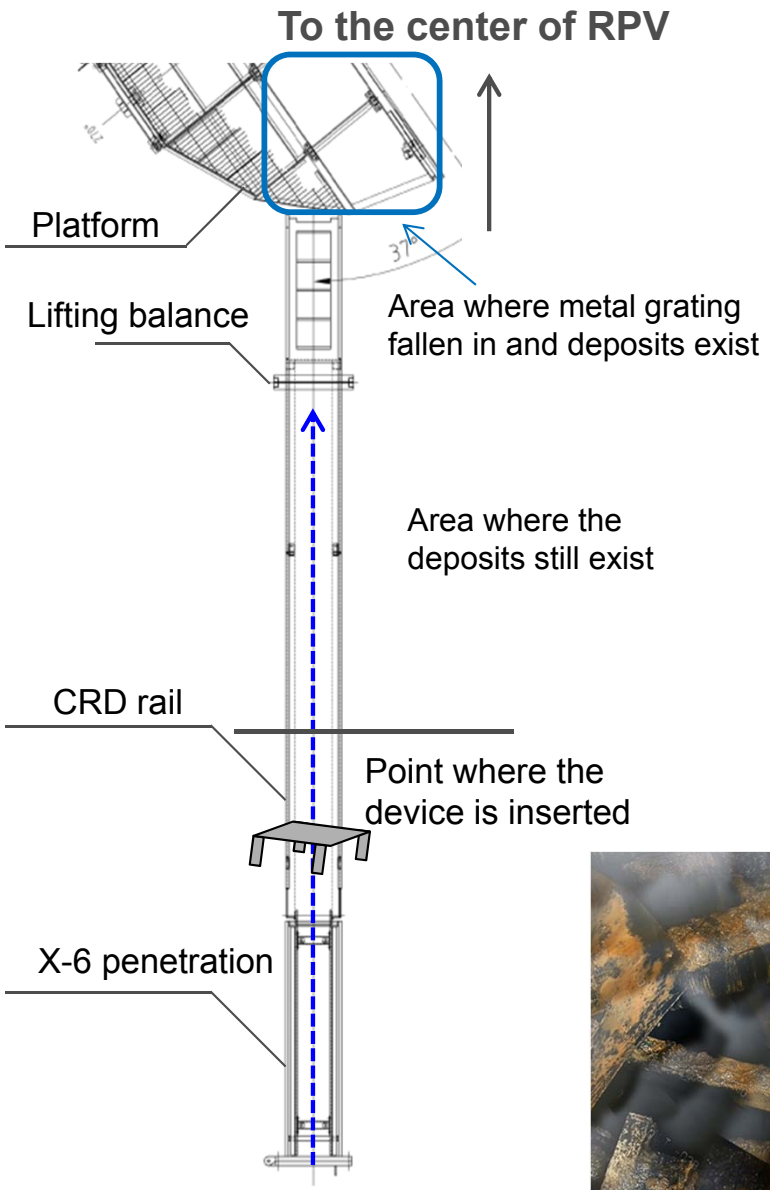
- The device may not be able to go further while running on the deposits.
- In that case, the device will be retrieved by pulling back the connection cable.

*The self-propelled investigation device has following characteristics compared with the deposit removal device, but it is not guaranteed that the device can run on the deposits because the conditions of the deposits are uncertain.
  - ・It has long crawler.
  - ・It weights more.
  - ・The center of gravity can be changed by shifting positions of the back camera.

*Depending on the deposits' conditions on the CRD rail, the self-propelled investigation device may not be able to reach the end of the rail, but I will still investigate temperatures and radiation levels on the rail and the conditions of surrounding structures as much as possible.

Image provided from International Research Institute for Nuclear Decommissioning (IRID)

6. Investigation by the self-propelled investigation device to the end of CRD rail



Investigation area	Investigation items	Information expected to be obtained
・On CRD rail ・Entrance to the pedestal area ・Inside of the pedestal	Visual observation	Information can be obtained of the vicinity of the metal grating fallen in. ・Damage on the bottom of the reactor ・Damage on the upper part of the interior structures such as CRD housing ・Deposits adhered to the structures ・Damage on the metal grating
	Temperature measurement	Temperatures can be measured up to the vicinity of the pedestal.
	Radiation measurement	Radiation levels can be measured up to the vicinity of the pedestal. *The dosimeter may be affected by the deposits because it is attached to the connection cable (or touches the floor surface). There is a possibility that the measurement data does not indicate ambient radiation.

■Access of the device (very difficult)

- The device needs to go over the gap between the CRD rail and platform. It may fall in the gap or may not be able to go further.
- The device needs to access the platform only with the images from its own front and back cameras, not with visual observation from the overview camera.
- If the device falls in the gap, it may not be retrieved. It may be stuck with the connection cable being pulled back.
- The device may be left inside the PCV if it takes too much time to retrieve it with priority on the investigation.

Image provided from International Research Institute for Nuclear Decommissioning (IRID)

Reference: Investigation results on the platform inside the pedestal