

“Development of a technology to investigate inside the Reactor Primary Containment Vessel (PCV)”

- Results of site test “Investigation B1” on grating around the
pedestal inside Unit 1 PCV -**

April 30, 2015

Tokyo Electric Power Company



東京電力

— The content of this material includes the output of the international Research Institute for Nuclear Decommissioning (IRID)

IRID

1. Investigation scope

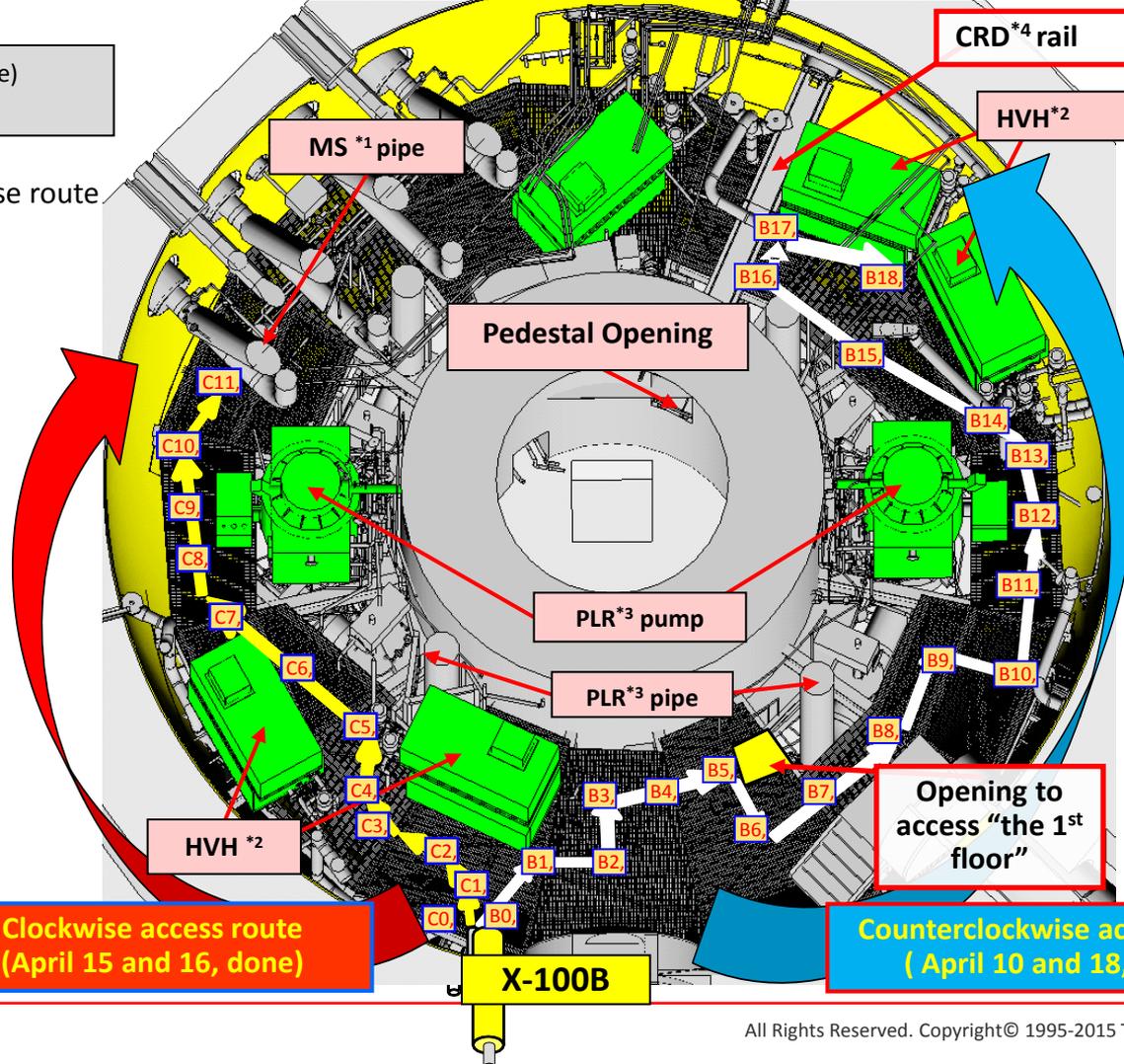
Purpose: For Unit 1, an investigation is to be conducted in order to collect information on “the 1st floor grating inside the Primary Containment Vessel (PCV)” from the robot inserted through X-100B penetration pipe.

→ : Access route (counterclockwise)
 → : Access route (clockwise)

B0, ~ B18, Counterclockwise route
 C0, ~ C11, Clockwise route

Access points (planned)

Investigation device



- *1 Main steaming system
- *2 Air conditioning unit
- *3 Reactor re-circulation system
- *4 Control stick drive system

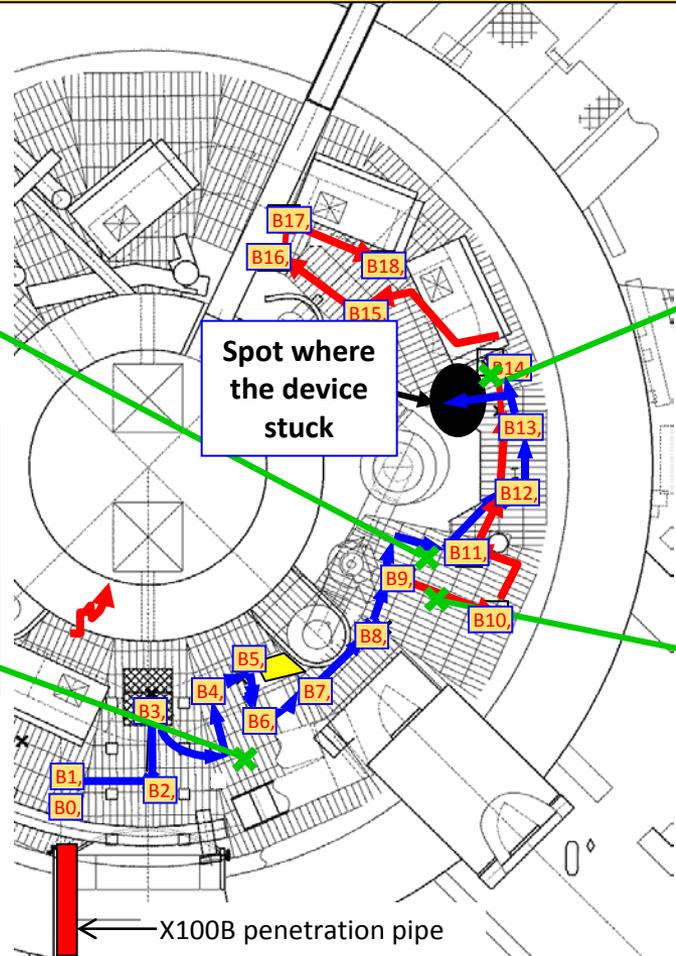
Clockwise access route (April 15 and 16, done)

Counterclockwise access route (April 10 and 18, done)

Opening to access “the 1st floor”

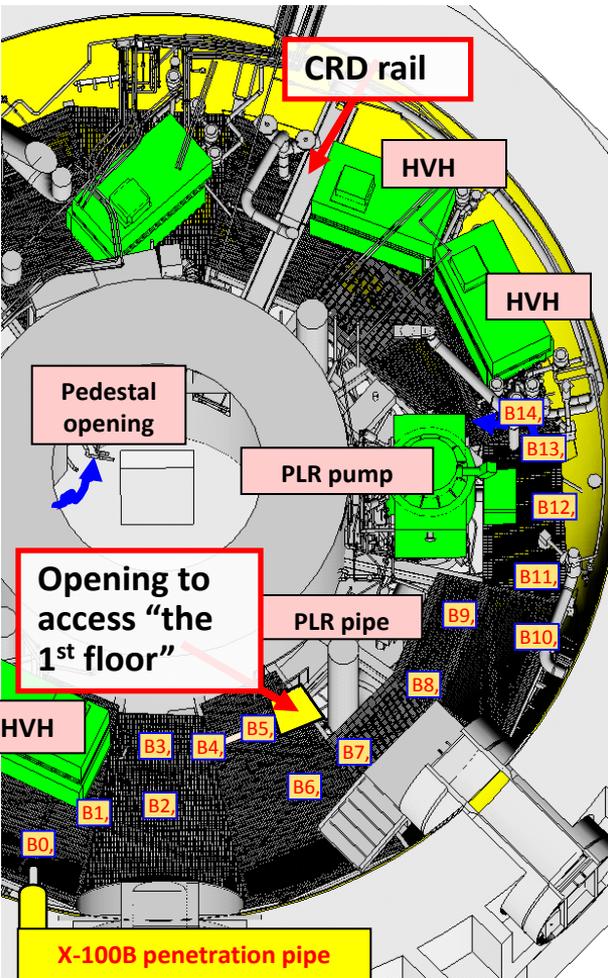
2. Access route along counterclockwise (actual results)

- Due to fallen objects found on the access route planned, the route was changed, and the investigation was conducted.
- The investigation device was stuck between the points of B14 and B15.



3-1 Investigation results (Counterclockwise: done on April 10)

The following data have been obtained through the investigation up to the point B14.

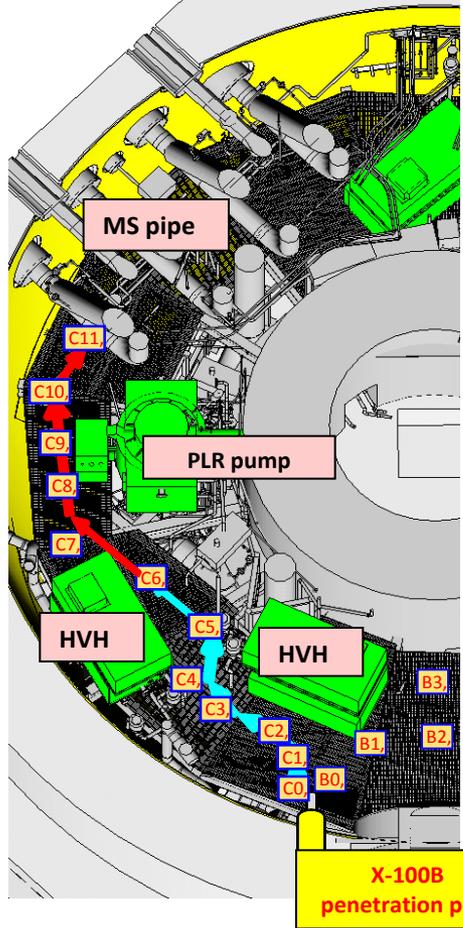


Investigation point	Investigation results
Opening to access the basement	<ul style="list-style-type: none"> For B2 investigation planned to be conducted (investigation on the basement around pedestal), it was confirmed that there is an accessible opening at the basement, and thus, there are no obstacle objects existed around it.
CRD rail	<ul style="list-style-type: none"> Yet to be reached at CRD rail. Images taken with a camera facing towards CRD rail at the end point where the robot reached at have been evaluated, to find that CRD rail can not be visually identified.
On access route	<ul style="list-style-type: none"> No significant damages are found on existing facilities (HVH, PLR pipe, and pedestal walls, etc.) Data on the temperature and radiation dose have been obtained at each investigation point.

* The first investigation device was stuck and ended up being disabled to be retrieved, therefore, it has been left inside the PCV after its corresponding cable was cut. (Apr. 13, 2015)

3-2 Investigation results (Clockwise: Done on April 15 and 16, 2015)

■ The following data have been obtained through the investigation up to the point C11.

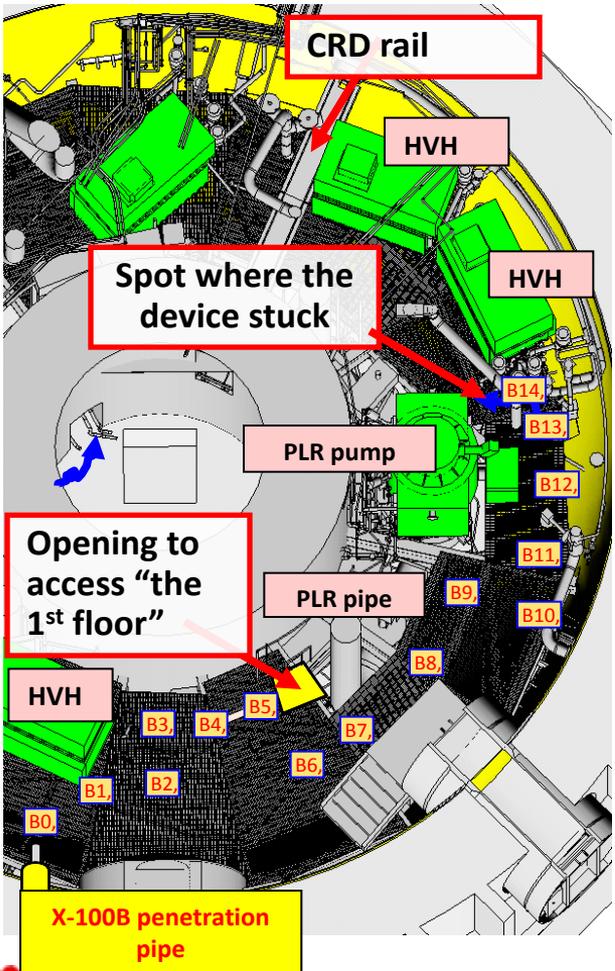


Investigation point	Investigation results
On access route	<ul style="list-style-type: none"> • No significant damages have been found on existing facilities (PLR pipe, walls inside the PCV, and HVH, etc.) • Data on the temperature and radiation dose have been obtained at each investigation point.

- ← : Route investigated on Apr 15, 2015.
- ← : Route investigated on Apr 16, 2015.

3-3 Investigation results (Clockwise: Done on April 18, 2015)

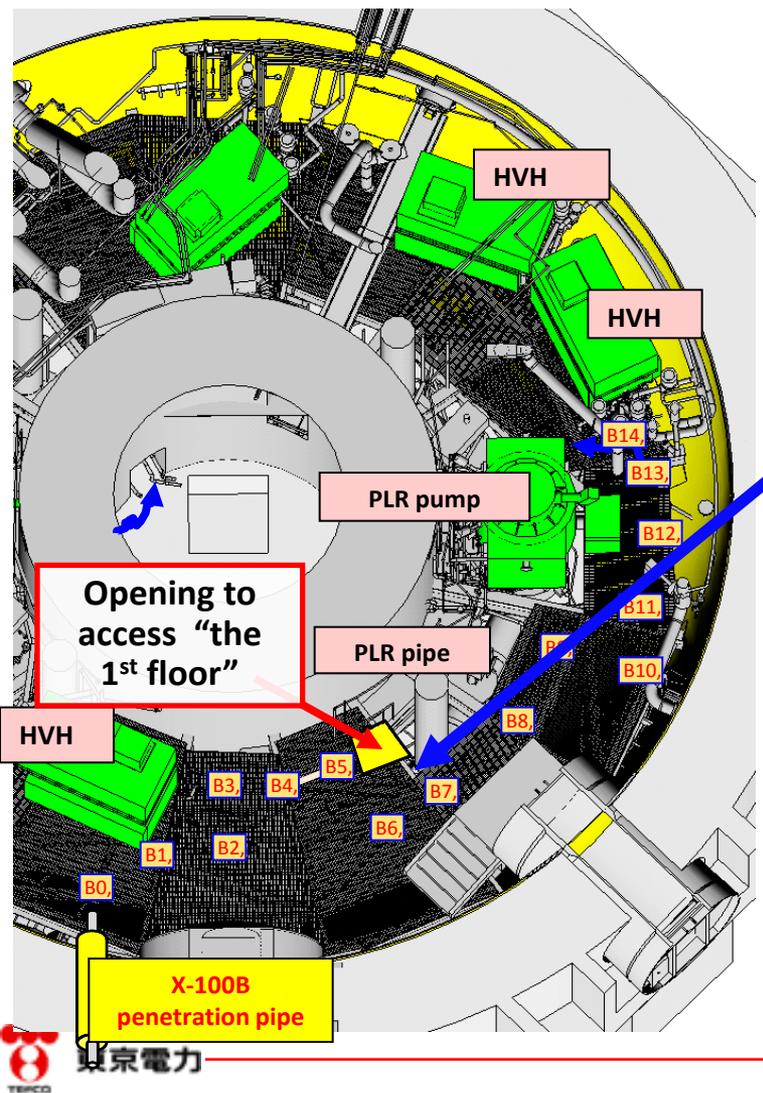
■ With the second investigation device, re-investigation on counterclockwise was conducted to obtain the following information.



Investigation point	Investigation results
Check the route of the cable remained	<ul style="list-style-type: none"> The cable being left around the opening to access the basement is confirmed of having no problem with B2 investigation.
Investigation device stuck	<ul style="list-style-type: none"> Checked on the condition of the crawler of the device stuck.
Check the access route up to CRD rail	<ul style="list-style-type: none"> The access route up to CRD rail goes through a narrow part between structures, which resulted in the investigation device having been disabled to pass through.

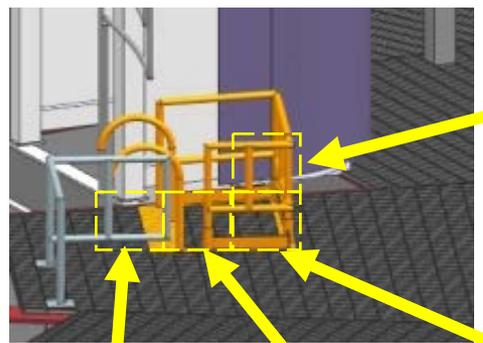
* A pan-tilt camera used for retrieving the device became dysfunctional due to, seemingly, the radiation effect, hence, it was determined to leave the second investigation device in the spot where will not interfere with future works inside the PCV (around C2 on the wall side of the PCV) . (dated Apr. 20, 2015)

4-1 Images (Opening to access the basement)



Taken from B4

- It was confirmed that there is an accessible opening at the basement for B2 investigation planned to be conducted, and thus, there are no obstacle objects existed around it.



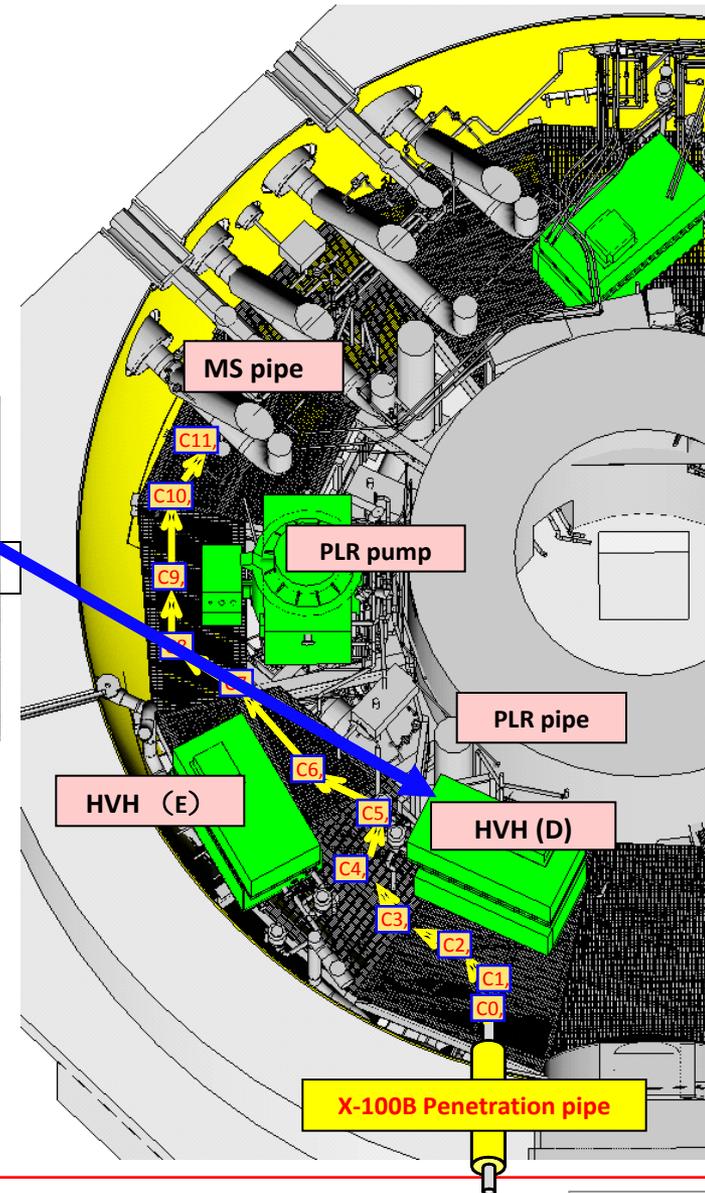
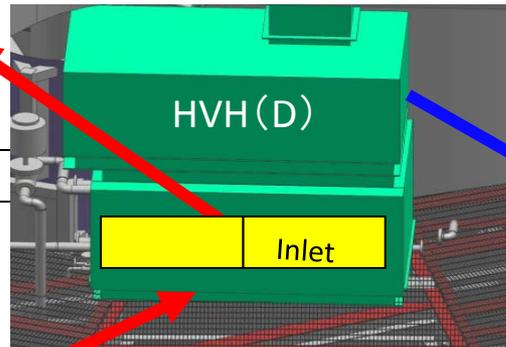
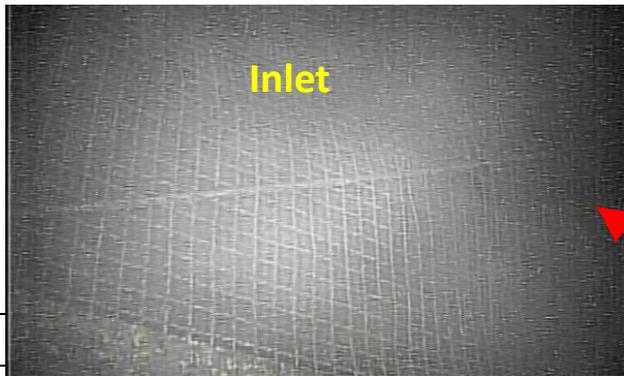
Spot available for inserting the device



4-2 Images (HVH (D))

Taken from C2

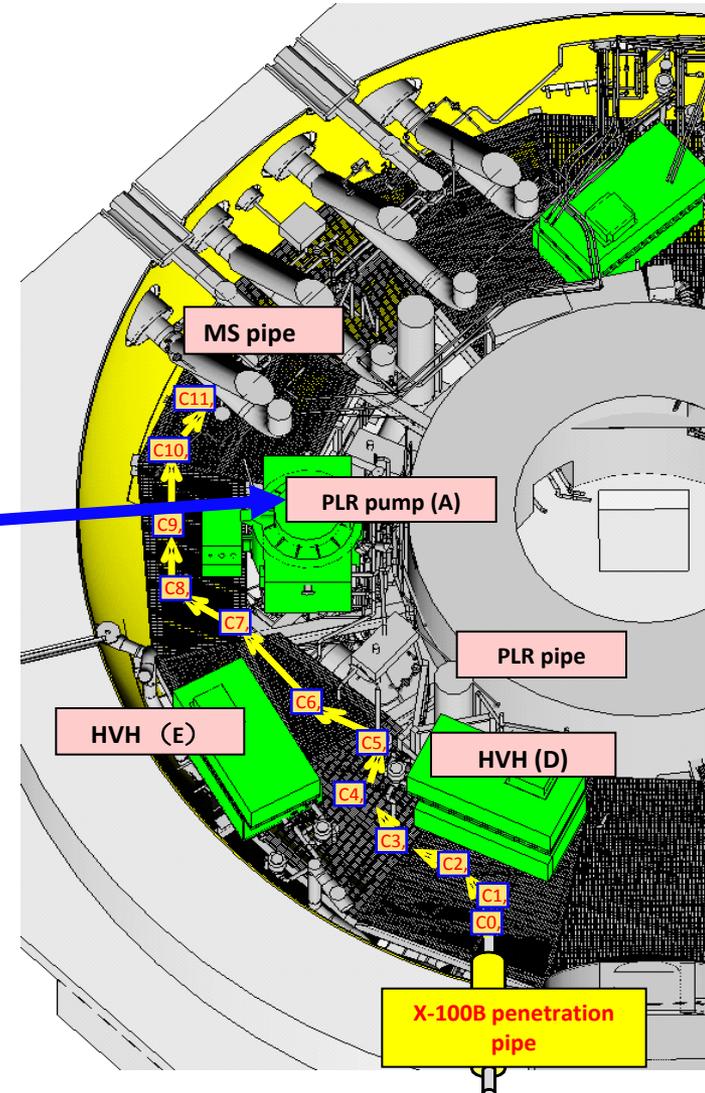
No significant damages are found on HVH (D)



4-3 Images (PLR pump (A))

Taken from C2

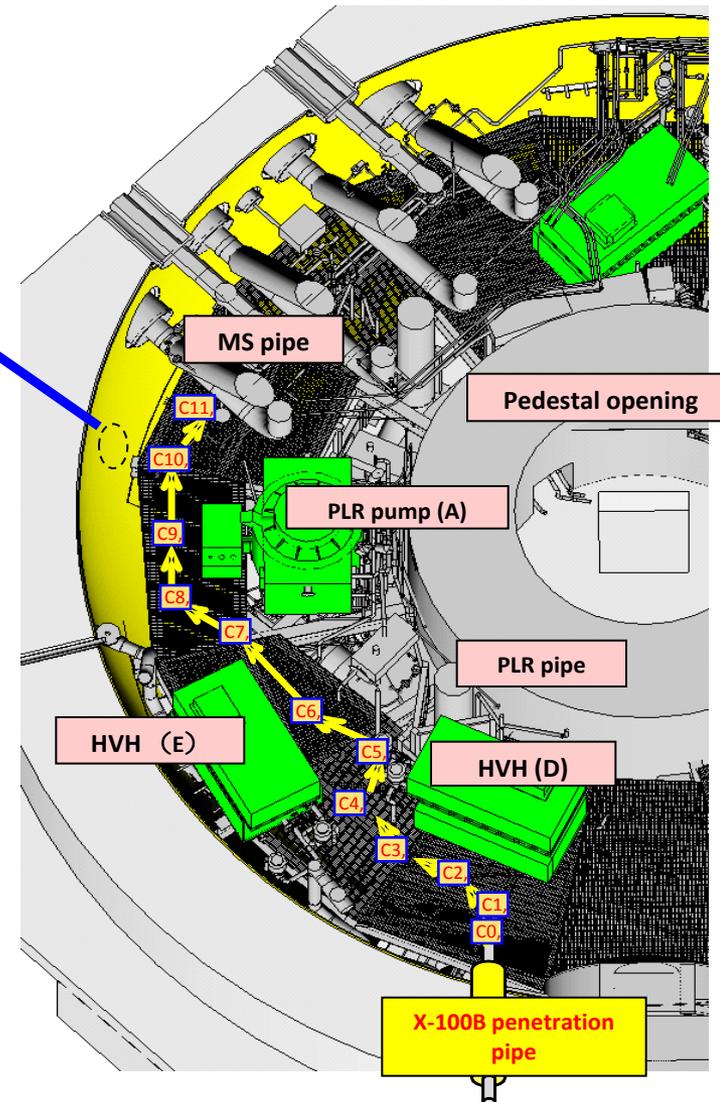
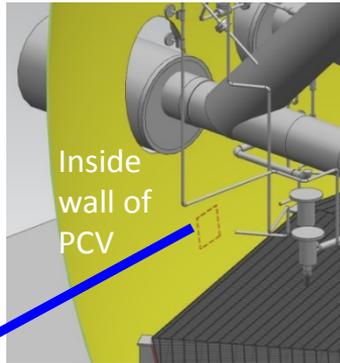
No significant damages are found on PLR pump (A).



4-4 Images (Wall inside PCV)

Taken from C10

No significant damages are found on the wall inside PCV.



5. Results obtained after processing the images of CRD

■ Shooting was performed towards the direction of CRD rail at the end point where the device reached at (around B14) during the investigation along counterclockwise route. The images taken were processed but CRD rail could not be visually identified.

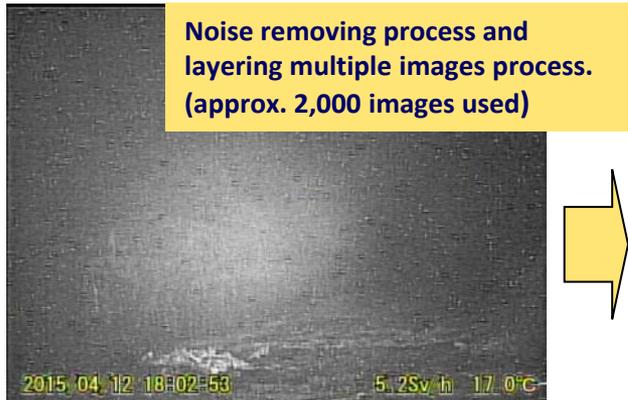
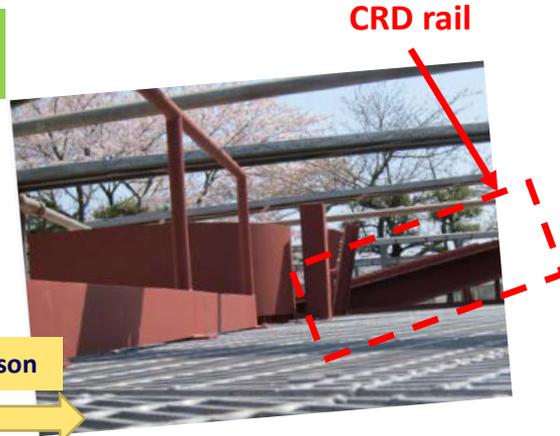


Image (taken at 6:00 PM, Apr. 12)



Images after processing done



Images by mock-up test

Comparison

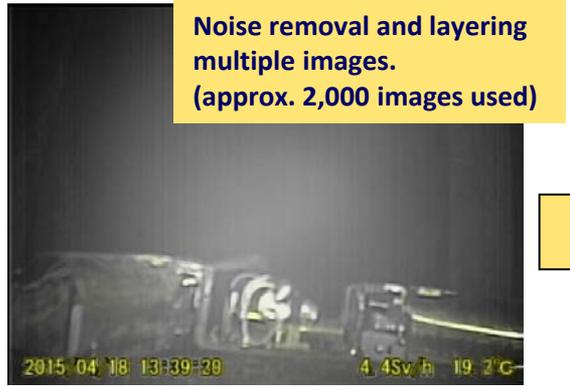


Image (taken at 2:00 PM, Apr. 18)

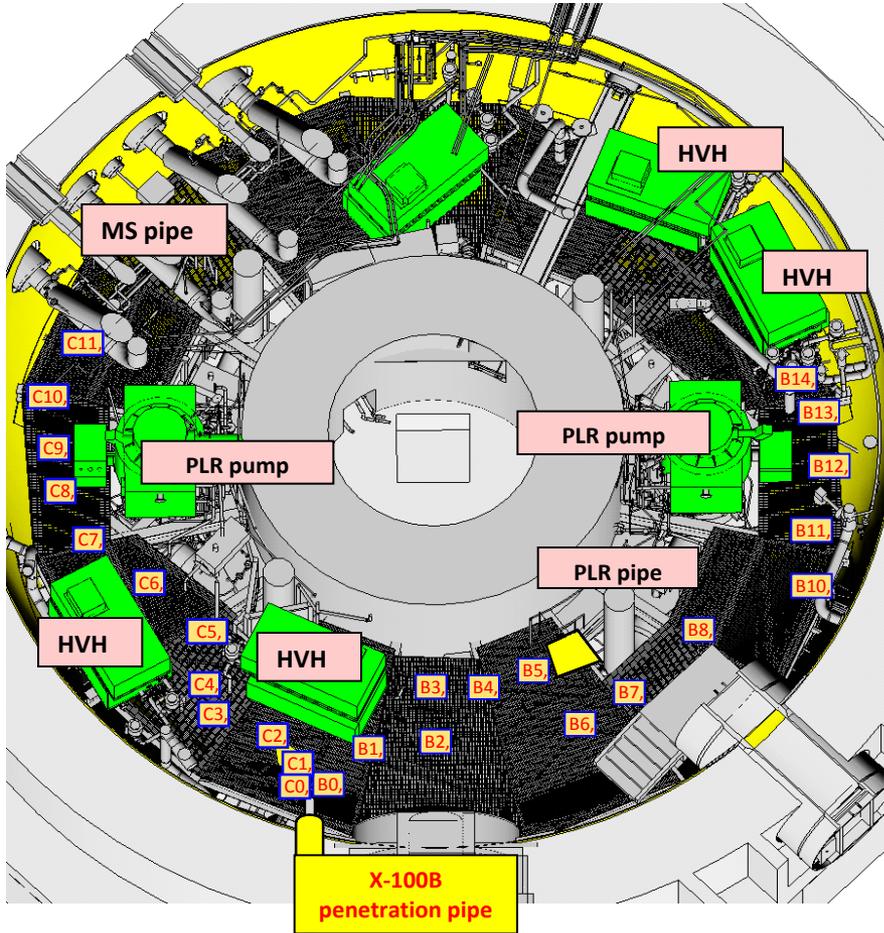


Image after processing images taken

For the image processing methods, multiple processing (addition of images = layering) and average processing (No. of images added up / No. of images used) were applied after finishing pre-treatment such as emphasizing contrasts among several images.

6. Measurement results for temperature and radiation dose rate

■ Temperature and dose rate were measured at the following points.

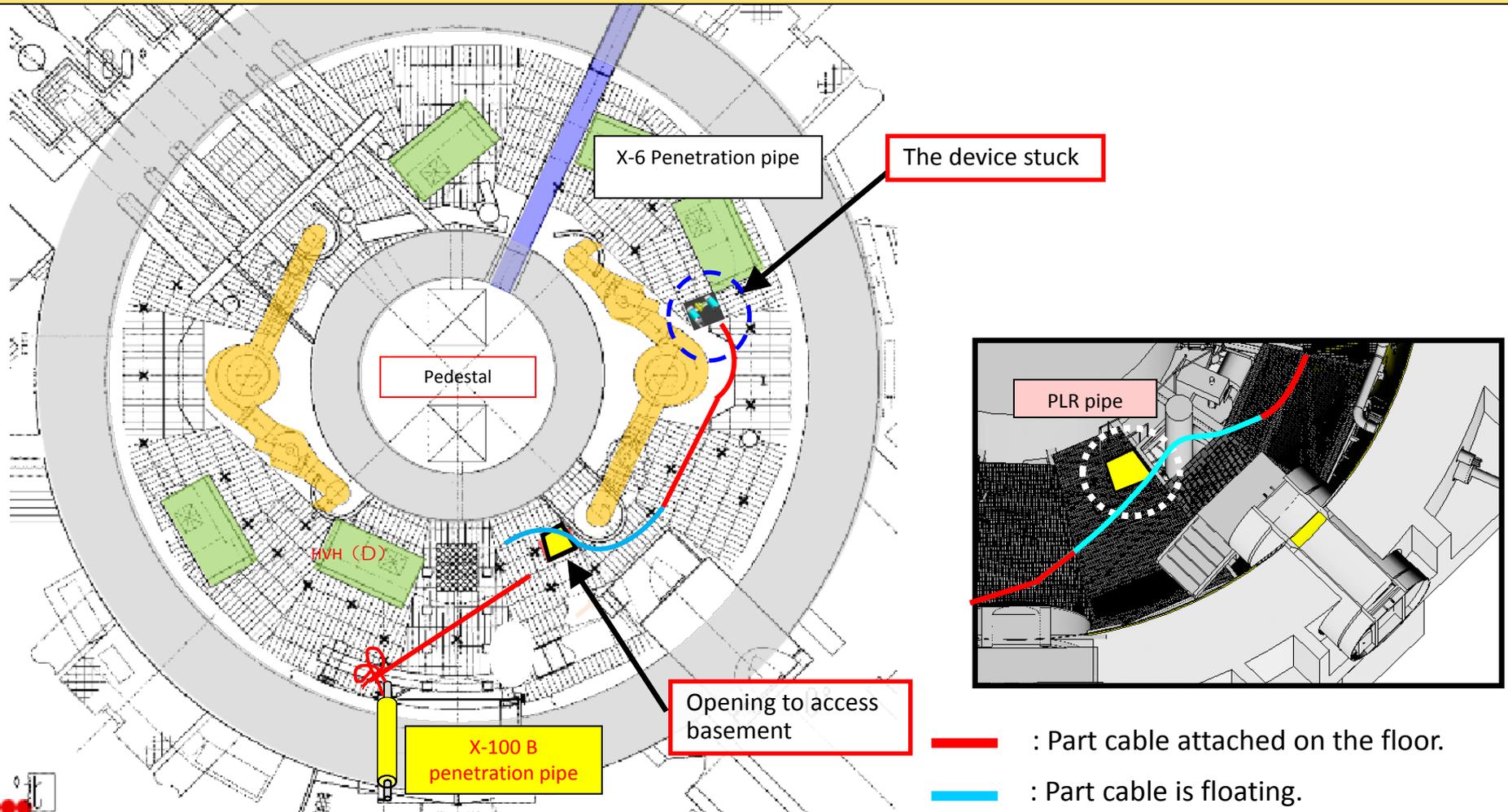


	Dose rate (Sv/h)	Temperature (°C)
B3	7.4	17.8
B4	7.5	19.2
B5	8.7	19.4
B7	7.4	19.5
B11	9.7	19.2
B14	7.0	20.2
C2	6.7	19.6
C5	8.3	19.5
C6	7.7	19.4
C9	4.7	20.8
C10	5.3	21.1
C11	6.2	20.7

B3 to B14 (Measurement date: Apr. 10, 2015)
 C2 to C6 (Measurement date: Apr. 15, 2015)
 C9 to C11 (Measurement date: Apr. 16, 2015)

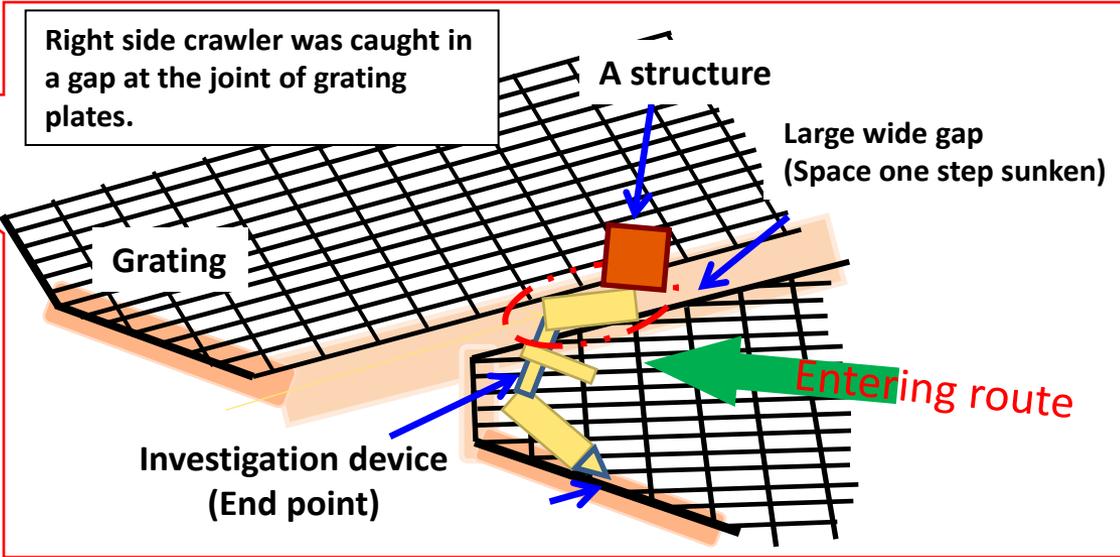
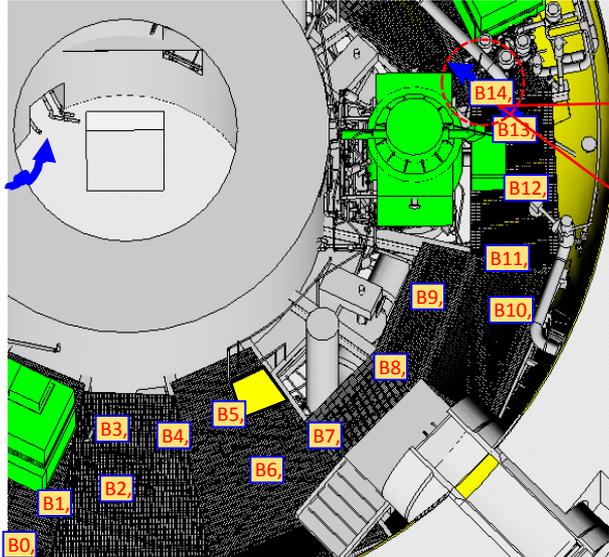
7. Conditions of cable remained

- The route of the cable remained is shown as below.
- It was confirmed that the cable remained around the opening to access the basement will not interfere with B2 investigation.



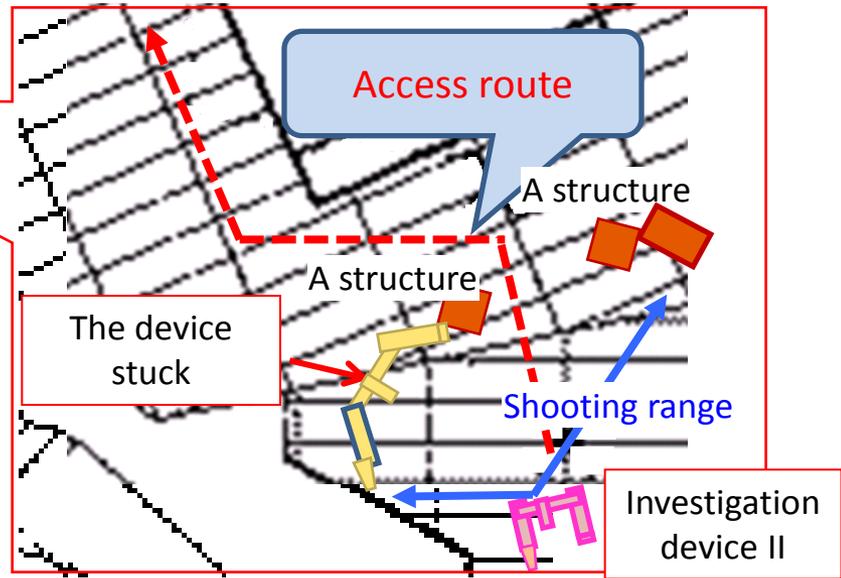
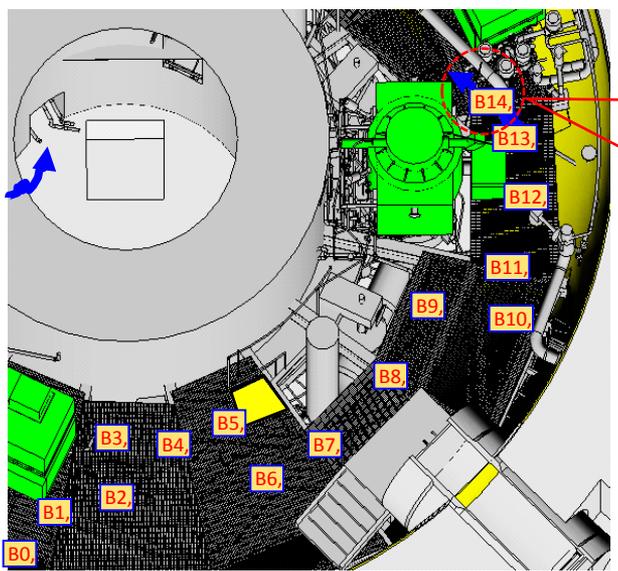
8. Status of the investigation device stuck

■ The status of the investigation device stuck was checked.



9. Check on the access route up to CRD rail

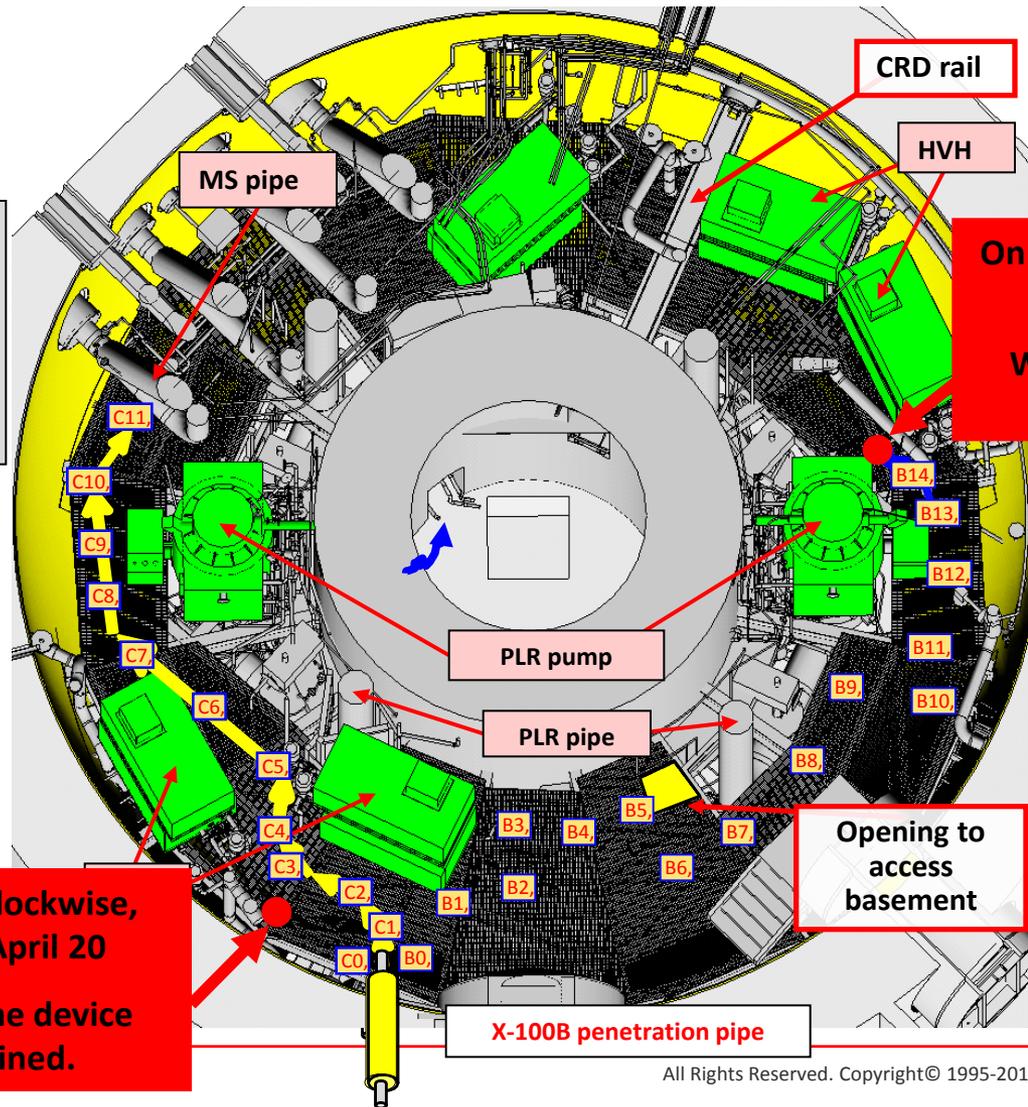
■ It was **concluded** that the access route up to CRD rail is **too narrow** to get the device pass through.



10. Investigation device remained

- Where the device remained is as shown in the figure below.
- The investigation device remained will not interfere with B2 investigation planned to be conducted.

 : Access route investigated (Counterclockwise route)
 : Access route investigated (Clockwise route)



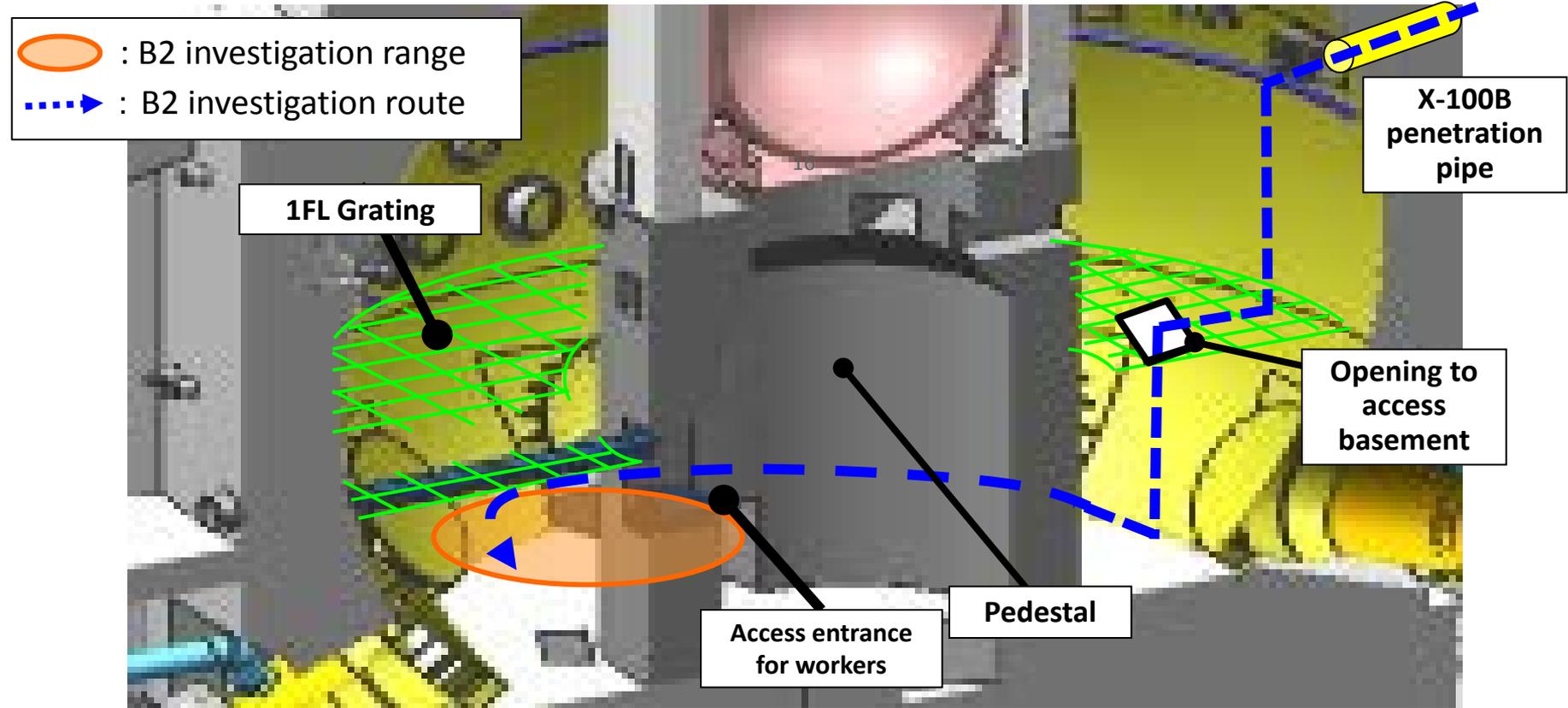
**On counterclockwise,
 dated Apr. 13.
 Where the device
 remained.**

**Counterclockwise,
 dated April 20
 Where the device
 remained.**

**Opening to
 access
 basement**

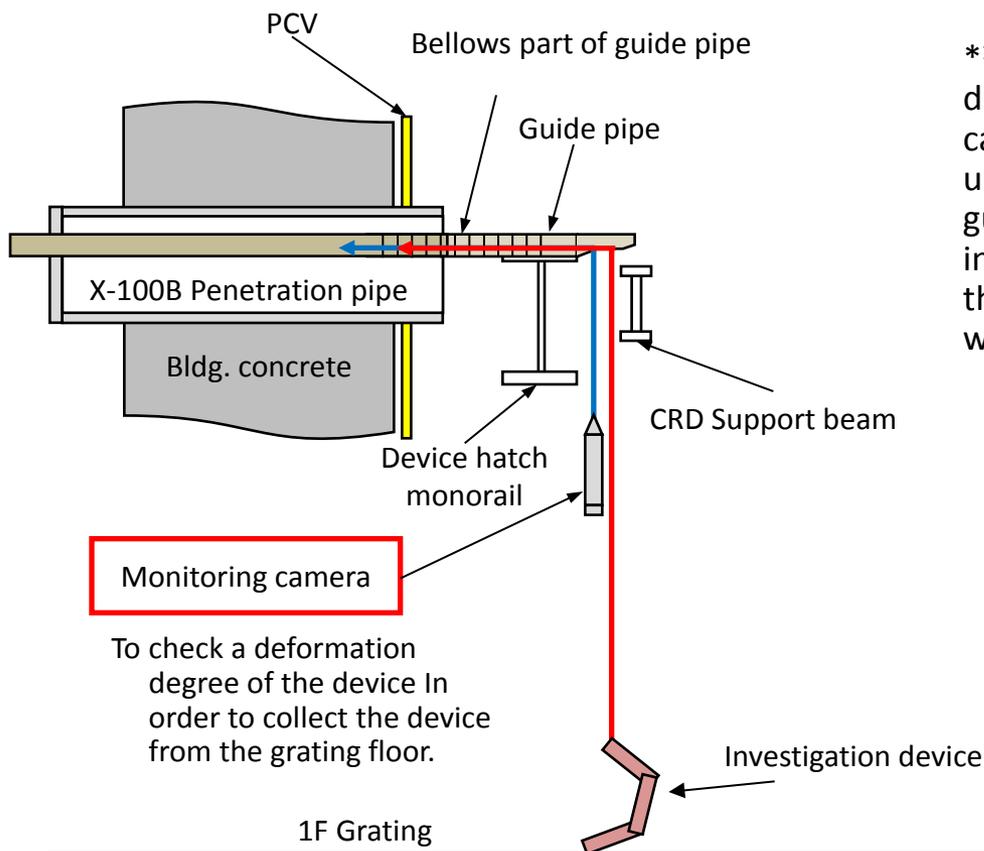
11. Summary

- The data on the grating around the pedestal inside Unit 1 PCV was obtained.
- Results of this investigation will be reflected on the study of construction methods for B2 investigation to be conducted (pedestal at basement).



(Reference) Second investigation device remained

■ Due to the deterioration of the monitoring camera with radiation (assumption), the camera's visibility was extremely dropped to the point disable to perform a deformation check on the device at the time of retrieving it from the vessel. Accordingly, the collection of the device to outside the reactor primary containment vessel was judged as risky. (*1)



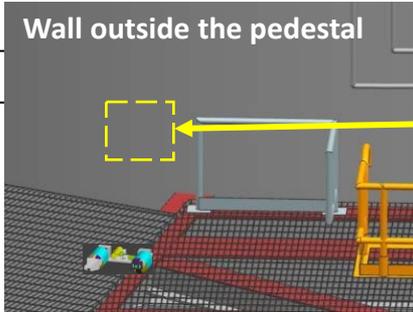
*1 Judging from the facts that the deterioration of the monitoring camera and that there was a slight unevenness at the bellow part of guide pipe for inserting the investigation device, there is a risk that the device might get caught when passing though the bellows.

(Reference) Image topics (Equipment hatch and wall outside the pedestal)

Taken from B3

Exterior status of the wall outside the pedestal

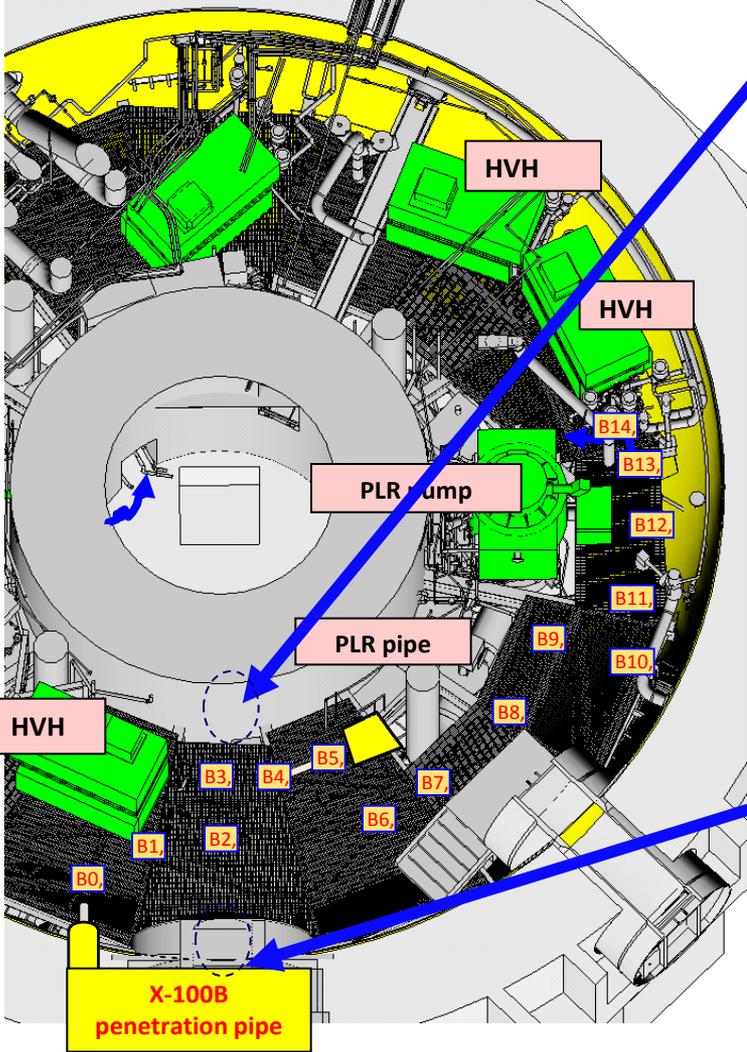
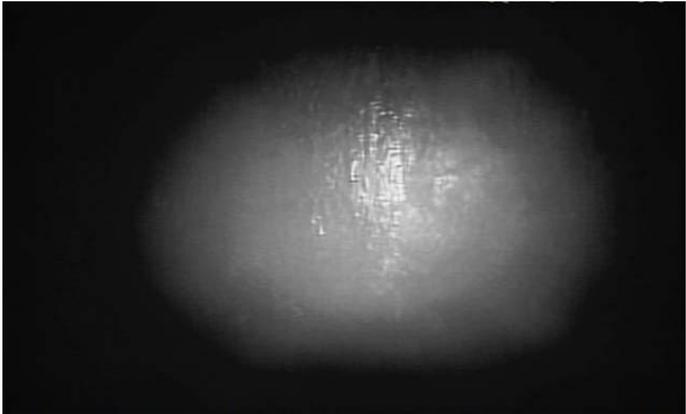
No significant damages were found on the wall outside the pedestal .



Taken from B2

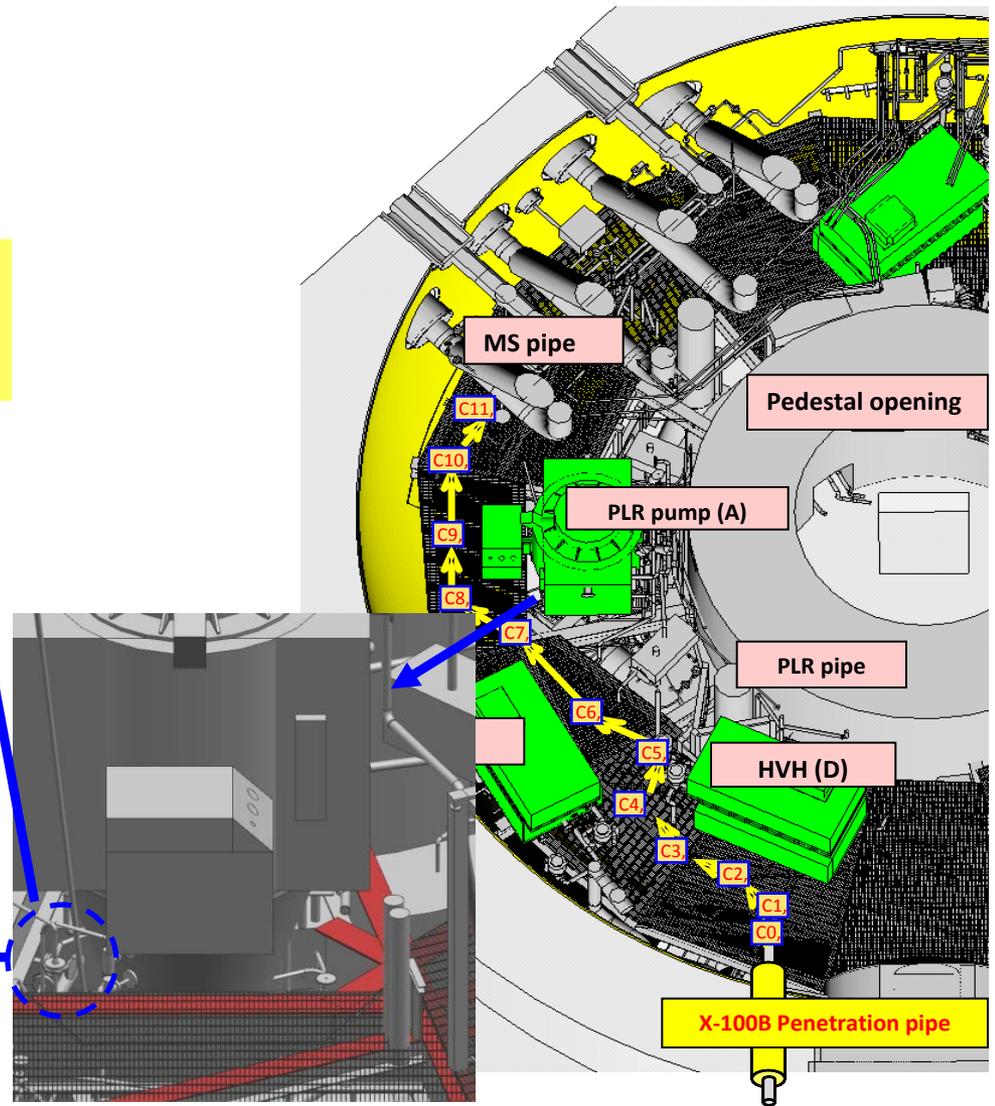
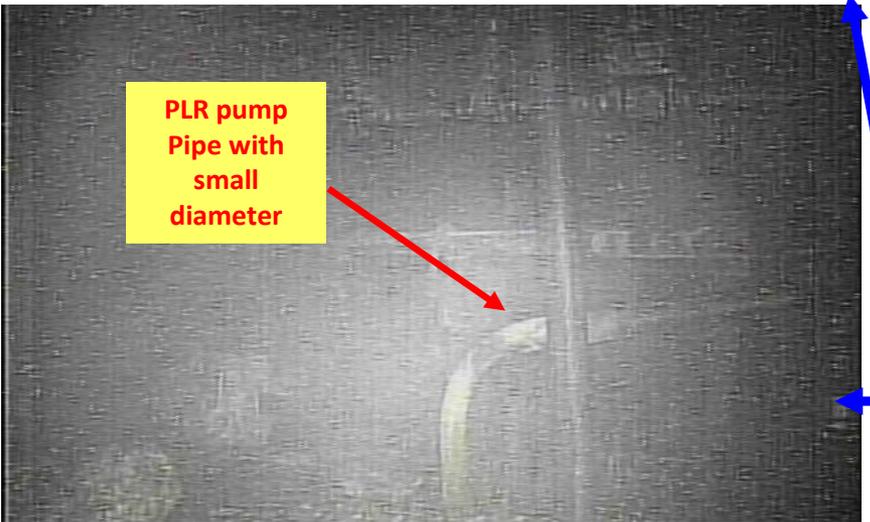
Exterior status of equipment hatch

No significant damages were found on equipment hatch.

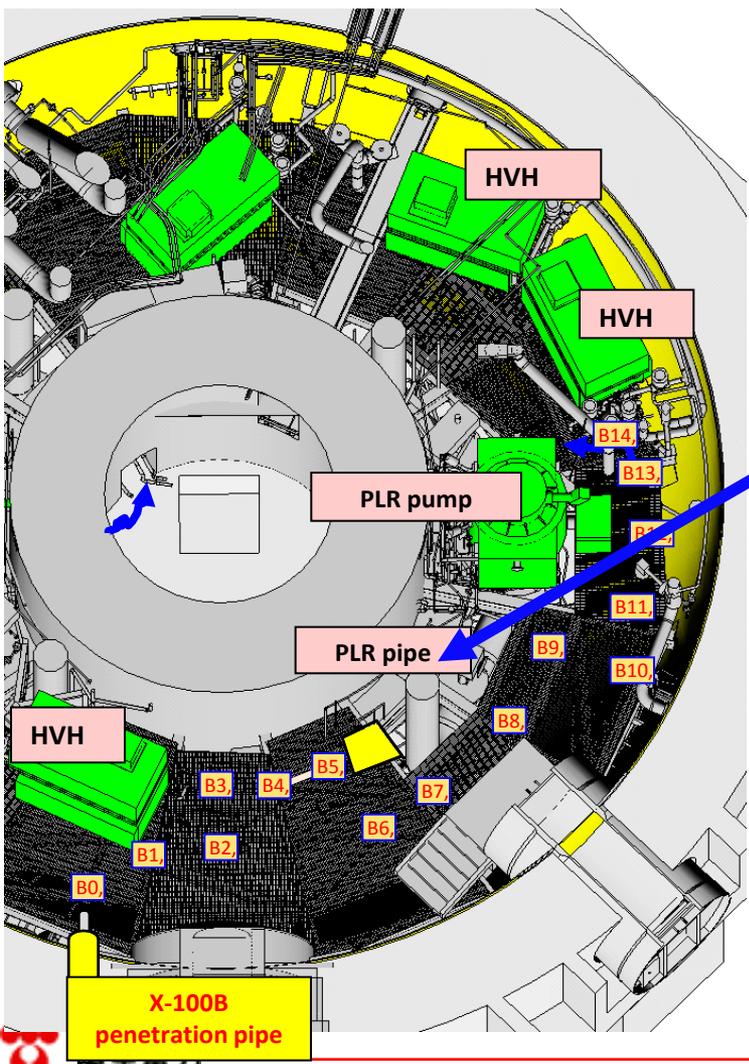


(Reference) Image topics (PLR pump (A))

Taken from C10

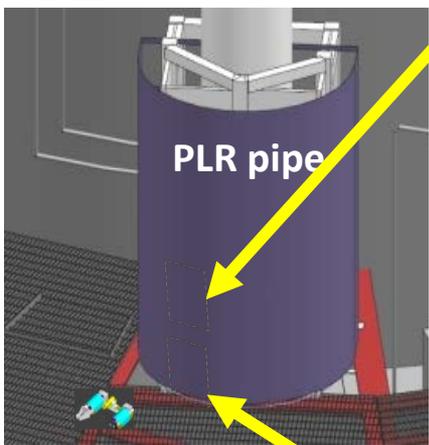


(Reference) Image topics (PLR pipe)



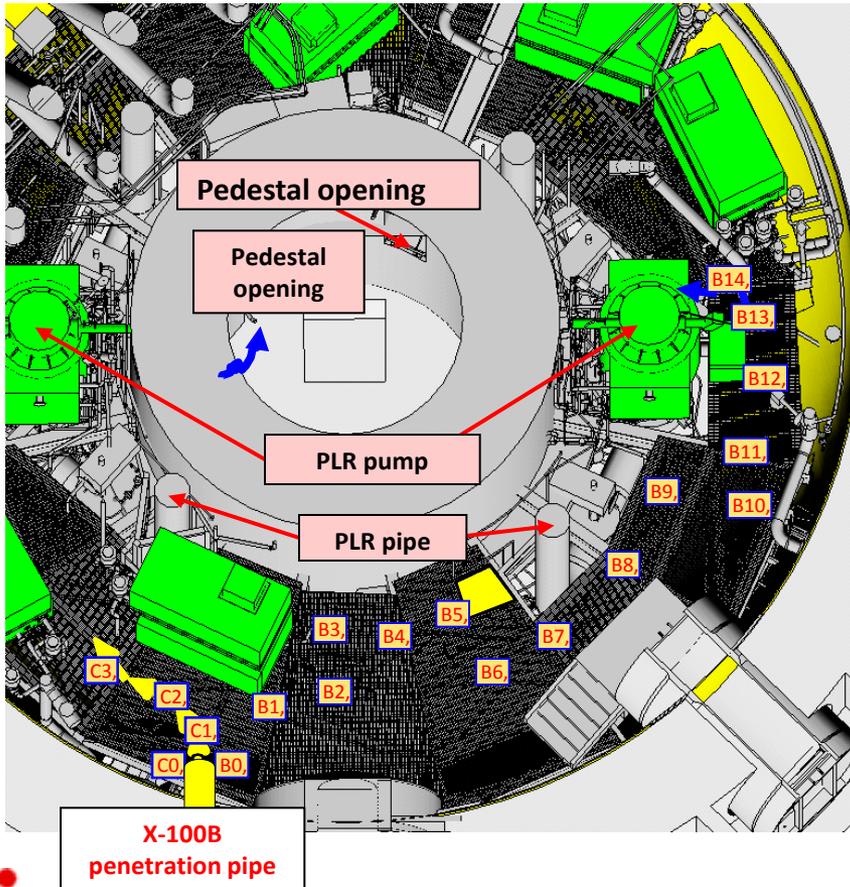
Taken from B7

- No significant damages were found on PLR pipe (heat insulation)
- Pieces of the shield of the pipe was found to be fallen off.



(Reference) Measurement of temperature and radiation dose rate

■ Temperature and dose rate were measured at the following points after conducting a review of the investigation on counterclockwise.



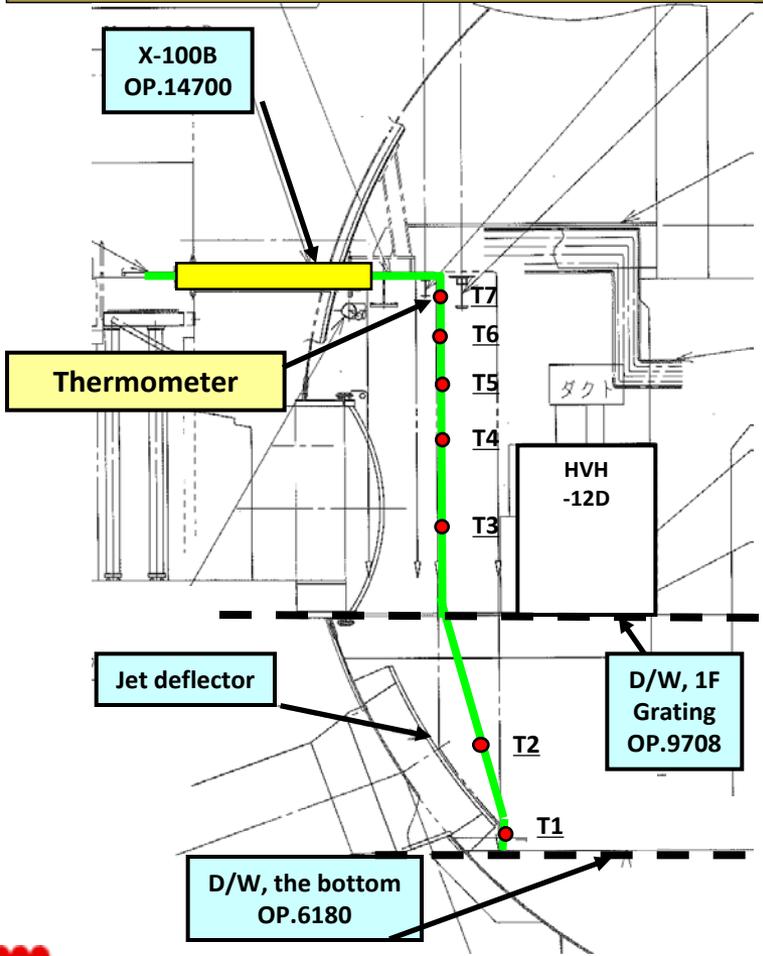
Measurement date: Apr. 19, 2015

	Dose rate (Sv/h)	Temperature (°C)
Around B14	4.4	17.9
Around B11	5.7	18.7
Around B7	5.9	19.1
End point where the device remained. (Around C3)	4.1	20.4

(Reference) Results obtained after the re-installation of measuring instruments inside the PCV for surveillance monitoring. (1)

Overview of the re-installation of measuring instruments inside the PCV for surveillance monitoring

Measuring instruments installed inside Unit 1 PCV for surveillance monitoring were removed in order to conduct B1 investigation. Having completed the investigation, new measuring instruments equivalent to the existing ones are newly installed on the same position where the former ones were set.



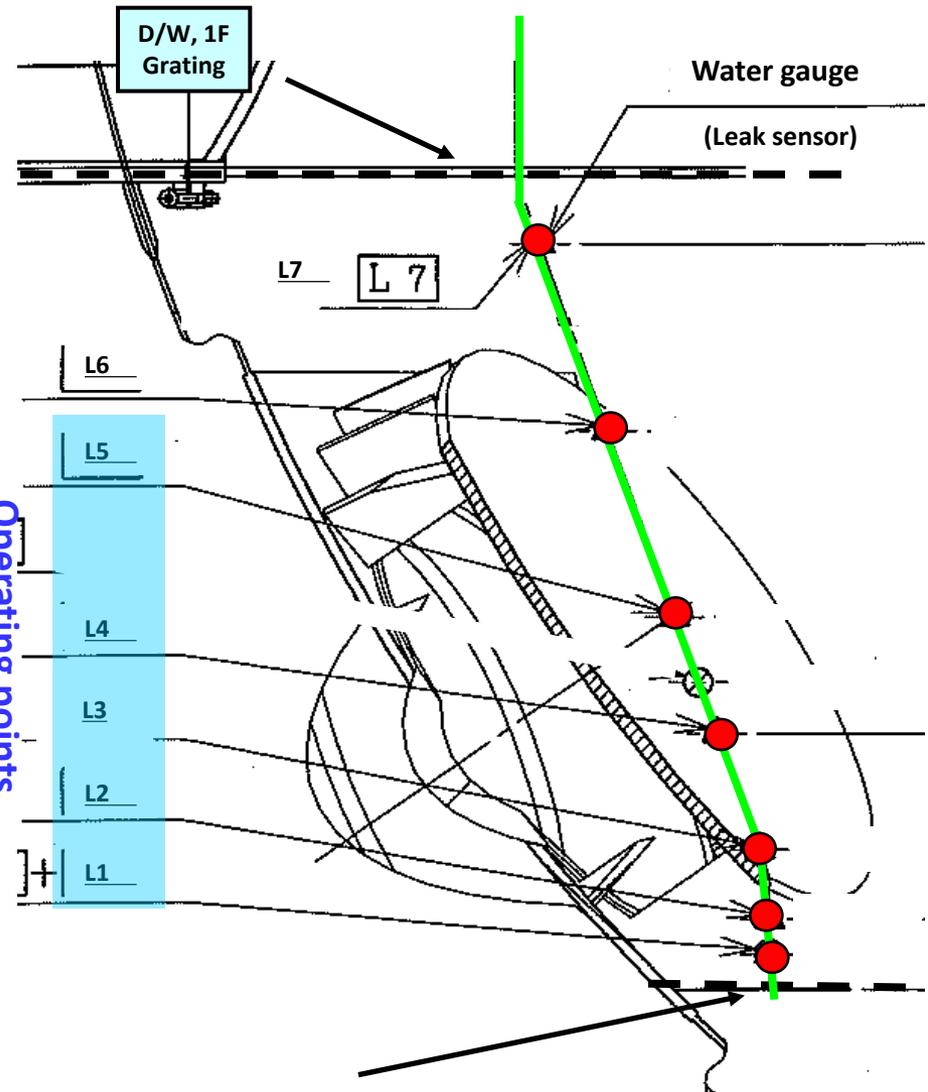
Newly installed thermometers			[Data taken as of 12:00, 4/23]
No	Installation level (Under evaluation)	Indication value (°C)	DC resistance (Ω) (Measuring value/ Design value(±56))
T7	OP.14500	18.1	1830 / 1842
T6	OP.14000	18.1	1845 / 1858
T5	OP.13230	18.0	1875 / 1889
T4	OP.12500	17.8	1903 / 1917
T3	OP.11200	17.8	1950 / 1965
T2	OP.7500	18.9	2091 / 2102
T1	OP.6330	18.9	2135 / 2146

Existing thermometers		[Data taken on as of 12:00, 4/23]
OP.14000	TE-1625J	24.9°C
OP.11200	TE-1625D	17.4°C

[Reference]
 Temperature measured at the B1 investigation (at the height of grating):
 Around 17 to 20 °C

(Reference) Results obtained after the re-installation of measuring instruments inside the PCV for surveillance monitoring. (2)

■ Check on the operating point of water gauge inside the PCV



■ Water gauge operating status

- In operation : L1~L5
- Non-operating : L6~L7

⇒ Both PCV water levels and water gauge installation levels are currently under evaluation.

(Reference) Summary of installation results/ Future handling of thermometers

■ Installation results

(1) Temperature inside PCV

Regarding the thermocouple reinstalled inside the PCV, with the fact that both DC and insulation resistance values after inserting are found to have no problem, plus the fact that value indicated before and after the replacement shows almost no difference in figure, it was verified that the reinstallation has been made without fail.

(2) Water levels inside the PCV

PCV water levels and the positioning for installing water level indicators are currently under evaluation.

■ Future handling of thermometers

Regarding the thermometer having installed, for the next one month or around, it will be checked whether the device is working in accordance with the status of water injection into reactor and the condition of outdoor temperature fluctuation, etc. And when the device was judged as acceptable for monitoring the cooling status, it will be selected as a surveillance thermometer for monitoring the cold shutdown condition specified at Article 18, Chapter III of the implementation plan.