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Workshop on Radiation Exposure Control at the TEPCO Holdings'
Fukushima Daiichi Nuclear Power Plant

Radiation Exposure Dose Survey of the Small Rooms on the First Floor of the Reactor Building for Unit 1 of the Fukushima Daiichi Nuclear Power Plant

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1. Introduction (1/2)

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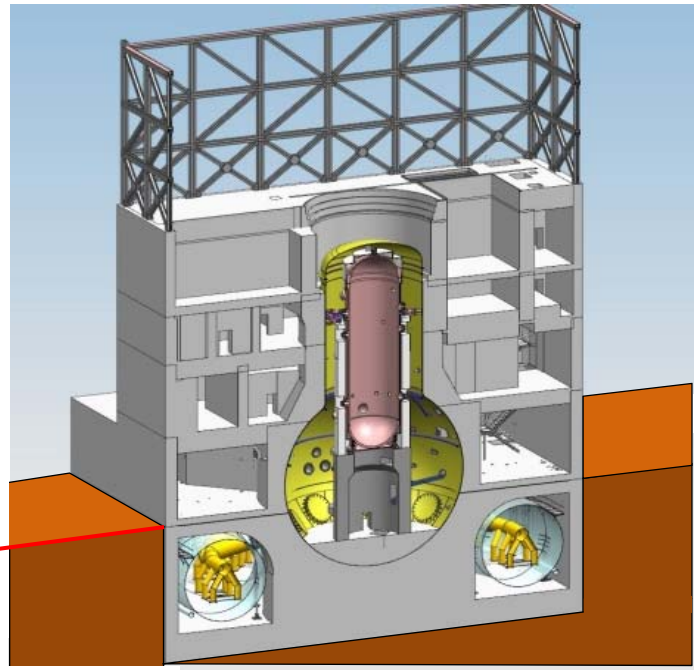
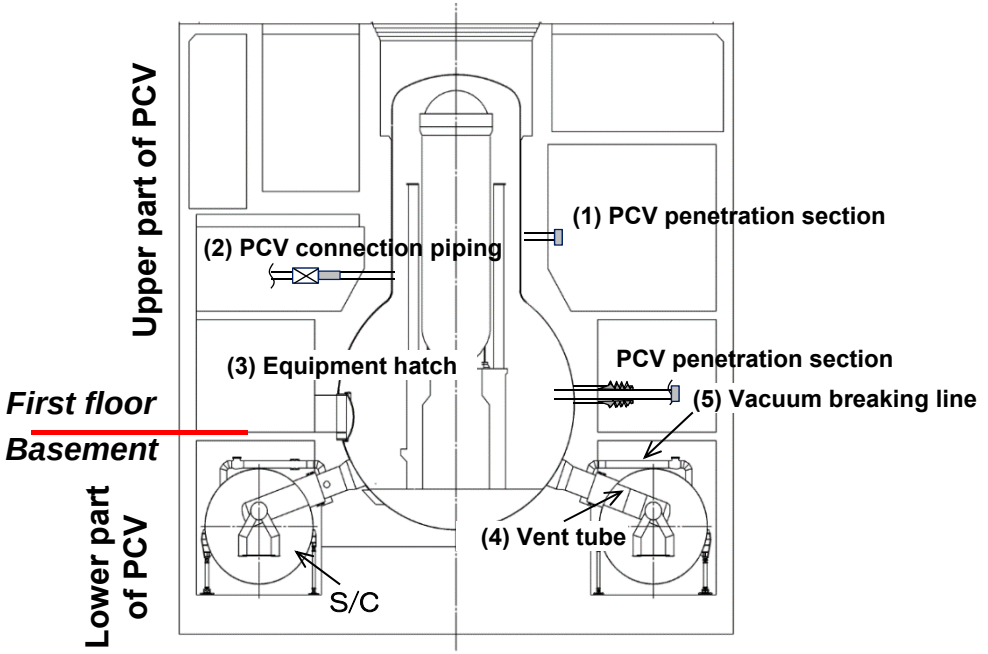
1.1 Primary containment vessel areas to be repaired for fuel debris removal (example)





Flooding of the PCV*1

→ Development of methods to stop PCV water leakage and to repair the PCV

→ Making environments of the target areas suitable and safe for the work to stop PCV water leakage and to repair the PCV

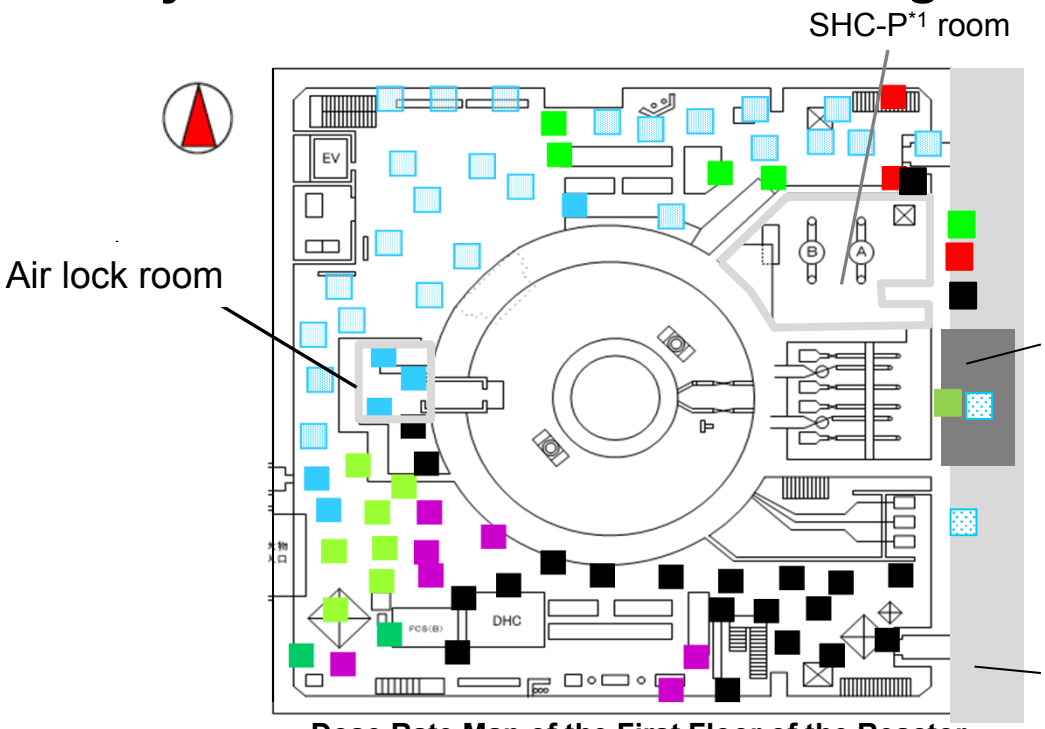
→ **It is necessary to grasp the situations of the work areas and the dose rates in the atmospheres of those areas.**

*1: Primary containment vessel

1. Introduction (2/2)

1.2 Survey status of the reactor building for Unit 1

*1: Reactor Shutdown Cooling System - Pump



Dose Rate Map of the First Floor of the Reactor Building for Unit 1

Legend for dose rate (at a height of 1500 mm above the floor)

- : < 3 mSv/h
- : < 5 mSv/h
- : < 7 mSv/h
- : < 10 mSv/h
- : > 10 mSv/h
- : > 20 mSv/h
- : > 50 mSv/h

Area	Status of survey
North side	Relatively low dose area. Survey by human workers has already been conducted.
South side	High dose area. A remotely-operated robot-based survey has already been conducted.
Small rooms	The HPCI valve room, TIP room, MSIV room and SHC-P room have not been surveyed yet.

* TEPCO: "About the Surveys of the Small Rooms on the First Floor of the Reactor Building for Unit 1 – Survey of the TIP Room," the 23rd Meeting of the Secretariat held in conjunction with the Meeting of the Team for Tackling Decommissioning and Contaminated Water Issues held on 29 October 2015
URL: http://www.tepco.co.jp/decommision/planaction/roadmap/index-j.html
"About the Surveys of the Small Rooms on the First Floor of the Reactor Building for Unit 1 – Results of the Surveys of the Main Steam Valve Room and Air Lock Room," the 25th Meeting of the Secretariat held in conjunction with the Meeting of the Team for Tackling Decommissioning and Contaminated Water Issues held on 24 December 2015
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1. Introduction (2/2)

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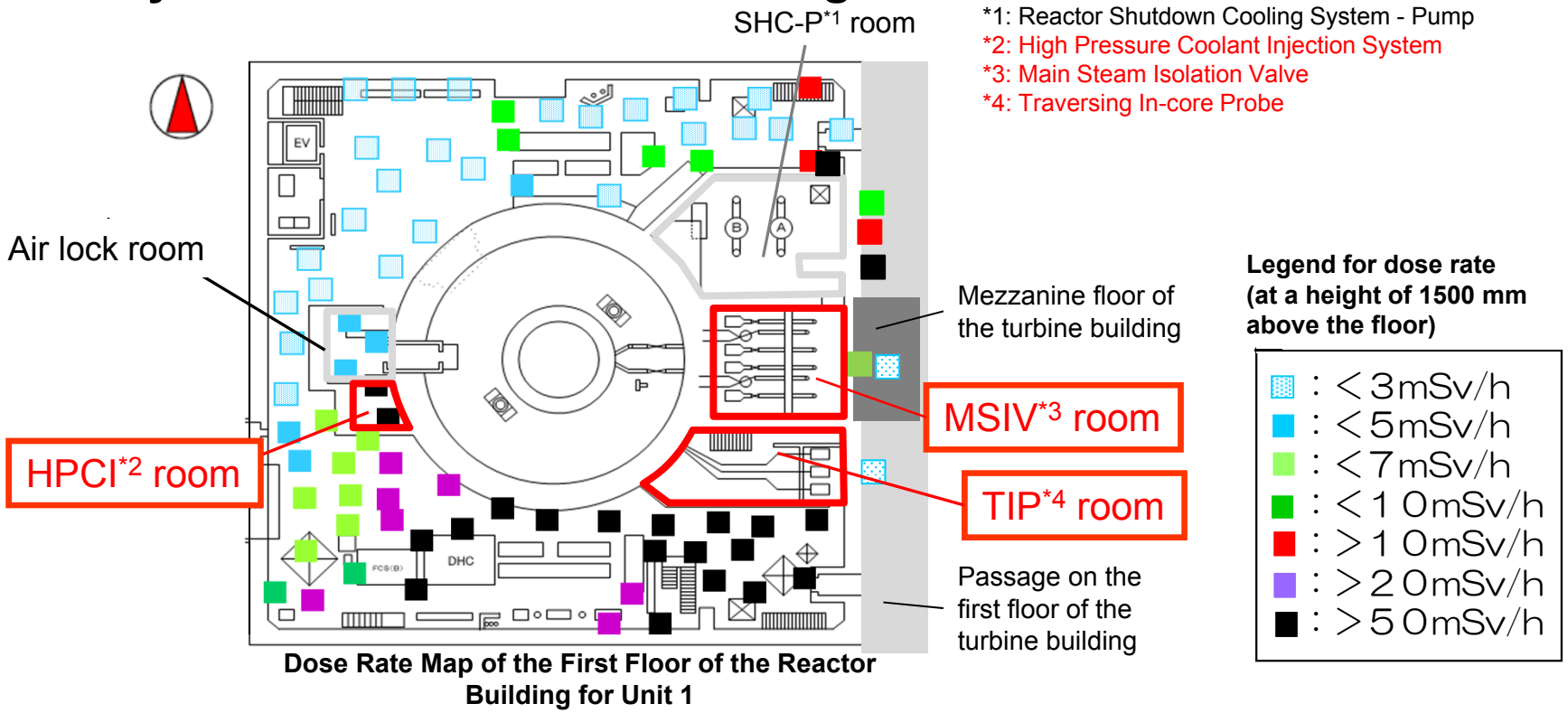
1.2 Survey status of the reactor building for Unit 1



Dose Rate Map of the First Floor of the Reactor Building for Unit 1

Area	Status of survey
North side	Relatively low dose area. Survey by human workers has already been conducted.
South side	High dose area. A remotely-operated robot-based survey has already been conducted.
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2.1 TIP room

(1) Survey plan

Survey period: August 2015 to October 2015

Purpose of survey	Survey target	Survey item
To obtain data for developing the plan to establish a safe and suitable work environment	Entire room	State of the inside of the room (traveling equipment camera) Dose rate (dosimeter) Radiation source location (gamma camera)

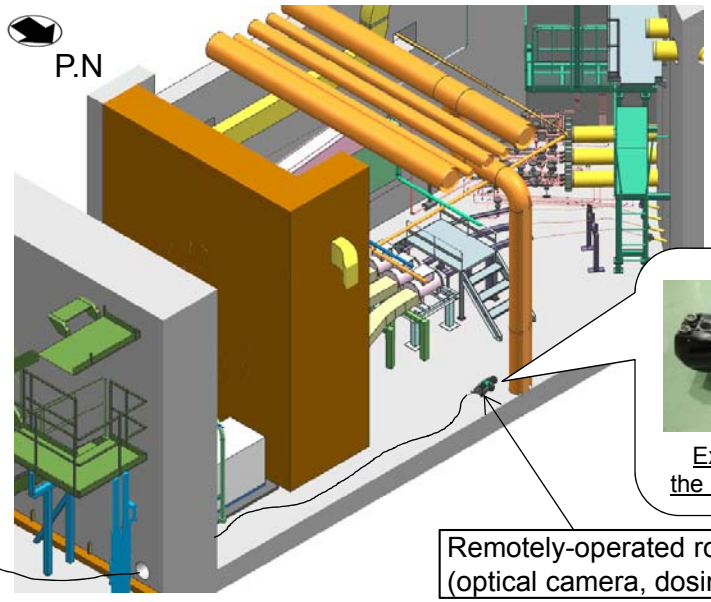
The dose rate in the room atmosphere is unknown.

A hole is drilled in a wall to gain access to the inside of the room.

Small remotely-operated robot-based survey
- **The robot is operated by workers from a low dose area.**
- **The robot is small enough to be able to get into the room through a small hole.**

The robot is remotely operated by workers from a low dose area.

* The surveys of the other small rooms also employ similar methods.



External appearance of the remotely-operated robot

Remotely-operated robot (optical camera, dosimeter)

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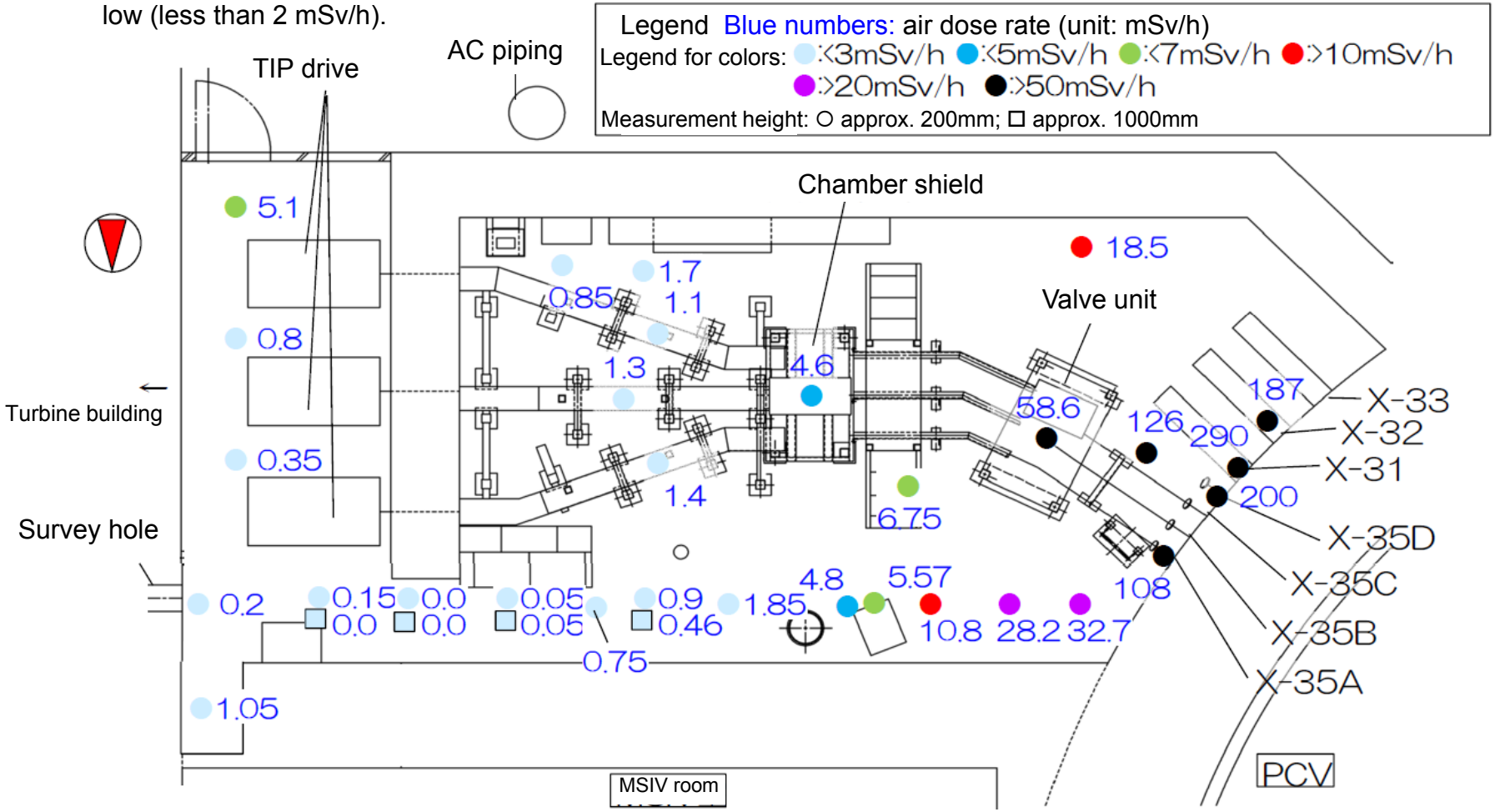
2.1 TIP room

(2) Dose rate measurement result

- The dose rate measurements were high at the instrumentation piping (X-31 to X-33) and in the area around the piping, but the measurements taken in the area located on the turbine building side with respect to the chamber shield were low (less than 2 mSv/h).



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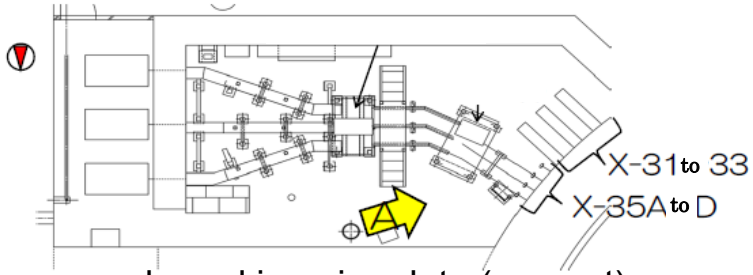
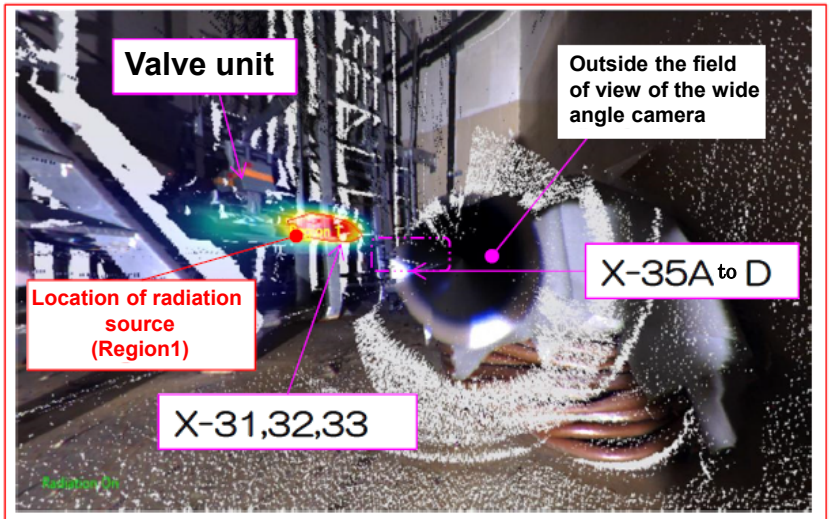
2.1 TIP room

(3) Results of the γ camera-based imaging and the 3D scanning

■ Radiation sources were identified near the instrumentation piping (X-31 to X-33) by observation in the A direction (arrow).

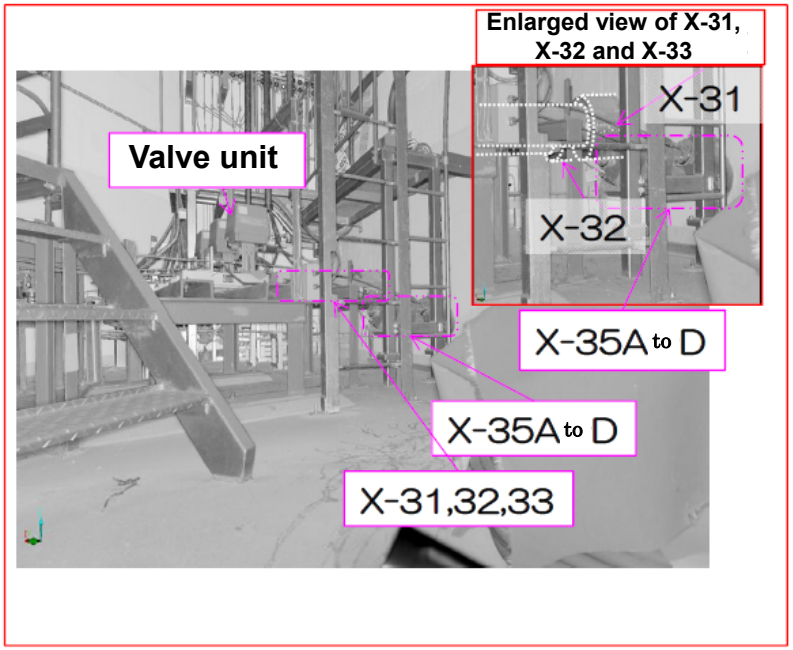


● γ camera-based imaging data (excerpt)



- Dose rate in the atmosphere at the location of the γ camera: approx. 3.8 mSv/h
- Contribution from the location of the radiation source: approx. 0.2 mSv/h (Region 1)
- No significant radiation source was found in the other areas.

● 3D scanning data (excerpt)



● By combining the γ camera data and the 3D scanning data, it was confirmed that X-31 to X-33 were highly likely to be radiation sources.

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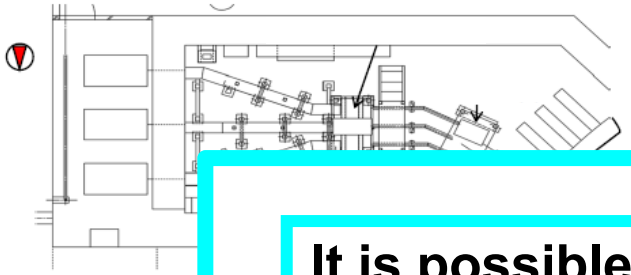

● γ camera-bas

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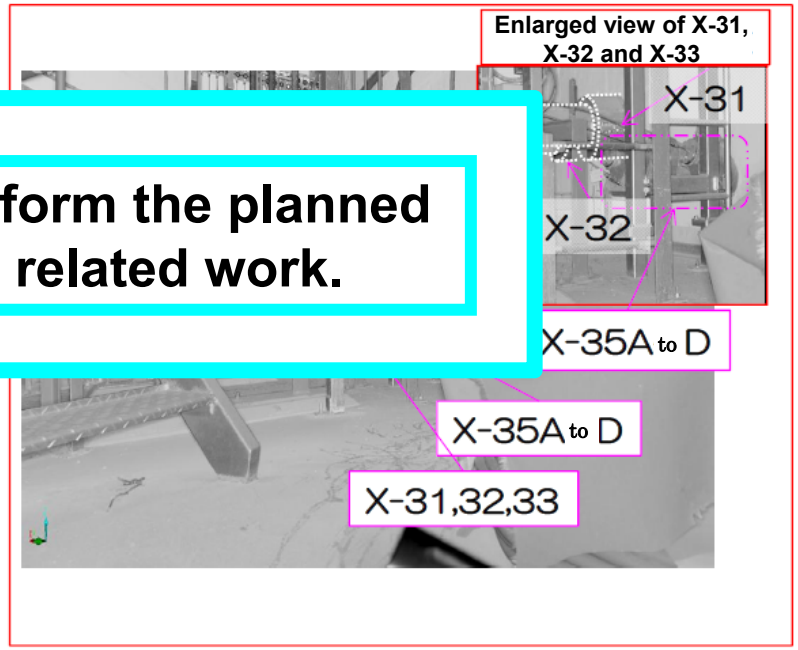
● 3D scanning data (excerpt)



● By combining the γ camera data and the 3D scanning data, it was confirmed that X-31 to X-33 were highly likely to be radiation sources.

It is possible to perform the planned PCV repair and related work.

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2.2 HPCI valve room

Survey period: December 2015

(1) Survey plan

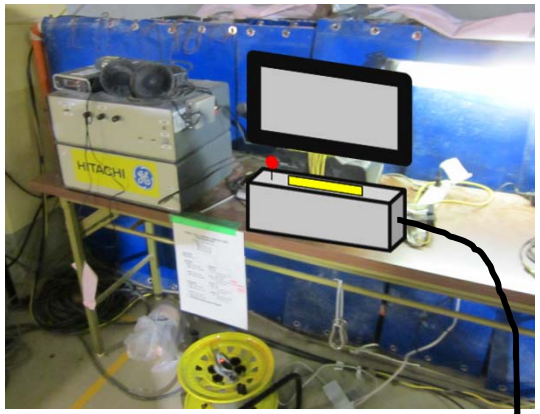
Purpose of survey	Survey target	Survey item
To obtain data for developing the plan to establish a safe and suitable work environment	Entire room	State of the inside of the room (robot camera) Dose rate (dosimeter)

The result of the preliminary survey had shown that dose rates in the HPCI valve room were high.

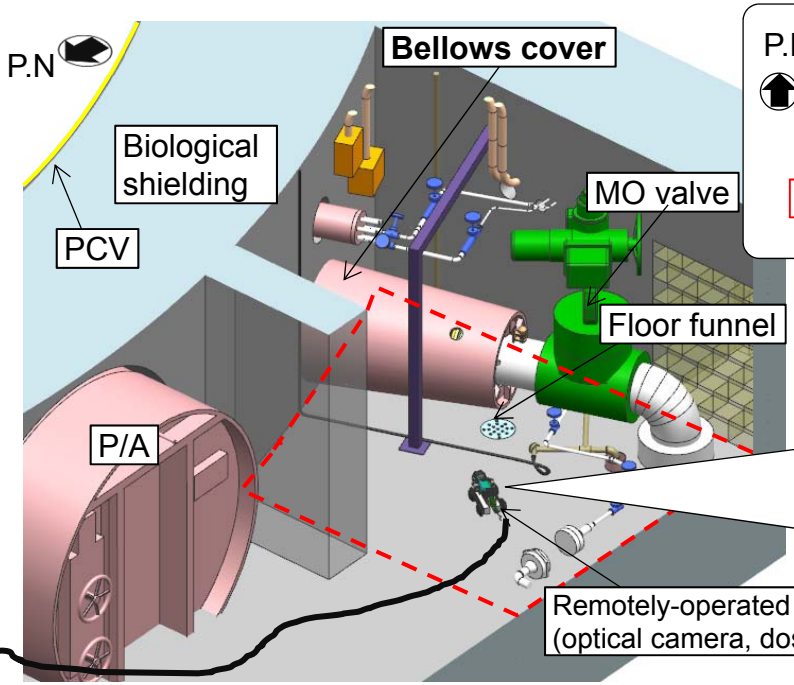
The space inside the room is narrow because of piping and other equipment.

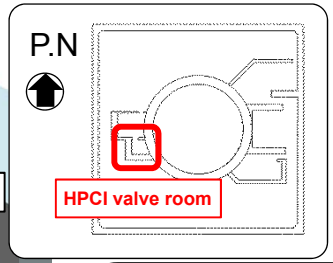
Small remotely-operated robot-based survey

- **Workers can remotely operate the robot from a low dose area.**
- **The robot can run through narrow gaps.**



Workers can remotely operate the robot from a low dose area





External appearance of the remotely-operated robot

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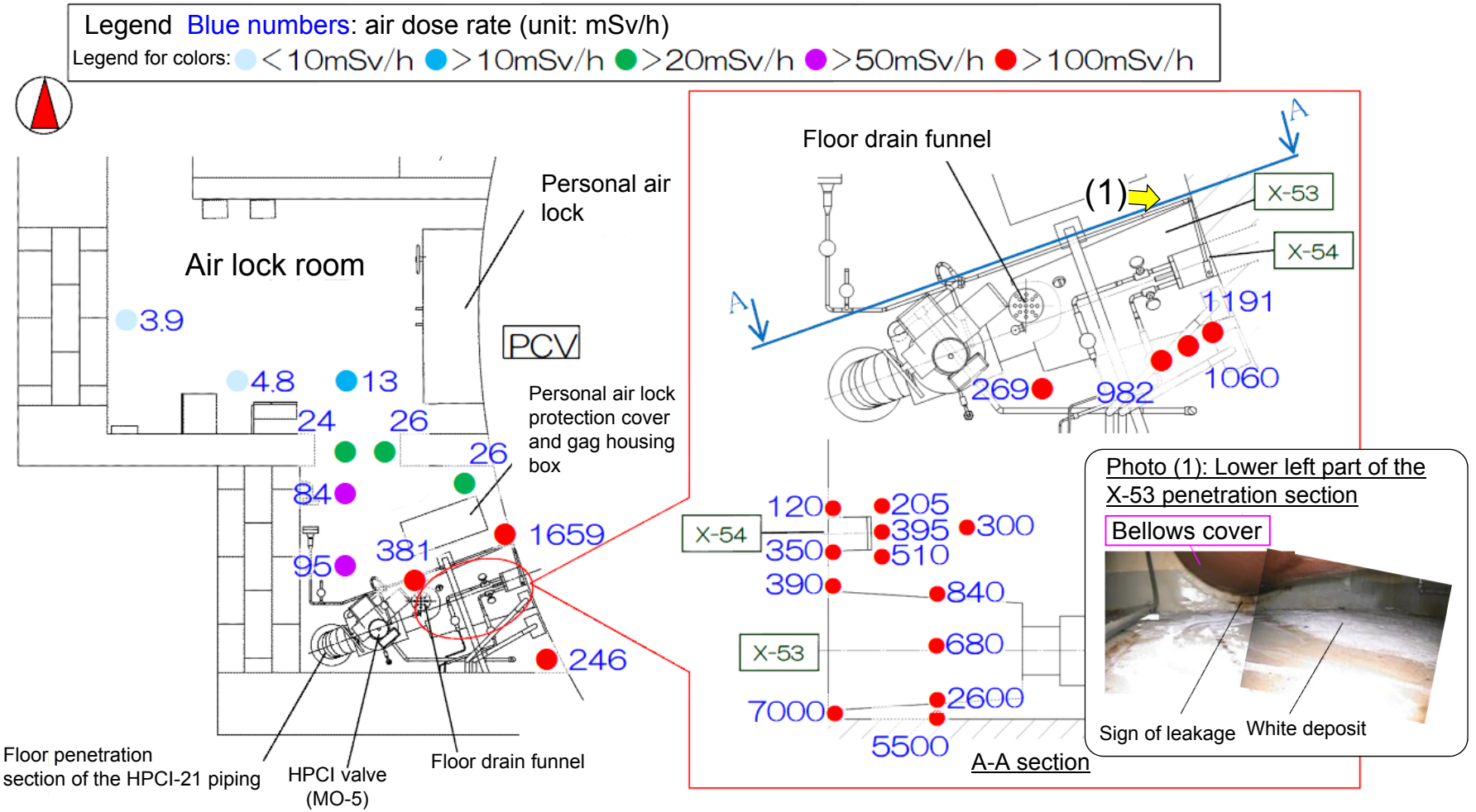
2.2 HPCI valve room

(2) Dose rate measurement result

- Dose rate measurements were very high (7000 mSv/h) near the root of X-53 (floor surface).



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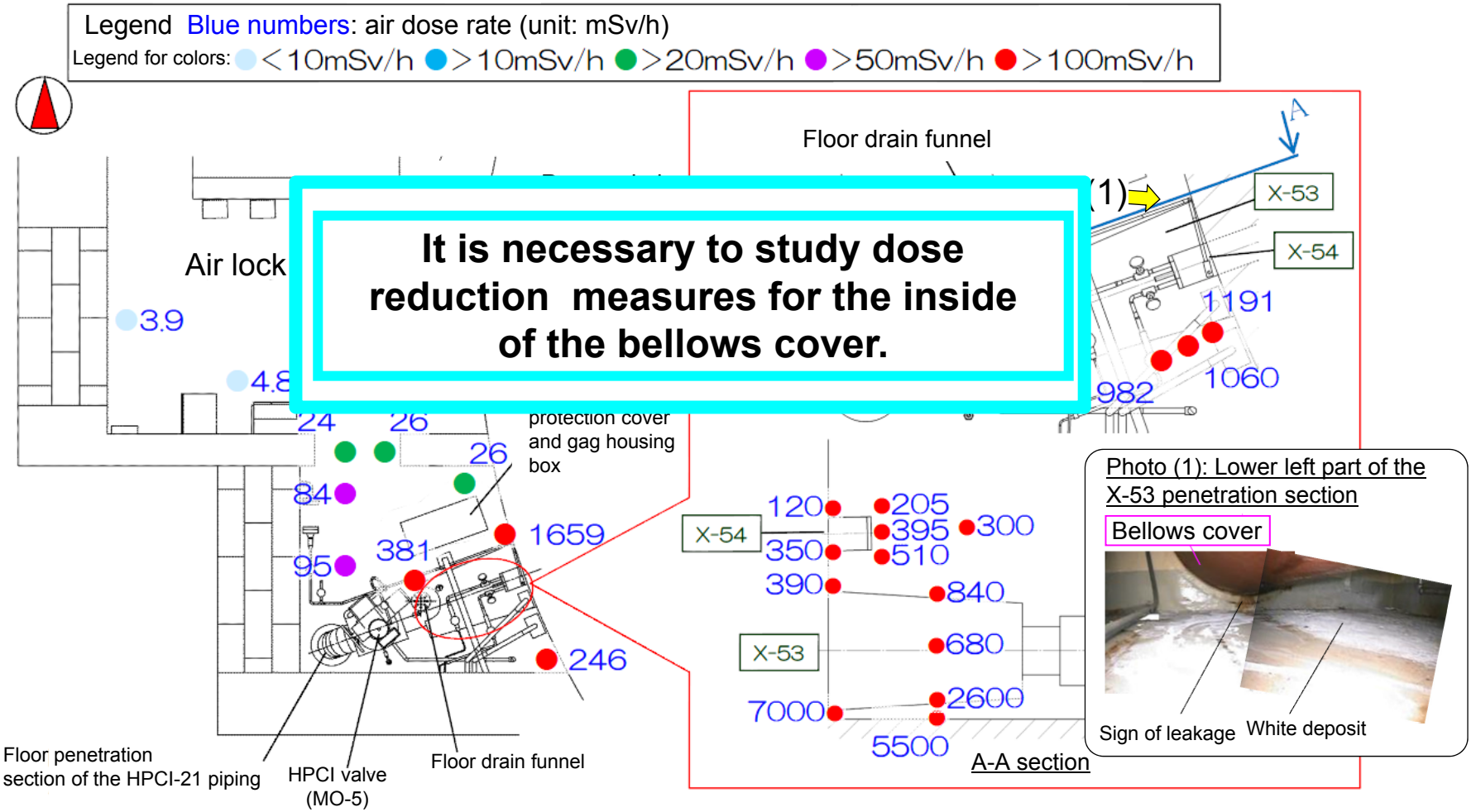

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2.3 MSIV room

Survey period: November 2015

(1) Survey plan

Purpose of survey	Survey target	Survey item
To obtain information on the east side area of the room (up to the common anchor)	Upper surface of the common anchor in the east side area	State of the inside of the room (camera) Dose rate (dosimeter) As-built data (3D laser scanner)

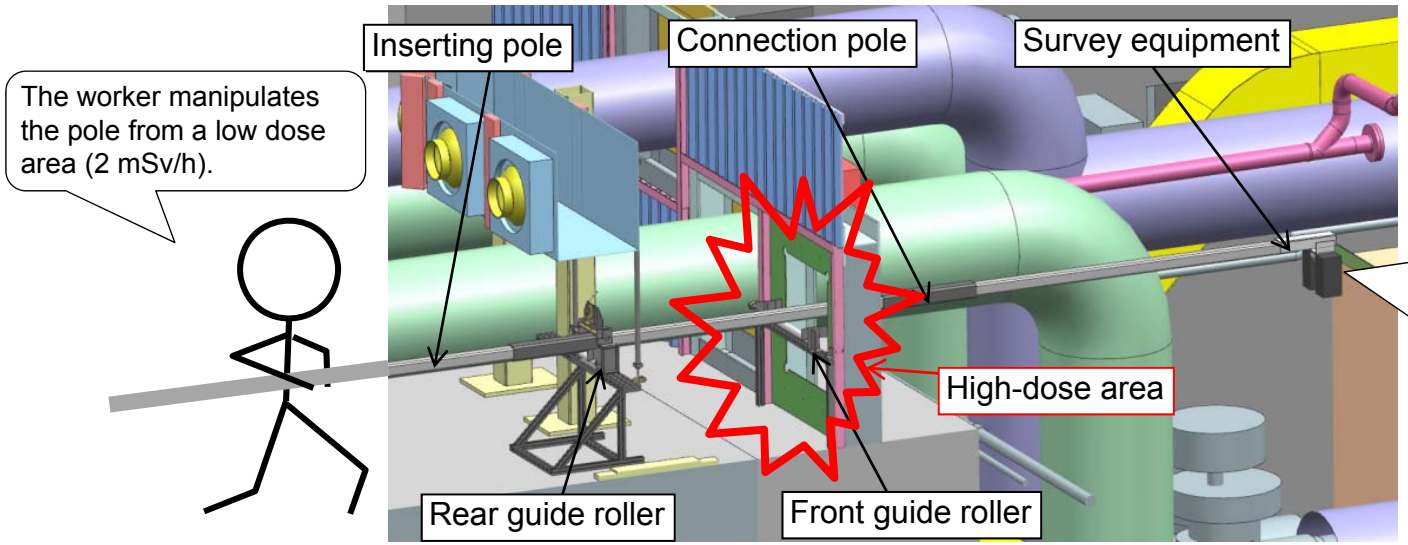
The dose rate in the room atmosphere is unknown.

Dose rates at and around the entrance to the room are high.

The entrance to the room is located at a height of approx. 4 m above the floor of the room.

The room is surveyed by inserting a long pole into the room.

- **Exposure of the worker is reduced by securing a long distance between the end of the long pole and the high dose entrance.**



External appearance of the 3D laser scanner

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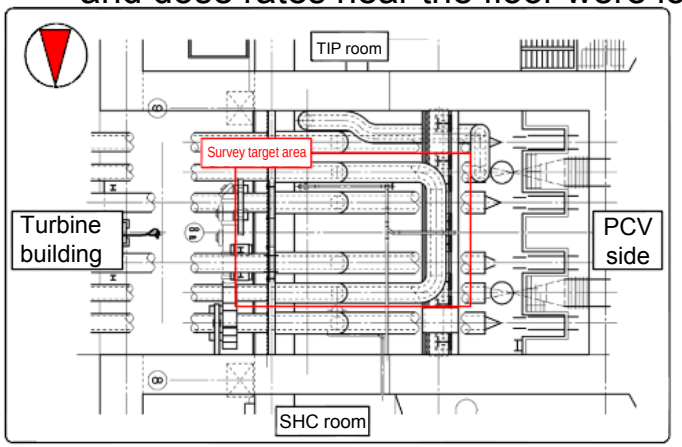
2.3 MSIV room

(2) Dose rate measurement result

■ Dose rates around the HVH* top plate and the duct were high, while dose rates above the HVH trestle and dose rates near the floor were low.



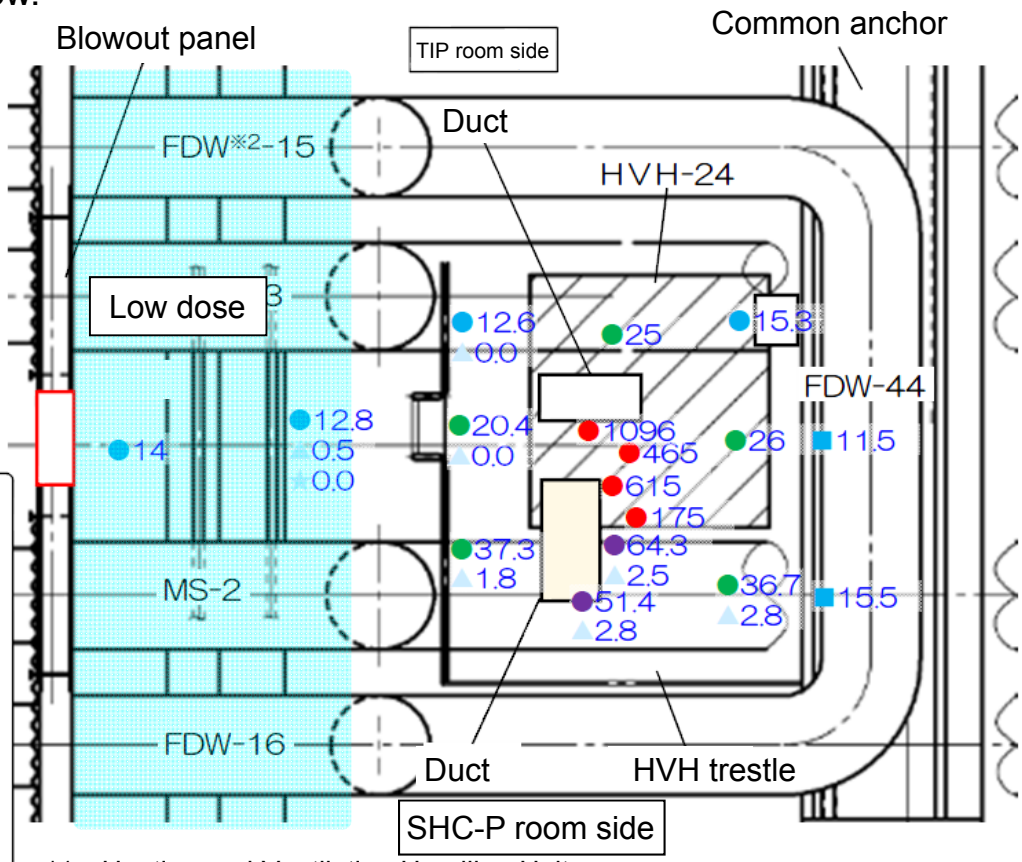
Legend Blue numbers: air dose rate (unit: mSv/h)

Measurement height:

- ○ Approx. 4200 mm (top surface of HVH)
- □ Approx. 3400 mm (top surface of the common anchor)
- △ Approx. 2000 mm (above the HVH trestle)
- ☆ Near the floor

Legend for colors:

- ●＜10mSv/h
- ●＞10mSv/h
- ●＞20mSv/h
- ●＞50mSv/h
- ●＞100mSv/h



*1：Heating and Ventilation Handling Unit
*2：Feed Water System
*3：Main Steam

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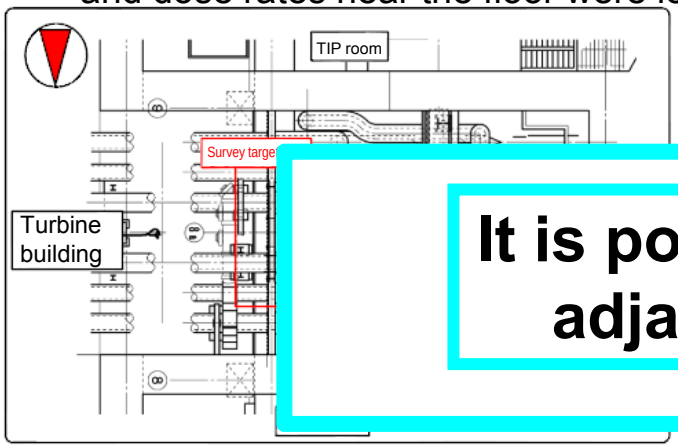
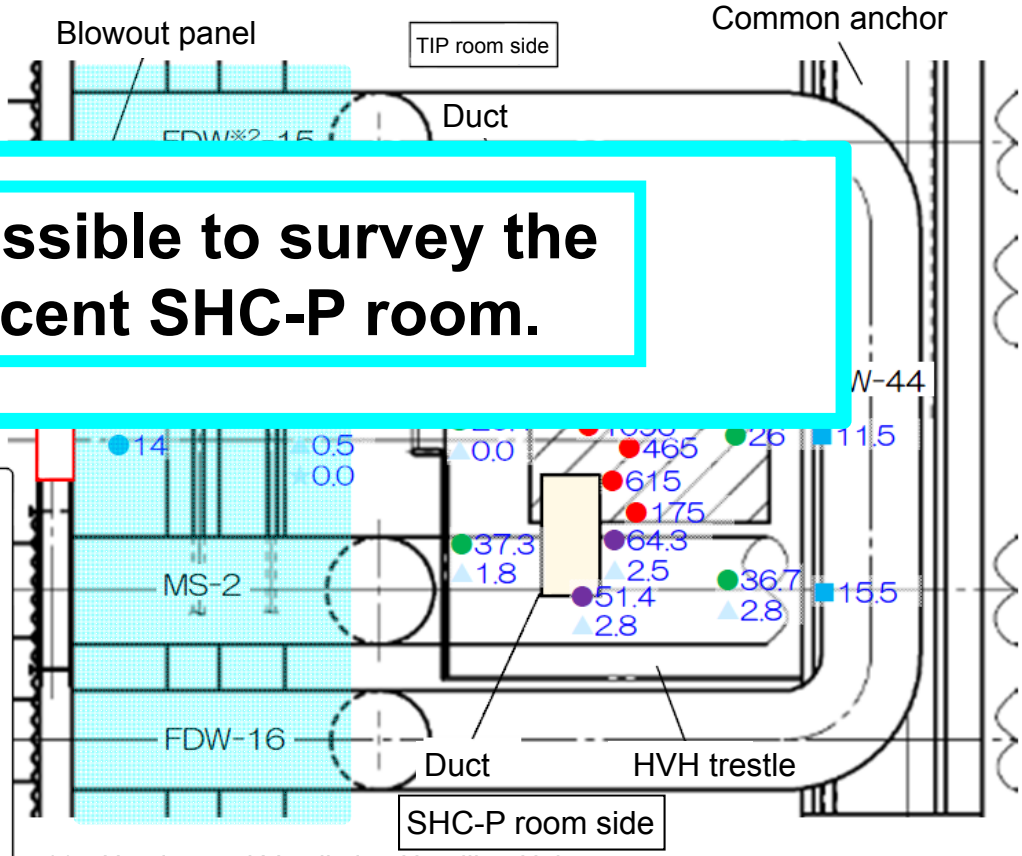


It is possible to survey the adjacent SHC-P room.



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- △ Approx. 2000 mm (above the HVH trestle)
- ☆ Near the floor

Legend for colors:

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- ＞10mSv/h
- ＞20mSv/h
- ＞50mSv/h
- ＞100mSv/h

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3. Conclusion

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- To perform the various jobs that are planned in the future in the reactor building, it is essential to take measures to reduce the exposure of workers. To achieve this, it is important to obtain environmental information about the work areas.
- The surveys were successfully completed without having workers approach high dose areas.
- Survey of the TIP room

  Dose rates in the east side area of the room were relatively low, which indicated the possibility to perform the planned PCV repair and other tasks.
- Survey of the HPCI valve room

  Dose rates at the root of the HPCI piping and in the area around the root were high (7000 mSv/h), which indicated that it is necessary to start studying dose reduction methods for the root and the area around it.
- Survey of the MSIV room

  Dose rates in the east passage in the room were relatively low, which indicated the possibility to survey the adjacent SHC-P room.

The Hitachi Group will continue tackling decommissioning work at the Fukushima Daiichi Nuclear Power Plant giving the highest priority to safety.