Results of an In-House Investigation Performed in the Vicinity of the Unit 1 X-25 Penetration to Confirm Accessibility

November 28, 2024

TEPCO

Tokyo Electric Power Company Holdings, Inc.

Overview

■ Background:

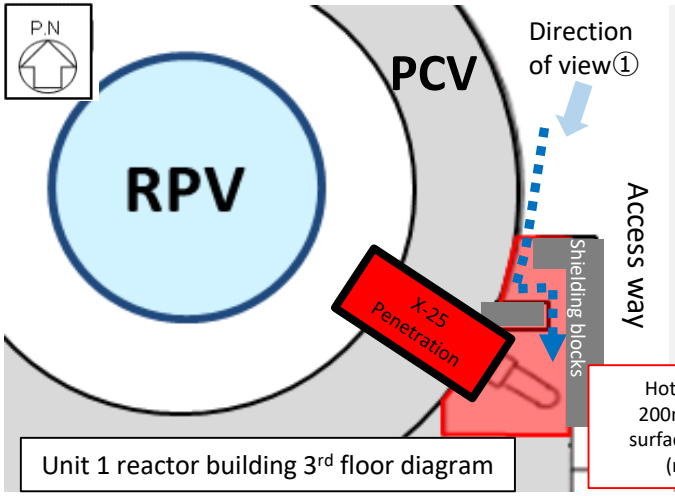
- During an internal investigation of the Unit 1 reactor building conducted in FY2021, dose levels of approximately 200mSv/h were measured near the floor in the vicinity of the X-25 penetration on the east side of the third floor (outside the shielding blocks) (reported during the Secretariat meeting of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment)
- Inside the shielding blocks there are valves and D/W vent pipes connected to the AC system pipes through which S/C vent gases flowed during the accident (vent gases did not flow through the valves).
- Since hotspots (locations of high doses) were found near the floor, it is assumed that radioactive substances leaked from the penetration or the valves, fell to the floor, and adhered to it.

■ Investigation summary:

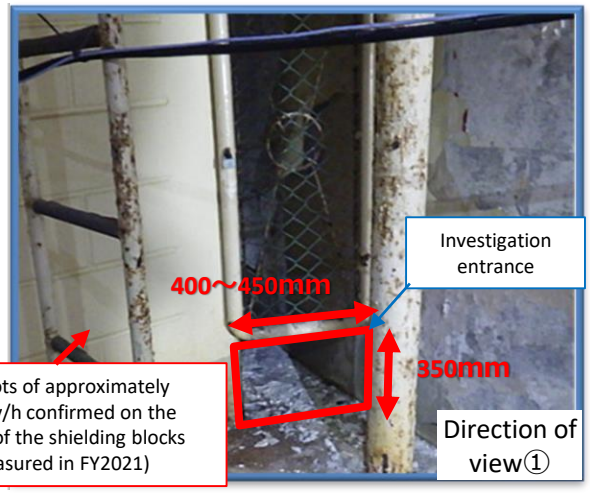
- An investigation of the area inside the shielding blocks was planned in order to obtain detailed information about conditions at the hotspot.
- Since the aforementioned area is a confined space and exhibiting high dose levels, a combination of crawler robots and drones were planned to be used to perform an in-house investigation via remote operation.
- On November 19, 2024, a crawler robot was used to confirm accessibility inside the shielding blocks and measure air dose rates.

■ Leveraging the data obtained from the investigation:

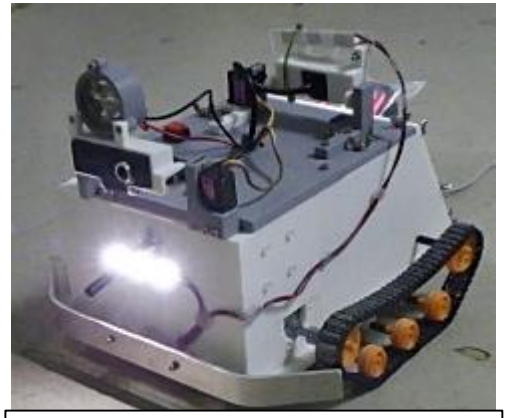
- The data obtained will be used to determine the pathway of the radioactive substances during the accident, if any, and hypothesize what conditions were like inside the PCV during the accident, etc.
- The data will also be used to create an environment in which Unit 1 decommissioning can continue systematically.



Unit 1 reactor building 3rd floor diagram



Hotspots of approximately 200mSv/h confirmed on the surface of the shielding blocks (measured in FY2021)

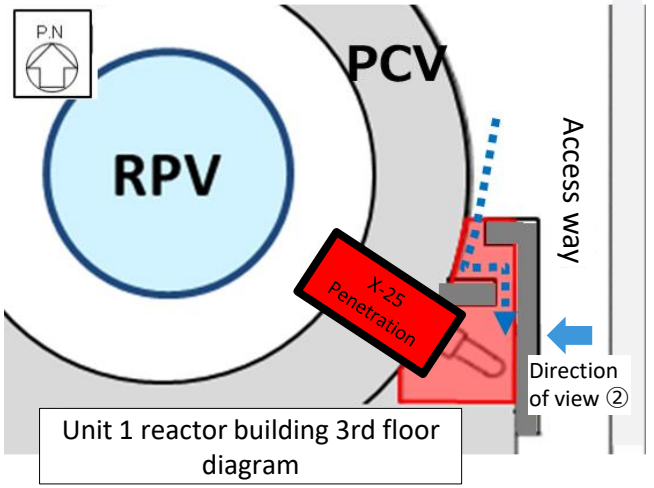

Crawler robot (manufactured/remotely operated in-house)

Overview of accessibility confirmation and drone investigation

- Since the area inside the shielding blocks has not been investigated, targets will be decided step-by-step as the investigation is conducted

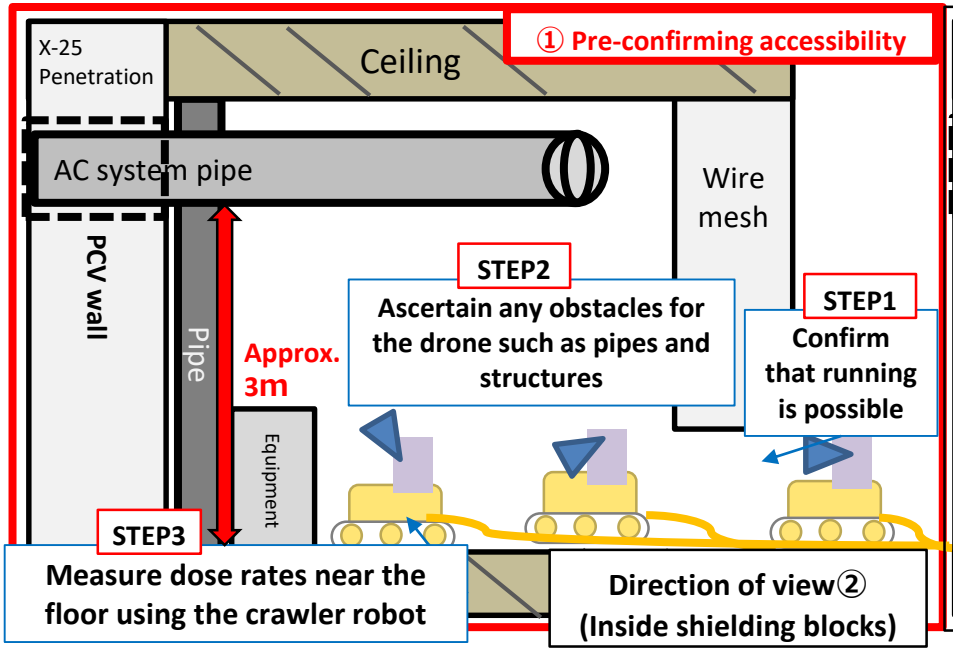
① Pre-confirming accessibility (this investigation)
- Implementation date: November 19, 2024
- Details: Crawler robot used to confirm accessibility inside of the shielding blocks and measure air dose rates
  - ✓ STEP1: Determine whether the crawler robot can move on the floor within the confined space
  - ✓ STEP2: Ascertain any obstacles for the drone such as pipes and structures
  - ✓ STEP3: Measure air dose rates

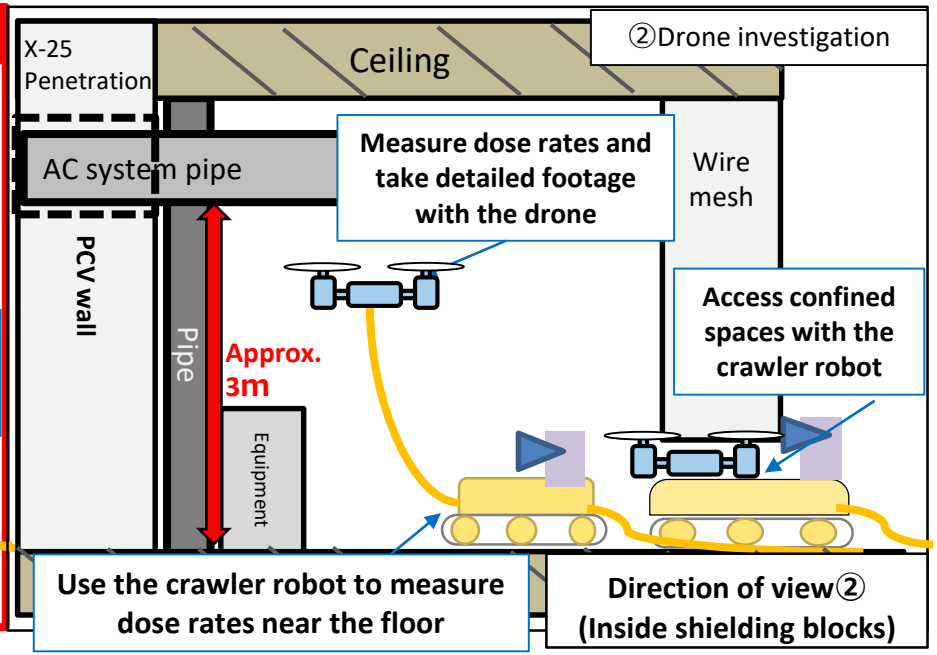
② Drone investigation
- In light of the results from ① we will deliberate conducting an investigation using a combination of the crawler robot and the drone



Unit 1 reactor building 3rd floor diagram

AC system: Inert gas system





Results of accessibility confirmation①

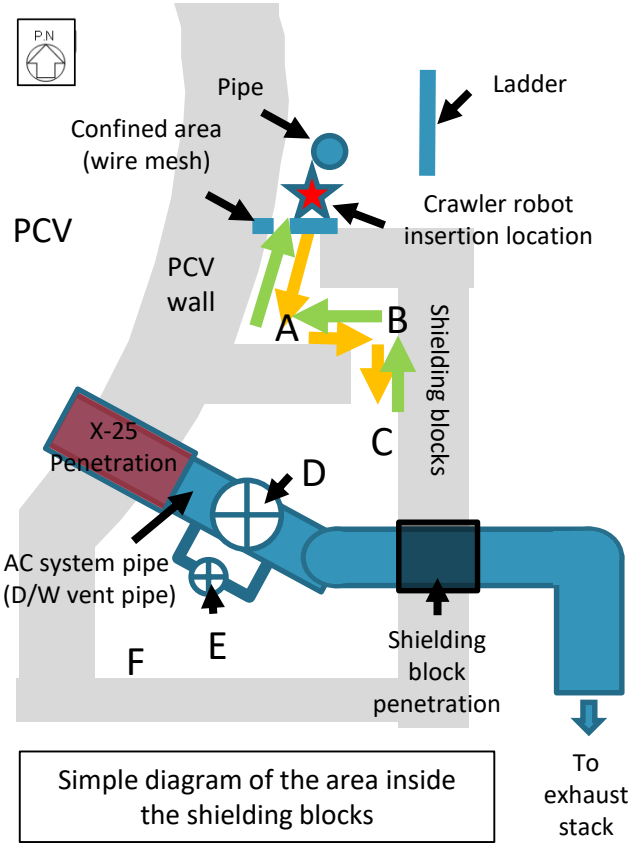
(STEP1: Determine whether the crawler robot can move on the floor within the confined space)

■ It was confirmed that there are no large obstacles and the crawler robot can move.

Photo 1：Location ☆(Location A direction)

Photo 2：Location A (Location B direction)

Photo 3：Location B (Location C direction)



Simple diagram of the area inside the shielding blocks

: Crawler robot route (outbound)

: Crawler robot route (return)

Location D: Directly underneath D/W vent valve (large valve)
Location E: Directly underneath D/W vent valve (small valve)

Photographed on November 19, 2024

Results of accessibility confirmation②

(STEP2: Ascertain any obstacles for the drone such as pipes and structures)

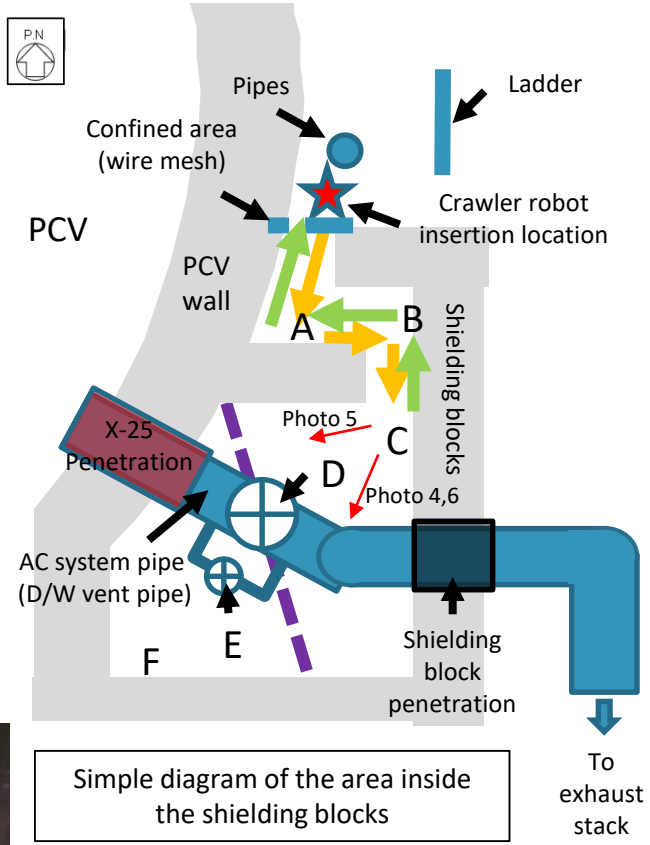
- It was confirmed that there are no obstacles that would hinder drone flight
- A step ladder that would hinder crawler robot movement was found

※Several photos of different contrast have been overlaid

Photo 4：Location C（Approximately 3m from the floor around the D/W vent pipe/valve）

Photo 5：Location C
（Approximately 3m from the floor around the X-25 penetration）

Photo 6：Location C (Step ladder on the floor)



Simple diagram of the area inside the shielding blocks

：Crawler robot route (outbound)

：Crawler robot route (return)

：Stepladder Location

Location D: Directly underneath D/W vent valve (large valve)
Location E: Directly underneath D/W vent valve (small valve)

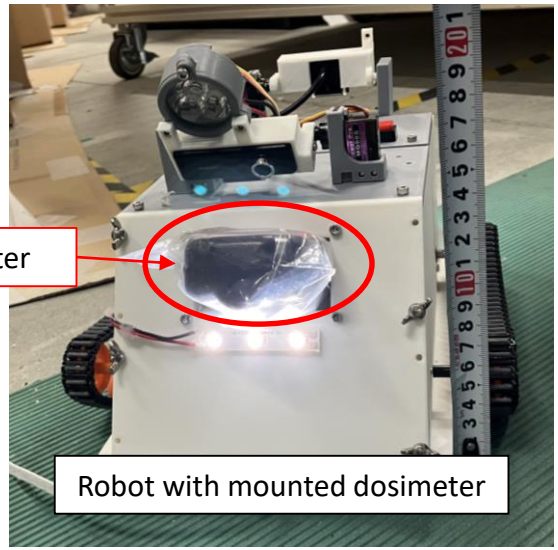
Photographed on November 19, 2024

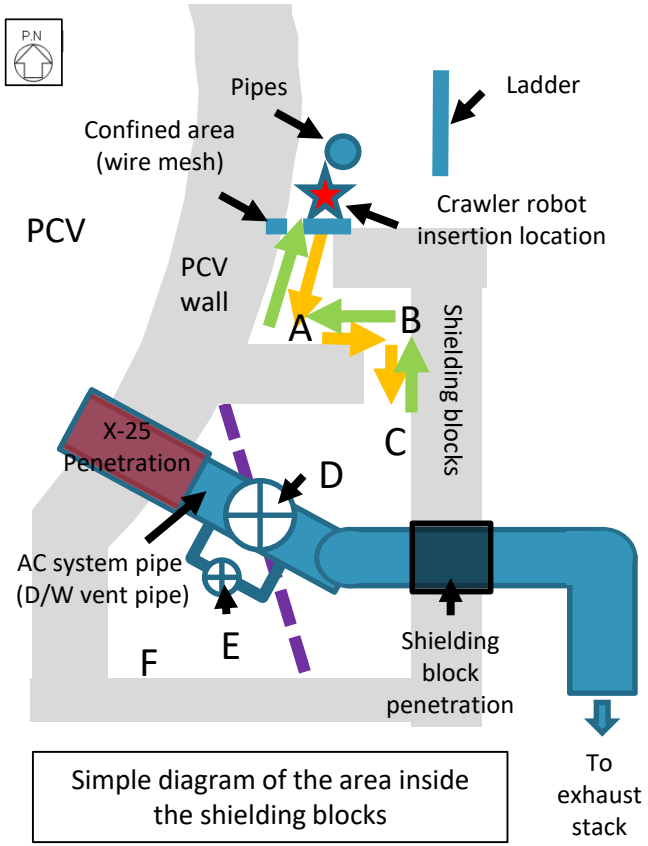
Results of accessibility confirmation③ (STEP3: Measure air dose rates)

- Approximately 2,900mSv/h was measured at the location just past the labyrinth structure (Location C)
- Over 3,000mSv/h was measured as the robot moved in the direction of the D/W pipe

Measurement Location ※	Air dose rate[mSv/h]
☆	570
A	1,620
B	1,100
C	2,900
Moving south from C	Over 3,000
D,E,F	Step ladder prevents crawler robot entry

※ Measured approximately 12cm from the floor





Simple diagram of the area inside the shielding blocks

: Crawler robot route (outbound)

: Crawler robot route (return)

: Stepladder Location

Location D: Directly underneath D/W vent valve (large valve)
Location E: Directly underneath D/W vent valve (small valve)

Measured on November 19, 2024

Future plans

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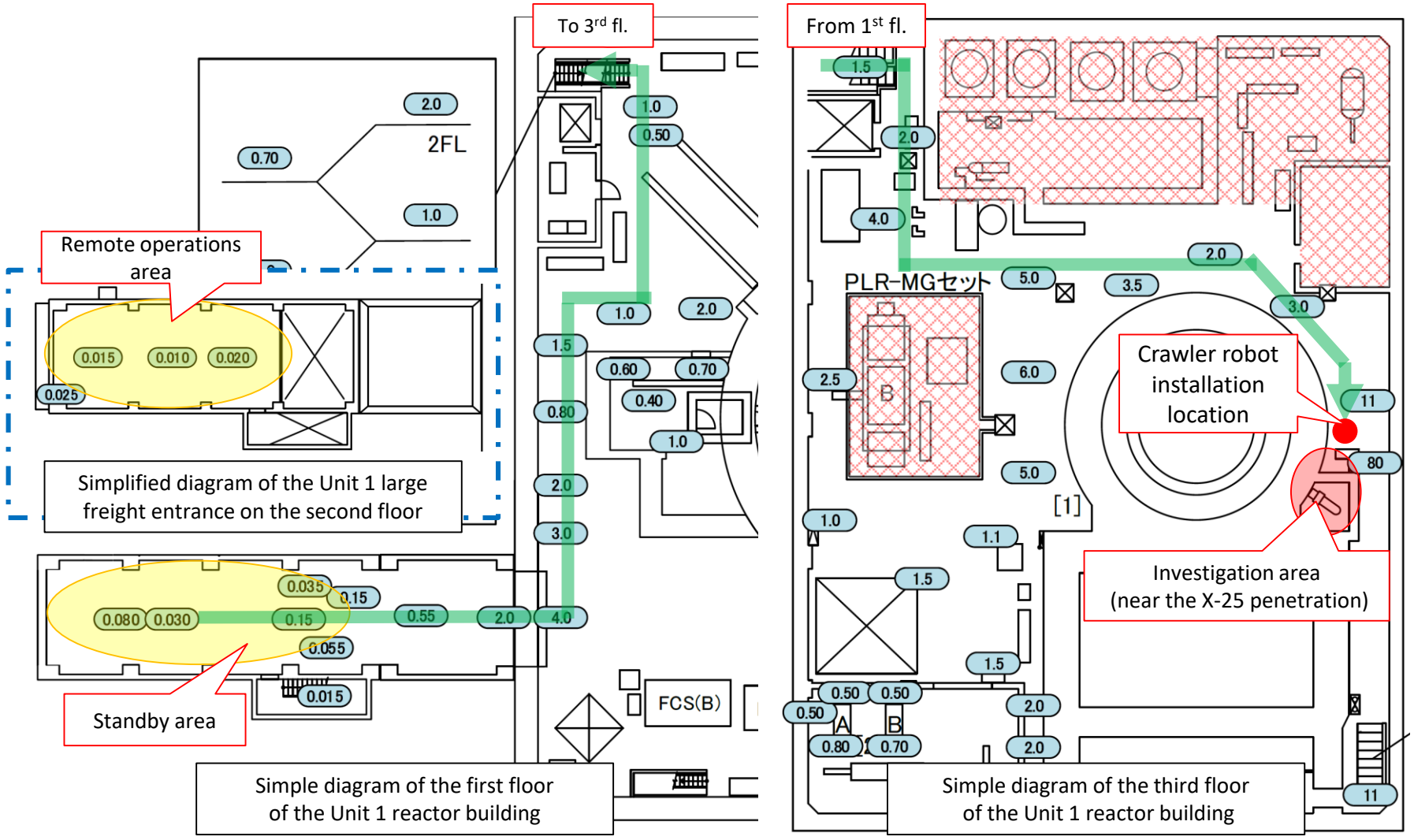
- Conclusion
  - In light of the results of STEP 1~3 investigations, we will deliberate how to use a combination of the crawler robot and the drone to perform an investigation and move forward with preparations.

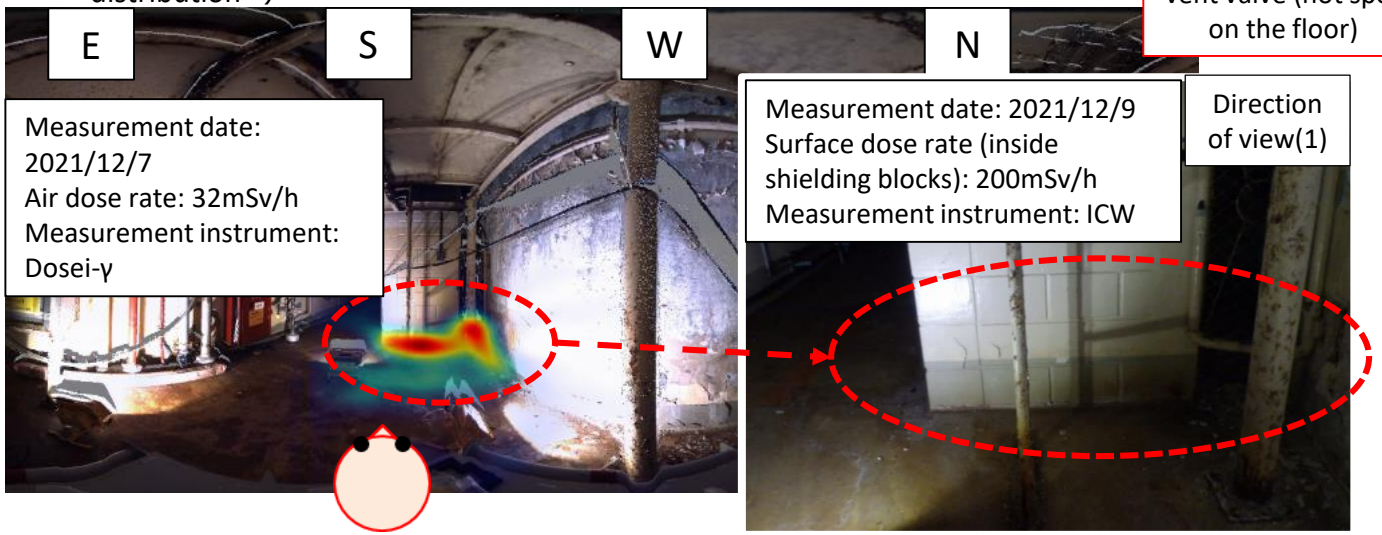
[Reference] Work area air dose rates, manned work routes

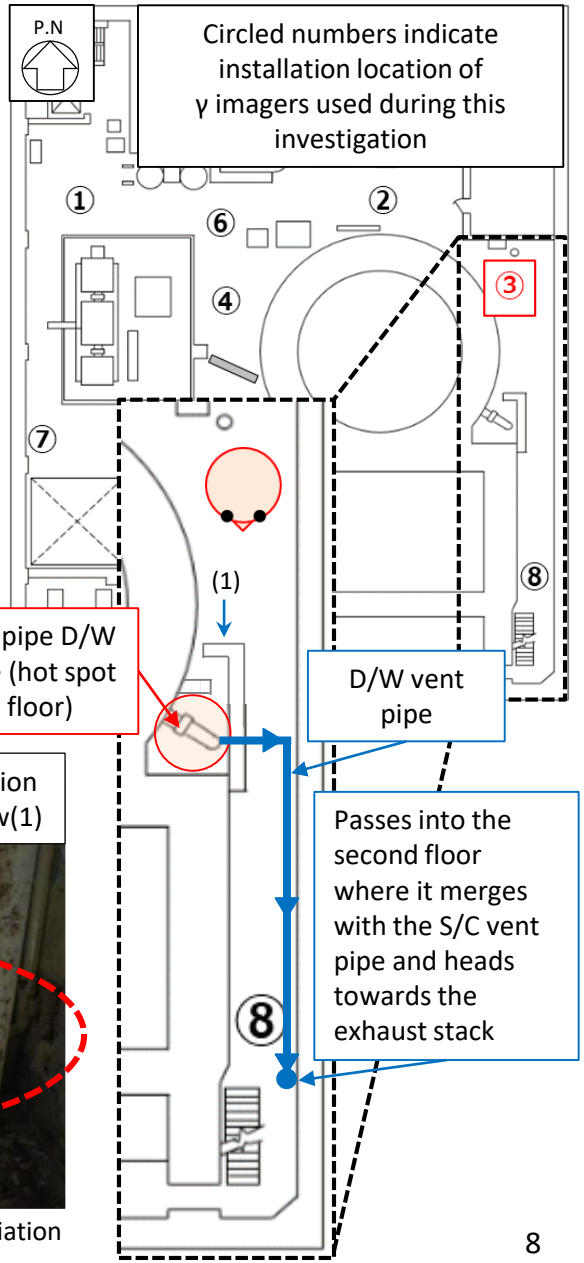


- Details of manned work: Cable laying/recovery and crawler robot loading/installation/recovery
- Planned dose: 2.5mSv（APD setting: 1.5mSv）

[Reference] Results from the Unit 1 AC system pipe investigation conducted during FY2021

- γ imager installation location ③ on east side of 3rd floor
- Identified hotspots:
  - Floor inside the shielding blocks where the AC system pipes (D/W vent pipe), and D/W vent valve exist (D/W venting was not performed during the accident)
    - The hotspot overlaid on the photo shows the direction of the high-dose location and indicates the high possibility that there is an actual hotspot inside the shielding blocks
- Assumed cause of the hotspot:
  - D/W pressure and temperature rose in conjunction with the generation of hydrogen. It is possible that this caused gases inside the D/W to leak outside the building via the penetration and the D/W vent valve, thereby concentrating within the shielding blocks and allowing radioactive substances to adhere to the floor.
- Overlay Photo（360° panoramic photo+ γ radiation source intensity distribution※）



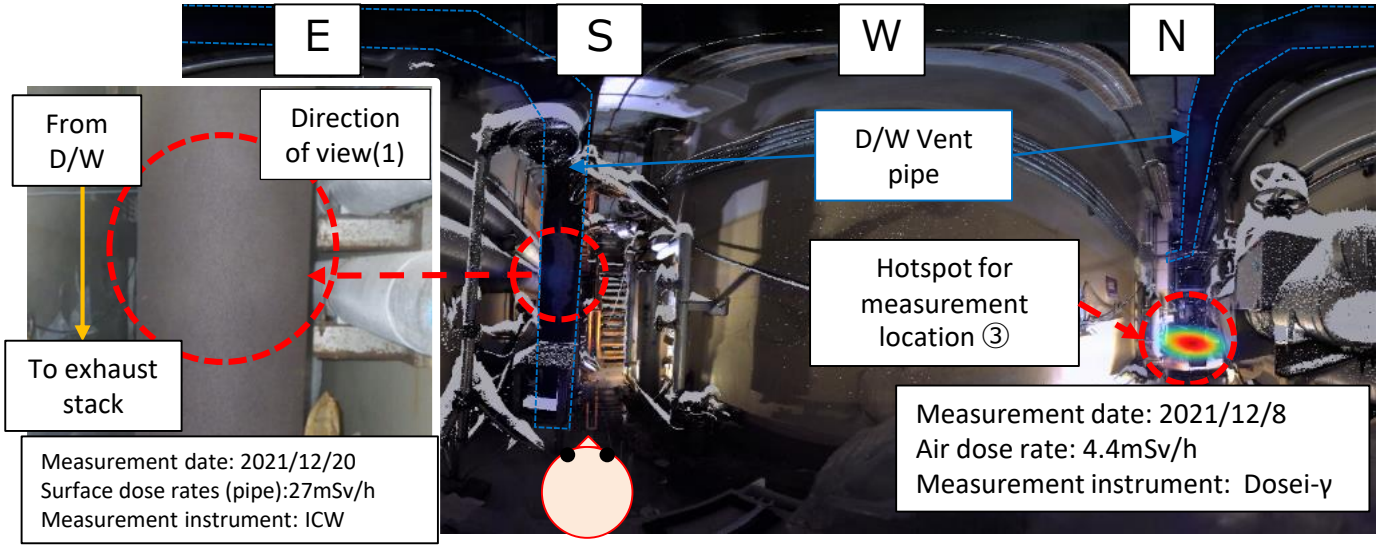


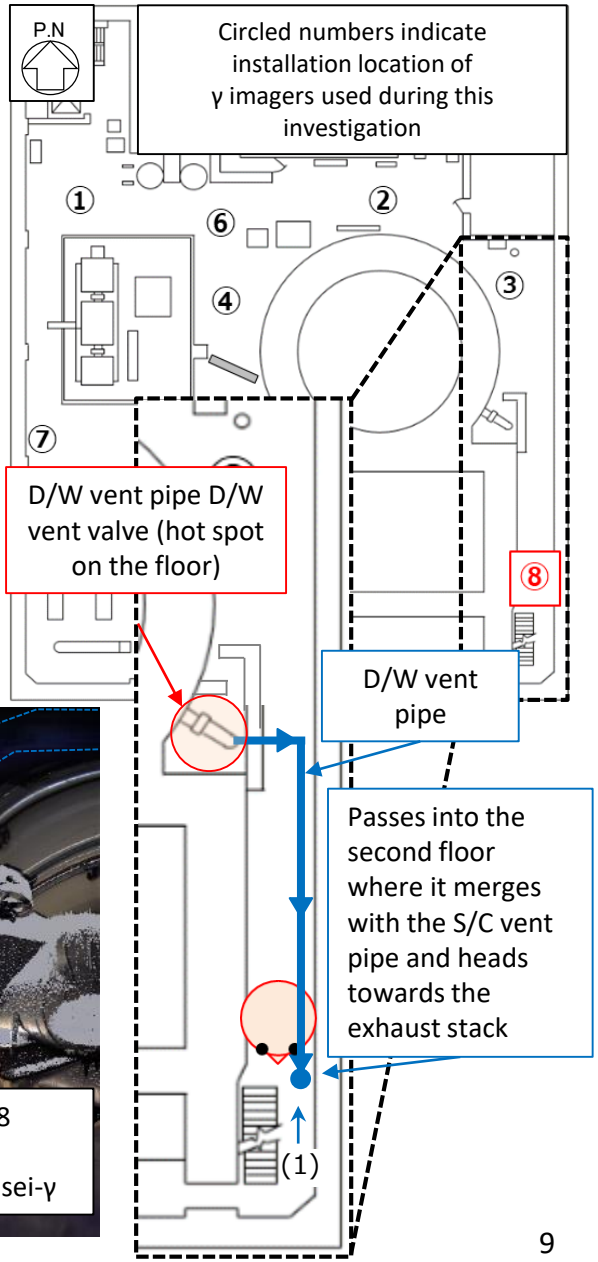
※ Shows relative intensity distribution up to 10% of the maximum value (shown in blue) using the maximum radiation source intensity (shown in red) as a baseline.

[Reference] Results from the Unit 1 AC system pipe investigation conducted during FY2021

■ γ imager installation location ⑧ on east side of 3rd floor

- Focus point: AC system pipes (D/W vent pipe)
  - The condition and contamination status of the pipes will be confirmed since it is connected to the S/C vent pipe that was used during the accident and was found to be covered with rust during past investigations
- Investigation results:
  - Since high dose rates were measured along the length of the pipe, it is assumed that the inside of the pipe is contaminated
    - ➢ Even though the D/W vent valve was closed, the high pressure and high temperature of the D/W might have caused some of the gases inside the D/W to leak downstream via the valve
    - ➢ It is possible that some of the S/C event gases flowed into the pipes
  - Rust was found along the entire surface of the pipe, which is different from other pipes in the area
    - ➢ It is possible that the paint on the pipe degraded due to hot gases passing through it and the heat given off by a radioactive substances adhered to the inner side of the pipes thereby allowing rust to form
- Overlay Photo（360° panoramic photo+ γ radiation source intensity distribution※）





※ Shows relative intensity distribution up to 10% of the maximum value (shown in blue) using the maximum radiation source intensity (shown in red) as a baseline.

[Reference] Simplified diagram of Unit 1 AC system pipes (vent pipes)

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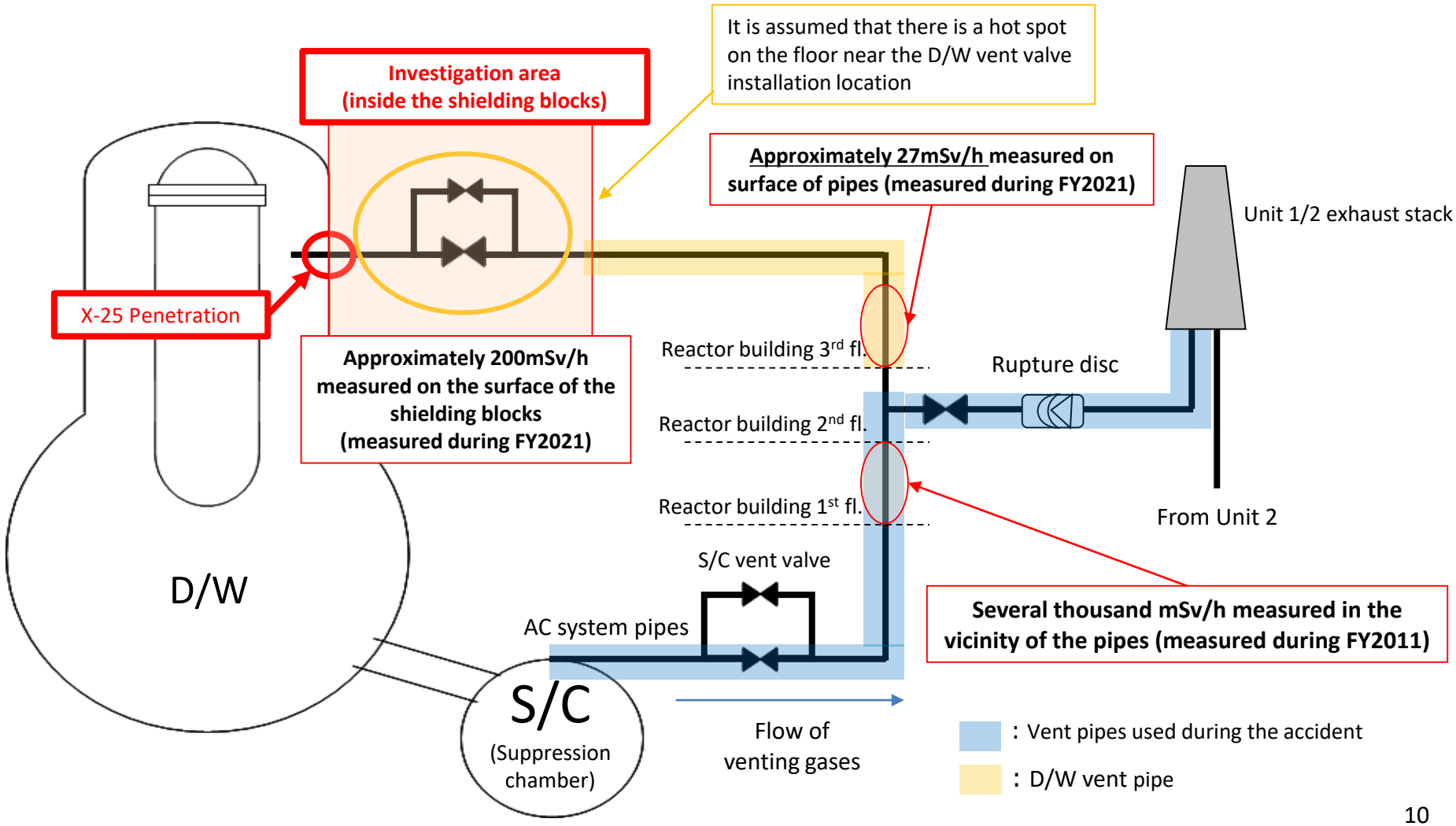
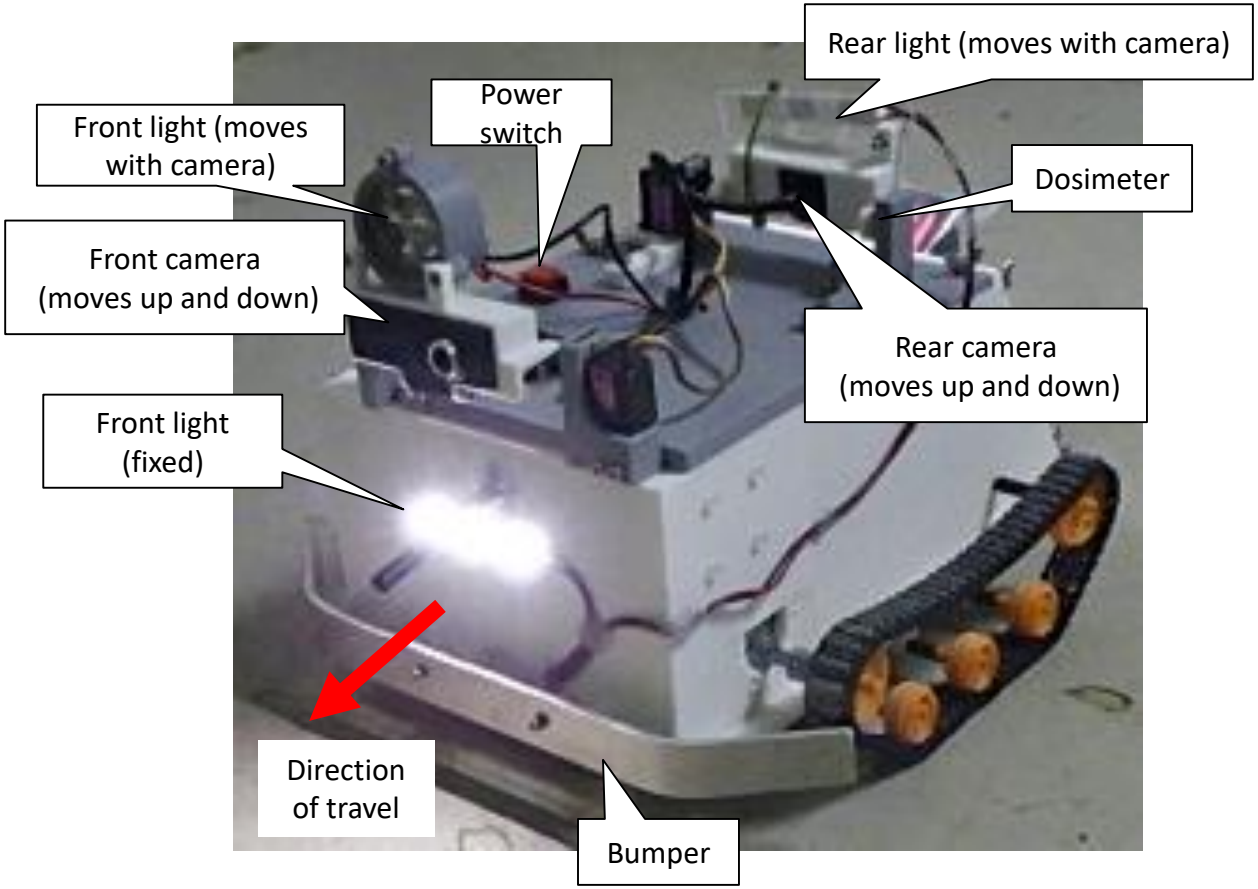
- The D/W vent pipe branches off from the vent lines used during the accident but dose rates in the vicinity of the investigation area (approximately 200mSv/h) are higher than the dose rates at the entrance to the branching pipe (approximately 27mSv/h), so it is assumed that the source of the high dose rates is something other than the vents.



[Reference] Investigation device specifications

■ Crawler robot (manufactured in-house)

Dimensions	L: Approx. 220mm W: Approx. 250mm H: Approx. 210mm
Mass	Approx. 1.6 kg （Including 10m cable）
Mounted equipment	Cameras (CMOS), LED lights, dosimeter
Power source	Battery driven
Running time	Can run for 40 minutes during unloaded operation
Communication method	Hardwired communication



■ Dosimeter

Measured nuclides	γ rays, X rays
Measurement range	5μSv/h~3000mSv/h
Dimensions	104mm × 67mm × 41mm (Including protective cover)
Mass	190g（Including protective cover）
Runtime	Approximately 900 consecutive hours (Two AAA alkaline batteries)

[Reference] Mockup conditions

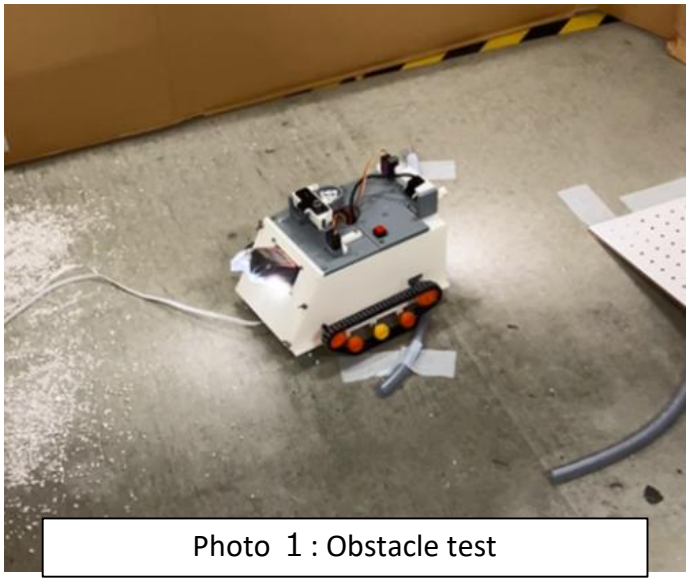


Photo 1 : Obstacle test

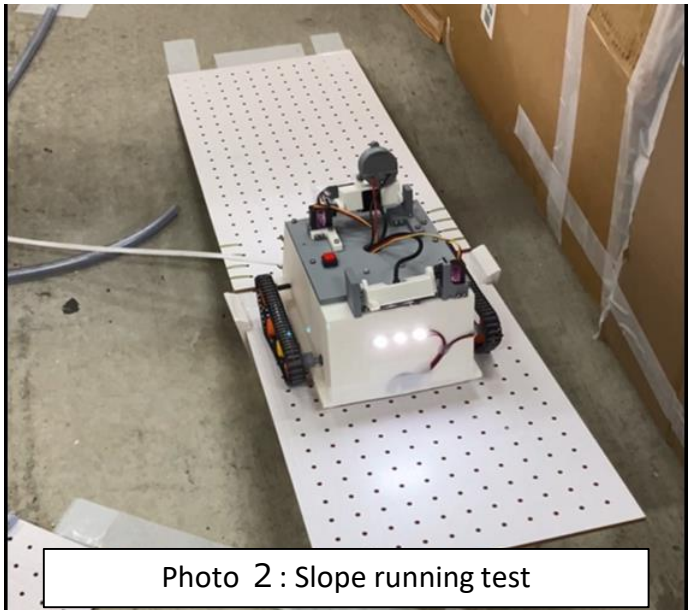


Photo 2 : Slope running test

Photo 3 : Dark location running test

Photo 4 : Running test over sand and paint chips on the floor

Photographed on October 16, 2024