Fukushima Daiichi Nuclear Power Station
Drone investigation of the inside of the Unit 1 and Unit 3 reactor buildings

November 27, 2025

TEPCO

Tokyo Electric Power Company Holdings, Inc.

1. Investigation overview

- Some areas inside the reactor building have not been sufficiently investigated because of the high doses resulting from the accident.
- As shown below, micro-drones will be used to perform investigations of the inside of the Unit 1 and Unit 3 reactor buildings (outside of the primary containment vessels). This investigation will be directly conducted by TEPCO.

Reactor building	Objective	Investigation scope	Investigation location	Investigation details
Unit 1	To inspect the condition of valves of IC(A), which poses a hydrogen accumulation risk, in order to deliberate a hydrogen purge.	IC(A) MO valve (3A), instrument line primary valves.	R/B 1st floor, northwest area 2nd floor, west area （Both are at high elevations）	**Visual inspection using a drone** ・Confirm the condition of valves used for purge operations ・Confirm conditions in the vicinity
Unit 3	Confirm the condition of valves since pipe PCV boundaries and sealing measures need to be considered if it becomes necessary to remove instrument racks in preparation for a fuel debris retrieval.	Primary valves of lines connected to the instrument racks on the northwest/west areas of the first floor of the R/B.	R/B 1st floor, northwest area 2nd floor, northwest area 3rd floor, northeast area （All are at high elevations）	**Visual inspection using a drone** ・Confirm the condition of the instrument rack master valves ・Confirm conditions in the vicinity

※IC: Reactor isolation condenser system

Micro-drone

Use: Taking footage with cameras
Dimensions: 199×194×58[mm]
Mass: 243[g]（Including battery）
Communications method: Radio
Flight time: Approximately 11 minutes
Camera performance: Quality: Full-HD, Frame rate: 60fps
Aspect ratio: Diagonal 144°, Horizontal 131°, Vertical 80°
Lights: Two LED lights on the right and left (Total: 380lm)
Radiation resistance: Approx. 300Gy
Notes: Equivalent to IP51, forward camera

2. Unit 1 reactor building internal investigation details

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Background

- In light of the confirmation of hydrogen gas in the unit 3 RHR piping in December 2021, an assessment was conducted focusing on similar cases (valve operations during accidents, water seals) and it was deemed possible that hydrogen may have accumulated at Unit 1 in the IC(A), RCW(DHC), and CRD(HCU), etc.

- During sampling performed in November 2022 prior to draining the RCX-Hx (heat exchanger), which is highly radioactive, it was confirmed that hydrogen was present in the gas that had accumulated inside the heat exchanger inlet/outlet header pipe , so a hydrogen gas purge was implemented through May 2025.

⇒ Since some locations in the systems identified above are highly radioactive, a field investigation will be conducted while deliberating a work plan that considers work safety, such as exposure prevention.

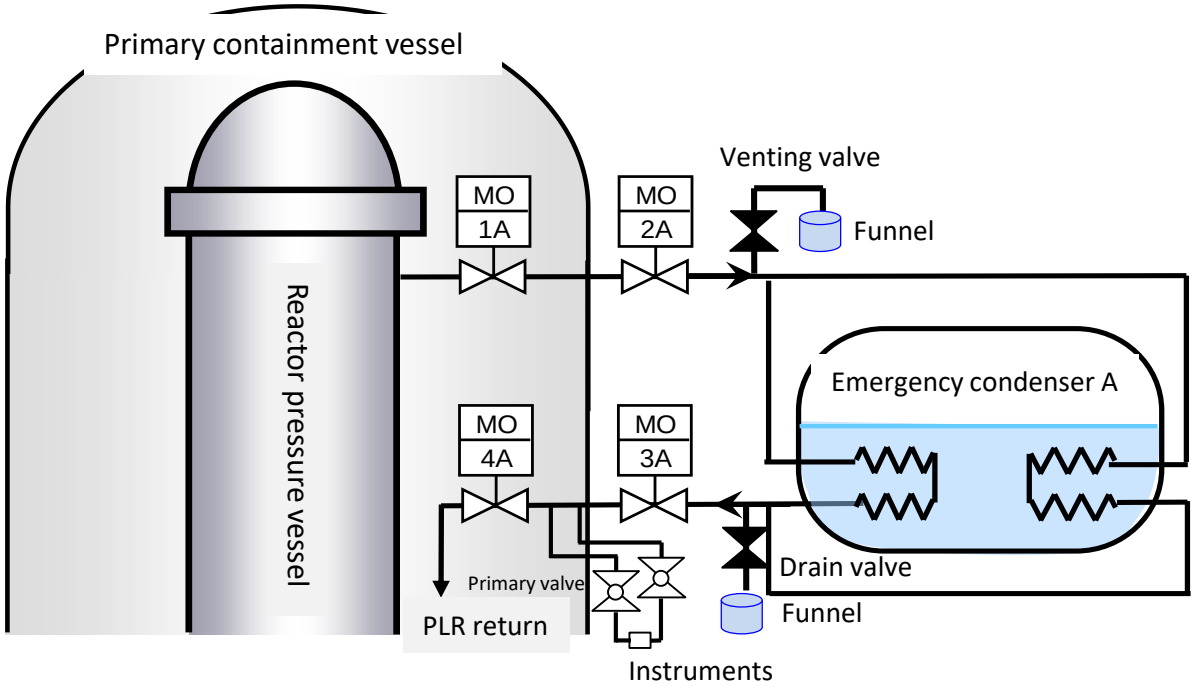
Objectives

Conduct a field investigation in order to assess the condition of valves and the condition of the surrounding area as well as access routes in order to formulate a work plan for a future purge of the IC(A), in which the accumulation of hydrogen is a risk.

※RHR: Residual Heat Removal System, RCW: Reactor Cooling Water System,
DHC: Drywell Humidity Control System, CRD: Control Rod Drive system, HCU: Hydraulic Control Unit

[Reference] Assessment of hydrogen accumulation in the Unit 1 IC(A)

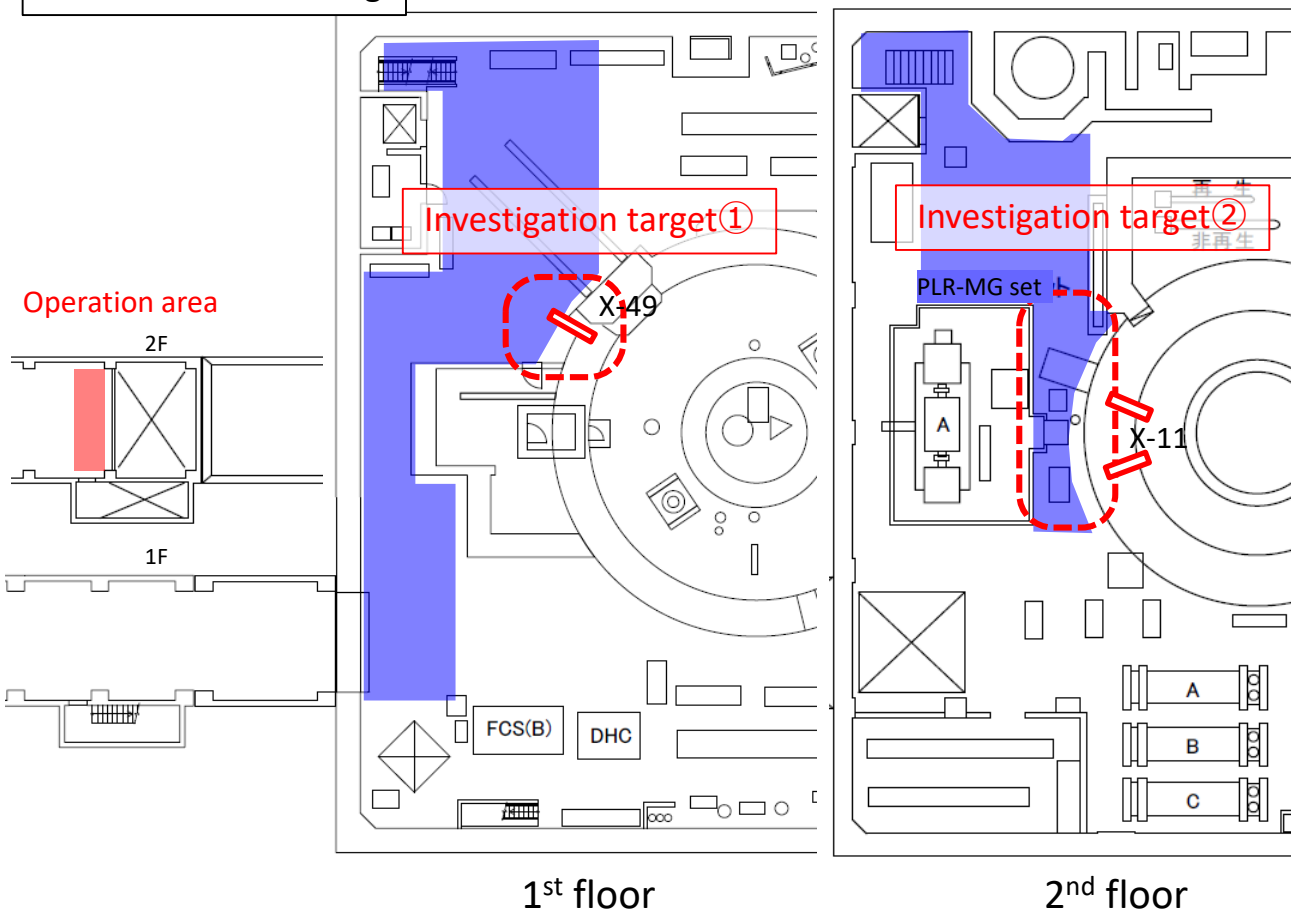
- An investigation of the condition of isolation valves outside and inside the PCV after the accident found the possibility that the Unit 1 IC(A) isolation valve (MO-1A,4A) may have been opened after core damage. If the IC(A) isolation valve was open, whereas it's connected to the RPV in which nitrogen replacement is currently underway, it is assumed that heat transfer tube and condenser downstream pipes are blocked by steam condensate thereby making it possible that hydrogen has accumulated inside the heat transfer tube, etc.



3. Unit 1 field investigation locations

- Check the condition of valves in order to implement a purge as well as surrounding conditions and access routes.
  Investigation target: IC(A) Motor operated valve (3A) 【2nd fl. near X-11】
  IC(A) instrument line primary valve 【1st fl. near X-49】
- Since all of the investigation locations are high off the ground (near the ceiling), drones will be used to conduct the investigation.

Unit 1 reactor building



- ✓ Drones will be operated from the low-dose area on the second floor of the reactor building by the large freight entrance.
- ✓ Since radio signals don't reach the second floor of the reactor building, a relay will be manually installed near the stairwell.

Drone operation area：
Drone flight area：
Drone Investigation target：

4. Unit 3 reactor building internal investigation details

■ Background

- Even though use of the Unit 3 X-6 penetration is being considered for internal investigations and fuel debris retrieval, the northwest area of the first floor of the reactor building, where the X-6 penetration is located, is a high dose area, so we need to deliberate how to reduce doses in that area.
- The jet pump instrument rack closest to the X-6 penetration in the northwest area contributes greatly to these high doses, and we are deliberating flushing the pipes or removing them in order to reduce doses, but since the pipes are connected to the PCV, removing them would require deliberation of how to build and seal a PCV boundary.
- Furthermore, the west area, which is the access route to the northwest area, is littered with instrument racks that may obstruct the carrying in of equipment, so likewise, deliberating a boundary that considers the PCV is necessary if they are to be removed.

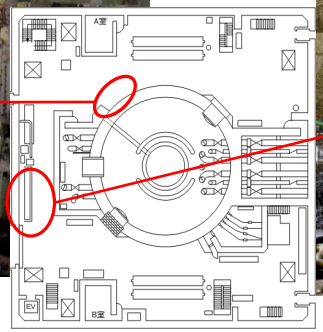
※ Instrument racks: Jet pump instrument rack, recirculation pump instrument rack, high-pressure coolant injection system instrument rack, PCV oxygen analyzer rack, inert gas system instrument rack, etc.

■ Objectives

In order to determine whether or not it is possible to remove the instrument racks located in the northwest and west areas of the first floor of the reactor building, we need to consider the PCV boundary, so we must first conduct a field investigation to examine the condition of system valves and the conditions in the surrounding area as well as access routes.

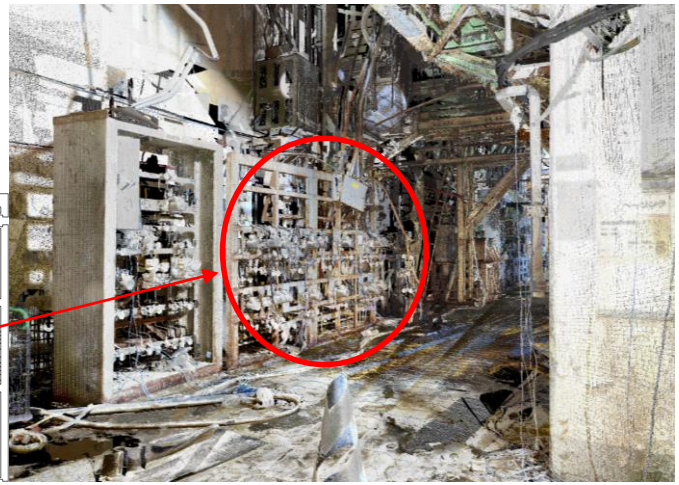
Jet pump instrument rack
(northwest area, 1st floor, reactor building)

＜ Point cloud data sampling ＞
Sampled in 2022



Unit 3 reactor building 1st floor

※ Shielding has been placed in front of the X-6 penetration



High pressure coolant injection system instrument rack
(west area, 1st floor, reactor building)

＜ Point cloud data sampling ＞
Sampled in 2022

Reference. Results of the investigation around the X-6 penetration

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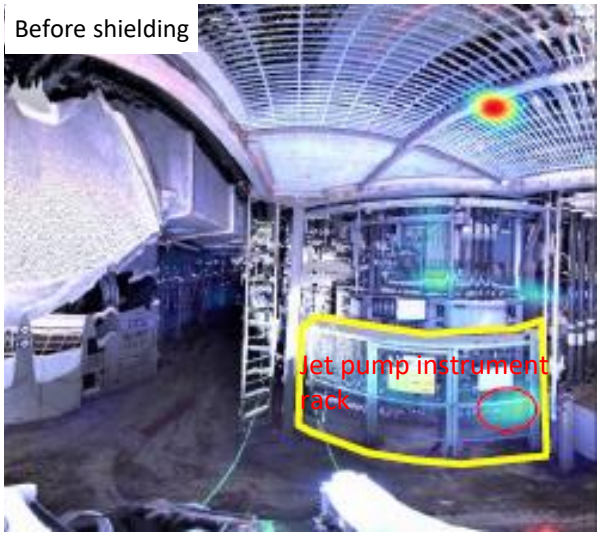
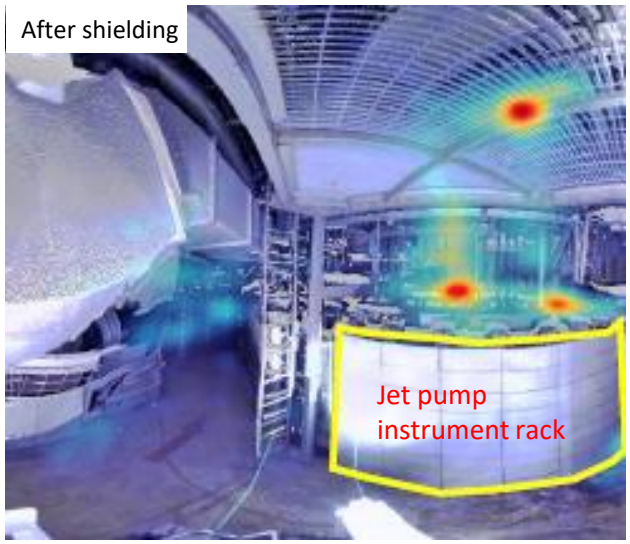
＜Issues＞

- The HCU (north side) is greatly affected by doses from the jet pump instrument rack, and it is not clear whether there are any other radiation sources.
- The HCU and jet pump instrument rack, which are the main radiation sources, have been shielded, and the air dose rate around the X-6 penetration is between 3~5mSv/h, thereby prohibiting workers from remaining in the area for a long period of time.

＜Plans＞

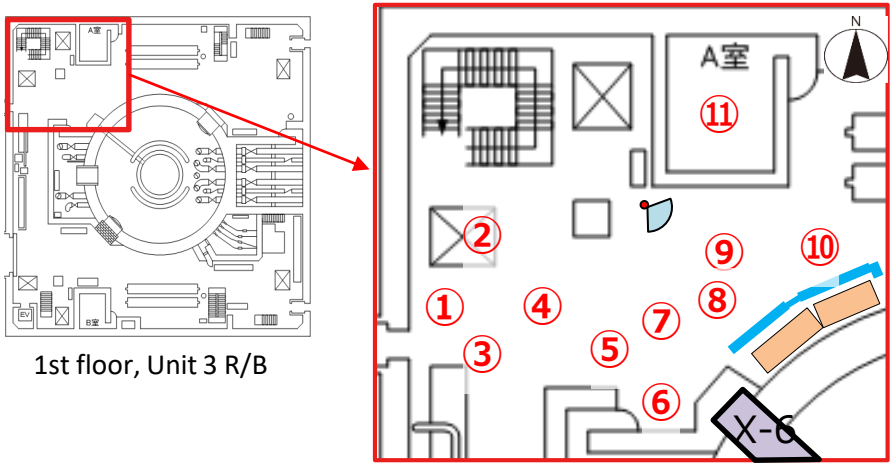
- Dose reduction measures for the jet pump instrument rack closest to the X-6 penetration are being deliberated.
- Due to the difficulty of work implementation, it is expected that much time will be needed to reduce doses in the HCU.





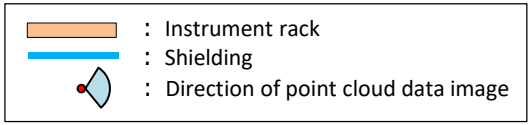
Location	Measurement (mSv/h)
	Air dose (1.5m above the floor)
①	2.49
②	2.99
③	2.98
④	2.72
⑤	3.32
⑥	4.62
⑦	3.36
⑧	5.16
⑨	4.27
⑩	4.15
⑪	0.96

＜G/I measurement＞
Measurements taken between 2019-2020



1st floor, Unit 3 R/B

＜Air dose measurement＞
Measurements taken during 2025



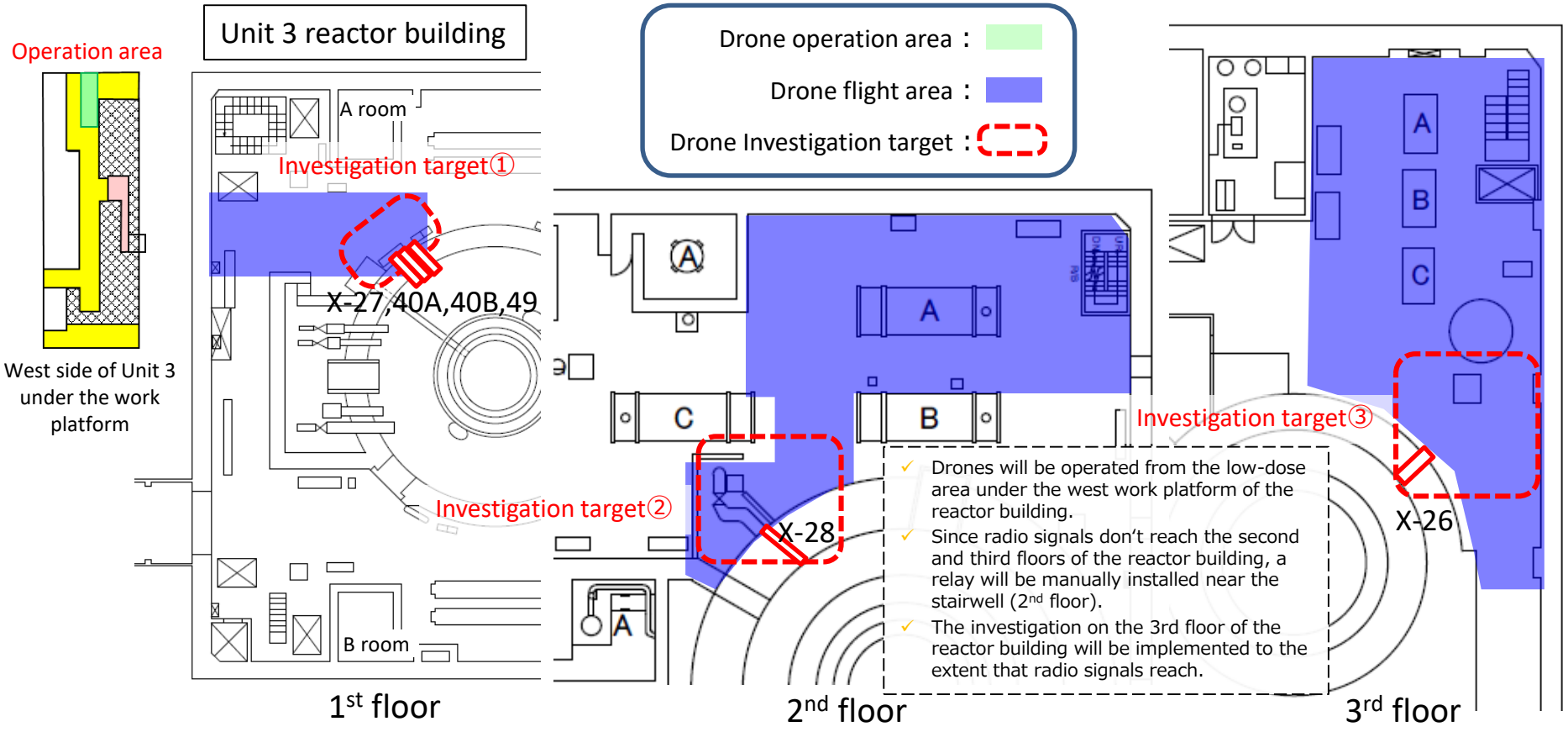
5. Unit 3 field investigation

- Check the condition of instrument master valves as well as the conditions in the vicinity and access route in order to deliberate a PCV boundary for each instrument rack.

Investigation target: Primary valves on lines connected to the instrument racks ※ on the northwest/west areas of the first floor of the reactor building

【1st fl. near X-27,40A/B,49, 2nd fl. near X-28, 3rd fl. near X-26】

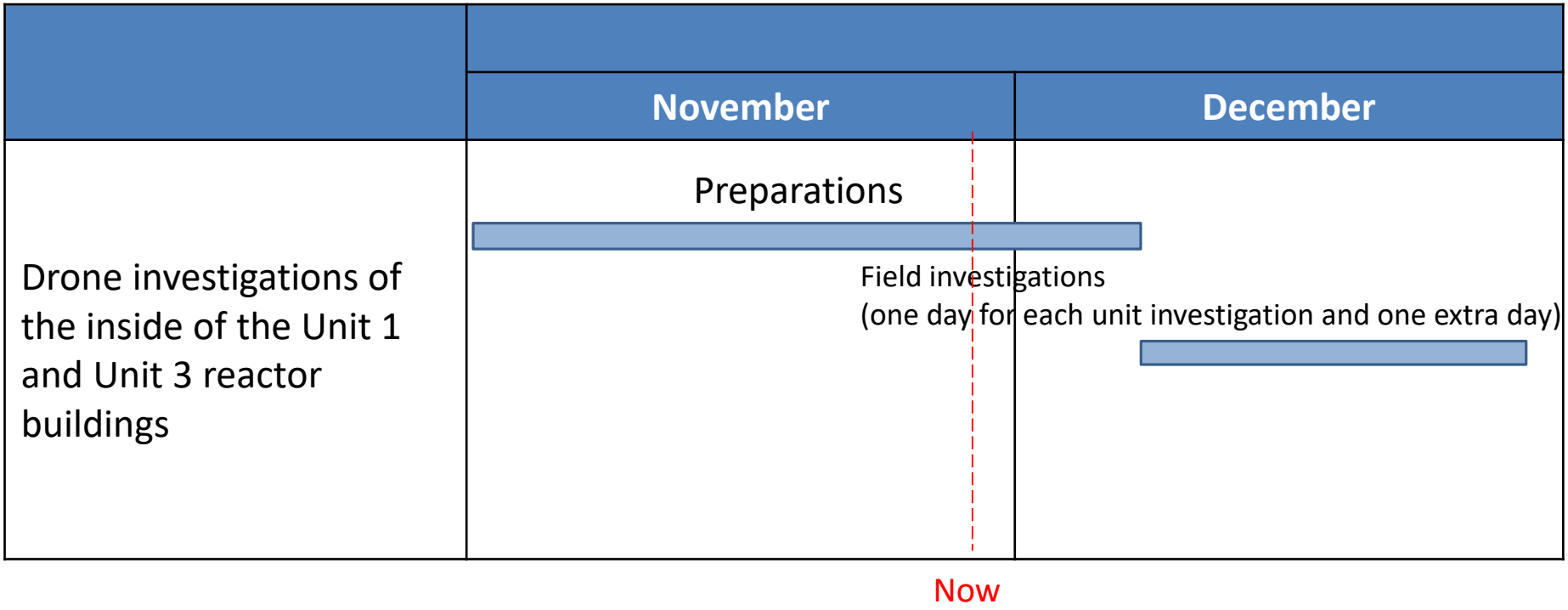
- Since all of the investigation locations are high off the ground (near the ceiling), drones will be used to conduct the investigation



※ Instrument racks: Jet pump instrument rack, recirculation pump instrument rack, high-pressure coolant injection system instrument rack, PCV oxygen analyzer rack, inert gas system instrument rack, etc.

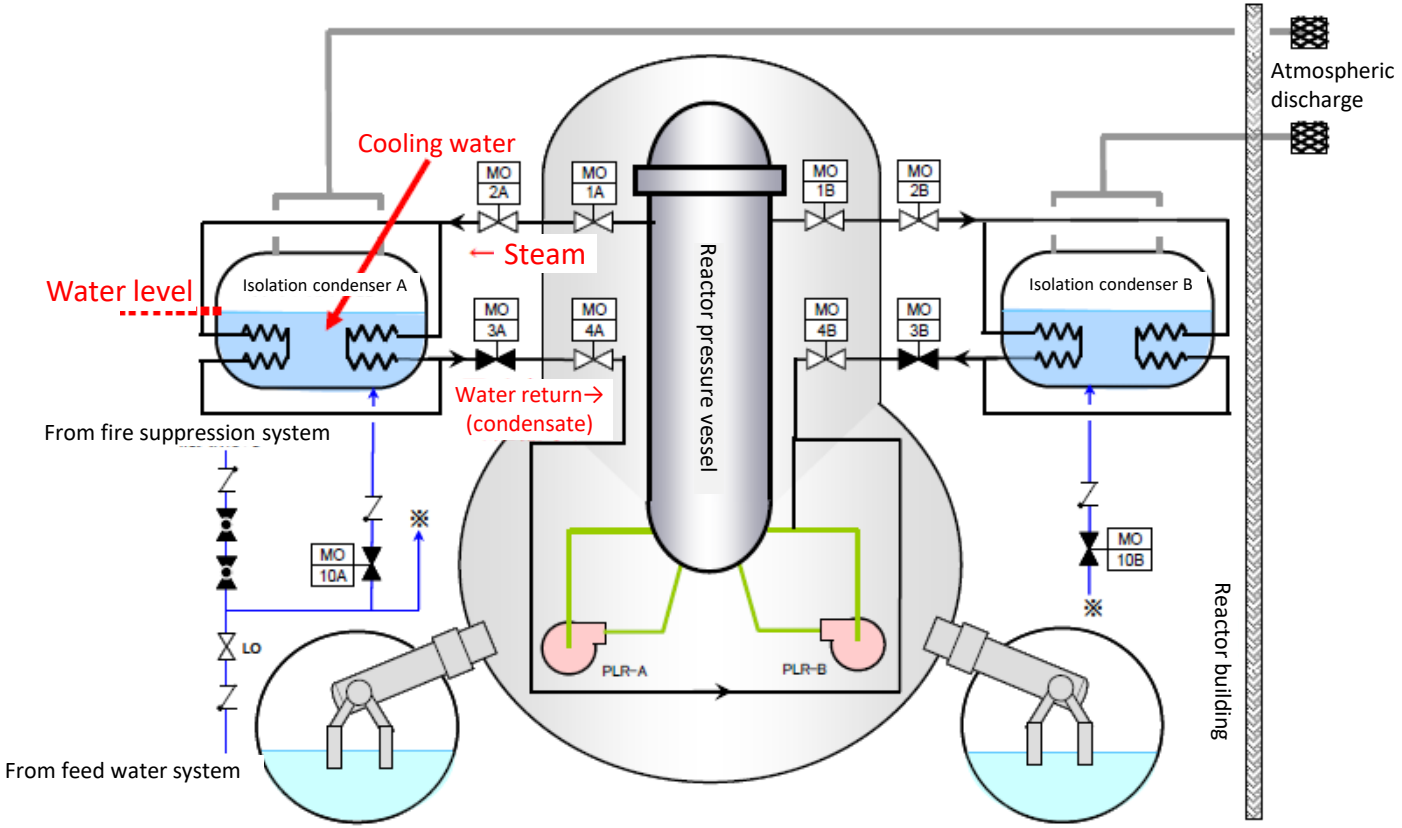
6. Schedule

- The field investigation is planned to begin at the beginning of December.
- Additional investigations may be implemented as necessary based on the results of the initial investigation.



[Reference] Information on the Isolation Condenser

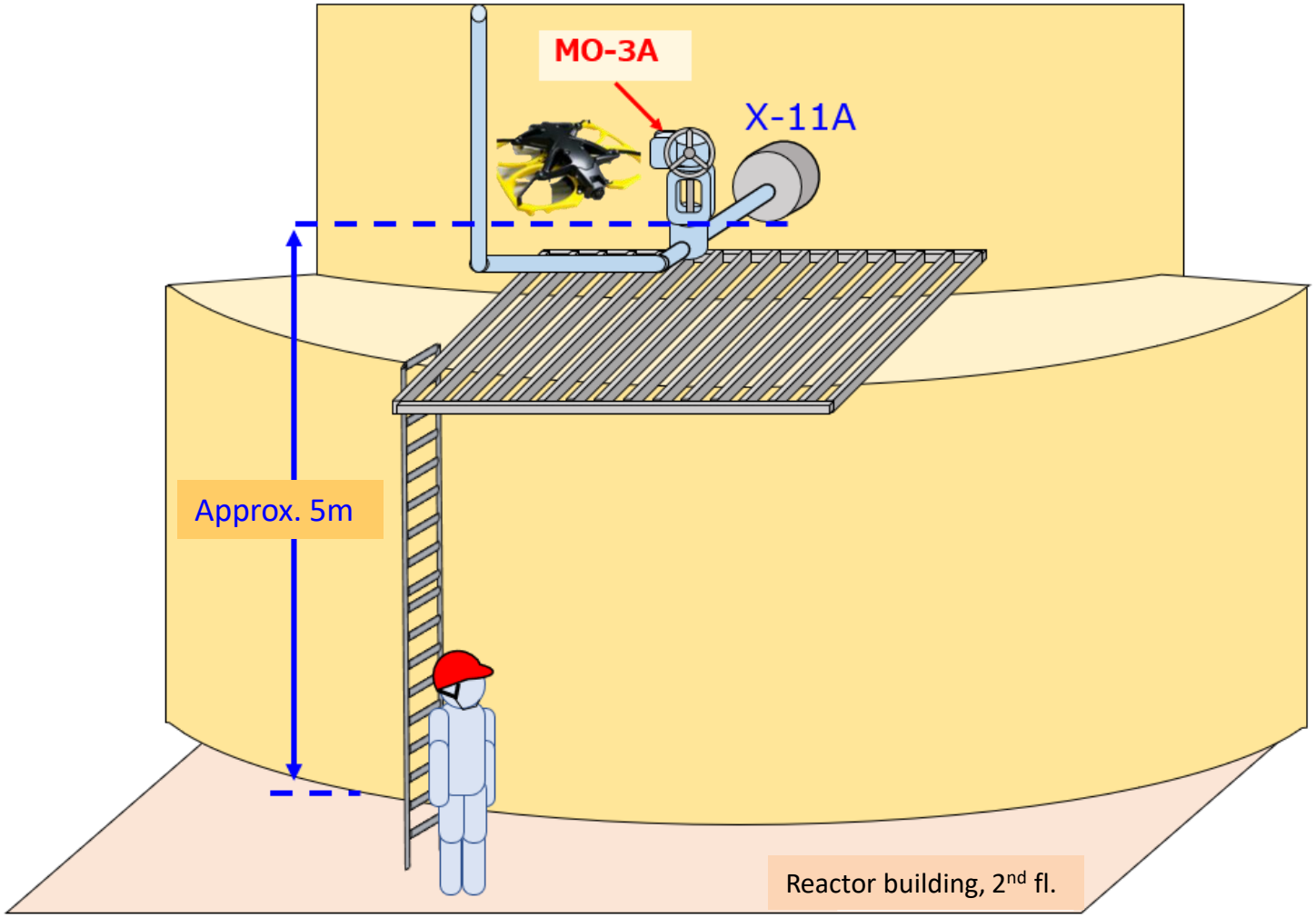
- The Isolation Condenser takes steam from the reactor and passes it through cooling pipes that exchange heat with the cooling pipes on the vessel side. As a result, steam from the reactor is cooled, condensed and returned to the reactor thereby removing heat from it.
- The aforementioned system has two lines, system A and system B, and each system has four valves that sandwich the primary containment vessel (system A valves: 1A~4A; system B valves: 1B~4B). Under normal conditions valve 3A of system A and valve 3B of system B are closed and the other valves are open.
- Normal system startup/shutdown is achieved by opening/closing valves 3A and valve 3B.



[Reference] Positional relationship of penetrations

Ex.) Unit 1, 2nd floor, X-11

- The penetration is approx. 5m from the floor, and neither the penetration, nor master valves in the vicinity, cannot be directly viewed, so drones will be used to investigate it.
- The same is true for the other investigation targets at Units 1 and 3.

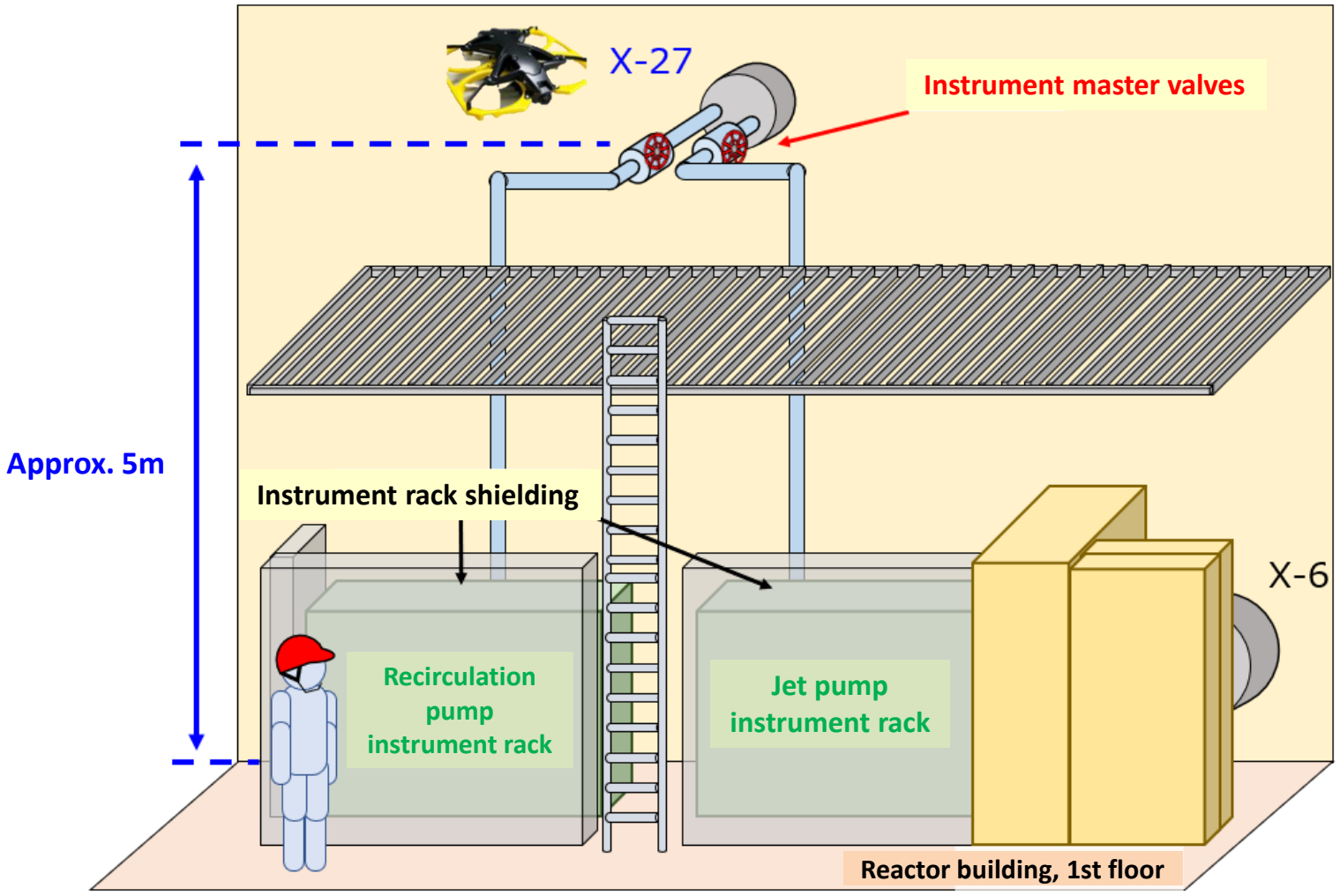


[Reference] Positional relationship of penetrations

Ex.) Unit 3, 1st floor, X-27

・The penetration is approx. +5m from the floor, and neither the penetration, nor master valves in the vicinity, cannot be directly viewed, so drones will be used to investigate it

・The same is true for the other investigation targets at Units 1 and 3



[Reference] Hydrogen accumulation assessment locations

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- Target systems
- Systems that are assumed to either be sealed or have flow as a result of operations taken during the accident or openings caused by damage. (already reported)
- Systems in addition to those mentioned above in which it is assumed that hydrogen has accumulated due to reassessment or in conjunction with decommissioning progress. (already reported)
- Systems in which it is assumed that hydrogen has accumulated because they are connected to the PCV and leaks from isolation valves have been found in the past. (newly added)

	Unit 1	Unit 2	Unit 3	Notes
High possibility of accumulation (already reported)	IC(A) Reactor isolation condenser system CRD(HCU) Control Rod Drive Hydraulic Control Unit RCW Reactor cooling water system	CRD(HCU) Control Rod Drive Hydraulic Control Unit	CRD(HCU) Control Rod Drive Hydraulic Control Unit	Flow from operation or damage 【Results】 ・Gas has been purged from the Unit 1 RCW-Hx header pipe, CUW（connected to S/C), and Unit 3 RHR(A) ・Gas is currently being purged from the Unit 3 S/C
	CUW clean up water system (connected to S/C)	RHR(A/B) Residual heat removal system AC Activated carbon system	RHR(B) Residual heat removal system S/C Suppression chamber	
Newly added due to the possibility of accumulation※	PLR Primary Loop Recirculation system（purge lines measures） SLC Standby liquid control system CUW clean up water system CCS Containment cooling system CS Core spray system HPCI High-pressure coolant injection system FCS Flammable gas control system SAM System analysis module AC Atmospheric Control SHC Shut down cooling system RW Radioactive waste treatment system	PLR Primary Loop Recirculation system（purge lines measures） SLC Standby liquid control system CUW Clean up water system RCIC Reactor core isolation cooling system CS Core spray system HPCI High-pressure coolant injection system FCS Flammable gas control system SAM System analysis module RW Radioactive waste treatment system	PLR Primary Loop Recirculation system（purge lines measures） SLC Standby liquid control system CUW Clean up water system RCIC Reactor core isolation cooling system CS Core spray system HPCI High-pressure coolant injection system FCS Flammable gas control system SAM System analysis module AC Activated carbon system RW Radioactive waste treatment system	

【Addendum】 Systems inside the PCV, or systems that open into the PCV, have been excluded (MS, FDW, PLR), including CRD, CUW and RHR system heat exchangers. Pumps have been excluded from the assessment under the assumption that they are flooded with water.

※ Includes systems into which it is possible that hydrogen gas flowed during the accident, but for which there is now little possibility that hydrogen has accumulated because the atmosphere in the PCV is gradually being replaced with nitrogen.