

Plans to perform internal investigations of the Unit 1 and 3 PCVs

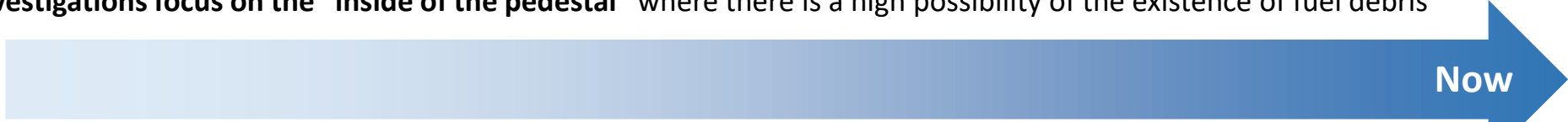
August 29, 2024



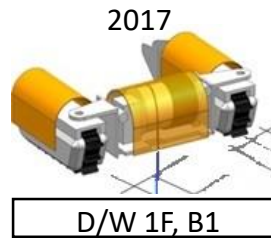
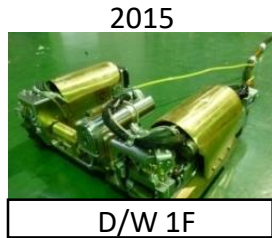
Tokyo Electric Power Company Holdings, Inc.

1. PCV internal investigations

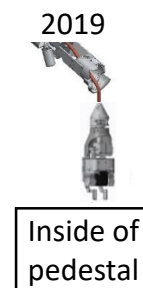
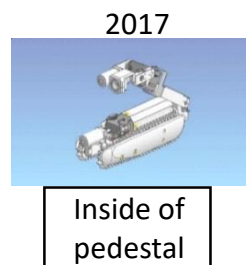
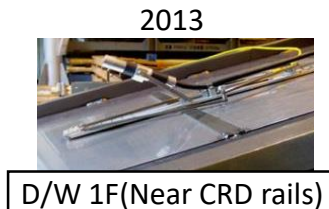
- The objective of PCV (Primary Containment Vessel) internal investigations: To acquire information that will contribute to "fuel debris retrieval" and "accident comprehension"
- The focus is on the distribution and composition of fuel debris, the condition and any differences in the environments of primary components before and after the accident
- Investigations focus on the "inside of the pedestal" where there is a high possibility of the existence of fuel debris



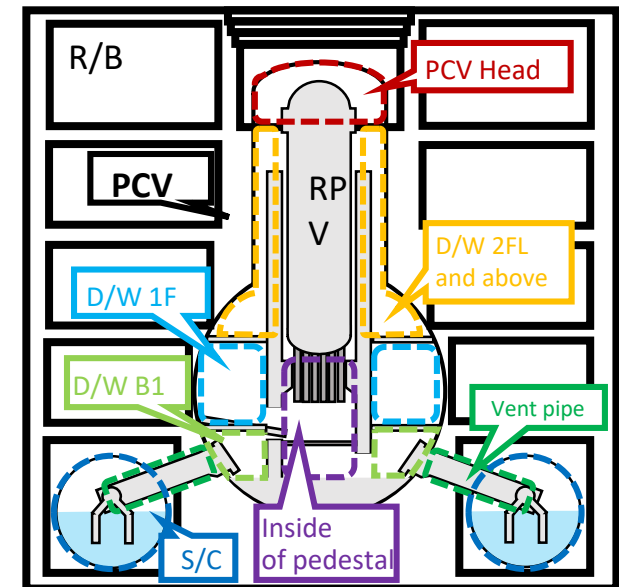
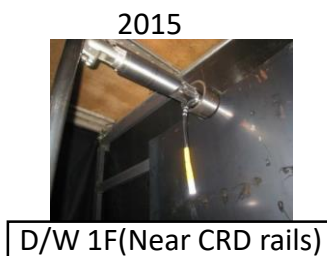
Unit 1



Unit 2

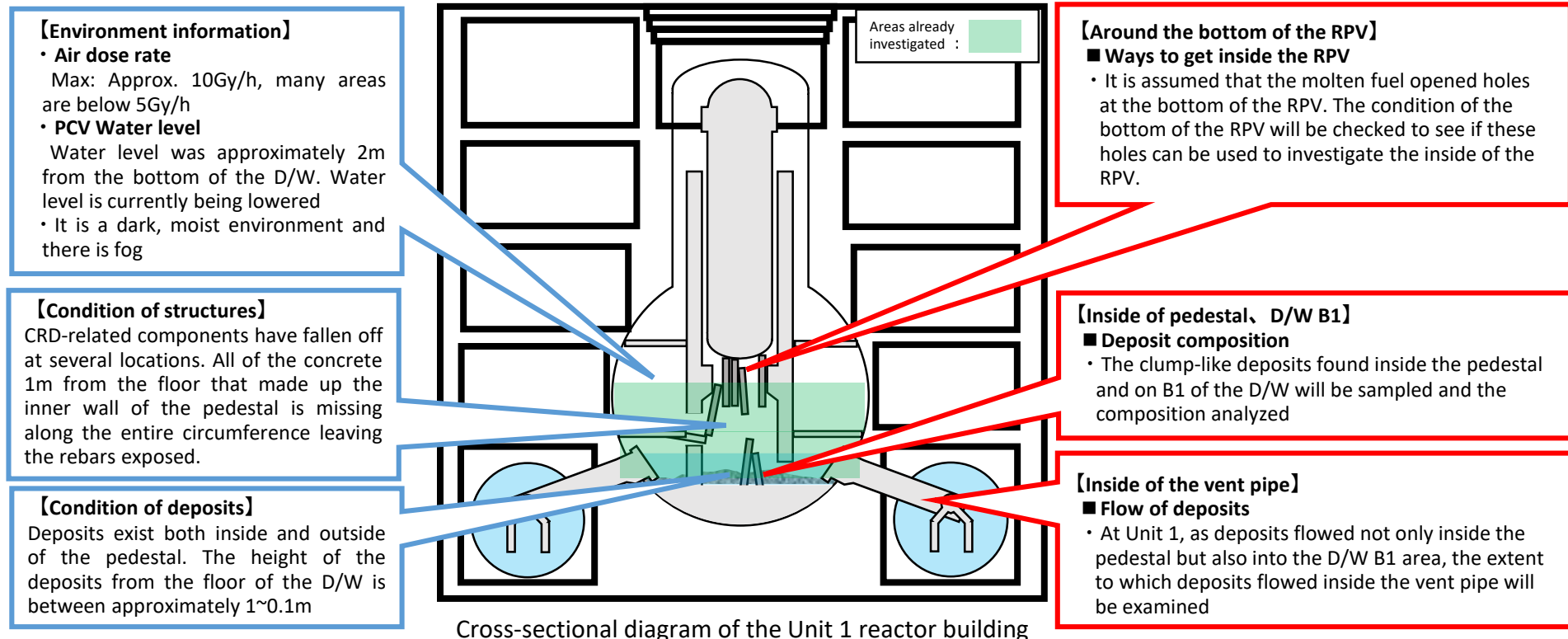


Unit 3



2. Unit 1 PCV internal investigation results and focus points


- **A wide variety of internal investigations have been performed at Unit 1, including not only the inside of the pedestal but also D/W 1F, and B1**
- We have confirmed that deposits are spread out both inside and outside the pedestal, and we have sampled/analyzed floating objects on the top layer of the deposits. We have not examined conditions inside the RPV (Reactor Pressure Vessel) or the extent to which deposits flowed into the vent pipe, nor have we sampled/analyzed clump-like deposits.
- In regards to the condition of primary structures, we have found that structures inside the pedestal have fallen and/or been damaged, and that all of the concrete 1m from the floor that made up the inner wall of the pedestal is missing along the entire circumference leaving rebars exposed.
- In order to obtain more information about deposits, going forward, we plan to conduct investigations about the **area around the bottom of the RPV**, which will eventually lead to an internal investigation of the RPV, information about the **inside of the vent pipe**, which we need to ascertain the extent to which deposits flowed, and information pertaining to the **composition of deposits**.



3-1. Unit 1 PCV internal investigation plan: Investigation using improved small drones

- **We plan to improve the small drone** used to perform internal investigations of the non-submerged area of the Unit 1 PCV in February and March 2024 based on the knowledge obtained during these investigations
- The drones used during the previous internal investigation will be updated to **improve photographic capabilities and flight time**
- We are also deliberating the use of drones that can take photographs above, wireless relays for cross-drone communication, as well as drones that can take dose measurements and sample deposits
- **We plan to sample/analyze deposits during investigations of the area near the bottom of the RPV and inside the vent pipe**

Small drones used for past investigations



■ Used to obtain footage

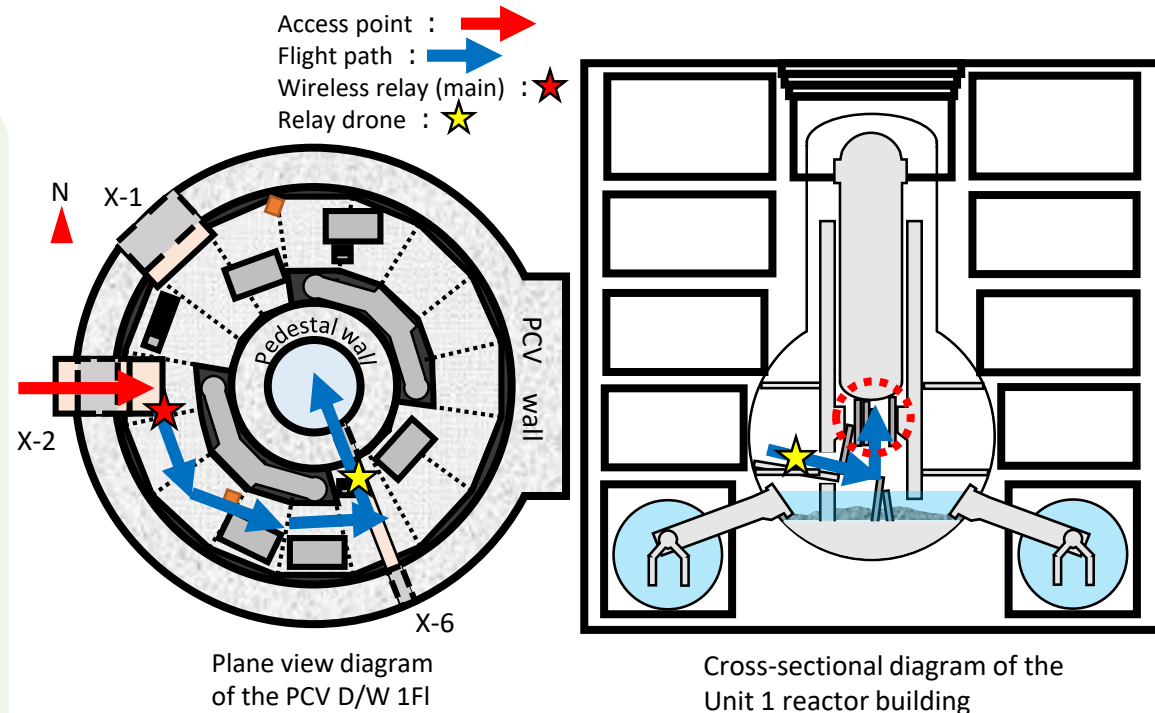
➔

Improved mini drones

<ul style="list-style-type: none"> ■ Improved photographic capabilities <ul style="list-style-type: none"> • Improved camera sensitivity • Better lights ■ Improved flight time ■ No significant changes in size or weight 	}	Same for all drones
<ul style="list-style-type: none"> ■ Wireless relays for cross-drone communication ■ Ability to take photographs above the drone ■ Dose measurements ■ Thermal camera ■ Specimen sampling 	}	Additional types

※Some are being tested/deliberated

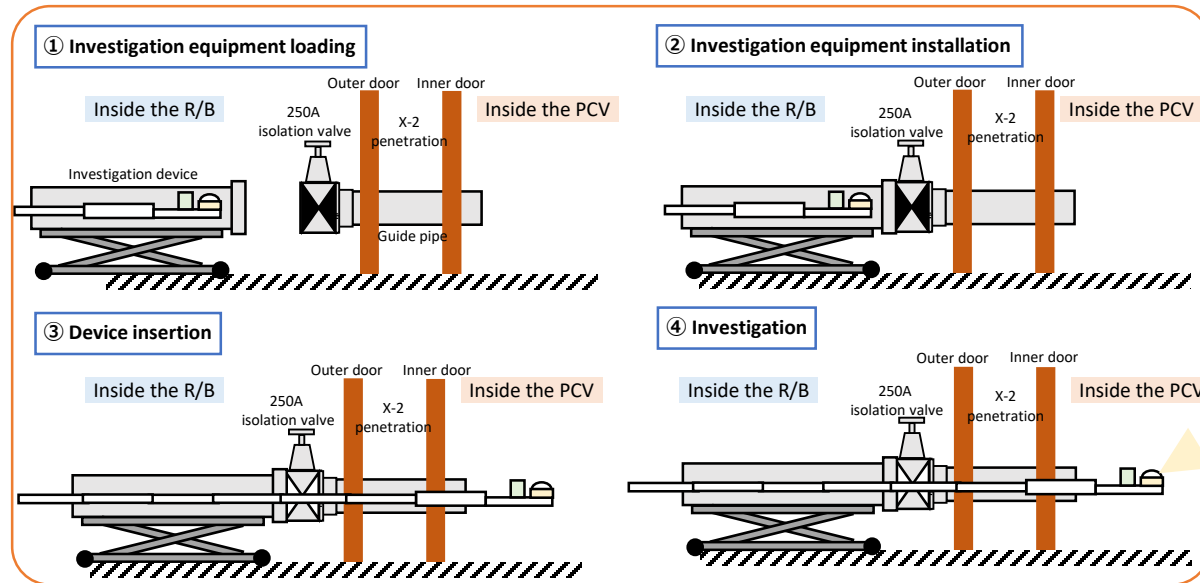
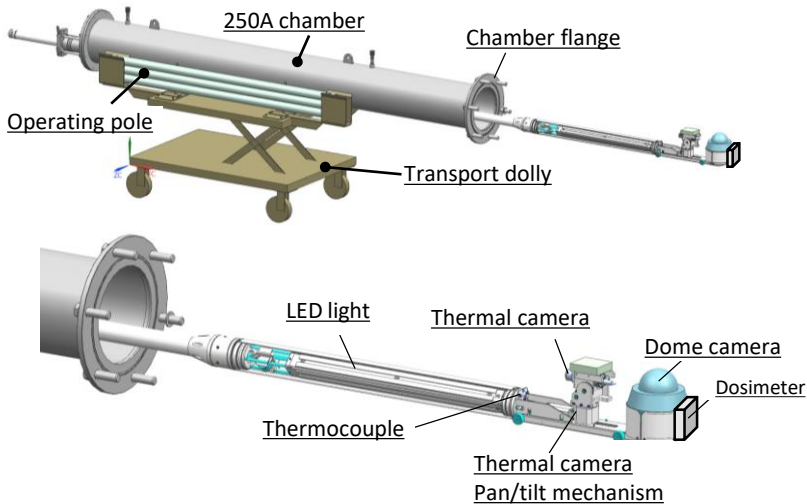
Small drone improvements



Concept diagram of investigating the area around the bottom of the RPV

3-2. Unit 1 PCV internal investigation plan: Investigation of the environment inside the PCV

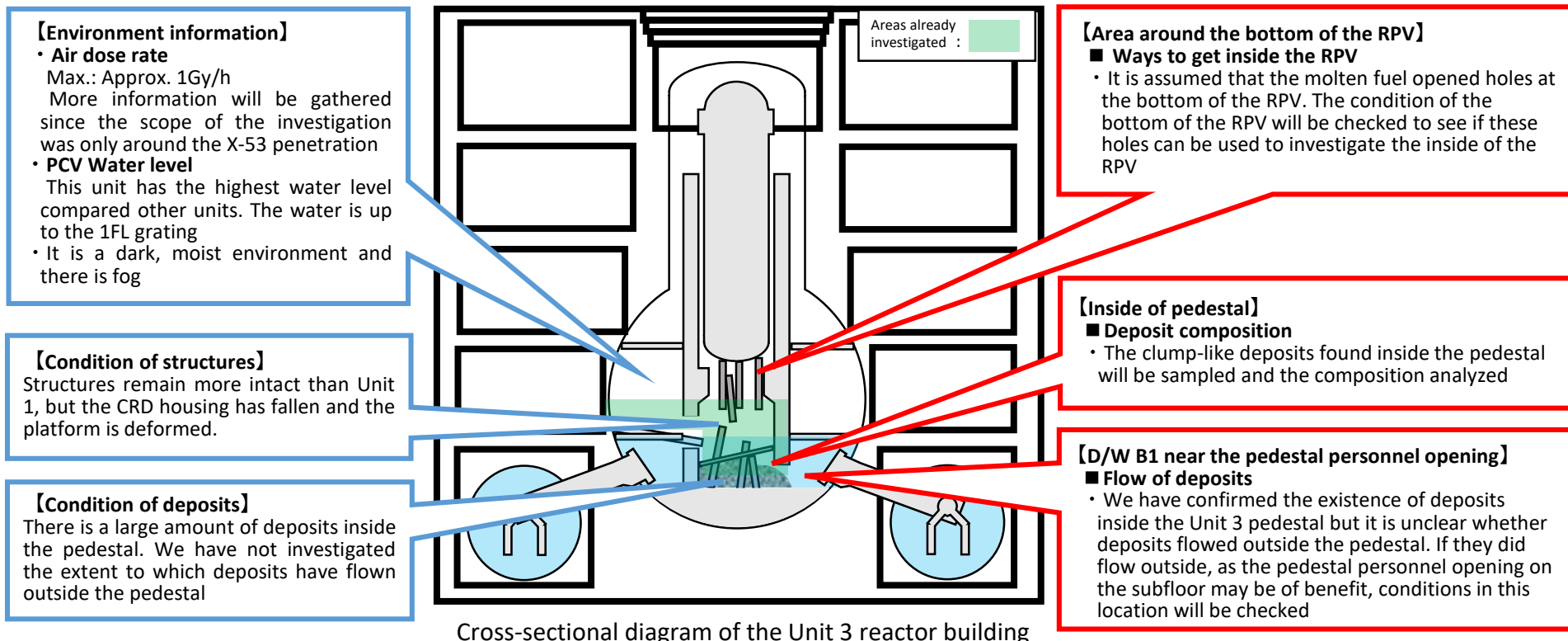
- We are currently lowering the water level in the Unit 1 PCV, therefore the **water level of the D/W has decreased since the last investigation**
- In conjunction with this decrease in water level, it is possible that some deposits may be partially exposed to the air, and **it is possible that there have been changes to air doses inside the PCV and the amount of fog**
- As air doses and the amount of fog will **impact M/U and training environment settings, as well as future investigation instrument design (lighting/cameras, etc.)**, information on these environmental conditions will be gained by implementing new investigations of the current environment inside the PCV
- **We will implement investigations around the X-2 penetration in order to acquire information on doses, temperatures and to take footage**
- We plan to take measurements during the summer (September) and winter (February) since fog is generally impacted by changes in temperature



	FY2024									
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar		
Device manufacturing	█									Implementation period to be adjusted based on summer investigation results
M/U and training		█		Suspended until winter			█			
Field work		Investigation Preparations █	Clean-up █				Investigation Preparations █	Clean-up █		

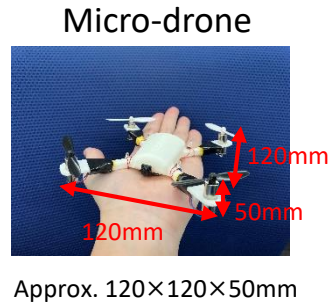
4. Unit 3 PCV internal investigation results and focus points

- At Unit 3 we are mainly investigating the **inside of pedestal**
- We have confirmed that deposits exist inside the pedestal. We have not examined conditions inside the RPV or the extent to which deposits flowed outside the pedestal
- In regards to the condition of primary structures, we have found that structures inside the pedestal have fallen and/or been damaged, but many structures have retained their original shape compared to Unit 1
- In order to obtain more information about deposits, going forward, we plan to conduct investigations about the **area around the bottom of the RPV**, which will eventually lead to an internal investigation of the RPV, information about the **D/W B1 (near the pedestal personnel opening)**, which we need to ascertain the extent to which deposits flowed, and information pertaining to the **composition of deposits**

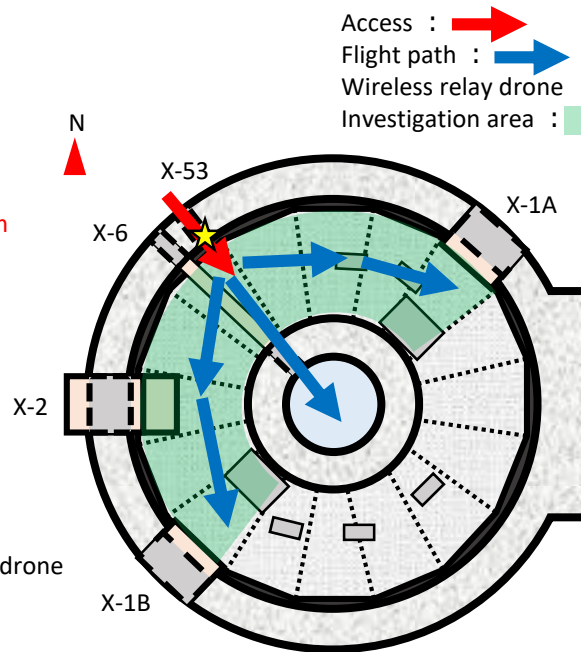
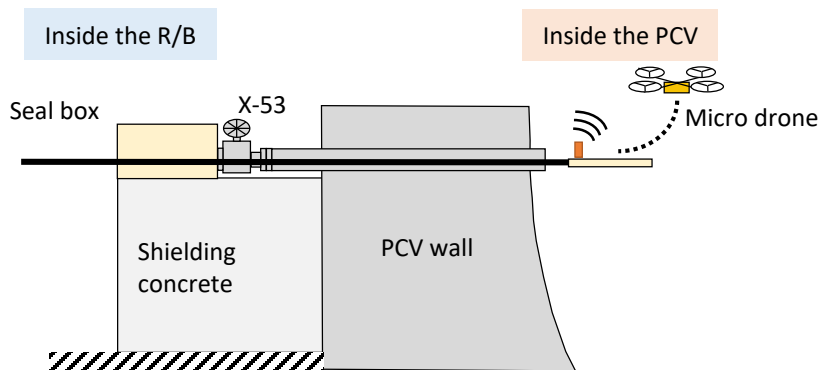


5-1. Unit 3 PCV internal investigation plan: Investigation using micro-drones

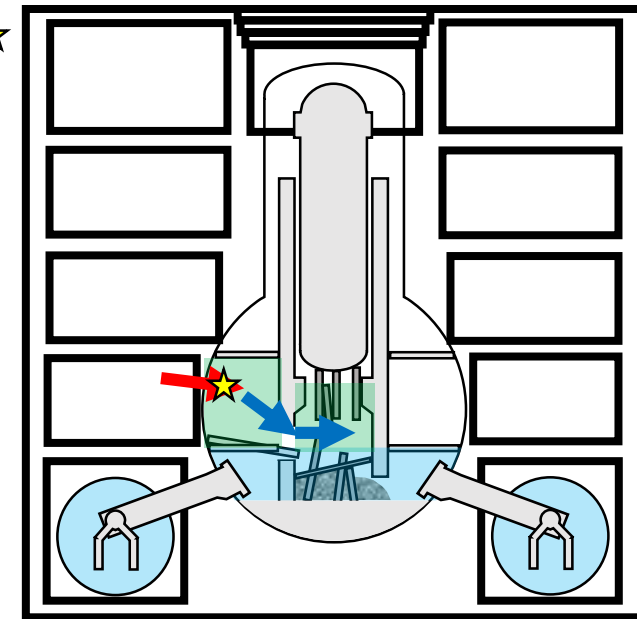
- Since the small X-53 penetration (Diameter: Approximately 140mm) provides the only access into the Unit 3 PCV currently, it is impossible to insert to the small drones that were used at Unit 1
- We are deliberating on constructing a new access route that will allow the use of the same type of drones that were used at Unit 1. In the meantime **micro drones will be used to perform investigations via the X-53 penetration**
- Although flight capabilities are not as good as the Unit 1 drones, **we should be able to acquire similar footage**
- **We plan to acquire more information about the area around the bottom of the RPV and the condition of main penetrations outside the pedestal (X-6, etc.)**



Size comparison



Plainview diagram of the PCV D/W 1FL



Cross-sectional diagram of the Unit 3 reactor building

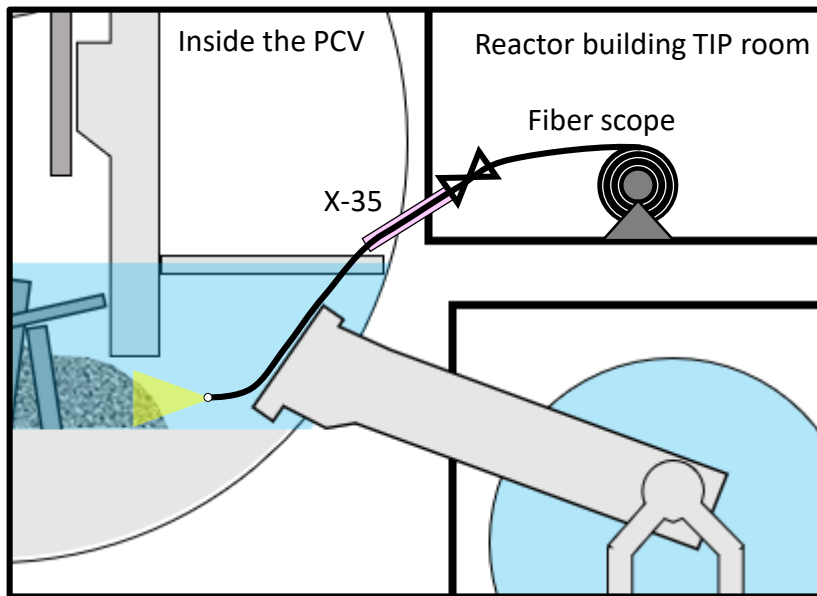
Scope of investigation (under deliberation※)

※ The scope of the investigation will be determined based upon mockup result

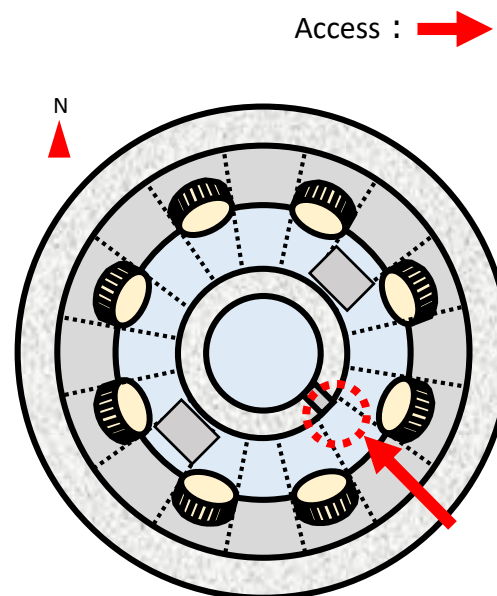
5-2. Unit 3 PCV internal investigation plan:

Investigation the extent of deposit flow outside the pedestal

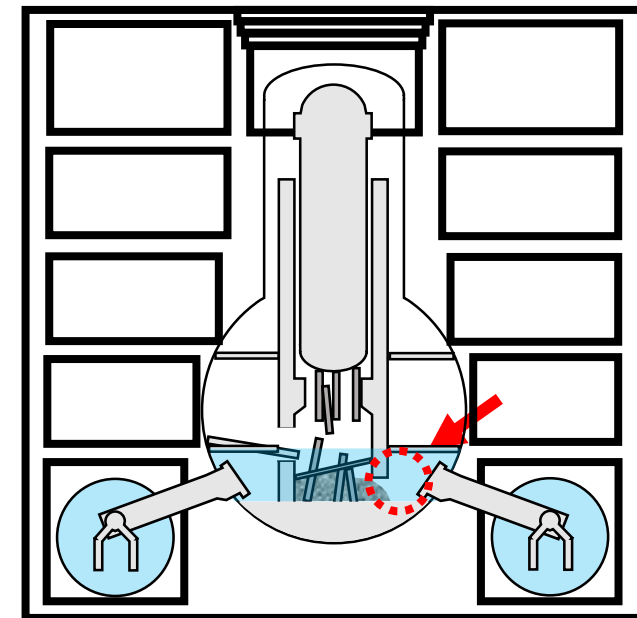
- It is possible that at Unit 3 deposits **flowed outside the pedestal through the pedestal personnel opening**
- As the pedestal personnel opening is in the same line as the penetration (X-35 penetration) for the Traversing In-Core Probe system (TIP), a **fiber scope will be inserted through the opening to examine the condition of deposits that flowed outside.**
- Since the X-35 penetration is an unconstructed access route, environment preparations, dose reduction measures, and boundary construction will be implemented



Concept diagram of the investigation to examine deposit flow conditions outside the pedestal



Plane view diagram of the PCV D/W B1



Cross-sectional diagram of the Unit 3 reactor building

Scope of investigation

[Reference] Using video footage obtained by the small drones: 3-D modeling

- The acquired footage was rendered using point cloud data (SfM^{*1}), mesh data (MVS^{*2}), and 3D scene data (Gaussian-Splatting^{*3})
 - **Point cloud data:** Expressed as a group of 3D points. **Size and position data can be acquired**
 - **Mesh data:** 3-D models can be created by connecting the point cloud data. In addition to size and position, **shape** can be ascertained
 - **3D scene data:** The footage is converted as is into a 3-D space. **This method allows the footage to be seen in a 3-D space with the same color spectrum**
- Each rendering method has the drawback **of deforming the target object or generating unneeded artifacts** due to clarity of the footage and obstacles
- In order **to extract only useful information from each rendering process and utilize it in a way that is helpful, ultimately a 3-D model will be created**
- The acquired information will be used to identify any obstructions to future fuel debris retrieval work and PCV internal investigations, and to deliberate device design

