

Fukushima Daiichi Nuclear Power Station Unit 2
RPV internal investigation using the existing reactor
water level instrument pipe

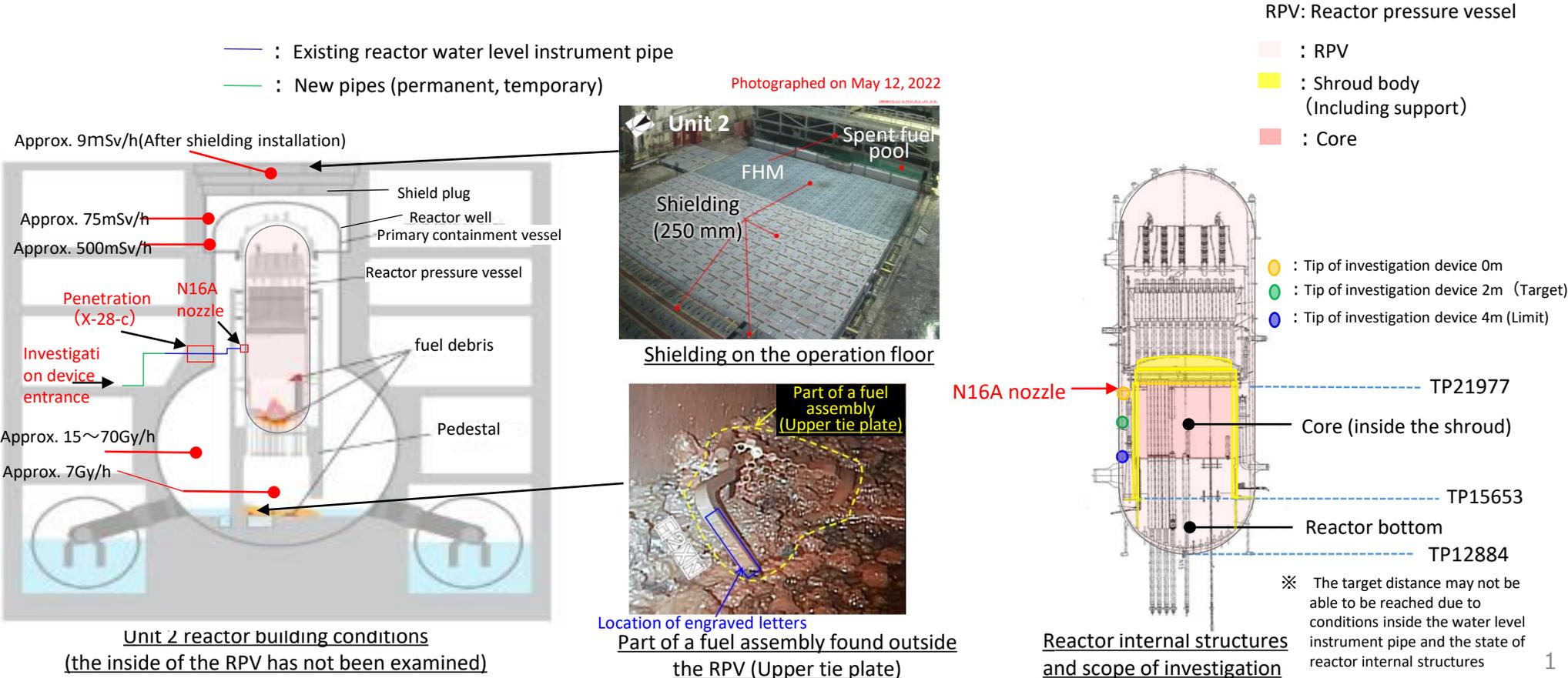
January 29, 2026



Tokyo Electric Power Company Holdings, Inc.

1. Background and objectives

- Investigations required to retrieve the fuel debris that remains in the core and at the bottom of the RPV have not been implemented.
- Firstly, an investigation of the inside of the RPV (outside the shroud) will be conducted using the existing Unit 2 reactor water level instrument pipe (N16A nozzle) that can be accessed quickly and does not require metalworking of reactor internal structures.
- The objective of the investigation is to use a radioactive resistant fiberscope to examine the condition of reactor internal structures and measure dose in order to acquire information needed to perform further investigations in the future.
- Quickly ascertaining information on conditions inside the RPV, which experienced high temperatures and high pressures during the accident, is important for smoothly proceeding with decommissioning.

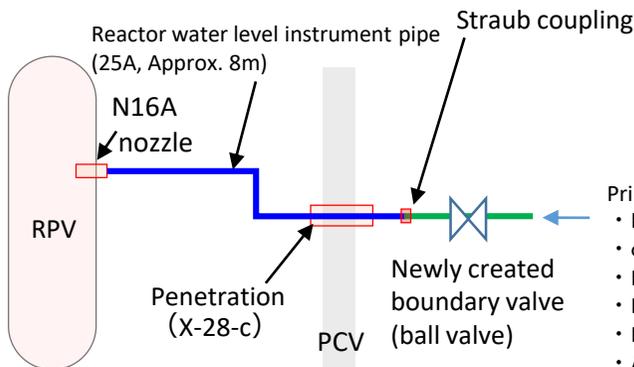


2. Plan overview

- In consideration of the field environment, the accessibility of the investigation device, the method for securing an RPV boundary, and objects that are visible, nozzle N16A, which is connected to the reactor water level instrument pipe, has been selected as the point of manual insertion of a fiberscope that will be used to perform an investigation of the inside of the RPV (first half of FY2026)
 - The development and manufacturing of a radiation resistant fiberscope^{※1} (which has a small internal dosimeter) that can pass through obstructions inside the pipe and access the inside of the RPV has been completed.
 - The investigation work area on the northwest side of the second floor of the reactor building has been prepared^{※2} and it has been confirmed that there are no significant clogs that would impact the investigation.
- Since the pipe must be cut in order to insert the fiberscope, after the investigation a new boundary will be created by newly installing a boundary valve in the pipe and the integrity of that boundary will be confirmed.

※1 Investigation device specifications are as noted below

※2 Shielding will be installed in order to reduce worker exposure during sampling from the pipes cleaning work



Primary specifications of the investigation device

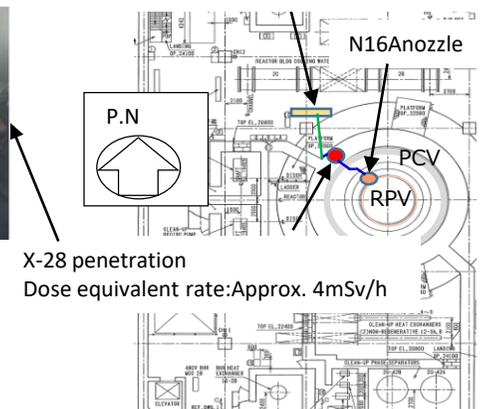
- Fiberscope 30m
- φ5mm and φ6mm composite
- Footage acquired through laser illumination
- No pan/tilt functions
- No focus function
- Angle of view:30 degrees
- Dose rate : Approx. 2.35kGy/h(no noise)
- Cumulative dose: Approx. 1.2MGy

Concept diagram of RPV internal investigation



PCV: Primary containment vessel
R/B: Reactor building

Work trestle
(extension of existing inspection trestle)
Dose equivalent rate: Approx. 4mSv/h



X-28 penetration
Dose equivalent rate: Approx. 4mSv/h

Unit 2 R/B 2nd floor

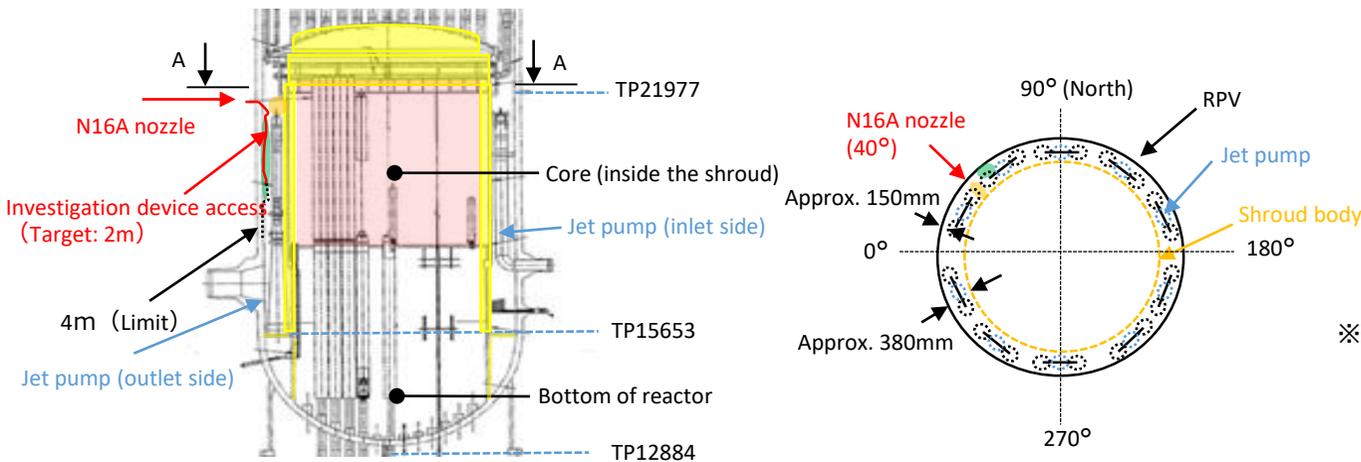
3. Anticipated accomplishments

- The results obtained (footage, dose data, method feasibility) will be reflected in the decommissioning plan and enable us to move steadily forward with decommissioning.

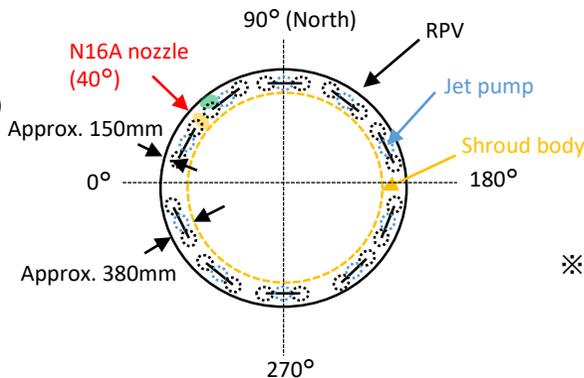
Anticipated accomplishments		How they will be leveraged for decommissioning
Footage	<ul style="list-style-type: none"> Significant deformation or tilting of reactor internal structures (shroud, etc.) Existence or non-existence of debris around the shroud and a water surface Status of reactor cooling water injection by the feed water system or core spray system 	<ul style="list-style-type: none"> Information used to decide the methods employed for the next investigation and retrieval Used for accident analysis (including predictions on how the accident unfolded at other units) Used to examine the effectiveness of cooling
Doses (γ-rays)	<ul style="list-style-type: none"> Dose distribution inside the reactor (at the top, middle, and bottom of the shroud) 	<ul style="list-style-type: none"> Used to estimate remaining fuel Reflected in the specifications of equipment used for investigations and during retrieval
Method feasibility	<ul style="list-style-type: none"> Practical application of investigation equipment, such as fiberscopes, etc., in the field Practical application of boundary equipment, such as straub couplings and water seal boundaries, etc., in the field Practical application of manual work (freezing, investigation tasks) in the field 	<ul style="list-style-type: none"> Used to deliberate the same actions at other units Repurposing for other investigations, the removal of obstructions, retrieval

- The plan is to check the conditions inside the reactor near N16A nozzle and lower the fiberscope to the bottom of the reactor as far as possible.

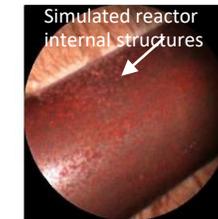
- : Scope of visual confirmation (if the tip of the investigation device reaches the vicinity of the N16A nozzle)
- : Scope of visual confirmation (if the tip of the investigation device reaches a point 2 meters below the N16A nozzle)
- : Shroud body (including supports)
- : Core



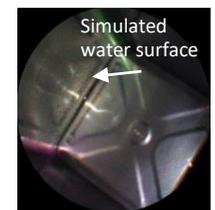
Investigation device access route and scope of visual confirmation (estimated)



The scope of visual confirmation (estimated) and cross sectional diagram A-A



Anticipated footage (Near the N16A nozzle)



Anticipated footage (4m below the N16A nozzle)

- ※ Footage confirming the visibility of the investigation device: After the tip of the investigation device reaches the inside of the RPV it will be vertical around the vicinity of the N16A nozzle, but because bends will develop in the fiberscope as it maneuvers around obstructions inside the pipe, at the point two meters below the N16A nozzle, it may bend to face north of the nozzle.

4-1. Task details (pre-investigation preparations~investigation)

- Since the pipe must be cut in order to insert the fiberscope, after the investigation a new boundary will be created by installing a boundary valve in the pipe and the integrity of that boundary will be confirmed.
- In order to reduce the risk of gasses from inside the RPV leaking into the work area, the pipe will be frozen and the pressure of the PCV reduced when installing the new boundary valve.

① Freezing and pipe cutting

- The pipe will be flooded with filtered water. A freezing jig will be used to completely freeze the pipe after which the existing valve will be cut out with a pipe cutter.
- The inside surface of the pipe shall be examined to ensure that there are no adhesions that may impact the investigation.



② installation of a new boundary valve (permanent equipment)

- The new boundary valve will be joined using a strap coupling.
- A leak test (atmospheric pressure) will be performed with the ice plug in place.



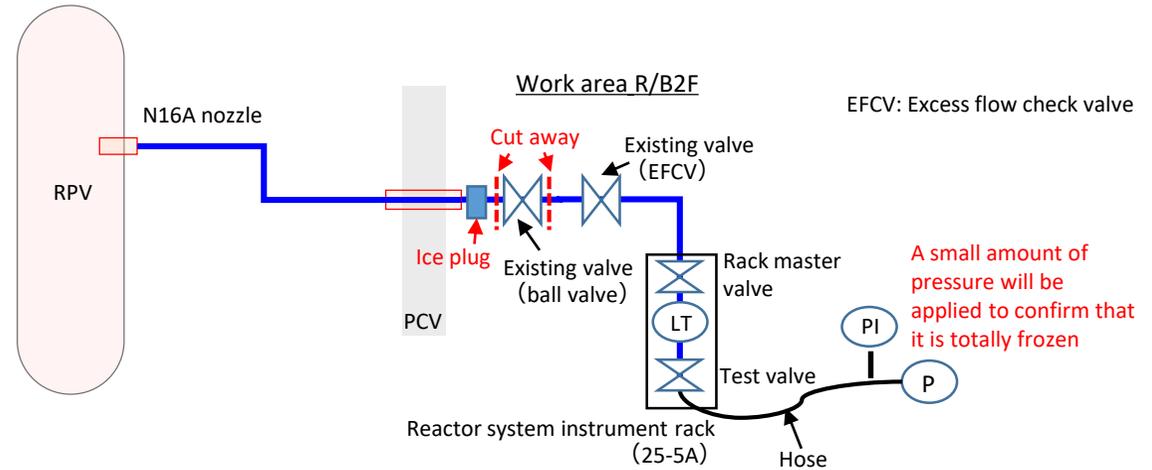
③ Installation of insertion spool (temporary)

- The inside of the existing pipe will be cleaned.
- During the investigation an insertion spool would be installed in order to from a water seal boundary.
- A leak test (atmospheric pressure) of the temporary pipe will be performed
- A water seal boundary will be constructed.

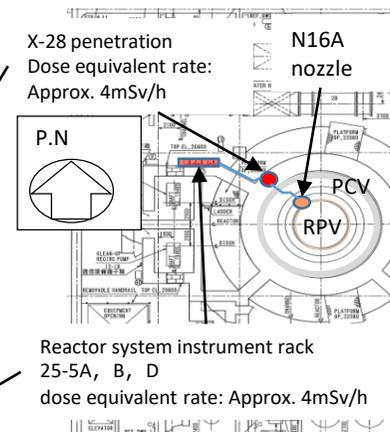


④ RPV Internal investigation (insertion and recovery)

- The new boundary valve will be opened and the integrity of the water seal boundary checked.
- An investigation device will be inserted up to the flow limiting orifice to examine the inside. If there are no abnormalities, the device will be inserted up to the N16A nozzle.
- The investigation will begin when the device reaches the N16A nozzle.
- After the investigation the investigation device will be withdrawn inside the investigation device recovery unit



Concept diagram of pipe freezing (X-28-c)



Unit 2 R/B 2nd floor



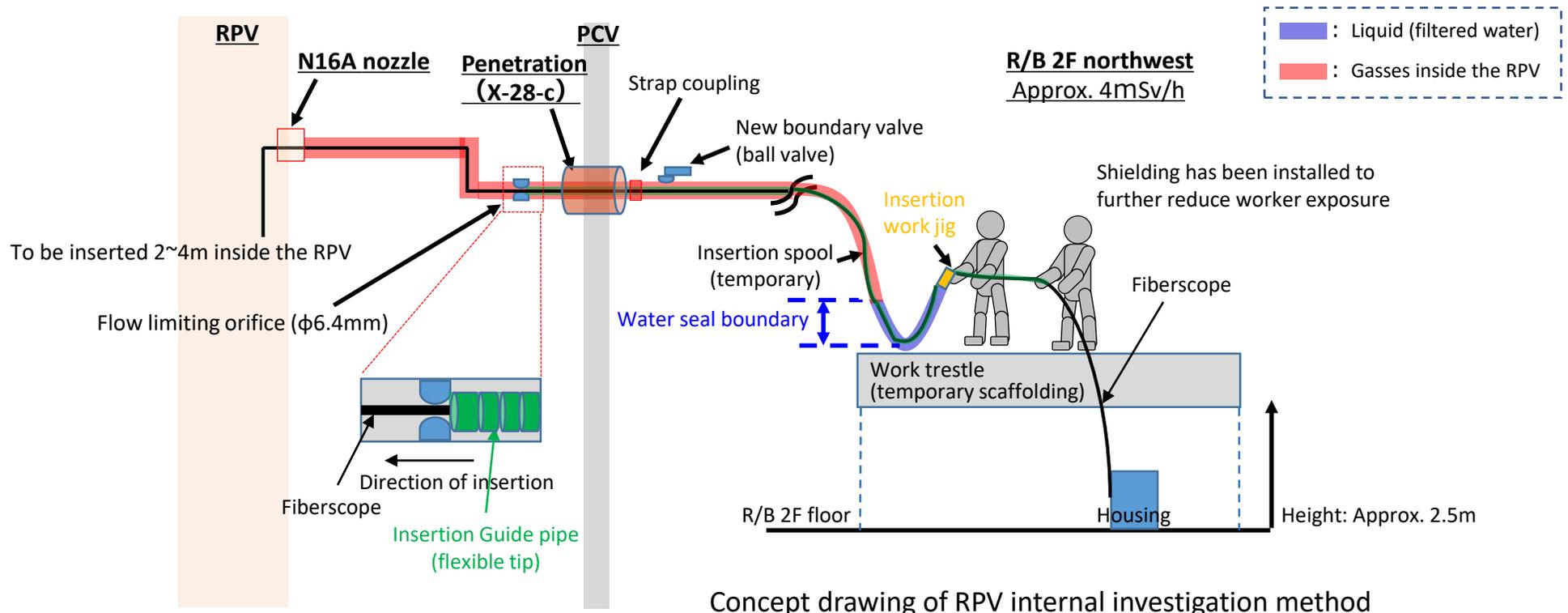
Refrigerant (dry ice + alcohol) replace regularly



A tool that does not create sparks has been chosen

4-2. Task details (investigation)

- While the investigation is underway, a water seal boundary will be maintained and the pressure of the PCV will be reduced in order to prevent gasses inside the RPV from leaking into the work area.
- From the top of the work trestle, an insertion work jig, which is a tool for assisting insertion of the investigation device, will be used to manually insert the insertion guide pipe (flexible tip, coil spring) and investigation device simultaneously. (After passing through the flow limiting orifice, only the fiberscope will continue to be inserted)
- After reaching the inside of the RPV the investigation device will be used to touch reactor internal structures and there is a high possibility that it will be subject to $\alpha\beta$ contamination, so in order to ensure worker safety, whether the device can be recovered or not will be decided at each step of the way as the device is withdrawn into the investigation device recovery unit.



5. Schedule (planned)

- Preparations are underway with the intent of commencing the RPV internal investigation during FY2026.

	FY2025	FY2026
Work location	2 nd half	1 st half
Off-site	Mastery M/U (Pre-investigation preparations~investigation)	
Inside Unit 2 R/B	Preparations	
	Freezing/pipe cutting, new boundary valve installation, etc. (permanent equipment), insertion spool (temporary) installation	
		RPV internal investigation

Schedule may be revised in conjunction with work progress

(Reference 1) Unit 2 investigation results to date

- It is highly possible that much fuel debris exists at the bottom of the reactor
- In light of the results of PCV internal investigations to date, we assume that there is an opening of approx. $\phi 14\text{cm}$ in the outer periphery.

CRD Housing

Fallen grating 1 (January 2017)

Enlargement

In foreground from the position of the camera

CRD flange

Hanger rod

Support bar

In the background from the position of the camera

Directly above fallen grating 1

In the background from the position of the camera

Hanger rod, support bar : Support that would take the load of the CRD (control rod drive mechanism) housing if it were to fall

Part of fuel assembly (upper tie plate)

Location of engraved letters

Conditions on the platform

(Reference) Unit 5 CRD housing

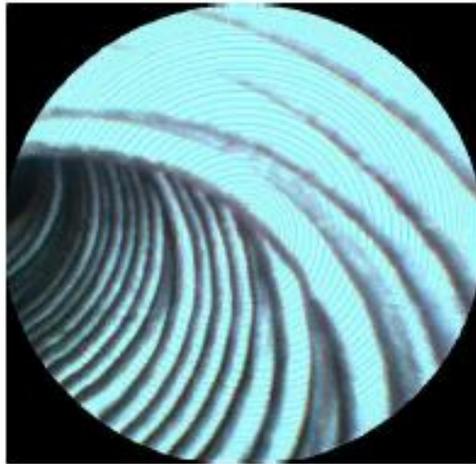
Legend:
 - Adhesions (dotted line)
 - Fallen grating (red)
 - Intact grating (blue)
 - Direction of camera (red arrow)

(Reference 2) Investigation device visibility

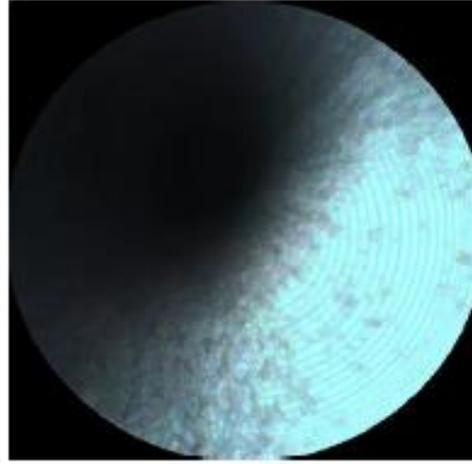
■ Visibility confirmation

① After passing through the insertion spool, we have confirmed that footage can be obtained without being impacted by the water seal.

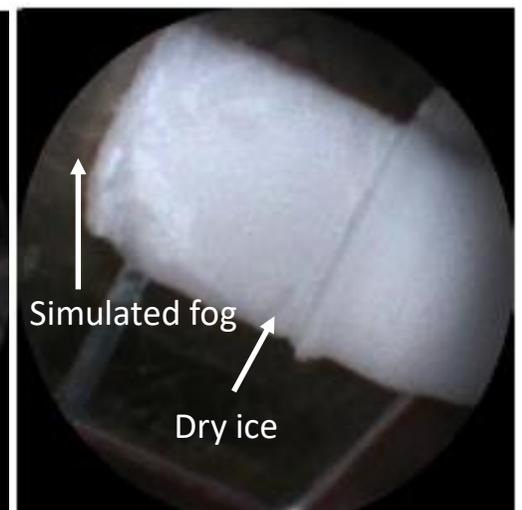
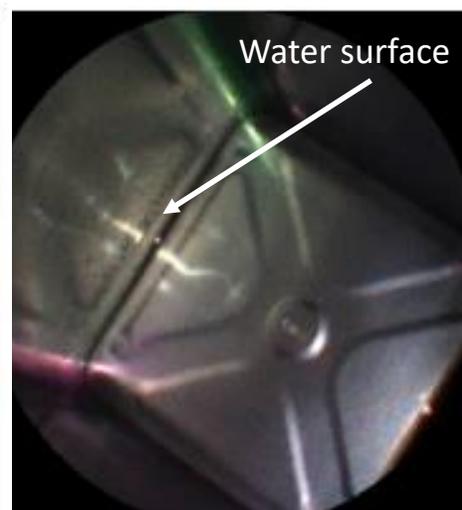
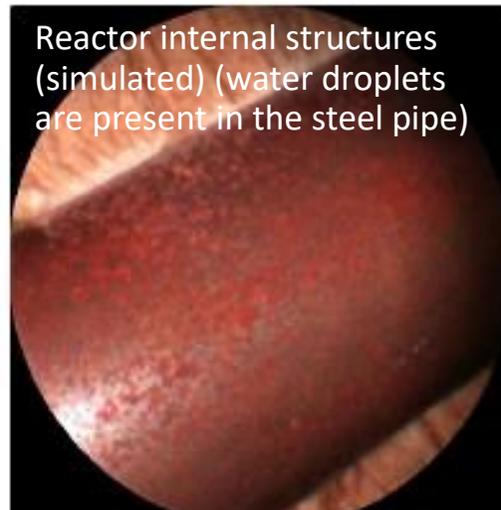
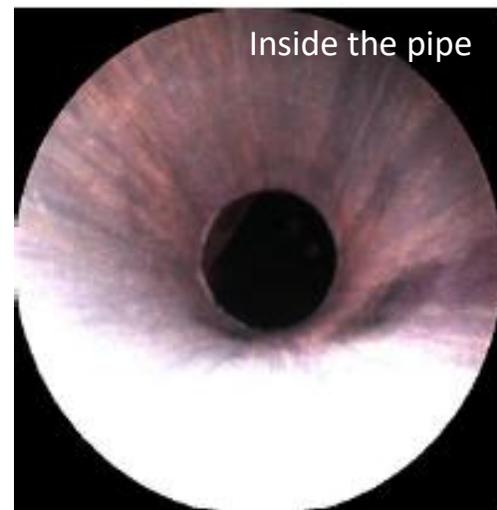
Right in front of the orifice (inside the guide pipe)



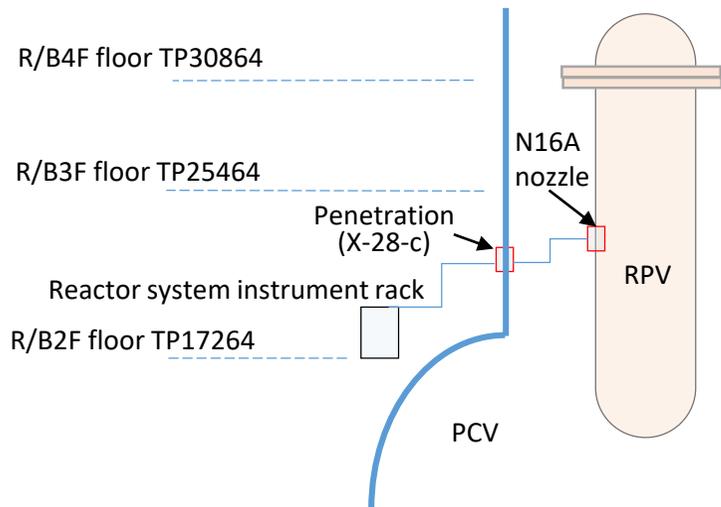
After passing through the orifice (inside the pipe)



② We have confirmed that footage of reactor internal structures (simulated) can be obtained in the dark, foggy environment.



(Reference 3) Penetration and nozzle position



Elevation diagram

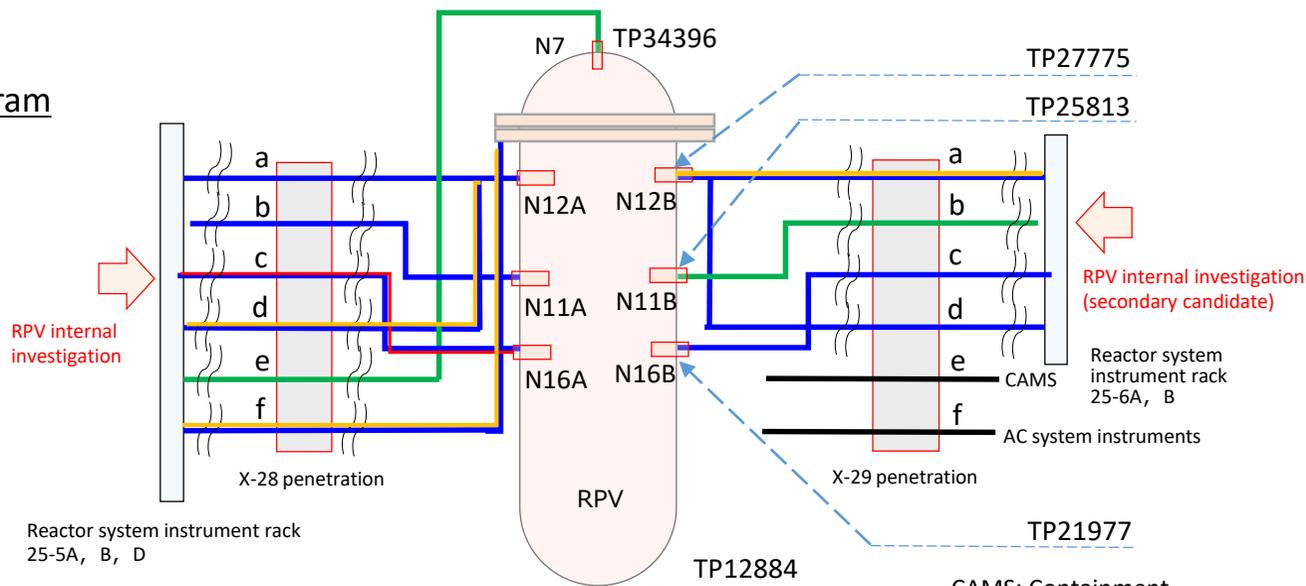


X-28 penetration

- Blue line: Pipe cleaning location
- Green line: Nitrogen injection location (no work)
- Red line: Sampling/pipe head pressure confirmation location
- Yellow line: Sampling location
- Black line: No work



Reactor internal structures (jet pump) test specimen



Detailed schematic of penetration and nozzle positions

CAMS: Containment atmospheric monitoring system
AC: Activated carbon system

(Reference 4) Equipment comparison

	Prior to equipment renovations	After the investigation
Contained fluids	Liquid (filtered water)	Gasses inside the RPV (nitrogen)
Usage	Containment function	Containment function Installation of new cooling water injection point and temperature gauge (under deliberation)
Equipment configuration		

(Reference 5) Anticipated risks and countermeasures (investigation risks)

Primary work step	Risk (large)	Risk (moderate)	Risk (small)	Countermeasure	Detecting and handling abnormalities
Investigation device insertion	Inability to access the inside of the RPV	Damage to access route	<ul style="list-style-type: none"> The RPV access route pipe, nozzle, or reactor internal structures are damaged preventing access to the inside the RPV 	【Field countermeasures】 <ul style="list-style-type: none"> The water head pressure inside the pipe is checked and it is predicted whether or not there are abnormalities along the access route up to the nozzle. 	<ul style="list-style-type: none"> Water head pressure checked again when confirming that the pipe is full of water during freezing.
		Clog	<ul style="list-style-type: none"> Access impossible due to adhesions inside the pipe 	【Field countermeasures】 <ul style="list-style-type: none"> The pipe has already been flushed from the reactor instrument rack side, but just to be safe, after the pipe is frozen and cut, the inside of the pipe will be flushed with filtered water. <u>Inside the ball valve that is cut away shall be examined to estimate conditions inside the pipe.</u> 	<ul style="list-style-type: none"> After reaching the flow limiting orifice, the tip of the investigation device will be removed from the guide pipe in order to check conditions inside the pipe.
		Investigation device gets caught on obstructions inside the pipe (elbows, safe ends, weld lines, etc.) or reactor internal structures	<ul style="list-style-type: none"> Investigation device gets caught on obstructions inside the pipe (elbows, safe ends, weld lines, etc.) or reactor internal structures 	【Device countermeasures】 <ul style="list-style-type: none"> An unused investigation device that can be easily inserted will be used and <u>lubricant applied.</u> Mastery M/U that simulates the same obstructions found in the field (elbows, etc.) used. (There are a total of four elbows) 	<ul style="list-style-type: none"> If recovery is impossible the task will be suspended and <u>methods for handling discussed.</u> The water seal will remain as a boundary in the interim. If it is decided that the investigation must be terminated, the pipe will be frozen again and the investigation device (including the guide pipe) cut away at the flange after which a blind flange will be attached.
		The end of the guide pipe, which is a loose part, falls off inside the pipe preventing insertion	<ul style="list-style-type: none"> The end of the guide pipe, which is a loose part, falls off inside the pipe preventing insertion 	【Device countermeasures】 <ul style="list-style-type: none"> <u>Construct the flexible end of the guide tube so it does not come off easily.</u> Conduct mastery M/U. 	
Freezing/cutting out of the valve		Foreign matter inclusion	<ul style="list-style-type: none"> Pipe cut pieces enter the pipe preventing insertion 	【Field countermeasures】 <ul style="list-style-type: none"> Check performed to confirm that burrs from pipe cutting <u>have not fallen into the pipe, and a strap coupling is fitted.</u> 	<ul style="list-style-type: none"> Double checks used to detect abnormalities
Investigation device insertion	Inability to acquire footage from inside the RPV	Worsening of visibility	Adhesions inside the pipe	Same as measures noted above to handle adhesions inside the pipe.	<ul style="list-style-type: none"> If there are adhesions, the priority will be changed to obtaining data using the investigation device's internal dosimeter. Reactor cooling water from the feed water system will be returned in an attempt to dislodge the adhesions.
			Environment inside the reactor (fog, moisture, water droplets, darkness, radiation resistance)	【Device countermeasures】 <ul style="list-style-type: none"> Laser type employed in consideration of darkness. No noise at radiation resistance of around 1.2MGy (cumulative) and a dose rate of 2.35kG/h. 【Field countermeasures】 <ul style="list-style-type: none"> <u>Reactor cooling water injection will be switched from the feed water system to the core internal spray system.</u> 	<ul style="list-style-type: none"> An attempt will be made to use gravity to make the water droplets fall off by turning the end of the investigation device vertical near the nozzle. Video images will be processed after the investigation. (Investigation continued)