Status of Deliberations on Fuel Debris Removal

December 19, 2019

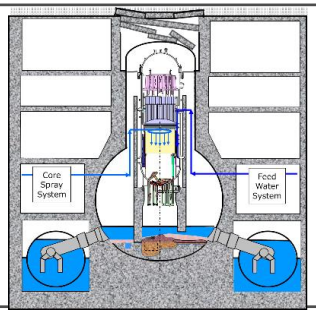
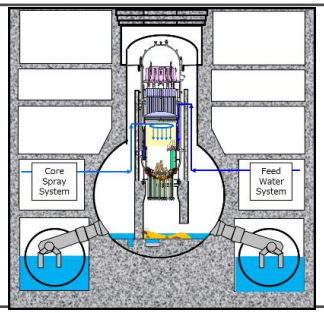
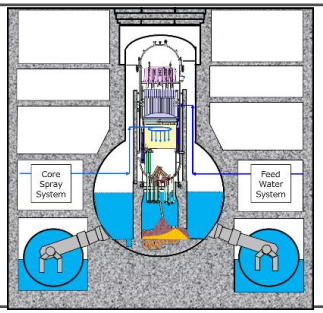
TEPCO

Tokyo Electric Power Company Holdings, Inc.

Info about the first unit from which fuel debris shall be removed

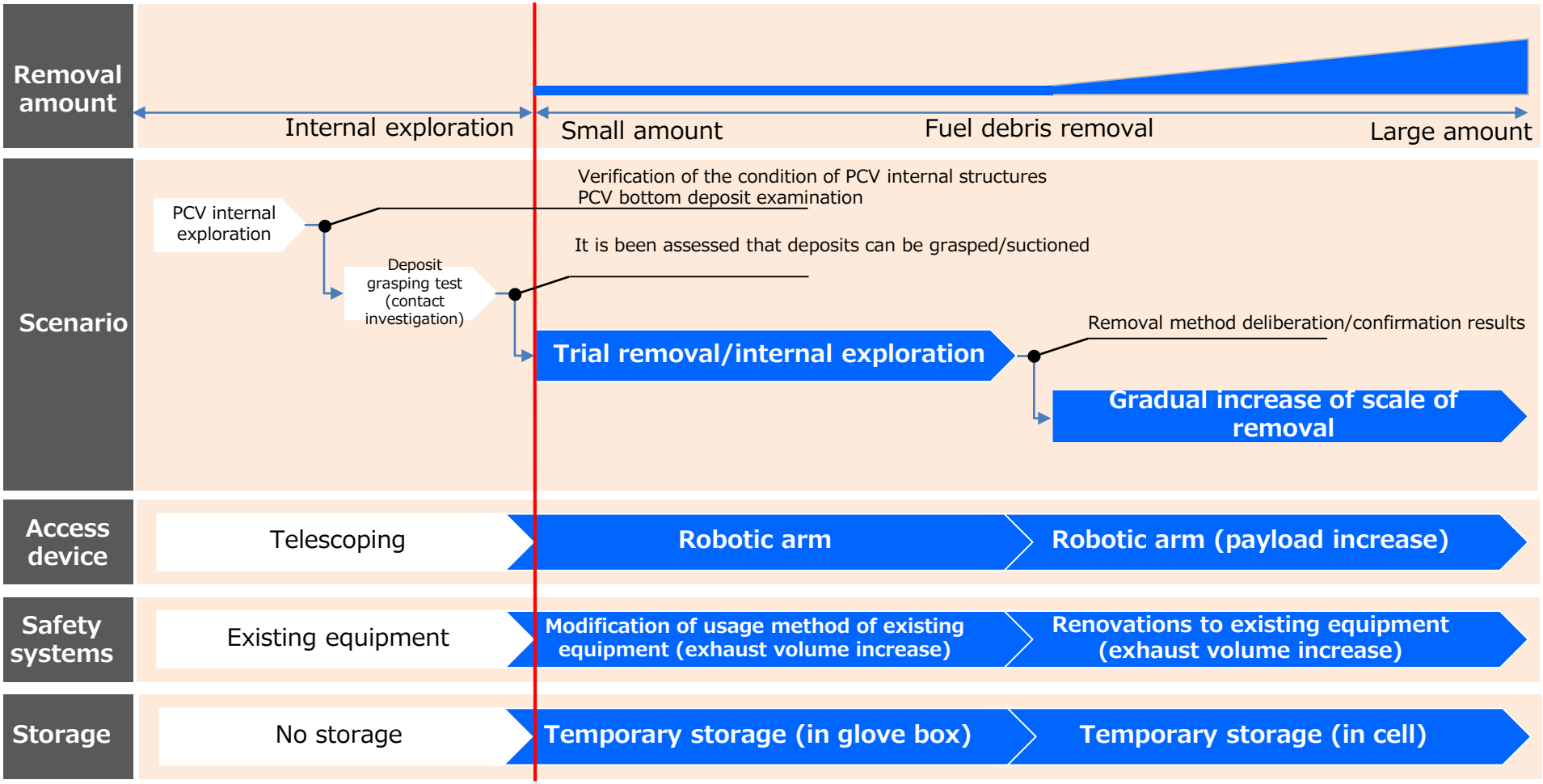
- In the Technical Strategic Plan 2019 for the Decommissioning of the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Company Holdings, Inc. (Nuclear Damage Compensation and Decommissioning Facilitation Corporation), it was concluded that Unit 2 is most suitable for commencing fuel debris in a safe, steady and quick manner from the perspective of optimizing the entire decommissioning process.
- Fuel debris removal has been examined while considering assumptions about the distribution of fuel debris in each reactor, the progress with internal explorations of the primary containment vessel (hereinafter referred to as, "PCV"), improvements to the building environment, and future plans for work in the vicinity of the buildings, etc.
- Unit 2 has been deemed suitable as the first unit from which fuel debris shall be removed in consideration of the progress with internal explorations of the PCV, the progress with environmental improvements made to the first floor of the reactor building (hereinafter referred to as, "R/B"), and the potential to engage in this task simultaneously with the removal of spent fuel.

Comparison of each unit

			Unit 1	Unit 2	Unit 3
Assumed fuel debris distribution	Concept diagram				
	Inside the RPV		Little debris	Much debris	Some debris
	Bottom of the PCV	Inside the pedestal	Majority of debris	Certain amount of debris	Much debris
		Outside the pedestal	Large possibility of debris	Small possibility of debris	Possibility of debris
Progress of PCV internal explorations (inside the pedestal)			Unimplemented	Telescoping exploration device ①visual ②dose measurements ③deposit examination	Submersible ROV ①visual ②dose measurements
Building environment improvements			R/B south side dose reductions	(further dose reductions)	R/B first-floor dose reductions PCV internal water level reduction
Radioactive material containment function			Hermetic seal in good condition	Hermetic seal in good condition	Hermetic seal in poor condition
Status of spent fuel removal at the time of debris removal			Schedule needs adjusting since debris removal will interfere with spent fuel removal preparations	No interference expected	Fuel removal should be completed

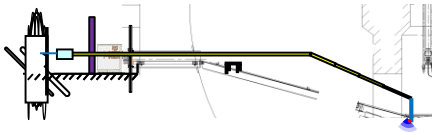
Conceptual diagram showing how we shall proceed with the removal of fuel debris from Unit 2

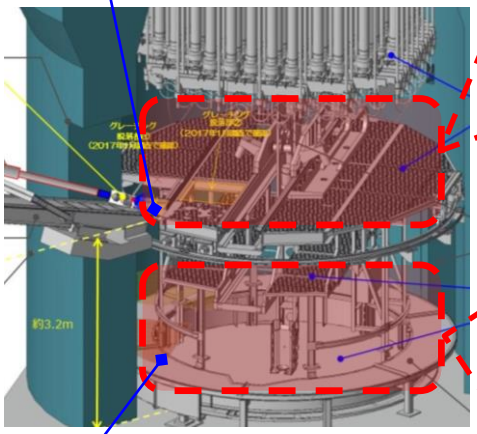
- We will engage in this process step-by-step starting with trial removal of fuel debris. Based on these tests we shall examine/refine the removal method and then gradually enlarge the scale of removal wok.



Achievements of Unit 2 PCV internal explorations to date

- We have confirmed that the areas above the platform inside the pedestal and the lower levels can be accessed
- We have confirmed that there are deposits above the platform and in the lower levels, and that some of these deposits can be grasped and moved





② Overview diagram of inside of pedestal

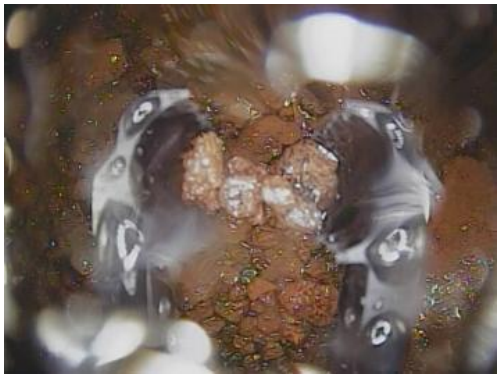
January 2018

Results of exploration above the platform inside the pedestal

Results of exploration of the lower levels inside the pedestal

February 2019

Grasping deposits above the platform (Near ① on the overview diagram)



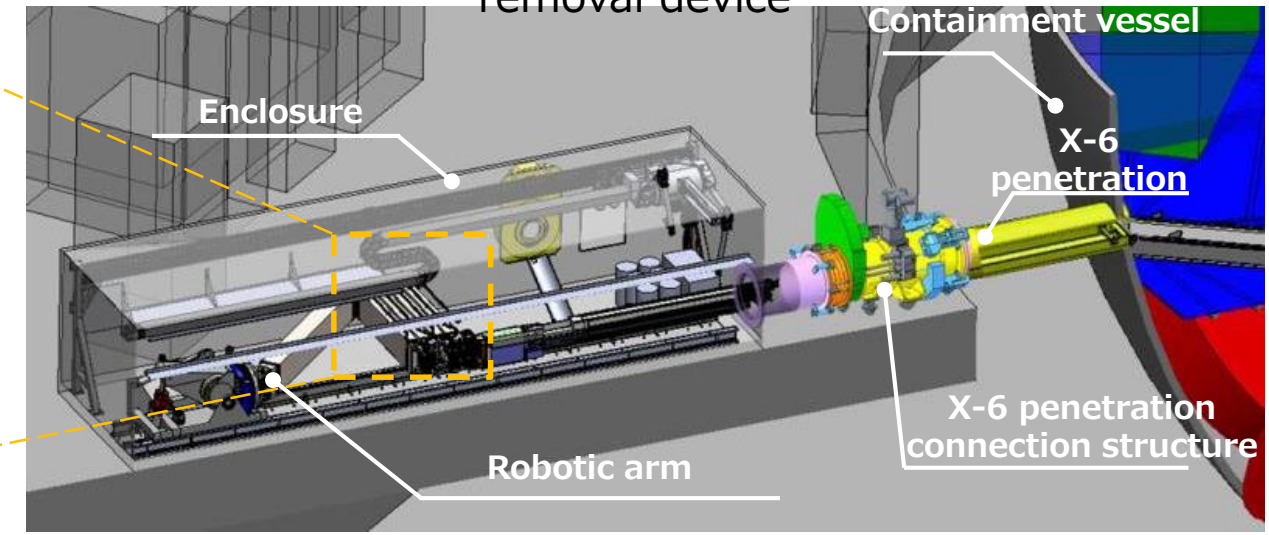
Grasping deposits on the lower level (Near ② on the overview diagram)

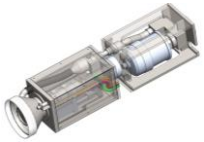
Access device/debris recovery device (open air/side access)

- A robotic arm will be used to remove the fuel on a trial basis
- After these tests the removal method will be examined/refined, and the same mechanism shall be employed as we increase the scale of removal

Photograph: Robotic arm

Diagram: Concept diagram of fuel debris removal device

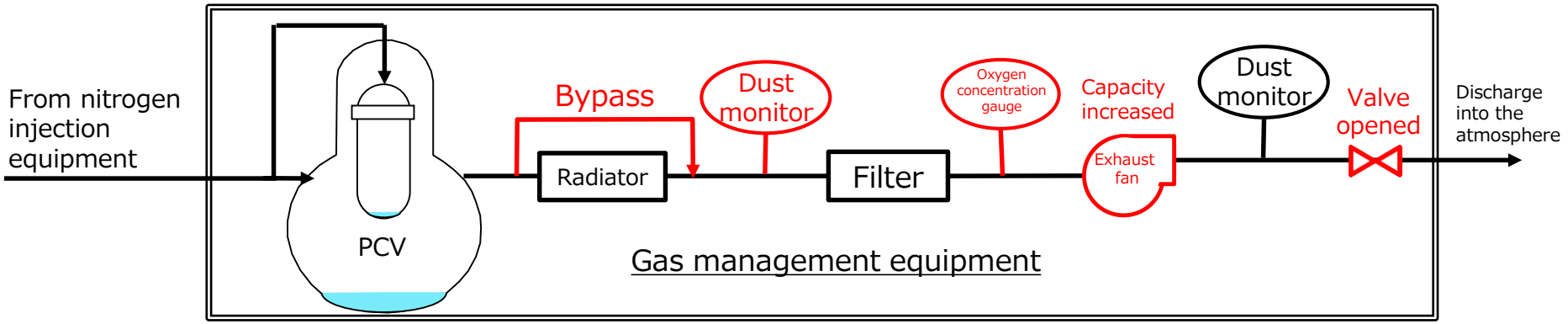


Trial removal		Scale of removal gradually increased	
Access device	**Debris recovery device**	**Access device**	**Debris recovery device**
	 Metal brush prototype; Vacuum container prototype		 Gripping tool prototype;  Excavation and recovery tool prototype

※This slide shows developments made by the International Research Institute for Nuclear Decommissioning (IRID)

- Monitoring functions enhanced by changing how existing gas management equipment is used and by renovating such equipment, and measures implemented to prevent dust from migrating outside of the PCV

Overview	Changes to usage methods/equipment renovations
Enhancing monitoring functions	・Addition of exhaust measurement equipment －Filter inlet dust monitor －Oxygen concentration gauge
By increasing the volume of exhaust that passes through the filter the amount of dust from inside the PCV that migrates outside of the PCV without passing through the filter can be suppressed	・System pressure loss reduced by radiator bypass and opening valves, etc. ・Exhaust fan capacity increased ・The way the pipes/ducts are turned will be changed in conjunction with the above renovations



Fuel debris storage

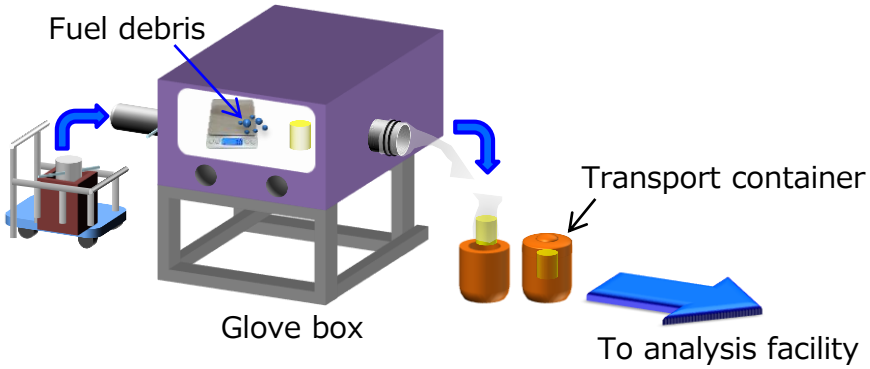


Diagram: Concept diagram of temporary storage during trial removal

- Removed fuel debris will be measured and temporarily stored in a glove box
- Fuel debris for analysis shall be put in a transport container and sent to the analysis facility

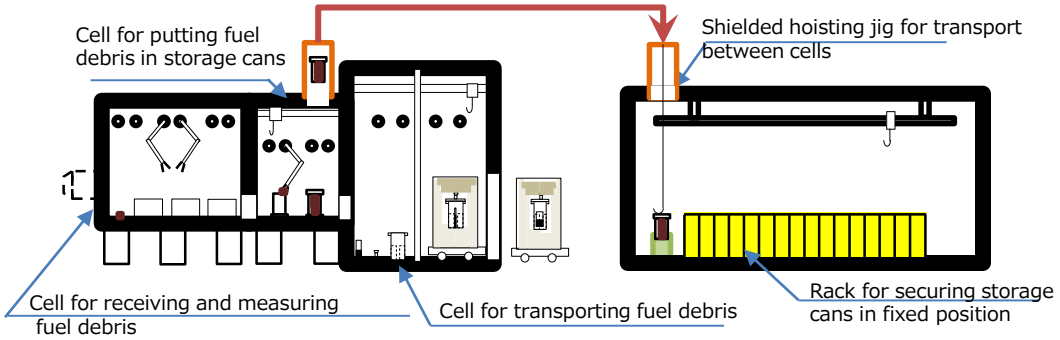


Diagram: Concept diagram of temporary storage after the scope of removal has been gradually enlarged (left: receiving/delivery cell, right: temporary storage cell)

- Removed fuel debris shall be measured in the receiving/delivery cell
- After this, the debris will be put in a temporary storage can in the receiving/delivery cell, and temporarily stored in a temporary storage cell
- Fuel debris for analysis shall be put in a transport container and sent to the analysis facility

Future countermeasures (constructing an access route)

- Deposits and obstructions have been found inside the X-6 penetration, which is to be used as an access route to Unit 2
- We are considering using an abrasive waterjet (hereinafter referred to as, “AWJ”) in order to remove the obstructions but we fear the dispersion of dust in the same manner that was seen at Unit 1
- We are examining methods for removing obstructions during the construction of the access route that will not disperse dust, as well as methods for carefully engaging in this task that do not impact the surrounding environment

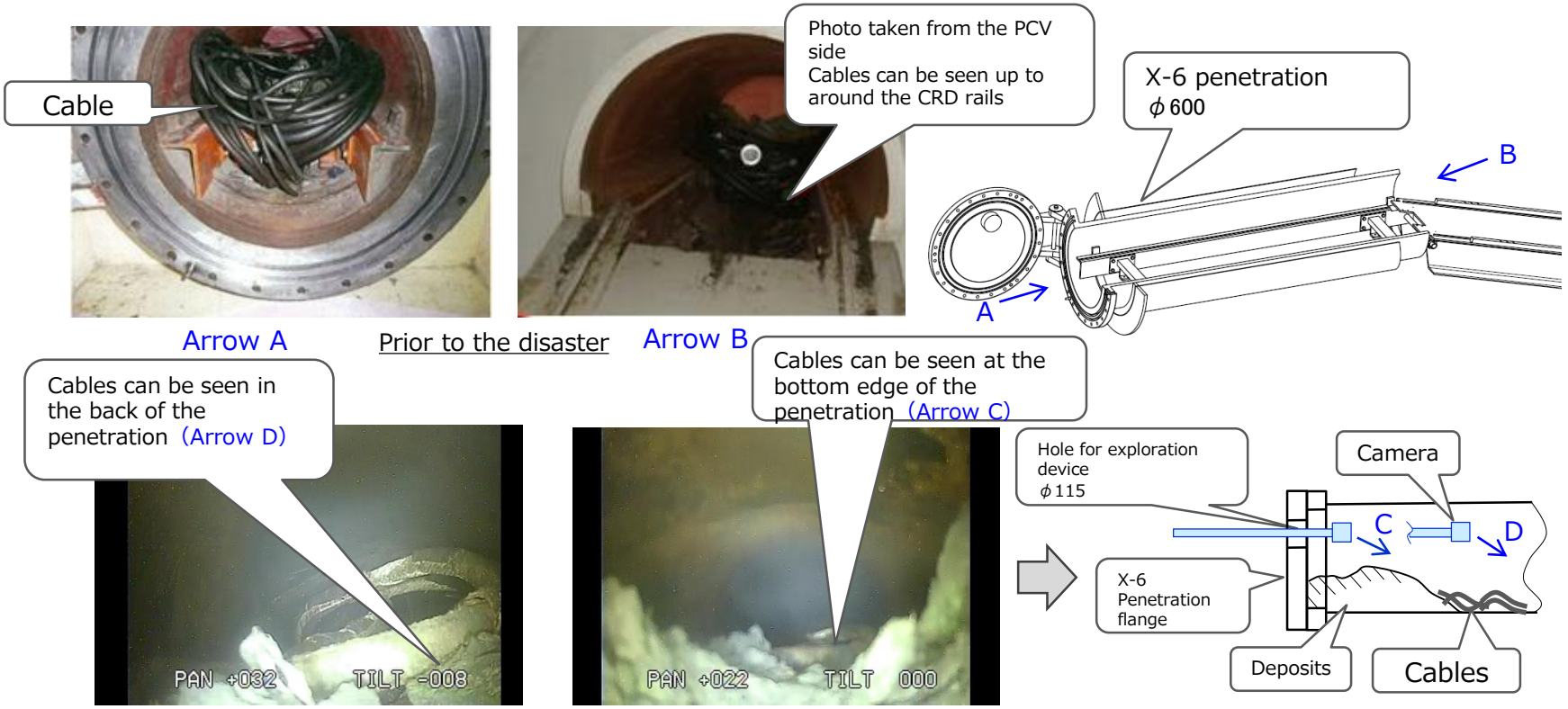
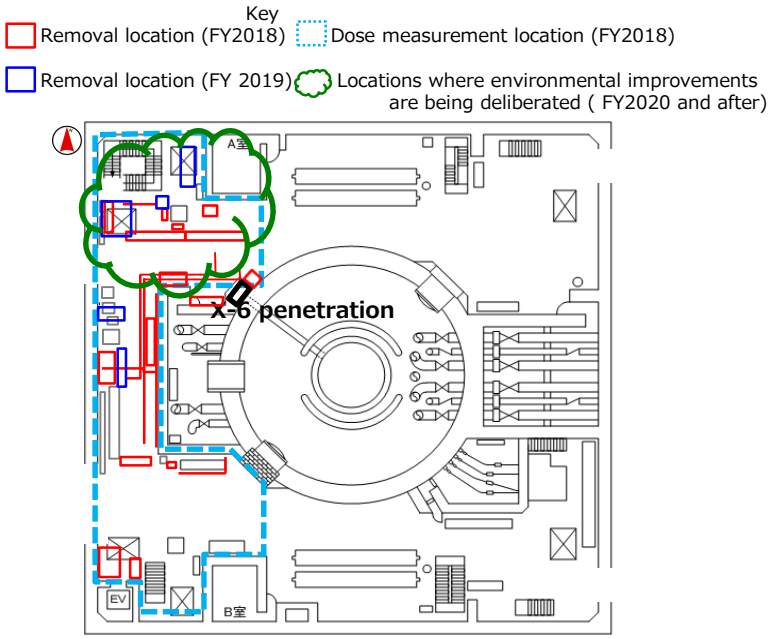


Diagram of anticipated deposits

Conditions in January 2017 (photos taken with camera inserted through hole used for X-6 penetration exploration device)

- The first floor of the Unit 2 R/B and the area around the large freight entrance will be the main work areas for fuel debris removal
- Atmospheric dose rates on the first floor of the Unit 2 R/B (around the X-6 penetration) have been reduced to approximately 5mSv/hour, however we plan to make further environmental improvements.
- Spent fuel will be removed from Unit 2 after construction of the work platform and anticum on the south side of the reactor building. Therefore, we believe the fuel debris removal work can be done simultaneously without interfering with spent fuel removal.



1st Floor, Unit 2 Reactor Building

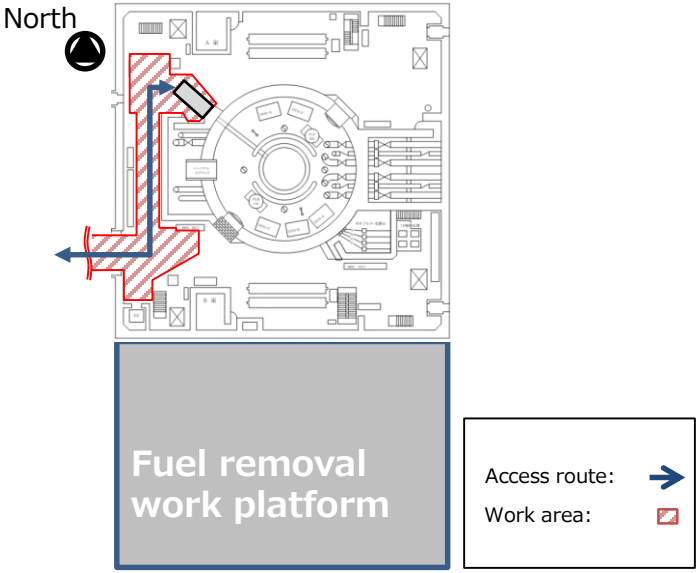


Diagram: Concept diagram of fuel debris removal work area