

Asian Youth Nuclear Symposium 2022

Decommissioning of TEPCO Fukushima Dai-ich NPP

R&D status by Industry

July. 10th, 2022 International Research Institute for Nuclear Decommissioning (IRID) Naoaki Okuzumi

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- 1. Introduction
- 2. Development of Investigation Technology for inside Primary Containment Vessel
 - (1) Completed investigation
 - (2) Next Investigation
- Technological development of fuel debris retrieval
 (1) Trial retrieval
 - (2) Increasing the scale of retrieval in stages
 - (3) Further increasing the scale of retrieval

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Outline of IRID

1. Name International Research Institute for Nuclear Decommissioning (IRID) https://irid.or.jp/en/ R&D 2. Date of Establishment August 1, 2013 IRID 3. Membership (18 organizations) 2 Research Institutes International HRD JAEA etc. **Entities** 4 Manufacturers ToshibaESS, Hitachi-GE,MHI etc. 12 Electric Utilities, etc. **TEPCO** Holdings etc.



5



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Robot Investigation of inside of the PCV

Investigation of inside the pedestal (Unit 2) Investigation of outside the pedestal (Unit 1) **O** Remote-operated crawler robot for investigation Crawler **During investigation** itional Winch Rear camera an Camera for travelling through guide pipe During Crawler Type I investigation (when passing through a guide pipe) Front camera and lighting Camera for travelling **CRD** rail **OSuspension type investigation** device (A2' investigation) Winch confirmation camera (inside) Investigation of inside the pedestal (Unit 3) Sensor unit measuring camera Thruster for up-and-down U-shape type Front camera (when travelling on the floor) Taper Thruster for Radiation driving dosimetry Light LED **Osubmersible Crawling Robot** Φ20 mm Measuring camera

7

Unit 2 investigation: Pedestal Floor



Bottom of the Unit 2 PCV (An overhead image)

Pedestal floor and wall Fuel debris? and a fuel assembly handle





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Boat Type Access Device

A boat type access device which can move on a wide range of the water surface in the primary containment vessel (PCV) has been developed.



Example: Guide ring installation

- Diameter: φ25cm
- Length: Approx. 1.1M
- Thrust: Over 25N

Appearance of the boat type access device



Travelling line of the device

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Boat Type Access Device (Video)





Boat Type Access Device (Investigation inside PCV through X-2 penetration)

Six kinds of boat type access/investigation devices with submersible functions will be prepared for each function.



*Deposit thickness, and existence and thickness of fuel debris are uncertain, therefore, the image is described in above figure.



Arm Type Access Device

- The arm type access device has been made which can access the wide range through the PCV penetration for maintenance of control rod drive mechanism.
 - Total length of the arm: Approx. 22m
 - An investigation device up to 10kg can be loaded.



Access Route of Arm Type Device

Isolation valve

X6 penetration flange

Extension pipe

Arm enclosure

The connection structure for PCV

The connection structure having the following functions has been developed.

- Remotely approaching and attaching the existing penetration flange.
- Seismic capacity of gripping mechanism
- Confinement functions
- ✓ Maintaining of capability that the arm can pass through.

Arm Type Access Device (Video)

Status of UK-Japan alliance for development of the robot arm to access fuel debris

Video



Installation of Mock-up Facility (JAEA Naraha Center for Remote Control Technology Development)





CRD

Appearance of the inside of the pedestal



Appearance of mockup X-6 penetration (after connecting the connection structure and extension pipe)



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Fuel Debris Trial Retrieval

The fuel debris collection device with ultrafine metal wire is equipped with the head of the arm type access device.



* Another tool can be equipped alternatively.

Arm type access device



Blush

Ultrafine metal blush type collection device

Vacuum blood collection tube



Suction port

Vacuum vessel type collection device

Increasing the Scale of Fuel Debris Retrieval in Stages

Access device for fuel debris retrieval

In order to improve the payload (maximum loading capacity), a motor for the arm type access device will be strengthen and the link configuration will be re-examined.



New Opening

A new hole will be opened to access PCV adjacent to the X-6 penetration to further increase the scale of fuel debris retrieval.



Robot Arm



Access Tunnel

- The access tunnel method is required to connect a heavy-lift tunnel (approximately 800 ton) with the primary containment vessel (PCV) from outside the reactor building through the precise position control system.
- Delivery technology for curved heavy-lift tunnel in narrow spaces has been developed with applied heavy delivery technology experienced in bridge constructions.



A layout image of the access tunnel method

Thank you!