

2-④ Development of closed circulation systems for water inside PCV

Project objectives

In order to ensure the safety of fuel debris retrieval work, develop technologies to access and connect to PCV while securing the PCV confinement function which is issue in constructing the necessary closed circulation system for water inside PCV.

Project details and progress

(1) Formulating technical specifications of repair and drafting work and development plan for access and connection to the inside of the PCV

① To ensure safety in fuel debris retrieval work, intaking water from the dry well (hereinafter referred to as "D/W"), a suppression chamber (hereinafter referred to as "S/C"), and the torus room were investigated for a water circulation system being studied or developed under the project of "Advancement of Retrieval Method and System of Fuel Debris and Internal Structures".

To intake water from the D/W and the S/C, it is necessary to establish a new access route to the inside of the PCV and water intaking system, while securing the confinement function. In order to realize this, it is necessary to establish a construction technology and a work plan taking into account severe on-site environmental conditions, such as high doses and narrow paths, reliability, inspectability, earthquake resistance, long-term soundness, remote maintainability, and other factors. The required technical specifications and a system establishment work procedure were investigated and development challenges were identified and a development plan was drafted. Required technology development challenges for the following items were identified and the development plan was drafted.

- i. Formulating technical specifications considering the on-site environment (example of study on the arrangement of S/C water intake structure: **Fig. 1**)
- ii. Investigating plans for access route construction work and its maintenance (example of study on the construction of access routes from D/W: **Fig. 2**)
- iii. Identifying development challenges and drafting a development plan

② Regarding PCV repair technology affecting the construction of closed circulation systems, technical development challenges corresponding to the situation at the on-site work and technical issues corresponding to situations in the field were extracted, and a development plan was drafted.

[Findings of the review]

- A) In Units 1 to 3, more than 8 S/C water intakes can be installed at θ of 66° or more as shown in the drawing. => Proceed with development of welding equipment by setting the pertinent angle (θ) to 66° or more.
- B) Obstacles in the torus room need to be removed remotely. => For the typical obstacles in the torus room (pipes, cable trays, air conditioning duct, and handrail), conceptual examination on removal procedures by repairing the lower PCV (FRM) should be performed.
- C) Examination on removing obstacles in the first floor of the R/B should be included in the scope of planned engineering, not in this project, as needed.
- D) Though it is necessary to verify the impact of interference in the internal S/C structures (vent tubes, vent header, downcomer) and water intake system, the impact is expected to be small due to flexible hoses.
- E) Decontamination is recommended or required.

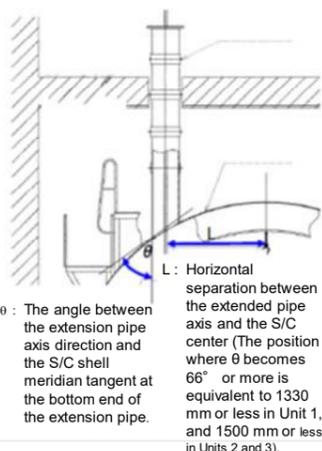


Fig. 1: Examination example on S/C water intake structural layout

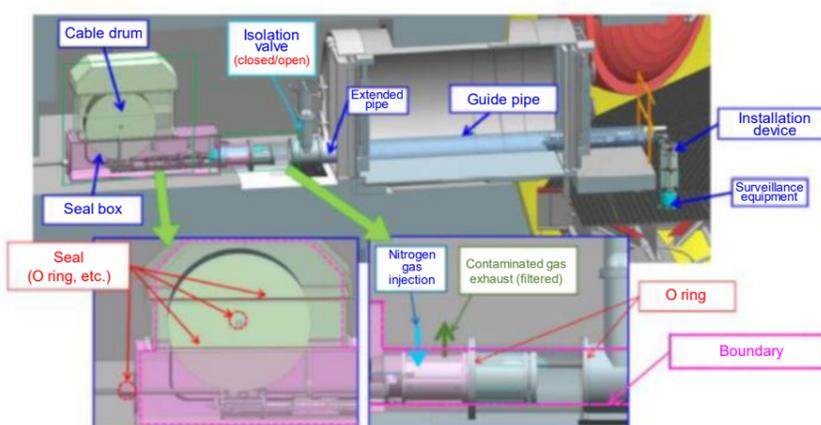


Fig. 2: Examination example on access route establishment from D/W

(2) Developing and verifying element technologies for access and connection to the PCV

Based on the development plan formulated under (1) above, we are developing and verifying each elemental technology required to access and connect to the PCV. Below are examples of possible elemental technologies.

- Remote construction technology for connections
- Remote access route inspection during service and construction
- Remote repair technology for connections during service and construction

(3) Verifying PCV access and connection technology on a full-scale

Based on the development results of each elemental technology, pilot designing for access/connection to the inside of the D/W and S/C is underway. In light of the results, the following verification of workability in a full-scale, clarification of work requirements and issue identification for actual construction work will be performed by using a full-scale test body for Naraha:

- Confirming the workability by remote control on a full-scale and identifying challenges
- Securing confinement function for actual construction work and the measures to reduce workers' exposure and identifying challenges
- Investigation of the test body after connection work

Implemented by

International Research Institute for Nuclear Decommissioning (IRID)

FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019
							Development of technologies to establish closed water circulation systems inside the PCV	