

2-⑤-2 Full-scale test of repair methods for leak spots in PCV

Project objectives

The repair methods of the bottom part of PCV from the R&D project entitled "Development of repair methods for leak spots in PCV" were tested using a full-scale test set to verify the acceptability of procedures from the viewpoints of actual implementation, the feasibility of implementation by remote control, and the sealing performance. In addition, the effectiveness of simulation using a virtual reality (VR) system for simulator-based operator training for the remote control manipulator was verified.

1. Project details and progress

The following outcomes have been achieved based on the results of "2. Related projects" below.

(1) Full-scale test of the repair methods of the bottom part of PCV, etc.

The following were tested using the full-scale test set:

① Reinforcement method for the suppression chamber (S/C) supports (Fig.1)

Experiments were conducted with implementing reinforcement by the injection of highly fluid grout material to the S/C bottom, and the applicability of an implementation procedure developed in consideration of actual plant conditions was verified, as was the feasibility of implementation monitoring, such as the checking of injection height.

② Sealing method by grouting the vent pipes

A test was conducted to check the feasibility of an implementation procedure that would involve remote controlled maneuvers to remove obstacles and drill a hole through the vent pipe model, and the feasibility of accessing targets under conditions resembling the actual plant conditions was verified.

③ Sealing by grouting inside S/C (downcomer plugging)

Experiments were conducted with stopping the leak by grouting highly fluid sealant into S/C, and the applicability of an implementation procedure developed in consideration of actual plant conditions was verified, as was the feasibility of implementation monitoring, such as the checking of injection height.

④ Preparation for testing, etc.

Maintenance services were administered for water feeding and draining facilities, and regular inspections were performed for this purpose.

(2) Preparation of VR data for preliminary simulation experiments

As efforts were being made to prepare an environment that would allow the performing of operator training on a VR system simulating the motions of the manipulator used for plugging the vent pipes, the effectiveness of VR system in operator training was evaluated by capturing manipulator motions using motion capture technology, etc., and comparing the motions simulated by VR system loaded with the motion data and the actual motions made by the manipulator.

Implemented by International Research Institute for Nuclear Decommissioning (IRID) (FY 2013 -)

2. Related projects

The following describes the results of previous related projects.

○ Full-scale test of repair methods for leak spots in PCV (FY 2014 - 2015)

(1) Testing of PCV bottom repair techniques using a full-scale test set, etc.

The designing and fabrication of a full-scale model reproducing a 1/8 sector portion of PCV bottom at Unit 2 was completed, as was the installation of water feeding and draining facilities required for testing, including the turbid water treatment system.

(2) Preparation of VR data for preliminary simulation experiments

Data on the motions of the remote operated device (manipulator) for loading into the VR system was prepared, and it was verified that the data can be used for simulating motions on the VR system. In addition, research was completed on the knowledge of various institutions inside and outside Japan regarding the functions of remotely operated devices and the systems used to verify operators' skills.

○ Full-scale test of repair methods for leak spots in PCV (FY 2016)

(1) Full-scale test of the repair methods of the bottom part of PCV etc. (Fig. 2)

① Reinforcement method for the suppression chamber (S/C) supports

An implementation procedure verification test was performed, and it was verified that works in a high dose environment, operation by remote control, and the application of devices prepared in the course of PCV repair method development may be accomplished without problems.

② Sealing method by grouting the vent pipes

The implementation procedure verification test was initiated.

③ Preparation for testing, etc.

Pre-testing preparations were completed by transporting the test set, installing buffer materials for S/C supports reinforcement, and ensuring readiness for filling the test set with water.

(2) Preparation of VR data for preliminary simulation experiments

Based on information collected through hearing sessions with remote control system designers and experienced operators, the issues that must be solved in order to achieve necessary improvement in accuracy were identified, and work was

conducted toward the realistic simulation of manipulator motions on the operation console and the improvement of remote control system functions.

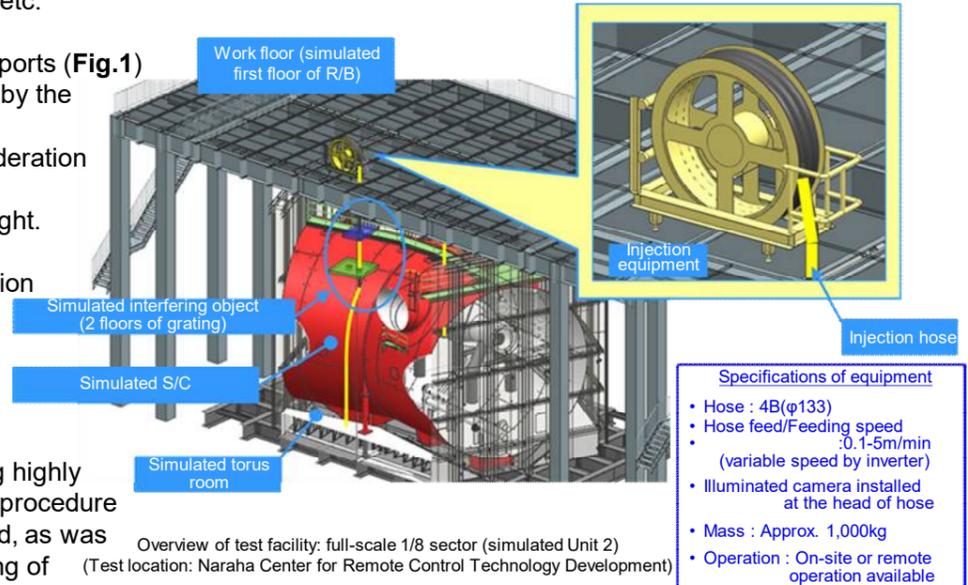


Fig. 1: Overview of the reinforcement test for S/C supports

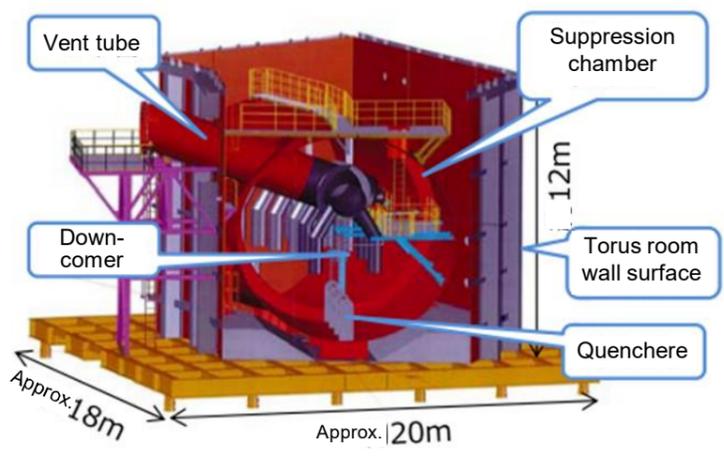


Fig. 2: Full-scale test facility

FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017
			Full-scale test of repair methods for leak spots in PCV			
				Full-scale test of repair methods for leak spots in PCV		