* In the section "Status of leak from underground water storage pools and measures to resolve this issue," a date was incorrect. We apologize for our mistake and corrected the date (written in red) (as of August 30)

August 29, 2013

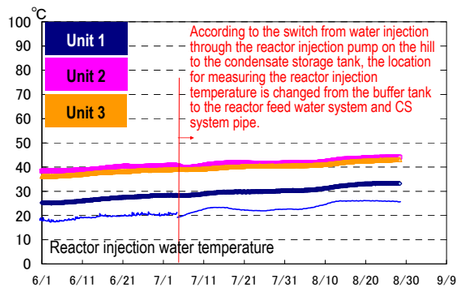
Secretariat of the Council for the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station

Progress Status and Future Challenges of Mid-and-long-Term Roadmap toward the Decommissioning of Units 1-4 of the TEPCO's Fukushima Daiichi Nuclear Power Station (Outline)

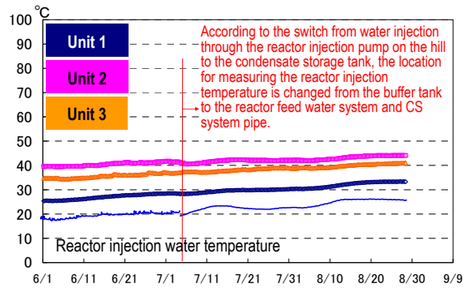
I. Confirmation of the reactor conditions

1. Temperatures inside the reactors

Through continuous reactor cooling by water injection, the temperatures of the Reactor Pressure Vessel (RPV) bottom and Primary Containment Vessel (PCV) gas phase have been maintained within the range of approx. 25 to 50℃ for the past month, though they vary depending on the unit and location of the thermometer.



RPV bottom temperatures



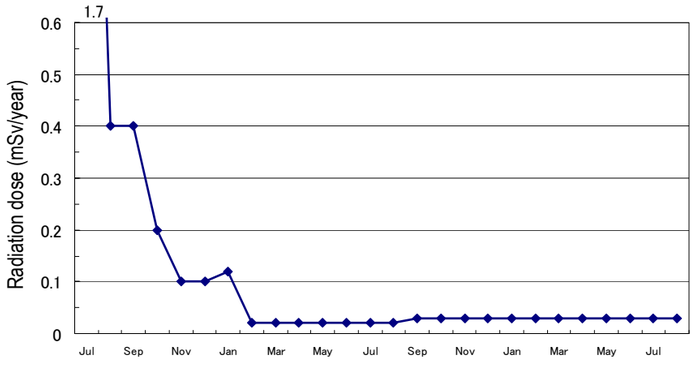
PCV gas phase temperatures

* The trend graphs show part of the temperature data measured at multiple points

2. Release of radioactive materials from the Reactor Buildings

The density of radioactive materials newly released from Reactor Building Units 1-3 in the air measured at the site boundaries was evaluated at approx. 1.6 x 10^{-9} Bq/cm^3 for both Cs-134 and Cs-137. The radiation exposure dose due to the release of radioactive materials was 0.03 mSv/year (equivalent to approx. 1/70 of the annual radiation dose by natural radiation (annual average in Japan: approx. 2.1 mSv/year)) at the site boundaries.

Annual radiation dose at site boundaries by radioactive materials (cesium) released from Reactor Building Units 1-3



(Reference)

*** The density limit of radioactive materials in the air outside the surrounding monitoring area:**
[Cs-134] : 2 × 10^{-5} Bq/cm^3
[Cs-137] : 3 × 10^{-5} Bq/cm^3

*** Dust density around the site boundaries of Fukushima Daiichi Nuclear Power Station (actual measurement value):**
[Cs-134] : ND (Detection limit: approx. 1x10^{-7} Bq/cm3)
[Cs-137] : ND (Detection limit: approx. 2x10^{-7} Bq/cm3)

(Note) Different formulas and coefficients were used to evaluate the radiation dose in the facility operation plan and monthly report. The evaluation methods were integrated in September 2012.

3. Other indexes

There was no significant change in parameters, including the pressure in the PCV and the PCV radioactivity density (Xe-135) for monitoring criticality, nor was any abnormality of the cold shutdown condition or sign of criticality detected. Based on the above, it was confirmed that the comprehensive cold shutdown condition had been maintained and the reactors were in a stabilized condition.

II. Progress status by field

1. Reactor cooling plan

The cold shutdown condition will be maintained by cooling the reactor via water injection, while measures to complement the status monitoring will continue to be implemented

➢ Nitrogen injection into the PCV to mitigate hydrogen-related risks

- To mitigate hydrogen-related risks, nitrogen is injected inside the PCVs and RPVs of Units 1 to 3.
- Residual air with a high hydrogen concentration in the upper part of the Suppression Chamber (S/C), which was generated in the early stage of the accident, is purged using nitrogen to reduce the hydrogen-related risks. As for Unit 1, the injection was started in December 2012, and the 6th injection is underway (from July 9). As for Unit 2, nitrogen has been injected intermittently since May 2013. As for Unit 3, no rise in hydrogen concentration was observed, and monitoring of parameter changes continues.

2. Accumulated water treatment plan

To mitigate the increasing accumulated water due to groundwater inflow into the Reactor Buildings, fundamental measure will be implemented while improving the decontamination capability of the water treatment facilities and preparing facilities for contaminated water management

➢ Preventing groundwater from flowing into the Reactor Buildings

- Preparation for a system to reduce the groundwater volume flowing into the Reactor Buildings by pumping the groundwater flowing from the mountain side upstream of the buildings (groundwater bypass) is underway. As for System A, test operation and water quality check were completed (March 31 – April 23). For System A, it was confirmed that the density of the representative indicator nuclide Cs-137 was low enough compared to that in the neighboring ocean area and rivers. Based on these results, explanatory meetings to local residents are held.
- As for Systems B and C, after the test operation is completed, checks on water quality will be performed.

➢ Installation of multi-nuclide removal equipment

- Multi-nuclide removal equipment was installed to further reduce the density of radioactive materials (except tritium) included in the accumulated water in the site as well as preventing any unexpected leakage risks. Hot tests using water containing radioactive materials have been performed (System A: from March 30, System B: from June 13). As of August 28, treatment of approximately 21,000m^3 had been completed.
- As for System A, minor leakage was detected from the tank (batch process tank 2A) used to pretreat contaminated water (removing radioactive materials by chemical treatment). System A was suspended to investigate the leak (June 15).
- During the suspension, the inside of the adsorption tower 6A of System A was inspected and a color change was detected, which may be attributable to corrosion (August 2) (see Figure 1). Based on the corrosion detected inside adsorption tower 6A, the investigation scope was expanded. The results of the horizontal investigation of Systems A and B (stopped due to planned suspension on August 8) confirmed corrosion on the weld parts of the absorption tower downstream of the absorption tower 6A. In the next step, the cause and recurrence prevention measures will be examined as well as considering repair methods.
- After performing these recurrence prevention measures, hot tests will be resumed in mid-September for System C, mid-October for System A and after November for System B respectively.

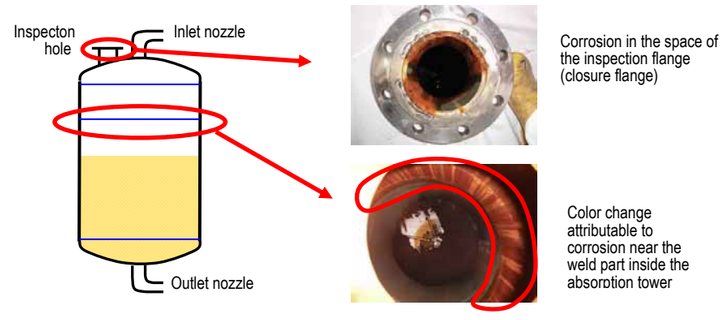


Figure 1: Status of the multi-nuclide removal facility absorption tower 6A

➢ Status of leak from underground water storage pools and measures to resolve this issue

- To identify the leak locations of Nos. 1 and 2, boring holes were drilled behind the underground water storage pool for sampling (No. 1: 8 holes, No. 2: 13 holes). As for No. 2, the distribution range was identified and contaminated soil removed (from July 13 to August 2). As for No. 1, additional boring holes (4 holes) will be drilled from September to identify the range of contaminated soil from mid-September.
- To reduce the contamination level of residual water leaking into detection hole Nos. 1 and 2, dilution of the residual water has been continued by repeatedly injection and discharging water to and from the storage pool (No. 1: from June 19, No. 2: from June 27).
- As for the underground water storage pool Nos. 3 and 4, uplift was detected; mainly at the center of the top surface (No. 3: approx. max. 40cm, No. 4: approx. max. 15cm) (August 10). There was no significant change in the analytical results related to total β of the drain and detection holes from late July to August 10, hence no leak of contaminated water caused by uplift was registered. Since August 11, the total β density was detected with the No. 3 drain and detection holes on the north-east side (approx. 6 x 10^{-1} Bq/cm^3). This is considered attributable to the impact of collecting groundwater from the drain hole on the north-east side on August 11 and 12.
- To monitor the uplift status, measurement is conducted at 5 points on the top surface of the underground water storage pools Nos. 1 to 4 (once/daily). As for the underground water storage pool Nos. 3 and 4, approx. 70 to 80cm of crushed stone will be added to the top surface for equalization (from August 29). As for other underground water storage tanks, the need for measures will be promptly examined.

➢ Water leak at H4 Area tanks

- Puddles were detected with the tank weir in the H4 Area storing contaminated water and outside the drain valve of the weir (August 19, see Figure 2). As there was water spread at the bottom of No. 5 tank, a bolt-fixed type, in the same area, the water level of the relevant tank was checked. The result showed that the water level had decreased by approx. 3m compared to neighboring tanks (equivalent to approx. 300m^3) and a leak of high density contaminated water was confirmed (August 20).
- Water was transferred from No. 5 tank in which the leak was detected (August 19-21).
- Overhaul (visual inspection of appearance, check for any leak by radiation dose measurement) was conducted regarding 305 bolt-fixed type tanks for accumulated water storage of Units 1 to 4 (August 22). By this overhaul high density points of radiation dose were detected near the bottom of the tank (2 points). These two points were dry and no outflow was detected to outside the weir. In addition, no change was detected with the water level within the tank.
- Initially, 3 tanks including No. 5 tank, with which leak was detected, were installed in H1 Area. It was revealed that these tanks were removed due to a depression having occurred with its foundation (August 24). The same as No. 5 tank, water was transferred from the tanks which were retransferred after the first transfer.
- It was confirmed that the weir around the bolt-fixed type tanks was not contaminated (August 22). On the soil outside H4 Area with which leak was detected, additional soil was applied and shield sheets were placed (August 20).
- After August 20, monitoring was strengthened on the sea side of the drainage to the sea. Investigation is being conducted to check for any possibility of outflow to the sea.
- 5 points shown below were ordered by the Minister of Economy, Trade and Industry as measures to be taken.
  1. Strengthening of the management system for tanks and areas around the tanks (closure of drainage valves in general, reinforcement of concrete at the bottom of the tank, installation of equipment to measure water levels and detect any leak to the tank, building of central monitoring system).
     - Drainage valves are closed in general (from August 28)
     - Possibility of reinforcement by placing concrete at the bottom of the tank is examined
     - Water level gauges will be installed to the tank (within 3 months), water levels will be checked using thermometers until installation of the water level gauges
  2. Reinforcement of patrol (frequency of patrol will be increased from twice to 4 times per day for the meanwhile, radiation dose will be checked and detail will be described about the record of the check including numeric values).
     - Frequency of patrol was increased to 4 times per day (from August 26)
     - The procedure was changed to measuring radiation dose for each tank and recording the results in the patrol check sheet
  3. Increase in the number of welded type tanks and replacement of bolt-fixed type tanks with the welded type tanks
     - According to the contaminated water generated, a schedule for measures are examined to increase comprehensive reliability of the tank.
  4. Acceleration of treatment of highly contaminated water (ALPS will steadily start operation from mid-September) and decrease in radiation dose around the relevant place by collecting contaminated soil
     - In addition to early operation start of the existing ALPS, control of contaminated water volume and additional installation of purification systems are being examined
     - Removal of soil around H4 Area and removal of contamination of the drainage are being addressed (from August 23)
  5. Identification of risks related to the high-density storage of contaminated water and implementation of measures to counter risks
     - Risks will be addressed, changes to a structure avoiding leaks and leak countermeasures will be implemented
     - In addition, TEPCO established the "Task Force for Contaminated Water and Tanks" led by the President to accelerate decision-making and concentrate its resources preferentially.

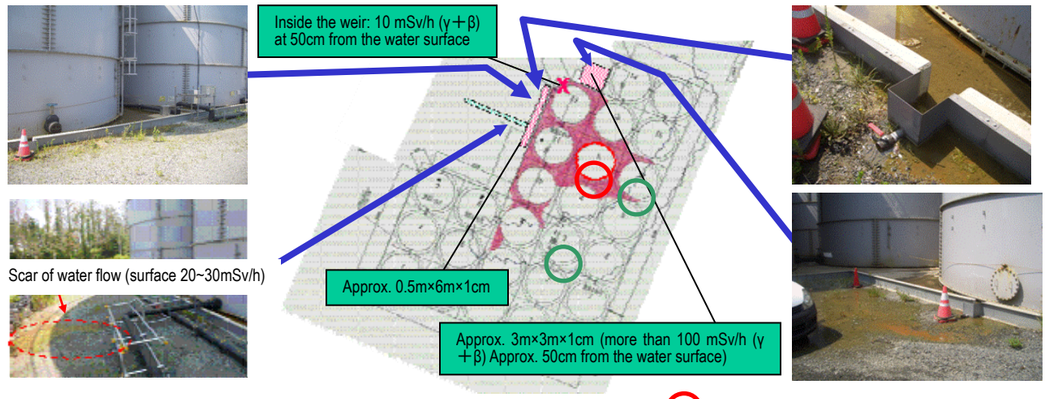


Figure 2: Status of leak with the H4 Area tank

3. Plan for radiation dose reduction and contamination mitigation

Effective dose reduction at site boundaries (reduced by 1 mSv/year by the end of FY 2012) and purification of the water in the port to mitigate the radiation impact on the external environment

➢ Measures to tackle the issue of increased density of radioactive materials in groundwater on the sea side and in seawater

- Analytical results of data such as on the density and level of groundwater on the east (sea) side of the Reactor Buildings showed that contaminated groundwater had leaked into the seawater.
- A significant increase in radioactive materials density was detected within the intake open canals for Units 1 to 4 only. While the density near the port boundaries (port canals, north and south discharge canals) increased, the rise was within the normal range of fluctuation over the past 2 months. No significant increase was detected in the offshore measurement results, hence there was little impact on the outside of the port (see Figure 3).
- As measures to prevent the spread of contamination out to sea, the following will be implemented (see Figure 4):
  (1) Preventing leak of contaminated water
     - Ground improvement behind the bank protection to prevent the expansion of radioactive materials.
       (Between Units 1 and 2: completed on August 9, Units 2 and 3: from August 28 and to be completed late November, Units 3 and 4: from August 23 and to be completed late September)
     - Pumping of groundwater into contaminated area
       By installing catchment pits and well points (compulsory pumping equipment by vacuuming), the groundwater level is reduced (catchment pit: transfer started on August 9, well point: part of the transfer started on August 15 and the full transfer was started on August 23). By pumping groundwater, the water level was reduced below the levee crown height of ground improvement (O.P.+2.20m), mitigating the risk of groundwater outflow into the port.
  (2) Keeping groundwater away from the contamination source
     - Enclosure by improving the side ground foundation
       Between Units 1 and 2, efforts to improve the ground foundation commenced on August 13 and were completed in mid-October.
     - To prevent rainwater introducing, the ground surface will be paved with asphalt (to commence mid-October)
  (3) Removing the contamination source
     - Removal and closure of contaminated water such as branch trench
       Contaminated water in the branch trench of Unit 2 and vertical shaft B to the branch trench was transferred to the Unit 2 Turbine Building (August 22-24). Subsequently, the trench will be closed (from August 28 to mid-September).
     - Purification and removal of contaminated water in the main trench (purification to commence in October)

- To examine the factors contributing to the increased density of radioactive materials in seawater within the port and verify the measures implemented by TEPCO, a review committee comprising experts was established to examine analysis of the contamination sources of increased density in groundwater and flows of groundwater (1st meeting: April 26, 2nd: May 27, 3rd: July 1, 4th: July 23, 5th: August 16).

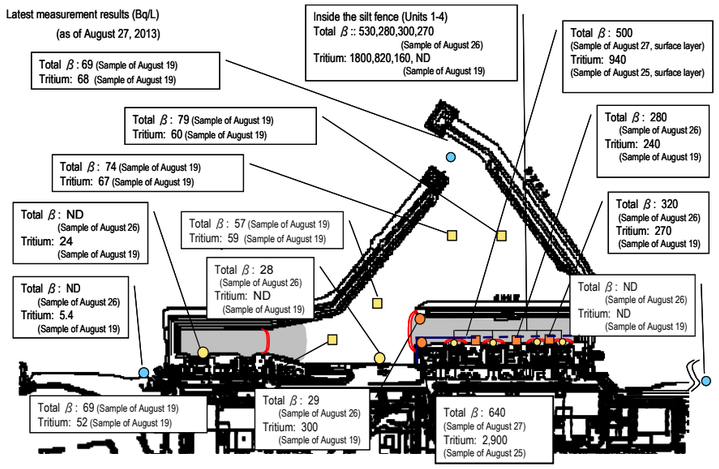


Figure 3: Seawater monitoring results

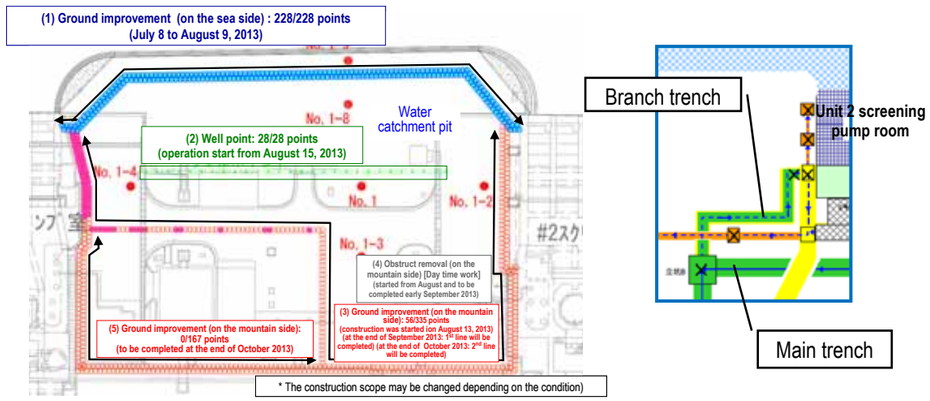


Figure 4: Layout of underground water measures between Units 1 and 2

4. Plan for fuel removal from the spent fuel pools

Work toward the removal of spent fuel from the pool progressed steadily while ensuring seismic capacity and safety. In particular, efforts are being made to commence and complete the removal of spent fuel from the Unit 4 pool as soon as possible (scheduled to start in November 2013 and be completed by around the end of 2014)

➢ Main works toward spent fuel removal at Unit 4

- The cover installation for fuel removal is ongoing (to be completed around October). Work on lifting the overhead crane (June 7-14), lifting the Fuel Handling Machine (July 10-13), and installing the outside walls of the fuel removal covers and exterior roof panels (April 1 – July 20) was completed. At present, assembly and installation work is ongoing (see Figure 5).
- Toward debris removal inside the spent fuel pool, which will be conducted before removing spent fuel, an investigation was conducted regarding the inside of RPV and the spent fuel pool (August 5-9). Reflecting the results of this investigation, the final step such as debris removal inside the pool is being conducted toward the start of fuel removal in November (from August 27).

➢ Confirmation of soundness of Unit 4 Reactor Building

- Together with the onsite inspection by external experts to check the health of the Reactor Building and the spent fuel pool, the 6th periodical inspection was conducted (August 6-28). The inspection confirmed that the building is in the sound condition that can store spent fuel safely.

➢ Main works toward spent fuel removal at Unit 3

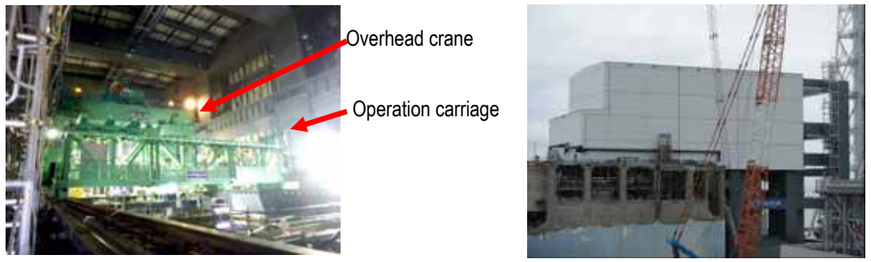
- Debris removal from the upper part of the Reactor Building is suspended due to the cause investigation on the steam detected near the center on the 5th floor of the Reactor Building. After the completion of debris removal, toward the installation work of a cover for fuel removal and the Fuel Handling Machine on the operating floor, decontamination and shielding will be performed to reduce the radiation dose (to commence early September), as well as removal of large debris within the pool (to commence mid-September).

➢ Steam detected near the center on the 5th floor of Unit 3 Reactor Building

- On July 18, 23, 24 and 25, steam was detected near the center of on the 5th floor of Unit 3 Reactor Building (on the equipment storage pool side). After the detection of steam, no significant release is detected in the results of dust measurement.
- Mechanism of steam generation (see Figure 6)
  (1) Humid air accumulated in the lower part of the shield plug was released on the operation floor through a space of the shield plug.
  (2) The released air contacted with air on the operation floor which was at low temperature and humid (approx. 20℃, 92%, respectively) and its temperature decreased below the dew point.
  (3) Fluid exceeding the saturated steam turned into particles and became visualized as steam (mist).

➢ Preparatory investigation toward the 5th floor of Unit 1 Reactor Building

- Toward fuel removal within the Unit 1 spent fuel pool, an investigation around the spent fuel pool on the 5th floor of the Reactor Building is being planned to examine the work schedule including debris removal after deconstruction of the existing cover over the Reactor Building and protection of the spent fuel pool. As preparatory investigation prior to the full investigation, an onsite investigation is conducted which extends a pole from the “skimmer surge tank room” on the 4th floor of the Reactor Building to the 5th floor to judge the feasibility of the future full investigation (August 8 and 9).
  The investigation results showed that the radiation dose in the skimmer surge tank room is high at 32 mSv/h and people cannot access to the room. Another investigation method is now being examined.



Inside the cover for fuel removal **Cover for fuel removal**

Figure 5: Installation status of fuel removal cover of Unit 4

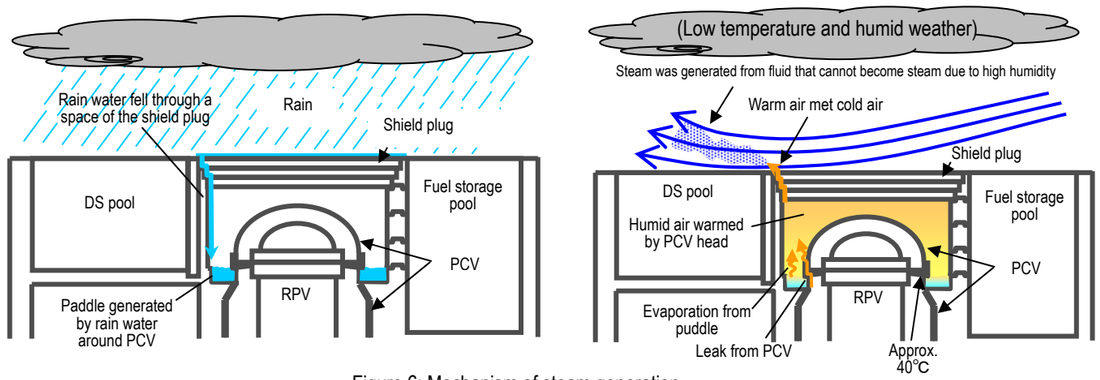


Figure 6: Mechanism of steam generation

5. Fuel debris removal plan

In addition to decontamination and shield installation performed to facilitate accessibility to the PCV, technology is being developed and data acquired to prepare for fuel debris removal (such as investigating and repairing PCV leak locations)

➢ Investigation inside the torus room

- To facilitate the development of PCV investigative equipment, the accumulated water and sediment inside the torus rooms of Units 1 and 2 were analyzed. As for the accumulated water, it was confirmed that the density of Cs137 and chlorine had decreased compared to the levels immediately after the accident, owing to the operation of the water treatment system. Based on the analytical results of γ nuclide in the sediment, few, if any, nuclear source materials were considered present.

➢ Investigation and installation of permanent monitoring gauges inside Unit 2 PCV

- To investigate the status inside Unit 2 PCV, the investigative equipment was inserted from the through-hole of the PCV (X-53) (March 19), but the investigation near the pedestal could not be conducted. Reinvestigation was conducted (August 2 and 12), which involved the investigative equipment being led to the CRD replacement rail to investigate up to a point near the pedestal aperture (see Figure 7). The camera images will be analyzed and the results reflected in the investigation plan for the inside pedestal; to be conducted through the X-6 through-hole (located below the X-53 through-hole) in the next step.
- Via the X-53 through-hole, a hose was inserted to sample approx. 800cc of accumulated water from approx. 100 mm below the surface (August 7). The analytical results are shown below.
- Via the X-53 through-hole, monitoring meters (8 thermometers and 5 water level gauges) were inserted to install them into the PCV. However, due to interference with the existing grating, these meters could not be installed into the planned locations except for 2 thermometers (August 13) (see Figure 8). In the next step, after identifying the cause, reinstallation in the initially planned locations will be examined.

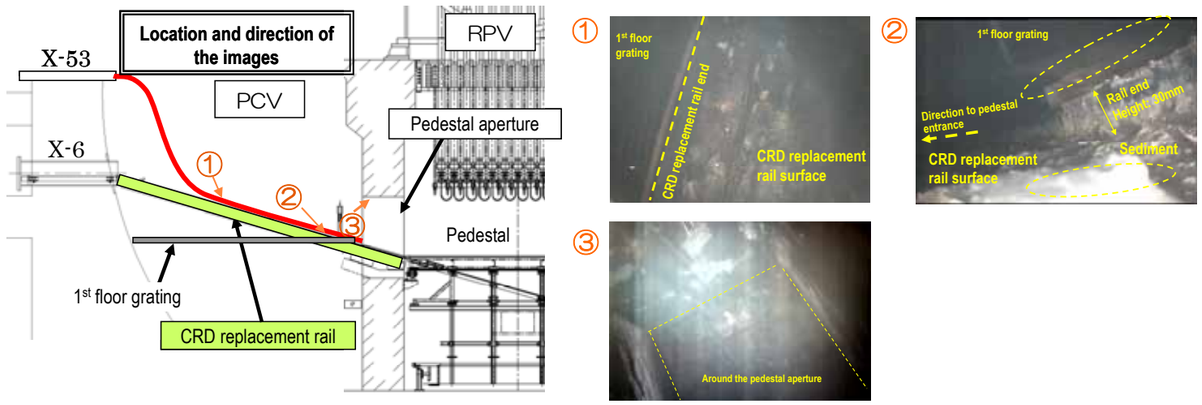


Figure 7: Status inside Unit 2 PCV

Analysis item		Analysis result	Analysis purpose	Evaluation
pH		7.4	Corrosion environment assessment and measures to prevent corrosion are examined to prevent corrosion of the PCV boundaries. * Used for examination on facility design toward reduction of circulating injection loop which is a medium- and long-term initiative.	It is not a severe corrosion environment and corrosivity is low.
Conductivity [μS/cm]		25		
Chlorine density [ppm]		2.9		
γ radioactivity density [Bq/cm³]	Cs134	2.14E + 03	Contribution to examination on radioactive materials release from PCV accompanied with water circulation of existing water, locations of radioactivity source in PCV, nuclide transfer behaviors (magnitude of transfer from deposit to water phase), etc. * Used for examination on facility design toward reduction of circulating injection loop which is a medium- and long-term initiative.	Evaluation is underway.
	Cs137	4.38E + 03		
	I-131	Below the detection limit (< 3.497E + 02)		
Tritium density [Bq/cm³]		6.77E + 02		
Sr 89/90 density [Bq/cm³]		Around the end of September		
α radioactivity density [Bq/cm³]		Below the detection limit (< 2.033E + 00)		

Table 1: Analysis results of accumulated water inside Unit 2 PCV

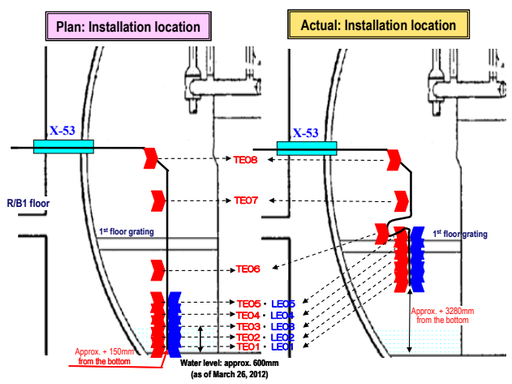


Figure 8: Installation status of permanent monitoring meters in Unit 2 PCV

6. Plan for storage, processing and disposal of solid waste and decommissioning of reactor facilities

Promoting the reduction and appropriate storage of waste generated and R&D toward adequate and safe storage, processing and disposal of radioactive waste

➢ Investigation into the waste property

- To investigate the waste property generated in the accident, radioactivity for the boring core samples on the 1st floor of Units 1 and 2 Reactor Buildings was analyzed after being sampled during the development of remote decontamination technology for the fuel debris removal plan. Cs-137, H-3 and Sr-90 were detected but α nuclides were not detected.

➢ Management status of debris and felled trees

- As of the end of July, the total storage volume of concrete and metal debris was approx. 63,000m³ (area occupation rate: 73%). The total storage volume of felled trees was approx. 46,000m³ (area occupation rate: 46%).

7. Plan for staffing and ensuring work safety

Securing an appropriate number of staff for the long term while thoroughly implementing workers' exposure dose control. Continuously improving the work environment and labor conditions based on an understanding of the needs of on-site workers

➢ Staff management

- The monthly average number of people registered for one day or more per month to work at the power station during the past quarter from April to June, 2013 totaled approx. 8,400 (TEPCO and partner company workers), which exceeds the monthly average number of people who actually worked there previously (approx. 6,100). Thus, there are sufficient people registered to work at the power station.
- It was confirmed that the estimated manpower necessary for the work in September (approx. 3,100 per day: TEPCO and partner company workers) had been secured.
- The local employment rate among partner company workers was approx. 55% as of July.

➢ Status of heat stroke

- As of August 28 this fiscal year, a total of 12 people had suffered heat exhaustion caused by the work here, including 6 possible heat stroke patients. Thorough measures to prevent heat stroke continue. (As of the end of August in the last fiscal year, a total of 24 people suffered heat exhaustion caused by the work here, including 7 potential heat stroke patients.)

➢ Body contamination due to increased dust density in front of the Main Anti-Earthquake Building

- On August 12, an alert signaling high radioactivity density was issued from the continuous dust monitor installed in front of the Main Anti-Earthquake Building and body contamination was detected by the entrance control monitor of the Entrance Control Building in 10 TEPCO workers who rode on a bus in front of the Main Anti-Earthquake Building (max. 19 Bq/cm²).
- On August 19, the same alert was issued and body contamination was detected in 2 workers of partner companies who rode on a bus in front of the Main Anti-Earthquake Building (max. 13 Bq/cm²).
- After being decontaminated, these 12 workers left the site. However, they underwent WBC for confirmation and it was verified that there was no uptake into their bodies.
- Since the increase in dust in front of the Main Anti-Earthquake Building is most likely attributable to the removal of debris from the upper part of Unit 3 Reactor Building, sampling related to the relevant work will be conducted in the next step.

8. Others

➢ Establishment of an organization to manage R&D

- Regarding the organization to manage R&D (name: International Research Institute for Nuclear Decommissioning (IRID)), the application for establishment was approved by the Minister of Economy, Trade and Industry on August 1 based on the Research Association for Technology Act. A special general meeting was held on August 8 to inaugurate the organization and start practical activities.