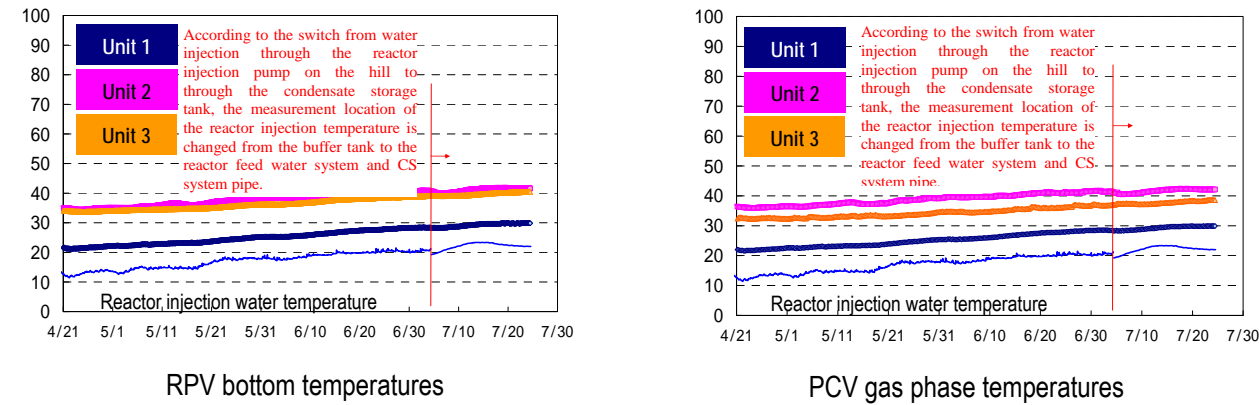


Progress Status and Future Challenges of the Mid-and-long-Term Roadmap toward the Decommissioning of Units 1-4 of TEPCO's Fukushima Daiichi Nuclear Power Station (Outline)

I. Confirmation of the reactor conditions

1. Temperatures inside the reactors

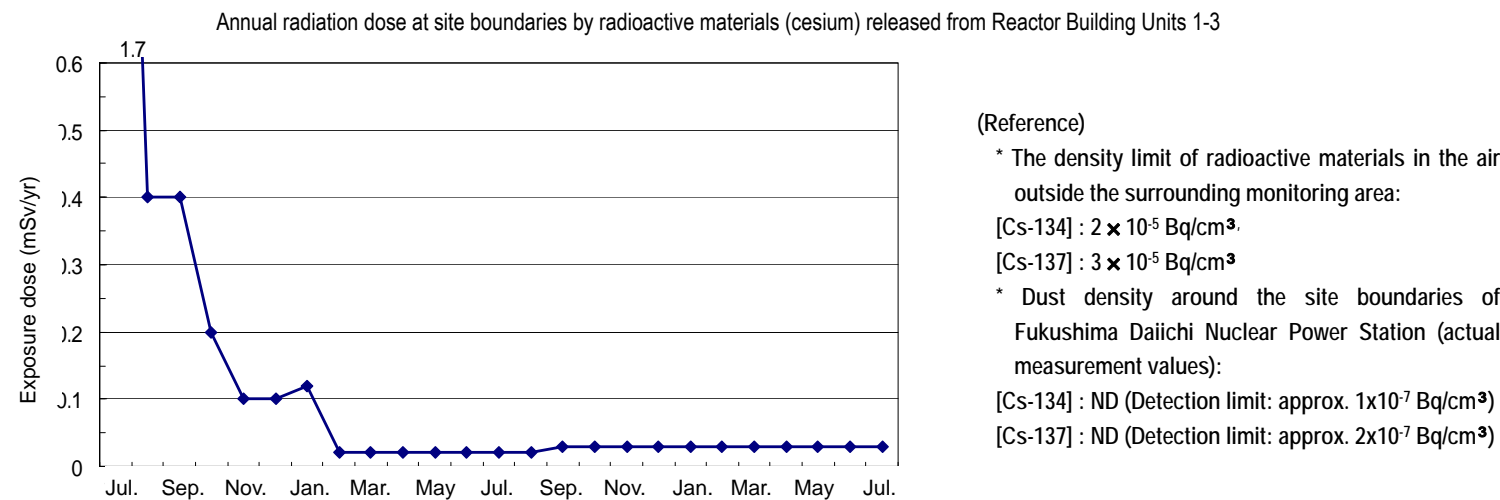
Through continuous reactor cooling by water injection, the temperatures of the RPV bottom and PCV gas phase have been maintained within the range of approx. 25 to 50 for the past month, though they vary depending on the unit and location of the thermometer.



The trend graphs show a portion 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 site boundaries were evaluated at approx. 1.4×10^{-9} Bq/cm³ for both Cs-134 and -137. The radiation exposure dose due to the radioactive materials released 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.



(Reference)
 * The density limit of radioactive materials in the air outside the surrounding monitoring area:
 [Cs-134] : 2×10^{-5} Bq/cm³
 [Cs-137] : 3×10^{-5} Bq/cm³
 * Dust density around the site boundaries of Fukushima Daiichi Nuclear Power Station (actual measurement values):
 [Cs-134] : ND (Detection limit: approx. 1×10^{-7} Bq/cm³)
 [Cs-137] : ND (Detection limit: approx. 2×10^{-7} Bq/cm³)

(Note) To evaluate the radiation dose, different formulas and coefficients had been used in the facility operation plan and the monthly report. A uniform evaluation method was 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, and no abnormality of cold shutdown condition or criticality sign was detected. Based on the above, it was confirmed that the comprehensive cold shutdown condition has been maintained and the reactors have remained in a stabilized condition.

II. Progress status by field

1. Reactor cooling plan

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

- Operation start of Condensate Storage Tank (CST*) Reactor Coolant Injection System
 - Operation of the Reactor Coolant Injection System taking its water from the Unit 3 CST started (from July 5). Reliability has improved compared to the previous circulating injection cooling line as shown below:
 - (1) Reduction of line length installed outdoors (approx. 4 km -> approx. 3 km)
 - (2) Increase in water source volume stored (approx. 1,000 m² -> approx. 2,500 m²)
 - (3) Improvement in seismic safety
 * CST: Condensate Storage Tank which temporarily stores water used in the plant.
- Investigation within the reactor and installation of thermometers using TIP guiding pipes in Unit 2
 - Before investigating the internal status of the reactor and installing permanent thermometers using TIP* guiding pipes, attempts were made to check the internal state of the TIP guiding pipes using fiber scopes (at 4 locations). However, this was impossible due to attachments and obstacles within said guiding pipes (February 25-28). Accordingly, a method involving applying a wire with a wedge-shaped end, pushing attachments and obstacles inside the guiding pipes with significant power was implemented, but it again proved impossible to insert the wire at almost the same points as the previous inspection (July 7-11). Insertion was retried with stronger force, but it got the same result (July 19).
 - Based on these results, the planned investigation of the inside the reactor and installation of thermometers were canceled, and componential analysis of the attachments will be performed in an effort to identify the types of obstacles and the route they are coming.
 - * TIP: Traversing Incore Probe, which moves the detector up and down within the incore to measure neutron distribution

➤ 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.
- To stably manage the nitrogen density, nitrogen injection is gradually shifted only to the PCVs (Unit 2: from October 2012, Unit 3: from June 2012). As for Unit 1, some airborne temperatures in the PCV increased when the nitrogen injection volume changed. A test was conducted to identify the impact of change in the nitrogen injection volume into the PCV on the airborne temperature inside the PCV by changing the balance of nitrogen injection in Unit 1 (June 18 – July 8). During this test, it was confirmed that the monitoring parameters were stable by injection through the RPV nitrogen injection lines only, and injection through the same lines was continued. As for the PCV, injection lines are used as backup, and when alternative lines are installed, the existing PCV injection lines will be examined, including operation termination.
- Residual air with high hydrogen concentration in the upper part of the S/C, which was generated in the early stages of the accident, is purged using nitrogen to reduce the hydrogen-related risks. As for Unit 1, the injection 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 increase in hydrogen concentration was observed, and monitoring of the parameter changes continued.

2. Accumulated water treatment plan

As a countermeasure for the accumulation of water due to inflowing groundwater, a drastic measure to prevent groundwater from flowing into the Reactor Buildings will be implemented while improving the decontamination capability of the water treatment facilities and preparing facilities for contaminated water control

- Preventing groundwater from flowing into the Reactor Buildings
 - Preparation for a system to reduce the groundwater volume flowing into the Reactor Buildings by pumping that flowing from the mountain side upstream of the buildings (groundwater bypass) is underway. As for System A, the test operation and water quality check were completed (March 31 – April 23). As for Systems B and C, after the test operation is completed, the water quality will be checked (to be completed after July). As for System A, the results of the water quality test showed 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 being held.
- Installation of multi-nuclide removal equipment

- Multi-nuclide removal equipment will be installed to further reduce the density of radioactive materials (except tritium) included in the accumulated water in the power station site as well as prevent unexpected risk of leaks. At present, hot testing using water containing radioactive materials is being performed (System A: from March 30, System B: from June 13). As of July 24, approximately 19,000m³ had been treated.
- As for System A, a minor leak was detected from the tank (batch process tank 2A) used to pretreat contaminated water (removing radioactive materials by chemical treatment) (June 15). System A was suspended to investigate the leak (June 15), and the results found two through-holes (June 18) (see Figure 1). In addition, the same through-hole was found in one part of the 1A tank (June 20). The cause of the leak was determined as accelerated corrosion due to the high density of chloride ions in water before treatment stored in the batch process tank and chemicals used for pretreatment. Based on this estimate, after applying a rubber lining to the inner surface of the tank to prevent recurrence, hot testing will be resumed (mid-October).
- As for System B, after terminating the system by early August, the batch process tank will be inspected.
- As for System C, after implementing a measure to prevent recurrence, hot testing will start (mid-September).

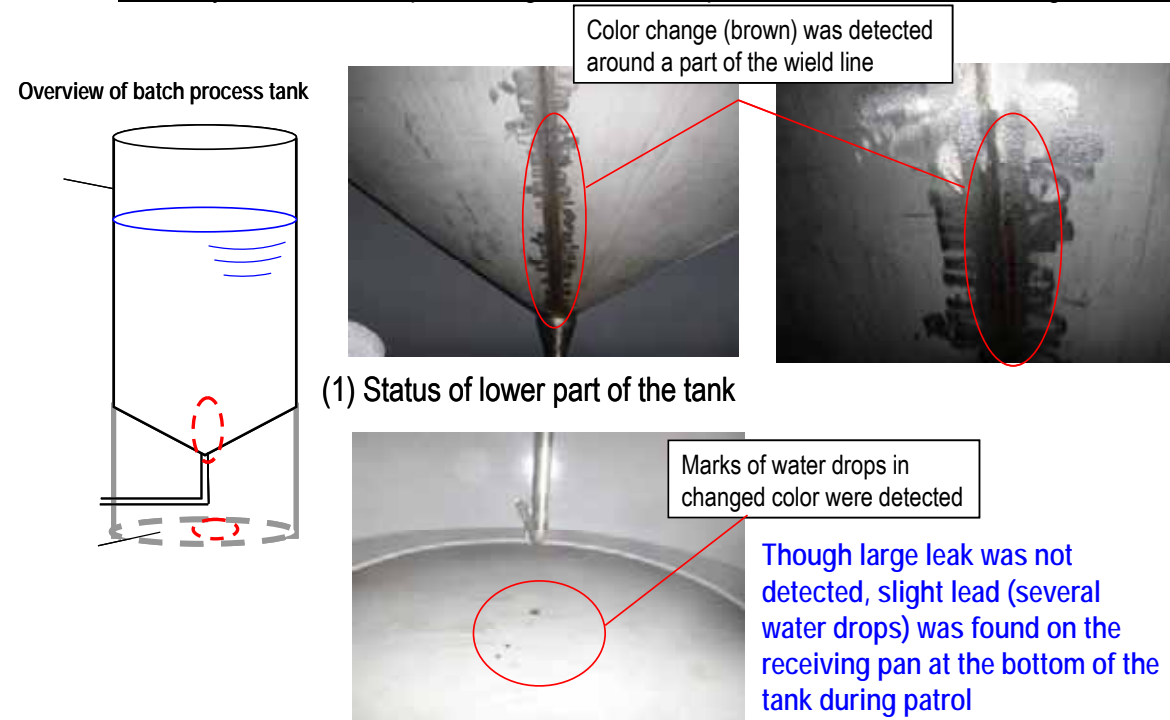


Figure 1: Status of multi-nuclide removal equipment batch process tank and measures

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

- As leaks were detected at Nos. 1 to 3 of underground water storage pool Nos. 1 to 7 for contaminated water, it was decided to terminate the use of all underground water storage pools. Contaminated water in the underground water storage pools was transported to tanks on the ground. Transfer of the contaminated water from all underground water storage pools was completed by July 1.
- The sampling results of underground water from the observation holes (new: 30 holes, existing: 7 holes) around the underground water storage pools confirmed that almost all the β radioactivity density was lower than the detection limit. However, as for No. 1, the total β radioactivity density (10^{-2} - 10^{-1} Bq/cm³ level) was detected at all 4 observation holes near No. 1 (July 10) and monitoring continues (at present, the value is below the detection limit).
- In addition, 8 boreholes were also drilled behind No. 1 underground water storage pool for sampling. The results detected total β radioactivity density (10^{-1} Bq/cm³ level) at all 4 observation holes (June 24 and July 11). Next, 4 additional boreholes will be drilled to identify the distribution status of the contaminated soil.
- To identify the leak locations of No. 2, boring holes were drilled behind the No. 2 underground water storage pool for sampling (13 holes). The results detected total β radioactivity density at 3 points (10^{-2} - 10^{-1} Bq/cm³ level) (May 21-24). A boring survey was additionally conducted at those 3 points (3 holes) and the distribution range identified. At present, the removal of the contaminated soil is underway (from July 13 and to be completed at the end of July) (see Figure 2).
- To reduce the contamination level of residual water leaking into the inside of detection hole Nos. 1 and 2, the residual water will be diluted by repeatedly injecting and discharging water to and from the storage pool (No. 1:

from June 19, No. 2: from June 27).

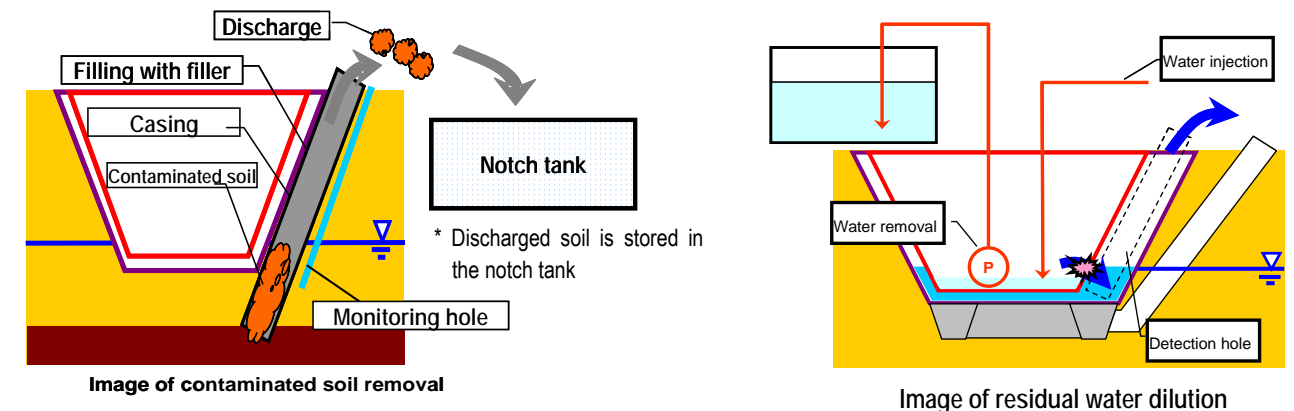


Figure 2: Measures to prevent leaks from the underground storage pool

3. Plan for radiation dose reduction and contamination mitigation

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

- Measures to tackle the issue of increased density of radioactive materials in underground water on the sea side and in seawater
 - In response to the high density of radioactive materials such as tritium detected since late May from underground water on the east (sea) side of the Reactor Buildings, the monitoring of the density of radioactive materials in underground water around the relevant location and in seawater within the port was enhanced (see Figure 3). The analytical results of data such as density and water level of the underground water showed that contaminated underground water had leaked into the seawater.
 - A significant increase in the density of radioactive materials 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) was almost below the detection limit (at least several Bq/L). No significant increase was detected in the measurement results off shore, either, hence there was little impact on the outside of the port (see Figure 4).
 - As measures to prevent the contamination expanding to the sea, the following will be implemented:
 - (1) Improving the ground and expanding the area by injecting chemicals
 - Improvement in the ground is underway around the revetment between Units 1 and 2 (preparation started on June 26 and the work will be completed by mid-August, preparation to enclose the contaminated area is underway). Preparation to improve the ground between Units 2 and 3 and 3 and 4 is underway.
 - (2) Discharging contaminated water from some trenches where there is the potential for leaks (branch trenches) and closing them
 - (3) Purifying contaminated water of the main trenches prone to accumulating high-density contaminated water (seawater pipe trenches) (purification will start in September)
 - (4) Testing a method to freeze and shut out the connection with the Turbine Buildings to discharge water from the main trenches and close them
 - (5) Installing water shield walls on the sea side (placement of steel sheet piles started in April 2013 and scheduled for completion in September 2014)
 - To examine the factors contributing to increase the density of radioactive materials in seawater within the port and verify the measures implemented by TEPCO, a review committee of experts was established to examine the contamination sources of increased density in underground water and flows of underground water (1st meeting: April 26, 2nd: May 27, 3rd: July 1 and 4th: July 23).

removal covers and exterior panels of the roof (April 1 - July 20) was completed. At present, assembly and installation work is ongoing.

- Next, removal of large debris in the pools will be implemented as the final stage toward the start of fuel removal in November.

➤ Main works toward removing spent fuel at Unit 3

- Toward completion in early August, debris removal from the upper part of the Reactor Building is ongoing (at present, temporarily suspended due to steam detected).
- Next, toward work to install a cover to remove fuel and the Fuel Handling Machine on the operating floor, decontamination and shielding will be performed to reduce the radiation dose (due to start early August) (see Figures 6 and 7).

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

- On July 18, steam was detected near the center of the 5th floor of Unit 3 Reactor Building (on the equipment storage pool side). As of July 24, water injection into the reactor and cooling of the spent fuel pool continued stably, with no significant change detected in the values of RPV and PCV temperatures, monitoring posts and noble gas monitors. At present, "infrared thermography measurement" and "airborne radiation measurement" are being implemented around the relevant location to investigate the steam generation mechanism (see Figures 8 and 9).

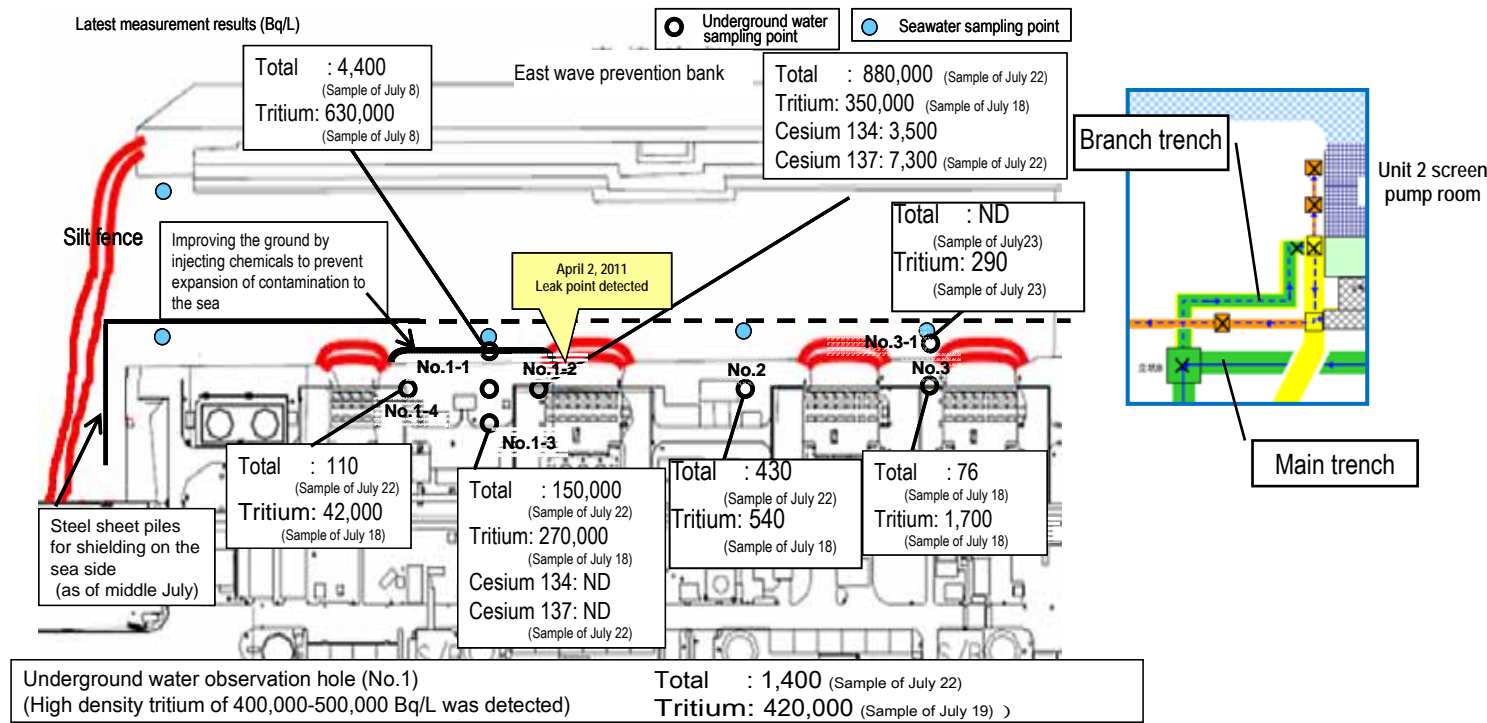


Figure 3: Underground water monitoring results (as of July 24, 2013)

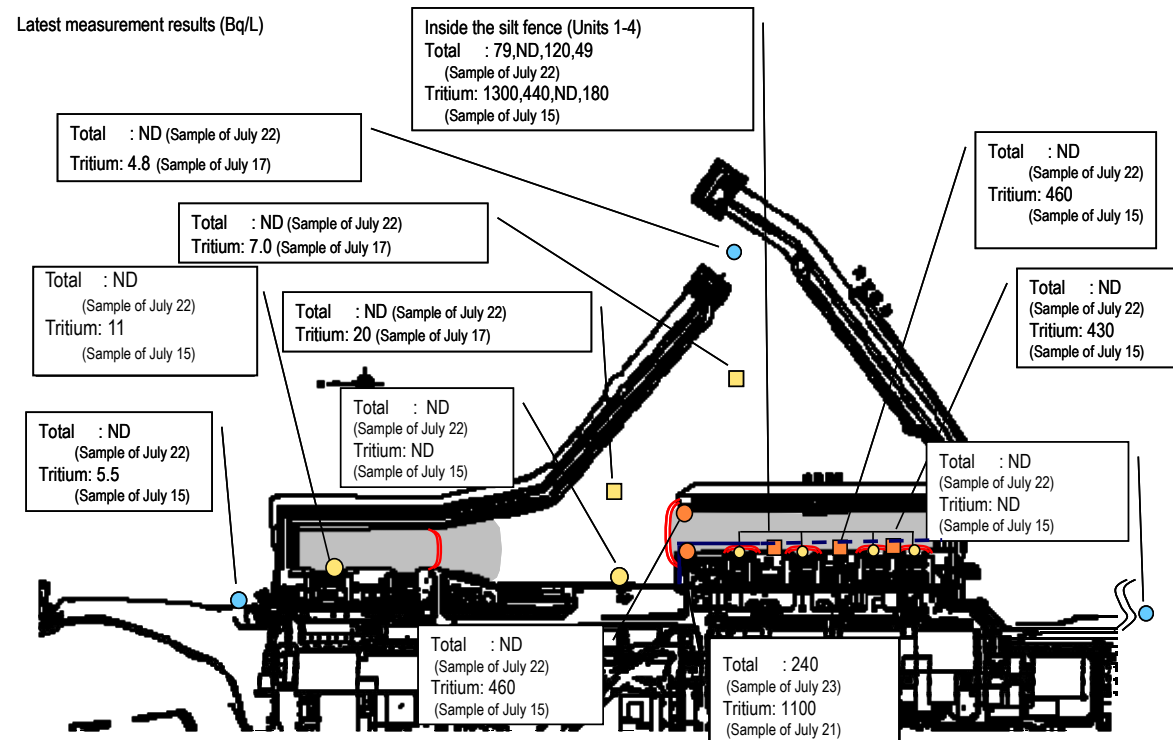


Figure 4: Seawater monitoring results (as of July 24, 2013)

4. Plan for fuel removal from the spent fuel pools

Work toward removing spent fuel from the pool has steadily progressed while ensuring seismic capacity and safety. In particular, efforts are being made to achieve an early start and completion of removing spent fuel from the Unit 4 pool (scheduled to start in November 2013 and be completed by around the end of 2014)

➤ Main works toward removing spent fuel at Unit 4

- The cover installation to remove fuel is ongoing (to be completed in around October). Work to lift the crane (June 7-14), the Fuel Handling Machine (July 10-13) (see Figure 5) and install the outside walls of the fuel

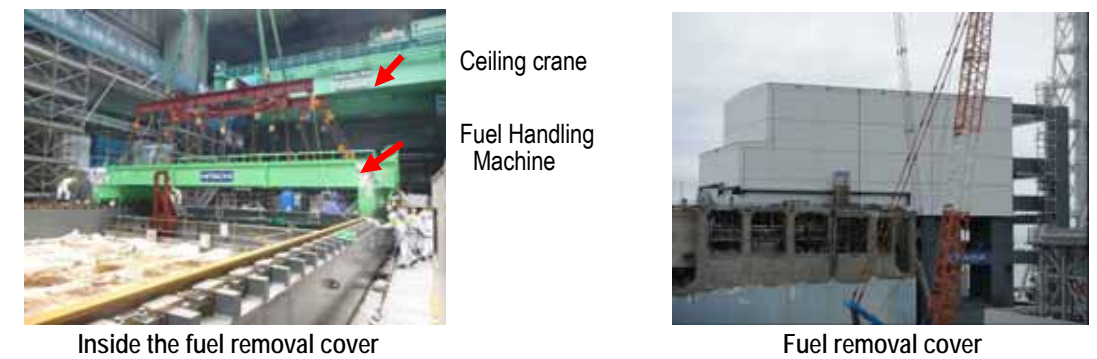


Figure 5: Installation status of the Unit 4 fuel removal cover

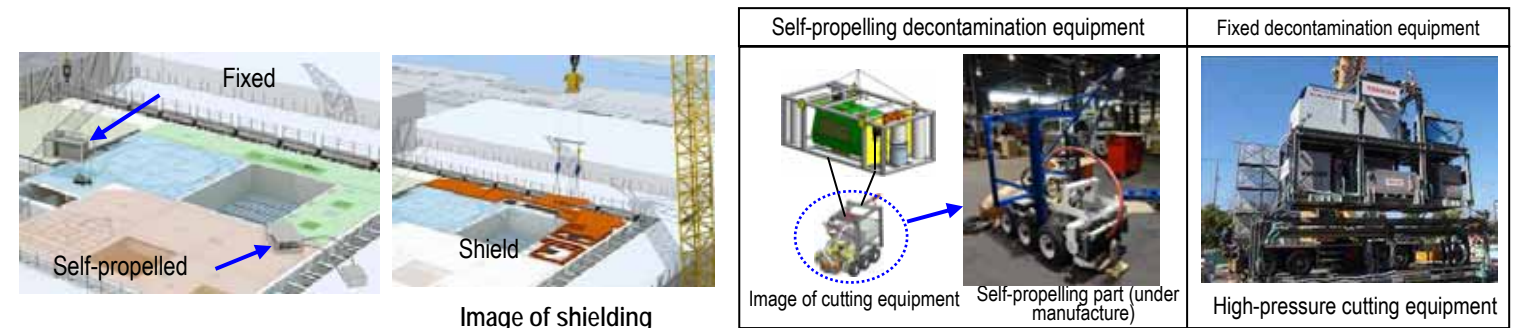


Figure 7: Major tools used for decontamination

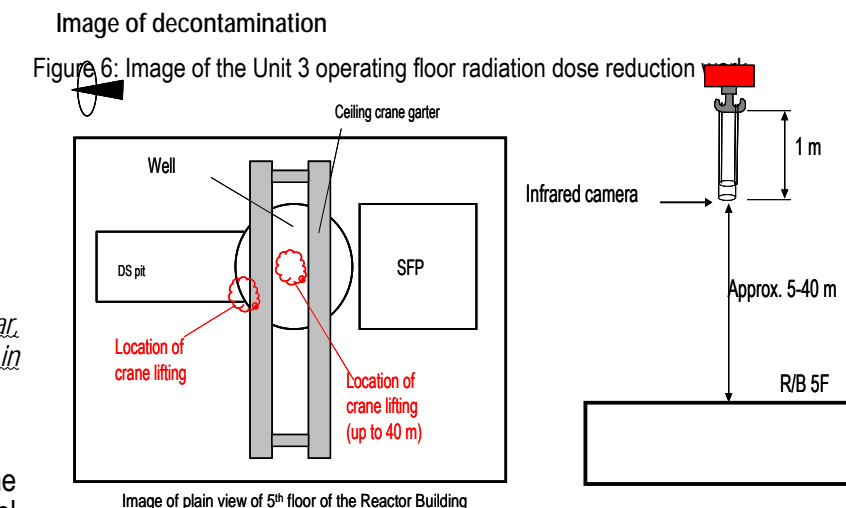


Figure 6: Image of the Unit 3 operating floor radiation dose reduction

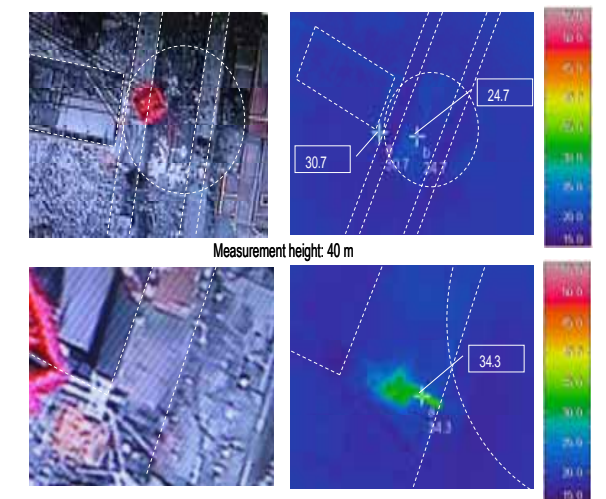


Figure 8: Infrared thermography measurement

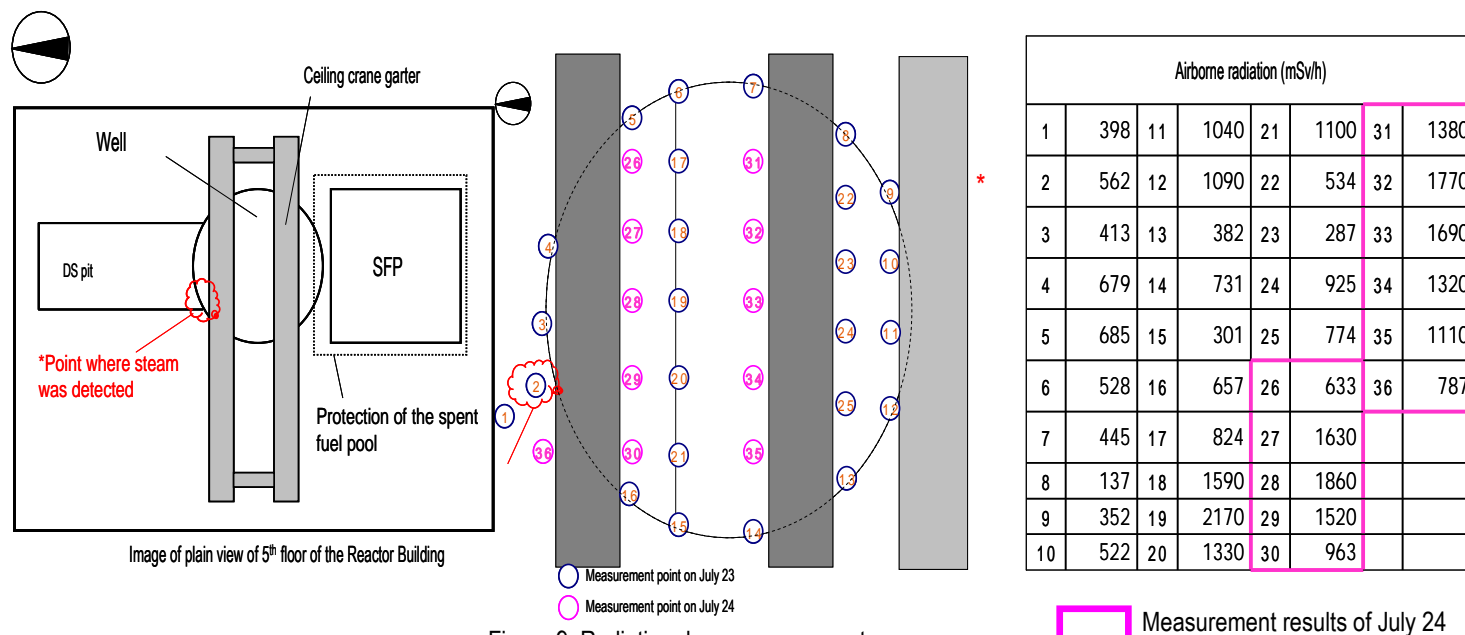


Figure 9: Radiation dose measurement

5. Fuel debris removal plan

In addition to decontamination and shield installation underway to improve accessibility to the PCV, the development of technology and acquisition of data to prepare for fuel debris removal (such as investigating and repairing the PCV leak location) are progressing

- Investigation and installation of permanent monitoring gauges inside Unit 2 PCV
 - To investigate the status inside Unit 2 PCV, investigative equipment was inserted via the through-hole of the PCV (X-53), but could not reach the control rod drive (CRD) replacement rail, and the guiding pipe could not be pulled out (March 19).
 - The results of cause analysis estimated that this was caused by turning the guiding pipe in the opposite direction. To prevent recurrence, tools will be used to visually check the turning direction and volume and over-turning, and reinvestigation will be implemented (early August) (see Figure 10).
- Removal of obstacles on 1st floor of Units 1 and 3
 - On the 1st floor of Units 1 and 3, to ensure access routes for decontamination equipment, removal of obstacles such as ducts spread across the Reactor Buildings due to the impact of the explosion started using remote control heavy machinery (from July 25).
- Investigation around the PCV upper part through-hole on 1st floor of Unit 2 Reactor Building
 - To help formulate measures to reduce the radioactive dose inside the Reactor Building and work plan for investigation and repair of PCVs, an investigation to measure the airborne radiation rate and check for any obstacles was performed using the "high-place investigation robot" (July 23). The results found that it was impossible to access the relevant location. Next, expansion of the investigation area and implementation in other Units will be examined.

Investigation items

Scope	Item	Equipment
CRD replacement rail, near the pedestal open	Appearance	CCD camera
	Airborne radiation	Dose gauge
	Airborne temperature	Thermocouple thermometer

Mockup of investigation equipment insertion

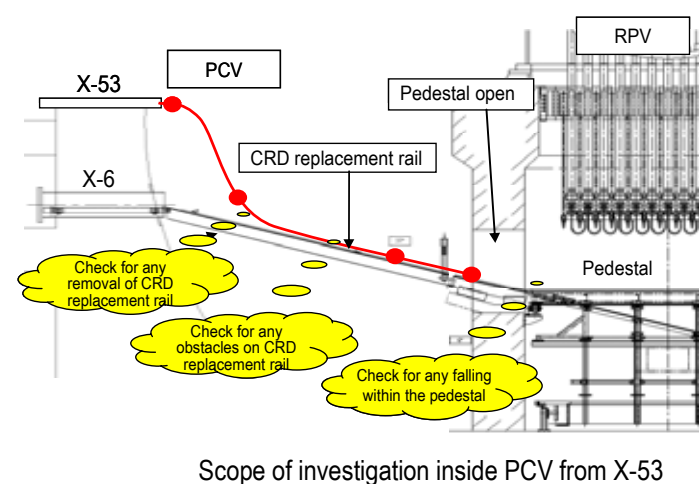
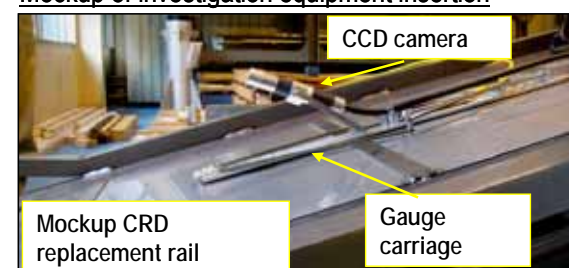


Figure 10: Investigation inside Unit 2 PCV

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 of the waste properties
 - To evaluate the density of the radioactive materials contained in waste, 14 samples (highly contaminated water at the basement of central RW treatment facility, highly contaminated water at the basement of HTI building, treated water at cesium adsorption apparatus, and treated water at second cesium adsorption equipment) were transported to JAEA for additional analysis (from July 1).
- Temperature trend of the felled trees temporary storage facilities
 - During the summer period (June - September), when the fire risk increases, temperature measurement and on-site inspection are performed more frequent (3 times per week). The temperature is maintained below approx. 60 that was detected in the trial.

7. Plan for staffing and ensuring work safety

Securing an appropriate number of staff over 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 who were registered for one day or more in a month to work at the power station in the past quarter from March to May, 2013 was approx. 8,700 (TEPCO and cooperative company workers), which exceeds the monthly average number of people who actually worked there previously (approx. 6,300). Thus, sufficient people are registered to work at the power station.
 - It was confirmed that the estimated manpower necessary for the work in August (approx. 3,100: TEPCO and cooperative company workers) will be secured.
 - The local employment rate among cooperative company workers was approx. 50% as of June.
- Status of heat stroke
 - As of July 24 this fiscal year, a total of 4 people suffered heat exhaustion caused by the work here, including 2 possible heat stroke patients. Thorough measures to prevent heat stroke have continued. (As of the end of July last fiscal year, a total of 17 people had suffered heat exhaustion caused by the work here, including 12 possible heat stroke patients.)
- Installation of entrance control facilities
 - Entrance control facilities near the main gate of the Fukushima Daiichi Nuclear Power Station entered operation on June 30. These provide services such as investigating contamination and decontamination, providing a venue to change into and from protection clothes, and distributing and collecting dosimeters provided at the J Village (see Figure 11).
- Review of the work scope of female radiation workers
 - Based on the improved on-site work environment (reduced radiation dose, etc.), the work scope of female radiation workers was reviewed (work at entrance control facilities (within the building) and work of guiding visitors while remaining within the vehicle were added) (the change will come into effect on August 1).



Figure 11: Entrance control facilities

8. Others

- Status of preparation for establishing an organization to manage R&D
 - The application for establishing an organization to manage R&D was submitted to METI by 17 members consisting of national research institutes, manufacturers and power companies on July 23. The organization (named "International Research Institute for Nuclear Decommissioning") aims to manage the R&D projects related to nuclear decommissioning.