September 26, 2013

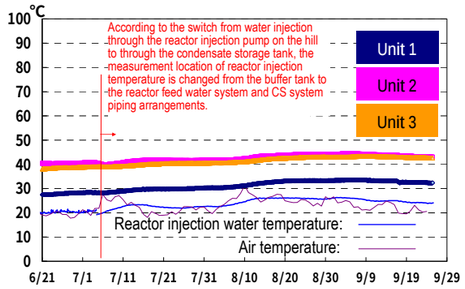
Secretariat of the Council for the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station

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

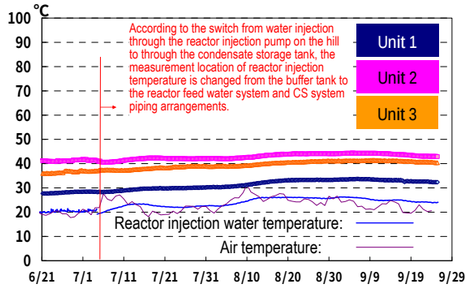
I. Confirmation of the reactor condiitions

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. 30 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 a part of temperature data measured at multiple points.

2. Release of radioactive materials from the Reactor Buildings

Regarding the evaluation on the radioactive materials newly released from Reactor Building Units 1-3, the measurement of radioactive material density released in the air above the Unit 3 Reactor Building was postponed to September 25 because of the need to suspend crane work due to the incline of a large remote control crane. The evaluation results will be reported by early October.

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 cold shutdown condition or sign of criticality detected.
Based on the above, it was confirmed that the comprehensive cold shutdown condition has been maintained and the reactors remain in a stabilized condition, except the density of radioactive materials. These conditions will be reconfirmed once the results of radioactive material density are reported.

II. Progress status by each plan

1. Reactor cooling plan

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

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

- The residual air with 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 hydrogen-related risks. As for Unit 1, intermittent injection was started in December 2012. At present the hydrogen concentration is in a stable condition and under the flammability limit. However, to ensure further stability, the intermittent injection was shifted to continuous injection from September 9 as a countermeasure to the potential additional supply of hydrogen.
- As for Unit 2, nitrogen has been injected intermittently since May 2013 and for Unit 3, no rise in hydrogen concentration was observed, and monitoring of any change in parameters continues.

2. Accumulated water treatment plan

As a countermeasure to the increasing amount of accumulated water due to groundwater inflow, drastic measures 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 to control contaminated water

➢ Preventing groundwater from flowing into the Reactor Buildings

- Measures 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) are underway. As for Systems A to C, test operation and water-quality check were completed (pumping wells: water sampling from December 2012 to March 2013; temporary storage tanks: water sampling from April to July, 2013) (System A: completed on April 23; Systems B and C: completed on September 9). It was confirmed that the density of the representative indicator nuclide Cs-137 was sufficiently low compared to that in the neighborhood ocean area and rivers. In the next step, Cs-137 will be remeasured for pumping wells within which highly concentrated tritium was detected.

➢ 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 stored water in the power station site as well as preventing unexpected risks of leakage. The steady implementation of hot testing using water containing radioactive materials was also commenced (System A: from March 30, System B: from June 13). To date, approximately 21,000m^3 has been treated.
- As for System A, a minor leak was detected from the (batch process) tank used to pretreat the contaminated water. System A was suspended to investigate the leak (June 15) and System B was scheduled to be suspended (August 8). Based on the investigative results, corrosion was detected in the piping flange and within the absorption tower and flanges.
- Factors behind the corrosion and measures to prevent its recurrence are as follows:
  - (1) Combined effects of formation of a crevice environment due to sediment generated by pre-treatment and acceleration of the corrosion environment due to chemical injection (mainly hypochlorous acid).
    → The inside of the batch process tank was rubber-lined (see Figure 1), and the injection of hypochlorous acid was suspended.
  - (2) Activated silver impregnated carbon placed in the absorption tower generated and accelerated corrosion under a non-alkaline environment.
    → Under a neutral environment, instead of using activated silver impregnated carbon, the absorption tower configuration was changed to ensure absorption capability.
  - (3) Within the flange, the low-velocity flow tended to generate local corrosion.
    → Sacrificial electrodes were installed in flanges prone to corrosion (Figure 2).
- First, mainly for System C, countermeasures for corrosion (installing sacrificial electrodes) and filling adsorbent and filling water in the systems (from September 19) were simultaneously implemented, and a water flow test was launched (from September 23). The next step will involve scheduled hot testing (from September 27).
- Hot testing will resume in late October for System A and mid-November for System B.

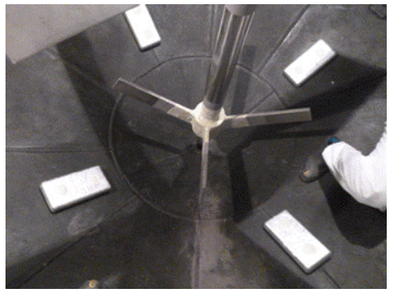


Figure 1: Batch process tank 1C
(after applying rubber lining)

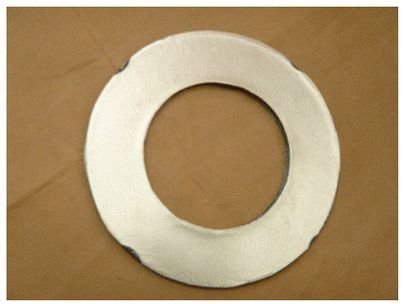


Figure 2: Gasket-type sacrificial electrodes

➢ Status of leak from underground reservoirs and measures to resolve this issue

- To identify the leak location Nos. 1 and 2, boring holes were drilled behind the underground resservoir for sampling (No. 1: 8 holes, No. 2: 13 holes). As for No. 2, the distribution range was identified and the contaminated soil was removed (from July 13 to August 2). As for No. 1, additional boring holes (4) will be drilled from October to identify the range of contaminated soil.
- As for the underground reservoir Nos. 2 to 4, uplift was detected mainly at the center of the top surface (Nos. 2, 3 and 4: peaking at approx. 7, 30 and 15cm respectively) (August 10).
- To monitor the uplift status, the top surface of the underground reservoir Nos. 1 to 4 is being measured (5 points) and Nos. 5 to 7 (1 point) (once/day). As for underground water storage pool Nos. 2 to 4, approx. 70 to 80cm of crushed stone will be added to the top surface for equalization (No. 2: September 13-27, No. 3: September 17-27, No. 4: August 29 to September 5). As for other underground reservoir, it was confirmed that no measures were needed.

➢ Water leak at H4 Area tanks

- Puddles were detected inside the channel in the H4 Tank Area, which stores contaminated water and outside the drain valve of the channel (August 19). As water had 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 and the results showed that the water level had decreased by approx. 3m (equivalent to approx. 300m^3) compared to neighboring tanks and the leak of highly concentrated contaminated water was confirmed (August 20).

(1) Cause analysis and direct response

- Air was channeled into the space between the flange surface of the tank bottom plate and the concrete foundation to investigate the leak point, but the attempt to identify this failed (September 5).
- The tank in which a leak was detected was decontaminated and dissembled (from September 17), to conduct the bottom plate vacuum test*. Based on the results, there were two points from which bubbles were absorbed (September 25) (See Figure 3). The investigation concerning the leak will continue.

* A test to apply bubbles to the flange inside the tank and absorb the air in the lower part of the bottom plate.

(2) Identification of contamination status and impact assessment (See Figure 4)

- To identify the contamination scope, an investigation into the radiation dose on the ground surface was conducted (Investigation <A>: August 19-22, 29). Based on the results, the contaminated soil was inspected and collected (Investigation <B>: from August 23), while a boring survey to a depth of approx. 2m was performed (Investigation <C>: September 2-6) to analyze the soil, etc. which is now underway.
- To check for any contamination immediately under the tank in which a leak was detected, soil analysis by a boring survey is underway (Investigation <D>: The drilling work was completed on September 13). Based on the results of measurement to determine the radiation dose rate of the boring cores, it was confirmed that the contamination had penetrated to a depth of approx. 1m (see Figure 5).
- A boring survey to a depth beyond groundwater level (7 to 25m) (Investigation <E>: from August 28) was conducted to continuously measure the radiation material density of the groundwater. At sampling point E-1 near the tank, the density of tritium had risen, although the values subsequently fluctuated over the announced density (60,000Bq/L) (see Figure 6). At other sampling points (E-2 to E-6), tritium was also detected, but the values remained under the announced density with little fluctuation. The trend will be continuously monitored to identify the contamination status and conduct an impact assessment.
- Since August 20, monitoring of drainage toward the ocean has been enhanced while adding observation points in the sea area for monitoring. In the coastal sea area near the north-south discharge channel, no total β was detected, based on which the impact on the sea area is estimated to be low.
- There are plans to install monitors for constant monitoring of drainage. (Operation will begin at the end of November)

(3) Transport of accumulated water inside the channel when a typhoon is approaching

- As an impact of rainfall due to the approaching typhoon No. 18, water accumulation was detected inside the channel on the south side of B Area. The accumulated water (total β: 37Bq/L) was collected in a tank (September 15). Later, as an emergency measure to prevent the water in the channel from flowing out, after sampling the water inside the channel, water with a total β density 30Bq/L or more* was transported to empty tanks within the relevant area, and water with a total β density below 30Bq/L was discharged outside the channel (September 16).
- Subsequent steps will include increasing the channel height, installing a cover to prevent rainwater inflow, and procuring a transport destination (tanks, etc.).

- As countermeasures for water leaking from tanks, the following 5 points were ordered by the Minister of Economy, Trade and Industry:

1. Strengthening the management framework for tanks and areas around them
   - Closing drainage valves in principle (from August 28)
   - Regarding reinforcement of the tank bottom, measures are planned at the time of tank replacement.
   - Water level gauges will be installed on the tanks and a concentrated monitoring system will be built (operation scheduled to start at the end of November).
2. Reinforcement of patrols
   - The frequency of patrols was increased to 4 times daily (from August 26)
   - The number of patrol personnel was increased to 60 persons during daytime (3 persons x 10 teams (rotation personnel 10 teams)), and 6 persons overnight (total of approx. 30 persons: 6 persons x 5 teams) (from September 2).
3. Accelerated increase in the number of welded-type tanks and replacement of bolt-fixed type tanks with those of the welded-type
   - Plans for an accelerated increase in welded-type tanks by simultaneously installing them in multiple areas and reducing waste materials generated by replacement, etc..
4. Accelerated 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
   - As for System C of the multi-nuclide removal equipment, countermeasures for corrosion will be preferentially implemented and hot testing is planned (from September 27).
   - As a project subsidized by the Ministry of Economy, Trade and Industry, installing contaminated water purification systems with high treatment capability was examined.
   - Including also installing multi-nuclide removal equipment, efforts are made to complete the purification of all contaminated water stored in tanks within fiscal 2014.
   - Removal of soil around H4 Area is conducted (from August 23).
5. Identifying risks related to the storage of contaminated water with high density and implementing measures to address risks
   - Examination is underway by the “Task Force for Contaminated Water Treatment.”

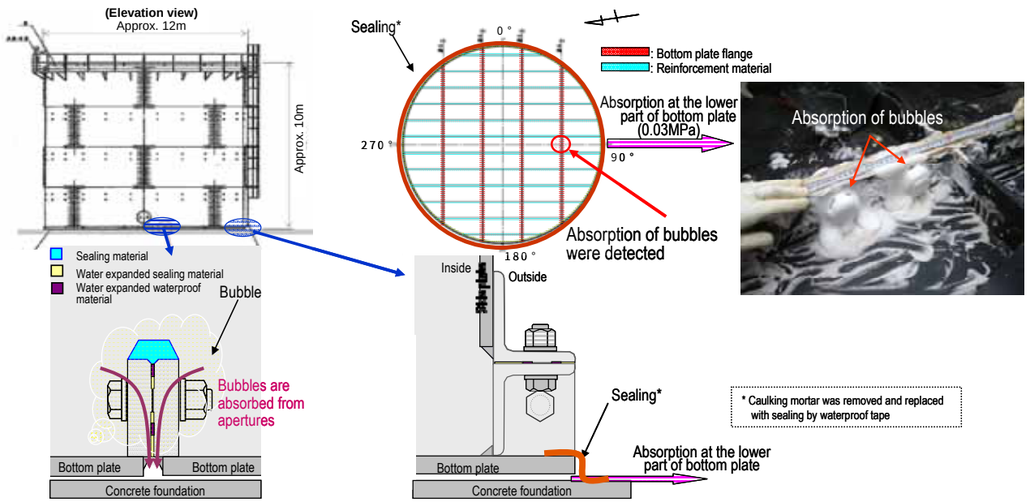


Figure 3: Investigation results related to leak of tanks

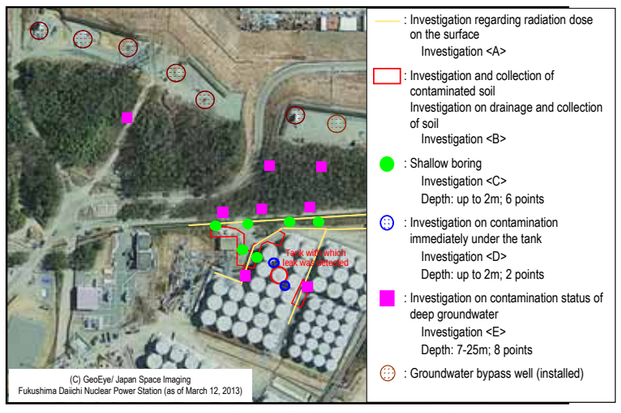
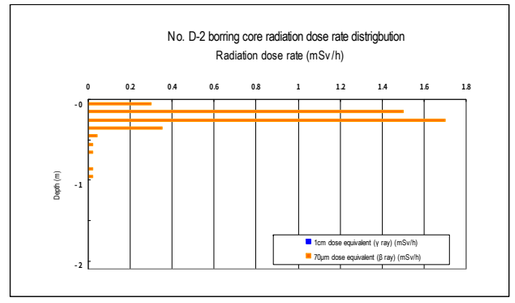


Figure 4: Boring survey points

Measured on September 20, 2013



Note: The depth is the value from the ground surface, and for the radiation dose rates, the background.(B.G.) is expressed in 0mSv/h. All radiation dose rates are B.G.

Figure 5: Distribution of boring core radiation dose

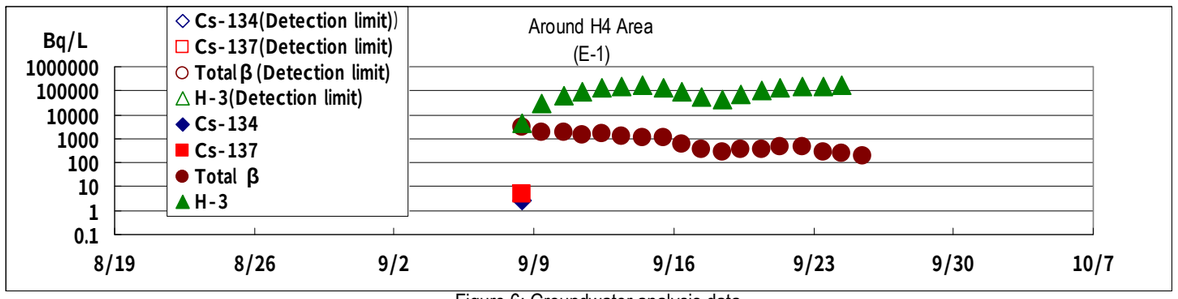


Figure 6: Groundwater analysis data

3. Plan for radiation dose reduction and contamination mitigation

Effective dose reduction at site boundaries (reduced 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 address emissions of increased radioactive material density in groundwater on the sea side and in seawater

- Analytical results of data e.g. concerning density and water levels 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 material density was detected within the intake open channels for Units 1 to 4 only. While the density near the port boundaries (i.e. the port channels and north and south discharge channels) was temporarily increased, it remained approx. below the detection limit level (peaking at several Bq/L) for the past month. No significant increase was detected in the offshore measurement results either. As shown by these observations, little impact was found on the outside of the port (see Figure 7).
- As measures to prevent expansion of the contamination to sea, the following shall be implemented:

(1) Preventing leakage of contaminated water

- Ground improvement behind the bank protection to prevent expansion of radioactive materials.
  (Between Units 1 and 2: completed on August 9; between Units 2 and 3: from August 29 and to be completed late November; between Units 3 and 4: from August 23 and to be completed mid-October)
- Pumping of groundwater in contaminated areas
  By installing catchment pits and well points (compulsory pumping equipment by vacuuming), the groundwater level is reduced. Between Units 1 and 2, by pumping groundwater, its water level will go below the levee crown height of ground improvement (O.P. + 2.20m).
  Between Units 2 and 3 and 3 and 4, by operating well points, contaminated water may be drawn from the seawater piping trench, which includes highly concentrated contaminated water, and expand the contamination. Accordingly, the well points will not be operated pending completion of ground improvements on the sea side and enhanced water-quality monitoring of groundwater.
  (Catchment pits: (Between Units 1 and 2 only) From August 9, the transport was started.
  Well points: (Between Units 1 and 2) From August 15, part of the transport was started, and from August 23, full transport started.
  (Between Units 2 and 3) Preparation for operation was completed.
  (Between Units 3 and 4) Preparation for operation was completed.)

(2) Isolating groundwater away from the contamination source

- Enclosure by improving the side ground foundation
  (Between Units 1 and 2: Started from August 13 and to be completed late November
  Between Units 2 and 3: Started from early October and to be completed early December
  Between Units 3 and 4: Started from early October and to be completed late November)
- To prevent ingress of rainwater, the ground surface will be paved with asphalt for the range enclosed by the ground improvement (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), whereupon the trench was closed (August 29 – September 19).
- Purification and removal of contaminated water in the main trench
  (Units 2 and 3: Purification will commence early October)

- Moves to report to and examine in the review committee, consisting of experts to examine the factors contributing to the increased density of radioactive materials in seawater within the port and verify the measures implemented by TEPCO, analyze the groundwater flow and evaluate transfer of radioactive materials are conducted (1st meeting: April 26, 2nd: May 27, 3rd: July 1. 4th July 23, 5th: August 16).

➢ Progress status of on-site decontamination

- From the perspective of reducing the radioactive dose in areas where many workers enter, the subject points and target radiation dose have been set for decontamination since 2012. This fiscal year, decontamination around the Welfare Building and Corporate Building is planned.
  (Before decontamination: up to 20μSv/h, target after decontamination: 5 - 10μSv/h)

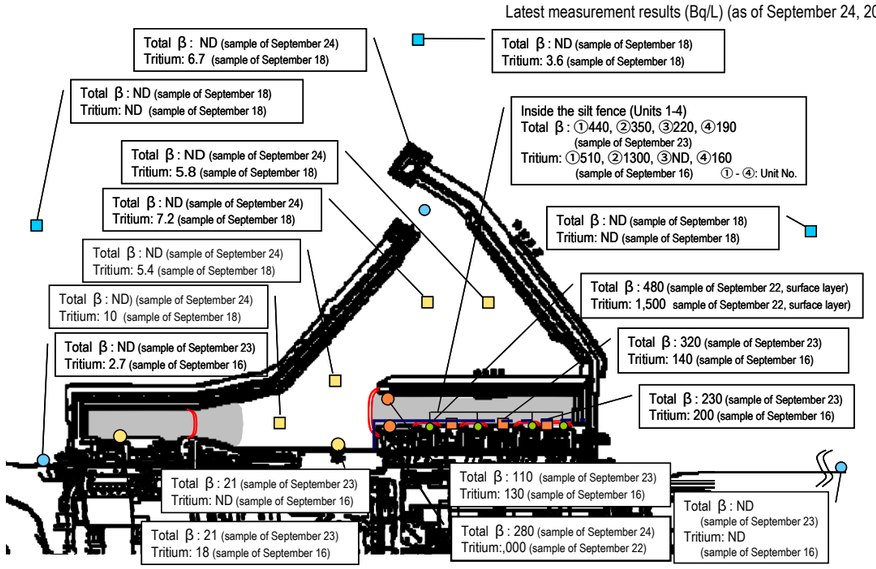


Figure 7: Seawater monitoring results

4. Plan for fuel removal from the spent fuel pools

Work toward removing spent fuel from the pool is steadily progressing while ensuring seismic capacity and safety. In particular, efforts are being made to achieve an early start and complete removing spent fuel from the Unit 4 pool (planned to commence in November 2013 and completed at around the end of 2014)

➢ Main works toward removing spent fuel at Unit 4

- The cover installation for fuel removal is ongoing (to be completed around October). The works for lifting the overhanging crane (June 7-14), lifting the Fuel Handling Machine (July 10-13), installing the outside walls of the fuel removal covers and exterior roof panels (April 1 – July 20) and the overhanging crane (September 25) were completed. At present, assembly and installation works are underway (see Figure 8).
- Toward the fuel removal start in November, removal of rubbles inside the pool is underway (from August 27).

➢ Main works toward removing spent fuel at Unit 3

- Reflecting a phenomenon whereby the top jib mast of the remote control-type large crane and a crack at the root of the upper part of the main mast were detected (September 5), work to remove rubbles from the upper part of the Reactor Building was suspended. Later, the crane was dissembled and investigated. Based on the results, it was confirmed that the factor was the loosened junction of the hydraulic pressure hose operating the lock brake for the drum, which rolls up the cable for lifting the top jib mast. After horizontally deploying recurrence prevention measures to remote control-type large cranes applying the same junctions, removal of rubbles will resume in around mid-October. Upon resumption of rubbles 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, as well as remove large rubbles within the pool. Dust sampling is conducted using other remote control-type large cranes.

➢ Main works toward removing spent fuel at Unit 1

- The first step toward fuel removal from the spent fuel pools is to dissemble the cover over the buildings. Beforehand, the exhaust system of the building cover was suspended (September 17). In the next step, after a yard for moving large heavy machinery is built and the exhaust system is removed, disassembly of the building cover will begin from around the end of fiscal 2013.

Figure 8: Status of installation of the Unit 4 Fuel Handling Machine and overhead crane

5. Fuel debris removal plan

In addition to the decontamination and shield installation to improve accessibility to the PCV, technology is being developed and data acquired as necessary to prepare for removing fuel debris (such as investigating and repairing the leak locations of the PCV).

➢ Demonstration test of the water level measurement robot inside Unit 2 S/C

- As for Unit 2, aiming to investigate and repair the leaking parts with PCV, a demonstration test for technology measuring water levels in the suppression chamber (S/C) via remote control from outside S/C using ultrasound waves (September 20, 24) (see Figure 9). This technology was developed by the FY2012 technology infrastructure development project related to measures for accidents in nuclear power generation reactors (development of a remote-control infrastructure to measure the water level inside cylindrical containers. At present, the collected data is being analyzed.
- As for Unit 5, a demonstration of the developed equipment confirmed that it could measure water levels inside S/C (September 12-14).

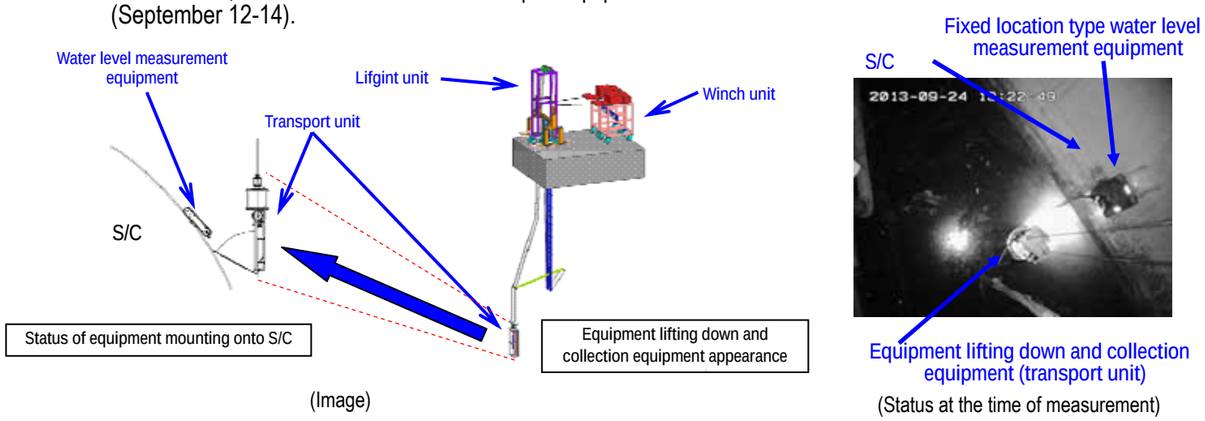


Figure 9: Demonstration test of Unit 2 S/C water level measurement robot

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

Promoting efforts to reduce and appropriately store waste generated and R&D toward adequate and safe storage, processing and disposal of radioactive waste

➢ Investigation into the property of waste

- To investigate the property of waste generated, the radioactivity has been analyzed by the JAEA, to which samples of dead leaves will be transported in around late September.

➢ Management status of rubbles and trimmed trees

- At the end of August, the total storage volume of concrete and metal rubbles was approx. 65,000m^3 (area occupation rate: 70%). The total storage volume of trimmed trees was approx. 51,000m^3 (area occupation rate: 51%).

7. Plan for staffing and ensuring work safety

Securing appropriate 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 workers ' on-site needs.

➢ 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 3 months from May to July, 2013 was approx. 8,300 (TEPCO and partner company workers), which exceeds the monthly average number of people who actually worked there (approx. 6,000). Accordingly, sufficient people are registered to work at the power station.
- It was confirmed that the estimated manpower necessary for the work in October (approx. 2,400 per day: TEPCO and partner company workers) would be secured.
- The local employment rate of the partner company and TEPCO workers was approx. 50% as of August.

➢ Preventive measures of heat stroke

- As of September 25 this fiscal year, a total of 17 people had suffered heat exhaustion caused by the work here, including 8 possible cases of heat stroke. Thorough preventive measures of heat stroke continue. (As of the end of September last fiscal year, a total of 24 people had suffered heat exhaustion caused by the work here, including 7 possible cases of heat stroke.)

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

- Alerts of high radioactivity density were issued from the continuous dust monitor installed in front of the Main Anti-Earthquake Building and bodily contamination was detected by the entrance control monitor of the Entrance Control Building in 10 TEPCO workers (August 12) and 2 partner company workers (August 19) who rode a bus in front of the Main Anti-Earthquake Building.
- The alerts were issued during the removal of debris from the upper part of the Unit 3 Reactor Building; the Main Anti-Earthquake Building is located downwind of that Reactor Building; and no alert has been issued since August 20 when debris removal was suspended. For these reasons, the most likely explanation for the dust density increase was the removal of debris from the upper part of the Unit 3 Reactor Building.
- Recurrence prevention measures include: (1) reviewing the method used to spray dust inhibitor (changing the spray range, frequency and density) to reduce scattering; (2) enhancing dust monitoring during debris removal on the upper part of Reactor Buildings (installing dust monitors on the refueling floor of Unit 3 and the neighboring slope of Unit 3 buildings); and (3) installing a cover tunnel in front of the Main Anti-Earthquake Building are implemented.
- From September 13, the move to establish an area imposing the wearing of full-face masks was eased and the area where wearing general working clothing is allowed was re-established.

➢ Influenza infection-control measures and prevention of the spread

- As was done last year, infection-control measures and efforts to prevent the spread, including influenza immunization, will be implemented from October for workers at Fukushima Daiichi and Daini Nuclear Power Stations and J-Village.

➢ Expansion of areas wearing full-face masks is not required

- As for Units 5 and 6, it was confirmed that the density of radioactive materials in air is below the criteria which would impose the requirement to wear full-face masks. Accordingly, for works with which little dust is stirred up, wearing disposable dust-protective masks (DS2) with a filtering efficiency of 95% or more is allowed (this rule will apply from early October). The protective clothing of workers will continue to be steadily optimized to decrease their burden and increase productivity.

8. Others

➢ Holding a meeting of the Intergovernmental Council for Fostering Mutual Understanding on the Contaminated Water Issue

- Aiming to enhance on-site information sharing and collaboration regarding the contaminated water issue, a meeting of the "Intergovernmental Council for Fostering Mutual Understanding on the Contaminated Water Issue" was held (September 9). The risks of the contaminated water issue were identified from the perspective of on-site workers and examination of countermeasures started.
- Specifically, the committee decided the following measures should be implemented:
  (1) Raising the height of channels around tanks to prevent contaminated water from flowing out.
  (2) Covering the ditches (drains) to reduce risks of contaminated water leaking from tanks and flowing out into the sea (measures to prevent inflow of contaminated water from outside).
  (3) Enhancing countermeasures for leaks around tanks (installing channels, applying concrete to the foundation, etc.).

➢ Workshop concerning the R&D plan and basic research toward reactor decommissioning

- Based on the mid-to-long-term roadmap, the first workshop (co-organized by the Ministry of Education, Culture, Sports, Science and Technology and IRID) was held in the Kanto Region aiming to identify and create the basic research, which is expected to be conducted by universities and research institutes. A total of six workshops will be held across Japan.

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

- Suspended steam has been detected above the Unit 3 Reactor Building intermittently since July 18 (during the past month, September 13, 15, 17 and 18). No abnormality was detected in the plant status and monitoring post indexes.

➢ Break or possible break phenomena of part of the bents of Units 1 and 2 exhaust stacks

- When taking photos by a telecamera to investigate the current status and check the soundness of the Units 1 and 2 exhaust stacks, breakage or potentially broken parts were detected with steel materials (bents) (September 18). The results of a simple earthquake safety evaluation confirmed that the earthquake safety of the support for the exhaust stacks had been maintained against the reference earthquake motion Ss-1*, and that there was no risk of collapse even if an earthquake as strong as the Tohoku Region Pacific Coast Earthquake (intensity 6 upper) recurs (September 19).
- A detailed investigation over the cracked parts and bolts is conducted by analyzing the collected photo data images (September 18-27) to then implement a detailed evaluation of earthquake safety.

* Ss-1: Reference earthquake motion of 450 and 300gal horizontally and vertically