Summary of Decommissioning and Contaminated Water Management

November 26, 2015

Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment

Main works and steps for decommissioning

Fuel removal from Unit 4 SFP had been completed and preparatory works to remove fuel from Unit 1-3 SFP and fuel debris (Note 1) removal are ongoing.

(Note 1) Fuel assemblies melted through in the accident.

Fuel Removal from SFP

Units 1&2 / Unit 3: Rubble removal & dose reduction → Installing a Fuel-Handling Machine → Fuel removal → Unit 4: Storage and handling

Unit 1: Fuel removal to start in FY2020
Unit 2: Fuel removal to start in FY2020
Unit 3: Fuel removal to start in FY2017
Unit 4: Fuel removal completed in 2014

Fuel Debris Removal

Unit 1-3: Capturing the status inside PCV/ examination of fuel debris removal method, etc. (Note 2) → Fuel debris removal → Storage and handling

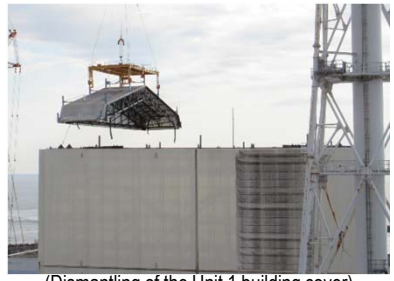
(Note 2)
The fuel debris removal method for each unit will be decided two years after revising the Mid-and-Long-term road map (June 2015). The method for the first unit will be confirmed in the first half of FY2018.

Dismantling Facilities

Scenario development & technology consideration → Design and manufacturing of devices/ equipment → Dismantling

Toward fuel removal from pool

Toward fuel removal from Unit 1 SFP, the building cover is being dismantled.
Dismantling of the building cover started in July 2015. The dismantling is being conducted steadily with anti-scattering measures fully implemented and radioactive materials monitored.



(Dismantling of the Unit 1 building cover)

Three principles behind contaminated water countermeasures

Countermeasures for contaminated water are implemented in accordance with the following three principles:

1. **Eliminate** contamination sources

① Multi-nuclide removal equipment, etc.

② Remove contaminated water in the trench (Note 3)

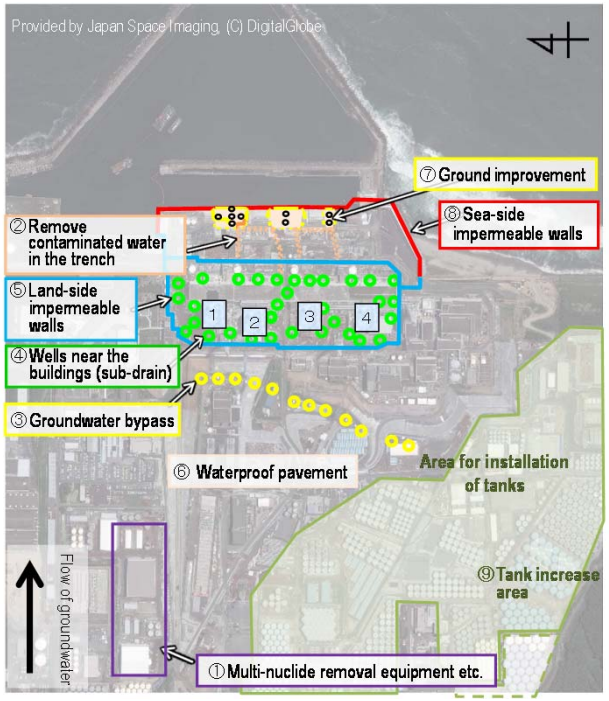
(Note 3) Underground tunnel containing pipes.

2. **Isolate** water from contamination

③ Pump up groundwater for bypassing
④ Pump up groundwater near buildings
⑤ Land-side impermeable walls
⑥ Waterproof pavement

3. **Prevent leakage** of contaminated water

⑦ Soil improvement by sodium silicate
⑧ Sea-side impermeable walls
⑨ Increase tanks (welded-joint tanks)



Multi-nuclide removal equipment (ALPS), etc.

- This equipment removes radionuclides from the contaminated water in tanks and reduces risks.
- Treatment of contaminated water (RO concentrated salt water) was completed in May 2015 via multi-nuclide removal equipment, additional multi-nuclide removal equipment installed by TEPCO (operation commenced in September 2014) and a subsidy project of the Japanese Government (operation commenced in October 2014).
- Strontium-treated water from equipment other than ALPS is being re-treated in ALPS.

(High-performance multi-nuclide removal equipment)

Land-side impermeable walls

- Land-side impermeable walls surround the buildings and reduce groundwater inflow into the same.
- Onsite tests have been conducted since August 2013. Construction work commenced in June 2014.
- Construction on the land side was completed in September 2015.
- On the sea side, drilling for freezing pipes was completed in October 2015.

(Installation of pipes for land-side impermeable walls)

Sea-side impermeable walls

- Impermeable walls are being installed on the sea side of Units 1-4, to prevent the flow of contaminated groundwater into the sea.
- The installation of steel pipe sheet piles was completed in September 2015 and they were connected in October 2015. These works completed the closure of sea-side impermeable walls.

(Installation status)

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

Progress status

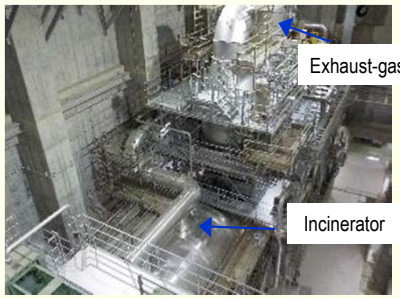
◆ The temperatures of the Reactor Pressure Vessel (RPV) and the Primary Containment Vessel (PCV) of Units 1-3 have been maintained within the range of approx. 20-40°C*1 for the past month. There was no significant change in the density of radioactive materials newly released from Reactor Buildings in the air*2. It was evaluated that the comprehensive cold shutdown condition had been maintained.

* 1 The values vary somewhat depending on the unit and location of the thermometer.
* 2 In October 2015, the radiation exposure dose due to the release of radioactive materials from the Unit 1-4 Reactor Buildings was evaluated as less than 0.0019 mSv/year at the site boundaries. The annual radiation dose by natural radiation is approx. 2.1 mSv/year (average in Japan).

Test operation of Radioactive Waste Incinerator started

Regarding the Radioactive Waste Incinerator, which will incinerate used protective clothing temporarily stored on site, installation of the facility was completed. Exhaust gas generated from incineration will be released after removing radioactive materials.

An incineration test using dummy waste started from November 25. Operations will start within this fiscal year.



<Radioactive Waste Incinerator>

Results of questionnaire survey for workers to improve the labor environment

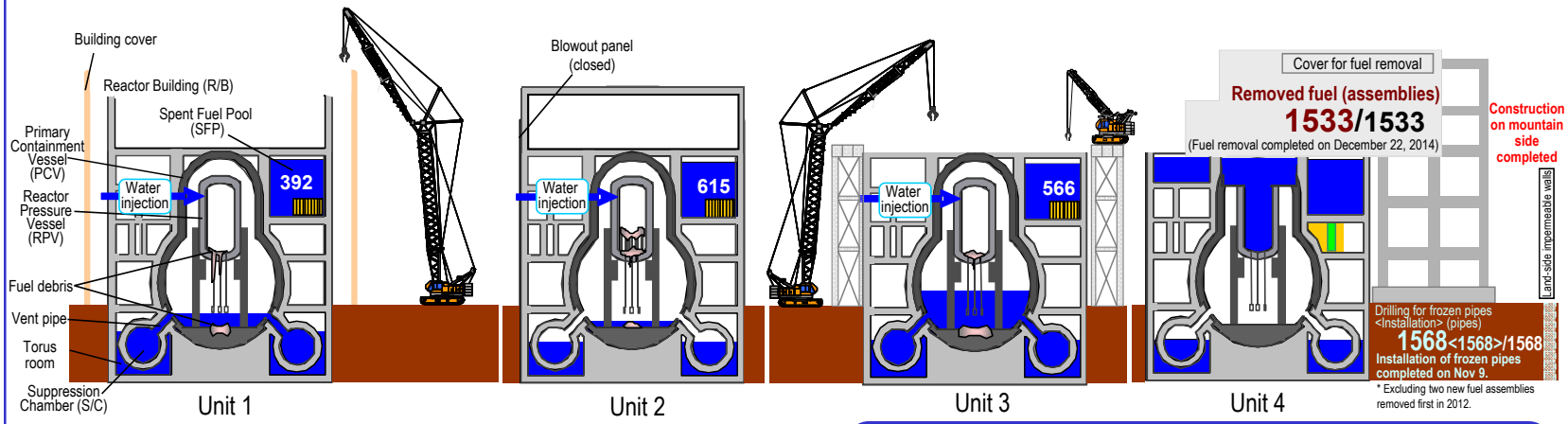
To improve the labor environment of workers at the power station, a 6th questionnaire survey was conducted, to which approx. 90% of workers responded.

Approx. 80% of respondents rated the following items as "good" or "reasonably good": operation start of the large rest house and dining room and expansion of the area where wearing of full-face masks is not required. Improvements will be made to meet requests such as setting up parking and rest houses on and off-site, and installing shower facilities.

Dismantling and modification of Unit 2 Reactor Building rooftop decided

To facilitate the removal of fuel assemblies and debris in the Unit 2 spent fuel pool, the scope of dismantling and modification of the existing Reactor Building rooftop was examined.

To ensure safety during the work, limit the impact on the outside of the power station and remove fuel rapidly to reduce risks, we decided to dismantle the whole rooftop above the highest floor of the Reactor Building. The dismantling will be conducted with safety prioritized above all.



Leakage from the accumulated water transfer facility, etc. into fences

Leakages were detected at the high-performance multi-nuclide removal equipment on November 2 and 25, at the Unit 2 accumulated water transfer facility on November 5, and at the desalination equipment (RO2-5) on November 15.

All these leakages remained within the fences and no leakage outside the buildings was identified.

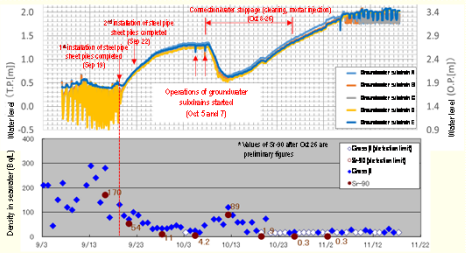
Operations resumed at the accumulated water transfer facility on November 11 after taking measures.

At the high-performance multi-nuclide removal and desalination equipment, investigations into the cause are currently underway.

Monitoring of seawater before and after closure of sea-side impermeable walls

Since the closure of the sea-side impermeable walls on October 26, a steady decrease has been identified in the density of radioactive materials inside the port.

During this stage, when the effect of the impermeable walls begins to emerge, thorough monitoring continues, including the impact on fluctuation by rainfall, etc.



<Monitoring before and after closure of sea-side impermeable walls>

Land-side impermeable walls Installation of frozen pipes completed

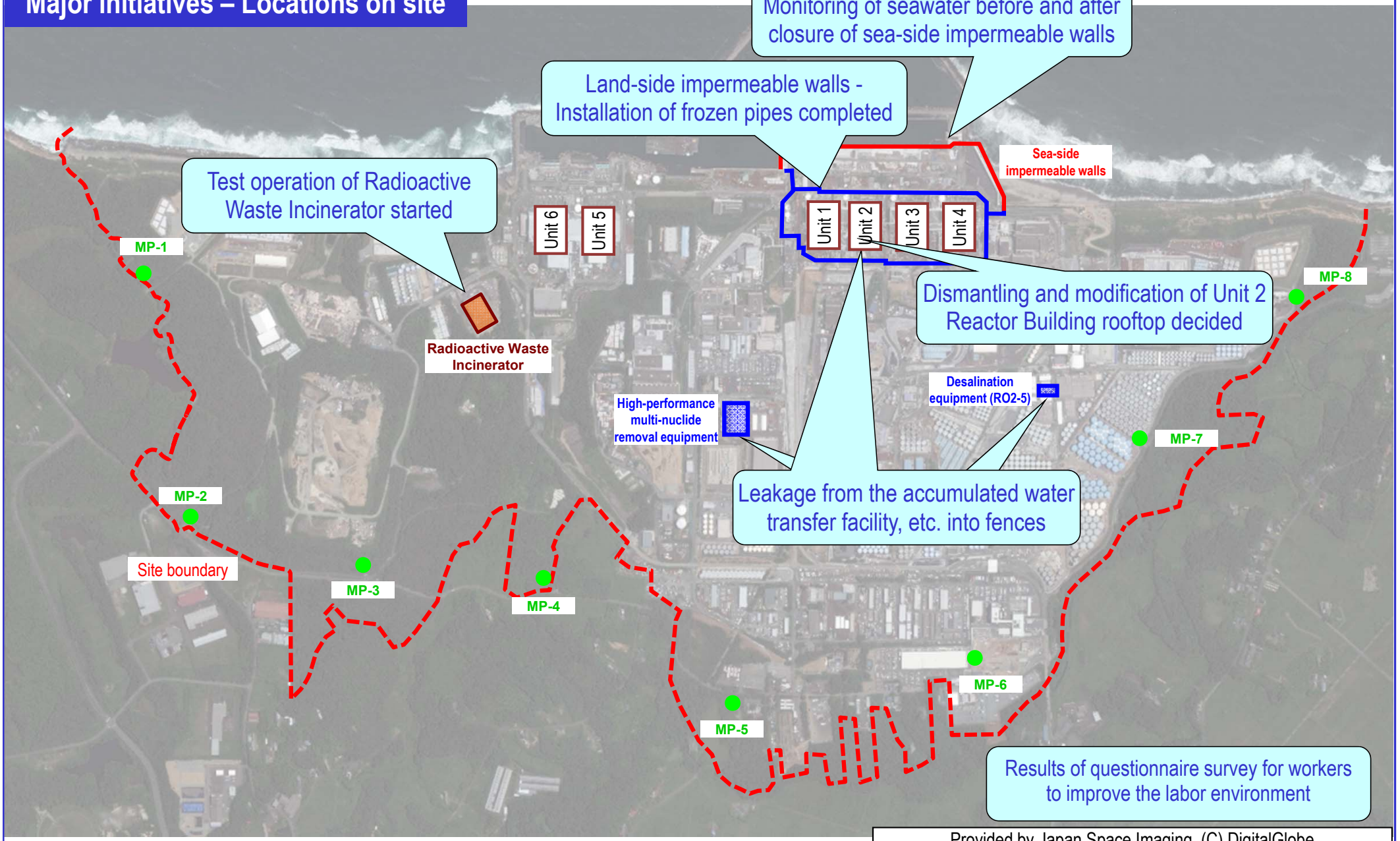
Land-side impermeable walls surrounding the Unit 1-4 buildings are being installed to reduce groundwater inflow into the same.

Construction on the land side, for which freezing will start first, was completed on September 15.

On the sea side, installation of frozen pipes was completed on November 9. The next step started to install pipes, etc.

<Sea side of land-side impermeable walls - Installation of frozen pipes>

Major initiatives – Locations on site



* Data of Monitoring Posts (MP1-MP8.)

Data (10-minute value) of Monitoring Posts (MPs) measuring airborne radiation rate around site boundaries show 0.840 - 3.522 μSv/h (October 28 – November 24, 2015).

We improved the measurement conditions of monitoring posts 2 to 8 for precise measurement of air dose rate. Construction works such as tree-clearing, surface soil removal and shield wall setting were implemented from Feb .10 to Apr. 18, 2012.

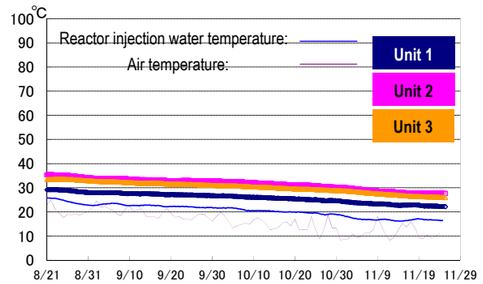
Therefore monitoring results at these points are lower than elsewhere in the power plant site.

The radiation shielding panel around monitoring post No. 6, which is one of the instruments used to measure the radiation dose of the power station site boundary, were taken off from July 10-11, 2013, since the surrounding radiation dose has largely fallen down due to further cutting down of the forests, etc

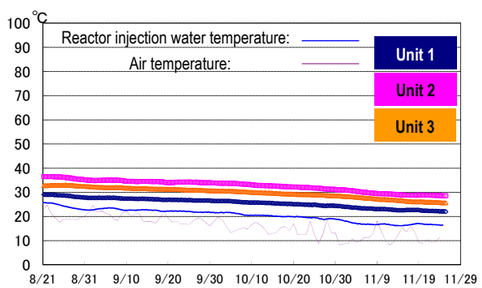
I. Confirmation of the reactor conditions

1. Temperatures inside the reactors

Through continuous reactor cooling by water injection, the temperatures of the Reactor Pressure Vessel (RPV) bottom and the Primary Containment Vessel (PCV) gas phase have been maintained within the range of approx. 20 to 40°C for the past month, though they vary depending on the unit and location of the thermometer.



RPV bottom temperatures (recent quarter)



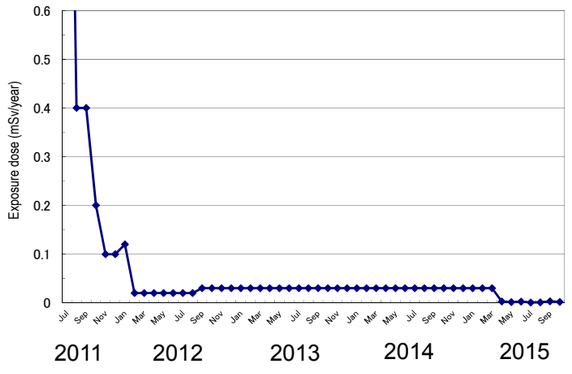
PCV gas phase temperatures (recent quarter)

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

2. Release of radioactive materials from the Reactor Buildings

As of October 2015, the density of radioactive materials newly released from Reactor Building Units 1-4 in the air and measured at the site boundaries was evaluated at approx. 6.1×10^{-11} Bq/cm^3 for Cs-134 and 1.4×10^{-10} Bq/cm^3 for Cs-137 respectively. The radiation exposure dose due to the release of radioactive materials was less than 0.0019 mSv/year at the site boundaries.

Annual radiation dose at site boundaries by radioactive materials (cesium) released from Reactor Building Units 1-4



(Reference)

* The density limit of radioactive materials in the air outside the surrounding monitoring area:
[Cs-134]: 2 x 10^{-5} Bq/cm³
[Cs-137]: 3 x 10^{-5} Bq/cm³

* Dust density around the site boundaries of Fukushima Daiichi Nuclear Power Station (actual measured values):
[Cs-134]: ND (Detection limit: approx. 1 x 10^{-7} Bq/cm³)
[Cs-137]: ND (Detection limit: approx. 2 x 10^{-7} Bq/cm³)

* Data of Monitoring Posts (MP1-MP8).
Data of Monitoring Posts (MPs) measuring the airborne radiation rate around site boundaries showed 0.840 - 3.522 μSv/h (October 28 – November 24, 2015).
To measure the variation in the airborne radiation rate of MP2-MP8 more accurately, environmental improvement (tree trimming, removal of surface soil and shielding around the MPs) was completed.

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. As the fuel removal from the spent fuel pool (SFP) commenced for Unit 4, the radiation exposure dose from Unit 4 was added to the items subject to evaluation since November 2013. The evaluation has been changed to a method considering the values of continuous dust monitors since FY2015, with data to be evaluated monthly and announced the following month.

3. Other indices

There was no significant change in indices, including the pressure in the PCV and the PCV radioactivity density (Xe-135) for monitoring criticality, nor was any abnormality in the cold shutdown condition or criticality sign detected.

Based on the above, it was confirmed that the comprehensive cold shutdown condition had been maintained and the reactors remained in a stabilized condition.

II. Progress status by each plan

1. Contaminated water countermeasures

To tackle the increase in accumulated water due to groundwater inflow, fundamental measures to prevent such inflow into the Reactor Buildings will be implemented, while improving the decontamination capability of water treatment and preparing facilities to control the contaminated water

➢ Operation of groundwater bypass

- From April 9, 2014, the operation of 12 groundwater bypass pumping wells commenced sequentially to pump up groundwater. The release started from May 21, 2014 in the presence of officials from the Intergovernmental Liaison Office for the Decommissioning and Contaminated Water Issue of the Cabinet Office. As of November 25, 2015, 148,898 m³ of groundwater had been released. The pumped-up groundwater has been temporarily stored in tanks and released after TEPCO and a third-party organization confirmed that its quality met operational targets.
- For pumping well Nos. 8, 9 and 12, pumping of groundwater was suspended for cleaning (No. 8: October 28 – November 19; No. 9: October 6 – November 13; No. 12: from November 16).
- On November 16, when part of the control power for the groundwater bypass was suspended for preparation, all groundwater bypass pumps stopped due to communication failure. As no abnormality was identified in the later inspection when the relevant system had recovered, the groundwater bypass pumps were reactivated on November 17.

➢ Status of water treatment facilities including subdrains

- To reduce the groundwater flowing into the buildings, work began to pump up groundwater from wells (subdrains) around the buildings on September 3. The pumped-up groundwater was then purified at dedicated facilities and released from September 14. As of November 25, a total of 23,928 m³ had been drained after TEPCO and a third-party organization had confirmed that the quality of this purified groundwater met operational targets.
- Due to rising water levels of the groundwater drain pond since the closure of the sea-side impermeable walls, pumping started on November 5. As of November 25, a total of 5,744 m³ had been pumped up.
- Regarding the Unit 1 control cable duct, at which the groundwater inflow to the Unit 1 Turbine Building was detected, reinvestigation of the status of groundwater inflow on November 12 identified termination of inflow. The cause of the termination was assumed to be the decreased groundwater level due to operation of subdrains, which consequently lowered the water level inside the relevant duct to below the height of the connection to the Unit 1 Turbine Building (see Figure 1).

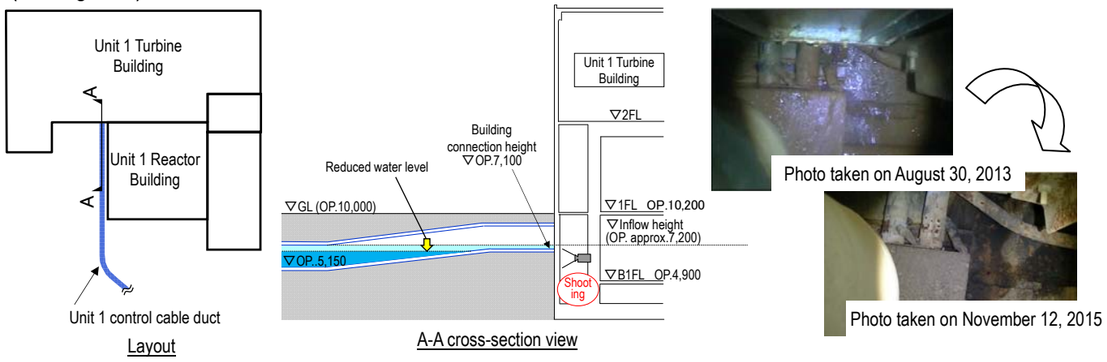


Figure 1: Unit 1 control cable duct connection – Status of groundwater inflow

➢ Construction status of land-side impermeable walls

- To facilitate the installation of land-side impermeable walls surrounding Units 1-4 (a subsidy project of the Ministry of Economy, Trade and Industry), drilling to place frozen pipes commenced (from June 2, 2014).
- Regarding the mountain side, following the finished installation of frozen pipes on July 28, filling of brine also finished on September 15. Through these works, preparation for freezing was completed for three sides on the mountain side.
- From April 30, the freezing functioning test was underway at 18 points (58 frozen pipes, approx. 6% on the mountain side). Brine supply to the freezing functioning test points was suspended from August 21 due to the filling of brine.
- Regarding the sea side, drilling was completed on October 15 (for frozen pipes: 532 points, for temperature-measurement pipes: 131 points). As of November 9, installation of frozen pipes had been completed (see Figure 3). Installation of brine pipes is currently underway.

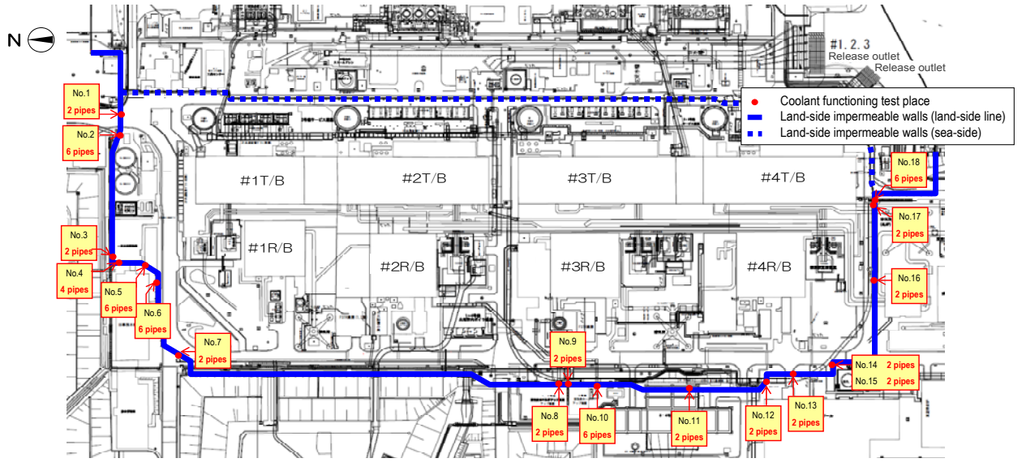


Figure 2: Freezing functioning test place on land-side impermeable walls

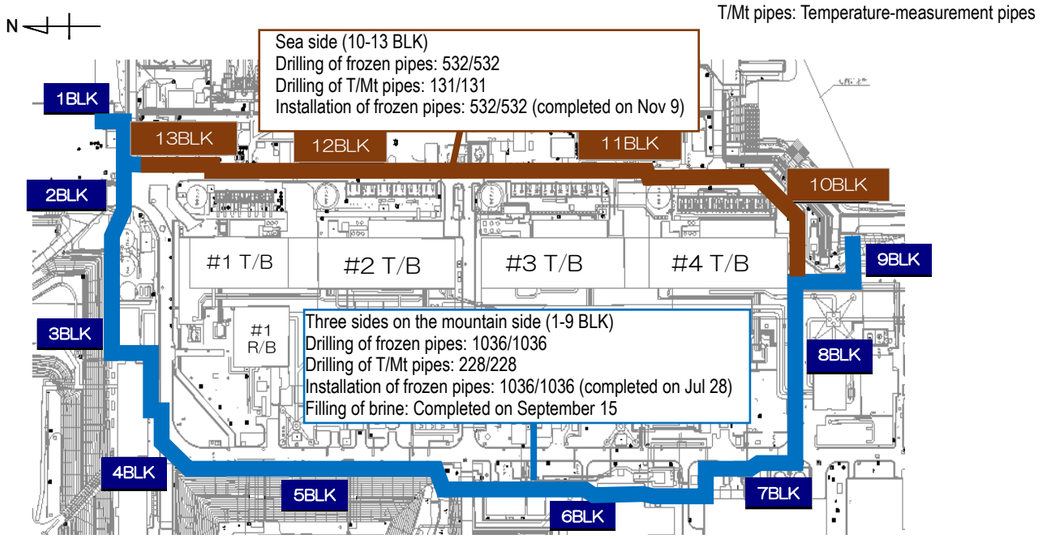


Figure 3: Drilling status for frozen-soil impermeable walls and installation of frozen pipes

➢ Operation of multi-nuclide removal equipment

- Regarding multi-nuclide removal equipment (existing, additional and high-performance), hot tests using radioactive water are underway (for existing equipment, System A: from March 30, 2013, System B: from June 13, 2013, System C: from September 27, 2013; for additional equipment, System A: from September 17, 2014, System B: from September 27, 2014, System C: from October 9, 2014; for high-performance equipment, from October 18, 2014).
- As of November 19, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 255,000, 230,000 and 92,000 m³ respectively (including as of November 19, approx. 9,500 m³ stored in the J1(D) tank, which contained water with a high density of radioactive materials at the System B outlet of existing multi-nuclide removal equipment).
- For Systems A and C of existing multi-nuclide removal equipment, following facility inspections and installation of additional absorption vessels to improve their performance, operations will resume from early December. An inspection for System B will be conducted after operations of Systems A and C resume.
- On November 2, approx. 50 liters of leakage was detected at two points near the mesh to prevent ingress of foreign substances into the vent pipes of the high-performance multi-nuclide removal equipment filter. The cause was assumed to be the valve, which was used for the first time after being replaced, which failed to work and remained closed. This exerted pressure on a portion of the system, discharging water to vent pipes and causing it to leak from the mesh. After taking provisional countermeasures, treatment resumed from November 12.
- On November 25, a 1m x 1m of dispersal was detected on the floor due to leakage of cleaning water from an elevated vent pipe of the high-performance multi-nuclide removal equipment while cleaning with filtered water. The leakage remained within the fences and no leakage outside the fences was identified.
- To reduce the risks of strontium-treated water, treatment by additional and high-performance multi-nuclide removal equipment is underway (additional: from May 27, high-performance: from April 15). As of November 19, approx. 134,000 m³ had been treated.

➢ Toward reducing the risk of contaminated water stored in tanks

- Treatment measures comprising the removal of strontium by cesium absorption apparatus (KURION) (from January 6) and secondary cesium absorption apparatus (SARRY) (from December 26, 2014) are underway. As of November 19, approx. 147,000 m³ had been treated.

➢ Measures in Tank Areas

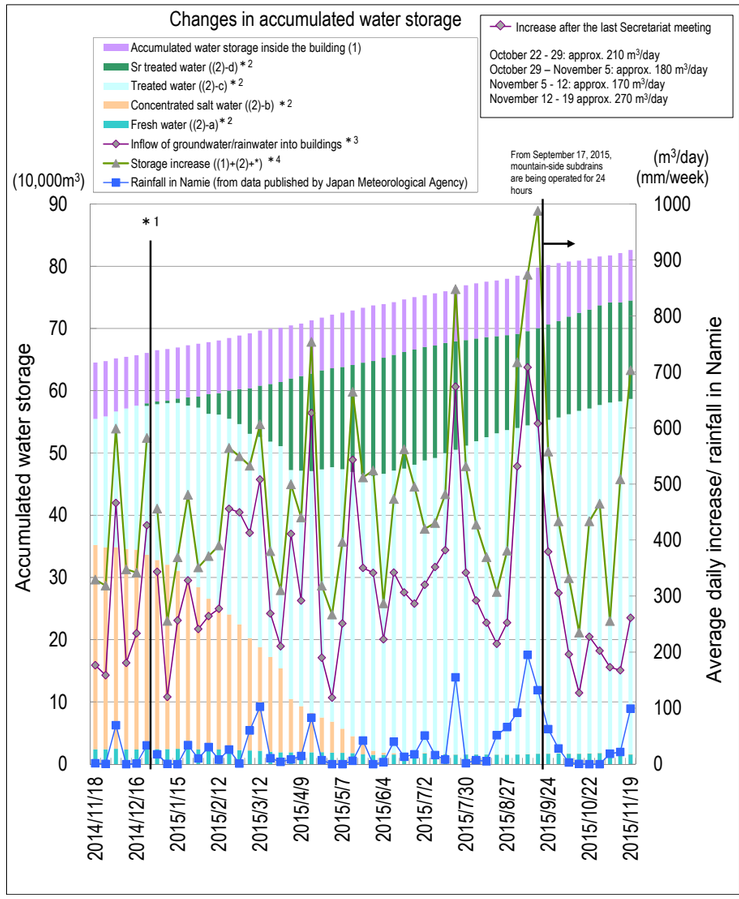
- Rainwater, under the release standard and having accumulated inside the fences in the contaminated water tank area, was sprinkled on site after eliminating radioactive materials using rainwater-treatment equipment since May 21, 2014 (as of November 23, 2015, a total of 39,260 m³)

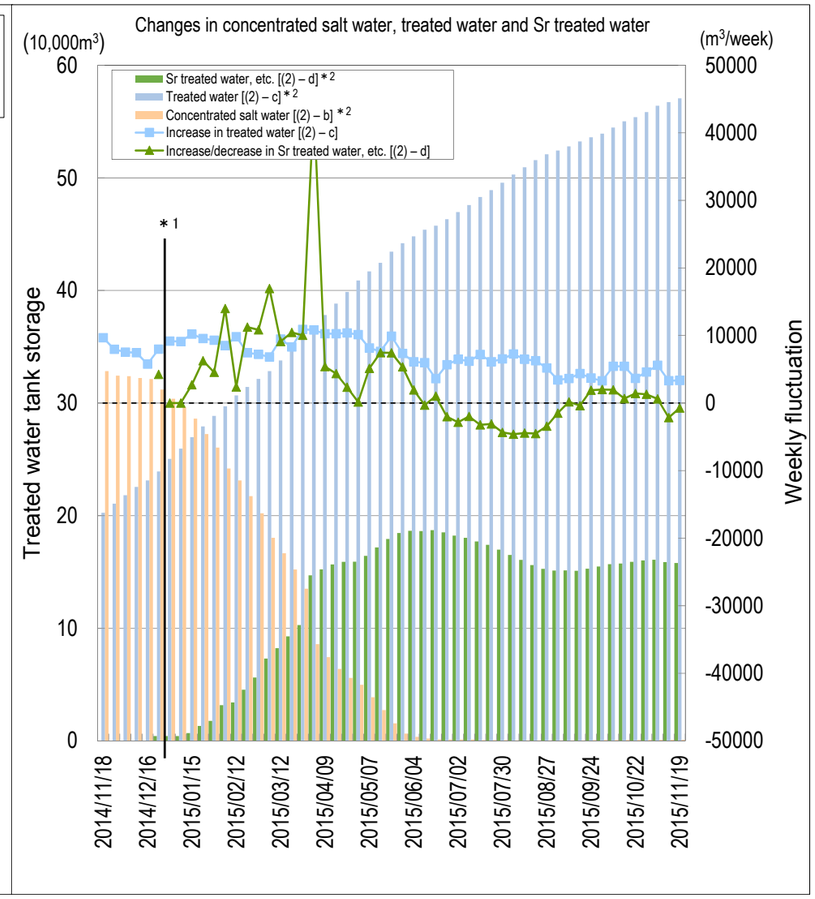
➢ Leakage from the accumulated water transfer facility into the building

- On November 5, the leakage detector of the accumulated water transfer facility installed in the Unit 2 Turbine Building issued an alert. An on-site inspection identified a drop of approx. 2 cm height inside the fences (approx. 2m x 5m x 5cm) installed at the lower part of the pipes to transfer accumulated water and a drop of approx. 5m x 5m x 1mm outside the fences.
- An investigation into four pipes near the leakage points revealed a crack and dimple on the surface of a pipe. After isolating the relevant pipe, the transfer resumed from November 11.

➢ Leakage from desalination equipment (RO2)

- On November 15, a leakage was detected from the booster pump outlet pipe joint of the desalination equipment (RO2-5) into the fences. The leakage, approx. 1m x 15m x 20mm large, remained within the fences. The cause is currently being analyzed and countermeasures considered.





As of November 26, 2015

*1: Since January 1, 2015, the data collection days have been changed (Tuesdays → Thursdays)
*2: Water amount with which water-level gauge indicates 0% or more
*3: Since September 10, 2015, the data collection method has been changed (Evaluation based on increased in storage: in buildings and tanks → Evaluation based on increase/decrease in storage in buildings)
"Inflow of groundwater/rainwater into buildings" =
"Increase/decrease of water held in buildings"
+ "Transfer from buildings to tanks"
- "Transfer into buildings (water injection into reactors and transfer from well points, etc.)
4: Since April 23, 2015, the data collection method has been changed (Increase in storage ((1)+(2) → (1)+(2)+))

Figure 4: Status of accumulated water storage

2. Fuel removal from the spent fuel pools

Work to help remove spent fuel from the pool is progressing steadily while ensuring seismic capacity and safety. The removal of spent fuel from the Unit 4 pool commenced on November 18, 2013 and was completed on December 22, 2014

➢ Main work to help remove spent fuel at Unit 1

- On July 28, work started to remove the roof panels of the building cover. By October 5, all six roof panels had been removed. During this work, no significant change was identified in the dust densities at dust monitors and monitoring posts, etc. To facilitate the removal of steel frames which would hinder the installation of sprinklers, pre-spraying of anti-scattering agents and suction of small rubble such as concrete pieces has been underway from November 9 and 19 respectively.
- The dismantling of the building cover is being conducted with anti-scattering measures steadily implemented and safety prioritized above all.

➢ Main work to help remove spent fuel at Unit 2

- To help remove spent fuel from the pool of Unit 2 Reactor Building, dismantling of hindrance buildings around the Reactor Building has been underway since September 7 to clear a work area to install large heavy-duty machines, etc.

➢ Scope of dismantling and modification of Unit 2 Reactor Building rooftop

- To facilitate the removal of fuel assemblies and debris in the spent fuel pool, the scope of dismantling and modification of the existing Reactor Building rooftop was examined. To ensure safety during the work, limit the impacts on the outside of the power station and removing fuel rapidly to reduce risks, we decided to dismantle the whole rooftop of the operating floor. The dismantling will be conducted with anti-scattering measures for dust steadily implemented based on the experience in Units 3 and 4 and with safety prioritized above all. In tandem, there is also consideration as to whether or not the same structure will be used to remove pool fuel assemblies and debris, which will be finally decided approx. two years later.

➢ Main work to help remove spent fuel at Unit 3

- Removal of rubble inside the spent fuel pool using large cranes was concluded on November 21.

3. Fuel debris removal

In addition to decontamination and shield installation to improve PCV accessibility, technology was developed and data gathered as required to prepare to remove fuel debris (such as investigating and repairing PCV leak locations)

➢ Investigation into the Main Stream Valve Room on Unit 1 Reactor Building 1st floor

- To confirm the need for a dose reduction that may facilitate future investigations inside PCV and repair, an investigation of the Main Steam Valve Room has been underway from November 18. The Airlock Room will also be investigated in December.

➢ Progress of decontamination around Unit 2 X-6 penetration

- To facilitate the investigation into the status of the platform inside the Unit 2 PCV pedestal (A2 investigation),

decontamination is underway around X-6 penetration from which the investigation device will be inserted (removal of eluted materials: October 30 – November 5, decontamination by steam: November 11-13, chemical decontamination: from November 17 to early December). If the radiation dose is not reduced by chemical decontamination, the floor surface will also be ground.

➢ Investigation into the Unit 3 PCV equipment hatch

- In 2011, high-dose puddles were identified in and around the grooves of the shield-plug transfer rail of the Unit 3 PCV equipment hatch. Due to potential leakage from the equipment hatch seal, the status of this seal, etc. was investigated using a small camera on September 9, 2015. This will be followed by further investigation on November 26 and 27 using a small self-traveling investigation device to access the equipment hatch more closely and confirm the status of the seal, etc.

Figure 5: Decontamination around Unit 2 X-6 penetration

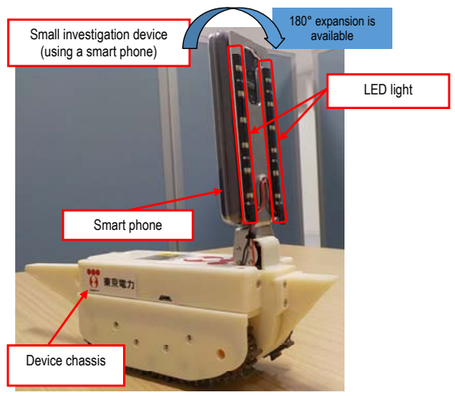


Figure 6: Small investigation device for Unit 3 PCV equipment hatch

4. Plans to store, process and dispose of solid waste and decommission of reactor facilities

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

➢ Management status of rubble and trimmed trees

- As of the end of October, the total storage volume of concrete and metal rubble was approx. 165,400 m³ (+4,400 m³ compared to at the end of September, with an area-occupation rate of 62%). The total storage volume of trimmed trees was approx. 84,200 m³ (+2,100 m³ compared to at the end of September, with an area-occupation rate of 79%). The increase in rubble was mainly attributable to construction related to facing and the installation of tanks. The increase in trimmed trees was mainly attributable to construction related to facing and the acceptance of branches and leaves accumulated in temporary storage.

➢ Management status of secondary waste from water treatment

- As of November 19, 2015, the total storage volume of waste sludge was 597 m³ (area-occupation rate: 85%) and that of concentrated waste fluid was 9,315 m³ (area-occupation rate: 47%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment, etc. was 2,877 (area-occupation rate: 48%).

➢ Test operation of Radioactive Waste Incinerator started

- From November 25, a cold test incinerating dummy waste, which generates no contamination, started to verify facility-wide functions and performance. Following the cold test, which will continue until the end of December, pre-operation and hot tests using actual contaminated waste will be conducted to start operations within this fiscal year.

5. Reactor cooling

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

➢ Investigation inside Unit 3 PCV and the installation of a permanent monitor

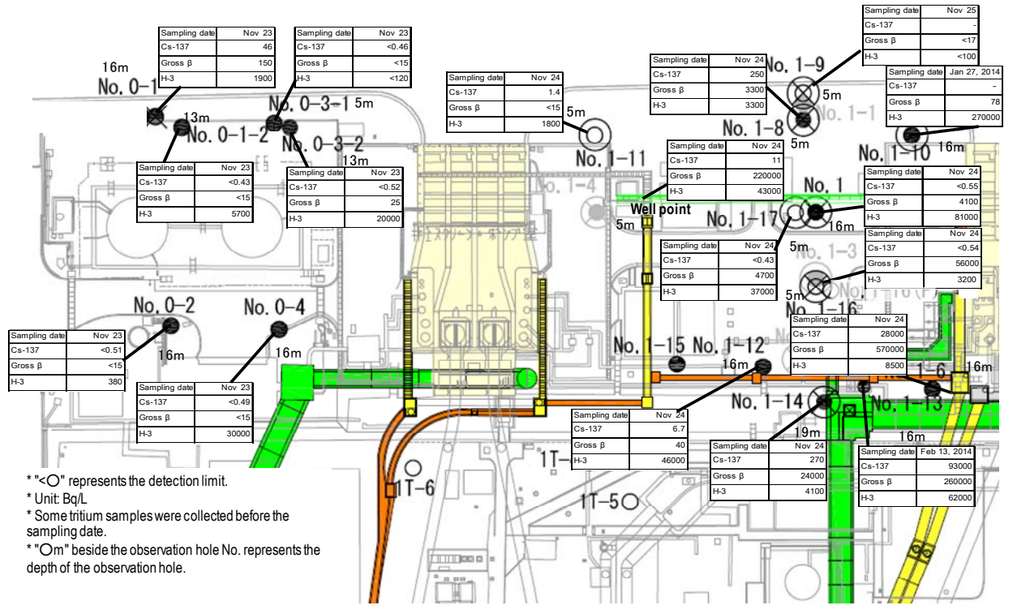
- Thermometers and a water-level gage will be installed from the Unit 3 PCV penetration (X-53) into the PCV (scheduled for December 10-17).

6. Reduction in radiation dose and mitigation of contamination

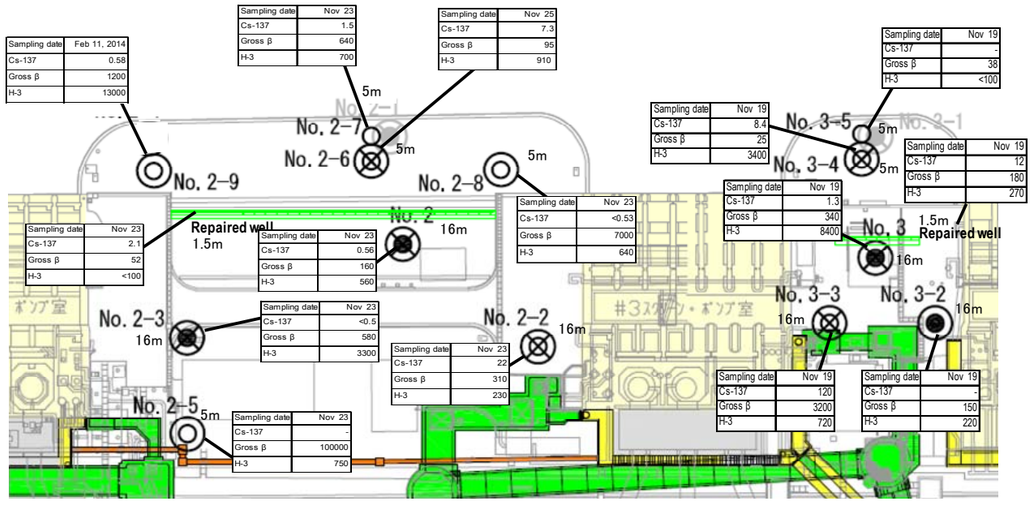
Effective dose-reduction at site boundaries and purification of port water to mitigate the impact of radiation on the external environment

➢ Status of groundwater and seawater on the east side of Turbine Building Units 1 to 4

- Regarding the radioactive materials in groundwater near the bank on the north side of the Unit 1 intake, the tritium density has remained constant at around 10,000 Bq/L at groundwater Observation Hole No. 0-3-2. However, after decreasing from September, the density has been increasing since October and currently stands at around 20,000 Bq/L.
- Regarding the groundwater near the bank between the Unit 1 and 2 intakes, though the tritium density at groundwater Observation Hole No. 1-11 has remained constant at around 10,000 Bq/L, it has been decreasing since September and currently stands at around 2,000 Bq/L. The density of gross β radioactive materials at groundwater Observation Hole No. 1 has been increasing and currently stands at around 10,000 Bq/L since February 2015. Though the density of gross β radioactive materials at groundwater Observation Hole No. 1-16 has remained constant at around 200,000 Bq/L, after decreasing from September, it has been increasing since October and currently stands at around 100,000 Bq/L. Water pumping at the repaired well point started (from October 14). Since August 15, 2013, pumping of groundwater continued at the well point between the Unit 1 and 2 intakes. Since October 14, 2015, it was shifted to pumping at the repaired well point. Since October 24, pumping at the well point resumed.
- Regarding radioactive materials in the groundwater near the bank between the Unit 2 and 3 intakes, though the tritium density at groundwater Observation Hole No. 2-3 has remained constant at around 1,000 Bq/L, it has been increasing from September and currently stands at around 3,000 Bq/L. Though the density of gross β radioactive materials at groundwater Observation Hole No. 2-5 has remained constant at around 10,000 Bq/L, it has been increasing since November and currently stands at around 100,000 Bq/L. Sampling frequency increased from monthly to weekly. Since December 18, 2013, pumping of groundwater continued at the well point between the Unit 2 and 3 intakes and since October 14, 2015, it was shifted to pumping at the repaired well point.
- Regarding radioactive materials in the groundwater near the bank between the Unit 3 and 4 intakes, the tritium density at groundwater Observation Hole No. 3-4 has been increasing since August and currently stands at around 3,000 Bq/L. Since April 1, 2015, pumping of groundwater continued at the well point between the Unit 3 and 4 intakes. Since September 17, 2015, it was shifted to pumping at the repaired well point.
- Regarding the radioactive materials in seawater outside the sea-side impermeable walls and within the open channels of Units 1-4, as well as those inside the port, the density was decreasing due to the effect of the completed installation and the connection of steel pipe sheet piles for the sea-side impermeable walls.
- Regarding the radioactive materials in seawater outside the port, the densities of cesium 137 and tritium have remained within the same range previously recorded.
- Regarding the Unit 1 drainage channel, though the density of radioactive materials increased in September, it has subsequently been decreasing. Cleaning by the mobile treatment device will start after completing the preparation.
- In response to multiple overflow of waste water from temporary fences of the K drainage channel during heavy rainfall, provisional countermeasures are underway pending the construction of a new drainage channel. These include transferring waste water through pumps from the branch channel in the groundwater bypass area in the upper stream of K drainage to the relay pit of B drainage channel (from November 2).



<Unit 1 intake north side, between Unit 1 and 2 intakes>



<Between Unit 2 and 3 intakes, between Unit 3 and 4 intakes>

Figure 7: Groundwater density on the Turbine Building east side

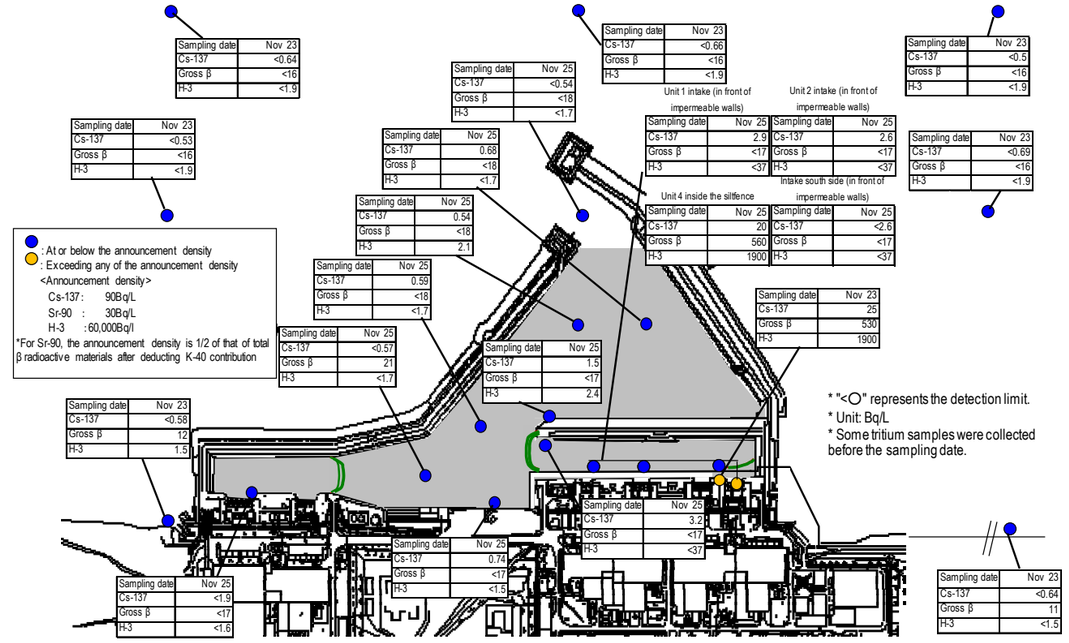


Figure 8: Seawater density around the port

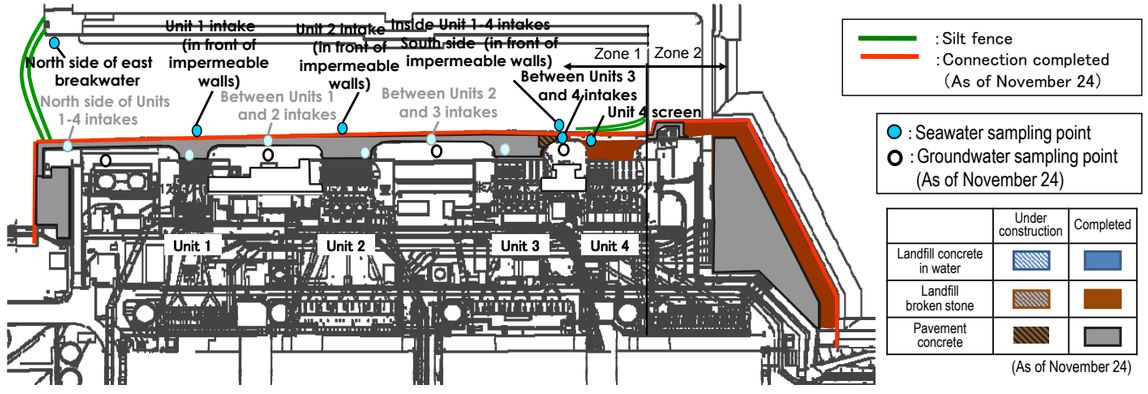


Figure 9: Progress status of impermeable walls on the sea side

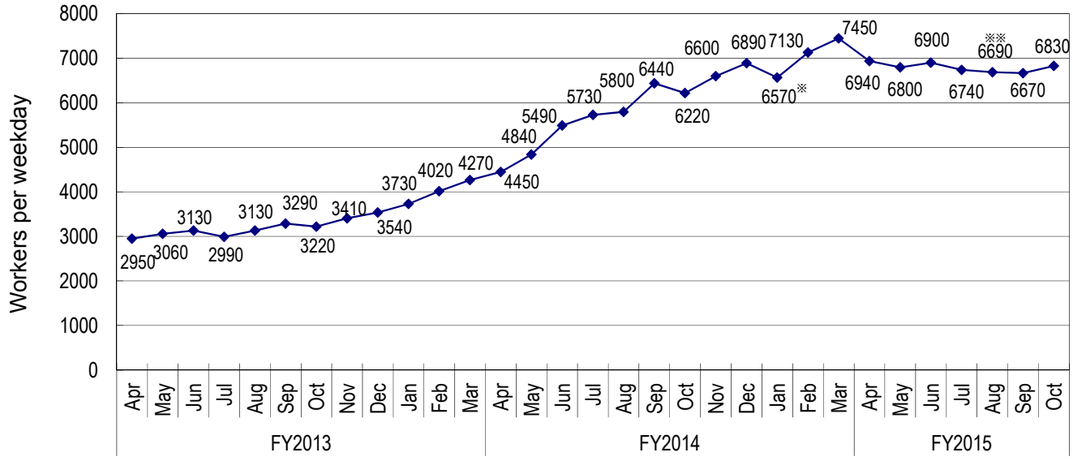
7. Review of the number of staff required and efforts to improve the labor environment and conditions

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

➢ Staff management

- The monthly average total of people registered for at least one day per month to work on site during the past quarter from July to September 2015 was approx. 13,800 (TEPCO and partner company workers), which exceeded the monthly average number of actual workers (approx. 10,800). Accordingly, sufficient people are registered to work on site.

- It was confirmed with the prime contractors that the estimated manpower necessary for the work in December (approx. 6,600 per day: TEPCO and partner company workers)* would be secured at present. The average numbers of workers per day for each month (actual values) were maintained, with approx. 3,000 to 7,500 since FY2014 (see Figure 10). * Some works for which contractual procedures have yet to be completed are excluded from the December estimate.
- The number of workers from Fukushima Prefecture has remained the same but the number from outside the prefecture has increased slightly. Accordingly, the local employment ratio (TEPCO and partner company workers) as of October remained at around 50% with a slight decline.
- The average exposure dose of workers remained at approx. 1 mSv/month during FY2013, FY2014 and FY2015. (Reference: Annual average exposure dose 20 mSv/year ≒ 1.7 mSv/month).
- For most workers, the exposure dose was sufficiently within the limit and allowed them to continue engaging in radiation work.



※ Calculated based on the number of workers as of January 20 (due to safety inspection from January 21)
※※ Calculated based on the number of workers from August 3-7, 24-28 and 31 (due to overhaul of heavy machines)

Figure 10: Changes in the average number of workers per weekday for each month since FY2013 (actual values)

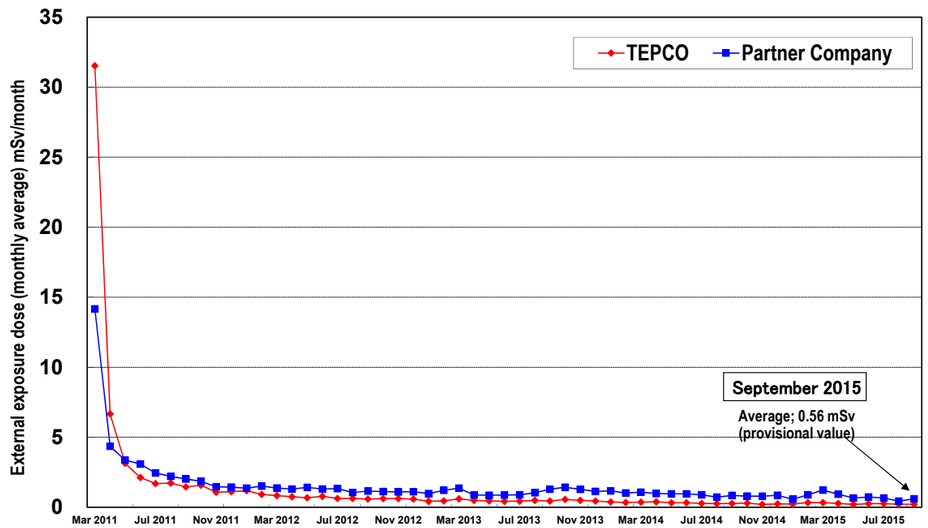


Figure 11: Changes in monthly individual worker exposure dose
(monthly average exposure dose since March 2011)

➢ Results of questionnaire survey for workers to improve the labor environment

- 86.4% (6,527 workers) of the personnel responded to the questionnaire. The results showed that compared with the last survey, evaluation of the labor environment had improved. Approx. 80% of respondents evaluated the following items achieved this year as “good” or “reasonably good”: operation start of the large rest house and dining room and expansion of the area where wearing full-face masks is not required. Based on feedback from workers, further improvements will be made, such as setting up parking and rest houses on and off-site and installing shower facilities.

➢ Measures to prevent infection and expansion of influenza and norovirus

- Since October, measures for influenza and norovirus have been implemented, including free influenza vaccinations (subsidized by TEPCO) in the Fukushima Daiichi Nuclear Power Station (from October 28 to December 4) and medical clinics around the site (from November 2, 2015 to January 29, 2016) for partner company workers. As of November 20, a total of 5,452 workers had been vaccinated. In addition, a comprehensive range of other measures is also being implemented, including daily actions to prevent infection and expansion (measuring body temperature, health checks and monitoring infection status) and response after detecting possible infections (control of swift entry/exit and mandatory wearing of masks in working spaces).

➢ Status of influenza and norovirus cases

- Until the 47th week of 2015 (November 16-22, 2015), there was one case of influenza infections and one case of norovirus infections. The totals for the same period for the previous season showed four cases of influenza infections and no case of norovirus infections. The totals for the entire previous season (November 2014 to March 2015) showed 353 cases of influenza infections and 10 cases of norovirus infections.

8. Other

➢ Smoke from the power panel of Main Anti-Earthquake Building

- On November 19, smoke was identified from the grounding current-limiting resistor in the power room on the Main Anti-Earthquake Building 1st floor (but soon stopped). The cause was assumed to be an iron pin used to fix the ropes for dividing the area near the slope on the west side of the old administration office building on site, which inadvertently came into contact with a high-pressure cable of the common metal-clad (M/C) 1A system on site, generating a current in the grounding current-limiting resistor in the power room on the Main Anti-Earthquake Building 1st floor and consequently generating smoke.

➢ Opening of the “1 FOR ALL JAPAN” website

- Aiming to provide workers with information on the “workplace”, convey messages from their fellows and supporters and help workers engage in long-term decommissioning safely and maintain motivation, the “1 FOR ALL JAPAN” website (http://1f-all.jp/) was opened in October for workers on site and their families.

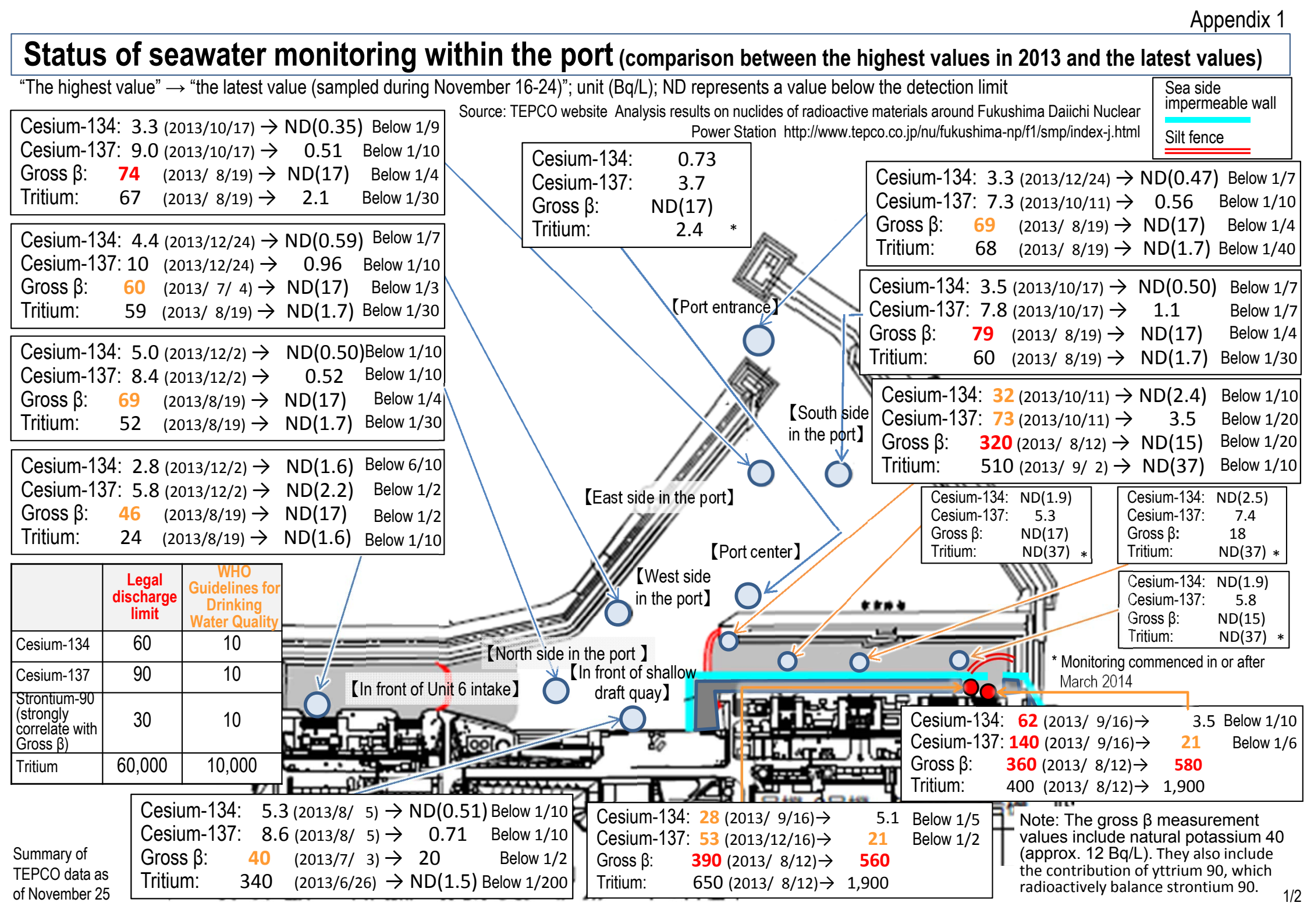
Status of seawater monitoring within the port (comparison between the highest values in 2013 and the latest values)

"The highest value" → "the latest value (sampled during November 16-24)"; unit (Bq/L); ND represents a value below the detection limit

Source: TEPCO website Analysis results on nuclides of radioactive materials around Fukushima Daiichi Nuclear Power Station http://www.tepco.jp/nu/fukushima-np/f1/smp/index-j.html

Sea side impermeable wall

Silt fence



Cesium-134: 3.3 (2013/10/17) → ND(0.35) Below 1/9
Cesium-137: 9.0 (2013/10/17) → 0.51 Below 1/10
Gross β: 74 (2013/ 8/19) → ND(17) Below 1/4
Tritium: 67 (2013/ 8/19) → 2.1 Below 1/30

Cesium-134: 4.4 (2013/12/24) → ND(0.59) Below 1/7
Cesium-137: 10 (2013/12/24) → 0.96 Below 1/10
Gross β: 60 (2013/ 7/ 4) → ND(17) Below 1/3
Tritium: 59 (2013/ 8/19) → ND(1.7) Below 1/30

Cesium-134: 5.0 (2013/12/2) → ND(0.50) Below 1/10
Cesium-137: 8.4 (2013/12/2) → 0.52 Below 1/10
Gross β: 69 (2013/8/19) → ND(17) Below 1/4
Tritium: 52 (2013/8/19) → ND(1.7) Below 1/30

Cesium-134: 2.8 (2013/12/2) → ND(1.6) Below 6/10
Cesium-137: 5.8 (2013/12/2) → ND(2.2) Below 1/2
Gross β: 46 (2013/8/19) → ND(17) Below 1/2
Tritium: 24 (2013/8/19) → ND(1.6) Below 1/10

	Legal discharge limit	WHO Guidelines for Drinking Water Quality
Cesium-134	60	10
Cesium-137	90	10
Strontium-90 (strongly correlate with Gross β)	30	10
Tritium	60,000	10,000

Cesium-134: 0.73
Cesium-137: 3.7
Gross β: ND(17)
Tritium: 2.4 *

Cesium-134: 3.3 (2013/12/24) → ND(0.47) Below 1/7
Cesium-137: 7.3 (2013/10/11) → 0.56 Below 1/10
Gross β: 69 (2013/ 8/19) → ND(17) Below 1/4
Tritium: 68 (2013/ 8/19) → ND(1.7) Below 1/40

Cesium-134: 3.5 (2013/10/17) → ND(0.50) Below 1/7
Cesium-137: 7.8 (2013/10/17) → 1.1 Below 1/7
Gross β: 79 (2013/ 8/19) → ND(17) Below 1/4
Tritium: 60 (2013/ 8/19) → ND(1.7) Below 1/30

Cesium-134: 32 (2013/10/11) → ND(2.4) Below 1/10
Cesium-137: 73 (2013/10/11) → 3.5 Below 1/20
Gross β: 320 (2013/ 8/12) → ND(15) Below 1/20
Tritium: 510 (2013/ 9/ 2) → ND(37) Below 1/10

Cesium-134: ND(1.9)
Cesium-137: 5.3
Gross β: ND(17)
Tritium: ND(37) *

Cesium-134: ND(2.5)
Cesium-137: 7.4
Gross β: 18
Tritium: ND(37) *

Cesium-134: ND(1.9)
Cesium-137: 5.8
Gross β: ND(15)
Tritium: ND(37) *

* Monitoring commenced in or after March 2014

Cesium-134: 62 (2013/ 9/16)→ 3.5 Below 1/10
Cesium-137: 140 (2013/ 9/16)→ 21 Below 1/6
Gross β: 360 (2013/ 8/12)→ 580
Tritium: 400 (2013/ 8/12)→ 1,900

Cesium-134: 5.3 (2013/8/ 5) → ND(0.51) Below 1/10
Cesium-137: 8.6 (2013/8/ 5) → 0.71 Below 1/10
Gross β: 40 (2013/7/ 3) → 20 Below 1/2
Tritium: 340 (2013/6/26) → ND(1.5) Below 1/200

Cesium-134: 28 (2013/ 9/16)→ 5.1 Below 1/5
Cesium-137: 53 (2013/12/16)→ 21 Below 1/2
Gross β: 390 (2013/ 8/12)→ 560
Tritium: 650 (2013/ 8/12)→ 1,900

Summary of TEPCO data as of November 25

Note: The gross β measurement values include natural potassium 40 (approx. 12 Bq/L). They also include the contribution of yttrium 90, which radioactively balance strontium 90.

Status of seawater monitoring around outside of the port
(comparison between the highest values in 2013 and the latest values)

(The latest values sampled during November 16-24)

Unit (Bq/L); ND represents a value below the detection limit; values in ( ) represent the detection limit; ND (2013) represents ND throughout 2013

	Legal discharge limit	WHO Guidelines for Drinking Water Quality
Cesium-134	60	10
Cesium-137	90	10
Strontium-90 (strongly correlate with Gross β)	30	10
Tritium	60,000	10,000

【Northeast side of port entrance(offshore 1km)】

Cesium-134: ND (2013) → ND (0.63)
Cesium-137: ND (2013) → ND (0.64)
Gross β: ND (2013) → ND (16)
Tritium: ND (2013) → ND (1.9)

【East side of port entrance (offshore 1km)】

Cesium-134: ND (2013) → ND (0.70)
Cesium-137: 1.6 (2013/10/18) → ND (0.66) Below 1/2
Gross β: ND (2013) → ND (16)
Tritium: 6.4 (2013/10/18) → ND (1.9) Below 1/3

【Southeast side of port entrance(offshore 1km)】

Cesium-134: ND (2013) → ND (0.68)
Cesium-137: ND (2013) → ND (0.50)
Gross β: ND (2013) → ND (16)
Tritium: ND (2013) → ND (1.9)

Cesium-134: ND (2013) → ND (0.71)
Cesium-137: ND (2013) → ND (0.53)
Gross β: ND (2013) → ND (16)
Tritium: 4.7 (2013/ 8/18) → ND (1.9) Below 1/2

【North side of north breakwater(offshore 0.5km)】

【Port entrance】

【South side of south breakwater(offshore 0.5km)】

Cesium-134: ND (2013) → ND (0.76)
Cesium-137: ND (2013) → ND (0.69)
Gross β: ND (2013) → ND (16)
Tritium: ND (2013) → ND (1.9)

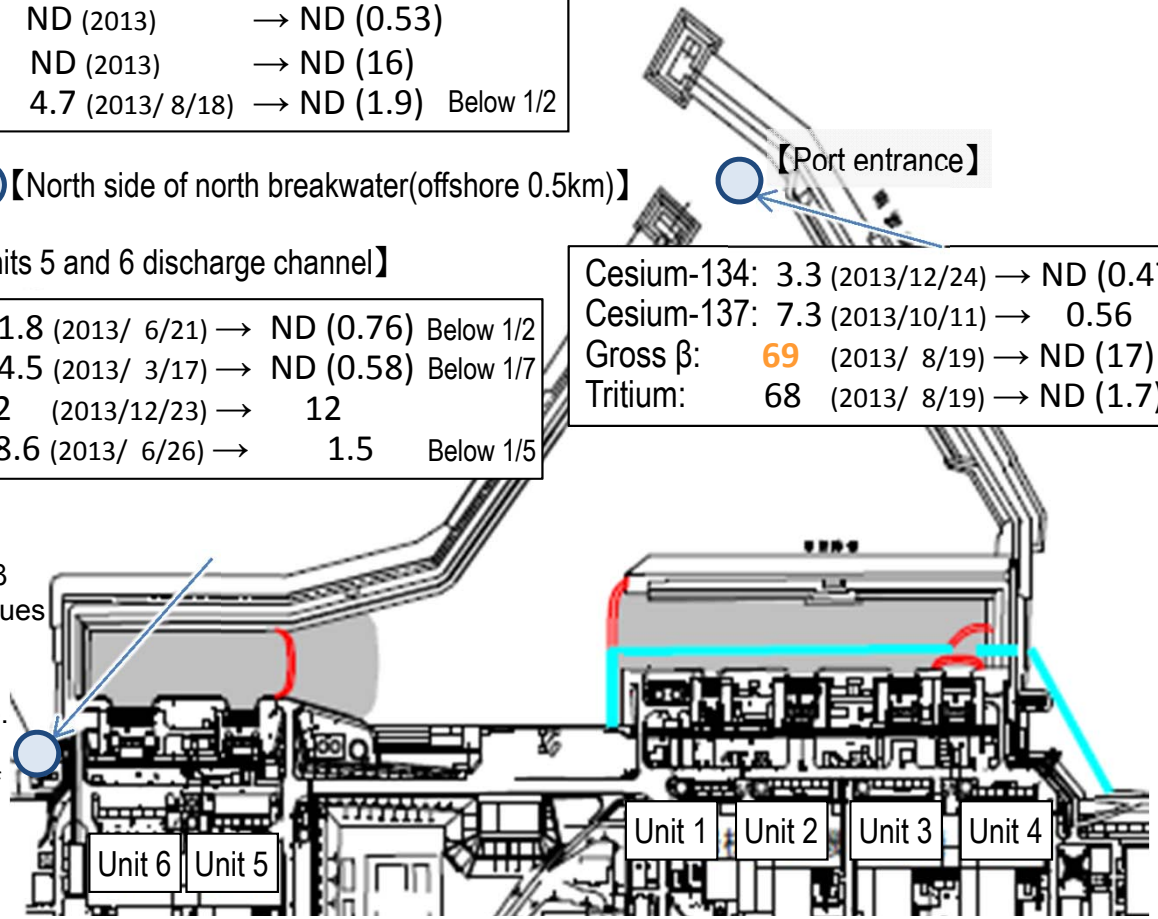
【North side of Units 5 and 6 discharge channel】

Cesium-134: 1.8 (2013/ 6/21) → ND (0.76) Below 1/2
Cesium-137: 4.5 (2013/ 3/17) → ND (0.58) Below 1/7
Gross β: 12 (2013/12/23) → 12
Tritium: 8.6 (2013/ 6/26) → 1.5 Below 1/5

Cesium-134: 3.3 (2013/12/24) → ND (0.47) Below 1/7
Cesium-137: 7.3 (2013/10/11) → 0.56 Below 1/10
Gross β: 69 (2013/ 8/19) → ND (17) Below 1/4
Tritium: 68 (2013/ 8/19) → ND (1.7) Below 1/40

Cesium-134: ND (2013) → ND (0.76)
Cesium-137: 3.0 (2013/ 7/15) → ND (0.64) Below 1/4
Gross β: 15 (2013/12/23) → 11
Tritium: 1.9 (2013/11/25) → ND (1.5)

【Around south discharge channel】



Sea side impermeable wall

Silt fence

Note: The gross β measurement values include natural potassium 40 (approx. 12 Bq/L). They also include the contribution of yttrium 90, which radioactively balance strontium 90.

Summary of TEPCO data as of November 25

Source: TEPCO website, Analysis results on nuclides of radioactive materials around Fukushima Daiichi Nuclear Power Station, http://www.tepco.co.jp/nu/fukushima-np/f1/smp/index-j.html

Appendix 2
November 26, 2015

TEPCO Fukushima Daiichi Nuclear Power Station Site Layout

Rubble storage area
Rubble storage area (planned)
Trimmed trees area
Trimmed trees area (planned)
Mid-/ low-level contaminated water tank
Mid-/ low-level contaminated water tank (planned)
High-level contaminated water tank
High-level contaminated water tank (planned)
Secondary waste from water treatment
Secondary waste from water treatment (planned)
Multi-nuclide removal equipment
Subdrain-purification system
Dry cask temporary storage facility


Rubble storage tent


Temporary soil cover type


Rubble


Inside the rubble


Rubble (container storage)


Solid waste storage facility


Rubble (outdoor accumulation)


Temporary trimmed trees


Trimmed trees (outdoor accumulation)

Tank installation status


Temporary waste sludge storage

Rubble
Trimmed trees
Temporary trimmed trees
Temporary trimmed trees storage pool
Underground reservoirs
Spent absorption vessel temporary storage
Land-side impermeable walls freezing plant
Pipe route
Unit 1
Unit 2
Unit 3
Unit 4
Land-side impermeable walls with frozen soil (Installation
Sea side impermeable wall
Futaba town
Ohkuma town
Unit 6
Unit 5
Periodical inspection material storage (cut of flange tank)
Town boundary
Mega float
Chiller for reactor water injection facility
Main Anti-Earthquake
High-performance multi-nuclide removal equipment
Additional multi-nuclide removal equipment
Multi-nuclide removal equipment
RO concentrated water treatment facility
Subdrain-purification system
Dry cask temporary storage facility
Vehicles maintenance site
Vehicle screening and decontamination site
Radioactive Waste Incinerator (Installation underway)
Trimmed
Administration Office Building
Groundwater bypass temporary storage tank
Temporary rest house outside the site
Administration Office Building (planned)
Large rest house
Access control facility
Water desalinations (evaporative concentration)
Water desalinations (RO)
Common pool
Underground
2nd cesium absorption apparatus (HTI
Cesium absorption apparatus (Incineration Workshop Building)
Decontamination instruments (Process Building)
Cesium absorption vessel temporary storage
Temporary waste sludge storage
High-level accumulated water reception tank (emergency reception)
Fresh water tank
Spent absorption vessel temporary storage (multi-nuclide removal equipment, etc.)
Spent absorption vessel temporary storage
Site boundary
MP-1
MP-2
MP-3
MP-4
MP-5
MP-6
MP-7
MP-8
H1
H2
H3
H4
H5
H6
H8
H9
D
E
J1
J2
J3
J4
J5
J6
J7
J8
K1
K2
K3
B
C
F
G
G3・G4・G5
G6
G7

Provided by Japan Space Imaging Corporation, (C)DigitalGlobe

0m 100m 500m 1000m

Progress toward decommissioning: Fuel removal from the spent fuel pool (SFP)

Immediate target	Commence fuel removal from the Unit 1-3 Spent Fuel Pools

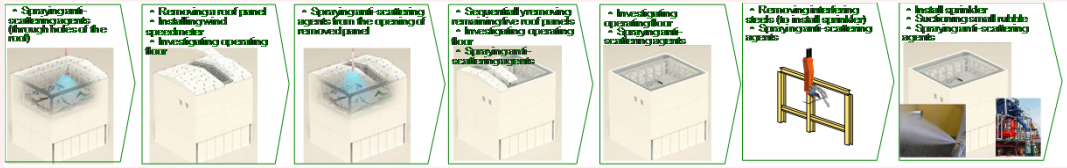
Unit 1

Regarding fuel removal from Unit 1 spent fuel pool, there is a plan to install a dedicated cover for fuel removal over the operating floor(*1).

Before starting this plan, the building cover will be dismantled to remove rubble from the top of the operating floor, with anti-scattering measures steadily implemented.

Removal of roof panels from the building cover started on July 28 and all panels were removed on October 5. Dismantling of the building cover will proceed with radioactive materials thoroughly monitored.

Status of removal of roof panels



Flow of building cover dismantling

Unit 2

To facilitate removal of fuel assemblies and debris in the Unit 2 spent fuel pool, the scope of dismantling and modification of the existing Reactor Building rooftop was examined. From the perspective of ensuring safety during the work, controlling impacts on the outside of the power station, and removing fuel rapidly to reduce risks, we decided to dismantle the whole rooftop above the highest floor of the Reactor Building.

Examination of the following two plans continues: Plan 1 to share a container for removing fuel assemblies and debris from the pool; and Plan 2 to install a dedicated cover for fuel removal from the pool.

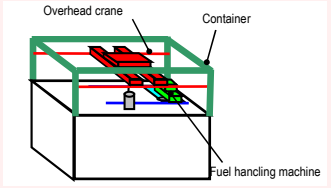


Image of Plan 1

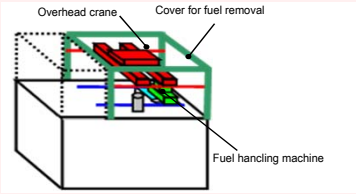


Image of Plan 2

Unit 3

To facilitate the installation of a cover for fuel removal, measures to reduce dose (decontamination and shielding) and rubble removal from the spent fuel pool are underway.
(Decontamination and shielding: from October 15, 2013, rubble removal from the pool: from December 17, 2013 – November 21, 2015)

On August 2, 2015, the fuel-handling machine, the largest rubble which fell in the Unit 3 spent fuel pool (approx. 20t), was removed.
To facilitate fuel removal, dose reduction on the top floor of the Reactor Building continues. In tandem with this work, training of fuel removal by remote control is underway.

Removal of fuel-handling machine on August 2

Fuel handling machine removed from the pool

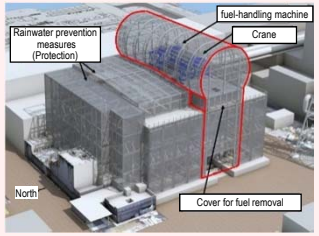


Image of the cover for fuel removal

Unit 4

In the Mid- and Long-Term Roadmap, the target of Phase 1 involved commencing fuel removal from inside the spent fuel pool (SFP) of the 1st Unit within two years of completion of Step 2 (by December 2013). On November 18, 2013, fuel removal from Unit 4, or the 1st Unit, commenced and Phase 2 of the roadmap started.

Fuel removal status

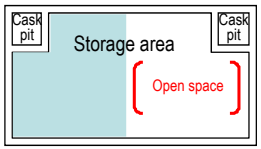
On November 5, 2014, within a year of commencing work to remove the fuel, all 1,331 spent fuel assemblies in the pool had been transferred. The transfer of the remaining non-irradiated fuel assemblies to the Unit 6 SFP was completed on December 22, 2014. (2 of the non-irradiated fuel assemblies were removed in advance in July 2012 for fuel checks)

This marks the completion of fuel removal from the Unit 4 Reactor Building.

Based on this experience, fuel assemblies will be removed from Unit 1-3 pools.

* A part of the photo is corrected because it includes sensitive information related to physical protection.

Common pool

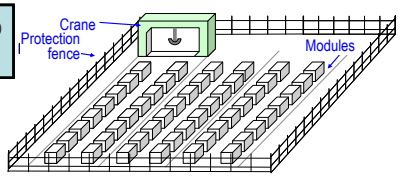


An open space will be maintained in the common pool (Transfer to the temporary dry cask storage facility)

Progress to date

- The common pool has been restored to a condition allowing it to re-accommodate fuel to be handled (November 2012)
- Loading of spent fuel stored in the common pool to dry casks commenced (June 2013)
- Fuel removed from the Unit 4 spent fuel pool began to be received (November 2013)

Temporary dry cask (*3) storage facility



Spent fuel is accepted from the common pool

Operation commenced on April 12, 2013; from the cask-storage building, transfer of 9 existing dry casks completed (May 21, 2013); fuel stored in the common pool sequentially transferred.

<Glossary>
(*1) Operating floor: During regular inspection, the roof over the reactor is opened while on the operating floor, fuel inside the core is replaced and the core internals are inspected.
(*2) Cask: Transportation container for samples and equipment, including radioactive materials.

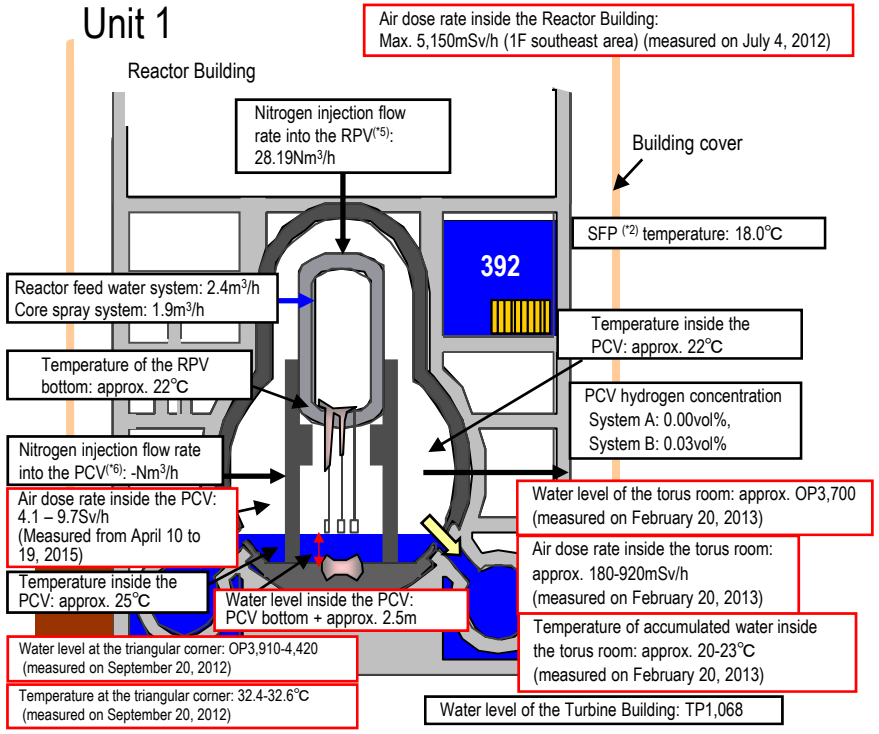
Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

November 26, 2015
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment

Immediate target	Identify the plant status and commence R&D and decontamination toward fuel debris removal

Investigation into TIP Room of the Unit 1 Reactor Building

- To improve the environment for future investigations inside the PCV, etc., an investigation was conducted from September 24 to October 2 at the TIP Room(*1). (Due to high dose around the entrance in to the TIP Room, the investigation of dose rate and contamination distribution was conducted through a hole drilled from the walkway of the Turbine Building, where the dose was low)
- The investigative results identified high dose at X-31 to 33 penetrations(*2) (instrumentation penetration) and low dose at other parts.
- As it was confirmed that work inside the TIP room would be available, the next step will include identification of obstacles which will interfere the work inside the TIP Room and formulation of a plan for dose reduction.



* Indices related to the plant are values as of 11:00, November 25, 2015

Investigations inside PCV	1st (Oct 2012)	- Acquiring images - Measuring air temperature and dose rate - Measuring water level and temperature - Sampling accumulated water - Installing permanent monitoring instrumentation
	2nd (May 2015)	Confirming the status of PCV 1st floor - Acquiring images - Measuring air temperature and dose rate - Replacing permanent monitoring instrumentation
Leakage points from PCV		- PCV vent pipe vacuum break line bellows (identified in May 2014) - Sand cushion drain line (identified in November 2013)

Investigation in the leak point detected in the upper part of the Unit 1 Suppression Chamber (S/C(*3))

Investigation in the leak point detected in the upper part of Unit 1 S/C from May 27, 2014 from one expansion joint cover among the lines installed there. As no leakage was identified from other parts, specific methods will be examined to halt the flow of water and repair the PCV.

Leak point

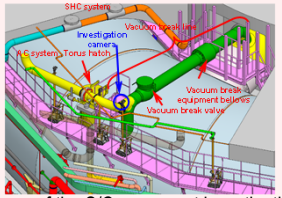


Image of the S/C upper part investigation

Status of equipment development toward investigating inside the PCV

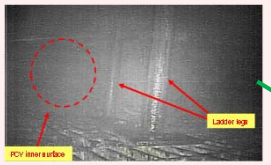
Prior to removing fuel debris, to check the conditions inside the Primary Containment Vessel (PCV), including the location of the fuel debris, investigation inside the PCV is scheduled.

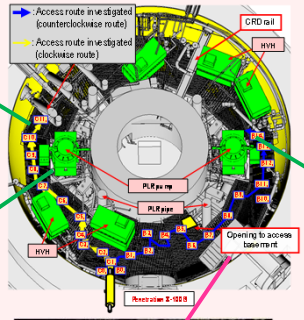
[Investigative outline]

- Inserting equipment from Unit 1 X-100B penetration(*5) to investigate in clockwise and counter-clockwise directions.

[Status of investigation equipment development]

- Using the crawler-type equipment with a shape-changing structure which allows it to enter the PCV from the narrow access entrance (bore: 100mm) and stably move on the grating, a field demonstration was implemented from April 10 to 20, 2015.
- Through this investigation, information including images inside the PCV 1st floor and airborne radiation was obtained. The investigation also confirmed the absence of obstacles around the access aperture leading to the basement floor, which will be used in the next investigation. These results will be considered in next investigation of the PCV basement floor.





Investigation inside PCV


Investigative equipment

<Glossary>
(*1) TIP (Traversing In-core Probe)
(*2) Penetration: Through-hole of the PCV
(*3) S/C (Suppression Chamber): Suppression pool, used as the water source for the emergent core cooling system.
(*4) SFP (Spent Fuel Pool):
(*5) RPV (Reactor Pressure Vessel)
(*6) PCV (Primary Containment Vessel)

Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

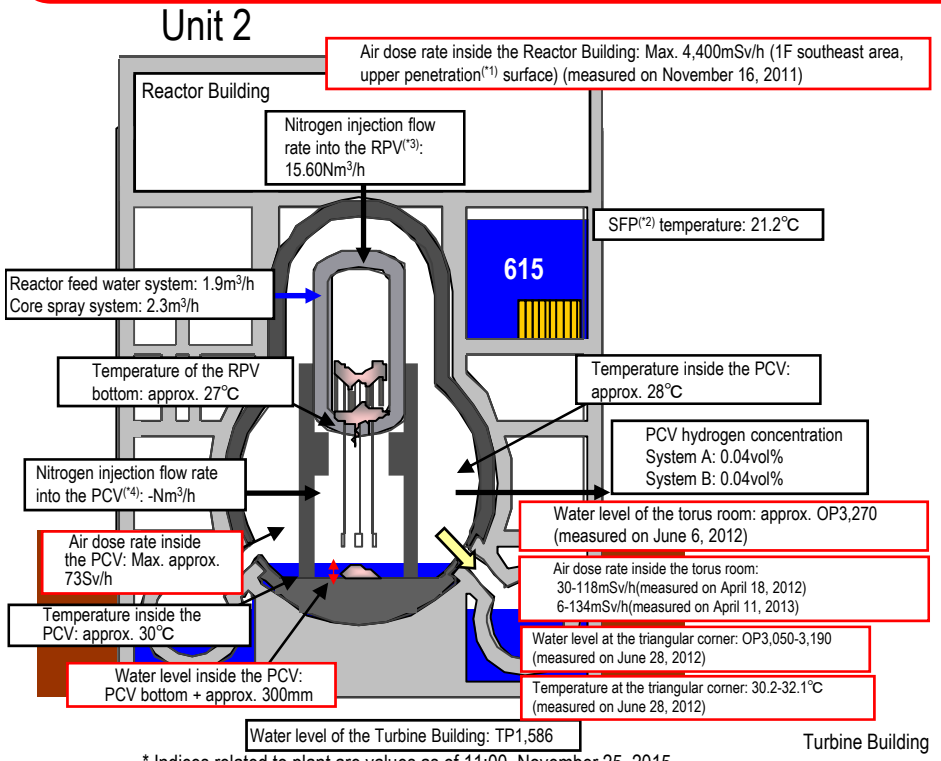
November 26, 2015
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment
3/6

Immediate target: Identify the plant status and commence R&D and decontamination toward fuel debris removal

Installation of an RPV thermometer and permanent PCV supervisory instrumentation

(1) Replacement of the RPV thermometer
- As the thermometer installed at the Unit 2 RPV bottom after the earthquake had broken in February 2014, it was excluded from the monitoring thermometers.
- On April 2014, removal of the broken thermometer failed and was suspended. Rust-stripping chemicals were injected and the broken thermometer was removed on January 2015. A new thermometer was reinstalled on March. The thermometer has been used as a part of permanent supervisory instrumentation since April.

(2) Reinstallation of the PCV thermometer and water-level gauge
- Some of the permanent supervisory instrumentation for PCV could not be installed in the planned locations due to interference with existing grating (August 2013). The instrumentation was removed on May 2014 and new instruments were reinstalled on June 2014. The trend of added instrumentation will be monitored for approx. one month to evaluate its validity.
- The measurement during the installation confirmed that the water level inside the PCV was approx. 300mm from the bottom.

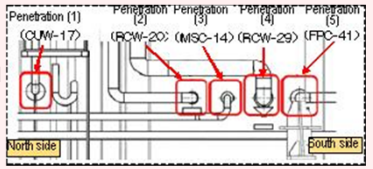


* Indices related to plant are values as of 11:00, November 25, 2015

Investigations inside PCV	1st (Jan 2012)	- Acquiring images - Measuring air temperature
	2nd (Mar 2012)	- Confirming water surface - Measuring water temperature - Measuring dose rate
	3rd (Feb 2013 – Jun 2014)	- Acquiring images - Sampling accumulated water - Measuring water level - Installing permanent monitoring instrumentation
Leakage points from PC	- No leakage from torus room rooftop - No leakage from all inside/outside surfaces of S/C	

Investigative results on torus room walls

- The torus room walls were investigated (on the north side of the east-side walls) using equipment specially developed for that purpose (a swimming robot and a floor traveling robot).
- At the east-side wall pipe penetrations (five points), "the status" and "existence of flow" were checked.
- A demonstration using the above two types of underwater wall investigative equipment showed how the equipment could check the status of penetration.
- Regarding Penetrations 1 - 5, the results of checking the sprayed tracer (*5) by camera showed no flow around the penetrations. (investigation by the swimming robot)
- Regarding Penetration 3, a sonar check showed no flow around the penetrations. (investigation by the floor traveling robot)



Penetrations investigated

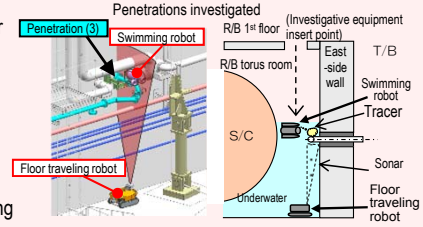


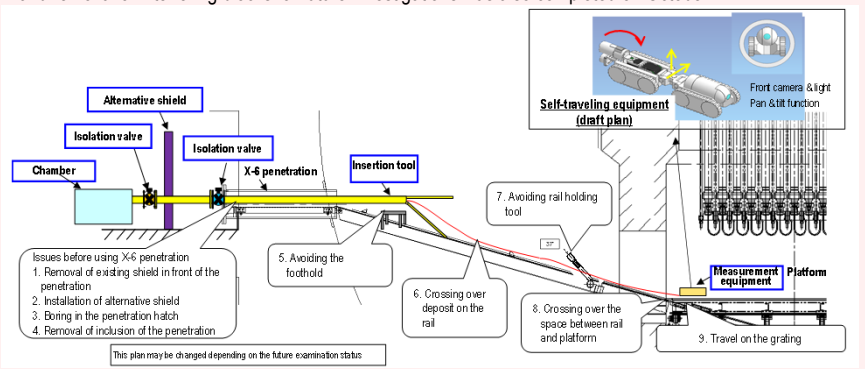
Image of the torus room east-side cross-sectional investigation

Status of equipment development toward investigating inside the PCV

Prior to removing fuel debris, to check the conditions inside the Primary Containment Vessel (PCV), including the location of the fuel debris, investigations inside the PCV are scheduled.

[Investigative outline]
- Inserting the equipment from Unit 2 X-6 penetration(*1) and accessing inside the pedestal using the CRD rail to conduct investigation.

[Status of investigative equipment development]
- Based on issues confirmed by the CRD rail status investigation conducted in August 2013, the investigation method and equipment design are currently being examined.
- As a portion of shielding blocks installed in front of X-6 penetration could not be moved, a removal method using small heavy machines was planned. The work for removing these blocks resumed on September 28 and removal of interfering blocks for future investigations was also completed on October 1.



Investigative issues inside the PCV and equipment configuration (draft plan)

<Glossary>
(*1) Penetration: Through-hole of the PCV (*2) SFP (Spent Fuel Pool)
(*3) RPV (Reactor Pressure Vessel) (*4) PCV (Primary Containment Vessel)
(*5) Tracer: Material used to trace the fluid flow. Clay particles

Progress toward decommissioning: Works to identify the plant status and toward fuel debris removal

November 26, 2015
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment
4/6

Immediate target	Identify the plant status and commence R&D and decontamination toward fuel debris removal

Water flow was detected from the Main Steam Isolation Valve* room

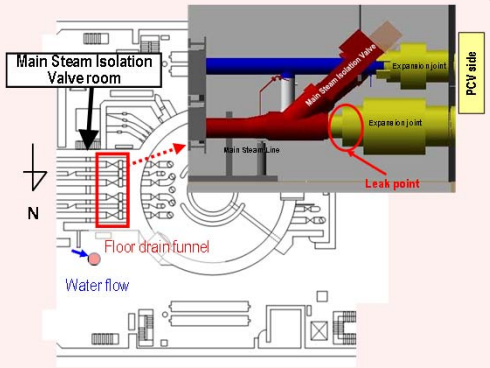
On January 18, 2014, a flow of water from around the door of the Steam Isolation Valve room in the Reactor Building Unit 3 1st floor northeast area to the nearby floor drain funnel (drain outlet) was detected. As the drain outlet connects with the underground part of the Reactor Building, there is no possibility of outflow from the building.

From April 23, 2014, image data has been acquired by camera and the radiation dose measured via pipes for measurement instrumentation, which connect the air-conditioning room on the Reactor Building 2nd floor with the Main Steam Isolation Valve Room on the 1st floor.

On May 15, 2014, water flow from the expansion joint of one Main Steam Line was detected.

This is the first leak from PCV detected in the Unit 3. Based on the images collected in this investigation, the leak volume will be estimated and the need for additional investigations will be examined. The investigative results will also be utilized to examine water stoppage and PCV repair methods.

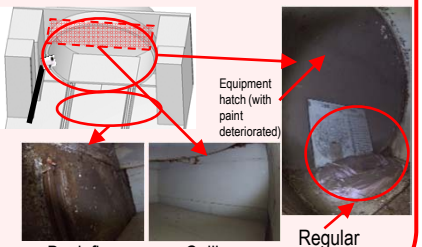
* Main Steam Isolation Valve: A valve to shut off the steam generated from the Reactor in an emergency



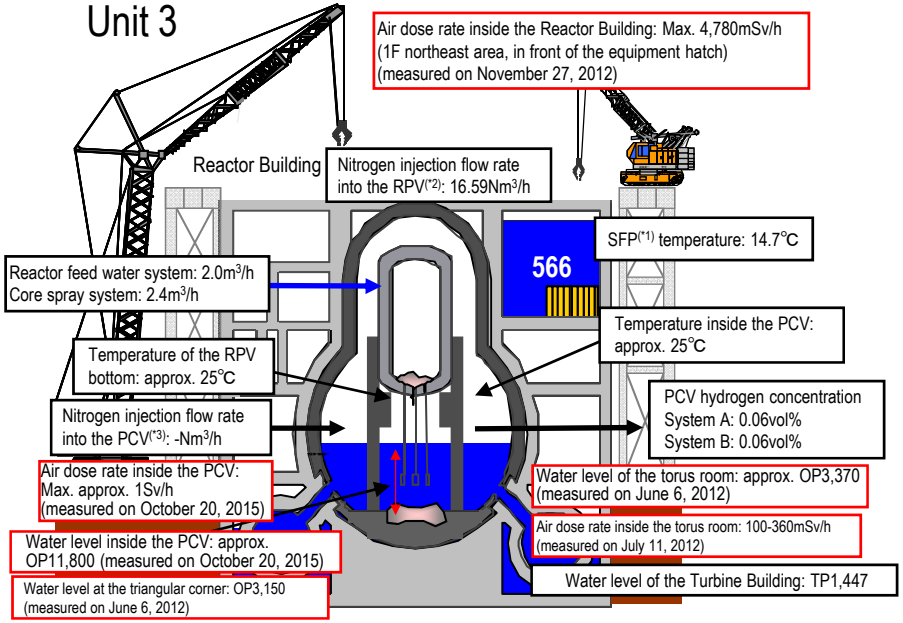
Outline of the water-flow status

Investigative results into PCV equipment hatch

- High-dose puddles were identified around PCV equipment hatch in the past. Due to the possibility of leakage from the equipment hatch seal, an investigation using a small camera was conducted on September 9
- The investigation identified no leakage from nor distortion of the equipment hatch, while detecting leakage from the ceiling and a deposit of coating films on the floor.



Unit 3



* Indices related to plant are values as of 11:00, November 25, 2015

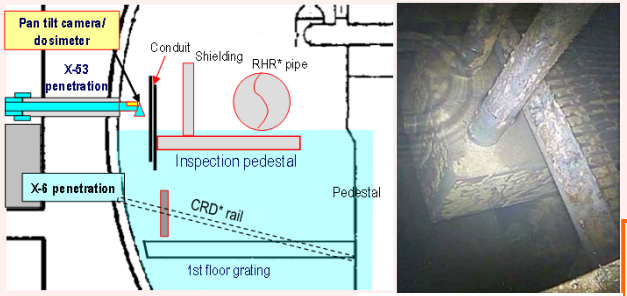
Investigations inside PCV	1st (Oct – Dec 2015)	- Acquiring images - Measuring air temperature and dose rate - Measuring water level and temperature - Sampling accumulated water - Installing permanent monitoring instrumentation (scheduled for December 2015)
Leakage points from PC	- Main steam pipe bellows (identified in May 2014)	

Investigation inside the PCV

Prior to removing fuel debris, to check the conditions inside the Primary Containment Vessel (PCV) including the location of the fuel debris, investigation inside the PCV was conducted.

[Steps for investigation and equipment development]
Investigation from X-53 penetration(*4)

- From October 22-24, the status of X-53 penetration, which may be under the water and which is scheduled for use to investigate the inside of the PCV, was investigated using remote-controlled ultrasonic test equipment. Results showed that the penetration is not under the water.
- For the purpose of confirming the status inside the PCV, an investigation device was inserted into the PCV from X-53 penetration on October 20 and 22, 2015 to obtain images, data of dose and temperature and sample accumulated water. No damage was identified on the structure and walls inside the PCV and the water level was almost identical with the estimated value. In addition, the dose inside the PCV was confirmed to be lower than in other Units.
- In the next step, the obtained information will be analyzed to be utilized in the consideration about the policy for future fuel debris removal.



Inspection pedestal and water surface

<Glossary>
(*1) SFP (Spent Fuel Pool)
(*2) RPV (Reactor Pressure Vessel)
(*3) PCV (Primary Containment Vessel)
(*4) Penetration: Through-hole of the PCV

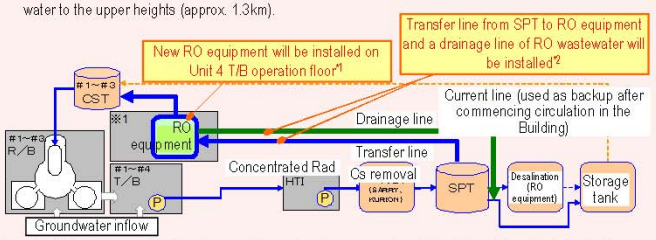
Progress toward decommissioning: Work related to circulation cooling and accumulated water treatment line

Immediate target | Stably continue reactor cooling and accumulated water treatment, and improve reliability

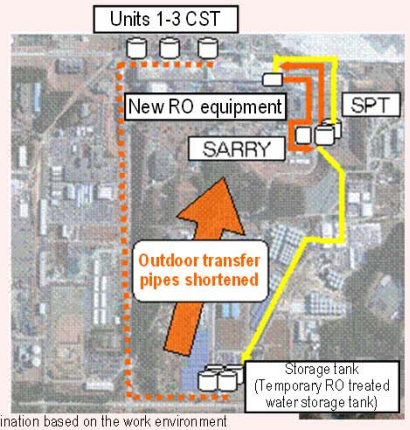
Work to improve the reliability of the circulation water injection cooling system and pipes to transfer accumulated water.

- Operation of the reactor water injection system using Unit 3 CST as a water source commenced (from July 5, 2013). Compared to the previous systems, in addition to the shortened outdoor line, the reliability of the reactor water injection system was enhanced, e.g. by increasing the amount of water-source storage and enhancing durability.
- By newly installing RO equipment inside the Reactor Building, the reactor water injection loop (circulation loop) will be shortened from approx. 3km to approx. 0.8km*.

* The entire length of contaminated water transfer pipes is approx. 2.1km, including the transfer line of surplus water to the upper heights (approx. 1.3km).



*1 Unit 4 T/B operation floor is one of the installation proposals, which will be determined after further examination based on the work environment
*2 A detailed line configuration will be determined after further examination



Typhoon measures improved for Tank Area

- Enhanced rainwater measures were implemented, including increasing the height of fences to increase the capacity to receive rainwater and installing rain gutters and fence cover to prevent rainwater inflow. Though a total of 300mm of rainfall was recorded by typhoon Nos. 18 and 19 in 2014, no outflow of contaminated rainwater from inside the fences was detected.

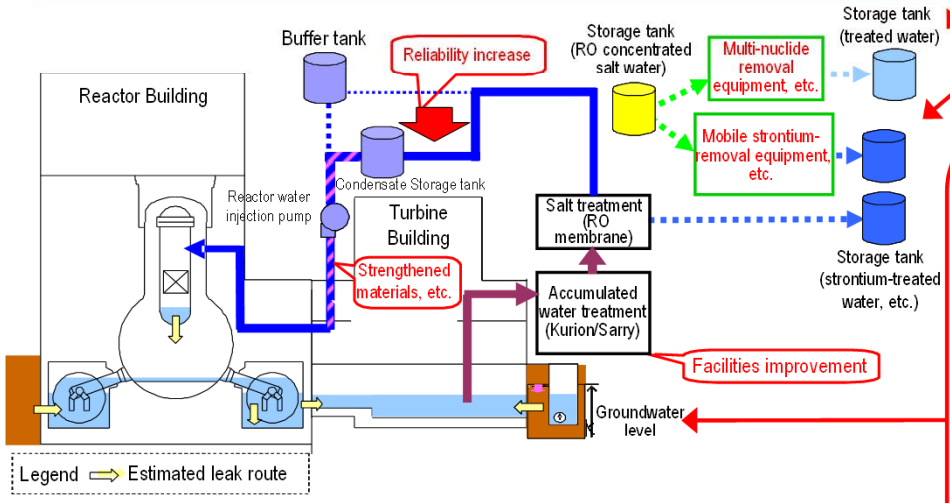
Before installing the fence cover

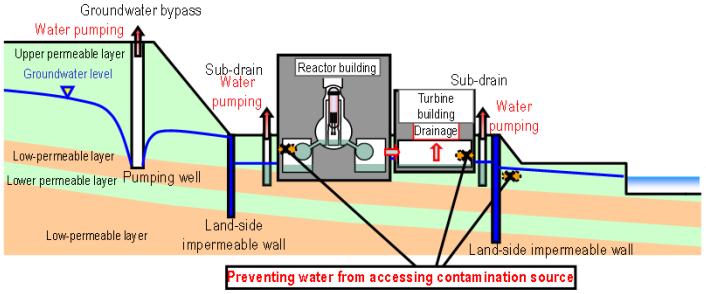
After installing the fence cover

Completion of purification of contaminated water (RO concentrated salt water)

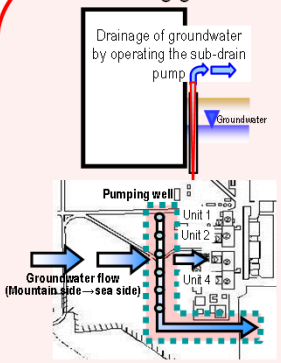
Contaminated water (RO concentrated salt water) is being treated using seven types of equipment including the multi-nuclide removal equipment (ALPS). Treatment of the RO concentrated salt water was completed on May 27, with the exception of the remaining water at the tank bottom. The remaining water will be treated sequentially toward dismantling the tanks.

The strontium-treated water from other facilities than the multi-nuclide removal equipment will be re-purified in the multi-nuclide removal equipment to further reduce risks.





Preventing groundwater from flowing into the Reactor Buildings



Reducing groundwater inflow by pumping sub-drain water

To reduce groundwater flowing into the buildings, pumping-up of groundwater from wells (subdrains) around the buildings started on September 3, 2015. Pumped-up groundwater was purified at dedicated facilities and released after TEPCO and a third-party organization confirmed that its quality met operational targets.

Via a groundwater bypass, reduce the groundwater level around the Building and groundwater inflow into the Building

Measures to pump up groundwater flowing from the mountain side upstream of the Building to reduce the groundwater inflow (groundwater bypass) have been implemented.

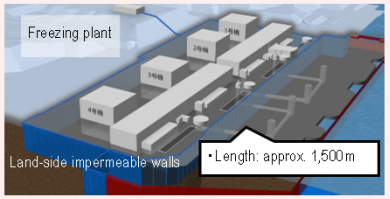
The pumped up groundwater is temporarily stored in tanks and released after TEPCO and a third-party organization have confirmed that its quality meets operational targets.

Through periodical monitoring, pumping of wells and tanks is operated appropriately.

At the observation holes installed at a height equivalent to the buildings, the trend showing a decline in groundwater levels is checked.

The analytical results on groundwater inflow into the buildings based on existing data showed a declining trend.

Installing land-side impermeable walls around Units 1-4 to prevent the inflow of groundwater into R/B



To prevent the inflow of groundwater into the Reactor Buildings, installation of impermeable walls on the land side is planned.
Drilling holes to install frozen pipes commenced from June 2, 2014.
On the mountain side, construction was completed in September 2015.
On the sea side, drilling for frozen pipes was completed in October.

<Glossary>
(*1) CST (Condensate Storage Tank)
Tank for temporarily storing water used in the plant.

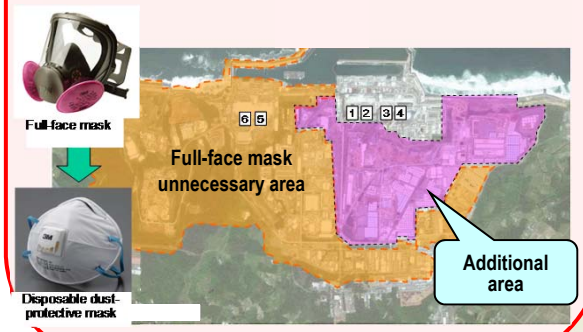
Progress toward decommissioning: Work to improve the environment within the site

Immediate targets	・Reduce the effect of additional release from the entire power station and radiation from radioactive waste (secondary water treatment waste, rubble, etc.) generated after the accident, to limit the effective radiation dose to below 1mSv/year at the site boundaries. ・Prevent contamination expansion in sea, decontamination within the site

Expansion of full-face mask unnecessary area

The number of dust monitors has increased to ten with additional monitors installed in Units 3 and 4 slopes and tank areas, the full-face mask unnecessary area will be expanded to approx. 90% of the site from May 29.

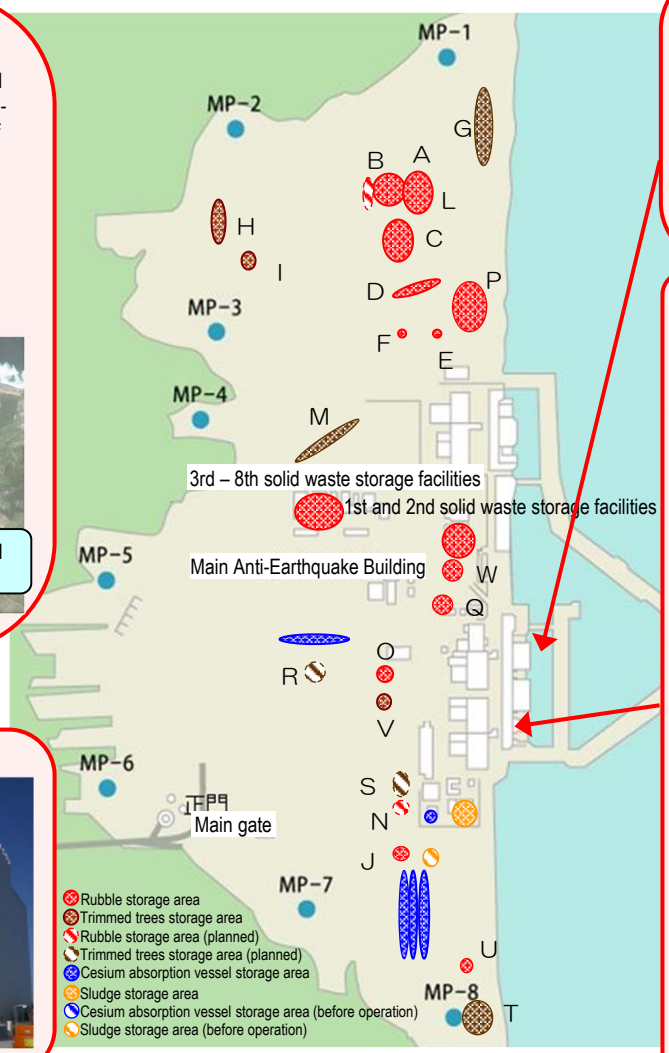
However, wearing full- or half-face mask is required for works exposed to highly concentrated dust; and full-face masks, for works involving a risk of ingesting concentrated salt water, etc.



Full-face mask unnecessary area

Operation start of the large rest house

A large rest house for workers was established and its operation commenced on May 31.
Spaces in the large rest house are also installed for office work and collective worker safety checks as well as taking rest.
Meal service at the dining space, which had been temporarily suspended due to the construction to ensure further improvement from a hygiene perspective, resumed on August 3.



Installation of sea-side impermeable walls

To prevent the outflow of contaminated water into the sea, sea-side impermeable walls have been installed.

Following the completed installation of steel pipe sheet piles on September 22, 2015, connection of these piles was conducted and connection of sea-side impermeable walls was completed on October 26, 2015. Through these works, closure of sea-side impermeable walls was finished and the contaminated water countermeasures have been greatly advanced.

Installation of steel pipe sheet piles for sea-side impermeable wall

Reducing radioactive materials in seawater within the harbor

- The analytical result for data such as the density and level of groundwater on the east (sea) side of the Building identified that contaminated groundwater was leaking into seawater.
- No significant change has been detected in seawater within the harbor for the past month, nor was any significant change detected in offshore measurement results as of last month.
- To prevent contamination expansion into the sea, the following measures are being implemented:

(1) Prevent leakage of contaminated water
- Ground improvement behind the bank to prevent the expansion of radioactive materials.
  (Between Units 1 and 2: completed on August 9, 2013;
  between Units 2 and 3: from August 29 and completed on December 12, 2013;
  between Units 3 and 4: from August 23, 2013 and completed on January 23, 2014)
- Pumping groundwater in contaminated areas (from August 9, 2013, scheduled to commence sequentially)

(2) Isolate water from contamination
- Enclosure by ground improvement on the mountain side
  (Between Units 1 and 2: from August 13, 2013 and completed on March 25, 2014;
  between Units 2 and 3: from October 1, 2013 and completed on February 6, 2014;
  between Units 3 and 4: from October 19, 2013 and completed on March 5, 2014)
- To prevent the ingress of rainwater, the ground surface was paved with concrete (commenced on November 25, 2013 and completed on May 2, 2014)

(3) Eliminate contamination sources
- Removing contaminated water in branch trenches and closing them (completed on September 19, 2013)
- Treatment and removal of contaminated water in the seawater pipe trench
  Unit 2: November 25 to December 18, 2014 - tunnel sections were filled.
  February 24 to July 10, 2015 - Vertical Shafts were filled. Removal of contaminated water was completed on June 30.
  Unit 3: February 5 to April 8, 2015 - tunnel sections were filled.
  May 2 to August 27, 2015 – Vertical Shafts were filled. Removal of contaminated water was completed on July 30.
  Unit 4: February 14 – March 21, 2015 - tunnel sections were filled.
  April 15 to 28, 2015 - opening apertures II and III were filled.