Summary of Decommissioning and Contaminated Water Management

December 24, 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

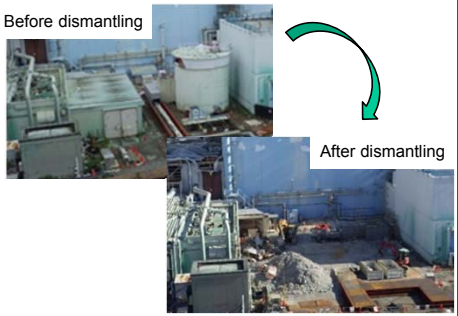
(Note 2)
The fuel debris removal method for each unit will be decided two years after revising the Mid-and-Long-term road map (June 2015). The method for the first unit will be confirmed in the first half of FY2018.

Dismantling Facilities

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

Toward fuel removal from pool

Toward fuel removal from Unit 2 SFP, preparation around the building is underway.
Dismantling of hindrance buildings around the Reactor Building has been underway since September 2015 to clear a work area to install large heavy-duty machines, etc.



(Preparation around Unit 2 Reactor Building)

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)

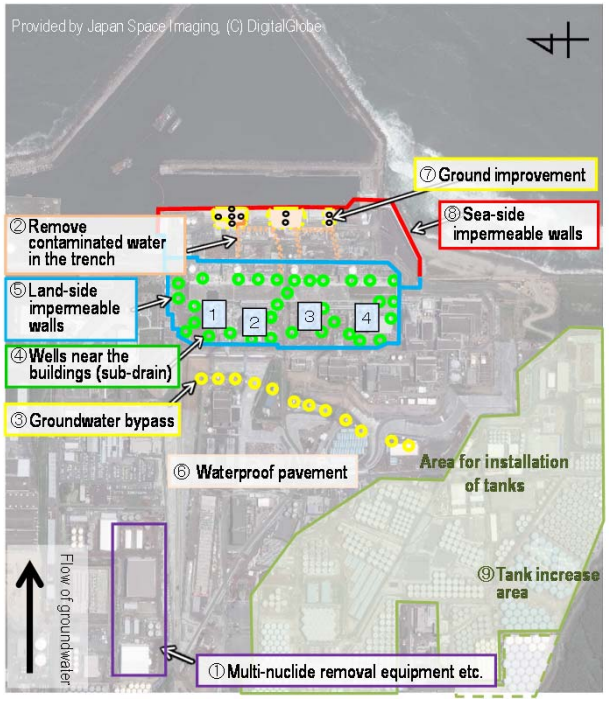
(Note 3) Underground tunnel containing pipes.

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. 15-35°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.

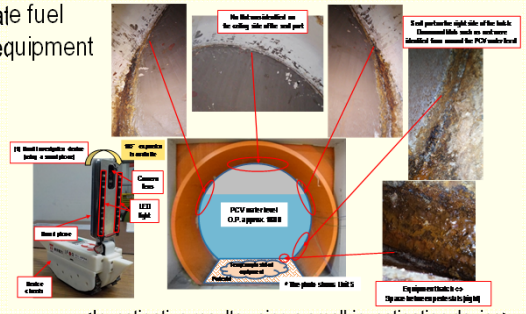
* 1 The values vary somewhat depending on the unit and location of the thermometer.

* 2 In November 2015, the radiation exposure dose due to the release of radioactive materials from the Unit 1-4 Reactor Buildings was evaluated as less than 0.0011 mSv/year at the site boundaries. The annual radiation dose by natural radiation is approx. 2.1 mSv/year (average in Japan).

Investigative results into the Unit 3 PCV equipment hatch using a small investigation device

As part of the investigation into the PCV to facilitate fuel debris removal, the status around the Unit 3 PCV equipment hatch was investigated using a small self-traveling investigation device on November 26.

Given blots such as rust identified below the water level inside the PCV, there may be a leakage from the seal to the extent of bleeding. Methods to investigate and repair the parts, including other PCV penetrations with a similar structure, will be considered.



<Investigative results using a small investigation device>

Expansion of areas where workers are allowed to wear general workwear

From December 8, in addition to newly adding the Radioactive Waste Incinerator, areas of the Main Anti-Earthquake Building, rest houses of the company building, and parking were expanded as those where workers are allowed to wear general workwear.

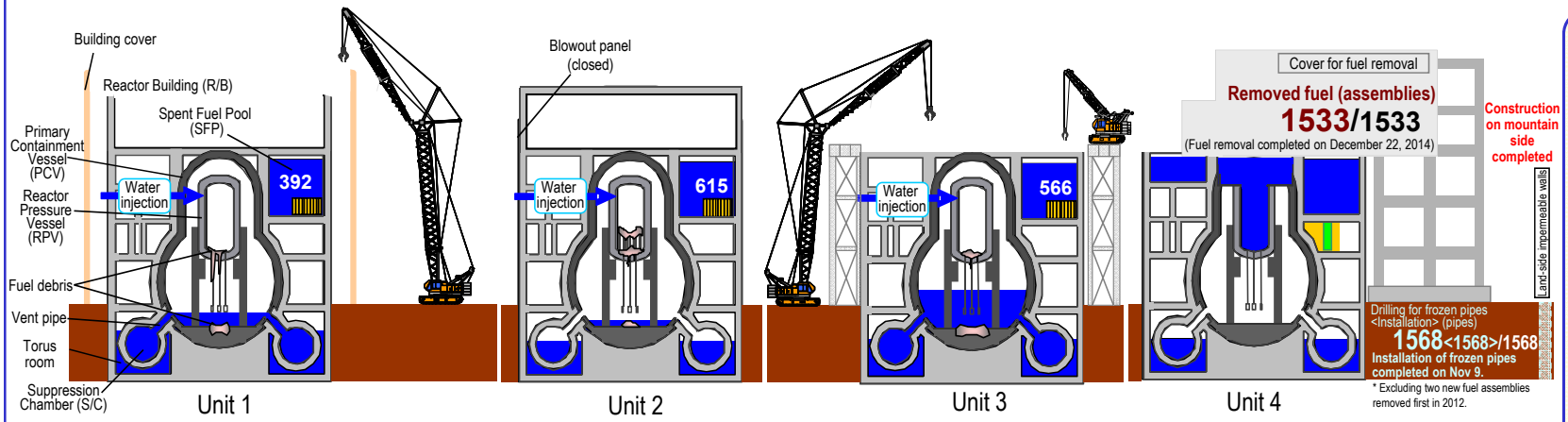
With this expansion, workers can move in general workwear from the access control facility to each rest house around the company building.

Introduction of elevated decontamination equipment into the Unit 3 Reactor Building

The Unit 3 Reactor Building 1st floor, which has a high dose at elevation, will be decontaminated by elevated decontamination equipment using dry ice.

After assessing the capability of the equipment inside the Reactor Building from December 23, decontamination using this equipment will start from mid-January.

<Elevated decontamination equipment>

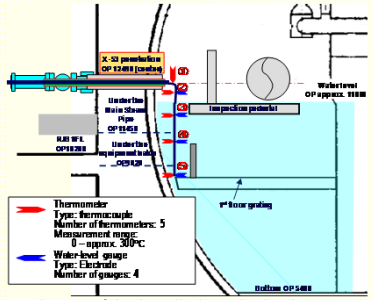


Additional installation of thermometers/water-level gages into Unit 3 PCV

Though the temperature inside the Unit 3 PCV was monitored with thermometers which had been used since before the accident, new thermometers and water-level gages were installed on December 11, and it was confirmed that the values measured by these instruments were similar to those measured by the existing instruments.

With this work, the temperatures and water levels of all PCVs of Units 1-3 can be monitored similarly.

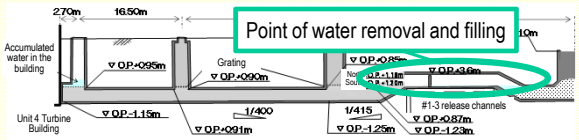
Data from these instruments will be monitored for about one month and then it will be assessed.



<Layout image of the installed monitoring instrumentation>

Removal of contaminated water and filling of Unit 4 seawater pipe trench complete

For the Unit 4 seawater pipe trench, removal of contaminated water and filling of the parts running over release channels was completed on December 21. This work completed the removal of 10,000 m^3 of high-dose contaminated water from Unit 2-4 seawater pipe trenches.



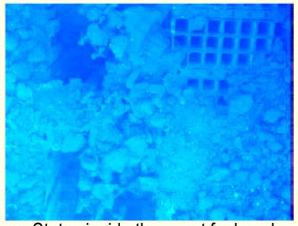
<Sectional view of the Unit 4 seawater pipe trench>

Investigative results inside the Unit 3 spent fuel pool

Following the removal of large rubble inside the Unit 3 spent fuel pool, which was concluded on November 21, inspections inside the pool were conducted on December 9, 10, 16 and 17.

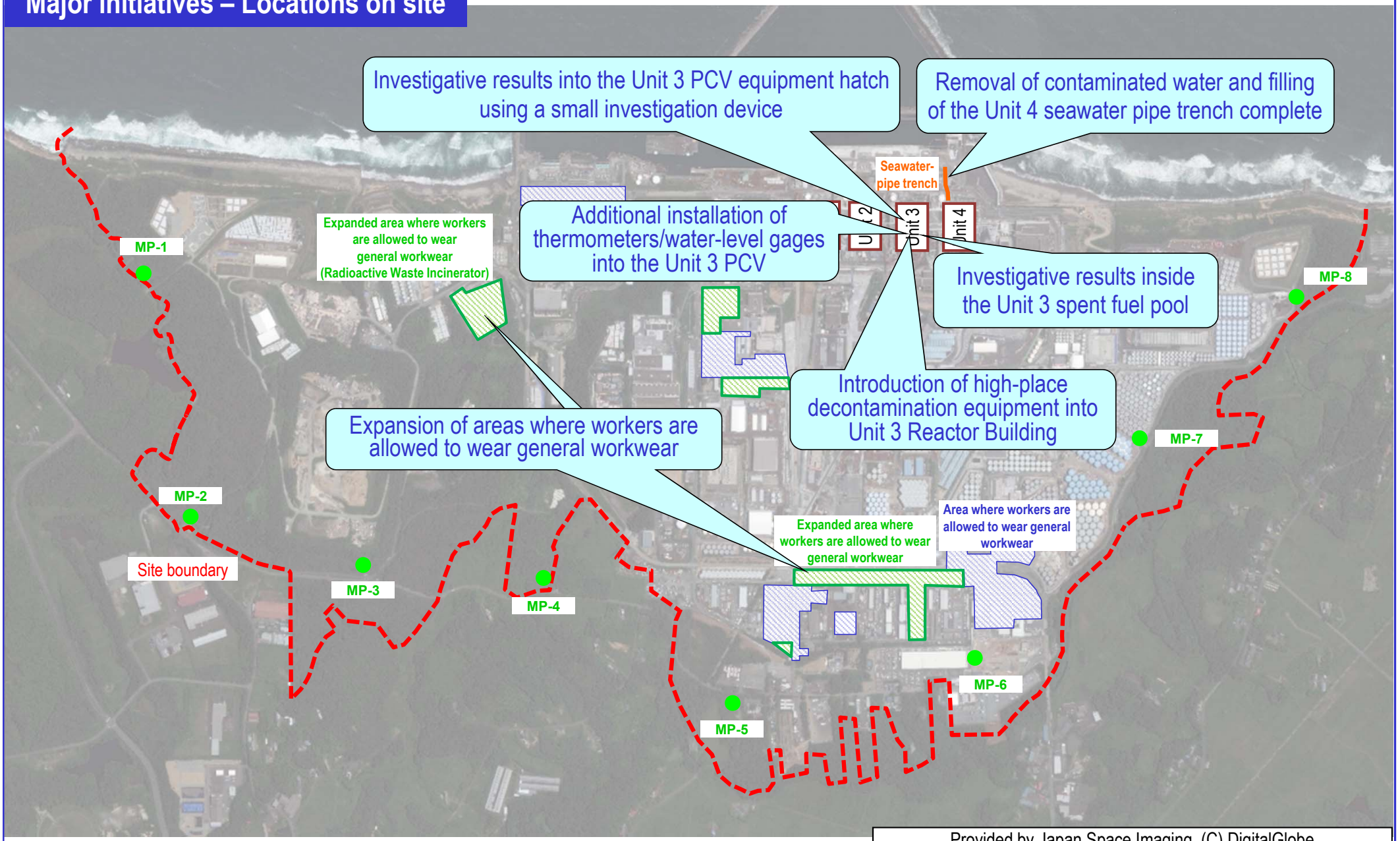
The investigative results inside the entire pool identified no significant deformity with other fuel assemblies except the six assemblies already confirmed to date.

To facilitate fuel removal, the dose will be reduced by shielding and a cover installed.



Status inside the spent fuel pool
(photo taken over the rack)

Major initiatives – Locations on site



Provided by Japan Space Imaging, (C) DigitalGlobe

* Data of Monitoring Posts (MP1-MP8.)

Data (10-minute value) of Monitoring Posts (MPs) measuring airborne radiation rate around site boundaries show 0.768 – 4,000 μSv/h (November 25 – December 21, 2015).

Monitoring posts 1 to 8 are being replaced from December 4, 2015 because they reached the time for replacement. During this work, some data may not be obtained and mobile monitoring posts or other equivalent facilities will be installed as alternatives.

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.

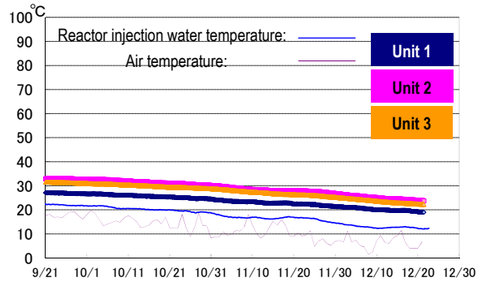
Therefore monitoring results at these points are lower than elsewhere in the power plant site.

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.

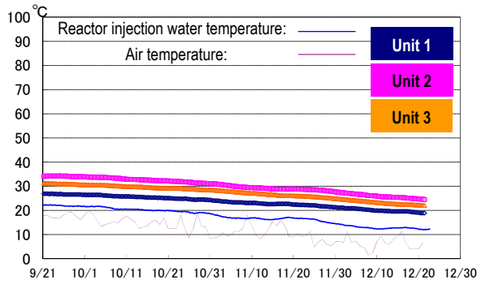
I. Confirmation of the reactor conditions

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. 15 to 35°C for the past month, though they vary depending on the unit and location of the thermometer.



RPV bottom temperatures (recent quarter)



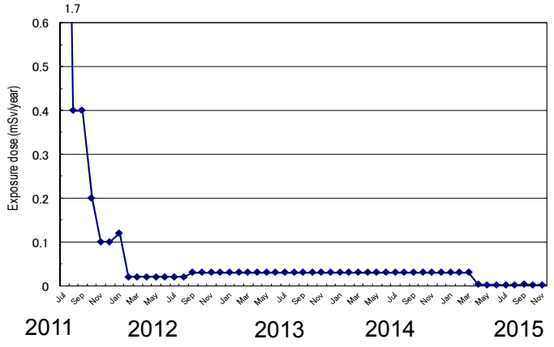
PCV gas phase temperatures (recent quarter)

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

2. Release of radioactive materials from the Reactor Buildings

As of November 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. 2.6×10^{-11} Bq/cm^3 for Cs-134 and 8.2×10^{-11} Bq/cm^3 for Cs-137 respectively. The radiation exposure dose due to the release of radioactive materials was less than 0.0011 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/cm^3
[Cs-137]: 3 x 10^{-5} Bq/cm^3

* 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/cm^3)
[Cs-137]: ND (Detection limit: approx. 2 x 10^{-7} Bq/cm^3)

* Data of Monitoring Posts (MP1-MP8).
Data of Monitoring Posts (MPs) measuring the airborne radiation rate around site boundaries showed 0.768 – 4,000 μSv/h (November 25 – December 21, 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

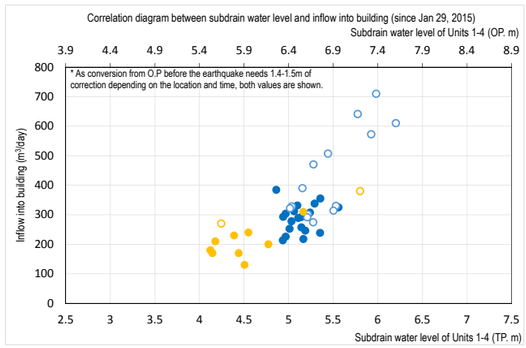
To tackle the increase in accumulated water due to groundwater inflow, fundamental measures to prevent such inflow into the Reactor Buildings will be implemented, while improving the decontamination capability of water treatment and preparing facilities to control the contaminated water

➢ 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 December 21, 2015, 154,021 m³ of groundwater had been released. The pumped-up groundwater was temporarily stored in tanks and released after TEPCO and a third-party organization confirmed that its quality met operational targets.
- For pumping well Nos. 7, 8, 10 and 12, pumping of groundwater was suspended for cleaning (No. 7: from November 27; No. 8: October 28 – November 26; No. 10: from December 10; No. 12: November 16 to December 9).

➢ 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 December 21, a total of 36,376 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 the level of the groundwater drain pond rising since the closure of the sea-side impermeable walls, pumping started on November 5. As of December 21, a total of 14,380 m³ had been pumped up. After the closure of sea-side impermeable walls, joint opening was detected on part of the paved surfaces due to increased deflection of steel pipe sheet piles in association with rising groundwater levels. To prepare for a potential increase in pumped-up water from groundwater drains, repairs were made and completed on December 5. Inspections will continue and repairs will be made as circumstances dictate.
- The effect of ground water inflow control by subdrains will be evaluated by both the correlation of “subdrain water levels” and the correlation of the “difference between water levels in subdrains and buildings” for the time being.
- However, given insufficient data about the effect of rainfall after the subdrains went into operation, the effect of the inflow into buildings will be reviewed as necessary by accumulating data.
- Inflow into buildings reduced to approx. 200 m³/day as of the times when the subdrain water level was decreased to approx. TP 4-5 m or when the difference with the water levels in buildings decreased to approx. 2.5-3 m after the subdrains went into operation.



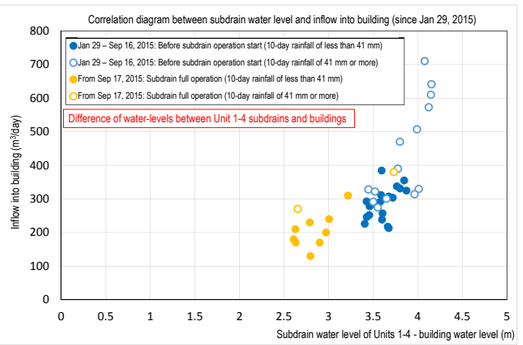


Figure 1: Evaluation of inflow into buildings after the subdrains went into operation

➢ 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 installation of frozen pipes on July 28, filling of brine was also completed 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 2). Installation of brine pipes is currently underway.

T/Mt pipes: Temperature-measurement pipes

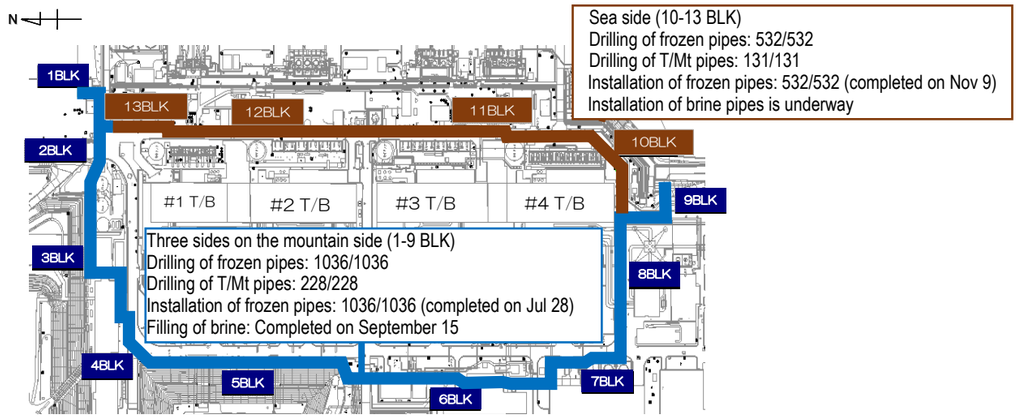
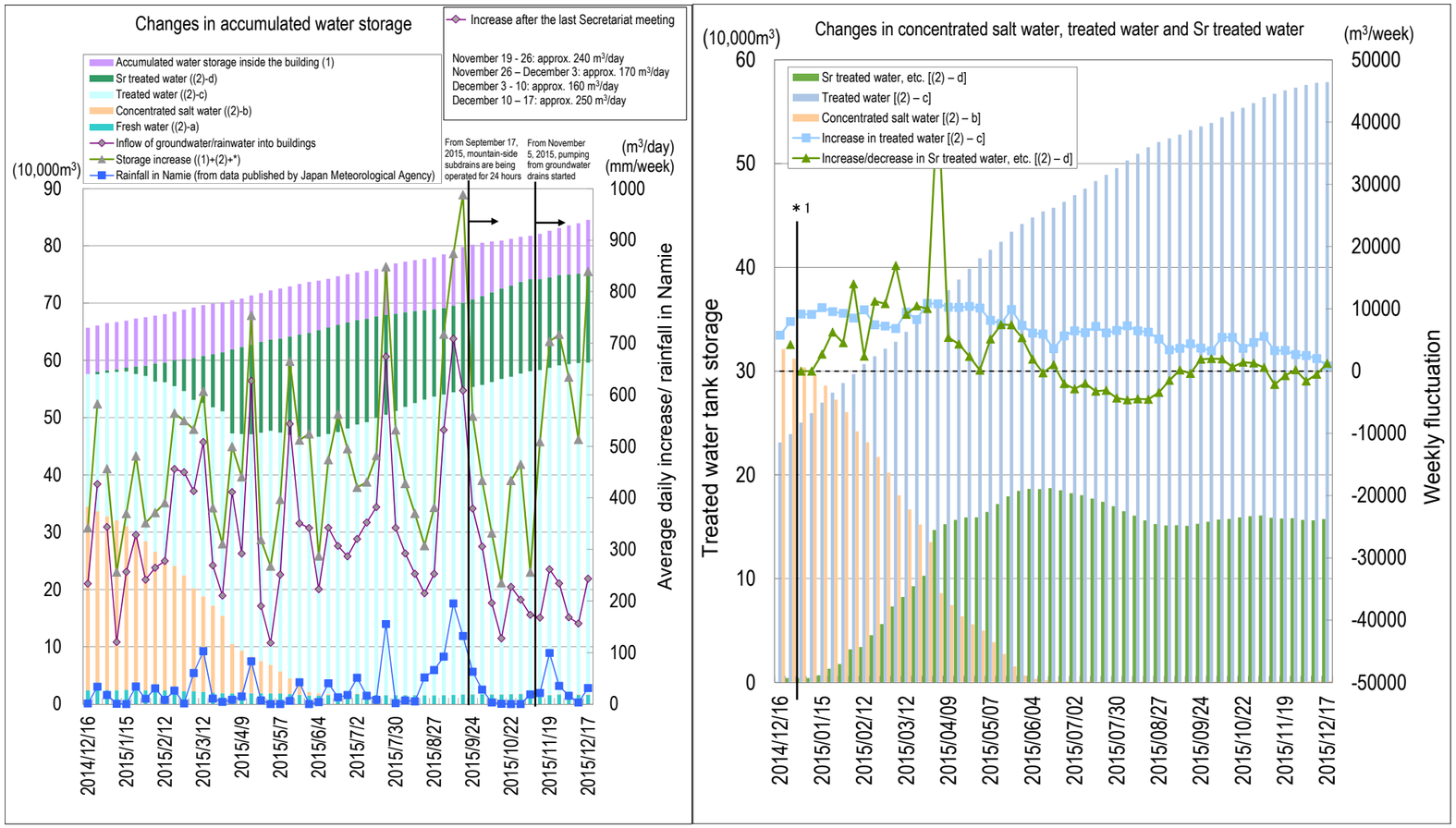


Figure 2: Drilling status for frozen-soil impermeable walls and installation of frozen pipes

➢ 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 December 17, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 257,000, 235,000 and 92,000 m³ respectively (including 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 resumed from December 4. For System B. facility inspections and installation of additional absorption vessels to improve its performance have been underway since December 4.
- For Systems A and B of additional multi-nuclide removal equipment, facilities inspections have been underway since December 1.
- 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 December 17, approx. 141,000 m³ had been treated.



As of December 17, 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 3: Status of accumulated water storage

➢ 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, 2015) and secondary cesium absorption apparatus (SARRY) (from December 26, 2014) are underway. As of December 17, approx. 155,000 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 December 21, 2015, a total of 40,730 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 had identified a drop of approx. 2 cm height inside the fences (approx. 2m x 5m x 5cm) surrounding the leakage detector installed at the lower part of the pipes to transfer accumulated water and a drop of approx. 5m x 5m x 1mm inside the fences of the cable process room. An investigation into four pipes near the leakage points revealed a crack and dimple on the surface of a pipe.
- The cause of the damage was assumed to be a PE pipe having melted due to the effect of radiation heat from the incandescent projector. The use of incandescent projectors in areas where PE pipes are installed is prohibited in principle.

➢ Leakage from desalination equipment (RO2)

- On November 15, a leakage of approx. 1m x 15m x 20mm large was detected from the booster pump outlet pipe joint of the desalination equipment (RO2-5) into the fences. An inspection of the joint with which the leakage was detected identified no damaged parts or loosened bolts but an incorrect relative position (angle) of the pipe to which the joint was placed and a lack of supporting structure for the pipe to fix the vertical direction around it. This was assumed to be attributable to a certain external force applied to the joint pipe, which meant the angle gap was nearly at the tolerance limit. Vibration applied through subsequent operations further expanded the gap, rendering the pipe unable to maintain the rubber-ring seal and triggering the leakage. The pipe joint will be restored after correcting the angle gap and a pipe-supporting structure to fix the vertical direction will be added.

➢ Removal of contaminated water from Unit 4 seawater pipe trench

- For the Unit 4 seawater pipe trench, filling of tunnels and apertures II and III was completed by April 28. Removal of contaminated water and filling of the parts running over release channels was also completed on December 21.
- With this work, removal of approx. 10,000 m³ of contaminated water from Unit 2-4 seawater pipe trenches was completed.

➢ Status of investigation into accumulated water in a communication duct with the waste treatment building

- An annual inspection is conducted for trenches and other relevant parts connecting to buildings where high-level contaminated water is accumulated. As an increase from FY2014 was detected in the density of radioactive materials included in accumulated water, a cause inspection was conducted for the communication duct with the waste treatment building among the facilities already inspected and countermeasures are being considered. Though no leakage of accumulated water from the duct is assumed given the lower water level inside the duct compared to that in the surrounding subdrains, monitoring has been strengthened.

Investigation year	Nuclide analysis results (Bq/L)					Classification of accumulated water*	Estimated amount of accumulated water (m³)
	Cs-134	Cs-137	Total Cs	Gross β	H-3		
FY2011 (Dec 2011)	1.5×10^{2}	1.7×10^{2}	3.2×10^{2}	ND	ND	C	150
FY2012 (Dec 2012)	9.9×10^{1}	2.0×10^{2}	3.0×10^{2}	ND	ND	C	400
FY2013 (Dec 2013)	ND	3.9×10^{1}	3.9×10^{1}	ND	ND	C	370
FY2014 (Dec 2014)	2.7×10^{1}	9.4×10^{1}	1.2×10^{2}	1.2×10^{2}	3.1×10^{2}	C	420
FY2015 (Dec 2015)	9.2×10^{4}	3.9×10^{5}	4.9×10^{5}	5.0×10^{5}	6.7×10^{3}	B	480

* Classification of accumulated water (total Cs density) A: 10^{6} Bq/L level or more B: 10^{5} Bq/L level or more C: 10^{4} Bq/L level or more

Figure 4: Analytical results of accumulated water in the communication duct with the waste treatment building

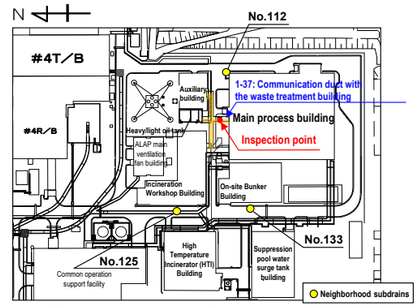


Figure 5: Location of the communication duct with the waste treatment building

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 since 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.

➢ 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.
- As one of the two large cranes used around the Unit 3 Reactor Building malfunctioned, inspections inside the spent fuel pool were conducted on December 9, 10, 16 and 17 using a well-functioning large crane which was used for decontamination on the operating floor. The investigative results inside the entire pool identified no significant deformity with other fuel assemblies except the six assemblies already confirmed to date.
- The malfunctioning large crane is being inspected and repaired until the end of January.

➢ Evaluation on the soundness of aluminum baskets in response to the abolition of aluminum alloy case standards for metal cask baskets

- The Japan Society of Mechanical Engineers abolished the aluminum alloy case standards of the metal cask structure standards on October 1.
- For the 20 dry casks in the Fukushima Daiichi Nuclear Power Station which used aluminum alloy, a material being registered in the relevant case standards, as a basket material for metal casks, a voluntary evaluation conducted to determine the soundness of these casks confirmed no problem. Appropriate actions will be taken as instructed by the Secretariat of the Nuclear Regulation Authority.

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 and the Airlock 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, investigations of the Main Steam Valve Room (November 17 – December 4) and the Airlock Room (December 1-7) were conducted.

➢ 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: November 17 – December 7, surface grind: from December 11).

➢ Future work to decontaminate Unit 3 Reactor Building 1st floor

- To decontaminate the Unit 3 Reactor Building 1st floor, rubble removal on the floor surface, suction of dust and decontamination by sprinkling brushes (approx. 70% of the floor area) and sprinkling decontamination of walls up to 4m in height and machinery (approx. 15-40% of the target area) were conducted. Given a large dose contribution from the area up to 4-8m in height which had not yet been decontaminated, the decontamination capability of the elevated decontamination equipment (dry-ice blast decontamination equipment) is being assessed from December 23. Following the assessment, decontamination using the elevated decontamination equipment will start from mid-January for areas which had not yet been decontaminated.

➢ 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.
- Based on the investigation into the status using a small camera, the status around the equipment hatch seal was investigated using a small self-traveling investigation device on November 26 and the dose around the floor surface into which a hot spot dosimeter was inserted was measured on November 27.
- Given blots such as rust identified around the equipment hatch below the PCV water level of the PCV equipment hatch seal, there may be a leakage to the extent of bleeding. Methods to investigate and repair the 10 PCV penetrations, which have a similar seal structure to the equipment hatch and are subject to repair, will be considered. In addition, in response to the leakage of possible rainwater detected during the investigation, methods to identify the route of rainwater ingress will be considered.

➢ 3D laser scan measurement at Unit 3 Reactor Building torus room

- To facilitate the obstacle evaluation necessary for the investigation to confirm the existence of leakage of Unit 3 PCV, repair, etc., a 3D data scan measurement inside the torus room has been underway since December 22.

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 November, the total storage volume of concrete and metal rubble was approx. 171,100 m³ (+5,700 m³ compared to at the end of October, with an area-occupation rate of 64%). The total storage volume of trimmed trees was approx. 84,500 m³ (+300 m³ compared to at the end of October, with an area-occupation rate of 79%). The increase in rubble was mainly attributable to construction related to the installation of tanks and collection of materials to be burnt. The increase in trimmed trees was mainly attributable to facing-related construction.

➢ Management status of secondary waste from water treatment

- As of December 17, 2015, the total storage volume of waste sludge was 597 m³ (area-occupation rate: 85%) and that of concentrated waste fluid was 9,292 m³ (area-occupation rate: 46%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment, etc. was 2900 (area-occupation rate: 48%)

➢ Test operation of Radioactive Waste Incinerator

- From November 25, a cold test incinerating dummy waste, which generates no contamination, was 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

➢ Installation of permanent monitoring instruments inside Unit 3 PCV

- Thermometers and water-level gages were installed from the Unit 3 PCV penetration (X-53) into the PCV (December 11). Data from these instruments will be monitored for about one month and then it will be assessed. If there is no problem with the data, operation of these monitors will start.
- Permanent supervisory monitoring instruments have already been installed for Units 1 and 2 (Unit 1: October 2012*, Unit 2: June 2014).

* Instruments in Unit 1 were temporarily removed in April 2015 due to an investigation inside the PCV.

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

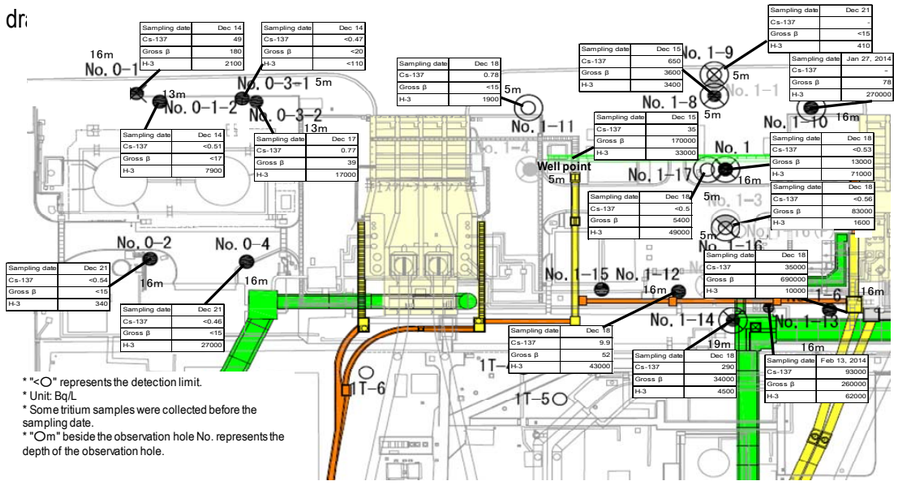
➢ Status of groundwater and seawater on the east side of Turbine Building Units 1 to 4

- Regarding the radioactive materials in the 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. 1-17 has remained constant at around 100,000 Bq/L, it has been decreasing since October and currently stands at around 40,000 Bq/L. The density of gross β radioactive materials at groundwater Observation Hole No. 1 has been increasing since February 2015 and currently stands at around 10,000 Bq/L. 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: August 15, 2013 – October 13, 2015 and from October 24; at the repaired well point: October 14 - 23, 2015).
- 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 200,000 Bq/L. Since December 18, 2013, pumping of groundwater continued (at the well point between the Unit 2 and 3 intakes: December 18, 2013 - October 13, 2015; at the repaired well point: from October 14, 2015).

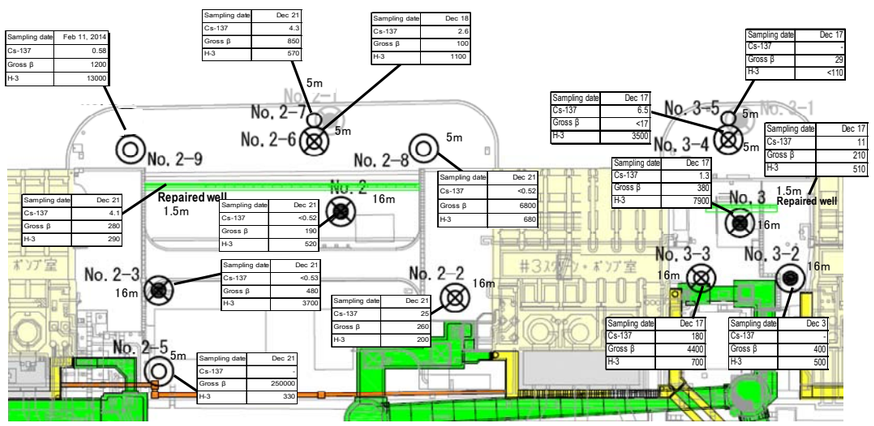
- Regarding radioactive materials in the groundwater near the bank between the Unit 3 and 4 intakes, the tritium density at groundwater Observation Hole No. 3-4 has been increasing since August and currently stands at around 3,000 Bq/L. Since April 1, 2015, pumping of groundwater continued (at the well point between the Unit 3 and 4 intakes: April 1 – September 16, 2015; at the repaired well point: from September 17, 2015).
- 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.
- In the Unit 1 drainage channel, cleaning using a mobile treatment device started on November 27.
- After the closure of sea-side impermeable walls, deflection of steel pipe sheet piles increased according to rising groundwater levels. To ease the burden related to the connection of steel pipe sheet piles, steel was installed to connect the pile heads.

➢ Progress of responses related to the comprehensive review of risks impacting on the outside of the boundaries

- Among items evaluated as “requiring investigation” in the comprehensive risk review, regarding exhaust stack drain sump pits of Units 1 and 2, image data was acquired on December 1 and 2 around the pits using a remote heavy-duty machine. Based on the acquired image data, the layout of the existing structure will be confirmed and methods to dr



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



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

Figure 6: Groundwater density on the Turbine Building east side

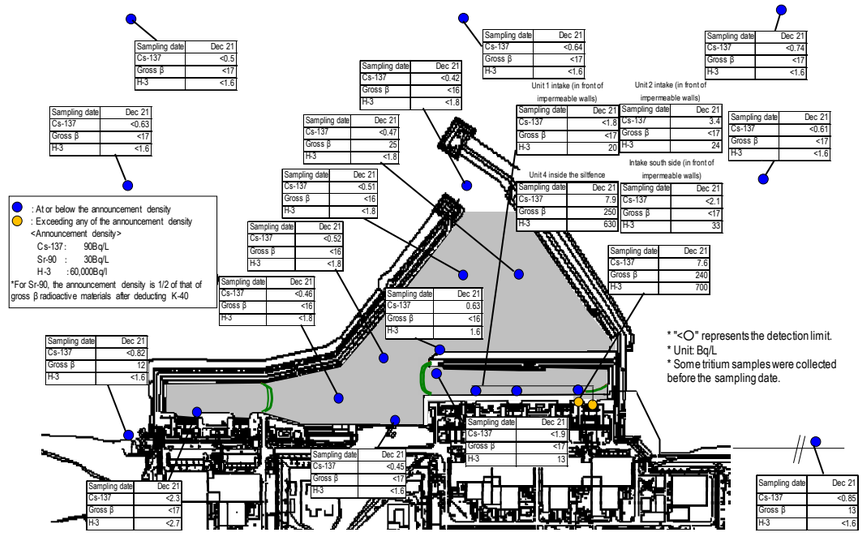


Figure 7: Seawater density around the port

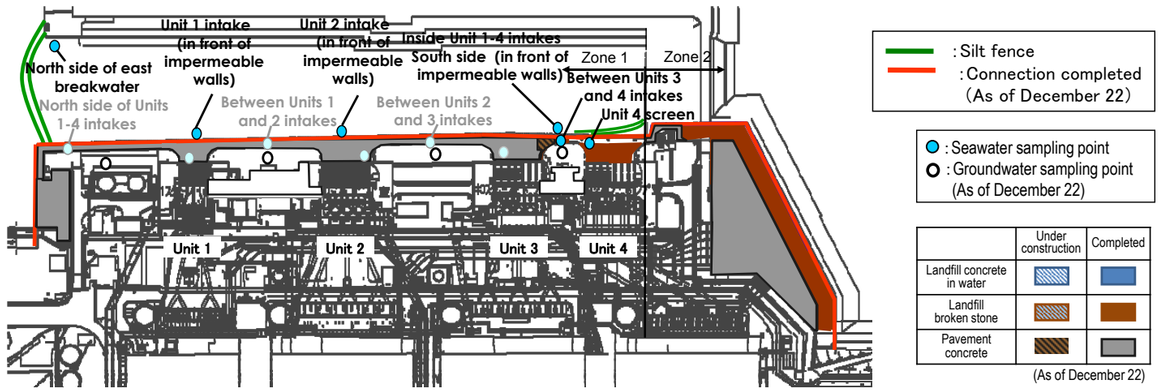


Figure 8: Progress status of impermeable walls on the sea side

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

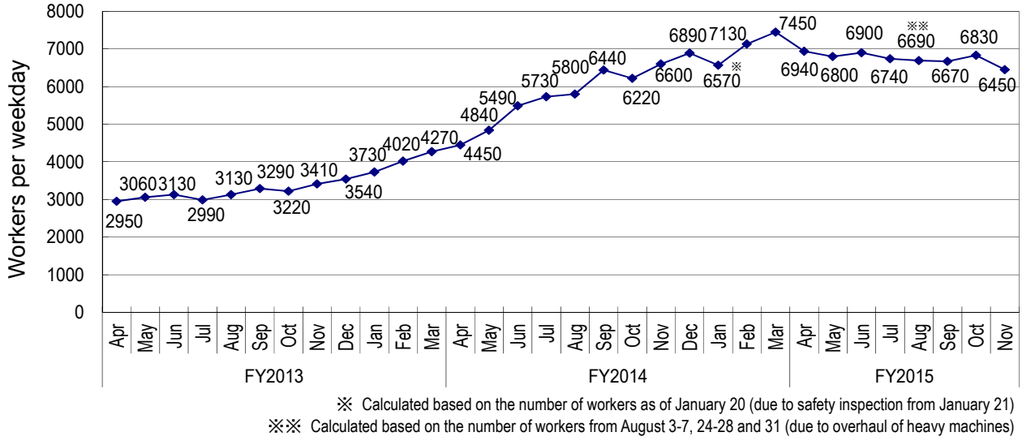
➢ Staff management

- The monthly average total of people registered for at least one day per month to work on site during the past quarter from August to October 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 January 2016 (approx. 6,550 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 FY2013 (see Figure 9).

  * Some works for which contractual procedures have yet to be completed are excluded from the estimate for January 2016.
- The number of workers from Fukushima Prefecture has remained the same but the number from outside the prefecture has decreased slightly. Accordingly, the local employment ratio (TEPCO and partner company workers) as of November remained at around 50% with a slight increase.
- 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 9: Changes in the average number of workers per weekday for each month since FY2013 (actual values)

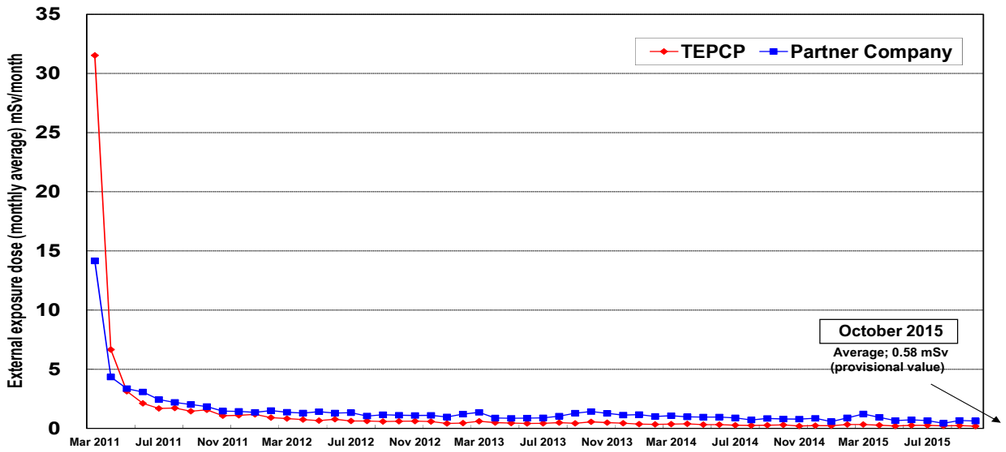


Figure 10: Changes in monthly individual worker exposure dose
(monthly average exposure dose since March 2011)

➢ 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 December 21, a total of 8,318 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 51st week of 2015 (December 14-20, 2015), there was six cases of influenza infections and three cases of norovirus infections. The totals for the same period for the previous season showed 112 cases of influenza infections and one case of norovirus infection. The totals for the entire previous season (November 2014 to March 2015) showed 353 cases of influenza infections and 10 cases of norovirus infections.

➢ Measures to improve management based on serious disasters

- Based on the serious disaster in FY2014, an action plan related to the “utilization and horizontal deployment of operation experience information (trouble information)”, “strengthening the mechanism, organization and system of safety management” and “involvement by TEPCO and enhancing its capability” has been continuously implemented as a safety improvement measure. Improvement will continue with the operation status checked as necessary.

➢ Expansion of areas where workers are allowed to wear general workwear

- From December 8, as well as newly adding the Radioactive Waste Incinerator, areas of the Main Anti-Earthquake Building, rest houses of the company building and parking were expanded as those where workers are allowed to wear general workwear. With this expansion, workers can move in general workwear from the access control facility to each rest house around the company building.

8. Status of Units 5 and 6

➢ Status of spent fuel stored in Units 5 and 6

- Regarding Unit 5, fuel removal from the reactor was completed in June 2015. The spent fuel pool (with a storage capacity of 1,590 assemblies) has stored 1,374 spent fuel assemblies and non-irradiated fuel assemblies and 168 non-irradiated fuel assemblies.
- Regarding Unit 6, fuel removal from the reactor was completed in FY2013. The spent fuel pool (with a storage capacity of 1,654 assemblies) has stored 1,456 spent fuel assemblies and non-irradiated fuel assemblies and 198 non-irradiated fuel assemblies (of which 180 assemblies was transferred from the Unit 4 spent fuel pool). The new fuel storage has stored 230 non-irradiated fuel assemblies (with a storage capacity of 230 assemblies).

➢ Status of accumulated water treatment of Units 5 and 6

- Accumulated water in Unit 5 and 6 buildings is being transferred from the Unit 6 Turbine Building to outdoor tanks and sprinkled after separating the oil content, applying RO treatment and confirming the radiation density.

9. Other

➢ Power-supply facility overload trip alert issued from the backup substation

- On December 4, an overload trip alert (which indicated a fail-safe due to overload) was issued from the backup substation of the power-supply facility on site. The cause of the overload trip alert was a switching error of the power system on December 3, whereby the switch remained on instead of going off. The following morning, the load system went into operation and the current increased, resulting in the overcurrent trip.

➢ Smoke from the power panel of the 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. The cause was a pin used to fix the ropes for dividing the area, which was inadvertently inserted to a power-supply cable during the construction to install new drainage channels on site, causing an earth fault.
- As the horizontal deployment, the following recurrence prevention measures will be implemented:
  - ✓ Educating subcontractors and workers on the risks of electricity
  - ✓ Introducing a permit system for works involving placement of iron pins, etc.
  - ✓ Physical protection of high-pressure cables and placement of caution signs

➢ Outline of the 2nd Meeting of Decommissioning Research and Development Cooperation Council

- On December 3, the 2nd Meeting of the Decommissioning Research and Development Cooperation Council, which was set up in the Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF), was held. Discussions were held regarding activities and issues to facilitate matching between research needs and seeds, progress related to research facilities and human resource development and specific activities and issues to enhance research and development collaboration.

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 December 14-21)"; 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(0.46) Below 1/7
Cesium-137: 9.0 (2013/10/17) → ND(0.51) Below 1/10
Gross β: 74 (2013/ 8/19) → ND(16) Below 1/4
Tritium: 67 (2013/ 8/19) → ND(1.8) Below 1/30

Cesium-134: 4.4 (2013/12/24) → ND(0.51) Below 1/8
Cesium-137: 10 (2013/12/24) → ND(0.52) Below 1/10
Gross β: 60 (2013/ 7/ 4) → ND(16) Below 1/3
Tritium: 59 (2013/ 8/19) → ND(1.8) Below 1/30

Cesium-134: 5.0 (2013/12/2) → ND(0.50) Below 1/10
Cesium-137: 8.4 (2013/12/2) → ND(0.46) Below 1/10
Gross β: 69 (2013/8/19) → ND(16) Below 1/4
Tritium: 52 (2013/8/19) → ND(1.8) Below 1/20

Cesium-134: 2.8 (2013/12/2) → ND(1.7) Below 7/10
Cesium-137: 5.8 (2013/12/2) → ND(2.3) Below 1/2
Gross β: 46 (2013/8/19) → ND(17) Below 1/2
Tritium: 24 (2013/8/19) → ND(2.7) 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: ND(0.52)
Cesium-137: 0.63
Gross β: ND(16)
Tritium: 1.6 *

Cesium-134: 3.3 (2013/12/24) → ND(0.48) Below 1/6
Cesium-137: 7.3 (2013/10/11) → ND(0.42) Below 1/10
Gross β: 69 (2013/ 8/19) → ND(16) Below 1/4
Tritium: 68 (2013/ 8/19) → ND(1.8) Below 1/30

Cesium-134: 3.5 (2013/10/17) → ND(0.53) Below 1/6
Cesium-137: 7.8 (2013/10/17) → ND(0.47) Below 1/10
Gross β: 79 (2013/ 8/19) → 25 Below 1/3
Tritium: 60 (2013/ 8/19) → ND(1.8) Below 1/30

Cesium-134: 32 (2013/10/11) → ND(1.4) Below 1/20
Cesium-137: 73 (2013/10/11) → ND(1.9) Below 1/30
Gross β: 320 (2013/ 8/12) → ND(17) Below 1/10
Tritium: 510 (2013/ 9/ 2) → 13 Below 1/30

Cesium-134: ND(1.5)
Cesium-137: ND(1.8)
Gross β: ND(17)
Tritium: 20 *

Cesium-134: ND(2.1)
Cesium-137: 3.4
Gross β: ND(17)
Tritium: 24 *

Cesium-134: ND(1.7)
Cesium-137: ND(2.1)
Gross β: ND(17)
Tritium: 33 *

【Port entrance】
【South side in the port】
【East side in the port】
【Port center】
【West side in the port】
【North side in the port】
【In front of Unit 6 intake】
【In front of shallow draft quay】

* Monitoring commenced in or after March 2014

Cesium-134: 62 (2013/ 9/16)→ 2.0 Below 1/30
Cesium-137: 140 (2013/ 9/16)→ 7.9 Below 1/10
Gross β: 360 (2013/ 8/12)→ 250
Tritium: 400 (2013/ 8/12)→ 630

Cesium-134: 5.3 (2013/8/ 5) → ND(0.43) Below 1/10
Cesium-137: 8.6 (2013/8/ 5) → ND(0.45) Below 1/10
Gross β: 40 (2013/7/ 3) → ND(17) Below 1/2
Tritium: 340 (2013/6/26) → ND(1.6) Below 1/200

Cesium-134: 28 (2013/ 9/16)→ ND(2.1) Below 1/10
Cesium-137: 53 (2013/12/16)→ 7.6 Below 1/6
Gross β: 390 (2013/ 8/12)→ 240
Tritium: 650 (2013/ 8/12)→ 700

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 December 22

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 December 14-21)

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 (0.68)
Cesium-137: ND (2013) → ND (0.50)
Gross β: ND (2013) → ND (17)
Tritium: ND (2013) → ND (1.6)

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

Cesium-134: ND (2013) → ND (0.67)
Cesium-137: 1.6 (2013/10/18) → ND (0.64) Below 1/2
Gross β: ND (2013) → ND (17)
Tritium: 6.4 (2013/10/18) → ND (1.6) Below 1/4

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

Cesium-134: ND (2013) → ND (0.74)
Cesium-137: ND (2013) → ND (0.74)
Gross β: ND (2013) → ND (17)
Tritium: ND (2013) → ND (1.6)

Cesium-134: ND (2013) → ND (0.59)
Cesium-137: ND (2013) → ND (0.63)
Gross β: ND (2013) → ND (17)
Tritium: 4.7 (2013/ 8/18) → ND (1.6) 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 (0.61)
Gross β: ND (2013) → ND (17)
Tritium: ND (2013) → ND (1.6)

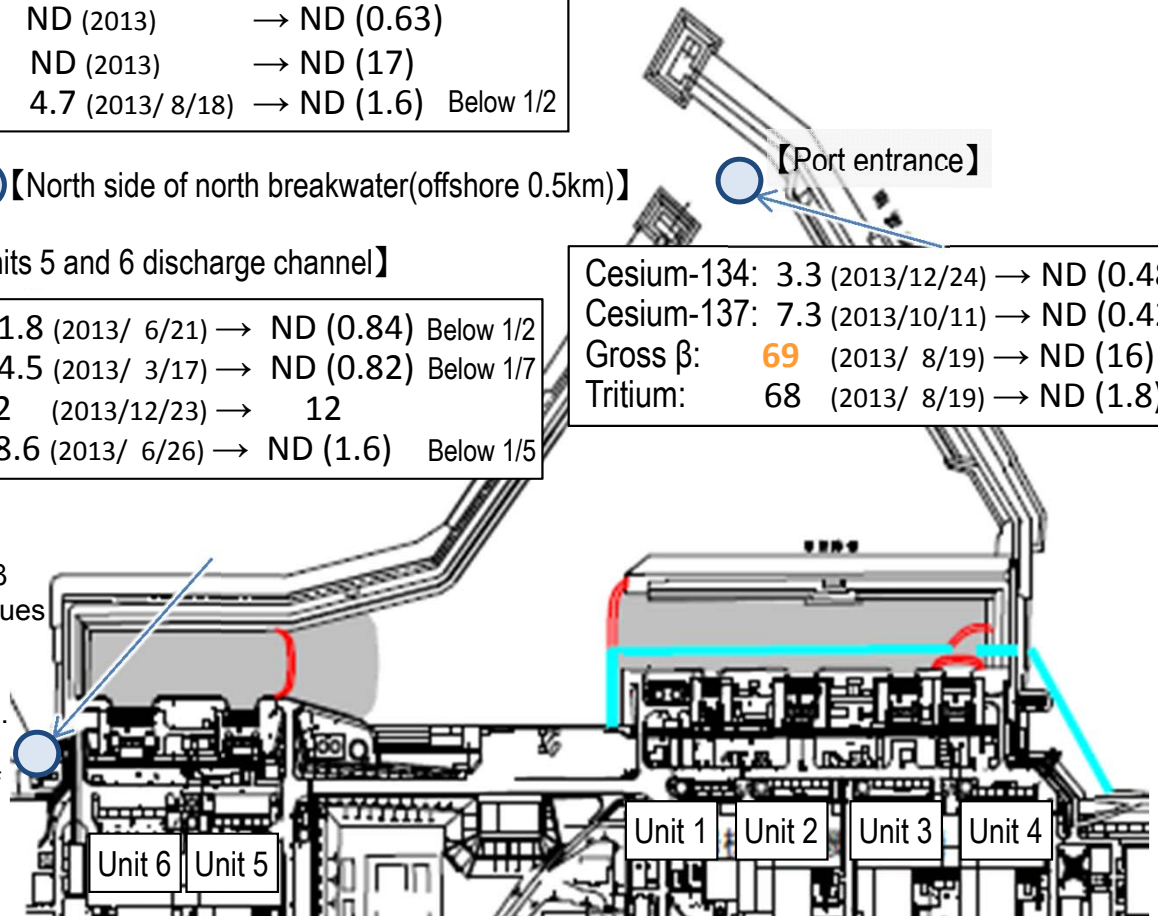
【North side of Units 5 and 6 discharge channel】

Cesium-134: 1.8 (2013/ 6/21) → ND (0.84) Below 1/2
Cesium-137: 4.5 (2013/ 3/17) → ND (0.82) Below 1/7
Gross β: 12 (2013/12/23) → 12
Tritium: 8.6 (2013/ 6/26) → ND (1.6) Below 1/5

Cesium-134: 3.3 (2013/12/24) → ND (0.48) Below 1/6
Cesium-137: 7.3 (2013/10/11) → ND (0.42) Below 1/10
Gross β: 69 (2013/ 8/19) → ND (16) Below 1/4
Tritium: 68 (2013/ 8/19) → ND (1.8) Below 1/30

Cesium-134: ND (2013) → ND (0.55)
Cesium-137: 3.0 (2013/ 7/15) → ND (0.85) Below 1/3
Gross β: 15 (2013/12/23) → 13
Tritium: 1.9 (2013/11/25) → ND (1.6)

【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 December 22

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
December 24, 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)

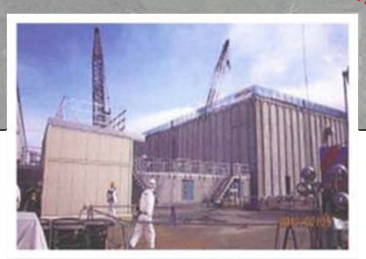

Solid waste storage facility


Rubble (outdoor accumulation)


Temporary trimmed trees


Trimmed trees (outdoor accumulation)

Tank installation status


Temporary waste sludge storage

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

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

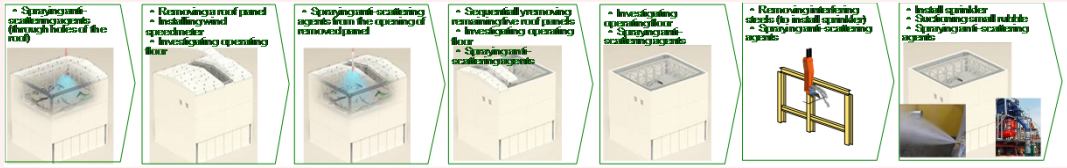
Unit 1

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.

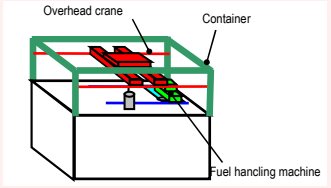


Image of Plan 1

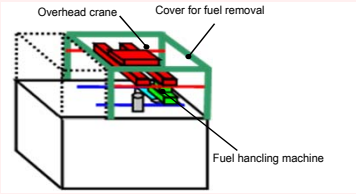


Image of Plan 2

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

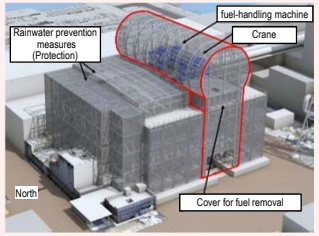


Image of the cover for fuel removal

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

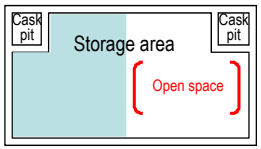
On November 5, 2014, within a year of commencing work to remove the fuel, all 1,331 spent fuel assemblies in the pool had been transferred. The transfer of the remaining non-irradiated fuel assemblies to the Unit 6 SFP was completed on December 22, 2014. (2 of the non-irradiated fuel assemblies were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

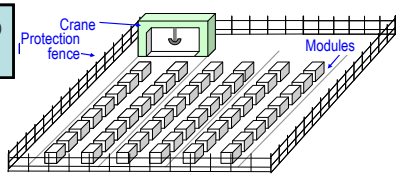


An open space will be maintained in the common pool (Transfer to the temporary dry cask storage facility)

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.

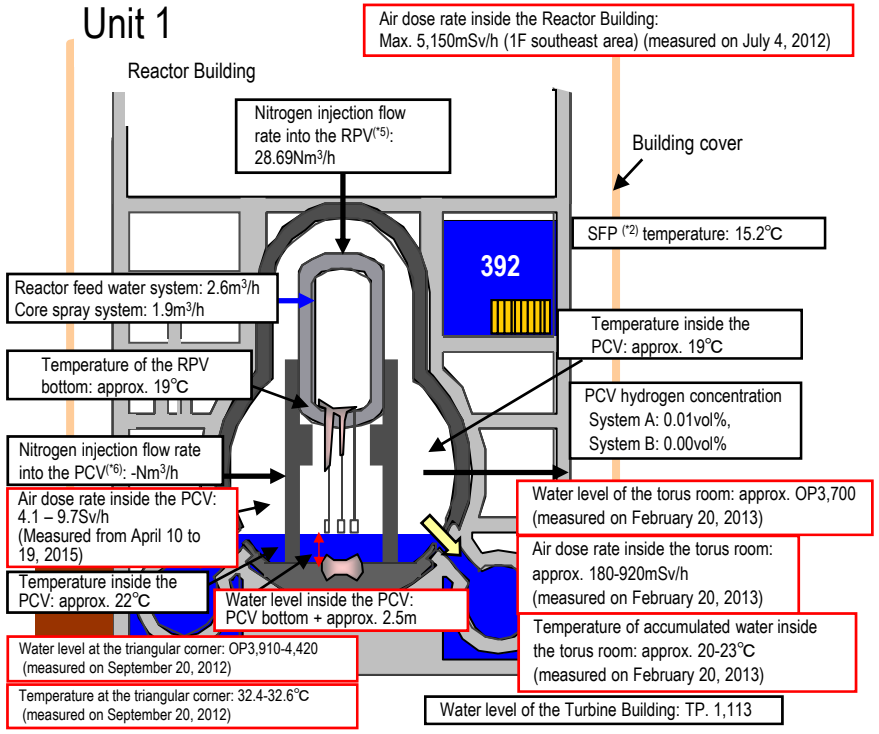
<Glossary>
(*1) Operating floor: During regular inspection, the roof over the reactor is opened while on the operating floor, fuel inside the core is replaced and the core internals are inspected.
(*2) Cask: Transportation container for samples and equipment, including radioactive materials.

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

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, December 22, 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 (Apr 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

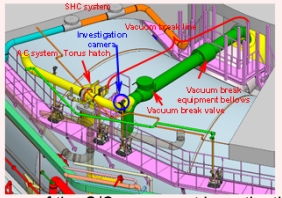


Image of the S/C upper part investigation

Status of equipment development toward investigating inside the PCV

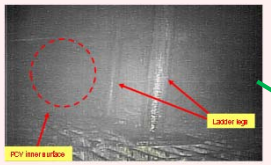
Prior to removing fuel debris, to check the conditions inside the Primary Containment Vessel (PCV), including the location of the fuel debris, investigation inside the PCV is scheduled.

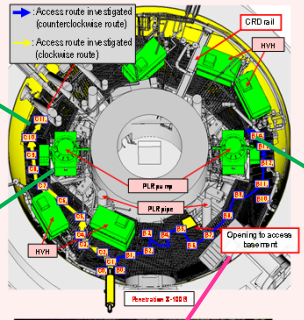
[Investigative outline]

- 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: φ100mm) 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.






Investigative equipment

Investigation inside PCV

<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

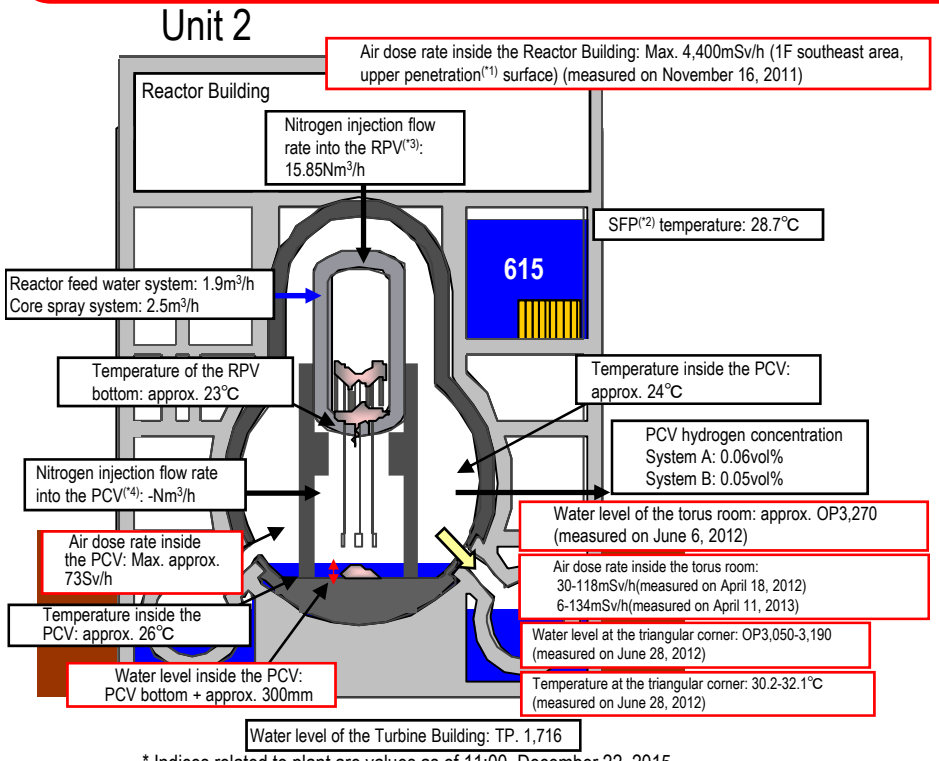
December 24, 2015
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment
3/6

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.

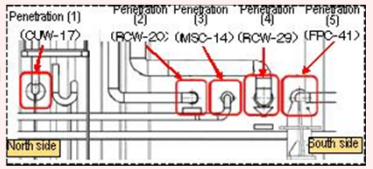


* Indices related to plant are values as of 11:00, December 22, 2015

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

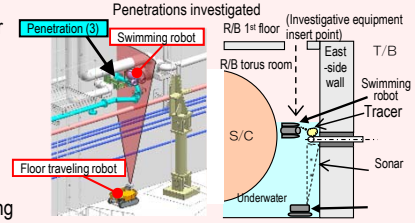


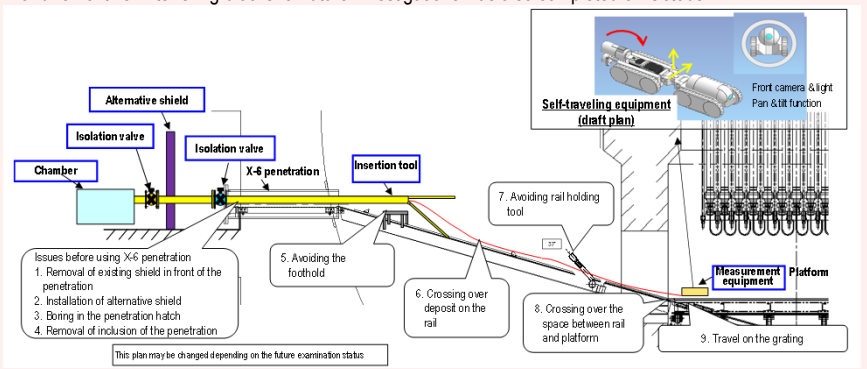
Image of the torus room east-side cross-sectional investigation

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

December 24, 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

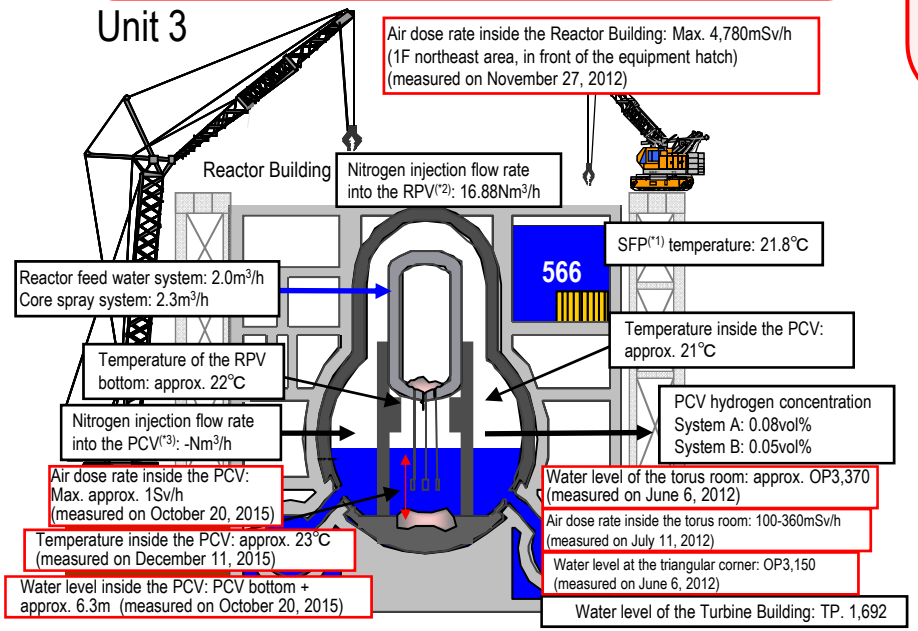
Water flow was detected from the Main Steam Isolation Valve* room

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

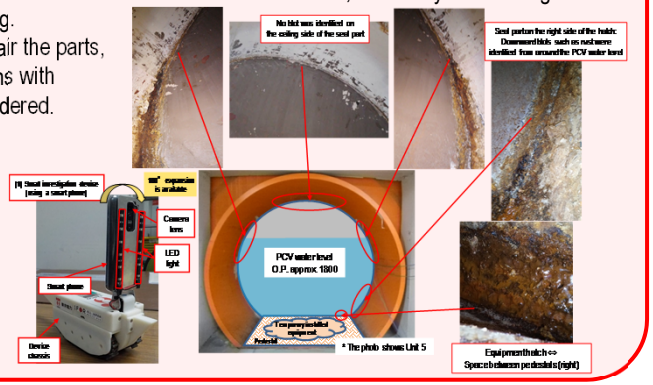


* Indices related to plant are values as of 11:00, December 22, 2015

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)	

Investigative results into the Unit 3 PCV equipment hatch using a small investigation device

- As part of the investigation into the PCV to facilitate fuel debris removal, the status around the Unit 3 PCV equipment hatch was investigated using a small self-traveling investigation device on November 26, 2015.
- Given blots such as rust identified below the water level inside the PCV, there may be a leakage from the seal to the extent of bleeding.
  Methods to investigate and repair the parts, including other PCV penetrations with a similar structure, will be considered.

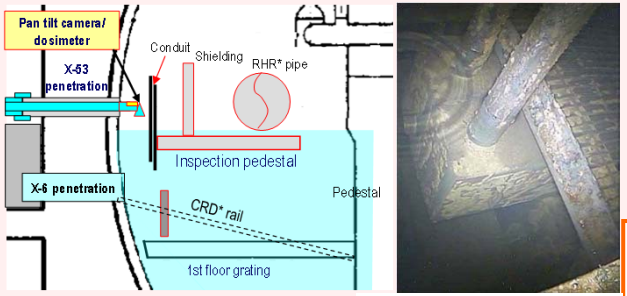


Investigation inside the PCV

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

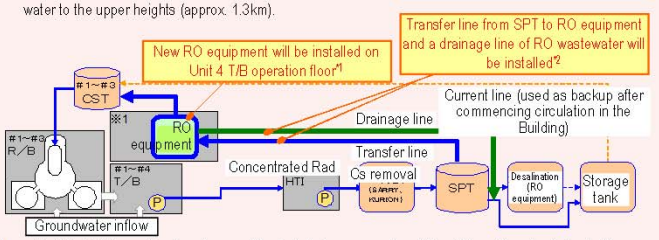
December 24, 2015
Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment
5/6

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

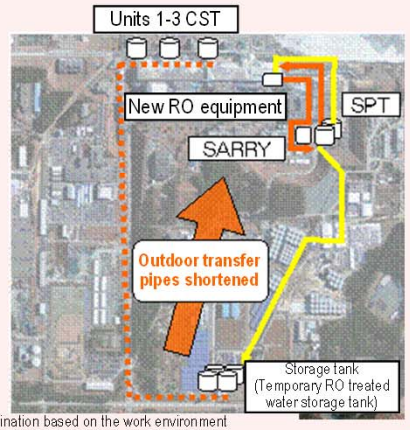
Work to improve the reliability of the circulation water injection cooling system and pipes to transfer accumulated water.

- 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



Dismantling of flange tanks completed in H1 east area

- To facilitate replacement of flange tanks, dismantling of flange tanks started in H1 east/H2 areas in May 2015. Dismantling of all flange tanks (12 tanks) in H1 east area was completed in October 2015. The work continues in H2 area.

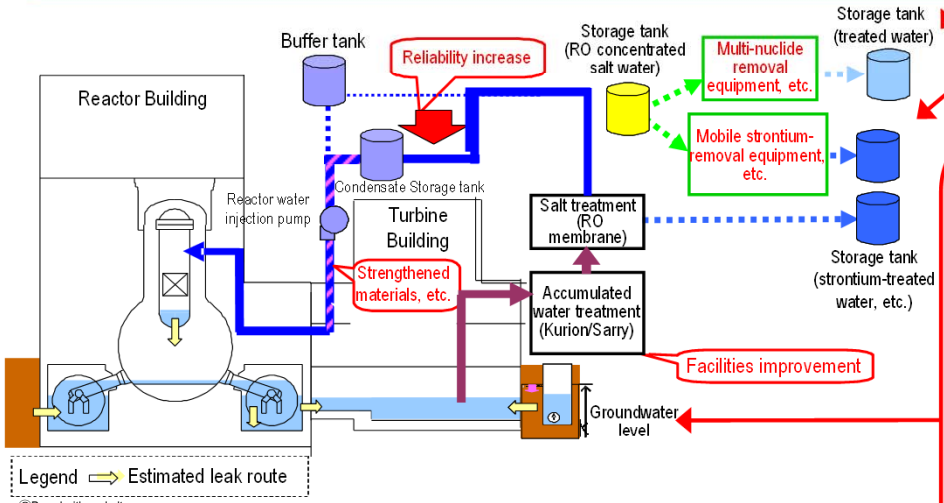

When dismantling started


After dismantling

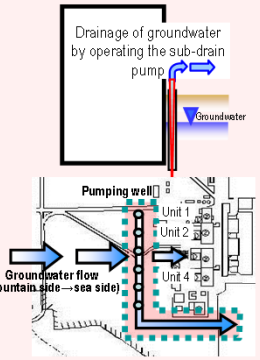
Completion of purification of contaminated water (RO concentrated salt water)

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.

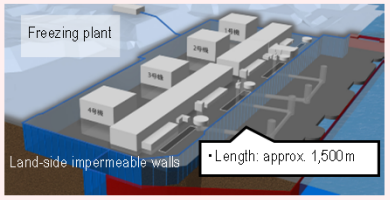
The pumped up groundwater is temporarily stored in tanks and released after TEPCO and a third-party organization have confirmed that its quality meets operational targets.

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.

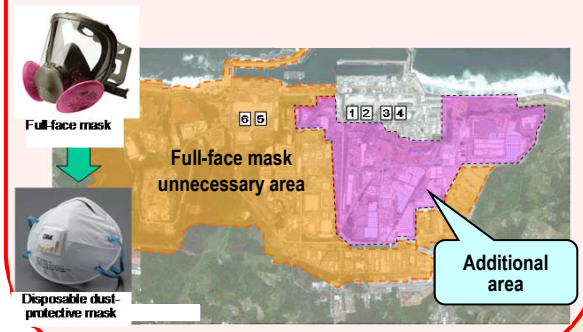
Progress toward decommissioning: Work to improve the environment within the site

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

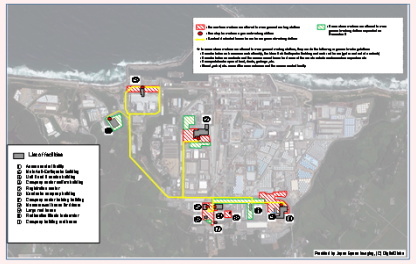
Operation start of the large rest house

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.

Expansion of areas where workers are allowed to wear general workwear

From December 8, 2015, in addition to newly adding the Radioactive Waste Incinerator, areas of the Main Anti-Earthquake Building, rest houses of the company building, and parking were expanded as those where workers are allowed to wear general workwear.

With this expansion, workers can move in general workwear from the access control facility to each rest house around the company building.



Installation of sea-side impermeable walls

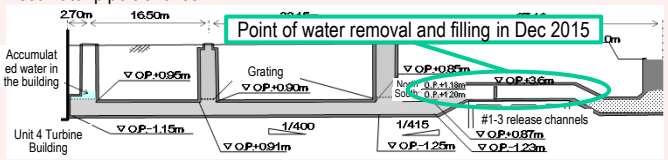
To prevent the outflow of contaminated water into the sea, sea-side impermeable walls have been installed.

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

Removal of contaminated water and filling of Unit 4 seawater pipe trench complete

- For the Unit 4 seawater pipe trench, removal of contaminated water and filling of the parts running over release channels was completed on December 21. This work completed the removal of 10,000 m^3 of high-dose contaminated water from Unit 2-4 seawater pipe trenches.



Sectional view of Unit 4 seawater pipe trench