October 22, 2012
Nuclear Emergency Response Headquarters
Government-TEPCO Mid-and-long Term Response Council
Working Council

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

## 1. Past One Month Summary and Future Plans

### 1) Maintenance of Cold Shutdown Condition

- Installation of alternative thermometer for Unit 2 RPV

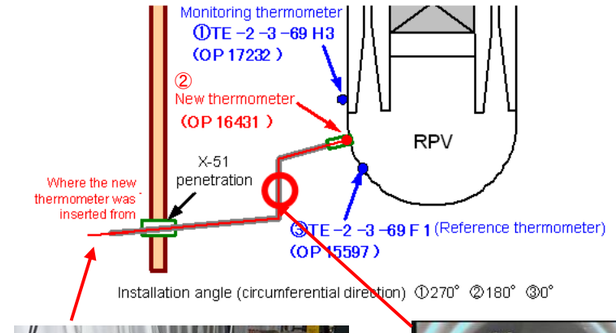
  An alternative thermometer to replace the broken Unit 2 thermometer has been installed. After removing water from X-27 penetration (September 23), performing flushing (cleaning inside the pipe) from X-51 penetration (September 24) and modifying the pipe (September 25-29), the thermometer was installed (October 2-3). (See 1 below) The soundness of the newly installed thermometer was confirmed as the direct current resistance was the same before and after the installation and the temperature indicated by the thermometer was about the same as that of an existing thermometer installed nearby (New thermometer: 42.6℃, existing thermometer installed nearby: 46.1℃ (11:00 AM on October 3)). We will monitor the temperature behavior of the thermometer for a month to determine whether or not it can be used as the monitoring thermometer. Thermometer installation in the TIP guide pipe will continue to be considered.

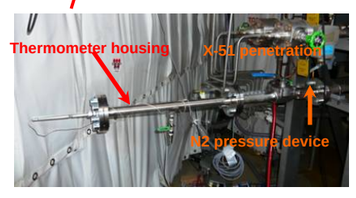
- Investigation of the inside of Unit 1 PCV and installation of PCV thermometer

  For the purpose of understanding the condition of the inside of the PCV, inside inspection and sampling of the accumulated water in the PCV were performed through X-100B penetration (October 9-12) (See 2 below). The results are as follows. Radiation dose: approx. 11.1Sv/h (Max.), water level: OP approx. 9,000mm (approx. +2.8m from the bottom of the PCV), radioactivity density of the accumulated water: Cs134: 1.9E+04 Bq/cm$^3$, Cs137: 3.5E+04 Bq/cm$^3$. From X-100B penetration, a permanent thermometer and water gauge were installed (October 13). The temperatures indicated by the newly installed permanent thermometer were about the same as those of an existing monitoring thermometer installed nearby (at OP. 11,200mm: new thermometer: 34.1℃, existing thermometer installed nearby: 34.4℃/ at OP. 14,000mm: new thermometer: 34.8℃, existing thermometer installed nearby: 41.5℃ (1:00 PM on October 13)). The water level indicated by the water gauge was also about the same as the result calculated based on the cable length on October 10. For a month to come, we will examine its temperature behavior according to changes in the reactor injection water amount and the outdoor air temperature as well as its correlation with the existing thermometers in order to determine whether or not the newly installed thermometer can be used to monitor the cooling condition of the PCV.

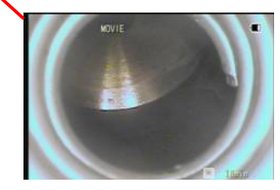
- Installation of multi-nuclide removal equipment (ALPS)

  A multi-nuclide removal equipment has been installed for the purpose of further reducing the densities of the radioactive materials included in the accumulated water in the power station site. Once the equipment was installed, water leakage test (using water not containing radioactive materials) and system testing (system A: August 24-September 6, system B: September 10-18, system C: September 24-October 1) were performed. After implementing additional measures to ensure safety (installing a rainwater protection cover, system separation dam, etc.), testing using radioactive water will be done before the equipment is put in operation.

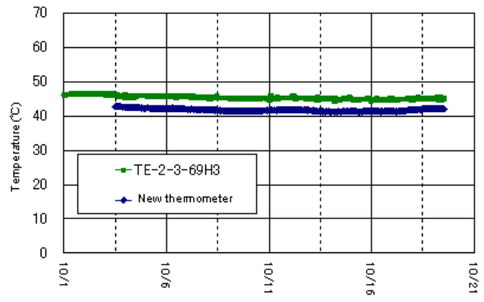



Thermometer installation condition (October 3)

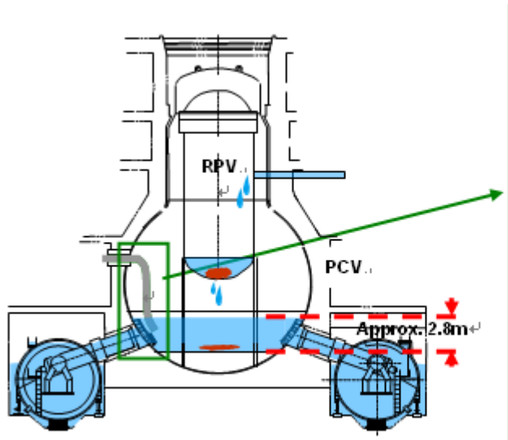


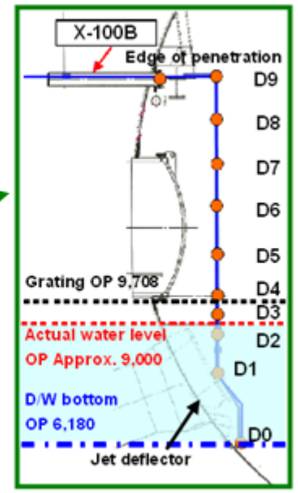
Inside of the pipe examined with an endoscope (October 2)




Change in the readings of the existing RPV monitoring thermometer (① TE-2-3-69H3) and the RPV altemative thermometer (② New thermometer)

1. Unit 2 RPV alternative thermometer installation




Radiation dose/ water level measurement results

| Measurement point | Distance from the bottom of D/W | Radiation dose (Sv/h) |
|---|---|---|
| The edge of penetration | 8,595 | Approx. 11.1 |
| D9 | 8,595 | 9.8 |
| D8 | Approx. 7,800 | 9.0 |
| D7 | Approx. 6,800 | 9.2 |
| D6 | Approx. 5,800 | 8.7 |
| D5 | Approx. 4,800 | 8.3 |
| D4 | Approx. 3,800 | 8.2 |
| D3 | Approx. 3,300 | 4.7 |
| D2 (Water surface) | Approx. 2,800 | 0.5 |
| D1 | — | — |
| D0 | 0 | — |

2. Investigation of the inside of Unit 1 PCV

### 2) Radiation Dose Reduction and Contamination Mitigation in the Power Station Site

- Decontamination in the power station site

  In addition to the iron plate installation at the bus stop in front of the Main Anti-earthquake Building in May 2011 (in order to mitigate radiation exposure), iron plates were installed in the bus standby area in front of the Main Anti-earthquake Building to further mitigate radiation exposure. As a result, the radiation dose inside the bus has been decreased from 60 $\mu$ Sv/h to 15 $\mu$ Sv/h (August 20 - September 26) (See 3 below).

Decontamination of the security guards office at the main gate is planned (from mid November).

Before iron plate installation

After iron plate installation

3. Iron plate installation in the bus standby area

3) Fuel Removal from the Spent Fuel Pools

- Debris removal from the upper part of Unit 3-4 Reactor Buildings
  - At Unit 3, debris removal from the upper part of the Reactor Building is ongoing (planned to be completed around March 2013) (See 4 below) and the protective platform is being installed (planned to be completed around December 2012).
  - At Unit 4, large equipments have been removed from the Reactor Building operation floor (July 24 - October 2). The cover for fuel removal is being installed (to be completed in mid FY 2013).
- Steel beam falling into Unit 3 spent fuel pool

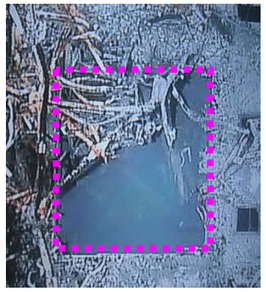
  During debris removal from the upper part of Unit 3 Reactor Building, an unstable steel beam was found. The debris removal work was temporarily suspended to remove the steel beam, however the steel beam fell into the spent fuel pool (September 22). As a result of investigation, no significant change was found with the atmosphere dose rate near the spent fuel pool, radioactivity density of the spent fuel pool water, skimmer surge tank water level, pool water surface and monitoring post data after the incident. A report including the cause of the incident and recurrence prevention measures was submitted to the Nuclear Regulation Authority (October 3, 19). The debris near the spent fuel pool is currently being investigated to prepare for restarting debris removal. With the lessons learned from the incident, further safety will be secured for future debris removal.
- Desalination of Unit 4 spent fuel pool

  Since the chloride ion concentration had been sufficiently reduced, desalination of Unit 4 spent fuel pool has been completed on October 12 (chloride concentration: approx. 9ppm or less, maximum allowed concentration stipulated by the technical specification: 100ppm). The pool water will be sampled regularly to examine its water quality (together with Unit 1 for which no seawater has been injected and Unit 2 for which desalination has been completed on July 2). Desalination is continuously being done in Unit 3 spent fuel pool.
- Investigation of the inside of Unit 3 spent fuel pool (Third investigation)

  The inside of Unit 3 spent fuel pool was investigated by an underwater camera to develop plan for fuel removal (October 11-12). Investigation will be done as necessary according to the progress of debris removal from the upper part of the Reactor Building.
- Reinvestigation of Unit 1 operation floor

  For the purpose of providing inputs on spent fuel removal, the operation floor will be investigated by a balloon with a camera attached. Considering that the balloon interfered with an object assumed to be a cable and could not reach the operation floor in the previous investigation (August 8), a balloon with modified size and shape will be prepared for the next investigation (planned on October 24).

Before debris removal
(November 12, 2011)



During debris removal
(September 20, 2012)

: Spent fuel

4. Debris removal from Unit 3 operation floor

4) Fuel Debris Removal

- Development of Remote Control Decontamination Technology

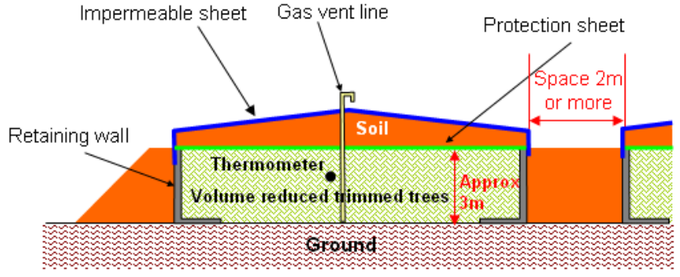
  Remote control decontamination equipments (high-pressure water decontamination, dry ice blast, and blast) are being developed in consideration of the decontamination condition inside the buildings. The equipments have been evaluated by an external committee (High-pressure water: August 6, Dry ice blast/blast: October 7) and are currently being manufactured. The equipments will be tested at the factory in December.
- Development of the Comprehensive Radiation Dose Reduction Plan

  In order to reduce radiation exposure among the workers who engage in radiation dose reduction in the buildings, a comprehensive radiation dose reduction plan (including the target areas for radiation dose reduction and radiation reduction measures to be implemented) will be developed. The cooperative company was selected on October 12, and plan development has just been started.

5) Reactor Facilities Dismantling and Radioactive Waste Processing/Disposal

- Installation of Temporary Storage Facilities for Trimmed Trees

  Trimmed trees will be covered with soil when stored in order to mitigate risk of fire and achieve the target effective radiation dose of less than 1mSv/year (radiation attributable to the radioactive materials released from the radioactive waste generated after the accident as well as those to be released). The installation will start in mid November and trimmed trees will be transported to the facilities starting from December. (See 5 below)




5. Overview of the temporary storage facility for trimmed trees

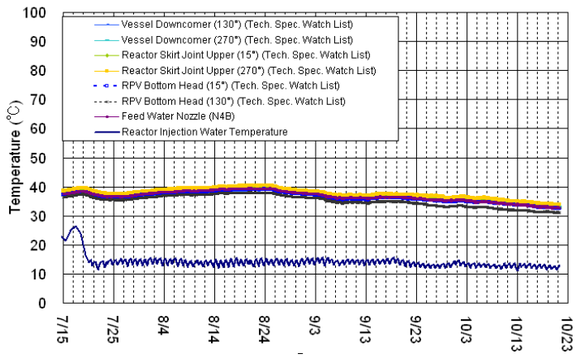
6) Organization and Staffing Plan

- Staff management
  - The manpower necessary for the work in November (about 3,600 people) will be provided by cooperative companies.
  - In order to comply with the legally mandated limit of 100mSv/5 years while considering the future mid-to-long-term work, personnel relocation of the employees whose dose exceeds 75mSv began in October 2011. 234 out of approx. 351 employees with dose exceeding 75mSv (as of the end of August 2012) have been relocated as of October 11.
  - The local employment rate of cooperative company workers was approx. 70% as of September.
- Work/living environment and actual working conditions
  - A survey on actual working environment, working conditions and employment situation among the workers at Fukushima Daiichi Nuclear Power Station was done. The questionnaires (approx. 4,000) were sent out on September 20 and approx. 3,200 (80%) have been sent back as of October 18. The results will be summarized by late November.

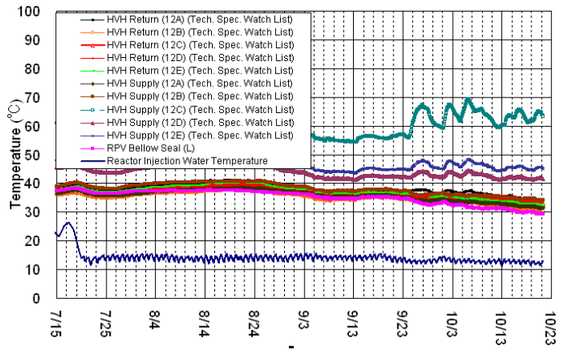
7) Ensuring work safety

- Thorough implementation of individual radiation control in collaboration with cooperative companies
  As a recurrence prevention measure for the inappropriate usage of alarm pocket dosimeter (APD) by some workers, the workers who engage in work with high radiation exposure dose are required to wear protective clothing with its chest area being transparent (starting from October 15).
- Radiation dose reduction
  For the purpose of reducing radiation exposure dose among workers, radiation reduction measures (such as shield installation) are being implemented in the areas where workers spend a long period of time (rest areas, Main Anti-earthquake Building, etc.). The measure implementation is being advanced for the rest areas in the Administration Office Building and in front of the Main Anti-earthquake Building with high priority (started on October 22).
- Heat stroke prevention measures
  Heat stroke prevention measures are being implemented.
  - As a result of implementing heat stroke prevention measures assuming an extremely hot season, the number of heat strokes reported has been significantly reduced (As of the end of September 2012: 7, FY2011: 23).
  - Heat stroke prevention measures are continued to be implemented as a part of the work safety measures implemented throughout the year.
    [Heat stroke prevention measures]
    - Work hours are shortened or changed according to WBGT value.
    - Working environment improvement (securing rest areas, preparing drinking water, etc.)
    - Work clothes with a function to cool the body
    - Health condition check before and during work

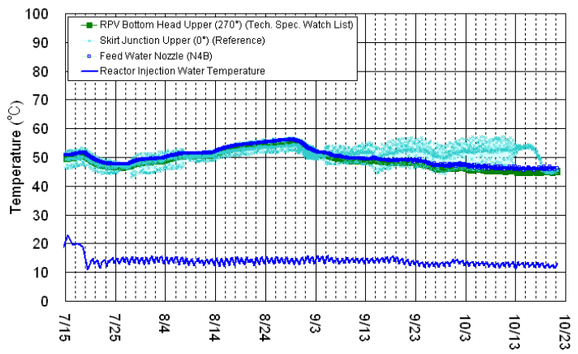
## 2. Parameters for Confirming Cold Shut Down Condition



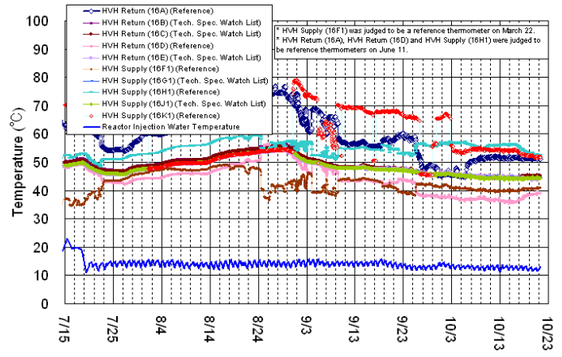

Temperatures around Unit 1 RPV



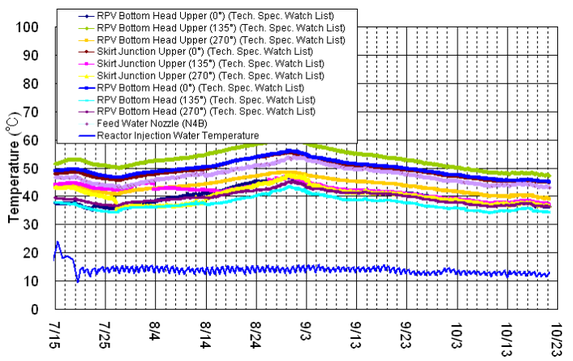

Ambient temperatures at Unit 1 D/W



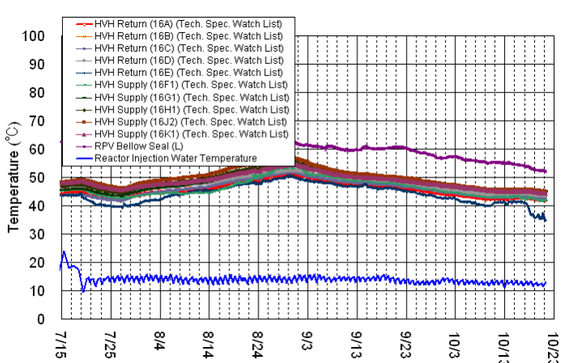

Temperatures around Unit 2 RPV




Ambient temperatures at Unit 2 D/W

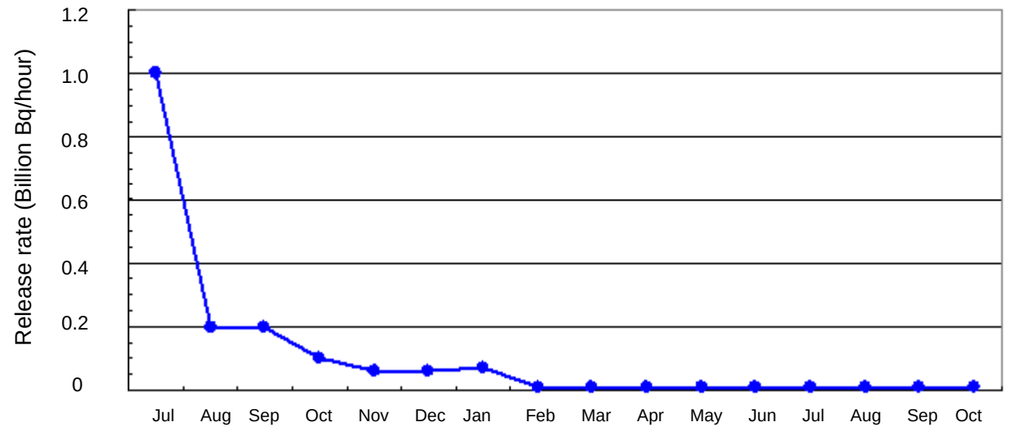



Temperatures around Unit 3 RPV




Ambient temperatures at Unit 3 D/W

Release rate of radioactive material (cesium) per hour at Unit 1-3 Reactor Building




The current release rates of cesium at Unit 1-3 Reactor Buildings were evaluated to be approx. 0.0002 Billion Bq/h (Unit 1), 0.0008 Billion Bq/h (Unit 2) and 0.0006 Billion Bq/h (Unit 3) based on the radioactivity density (dust radioactivity density) of the air in the upper part of the Reactor Buildings. The maximum total release rate of cesium (Unit 1-3) is approx. 0.01 billion Bq/h, which is the same as the previous month considering that the same equipments are used. Based on this, the radiation exposure dose at site boundaries is evaluated to be 0.03mSv/year (excluding the effects of the radioactive materials so far released).

End

[Abbreviations]

- Flushing: Washing away the radioactive materials accumulated inside the pipe with clean water.
- Penetration: Penetration area in the PCV, etc.
- TIP: Portable in-core instrumentation system which measures the neutron flux distribution in the reactor.
- OP: Onahama Point. Height assuming the mean sea level of Onahama in Fukushima Prefecture is 0.
- Platform: Installed as the running roadbed for heavy machinery at debris removal from the upper part of the Reactor Building.
- Operation floor: Floor where the upper lid of PCV is opened for fuel replacement, inspection of structures inside the reactor at regular inspection, etc.
- Fuel debris: Fuel and fuel cladding tube, etc. melted and resolidified
- Sludge: Secondary waste generated in water treatment.
- WBGT value: An index of humidity, radiant heat and air temperature which has a significant impact on the heat balance of a human body.