December 3, 2012
Nuclear Emergency Response Headquarters
Government-TEPCO Mid-and-long Term Response Council
Working Council

Progress Status and Future Challenges of Mid-to-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

- Nitrogen injection to Unit 1 suppression chamber (S/C)

  As a result of investigating the mechanism of the intermittent increase in the hydrogen concentration in Unit 1 PCV, it was considered that air with high hydrogen concentration which was generated in the early stage of the accident still remains in the upper part of the S/C. Though there is no immediate risk of hydrogen explosion as hardly no oxygen is contained in the residual air, hydrogen purging is being performed through continuous nitrogen injection until the hydrogen concentration becomes sufficiently low. The continuous nitrogen injection has been ongoing since October 23, and the injection will be continued until the hydrogen concentration in the S/C is reduced to about 2%*[1].

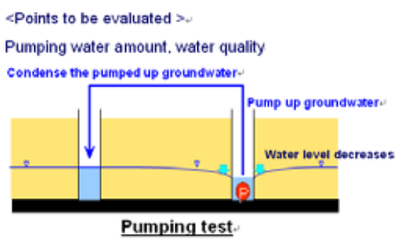
  *[1] Hydrogen concentration needs to be lower than its flammability limit (4%). The flammability limit represents the limit allowing for combustion (4% or more hydrogen and 5% or more oxygen need to be present). Combustion does not necessarily occur once the hydrogen concentration exceeds 4%.

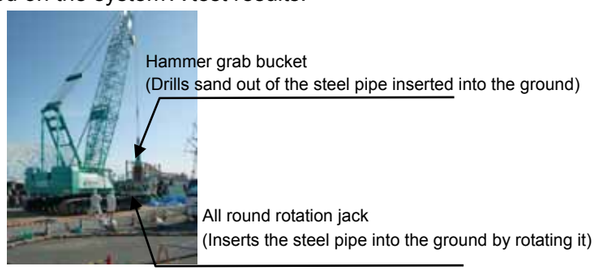
- Preventing groundwater to flow into the Reactor Building

  A system to prevent groundwater flowing into buildings by pumping the groundwater flowed from the mountain side in the upstream side of the buildings (groundwater bypass) is being planned. From November 22, drilling for the pilot pump well has started and a pumping test is planned to be performed from early to the end of December (See 1 below). The discharge equipment installation completion has been changed to late March 2013 due to a substantial time spent for considering its specifications in detail. After the discharge equipment is installed, the pumping system will start operation based on the pumping test results.

- Installation of multi-nuclide removal equipment (ALPS)

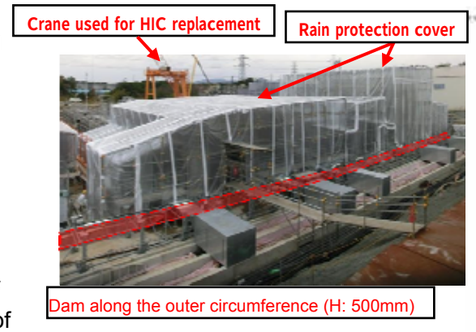
  A multi-nuclide removal equipment is being installed for the purpose of further reducing the densities of the radioactive materials (except for tritium) included in the accumulated water in the power station site. Equipment installation and system testing have been completed for systems A, B and C. Additional measures such as installing rain protection cover and building a system separation dam are being implemented to enhance further safety (System A: Completed on November 19, Systems B and C: To be implemented) (See 2 below). After evaluating the risk of the high integrity container (HIC) storing waste falling and implementing countermeasures, testing using radioactive water will be performed at system A. The test will be done for systems B and C based on the system A test results.



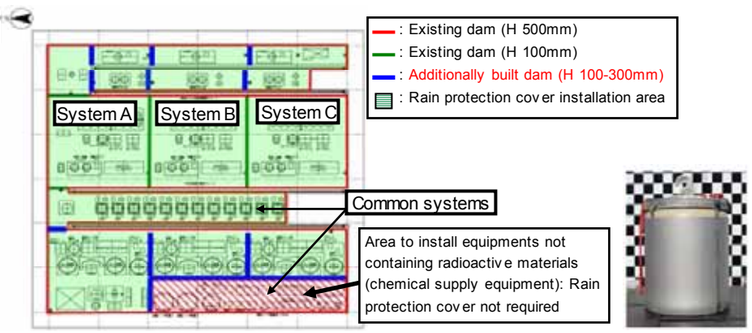


Drilling for the pump well

1. Pilot pump well construction for the groundwater bypass



Full view of the installation area (Nov. 17)



Rain protection cover/system separation dam installation area

HIC

2. Additional measures for the multi-nuclide removal equipment

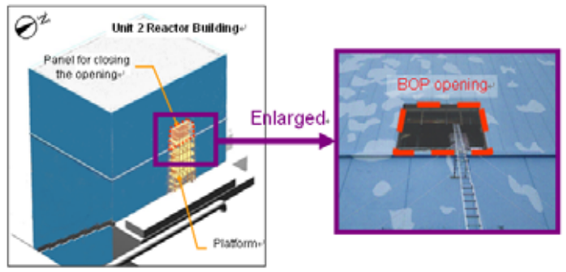
2) Radiation Dose Reduction and Contamination Mitigation in the Power Station Site

- Closure of Unit 2 Reactor Building blow-out panel (BOP) opening

  For the purpose of reducing the amount of radioactive materials released from Unit 2 Reactor Building, the BOP opening will be closed with a panel (See 3 below). An exhaust system will be installed for ventilation in the building. The design to close the BOP opening was determined and submitted to the Nuclear Regulatory Agency on November 30. The BOP opening is planned to be closed around the end of March 2013.

- Radioactivity density of the seawater in the port

  Back in September, radioactivity densities of samples obtained in some locations (such as inside of the silt fence near Units 2-4 water intake channel) exceeded the density limit (cesium) stipulated by the Reactor Regulation. Unit 3 silt fence which was assumed to have radioactive materials attached has been replaced (November 14-17) (See 4 below). Additional investigation will be performed on radioactivity densities of groundwater and seawater in order to study the fluctuation factors of the seawater radioactivity density and the necessity of additional countermeasures. Depending on the investigation results, additional countermeasures for purification and preventing pollution expansion will be studied by the end of December. In order to confirm selecting target nuclides with radioactivity density below the density limit, a measurement plan will be created (such as selecting target nuclides). Measurement and evaluation will be completed by the end of January next year.



3. Closure of the BOP opening

[Silt fence replacement procedure]

1. Newly install silt fence outside the existing silt fence.

2. Once removing the existing silt fence, the replacement is complete.

4. Silt fence replacement

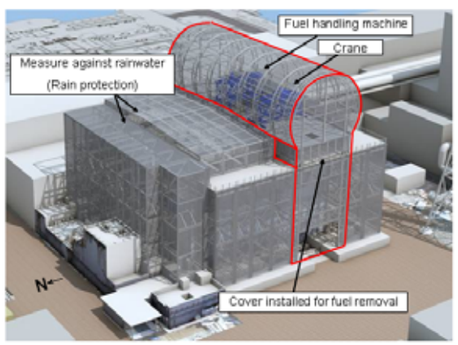
3) Fuel Removal from the Spent Fuel Pools

- Work towards spent fuel removal at Units 3 and 4
  - At Unit 3, platform installation and debris removal from the upper part of the Reactor Building is ongoing (planned to be completed around March 2013). A report on the structural strength and seismic capacity of the cover installed for fuel removal and the design of its features to prevent radioactive materials from being scattered and dispersed has been submitted to the Nuclear Regulatory Agency (November 14) (See 5 below).
  - At Unit 4, following the removal of large equipments from the operation floor, debris removal is ongoing (started on October 3 and planned to be complete by mid December). Cover installation for fuel removal will be continued (to be completed by mid FY2013).
  - The start of Unit 4 fuel removal is planned in November 2013, which is one month ahead of schedule (originally planned in December 2013). The target completion is planned a year or more ahead of schedule (around the end of 2014).
- Removal of the steel beam which fell into Unit 3 spent fuel pool

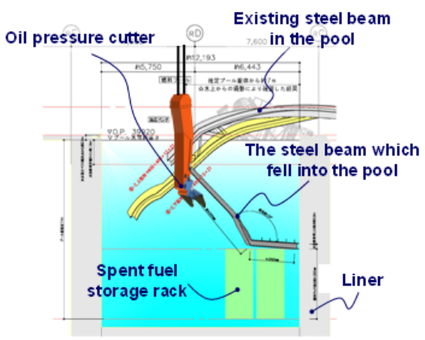
  During debris removal from the upper part of Unit 3 Reactor Building, an unstable steel beam was found. Though the debris removal work was temporarily suspended to remove the steel beam, the steel beam fell into the spent fuel pool (September 22). The best method to remove the beam has been determined to be grabbing it with an oil pressure cutter (See 6 below). For the purpose of improving certainty of removal work, the visibility confirmation of the spent fuel pool and a mockup testing are currently being carried out. The removal of the steel beam will be started as soon as preparation is complete (Planned to start from late December).
- Soundness inspection of Unit 4 Reactor Building

  The third soundness inspection of Unit 4 Reactor Building and spent fuel pool was performed (November 19-28). As a result of building tilt measurement (reactor well/spent fuel pool water level measurement, exterior wall fixed-point measurement), visual inspection of the walls and floors and concrete strength evaluation, no significant change was found compared to the previous inspection and it was confirmed that spent fuel can be safely stored.
- Reinvestigation of Unit 1 operation floor

  For the purpose of providing inputs on spent fuel removal, the operation floor was investigated by a balloon with a camera attached and radiation dose of each floor was measured (the maximum dose on the operation floor was 53.6mSv/h at 1m above the floor surface) (October 24).



5. Cover installation for Unit 3 fuel removal

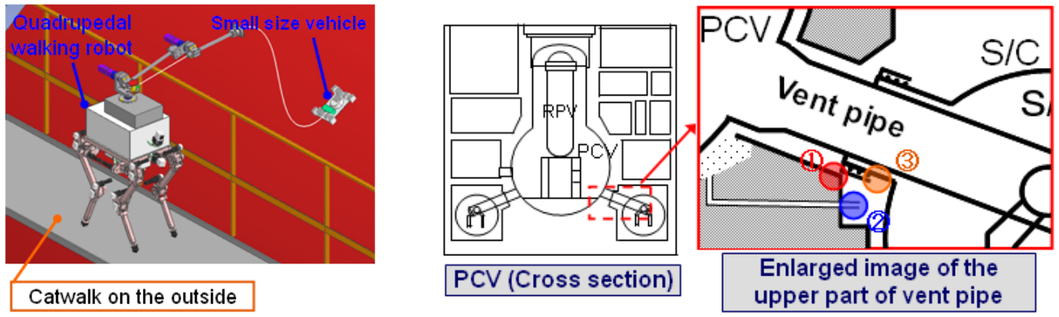


6. Steel beam removal
(Grabbing with an oil pressure cutter)

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 are currently being manufactured by the manufacturers selected from among the public. The completion is planned in January 2013 and the equipments will be tested at Fukushima Daini Nuclear Power Station from January to March 2013 after a mockup test at the factory.
- Investigation and Repair of the PCV Leakage Location
  - A device to investigate the PCV leakage location is currently being developed as a part of the government research and development project (government project) and is planned to be put in operation in the second half of 2013. After the required specification of the device was discussed at the government project meeting, general competitive bidding for manufacturers was started.
  - In order to allow rapid understanding of plant condition and feedback to the government project, a precedent investigation utilizing existing technologies (a quadrupedal walking robot) will be performed on the lower part of Unit 2 vent pipe (① vent pipe sleeve edge, ② sand cushion drain line, ③ vent pipe bellows) starting from mid December (See 7 below).



7. Investigation on the lower part of Unit 2 vent pipe utilizing a robot.

5) Reactor Facilities Dismantling and Radioactive Waste Processing/Disposal

- Installation of Temporary Storage Facilities for Felled Trees

  Felled 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). Preparatory work has started on November 8 and felled trees will be transported to the facilities starting from mid January.

6) Organization and Staffing Plan

- Staff management
  - The number of people who were registered (for one day or more in a month) to work at the power station in the past 3 months (July-September) was approx. 8,000 (TEPCO and cooperative company workers), which is more than the number of people who actually worked (approx. 5,500) (TEPCO and cooperative company workers). There are a sufficient number of people registered to work at the power station.
  - As a result of interview with main contractors about the number of available workers, it was confirmed that the manpower necessary for the work in December (about 3,300 people) will be secured.
  - The local employment rate of cooperative company workers was approx. 70% as of October.

- 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 (summarized on December 3). Taking the comments and opinions received by heart, we will continue our efforts in improving treatment and work environment. Specific measures are to be implemented as follows.

  [Educational activities] In addition to giving feedback on the survey results, a seminar will be held in collaboration with the Ministry of Health, Labour and Welfare to inform about illegal worker dispatch, work contract fraud and fair work contract. The contents of the seminar will be incorporated into the orientation for new workers at Fukushima Daiichi Nuclear Power Station.

  [Countermeasure promotion in collaboration with main contractors] In addition to giving feedback on the survey results and requesting to implement enhanced countermeasures, discuss and implement measures in the future. Also, investigate the status of measure implementation towards exclusion of inappropriate subcontracts and fair employment.

  [Enhanced PR for the consultation service] PR for the consultation service will be enhanced so as to encourage its use among workers.

  A survey on the overall work environment (performed twice a year) will be distributed starting from late December.

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), the workers who engage in work with high radiation exposure dose are required to wear protective clothing with its chest area transparent (effective on October 15). Starting from February 2013, the rule will be applied to all workers who put on APD, which will allow visually checking for APD from the outside (without touching).

- Reduction of full-face mask requirement area

  Considering that the radioactive materials retained in the Entrance Control Building construction area were removed through tree felling and surface soil removal and that the radioactivity density in the air is sufficiently below the level requiring full-face mask, it has been determined that full-face mask will no longer be required in the area for the purpose of reducing burden for workers and improving workability while continuing thorough radiation exposure control (monitoring radioactivity density by the PCV gas control system and the continuous dust monitor installed outside) (From November 19).

- Expansion of area allowing full-face mask with a dust filter attached

  As iodine 131 density in the air surrounding Units 1-4 and the buildings nearby is sufficiently below the level requiring full-face mask, workers will be allowed to wear full-face mask with a dust filter attached which is lighter and has smaller inhalation resistance compared to that with charcoal filter attached in Units 1-4 (except for some areas in Units 1-3) starting from mid December. Radiation exposure control will be continued through monitoring radioactivity density by the PCV gas control system and installing charcoal filters in the buildings. Workers have already been allowed to wear full-face mask with a dust filter attached in the outdoors and in areas excluding Units 1-4 and buildings nearby since March 1.

- Heat stroke prevention measures

  As a result of implementing heat stroke prevention measures assuming an extremely hot season until the end of September 2012, the number of heat strokes reported was significantly reduced compared to last year (As of the end of September 2012: 7, FY2011: 23). The following improvements were made this year based on the lessons learned in the previous year.

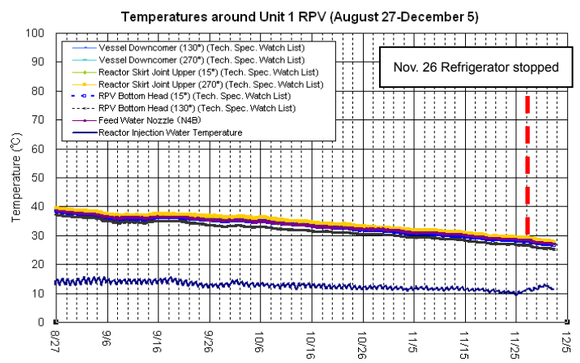
  - The implementation of the heat stroke prevention measures was started in May (while it was started in July in the previous year).
  - Focused on establishment of heat stroke prevention measures (Come forward when feeling sick, check health conditions before and after work, encourage workers to wear cool vest).

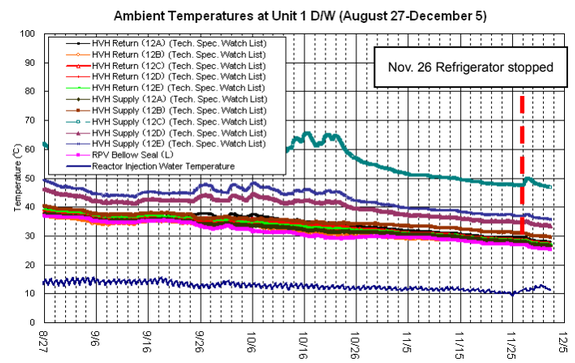
  Heat stroke prevention measures are continued to be implemented as a part of the work safety measures implemented throughout the year.

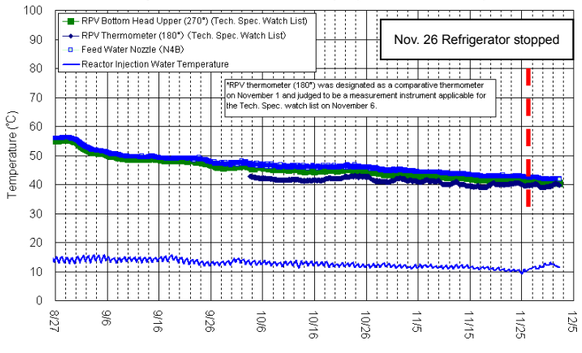
- Construction of the Entrance Control Building

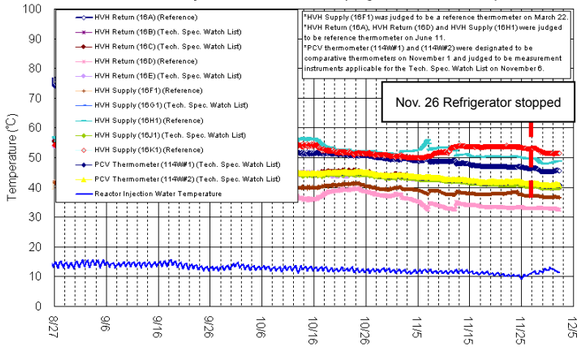
  A building in which entering/exiting the controlled area is controlled (through screening, checking for protective clothing and dosimeter) is being built near the main gate of Fukushima Daiichi Nuclear Power Station. Though the building was originally planned to be in operation at the end of this fiscal year, it has been postponed to the end of June 2013 since it took a substantial amount of time in deciding where to store the debris generated during removal of the existing facility and the equipment installation is likely to be postponed.

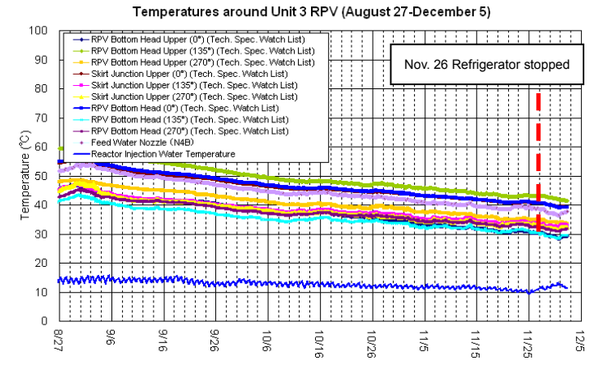
2. Parameters for Confirming Cold Shut Down Condition

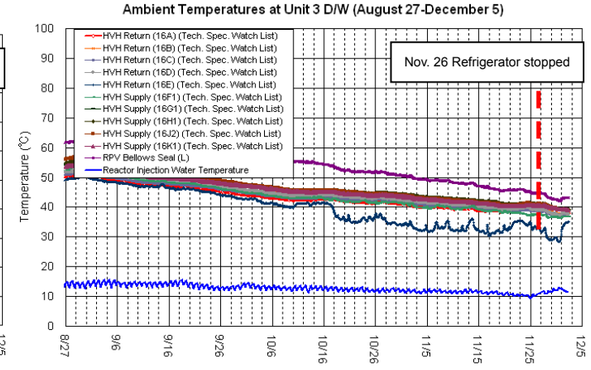




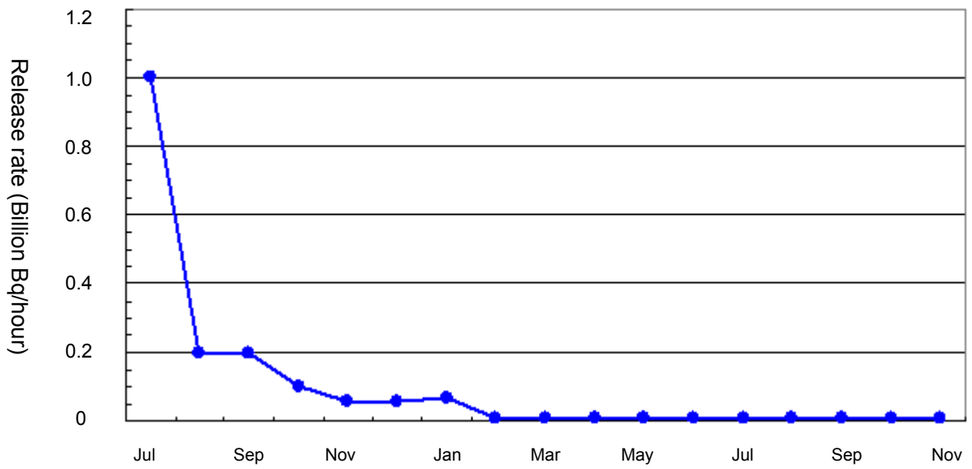








Release rate of radioactive material (cesium) per hour at Unit 1-3 Reactor Building



The current release rates of cesium at Unit 1-3 Reactor Buildings were evaluated to be approx. 0.0002 Billion Bq/h (Unit 1), 0.0007 Billion Bq/h (Unit 2) and 0.0001 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]

- S/C (Suppression Chamber): Pressure suppression pool. Used as water source, etc. for the emergency reactor core cooling system.
- Tritium: Tritiated hydrogen. Radioactive material which emits βray. Natural tritium is generated by nuclear reaction with cosmic ray in the upper layer of the atmosphere. It is contained in the moisture in the air and falls down due to its property similar to hydrogen. In nuclear power stations, tritium is generated by nuclear reaction with neutron and nuclear fuel fission.
- BOP (Blow-out Panel): Panel that opens to release pressure in the case of an excessive pressure increase in the building.
- Silt fence: Curtain-like underwater fence which is used to accumulate the contaminated water.
- Platform: Installed as the running roadbed for heavy machinery at debris removal from the upper part of the Reactor Building.
- Operation floor: The highest floor of the Reactor Building where the upper lid of PCV is opened for fuel replacement, inspection of structures inside the reactor at regular inspection, etc.
- Vent pipe: Pipe that guides the mixture of water and steam released into the dry well to the suppression pool and have it condensed in the case of loss-of-coolant accident.
- Vent pipe sleeve: Hole that penetrates through the concrete frame supporting the dry well.
- Sand cushion: Sand installed on the border between the dry well and the concrete frame of the foundation as a stress buffer.
- Sand cushion drain line: Pipe that detects water immersion of the sand cushions.
- Vent pipe bellows: Extendable pipe used as a stress buffer for the vent pipe.
- PCV: Primary Containment Vessel. Steel vessel with a thickness of about 3cm. PCV stores primary nuclear facilities including the Reactor Pressure Vessel (RPV).
- RPV: Reactor Pressure Vessel. Stores fuel assemblies, control rods and other structures inside the reactor and generates steam through nuclear reaction of the fuel.