Appendix 2

“Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station, TEPCO”

Progress Status

August 17th, 2011
Nuclear Emergency Response Headquarters
Government-TEPCO Integrated Response Office

I. Cooling

(1) Reactor

1. Target for Step 2: “Cold Shutdown Condition”

- Circulating water cooling will be continued and enforced, thus bringing the reactors to a “Cold Shutdown Condition” monitoring the RPV temperatures, etc.
- Maintain stable operation of accumulated water processing facility. (Implementation items are stated in II. (3))
- NISA to continue confirming operating status and related matters.

Definition of “Cold Shutdown Condition”

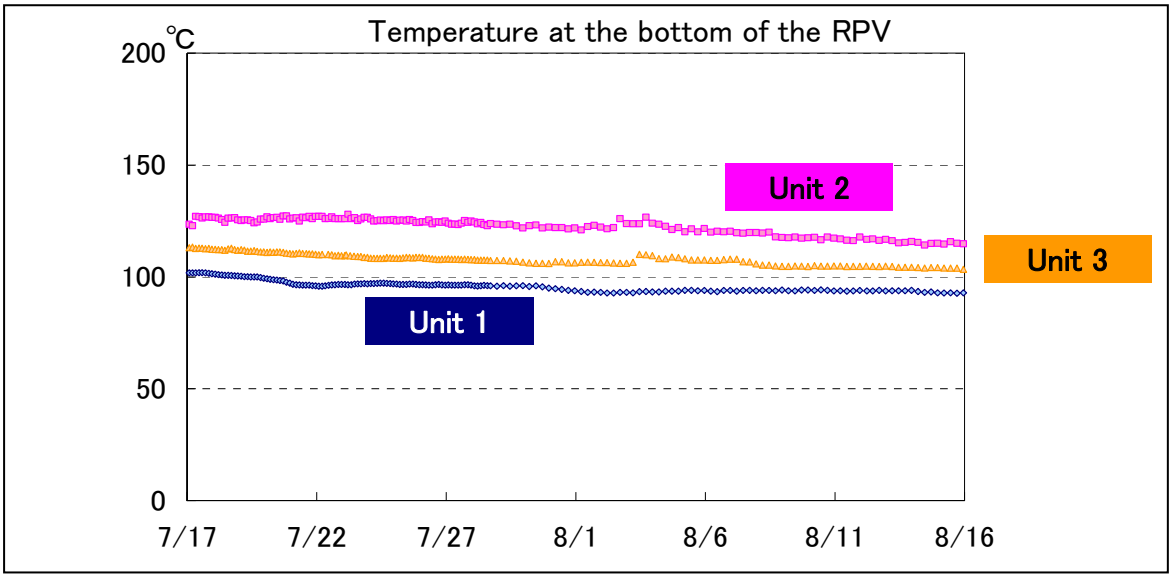
- Temperature of RPV bottom is below approximately 100 degrees Celsius.
- Release of radioactive materials from PCV is under control and public radiation exposure dose by additional release is being significantly held down.

In order to keep satisfying the above two conditions, secure mid-term safety of the circulating water cooling system (reliability of parts and materials, redundancy and independency, assessment of margin time in abnormal case, detection of failure and trouble, confirmation of restoration measures and recovery time.)

2. Current status and works implemented

① Evaluation of necessary flow rate of injecting water for “Cold Shutdown Condition” [Countermeasures 12, 14, 45]

- Re-evaluated minimum flow rate of injecting water for cooling heat produced in the reactor (decay heat) (flow rate equivalent to decay heat) by simulation analysis: 1.1m^3/h for Unit 1, 1.7 m^3/h for Unit 2, 1.7 m^3/h for Unit 3 (as of Aug. 1.)
- Actual flow rates (as of Aug. 1) are, approx. 3.5 m3/h for Unit 1, approx. 3.5 m3/h for Unit 2, and approx. 9.0 m3/h for Unit 3, which are above the flow rate equivalent to decay heat. Temperatures are trending in a stable manner (see figure below.)
- Reactors are being sufficiently cooled with the current flow rates; however towards “Cold Shutdown Condition,” for Units 2 and 3, whose temperatures of RPV bottom are above 100 degrees Celsius, it is planned to evaluate the necessary flow rate to achieve Cold Shutdown Condition by changing flow rates on a trial-basis and confirming the change of reactor temperature.



② Installation of centralized monitoring system in the Main Anti-Earthquake Building [Countermeasures 12, 14, 45]

- Developing a system that will enable monitoring various parameters such as injection flow rate, injection pressure, buffer tank water level, from monitors installed in the Main Anti-Earthquake Building.

③ Submission request for report on maintenance of water injection into reactors [Countermeasures 12, 14, 45]

- NISA instructed TEPCO to submit report on maintenance of water injection into reactors (Aug. 2.)
- TEPCO submitted a report on reactor water injection system, including: (a) structural strength and seismic safety of facilities; (b) cooling capacity; (c) operations and maintenance management; (d) countermeasures against loss of functions (Aug. 3.) NISA confirmed it (Aug. 4.)

(a) Structural strength and seismic safety of facilities

Seismic strength of the water injection pump unit (injection pumps, power sources, and main piping such as steel pipes) has been improved by implementing countermeasures against falling such as fixation by bolts, etc.

Polyethylene pipes, pressure-resistant hoses and fire hoses have flexibility.

(b) Cooling capacity (as mentioned in the above ①)

Water is being injected at a rate of approximately 16 m^3/h in total for Units 1-3 in comparison to an injection rate of 4.5 m^3/h which is equivalent to decay heat.

Temperatures at the bottom of reactor pressure vessels do not show

continuous increasing trend, indicating sufficient cooling.

(c) Operations and maintenance management

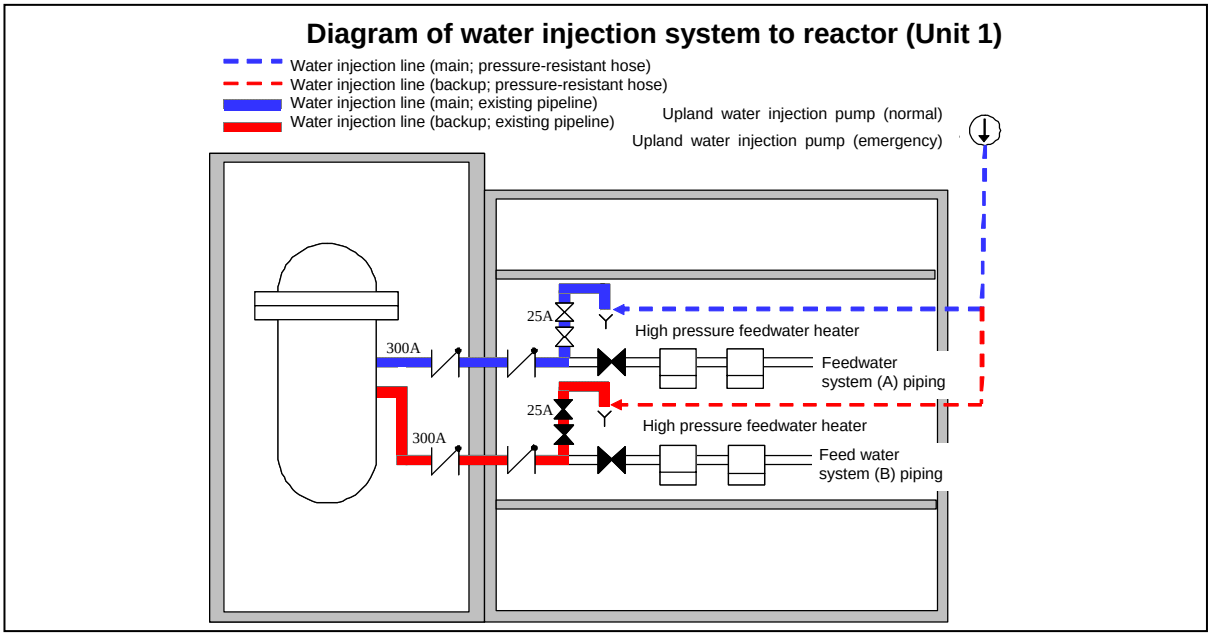
Parameters such as injection flow rate, injection pressure, and buffer tank water level are being monitored from the Main Anti-Earthquake Building.

Procedures to cope with abnormal events have been prepared and managed and training was conducted.

Spare parts for the water injection pump unit have been secured and expendable components are replaced as necessary.

(d) Countermeasures against loss of function

In preparation for loss of injection system function, redundancy has been secured for power source, water source and water injection lines, enabling to restart water injection within about 1 hour after loss of function.



(2) Spent Fuel Pool

1. Target for Step 2: “More stable cooling”

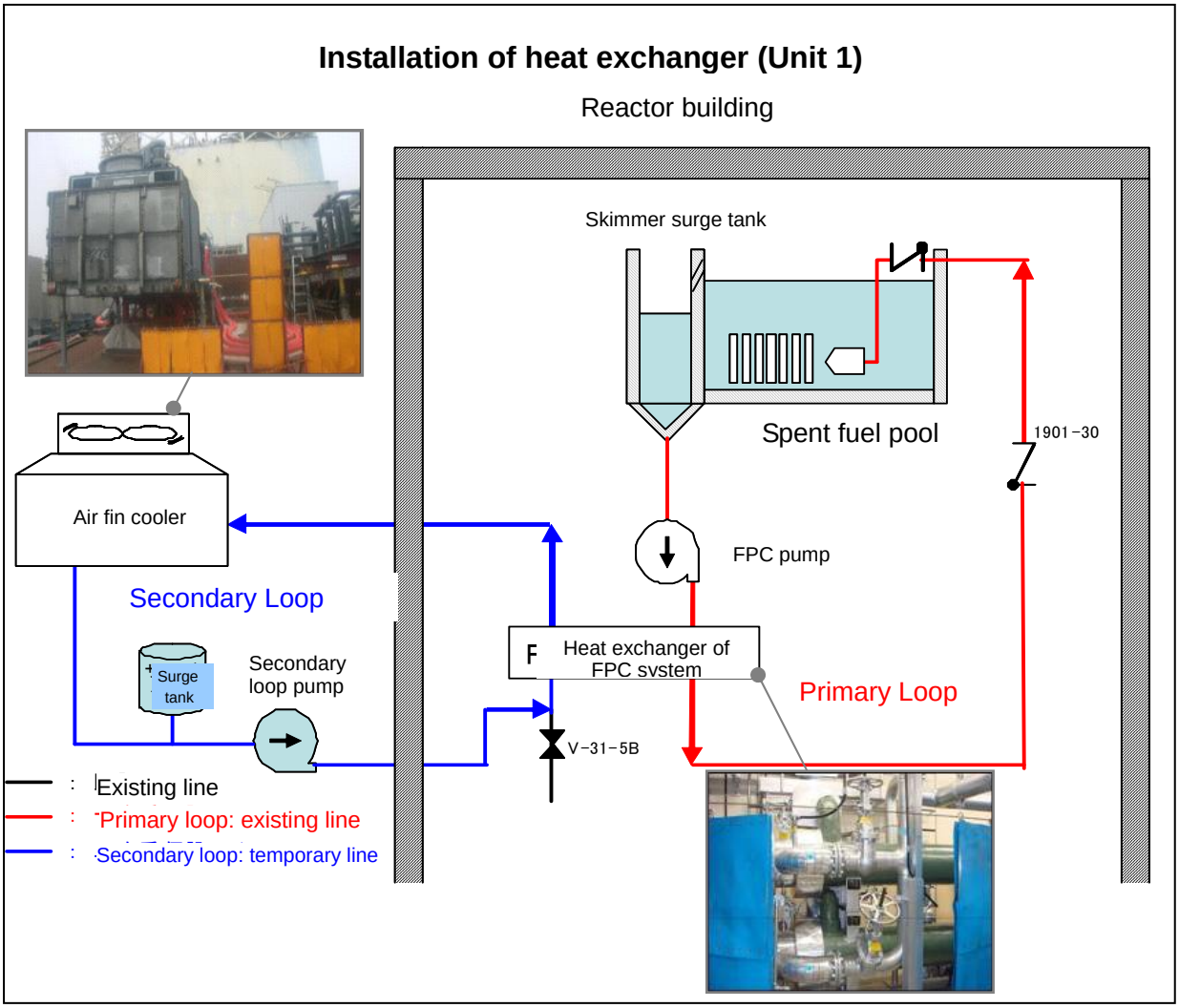
- “More stable cooling” (target for Step 2) for Units 2 and 3 was achieved by the end of Step 1 by having installed heat exchangers and maintaining pool water level.
- Circulating cooling systems for Units 1 and 4 have been installed and thus have achieved the target for Step 2.

2. Current status and work implemented

① Installation of heat exchangers and start of circulating cooling [Countermeasures 25, 27]

- Regarding the circulating cooling systems, TEPCO submitted to NISA the final report on the effectiveness of the systems with respect to stable cooling and on confirmation based on safety evaluation (Jul. 28) NISA evaluated and verified the contents of the report on the same day.
- Circulating cooling for Units 1 and 4 also started (Unit 1: Aug. 10, Unit 4: Jul. 31)
- By the start of circulating cooling for both units, the target for Step 2 for the spent fuel pools has been achieved.
- Unit 1: 34 degrees Celsius, Unit 2: 37 degrees Celsius, Unit 3: 34 degrees Celsius, Unit 4: 43 degrees Celsius (as of Aug. 16)

Installation of heat exchanger (Unit 1)



II. Mitigation

(3)Accumulated Water

1. Target for Step 2: “Reducing total amount of accumulated water”

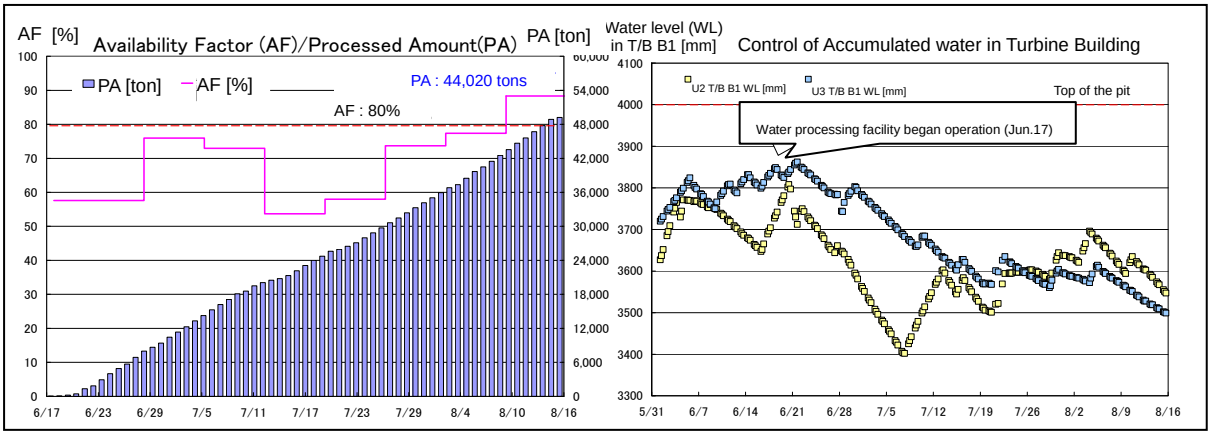
- Reduction of the total amount of accumulated water by processing the accumulated water in the buildings via the stable operation of processing facility.
- Augmentation of reuse by expansion of high-level contaminated water processing facility, steady operation and desalination of decontaminated water.
- Begin consideration of full-scale water processing facilities for high-level contaminated water.
- Storage/management of sludge waste generated from high-level contaminated water processing facility.
- Implement installation work for steel pipe sheet pile at the port to mitigate contamination to the ocean.

2. Current status and work implemented

①Status of the accumulated water processing

- Total volume of accumulated water processed to date is approx. 49,230 tons (as of Aug. 16.) Average availability factor for one week was88% (as of Aug. 16.) The water level of the accumulated water sufficiently dropped under the top of pits (already covered the top on the pits).
- Decontamination factor* of the processing facility for cesium is 10^6; chlorine concentration was decreased from 6,600 ppm to approx. 20ppm (both results are as of Jul. 28.)

  ∗Decontamination factor = cesium concentration of a sample before processing / cesium concentration of a sample after processing
- Implemented reliability enhancement measures towards stable processing.
  - Implemented maintenance work for the processing facilities such as installing a by-pass line to secure water flow (Aug. 4.)
  - Augmented the facility such as installation of SARRY (cesium adsorption facility; operation planned to commence on Aug.18.)
  - Augmented desalination processing facility by expansion of the evaporative concentration apparatus (two lines, Aug. 7 and 20)
- Hereafter, accumulated water will be processed stably with the aim of reducing the volume of it .



・ Installation work of SARRY



②Storage/management of sludge waste, etc. [Countermeasure 81]

- Properly securing and managing sludge waste with high radioactive concentration derived from processing high level contaminated water in the centralized waste processing building.
- Designing storage facility for sludge waste in order to expand storage capacity for sludge waste.

③Securing storage [Countermeasure 42]

- Implementing installation of tanks for high level contaminated water in order to expand storage facility for high level contaminated water.
- Continuing to decontaminate low level contaminated water by using zeolite.

④Prevent contamination in the ocean [Countermeasure 64]

- Shipping steel pipe sheet pile the port in order to implement translucent prevention work and repair the blocks damaged by tsunami at the south side of intake canal of Unit 1 to 4 (Aug. 10.)

Shipping steel pipe sheet pile

(4)Groundwater

1. Target for Step2: “Mitigating contamination to the ocean”

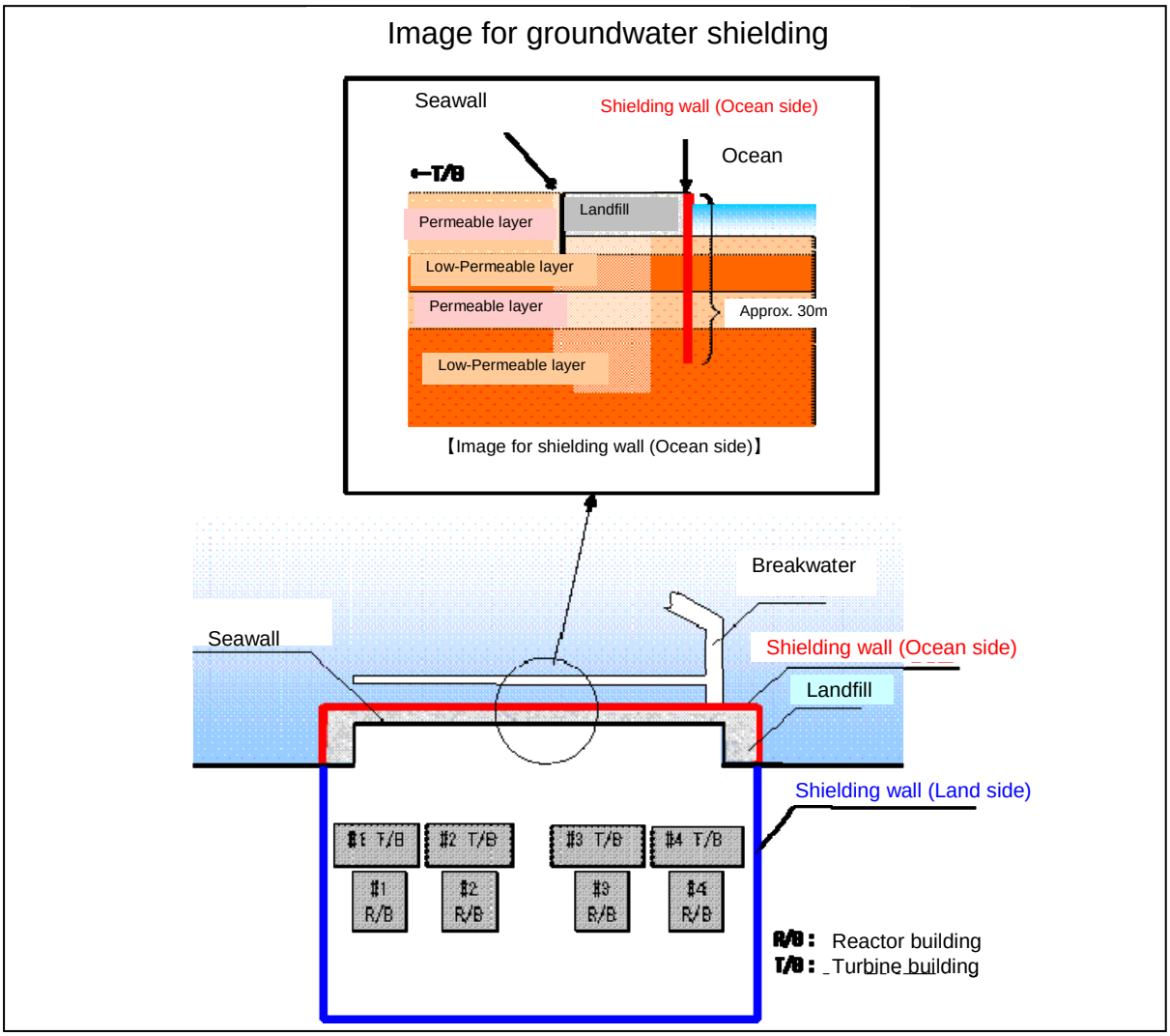
- Mitigate contamination in groundwater as well as contamination to the ocean via groundwater by controlling accumulated water inflow into groundwater.
- Commencing installation work for shielding wall in front of existing seawalls of Units 1 to 4, with the expectation of mitigating contamination in the ocean via groundwater.

2. Current status and work implemented

①Consideration of shielding wall of groundwater [Countermeasure 68]

- In the process of designing water-proof steel pipe sheet piles to be installed in front of existing seawalls of Units 1 to 4 in order to further ensure prevention against expanding seawater contamination due to underground water.

Image for groundwater shielding



② Implementing prevention against expansion of contamination of groundwater [Countermeasure 67]

- Install pumps at sub-drainage pit on the turbine building side. Seven places completed (Jul. 29.)
- Under consideration of the places to install sub-drainage pump on the reactor building side.

(5)Atmosphere/Soil

1. Target for Step 2: “Mitigating dispersion of radioactive materials”

- Reduce dispersion of radioactive materials deposited in the site.
- Continue dust inhibitor spraying as well as removal of debris.
- Installation of the reactor building cover (Unit 1); commencing removal of debris on top of the reactor buildings (Units 3 and 4.)
- Consideration of containers for the reactor buildings.

2. Current status and work implemented

①Installation work for the Unit 1 reactor building cover [Countermeasures 54, 55]

- Conducted tentative assembly of steel frames at Onahama (Aug. 1.)

Tentative assembly of steel frames at Onahama	Began assembly of steel frames
	

②Preparation work for removal of debris on top of the reactor building (Units 3 and 4) [Countermeasure 84]

- Preparing basic design for both units. Removing debris on the ground and dismantling obstacles. Road improvement for cranes as well as carrying in heavy equipment and their assembly is under way.
- Began assembling the bottom part of the frame at Unit 3.

Removal work of debris on the ground (Unit 4)	Condition of debris on top of reactor building (Unit 4)
	

III. Monitoring and decontamination

(6) Measurement, reduction, disclosure

1. Target for Step 2: “sufficient reduction of radiation dose”

- Expansion and enhancement of monitoring, and continuation of disclosure.
- Monitoring by government, prefecture, municipalities and operators.
- Commencement of full-scale decontamination.

2. Current status and work implemented

① Implement monitoring [Countermeasures 60・61・62]

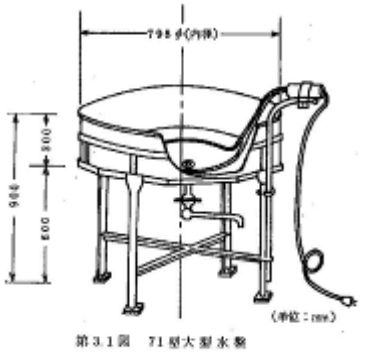
- Monitoring continuously from Step 1. Since airborne radioactivity concentration has been decreasing, monitoring has been continued by gradually lowering the detection limit (from Aug. 6.)
- Implementing additional sampling at land and sea as below:

[Land]

- In addition to around West Gate per Step 1, airborne radioactivity concentration at 12 points within the site will be measured (once a week / once a month.)
- Sampling of radioactive fallout will be conducted from August (sampling method is as per below figure.)
  <Within the site: one point>
  <Outside: 5km / 10km from NPS, 5 directions, 10 points in total>

Sampling method of radioactive fallout (water basin)

- Place the sampling equipment (water basin) at the sampling point.
- Sample radioactive fallout in the water basin periodically (once or twice a month)
- Measure the amount of radioactive materials.



第３.１図　７１型大型水盤

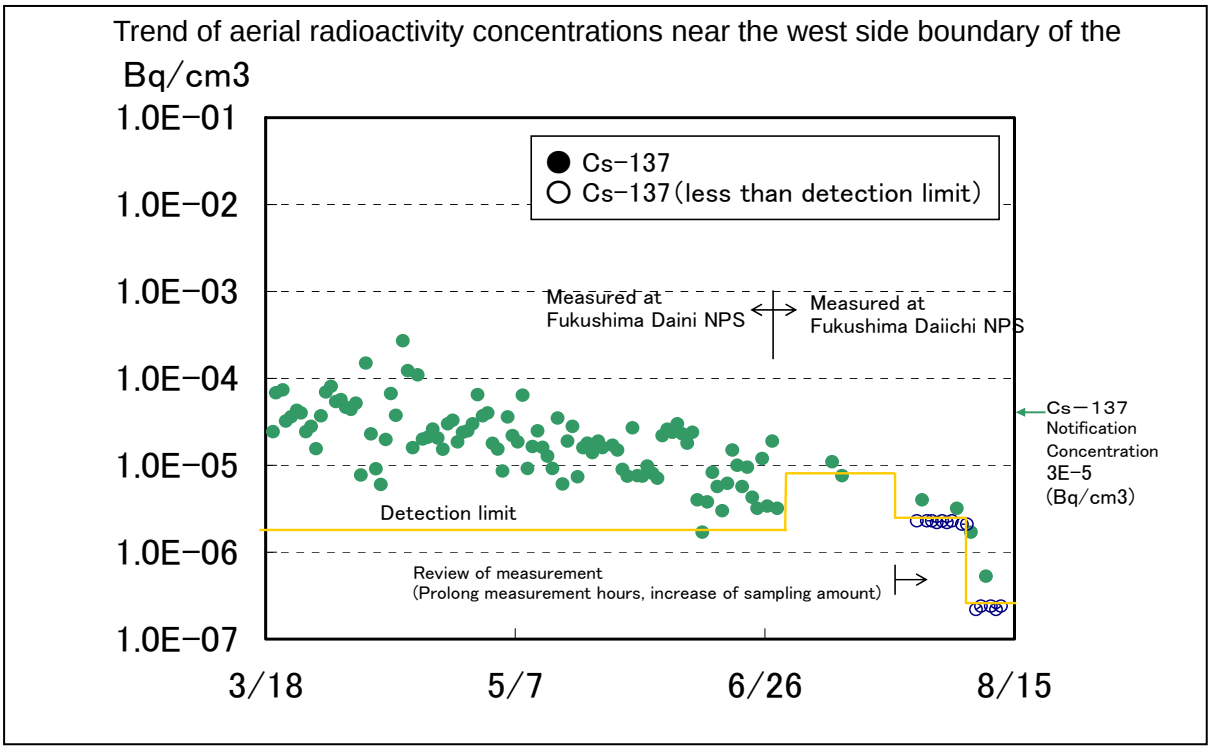
[Sea]

- Introduction of an unmanned survey boat a few km offshore of the front of NPS (late August.) Planning to sample and measure radiation dose of seawater and marine soil.

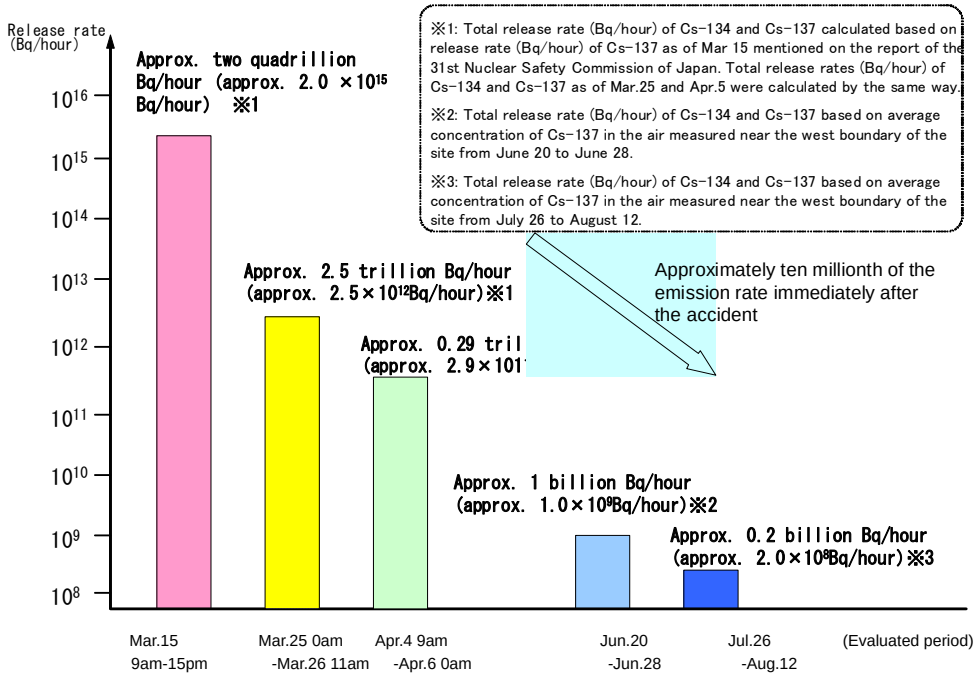
Unmanned investigation boat

② Evaluate the amount of radioactive materials currently released [Countermeasures 60・61]

- Monitoring continuously from Step 1 in order to confirm the declining tendency.
  - Measuring airborne radioactivity concentration at 12 points in addition to around West Gate within the site.
  - Measuring radioactive fallout at one point within the site and plan to begin measuring radioactive fallout at 10 points outside of the site.
- TEPCO has assessed current value of released amount from Units 1 to 3 through the same method as announced on July 19.
  - The release rate on the assumption that all measured radioactivity arises from the current emission from the reactor buildings is evaluated to be approximately two-hundred-million Bq/hour (This is approximately ten millionth of the emission rate after the accident.)
  - Excluding the effect of already released radioactive materials, evaluation of exposure doses at the site boundary using the current release rate showed that the maximum exposure dose is 0.4 mSv/year.
- Analyze the effect of reducing release as well as improve accuracy of estimated exposure doses through measures including measuring the radioactive materials concentration around the reactor buildings, measuring radioactive materials newly falling at survey points, etc.



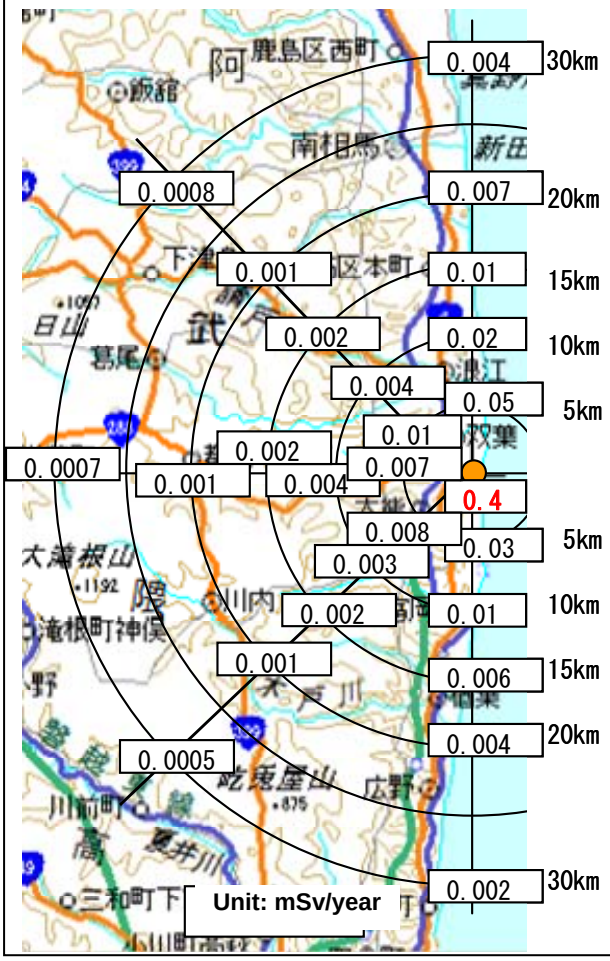
Release rates of radioactive materials from Units 1 to 3 at the Fukushima Daiichi



Exposure doses in case that the current release rate from the power station Units 1 to 3 continues for one year (mSv/year)

(Excluding the effect of already released radioactive materials)

[Map Source: “Digital Japan" URL http://cyberjapan.jp/]



(Overview of the evaluated figures)

Site boundary: Less than or equal to approx. 0.4 mSv/year

5km radius : Less than or equal to approx. 0.05 mSv/year

10km radius : Less than or equal to approx. 0.02 mSv/year

20 km radius : Less than or equal to approx. 0.007 mSv/year

As a reference, the dose limit by reactor facilities at an outside of a nuclear power station is 1 mSv/year.

③Consider and start full-fledged decontamination [Countermeasure 63]

- Plan to formulate emergency decontamination basic policy including basic view of an emergency countermeasure for decontamination.
- Plan to formulate decontamination manual through demonstration etc. of decontamination way at schools, parks, roads, farmland, forests and facilities etc.
- Based on the consideration results, start full-fledged decontamination.

IV. Countermeasures for aftershocks, etc.

(7) Tsunami and reinforcement, etc.

1. Target for Step 2 “Mitigation of further disasters”

- Prevent situation from deterioration by mitigating disasters with countermeasures against emergency (earthquakes and tsunami, etc.)
- Consideration of reinforcement work of each unit as necessary
- Continue implementing various radiation shielding measures

2. Current status and work implemented

① Installed support structures at the bottom of the fuel pool of Unit 4 [Countermeasure 26]

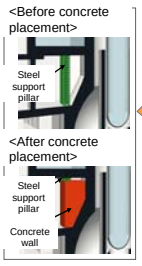
- Support structures were installed at the bottom of the spent fuel pool to enhance margin of safety
- Completed installation work of steel support pillars (Jun. 20) and decrease in loading weight took effect
- Concrete and grout were filled to further ensure the effect (Jul. 30)

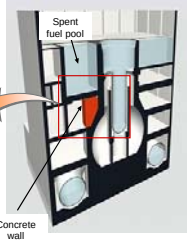
Installation status of support structures

Before installing steel support pillars (photographed on May 31)

Installation status of steel support pillars (photographed on Jun. 20)

Concrete placement status (photographed on Jul.21)





Image

Grout filling status (photographed on Jul. 30)

Completion of support structures (photographed on Jul. 30)

V. Environment improvement

(8) Living/ working environment

1. Target for Step 2 “Enhancement of Environment Improvement”

- Improve workers’ Living/ working environment that had been harsh during the initial phase of the accident, thus leading to maintaining workers’ motivation
- Expansion of temporary dormitories and on-site rest stations
- Improvement of environment such as meals, bath, laundry, etc.

2. Current status and works implemented

① Expansion status of temporary dormitories [Countermeasure 75]

- Plan to build temporary dormitories capable of accommodating approximately 1,600 people; approx. 1,200 people have already moved in (as of Aug. 15.)
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② Establishment status of on-site rest stations [Countermeasure 75]

- Sixteen on-site rest stations have been built (approx. 3,500m^2 in size with a capacity to accommodate approx. 1,200 people.) (As of Aug. 15) Air showers and restrooms as well as drinking water equipments have been installed in part of them.

Exterior (left) and interior (right) appearances of on-site rest stations

Inside of on-site rest stations (from left: drinking water, etc., restroom and air shower)

(9) Radiation Control/Medical Care

1. Target for Step 2 “Enhancement of Healthcare”

- Thorough radiation exposure control and countermeasures against heat stroke
- Reinforcement of radiation control by NISA
- Increase in the number of whole body counters, monthly measurement of internal exposure
- Automated recording of personal radiation dose, report of personal exposure dose in writing, introduction of workers’ certificates with photos
- Consideration of a long-tem healthcare such as enhancement of workers’ safety training and establishment of a database

2. Current status and works implemented

① Expansion of whole body counters (WBC) [Countermeasure 78]

- Installing WBCs as planned (6 units have already been added as of Aug. 11.)

Installation of WBC

② Consideration for long-tem healthcare such as establishing database [Countermeasure 78]

- Announced the creation of database as well as a framework of comprehensive long-term health care as a “Grand Design” (Aug. 3.) Continue considering the concept of long-term healthcare.

③ Speedy transportation of patients [Countermeasure 80]

- Confirm rules for patient survey etc. at the Unit 5/6 emergency medical service room.
- Conducted decontamination of patient transportation vehicle and preparing decontamination facility at the Unit 5/6 emergency medical service room.

(10) Staff training/personnel allocation

1. Target for Step 2 “Systematic staff training and personnel allocation”

- Promotion of staff training etc. in conjunction with the Government and operators.

2. Current status and work implemented

① Promote staff training, etc. in conjunction with the government and operators in order to train and mobilize staffs systematically. [Countermeasure 85]

- Conducting training for staffs engaged in radiation related work, who will be in great demand.
- TEPCO has been conducting “radiation survey staff training” targeted for employees and TEPCO group companies’ employees and has already trained approx. 1,900 personnel.
- The government has been conducting “radiation survey staff” and “radiation protection staff” development trainings and will train 250 personnel.
- According to affiliated companies needs, launched a new framework of looking for specialized technical workers widely through Japan Atomic Industrial Forum (JAIF).

Photos from radiation protection staff training

VI. Countermeasures against midterm issues

1. Target for Step 2

- Mid-term safety securement policy to be drafted by the government
- Plant operation plans to be developed by the operator based on the above policy

2. Current status and work implemented

①“Mid-term safety securement policy” is under consideration by NISA

END