Emergency Safety Measures for Fukushima Daiichi Nuclear Power Station (announced on November 8, 2013)

The progress status of Emergency Safety Measures formulated based on instructions by the Chairman of the Nuclear Regulation Authority on October 28, 2013 is reported.

On-site dose reduction
- A half of one-hour value (10 μSv/h) with which the exposure dose of 2000-hour of work per year reaches the dose limit 100mSv during 5 years.

Removal of the Fallouts
- On-site decontamination
  - Ground surface: other than asphalt
    - Removal of surface soil, deep plowing, and asphalt placement
  - Ground surface: asphalt
    - Cleaning and high-pressure water cleaning of surface soil

Treatment of highly contaminated water
- RO treatment water

On-site safety measures
- Improving the on-site outdoor communication environment
  - (Completed)

Improving and enhancing diet
- Installing a Meal Service Center near Fukushima Daiichi Nuclear Power Station to serve meals for 3,000 workers
  - Construction began from January 27, 2014

Emergency medical services
- Establishing a vehicle maintenance site on site
  - Site development and piloting were complete; at present foundation construction and disassembling (reinforcing steel) are underway (Scheduled to go into operation in May 2014)

Labor environment of workers
- Installing an additional Rest House on site
  - Mobile Rest House using large bus/ concrete prefabricated Rest House
    - Operation of mobile Rest House began from January 14, 2014

Labor environment of employees
- Enhancing the facilities of the Shin Hirono single-person dormitory
  - Installing a toilet and shower in all housing facilities
  - Enhancing cafeteria menus


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### Category | Item | Contents | Progress status
--- | --- | --- | ---
Work safety | On-site decontamination (expanding non full-face mask required area) | Expanding non full-face mask required area | • (Completed) Central area and north side area of the site • South area of the site. The non full-face mask required area will be expanded according to the progress of dose reduction (to be implemented from FY2014-2015)
 | Reducing dose within the site | Decontamination on the south side area of the site (tree trimming, removal of surface soil, deep plowing, and asphalt placement) is underway (target dose rate: average 5μSv/h) | • (Completed) Central area and north side area of the site • South area of the site. The non full-face mask required area will be expanded according to the progress of dose reduction (to be implemented from FY2014-2015)
 | Removing rubble on the sea side | 24 of a total 25 damaged vehicles were removed. As the remaining 1 vehicle is located near the light oil tank, it will be removed after removing oil from the tank (at the end of June 2014) | • (Completed) Central area and north side area of the site • South area of the site. The non full-face mask required area will be expanded according to the progress of dose reduction (to be implemented from FY2014-2015)
 | Enhancing on-site lighting facilities | • Around the Tank Area, construction of utility pole and installation of lighting units are underway (scheduled for completion in May 2014) • Installation of 62,733 utility poles and approx. 186,020 meters high-voltage electrical power lines is completed | • (Completed) Central area and north side area of the site • South area of the site. The non full-face mask required area will be expanded according to the progress of dose reduction (to be implemented from FY2014-2015)
 | Improving the communication environment | Improving the on-site outdoor communication environment | • (Completed) Entry control facility and emergency medical service room (December 25, 2013) • Cardiac ultrasound (January 13, 2014) Temporary Administration Office Building, large Administration Office Building
 | Administration Office Building | Installing a new Administration Office Building at Fukushima Daiichi Nuclear Power Station | Temporary Administration Office Building (Capacity: approx. 1,000 employees)
 | • (Completed) Central area and north side area of the site • South area of the site. The non full-face mask required area will be expanded according to the progress of dose reduction (to be implemented from FY2014-2015)
 | Administration Office Building (for employees of TEPCO and partner companies) | Location of the Administration Office Building (west side of the entry control facility) was selected • Basic requirements (size, etc.) are under examination (scheduled for completion by the end of 2015) | • (Completed) Central area and north side area of the site • South area of the site. The non full-face mask required area will be expanded according to the progress of dose reduction (to be implemented from FY2014-2015)
 | Improving and enhancing diet | Installing a Meal Service Center near Fukushima Daiichi Nuclear Power Station to serve meals for 3,000 workers | • Construction began from January 27, 2014 • Foundation construction is underway (Scheduled for completion by the end of March 2015)
 | Emergency medical services | Establishing a vehicle maintenance site on site | Establishing a maintenance site for vehicles used on site only • Site development and piloting were complete; at present foundation construction and disassembling (reinforcing steel) are underway (Scheduled to go into operation in May 2014)
 | Increasing commuter bus services | Increasing commuter bus services to reduce bus waiting time during commuting time zone | (Completed) (continued)
 | Increasing designed additional labor compensation | Increasing designed additional labor compensation applied to on-site work (10,000 yen/day -> 20,000 yen/day) | (Completed) (continued)
 | Reviewing subcontract work order system | Early completion of facility construction related to efforts to enhance the labor environment and application of long contracts to ensure an appropriate number of workers in the medium- and long-term | (Completed) (continued)
 | Labor environment of workers | Enhancing the facilities of the Main Anti-Earthquake Building | Installing items for naps | (Completed)
 | Labor environment of employees | Enhancing the facilities of the Shin Hirono single-person dormitory | Installing an additional shower for temporary stay workers | Building of water supply and distribution pipes and water quality inspection are underway (Scheduled for completion March 2014)
 | Enhancing the facilities of the Shin Hirono single-person dormitory | Installing a toilet and shower in all housing facilities | (Completed)
 | Enhancing cafeteria menus | Enhancing cafeteria menus | (Completed)
 | Reviewing benefits of employees | Increasing benefits | (Completed)
# Enhancing management and organization to assure safety and quality

## Contents

<table>
<thead>
<tr>
<th>Improving management regarding safety and quality such as formulating work procedures according to fieldwork, thorough risk prediction activities, and enhancing communication with partner companies</th>
<th>Progress status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past measures have been based on the cause of leak from tanks. However, in response to the detected leak from HS area tank top, additional measures to review procedures and education are underway.</td>
<td></td>
</tr>
</tbody>
</table>

## Enhancing organization and human resources such as safety and quality control department

1. Under the head of the Nuclear Power & Plant Siting Division, a “Safety and Quality Officer” supervising Safety and Quality Control departments of Head Office and Power Stations was established (Scheduled for establishment in April 2014)
2. At Power Stations, an additional 3 staff members have been assigned to Safety and Quality Control department
3. A staff member dedicated to improving the labor environment is established (established in January 2014)

## Enhancing employees’ HR rotation and appropriate allocation of human resources

1. An exchange target is set for each nuclear power department and site, and periodical transfer is conducted (Scheduled for start from transfer in July 2014)
2. The organization related to contaminated water/tank areas are reconstructed and enhanced, and management staff is increased (Organization is strengthened by establishing the Fukushima Daiichi D&D Engineering Company*3 in April 2014, and management staff has been steadily increased since November 2013)

## Enhancing human resources related to measures for contaminated water and tanks by mobilizing all human resources at the company (increasing 220 workers)

1. Redeployment of Fukushima Daiichi, and transfer from Fukushima Daiichi and Kashiwakari-Kariwa (approx. 70 persons)
2. Transfer from Group companies such as thermal power, building, civil engineering, and distribution of electric power departments (approx. 130 persons)
3. Transfer from other Electric Power Companies (approx. 20 persons)

### Breakdown of resource enhancement

- (1) new installation and replacement of tanks: approx. 110
- (2) tank patrol: approx. 60
- (3) safety and quality control: approx. 30
- (4) radiation control (including analysis resources): approx. 20

## Prevention of overflow

- Installing rainwater gutters to tank top at contaminated places with high level of dose

## Preventing rainwater inflow

- Installing rainwater gutters to all other tanks

## Preventing underground seeping

- Facing ground surface around tanks

## Preventing inflow into drainage

- Covering B drainage

### Contents Progress status

<table>
<thead>
<tr>
<th>Installing new permanent facilities to ensure long-term decommissioning</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing a new central monitoring room (Improving central management capability)</td>
<td>Functions required for the new monitoring room are under examination and being formulated</td>
</tr>
</tbody>
</table>

### Building on site infrastructure

| North side (Units 5-6 side): constructing a new power supply platform | Regarding the power supply platform on the north side (Units 5-6), application of the existing facility is under examination |
| South side (Units 1-4 side): enhancing the facilities | Construction to increase power supply reliability (redundant DC power source, and redundant power supply for water treatment facilities, etc.) steadily underway |

### Repairs on roads

- Recar of the G area east side road, 5 junction to Units 2-3 road, and Unit 4 east side 10-4m road was completed

### Updating water supply pipes and building an additional treatment pool for the seismic isolated building

- Replacement of on-site water supply pipes is scheduled for completion by the end of March 2014

### Updating the emergency generator for the seismic isolated building

- Design of building where generator is installed is underway (Purchase order of the generator was completed)

### Replacing C/drainage

- Removal and transfer of on-site obstacles is ongoing

### Cleaning/conversion/removing operation of part of the old Administration Office Building

- Operation of the expanded office area on the Administrative Office Building 2nd floor began from January 15, 2014

### Waste treatment/storage facilities

- Installation of 9th solid waste storage: application for the revision of the Implementation Plan on the Specified Nuclear Power Facilities is in preparation

### Fire prevention measures such as fire alarm and extinguisher

- Replacement of high-voltage cables placed in the side ditch of roads is underway
- Replacement of a water treatment facility transfer line with polyethylene pipes is underway

### Measurement/monitoring and analysis

- Measurement lines for measuring radioactivity and rainwater inflow of the tank top are under examination

### Installation of permanent facilities

- Installing 9 tanks is completed; piping work is steadily underway
- Replacement of on-site water supply pipes: is scheduled for completion by the end of March 2014
- An additional 5 tanks are scheduled for installation

### Disposal of solid waste

- Temporary storage of solid waste (1-2 pools)

### Recycling partially on-site

- Disposal facility site is considered

### After cleaning/decontamination, resuming operation of part of the old Administration Office Building

- Pre-treatment

### Treatment for temporary storage and treatment facilities

- Post-treatment

### Updating water supply pipes and building an additional treatment pool for the seismic isolated building

- Operation of the expanded office area on the Administrative Office Building 2nd floor began from January 15, 2014

### Waste treatment/storage facilities

- Installation of 9th solid waste storage: application for the revision of the Implementation Plan on the Specified Nuclear Power Facilities is in preparation

### Fire prevention measures such as fire alarm and extinguisher

- Replacement of high-voltage cables placed in the side ditch of roads is underway
- Replacement of a water treatment facility transfer line with polyethylene pipes is underway
5. Causes of leakage of accumulated water from tank and measures

<table>
<thead>
<tr>
<th>Measures</th>
<th>Progress status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water stoppage from tank bottom by caulking</td>
<td>As of March 12, 2014, 16/26 tanks; scheduled for completion in early April</td>
</tr>
<tr>
<td>Applying sealing material to the bottom</td>
<td>Demonstration using the actual tank size was conducted in January; Examination is underway based on issues in the demonstration</td>
</tr>
<tr>
<td>Applying sealing material to bottom part (inside)</td>
<td>The demonstration confirmed that the requirements had largely been met; An implementation plan based on a tank replacement plan is currently being formulated</td>
</tr>
</tbody>
</table>

Enhancing patrol (4 times/day, total 120/day)

- Patrol is enhanced by outsourcing; patrol manual is enhanced and the implementation status of the outsource patrol is checked by employees
- In response to a leak from the H6 area tank top, the field patrol is enhanced

Installing water level observation apparatus to all flange-type tanks

- Installation of water level gauges to flange-type tanks was completed and operation began
- For welded tanks already installed, installation of water level gauges was completed: during March, operation is scheduled for start; for areas where the installation of tanks is underway such as J area, installation of water level gauges is steadily underway
- In response to the leak from H6 area tank top, improvement in water level monitoring and control systems is underway

Replacement with welded-type tanks

- Replacement of D area tanks began from March 2014
- In addition to increasing tanks, replacement is implemented in the prioritized order sequentially: H1, H2 and H4 area tanks

6. Storage plan and measures to appropriately manage contaminated water

<table>
<thead>
<tr>
<th>Measures</th>
<th>Progress status</th>
</tr>
</thead>
</table>
| Storage status and increase plan of tanks | At present, the total volume of stored concentrated salt water is approx. 440,000 tons and storage capacity is approx. 490,000 tons
| | In J area, the installation of larger tanks is accelerated; targeting efforts to increase the capacity to approx. 800,000 tons by the end of 2015 (Installation of 27 tanks in J1 area was completed)
| Replacement of tanks | With the target of completion within FY2015, flange-type and horizontal tanks are scheduled to be replaced with welded tanks
| Measures to prevent groundwater inflow | Reduction of groundwater inflow by groundwater bypass, pumping of sub-drain and shield on the land side is in preparation
| | A treatment facility for sub-drain is under production; application for approval for change in the facility implementation plan was submitted (December 19, 2013)

Enhancement and reliability improvement in multi-nuclide removal equipment (ALPS)

ALPS is enhanced with the target of operating after mid-FY2014 and completing the treatment of contaminated water stored in tanks within FY2014

- Basic design of additional and high-performance multi-nuclide removal equipment was completed and application for approval for change in the implementation plan was submitted (additional: February 12, 2014, high-performance: March 7, 2014)
- Site development and foundation construction for buildings for both sets of equipment is steadily underway since March 2014
- Through measures for defects such as improving corrosion resistance and correction are ensured and measures to increase operational reliability are implemented

Regarding the ALPS defect detected on March 18, the causes and influence range are identified and measures are promptly implemented, while accelerating treatment on the condition of assuring safety.

7. Fuel removal from Unit 4 spent fuel pool

<table>
<thead>
<tr>
<th>Measures</th>
<th>Progress status</th>
</tr>
</thead>
</table>
| From November 18, 2013, fuel removal began. | As of March 17, 2014, 506/1533 fuel assemblies had been transferred from Unit 4 to the common pool (spent fuel assemblies: 484/1331, non-irradiated fuel assemblies: 22/202, number of casks transported: 23)
| As measures to reduce the exposure dose during fuel removal, installation of shields in appropriate places on operating floor is steadily underway (until the end of March 2014) | Average exposure dose was reduced by approx. 56% after the installation of shields (during operation of the fuel-handling system, average of 21-23 casks); air dose rate on the trolley of fuel-handling machine was reduced from 0.055mSv/h before installation to 0.025mSv/h after the installation of shields (approx. 55%)

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Average exposure dose per worker per group (average exposure dose per worker working for approx. 2 hours)
1. Results of exposure dose

Status of FY2013
(Accumulated exposure dose of radiation-related workers
<Exposure dose: FY2013>

<table>
<thead>
<tr>
<th>Category (mSv)</th>
<th>April 2013 - May 2014</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.</td>
<td>100mSv or lower</td>
<td>416</td>
</tr>
<tr>
<td>Max.</td>
<td>50mSv or lower</td>
<td>169</td>
</tr>
<tr>
<td>Avg.</td>
<td>10mSv or lower</td>
<td>3,154</td>
</tr>
<tr>
<td>Avg.</td>
<td>5mSv or lower</td>
<td>9,125</td>
</tr>
<tr>
<td>Avg.</td>
<td>2.5mSv or lower</td>
<td>12,665</td>
</tr>
<tr>
<td>Avg.</td>
<td>1.75mSv or lower</td>
<td>13,154</td>
</tr>
<tr>
<td>Avg.</td>
<td>1.0mSv or lower</td>
<td>39.96</td>
</tr>
</tbody>
</table>

* Among 13,154 persons working in FY2013 (April 2013 - January 2014)
  - 13,154 (100%) 50mSv or lower
  - 12,665 (96.3%) 20mSv or lower
  - 9,125 (69.4%) 5mSv or lower

Exposure dose of most workers is at a level largely below the dose limit and continued engagement is available.

Overall dose status of the Power Station is improving
- Exposure dose of most workers since the accident is maintained at a level largely below the dose limit of 100mSv
- Monthly average dose in FY2013 is stable at approx. 1mSv

2. Measures to increase workers

Workers are increasing in association with future measures for contaminated water (increasing tanks, enhancing ALPS and installing frozen impermeable walls) and demolition of building cover

Secure workers
- To ensure that, with stable and long-term employment, workers are able to work safely, the scope of long-term contracts is expanded

Building infrastructure
- Labor environment improvement G is assigned in the field to examine infrastructure building:
  - Means of transport (bus operation service)
  - Parking
  - Entry control facility (measures to mitigate congestion and switch protective equipment on and off)
  - Rest House (measures to mitigate congestion)

Supervision of on-site works
- The Project Supervisory Center centrally manages information related to on-site facilities and works. The Center coordinates the entire project to ensure multiple tasks progress smoothly and simultaneously.

3 Collaboration between Company and Corporate

As the top of Fukushima Daiichi D & D Engineering Company, making decisions related to the implementation of measures to ensure flexible and prompt responses to various issues occurring in the company and implementation of measures to ensure flexible and prompt responses to various issues occurring in the field.
TEPCO Organization Chart

Board of Directors
Chairman President
Office of Audit Committee
Nuclear Safety Oversight Office

Fukushima Revitalization Headquarters
Representative of the Fukushima Revitalization Headquarters <1>
Fukushima Planning & General Affairs Dept.

Management Restructuring Division
Secretariat of Management Restructuring Division
Secretariat of the New Growth Task Force
Corporate Planning Dept.
Inter-corporate Business Dept.

Corporate Communications Dept.

Corporate Affairs Dept.
Legal Office

Employee Relations
& Human Resources Dept.
Office Service Center
Accounting & Treasury Center

& Procurement Dept.
Transmission & Distribution Procurement Center

International affairs Dept.
Overseas Business Department

Washington Office
London Office
Beijing Office

Engineering R & D Dept.
R & D Center

Intellectual Property Center

Constructions Dept.
Construction Engineering Center

Construction Office

Fuel & Power Company
Fuel Dept.
Thermal Power Dept.
Thermal Power Plant Engineering Dept.
Thermal Power Plant Operation & Maintenance Training Center
General Affairs Dept.
Planning Dept.
Maintenance Dept.
Thermal Power Station
Thermal Power Plant Construction Office

Power Grid Company

Transmission Dept.
Transmission & Substations Construction Center
Distribution Engineering Center
Power System Operation Dept.
Central Load Dispatching Office
Load-dispatching Station
Network Service Center
Telecommunications Network Engineering Center
Real Estate Acquisition & Management Dept.
Power System Office

Integrated Control Office
Integrated Control Office, Transformer Substation, Transmission Substation

(Shatin) (Matsumoto, Shinshu) (Nagoya) (Washington)

Hama Dori Power System Office (Inawashiro)
Transmission Substation, Switch Substation

Chikumagawa Power System Office (Matsumoto)

Hitachi-ko Thermal Power
Kashiwazaki Thermal Power

Power System Engineering Center

Gas Business Dept.

Smart Meter Promotion Office
Branch Office

General Affairs Dept.
Sales Dept.
Facilities Dept.
Customer Center
Service Center
Control & Maintenance Office

Island Business Center (Tokyo)

Office (located in islands)

Load-dispatching Station
Construction Center (Saitama, Chiba, Tokyo, Kanagawa)

Construction Office (Tochigi, Niihari)
Telecommunications Network Center

Fukushima Daiichi D & D Engineering Company

General Administration Dept.
Project Planning Dept.

Fukushima Daiichi D & D Nuclear Power Station

General Affairs Dept.
Engineering & Quality Safety Dept.
Disaster Prevention & Safety Dept.

Project Supervisory Center
Unit 1-4 Facility Operation Management Dept.

Cooling Facilities Dept.
Machinery Facilities Dept.
Electric & Communication Platform Dept.

Construction Dept.
Water Treatment Operation Dept.
Water Treatment Facilities Dept.
Water Treatment Engineering Dept.
Units 5 & 6 Operation Management Dept.

<1> In Fukushima Revitalization Headquarters, offices (Fukushima City, Iwaki City, Koriyama City,
Ainu Wakamatsu City, Minamisoma City) are established.

<2> (Fukushima Daiichi) In the Center, Safety Administration Dept. and Disaster Prevention &
Radiation Safety Dept. are established
(Kashiwazaki-Kariwa) In the Center, Safety Administration Dept., Disaster Prevention & Safety
Dept. and Radiation Safety Dept. are established.

<3> (Fukushima Daiichi) Operation Management Dept.
(Kashiwazaki-Kariwa) Daiichi Operation Management Dept., Daiichi Operation Management Dept.

<4> (Fukushima Daiichi) Conservation Dept.
(Kashiwazaki-Kariwa) Daiichi Conservation Dept., Daiichi Conservation Dept.
Progress Status of Emergency Safety Measures at Fukushima Daiichi Nuclear Power Station

March 20, 2014
Tokyo Electric Power Company
1. Dose reduction plan at Fukushima Daiichi Nuclear Power Station site (1/3)

**Objectives**

After identifying the effect of the Fallouts spreading across the site of Fukushima Daiichi Nuclear Power Station and direct radiation from the plant through actual measurement, reducing radiation dose by tree trimming, removal of surface soil, deep plowing, and shield, improving work environment of the Site, and establishing the foundation for facilitating safe termination and decommissioning of the accident reactors over a long term.

**Implementation policy**

Reduction of radiation dose is steadily conducted from areas where many workers are involved and there is less work interference. After checking the dose rate following the decontamination, for the places where the target dose rate is not achieved, further dose reduction measures are implemented. The target dose rate is decreased gradually, and finally reaches to the condition before the accident.

*Area I: Area of particularly high dose rate around Units 1-4
Area II: Area where plants and woods remain
Area III: Area where facilities are installed or scheduled for installation
Area IV: Area of roads and parks which are already paved
Scope of scheduled dose reduction on site*

Provided by Japan Space Imaging, (C)DigitalGlobe
1. Dose reduction plan at Fukushima Daiichi Nuclear Power Station site (2/3)

The target dose rate at south part of the site (Areas II, III and IV) is set to the average of 5μSv/h*, and evaluated using the dose rate at the person’s breast. In addition, for places which have effect of direct radiation from the plant, evaluation using the dose rate on the ground surface is also introduced.

* A half of one-hour value (10μSv/h) with which the exposure dose of 2000-hour of work per year reaches the dose limit 100mSv during 5 years.

In addition to the Fallouts,

- Effect of direct radiation from facilities (plants, tanks, etc.)

Effect of the Fallouts

- Effect of Fallouts (Mainly attached to trees and surface soil)
- Effect of Fallout contamination (Attached on asphalt)
- Effect of high dose rubble and fallout contamination (Attached on asphalt and surface soil)
- Effect of the Fallouts (Attached on vegetation and surface soil)
- In addition to the Fallouts, effect of direct radiation from facilities (plants, tanks, etc.)

Removal of the Fallouts

- [Ground surface: other than asphalt]
  - Removal of surface soil, deep plowing, lay of crushed stone
  - Tree trimming
- [Ground surface: asphalt]
  - Cleaning and high-pressure water cutting of side strips on which soil and sand are likely to be accumulated

Removal of rubble

- Removal of high-dose rubble, and obstacle rubble that hiders works

Treatment of highly contaminated water

- Treatment of highly contaminated water such as RO treatment water

Shield of high dose facilities

- Shield of direct radiation from facilities that cannot be reduced by decontamination
In Area I around Units 1-4, radiation dose is reduced by removing rubble that may hinder the work and shielding the work area. However, as high radiation dose is detected at some points of the plant and facilities, reduction is conducted in alignment with the progress in removing high-dose facilities (exhaust stack, etc.) and rubble of Reactor Building.
2. Status of rubble removal on the sea side (1/7)

● Removal completed: **24/25 vehicles**  ☐: Removal completed

* As Vehicle Q is located near the light oil tank, it will be removed after removing light oil from the tank (at the end of June 2014)
2. Status of rubble removal on the sea side (2/7)

<table>
<thead>
<tr>
<th>Status</th>
<th>Photo</th>
<th>Status</th>
<th>Photo</th>
<th>Status</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before removal</td>
<td><img src="image1" alt="Before removal A" /></td>
<td>Before removal</td>
<td><img src="image2" alt="Before removal E" /></td>
<td>Before removal</td>
<td><img src="image3" alt="Before removal F" /></td>
</tr>
<tr>
<td>After removal</td>
<td><img src="image4" alt="After removal D" /></td>
<td>After removal</td>
<td><img src="image5" alt="After removal" /></td>
<td>After removal</td>
<td><img src="image6" alt="After removal" /></td>
</tr>
<tr>
<td>Removal completed on December 10</td>
<td>Removal completed on January 11</td>
<td>Removal completed on November 28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Status of rubble removal on the sea side (3/7)

<table>
<thead>
<tr>
<th>Status</th>
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<tbody>
<tr>
<td>Before removal</td>
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<td>Before removal</td>
<td><img src="image" alt="K" /></td>
<td>Before removal</td>
<td><img src="image" alt="L" /></td>
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<tr>
<td>After removal</td>
<td><img src="image" alt="M" /></td>
<td>After removal</td>
<td><img src="image" alt="N" /></td>
<td>After removal</td>
<td></td>
</tr>
</tbody>
</table>

Removal completed on December 16
Removal completed on March 2
Removal completed on March 2
2. Status of rubble removal on the sea side (4/7)

<table>
<thead>
<tr>
<th>Status</th>
<th>Photo</th>
<th>Status</th>
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<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before removal</td>
<td><img src="image" alt="O" /></td>
<td>Before removal</td>
<td><img src="image" alt="P" /></td>
<td>Before removal</td>
<td><img src="image" alt="R" /></td>
</tr>
<tr>
<td>After removal</td>
<td><img src="image" alt="O" /></td>
<td>After removal</td>
<td><img src="image" alt="P" /></td>
<td>After removal</td>
<td><img src="image" alt="R" /></td>
</tr>
</tbody>
</table>

- Removal completed on January 11
- Removal completed on December 16
- Removal completed on December 16
2. Status of rubble removal on the sea side (5/7)

Status of rubble removal on the sea side

<table>
<thead>
<tr>
<th>Status</th>
<th>Photo</th>
<th>Status</th>
<th>Photo</th>
<th>Status</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before removal</td>
<td><img src="image1" alt="Photo" /></td>
<td>Before removal</td>
<td><img src="image2" alt="Photo" /></td>
<td>Before removal</td>
<td><img src="image3" alt="Photo" /></td>
</tr>
<tr>
<td>After removal</td>
<td><img src="image4" alt="Photo" /></td>
<td>After removal</td>
<td><img src="image5" alt="Photo" /></td>
<td>After removal</td>
<td><img src="image6" alt="Photo" /></td>
</tr>
</tbody>
</table>

Removal completed on December 16
2. Status of rubble removal on the sea side (6/7)

<table>
<thead>
<tr>
<th>Status</th>
<th>Photo</th>
<th>Photo</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before removal</td>
<td><img src="Image1" alt="Status" /></td>
<td><img src="Image2" alt="Status" /></td>
<td><img src="Image3" alt="Status" /></td>
</tr>
<tr>
<td>After removal</td>
<td><img src="Image4" alt="Status" /></td>
<td><img src="Image5" alt="Status" /></td>
<td><img src="Image6" alt="Status" /></td>
</tr>
</tbody>
</table>

- Removal completed on February 18
- Removal completed on January 20
- Removal completed on January 20
2. Status of rubble removal on the sea side (7/7)

<table>
<thead>
<tr>
<th>Status</th>
<th>Photo</th>
<th>Status</th>
<th>Photo</th>
<th>Status</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before removal</td>
<td><img src="before_photo1.png" alt="Before" /></td>
<td>Before removal</td>
<td><img src="before_photo2.png" alt="Before" /></td>
<td>Before removal</td>
<td><img src="before_photo3.png" alt="Before" /></td>
</tr>
<tr>
<td>After removal</td>
<td><img src="after_photo1.png" alt="After" /></td>
<td>After removal</td>
<td><img src="after_photo2.png" alt="After" /></td>
<td>After removal</td>
<td><img src="after_photo3.png" alt="After" /></td>
</tr>
<tr>
<td>W-2</td>
<td></td>
<td>X</td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Removal completed on January 20</td>
<td>Removal completed on February 17</td>
<td>Removal completed on November 28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Enhancement of lighting facilities on site (1/2)

Outline of the work
- Building high-voltage distribution system
- Installing area lighting
- Building low-voltage distribution board and low-voltage service system
- Installing lighting for tanks inside the area

[Reference]
- Breakdown of completed installation
  - Utility poles: 62/73
  - High-voltage electrical power lines: approx. 1850m/approx. 2500m
  - Pole transformers: 6
  - Pole switches: 7
  - Lighting apparatuses: 44
3. Enhancement of lighting facilities on site (2/2)

Zone D installation status of distribution lines and lighting facilities

Zone E installation status of distribution lines and lighting facilities

Zone D status of area lighting

Zone E status of area lighting
4. Location of Administration Office Building and Rest House

Location

- Existing Administration Office Building
- Main Anti-Earthquake Building
- Large Rest House
- Temporary Administration Office Building
- Administration Office Building
- External temporary Rest House
- 1F Main Gate
- Entry control facility
- Large Rest House
- Temporary Administration Office Building
- External temporary Rest House
- Administration Office Building

Location (a portion expanded)
4.1 Establishment of temporary Administration Office Building (1/2)

Outline of the facility

- Construction start: December 2013
- Operation start: gradually started from July 1, 2014

<table>
<thead>
<tr>
<th>Item</th>
<th>Planned specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building structure</td>
<td>Steel frame two-storied</td>
</tr>
<tr>
<td>Size</td>
<td>Total floor area: approx. 14,000m²</td>
</tr>
<tr>
<td></td>
<td>Construction area: approx. 7,000m²</td>
</tr>
<tr>
<td>Capacity</td>
<td>Approx. 1,000 workers</td>
</tr>
<tr>
<td>Radiation dose inside the building</td>
<td>Non-controlled area</td>
</tr>
</tbody>
</table>

Cross-sectional image

Approx. 9m

Common area
Office

Common area
Office

Approx. 140m

Cross-sectional image
4.1 Establishment of temporary Administration Office Building (2/2)

Ground improvement and foundation construction are underway.
4.2 Mobile Rest House

**Outline of mobile Rest House**

- Length of the bus: 12m
- Rest space for approx. 6 workers
- Positive pressure maintained inside the bus
- No mask required
- Eating and drinking allowed
- Air-conditioned
- Toilet equipped

**<Major specifications>**

- January 14, 2014

**<Operation start>**

- January 14, 2014

---

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### Outline of the facility

Construction start: December 2013  
Operation start: gradually started from early April, 2014

<table>
<thead>
<tr>
<th>Item</th>
<th>Planned specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building structure</td>
<td>Steel frame three-storied (prefabricated)</td>
</tr>
<tr>
<td>Size</td>
<td>Total floor area: approx. 1,000m² x 2 buildings</td>
</tr>
<tr>
<td>Capacity</td>
<td>Approx. 1,000 workers</td>
</tr>
</tbody>
</table>
4.4 Establishment of large Rest House (1/2)

Outline of the facility

Construction started: January 27, 2014
Construction completed: scheduled at the end of March, 2015

<table>
<thead>
<tr>
<th>Item</th>
<th>Planned specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building structure</td>
<td>Steel frame</td>
</tr>
<tr>
<td>Size</td>
<td>Total floor area: approx. 64,000m²*</td>
</tr>
<tr>
<td></td>
<td>Construction area: approx. 900m²*</td>
</tr>
<tr>
<td>Capacity</td>
<td>1,200 workers</td>
</tr>
<tr>
<td>Radiation dose in Building</td>
<td>Non-controlled area</td>
</tr>
</tbody>
</table>

* Excluding the access-way

Diagram:
- **Large Rest House (non-controlled area)**
- **Access-way**
- **Entry control facility**
- **Non-controlled area**
- **Controlled area**
- From external area
- From the field

Relation of entry control facility and Large Rest House Image
4.4 Establishment of large Rest House (2/2)

Foundation construction underway (including piling)
5. Establishment of vehicles maintenance site (1/2)

**Location**

Construction start: August 2013
Operation start: scheduled in May 2014

Planned building
Max. height: 9.30m
Max. eave height: 9.00m

Construction landscape: status as of February 25, 2014
5. Establishment of vehicles maintenance site (2/2)

**Outline of vehicles maintenance**

- **Type of vehicles maintenance**
  - Periodical inspection (legal inspection)
    * Operated as uncertified factory
- **Capacity of vehicles maintenance**
  - Large vehicles: 2
  - Small vehicles: 2
- **Scheduled operation start**
  - May 2014

- **Usage inside the building**
  - Work room (700.65m²): inspection and maintenance of vehicles
  - Office room (24.29m²): administration work related to inspection and maintenance
  - Grease storage (27.82m²): [Temporary hazardous materials storage]
    * Temporary storage of grease generated during inspection and maintenance
6. Image of waste treatment and storage (1/2) (rubble)

Present
- Outdoor storage
- Soil-covered temporary storage (1-2 pools)
- Temporary shield
- Container storage
- Sheet coverage

Around 5 years later (FY2018)
- (*) Facilities will be installed to reduce as much volume as possible
- Soil-covered temporary storage (1-4 pools)
- Sheet coverage

Around 10 years later (FY2023)
- (*) Facilities will be installed to reduce as much volume as possible
- Soil-covered temporary storage (1-4 pools)
- Sheet coverage
- Recycling partially on site is considered

Around 15 years later (FY2028)
- (*) Facilities will be installed to reduce as much volume as possible
- Soil-covered temporary storage (1-4 pools)
- Sheet coverage

From then onward
- Pre-treatment
- Treatment for disposal
- Buried
- Disposal facility
6. Image of waste treatment and storage (2/2)

(flammable materials, protective clothing, trimmed trees)

- Flammable rubble
  - Outdoor storage
  - Temporary trimmed trees storage pool
- Protective clothing
  - Container storage
  - Temporary trimmed trees storage pool
- Branches, leaves, roots
  - Outdoor storage
  - Temporary trimmed trees storage pool
- Trunks, roots
  - Outdoor storage
  - Temporary trimmed trees storage pool

Pre-treatment of trimmed branches, leaves, and roots is performed in the present. 

1 year later (FY2014):
- Incinerator
- Outdoor storage
- Temporary trimmed trees storage pool

Around 5 years later (FY2018):
- Incinerator
- Outdoor storage
- Temporary trimmed trees storage pool

Around 10 years later (FY2023):
- Incinerator
- Solid waste storage
- Pre-treatment
- Treatment for disposal
- Disposal facility

Later years from FY2028:
- Recycling partially on site is considered
- Buried

Storage after incineration

Present 1 year later (FY2014) Around 5 years later (FY2018) Around 10 years later (FY2023) Storage after incineration

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7. Location of tanks
8. Measures to prevent overflow (raising fence height by steel plates)

- General area (outside)
- General area (inside)
- Pipe connection (outside)
- Pipe connection (inside)

**Rainwater prevention measures**

- Urethane painting
- Caulking
- Cutout part
- Steel plate for height raising
- Concrete
- Caulking
9. Measures to prevent overflow (raising fence height by steel plates)

**Catch basin before closure (outside)**

- Steel plate for height raising
- Concrete

**Catch basin after closure (outside)**

- Catch basin filled by concrete
- Steel plate for height raising
- Drain valve steel pipe
- Concrete

**Catch basin before closure (inside)**

- Steel plate for height raising
- Concrete

**Catch basin after closure (inside)**

- Closed by steel plates
- Additionally painted by urethane
- Urethane painting
- Caulking
- Installing flexible pipe

**<Rainwater prevention measures>**
10. Measures to prevent inflow (installing rain gutters (1))

Priority: Priority to implement measures is placed on areas with higher level of contamination

Image of rain gutter installation
- Metal gutters are placed around the top of tanks.
- Rainwater of several tanks are combined and discharged outside concrete fences via drain pipes.

* To prevent ingress of rainwater from the side, gutter are installed
10. Measures to prevent inflow (installing rain gutters (2))

Mockup of H2 south side tank

Image after water drip

- (1) Metal gutter
- (2) Fixing bracket
- (3) Support
- (4) PVC drain pipe
- (5) Permeable drain pipe
- (6) Water drip
- (7) Drain pipe support
11. Underground seeping prevention measures and further height raise

- Installation status of H8 external fences and seeping prevention

- Installation status of H8 internal fences
  - Steel fence
  - Height: 90cm

- Installation status of G5 internal fences
  - Height: 105cm

Surrounding fence
Drainage
Seeping prevention
12. Drainage inflow prevention measures
(coverage over B drainage (1))

- **Drainage coverage**
  - Buried pipe type → **Double pre-stressed pipe Φ1000-1100mm: L=460m / FRP pipe 2000mm: L=212m**
  - Cap type → **FRP cap: L=400m / concrete cap (penetration for cables): L=50m (distributed across the site)**

- **Water stoppage gates:** 3

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**Fig. 1:** Buried pipe type covered drainage

**Fig. 2:** Cap type covered drainage

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12. Drainage inflow prevention measures
(coverage over B drainage (2))

- **High-pressure water cleaning**
- **Base treatment (side wall)**
- **Lining 1st layer (side wall)**
- **Lining 2nd layer (deck slab)**

**B system channel before lining**

**B system channel after lining**
13. Measures to increase capacity of temporary storage tanks for rainwater inside the fences

Capacity increase of temporary storage tanks is underway. At present, 9 tanks were installed. Additional 5 tanks will be installed.
14. Caulking around bottom edge of flange tanks

- In conjunction with painting on the concrete surface inside the Tank Area fences, mainly to prevent rainwater into the tank bottom, caulking around tank bottom edge is underway.
- By early April 2014, the work is scheduled for completion (the schedule may change depending by weather).
15. Patrol enhancement for flange type tanks

Unifying measurement procedure geometry for each worker (reflected in the manual for which training was provided)

- **Unifying measurement distance**: Need to reduce variation of measured values due to miner difference in measurer’s route, and distance [refer to the image below]
- **Unifying measurement direction (unifying direction (direction and location of measurement equipment))**: Need to reduce variation of measured values due to direction and location of measurement equipment
- **Ensuring time constant**: Need to prevent accuracy shortage due to miner difference of walking speed and time reading [refer to the image below]
- **Clearly specifying roles and responsibilities of patrollers**: Potential inspection mistake if the scope of inspection roles is not clearly specified
- **Appropriate inspection procedures**: Potential inspection mistake if inspection is simultaneously conducted for tanks and fences

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**Unifying measurement distance**

- Tank circumference is measured from approx. 1m from the tank side surface

**Ensuring time constant**

- The gauge must always be directed to the measurement target
- Regarding the drop phenomenon from G6 south C3 tank (November 15, 2013), by tentative survey, the drops (one drop/4 second) were detected from the top in the situation where water was accumulated inside the fences.
Installation of water level observation apparatus in flange-type tanks was completed, and monitoring is in operation from December 9, 2013. The next step will involve the scheduled evaluation of the water level data and improvement of alert issuance value.
17. Work environment improvement for fuel removal from Unit 4 spent fuel pool (1/4)

- In addition to the north side of the cover, shields are installed mainly on work area.
- For fuel handling system and work workbench vehicle, shields of lead equivalent 3-12mm Pb* are installed. Regarding radiation source under the floor, approx. 60% reduction is expected.
- For places where shields cannot be installed as planned above due to installation conditions, shields as thick as possible are installed in consideration of weight.
- Regarding radiation source on the north side of the cover, approx. 40% reduction is expected. (Cover north side lead plate mat 4.4mm Pb + Well west side protection partition 2mm Pb = 6.4mm Pb)
- Steel plate on the north side of the cover is fixed with bolts on fuel handling system structure. Lead plate mat on the north side is hung down using fixing bracket on the cover structure.

* For places where shields cannot be installed as planned above due to installation conditions, shields as thick as possible are installed in consideration of weight.
Dose rate was measured on operating floor before and after the installation of shields.

- Dose rate around DSP (Points No.1-17) is decreasing by 32-36% compared to that before shields installation.
- Dose rate around Well (Points No.18-36) is decreasing by 37-40% compared to that before shields installation.
- Dose rate around SFP (Points No.37-55) is decreasing by 8-12% compared to that before shields installation.
- Dose rate at upper point is higher than that at lower point, the same as before shields installation.
17. Work environment improvement for fuel removal from Unit 4 spent fuel pool (3/4)

Example of shields installation status

<table>
<thead>
<tr>
<th>Measurement point</th>
<th>On the trolley of fuel-handling machine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In front of control panel</td>
</tr>
<tr>
<td></td>
<td>Approx. 1m high</td>
</tr>
<tr>
<td></td>
<td>Northwest overhang</td>
</tr>
<tr>
<td></td>
<td>Approx. 1m high</td>
</tr>
</tbody>
</table>

**Installation effect**

**Before installation:**
- On the trolley of fuel-handling machine: 0.055mSv/h
- Northwest overhang: 0.080mSv/h*

**After installation:**
- On the trolley of fuel-handling machine: 0.025mSv/h (Approx. 55% reduction)
- Northwest overhang: 0.050mSv/h (Approx. 38% reduction)

**Remarks**

- On floor surface, lead plate mat of lead equivalent 12mmPb was installed. On handrail, tungsten mat of lead equivalent 6mmPb was installed. On the upper part of control panel, plate glass including lead of lead equivalent 2mmPb was installed.
- Dose rate after installation includes effects after installation of steel plate and lead plate mat on the north side of fuel removal cover.
- * As the dose rate was not measured before installation, measurement value during installation of shields for floor surface and handrail is written.
Average exposure dose per worker in one group (average exposure dose per worker working for approx. 2 hours)

- Average exposure dose during initial period of fuel removal (average of 2\textsuperscript{nd}-5\textsuperscript{th} casks): approx. 0.098mSv/worker-group
- Average exposure dose during initial period of shields installation (average of 13\textsuperscript{th}-18\textsuperscript{th} casks): approx. 0.055mSv/worker-group (approx. 44\% reduction)
- Latest average exposure dose (average of 21\textsuperscript{st}-23\textsuperscript{rd} casks): approx. 0.043mSv/worker-group (approx. 56\% reduction)

Average exposure dose was high because some groups work twice during the same day.

(Reflecting until completion of 23\textsuperscript{rd} cask)