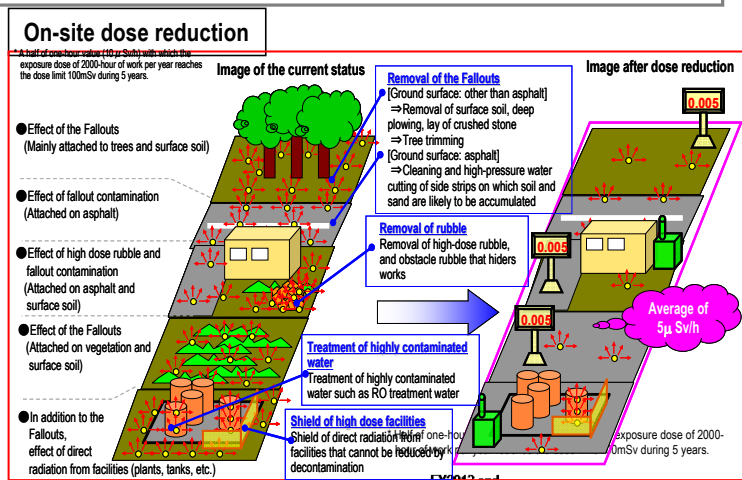


- The progress status of Emergency Safety Measures formulated based on instructions by the Chairman of the Nuclear Regulation Authority on October 28, 2013 is reported.
- The Emergency Safety Measures will also be strongly promoted at Fukushima Daiichi D&D Engineering Company scheduled for launch in April 2014.

## 1. Drastic improvement in the work environment toward acceleration and reliability improvement in fieldwork

- Improving the work environment and welfare facilities, and preventing human errors through such improvement

Category	Item	Contents	Progress status
Work safety	On-site decontamination (expanding non full-face mask required area)	Expanding non full-face mask required area	<ul style="list-style-type: none"> <li>• (Completed) Central area and north side area of the site</li> <li>• 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)</li> </ul>
		Reducing dose within the site*1	<ul style="list-style-type: none"> <li>• 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)</li> </ul>
	Removing rubble on the sea side	Removing damaged vehicles on the east side of the Turbine Building	<ul style="list-style-type: none"> <li>• 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)</li> </ul>
	Enhancing on-site lighting facilities	Flange-type tank areas	<ul style="list-style-type: none"> <li>• Around the Tank Area, construction of utility poles and installation of lighting units are underway (scheduled for completion in May 2014)</li> <li>• Installation of 62/73 utility poles and approx. 1850/2500 meters high-voltage electrical power lines is completed</li> </ul>
		South side tank areas	
Improving the communication environment	Improving the on-site outdoor communication environment	(Completed)	
	Measures for areas with inadequate communication environment inside buildings	(Completed) Entry control facility and emergency medical service room (December 25, 2013) (Commenced/ongoing) Temporary Administration Office Building, large Administration Office Building	
Administration Office Building/ Rest House	Installing a new Administration Office Building at Fukushima Daiichi Nuclear Power Station	Temporary Administration Office Building (Capacity: approx. 1,000 employees)	<ul style="list-style-type: none"> <li>• In conjunction with the design, site development, ground improvement and foundation construction are underway (Scheduled for completion: Phase I, June 2014; Phase II, September 2014)</li> </ul>
		Administration Office Building (for employees of TEPCO and partner companies)	<ul style="list-style-type: none"> <li>• Location of the Administration Office Building (west side of the entry control facility) was selected</li> <li>• Basic requirements (size, etc.) are under examination (scheduled for completion by the end of 2015)</li> </ul>
	Installing an additional Rest House on site	Mobile Rest House using large bus/ concrete prefabricated Rest House	<ul style="list-style-type: none"> <li>• Operation of mobile Rest House began from January 14, 2014</li> <li>• As alternative of concrete prefabricated Rest House, external temporary Rest House is under construction (Scheduled to go into operation from early April 2014)</li> </ul>
		Large Rest House (9-storied, with capacity for approx. 1,200 workers)	<ul style="list-style-type: none"> <li>• Construction began from January 27, 2014</li> <li>• Foundation construction is underway (Scheduled for completion by the end of March 2015)</li> </ul>
Improving and enhancing diet	Installing a Meal Service Center near Fukushima Daiichi Nuclear Power Station to serve meals for 3,000 workers	<ul style="list-style-type: none"> <li>• Candidate location (Ohgawara district in Ohkuma town) was selected</li> <li>• Informative presentation regarding the installation in Ohkuma town (March 19, 2014) (Scheduled for completion by the end of 2014)</li> </ul>	
Emergency medical services	Enhancing emergency medical instruments	Installing additional echocardiograph, automatic cardiac massager and ambulance	<ul style="list-style-type: none"> <li>• Echocardiograph (1) and automatic cardiac massager (1) were ordered; scheduled for delivery on March 25, 2014</li> <li>• Ambulances (3); purchase procedures are underway toward acquisition in March 2014</li> </ul>
Labor environment of workers*2	Establishing a vehicle maintenance site on site	Establishing a maintenance site for vehicles used on site only	<ul style="list-style-type: none"> <li>• Site development and piling were complete; at present foundation construction and disassembling (reinforcing steel) are underway (Scheduled to go into operation in May 2014)</li> </ul>
		Increasing commuter bus services	Increasing commuter bus services to reduce bus waiting time during commuting time zone
	Increasing designed additional labor compensation	Increase designed additional labor compensation applied to on-site work (10,000 yen/day -> 20,000 yen/day)	<ul style="list-style-type: none"> <li>• Examination on measures to reflect in wages of workers and report on examination status were requested to prime contractors (as of January 24, 2014, aggregation of reports is underway)</li> </ul>
	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 employees	Enhancing the facilities of the Main Anti-Earthquake Building	Installing items for naps	(Completed)
		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	(Completed)
Reviewing benefits of employees	Increasing benefits	(Completed)	



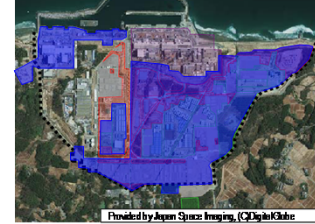
### [Expanded image of 5 μSv/h area]

\* Areas of approx. 5 μSv/h is marked with [blue box]

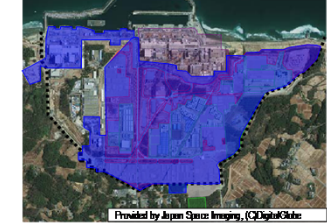
In Area I around Units 1-4, radiation dose is reduced by removing rubble that may hinder the work and shielding the work area. However, as high radiation dose is detected at some points of the plant and facilities, reduction is conducted in alignment with the progress in removing high dose facilities (exhaust stack, etc.) and rubble of Reactor Building.

Legend:  
 ■ 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

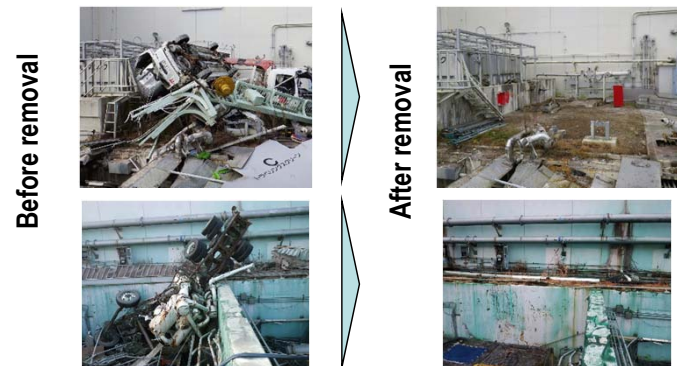
FY2014 end (estimated)



FY2015 end (estimated)



### Removal status of damaged vehicles



## 2. Enhancing management and organization to assure safety and quality

Contents	Progress status
Improving management regarding safety and quality such as formulating work procedures according to fieldwork, thorough risk prediction activities, and enhancing communication with partner companies	Past measures have been based on the cause of leak from tanks. However, in response to the detected leak from H6 area tank top, additional measures to review procedures and education are underway.
Clearly specifying roles and responsibilities in reporting lines in the field, including the relationship with partner companies	
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 issues are restructured and enhanced, and management staff is increased (Organization is strengthened by establishing the Fukushima Daiichi D&D Engineering Company <sup>93</sup> in April 2014, and management staff has been steadily increased since November 2013)
Enhancing human resources related to measures for contaminated water and tank by mobilizing all human resources at the company (increasing 220 workers)	(1) Redeployment at Fukushima Daiichi, and transfer from Fukushima Daini and Kashiwazaki-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

## 3. Installation of permanent facilities

- Installing permanent facilities to ensure long-term decommissioning

Contents	Progress status	
Installing a new central monitoring room (Improving central management capability)	Functions required for the new monitoring room are under examination and being formulated	
Replacing switching station/power panel	North side (Units 5-6 side): constructing a new power supply platform South side (Units 1-4 side): enhancing the facilities	
Repairing roads	<ul style="list-style-type: none"> <li>Repair of the G-area east side road, 5 junction to Units 2-3 road, and Unit 4 east side 10-4m road was completed</li> <li>Repair of road around the B area, road around the Unit 2 soil disposal site, road on the south side of the observation deck, and road around HTI are scheduled for completion by the end of March 2014</li> </ul>	
Building on site infrastructure	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
Waste treatment/storage facilities	In coordination with local communication, installing waste treatment and storage facilities	<ul style="list-style-type: none"> <li>Installation of 9th solid waste storage: application for the revision of the Implementation Plan on the Specified Nuclear Power Facilities is in preparation</li> <li>Regarding the installation plan for additional solid waste storage and reduction facilities such as incinerator, policies including a temporary site utilization plan are being formulated</li> </ul>
Fire prevention measures such as fire alarm and extinguisher	<ul style="list-style-type: none"> <li>Reviewing rules for handling flammable waste/hazardous substances, ensuring storage site</li> <li>Increasing the number of fire alarms and extinguishers in/out of the building</li> </ul>	<ul style="list-style-type: none"> <li>Rules for handling flammable waste/hazardous substances are in operation and reviewed as necessary</li> <li>Collection of handling flammable waste/hazardous substances is underway; notification of storage site is scheduled to be submitted</li> <li>For outdoor fire alarms, installation of a monitoring camera is under examination</li> <li>Installation of fire alarms and extinguishers in a high-dose area inside the buildings is under examination</li> </ul>
Improving reliability of conduits	<ul style="list-style-type: none"> <li>Replacement of high-voltage cables placed in the side ditch of roads is underway</li> <li>Replacement of a water treatment facility transfer line with polyethylene pipes is underway</li> </ul>	

## 4. Rainwater prevention measures

- Implementing measures to prevent overflow from fences and reduce inflow into fences to appropriately manage rainwater (-> preventing contaminated rainwater from overflowing)

Measures	Progress status	
Preventing overflow	Raising height of fences by steel plate H4 north area (highly contaminated)	(Completed)
	Other areas	(Completed)
Preventing rainwater inflow	Further raising height of fences by concrete or steel plate (improving reliability)	<ul style="list-style-type: none"> <li>At C, G3, G4, G5 and G6 areas, installation of concrete base fences is underway</li> <li>At H2 and H8, installation of steel base fences is underway (Completion of all areas is scheduled in May 2014)</li> </ul>
	Installing rainwater gutters to tank top at contaminated places with high level of dose	(Completed)
Preventing underground seeping	Installing rainwater gutters to all other tanks	<ul style="list-style-type: none"> <li>By the end of June 2014, installation of gutters onto cylindrical flange tanks is scheduled for completion</li> <li>In response to the leak from the top of the H6 area tank, drastic measures to reduce rainwater into Tank Area are under examination</li> </ul>
	Facing ground surface around tanks	<ul style="list-style-type: none"> <li>At G3-G5, H5 and H8 areas, installation of surrounding fences and facing to prevent underground seeping are underway</li> <li>At H3, H4, H8 and H9 areas, development to prevent underground seeping is underway (Completion of all areas is scheduled in May 2014)</li> </ul>
Preventing inflow into drainage	Covering B drainage	Covering was completed and operation began from March 12, 2014
Increasing capacity of the temporary storage tank of accumulated rainwater inside fences		<ul style="list-style-type: none"> <li>Installation of 9 tanks is completed; piping work is underway (Scheduled for completion in end of March 2014)</li> <li>An additional 5 tanks are scheduled for installation</li> </ul>

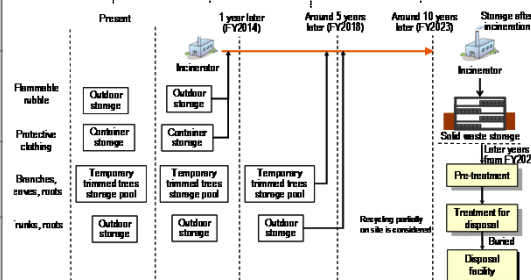
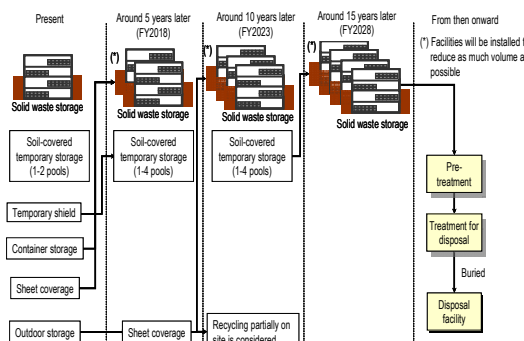


Image of waste treatment and storage



Status of height raising of fences by steel plate



Status of facing over ground surface around tanks

### 5. Causes of leakage of accumulated water from tank and measures

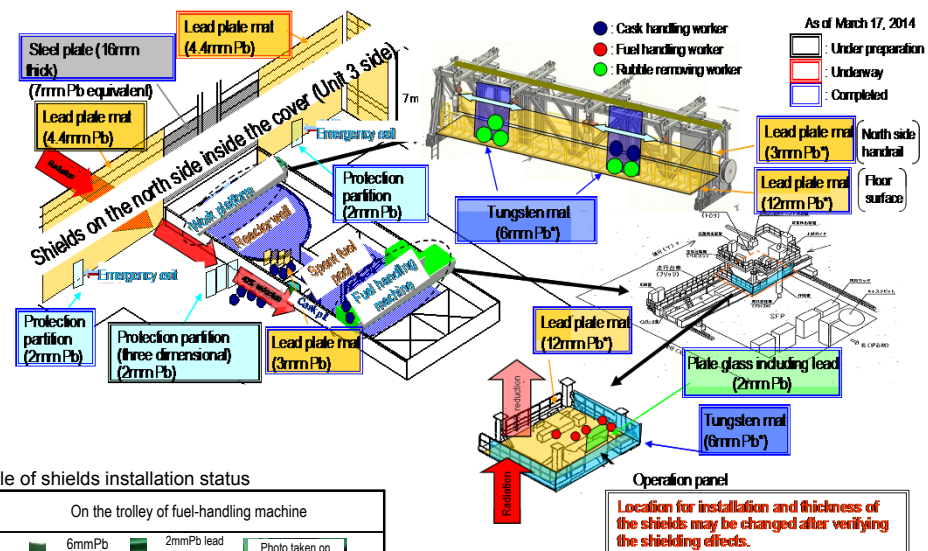
Measures		Progress status
[Temporary measures] Water stoppage for same type of tanks	Water stoppage from tank bottom by caulking	As of March 12, 2014, 16/26 tanks; scheduled for completion in early April
	Applying sealing material to the bottom	<ul style="list-style-type: none"> <li>Demonstration using the actual tank size was conducted in January</li> <li>Examination is underway based on issues in the demonstration</li> </ul>
	Applying sealing material to bottom part (inside)	<ul style="list-style-type: none"> <li>The demonstration confirmed that the requirements had largely been met</li> <li>An implementation plan based on a tank replacement plan is currently being formulated</li> </ul>
[Measures for operation]	Enhancing patrol (4 times/day, total 120/day)	<ul style="list-style-type: none"> <li>Patrol is enhanced by outsourcing; patrol manual is enhanced and the implementation status of the outsourced patrol is checked by employees</li> <li>In response to a leak from the H6 area tank top, the field patrol is enhanced</li> </ul>
	Installing water level observation apparatus to all flange-type tanks	<ul style="list-style-type: none"> <li>Installation of water level gauges to flange-type tanks was completed and operation began</li> <li>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.</li> <li>In response to the leak from H6 area tank top, improvement in water level monitoring and control systems is underway</li> </ul>
Replacement with welded-type tanks		<ul style="list-style-type: none"> <li>Replacement of D area tanks began from March 2014</li> <li>In addition to increasing tanks, replacement is implemented in the prioritized order sequentially: H1, H2 and H4 area tanks</li> </ul>

### 6. Storage plan and measures to appropriately manage contaminated water

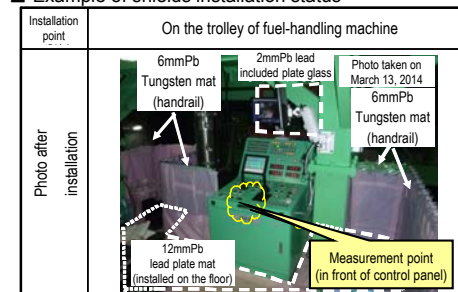
Measures	Progress status
Storage status and increase plan of tanks	<ul style="list-style-type: none"> <li>At present, the total volume of stored concentrated salt water is approx. 440,000 tons and storage capacity is approx. 490,000 tons</li> <li>In J area, the installation of larger tanks is accelerated; 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)</li> </ul>
Replacement of tanks	<ul style="list-style-type: none"> <li>With the target of completion within FY2015, flange-type and horizontal tanks are scheduled to be replaced with welded tanks</li> </ul>
Measures to prevent groundwater inflow	<ul style="list-style-type: none"> <li>Reduction of groundwater inflow by groundwater bypass, pumping of sub-drain and shield on the land side is in preparation</li> <li>A treatment facility for sub-drain is under production; application for approval for change in the facility implementation plan was submitted (December 18, 2013)</li> </ul>
Enhancement and reliability improvement in multi-nuclide removal equipment (ALPS)	<ul style="list-style-type: none"> <li>ALPS is enhanced with the target of operating after mid-FY2014 and completing the treatment of contaminated water stored in tanks within FY2014</li> <li>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)</li> <li>Site development and foundation construction for buildings for both sets of equipment is steadily underway since March 2014</li> <li>Thorough measures for defects such as improving corrosion resistance and correction are ensured and measures to increase operational reliability are implemented</li> <li>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.</li> </ul>

### 7. Fuel removal from Unit 4 spent fuel pool

Progress status
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%))



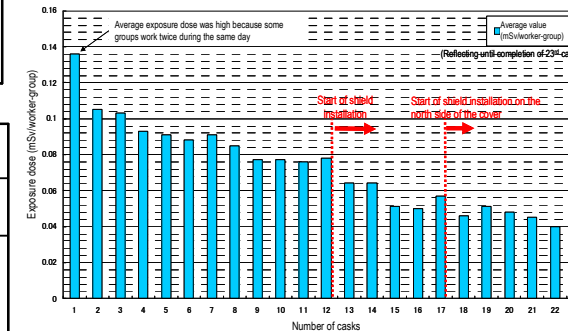
Example of shields installation status



Example of shields installation effect

Measurement point	On the trolley of fuel-handling system In front of control panel	Measured on March 17, 2014
Installation effect	Before installation: 0.055mSv/h After installation: 0.025mSv/h (Approx. 55% 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, lead included plate glass mat 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.	

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



# \* 1. Results of exposure dose

## Distribution of accumulated exposure dose since the accident

(Accumulated dose since March 11, 2011)

Category (mSv)	Mar 2011-Jan 2014		
	TEPCO	Partner companies	Total
More than 250	6	0	6
More than 200 up to 250	1	2	3
More than 150 up to 200	24	2	26
More than 100 up to 150	118	20	138
More than 75 up to 100	258	117	375
More than 50 up to 75	325	878	1,203
More than 20 up to 50	610	4,291	4,901
More than 10 up to 20	544	3,952	4,496
More than 5 up to 10	432	3,783	4,215
More than 1 up to 5	722	6,970	7,692
Up to 1	1,062	7,917	8,979
Total	4,102	27,932	32,034
Max. (mSv)	678.80	238.42	678.80
Average (mSv)	23.61	10.96	12.58

↓ 100mSv or lower  
↓ 50mSv or lower

○ Among 32,034 persons working between March 11, 2011 to January 31, 2014  
 • 31,861 (99.5%): accumulated dose since the accident is 100mSv or lower  
 • 30,283 (94.5%): accumulated dose is 50mSv or lower

## Status of FY2013

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

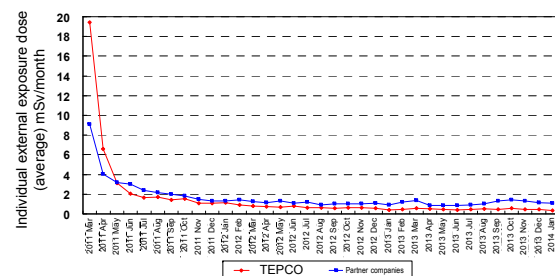
Category (mSv)	Apr 2013-Jan 2014		
	TEPCO	Partner companies	Total
More than 100	0	0	0
More than 75 up to 100	0	0	0
More than 50 up to 75	0	0	0
More than 20 up to 50	24	465	489
More than 10 up to 20	64	1,593	1,657
More than 5 up to 10	169	1,714	1,883
More than 1 up to 5	667	3,426	4,093
up to 1	716	4,316	5,032
Total	1,640	11,514	13,154
Max. (mSv)	36.61	39.96	39.96
Average (mSv)	2.82	4.96	4.69

○ 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

## Transition of monthly individual exposure dose since the accident

Through dose reduction measures and assignment change, average exposure dose is maintained at approx. 1mSv/month (Reference: index annual exposure dose 20mSv/year ⇒ 1.7mSv/month)



○ 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

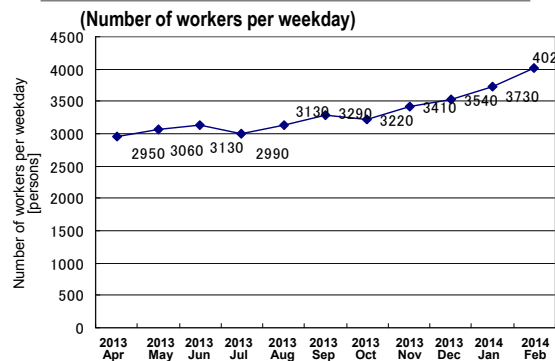
Exposure dose of most workers is at a level largely below the dose limit and continued engagement is available

Efforts to reduce the dose in the work environment will be continued while carefully observing workers' exposure dose status

# \* 2. Measures to increase workers

## Workers are increasing

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



## Securing 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

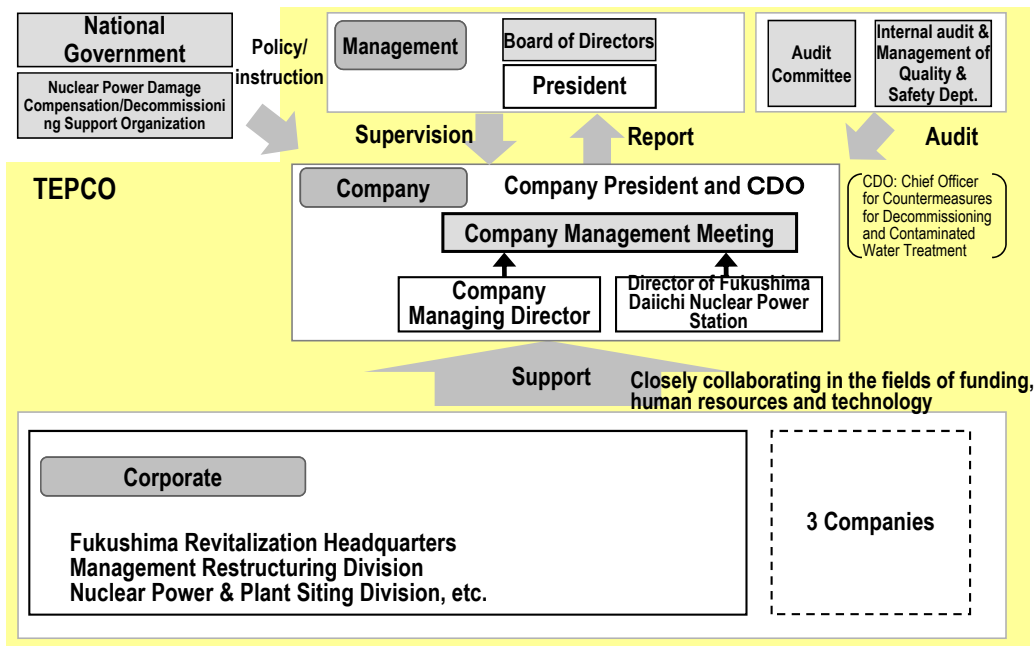
Labor environment improvement G is assigned in the field to examine infrastructure building:  
 • Means of transport (bus operation service)  
 • Parking  
 • Entry control facility (measures to mitigate congestion and switch protective equipment on and off)  
 • Rest House (measures to mitigate congestion)

## Supervision of on-site works

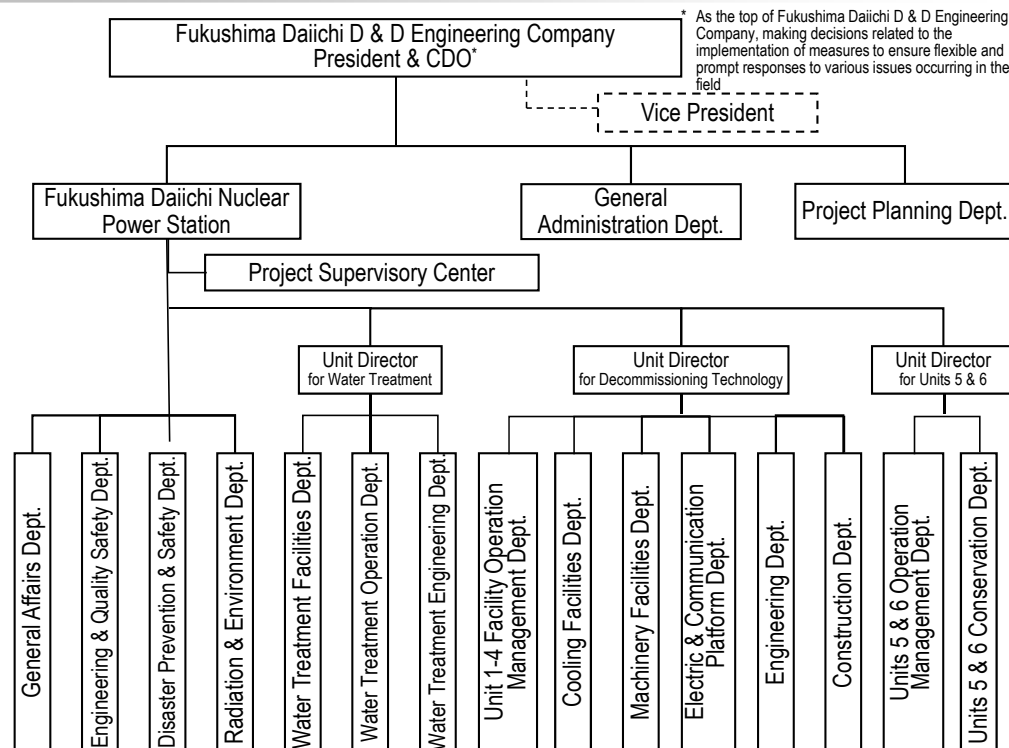
• The Project Supervisory Center centrally manages information related to on-site facilities and works. The Center coordinates the entire project to ensure multiple tasks progress smoothly and simultaneously.

# \* 3 Collaboration between Company and Corporate

# (Reference)



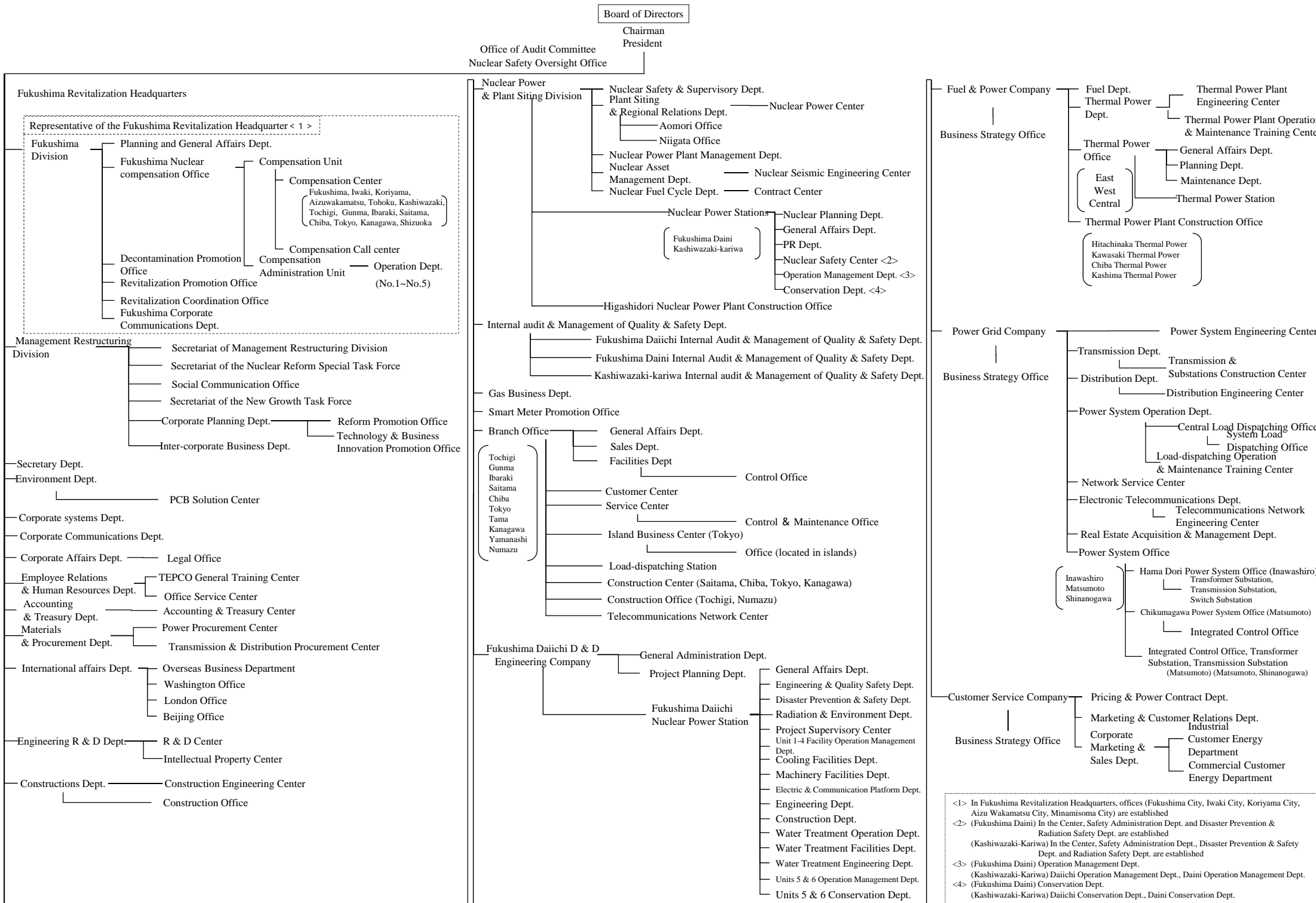
## (Organization)



\* 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 field

# TEPCO Organization Chart

(As of April 1, 2014)



<1> In Fukushima Revitalization Headquarters, offices (Fukushima City, Iwaki City, Koriyama City, Aizu Wakamatsu City, Minamisoma City) are established  
 <2> (Fukushima Daini) 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 Daini) Operation Management Dept.  
 (Kashiwazaki-Kariwa) Daiichi Operation Management Dept., Daini Operation Management Dept.  
 <4> (Fukushima Daini) Conservation Dept.  
 (Kashiwazaki-Kariwa) Daiichi Conservation Dept., Daini Conservation Dept.

**(Reference)**

**Progress Status of Emergency Safety  
Measures at Fukushima Daiichi Nuclear  
Power Station**

**March 20, 2014**

**Tokyo Electric Power Company**



**東京電力**

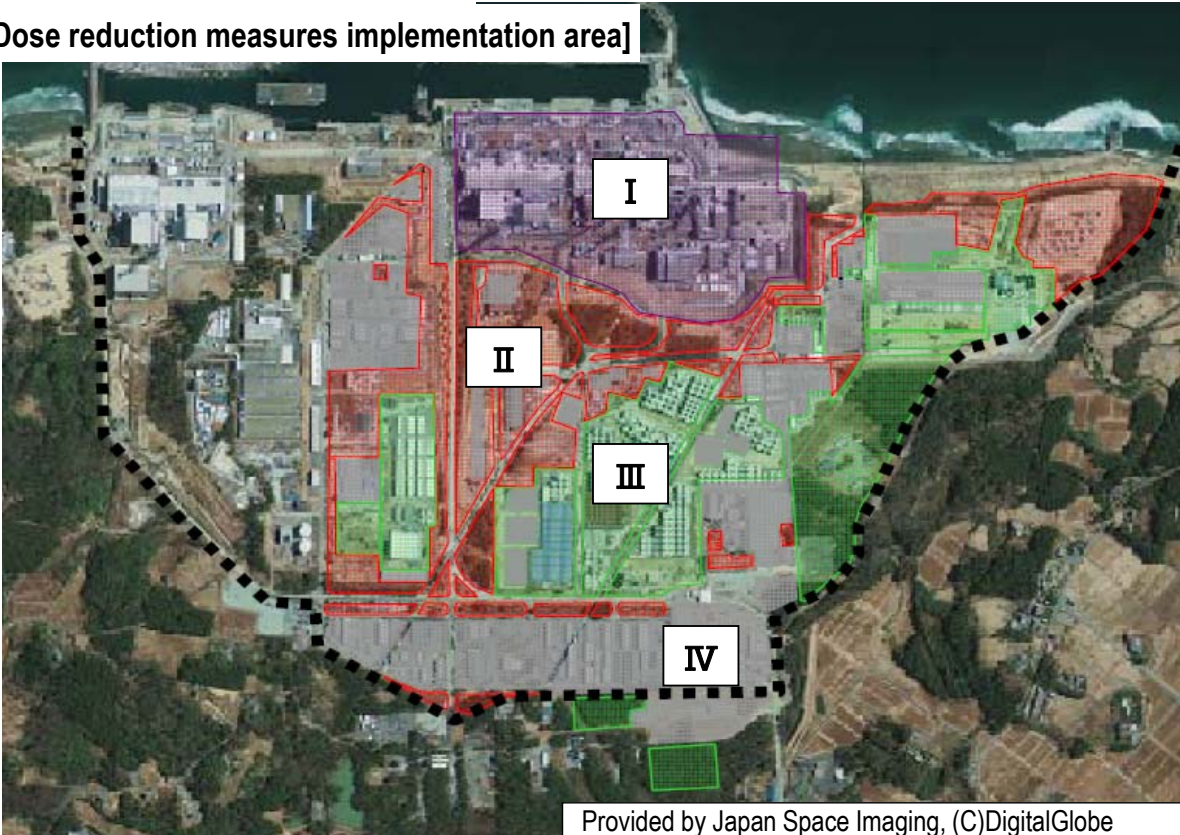
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# 1. Dose reduction plan at Fukushima Daiichi Nuclear Power Station site (1/3)

## [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.

[Dose reduction measures implementation area]



Provided by Japan Space Imaging, (C)DigitalGlobe

- 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

## [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.

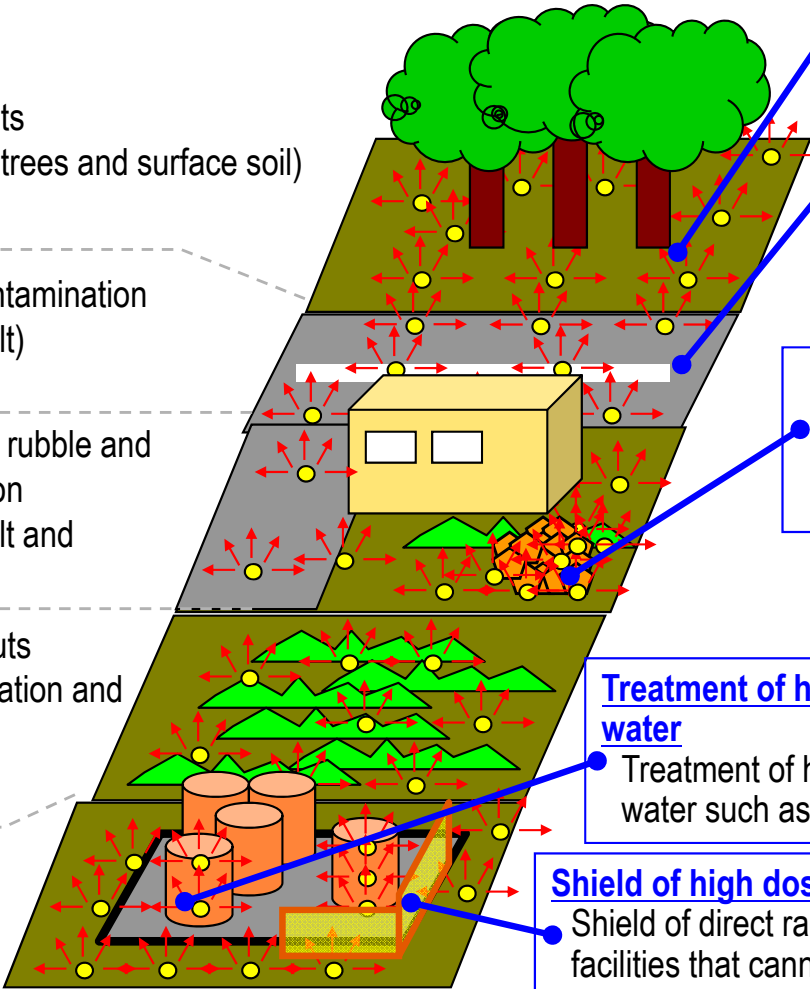
# 1. Dose reduction plan at Fukushima Daiichi Nuclear Power Station site (2/3)

**The target dose rate at south part of the site (Areas II, III and IV) is set to the average of  $5\mu\text{Sv/h}^*$ , 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 ( $10\mu\text{Sv/h}$ ) with which the exposure dose of 2000-hour of work per year reaches the dose limit 100mSv during 5 years.

- Effect of the 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.)

Image of the current status



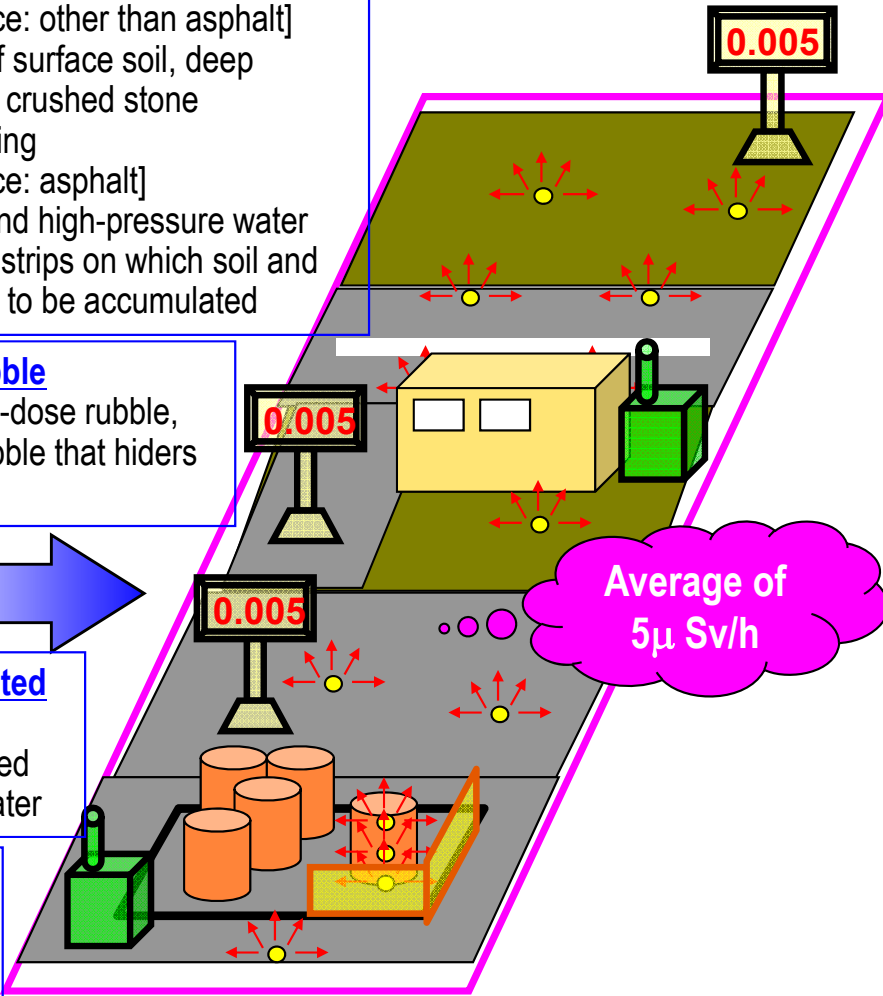
**Removal of the Fallouts**  
 [Ground surface: other than asphalt]  
 ⇒ Removal of surface soil, deep plowing, lay of crushed stone  
 ⇒ Tree trimming  
 [Ground surface: asphalt]  
 ⇒ Cleaning and high-pressure water cutting of side strips on which soil and sand are likely to be accumulated

**Removal of rubble**  
 Removal of high-dose rubble, and obstacle rubble that hinders 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


Image after dose reduction





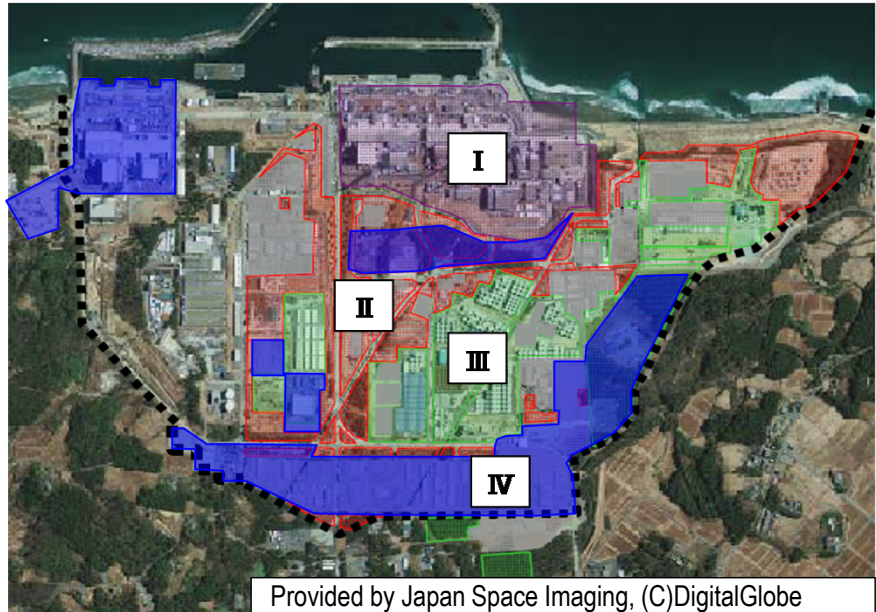
# 1. Dose reduction plan at Fukushima Daiichi Nuclear Power Station site (3/3)

## [Expanded image of 5 $\mu$ Sv/h area]

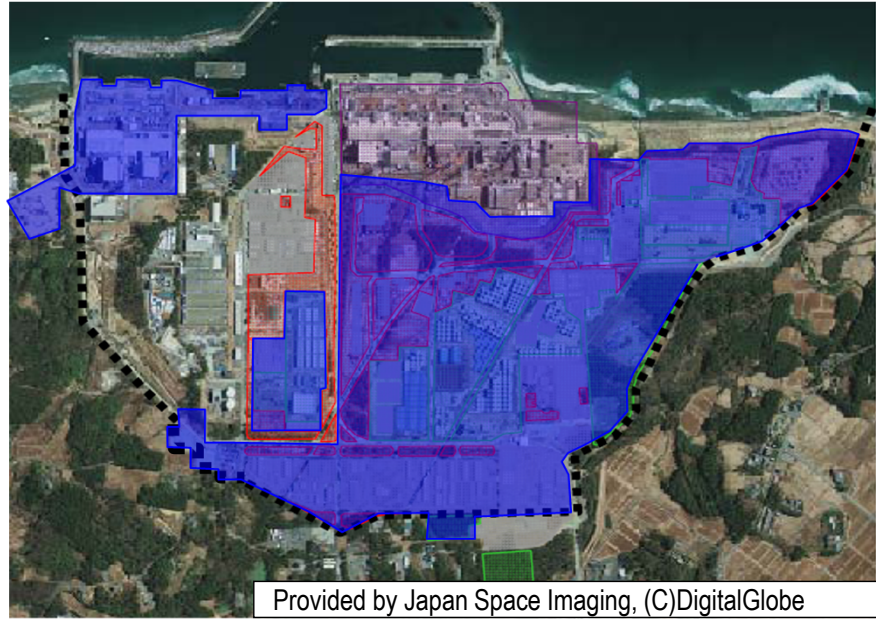
\* Areas of approx. 5 $\mu$ Sv/h is marked with 

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.

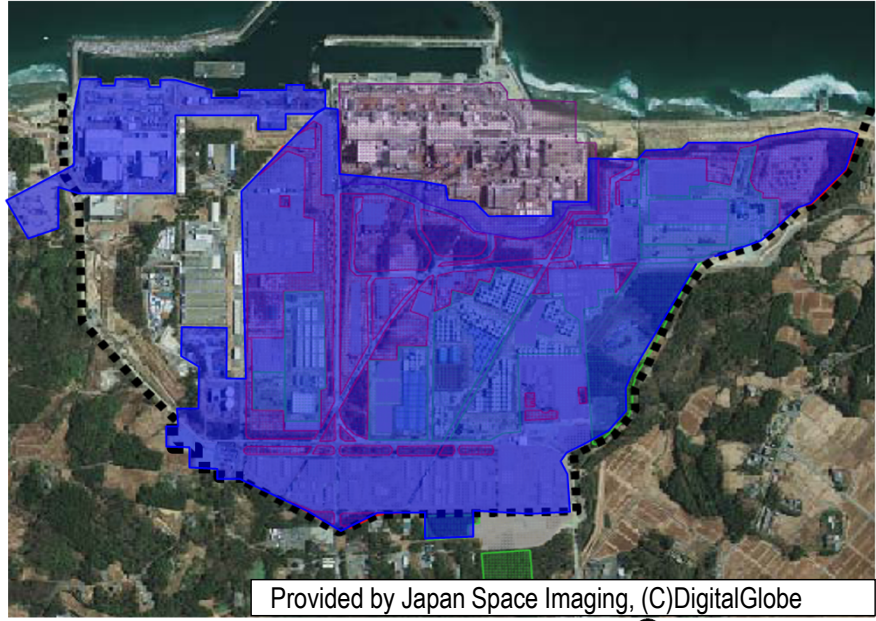
FY2013 end



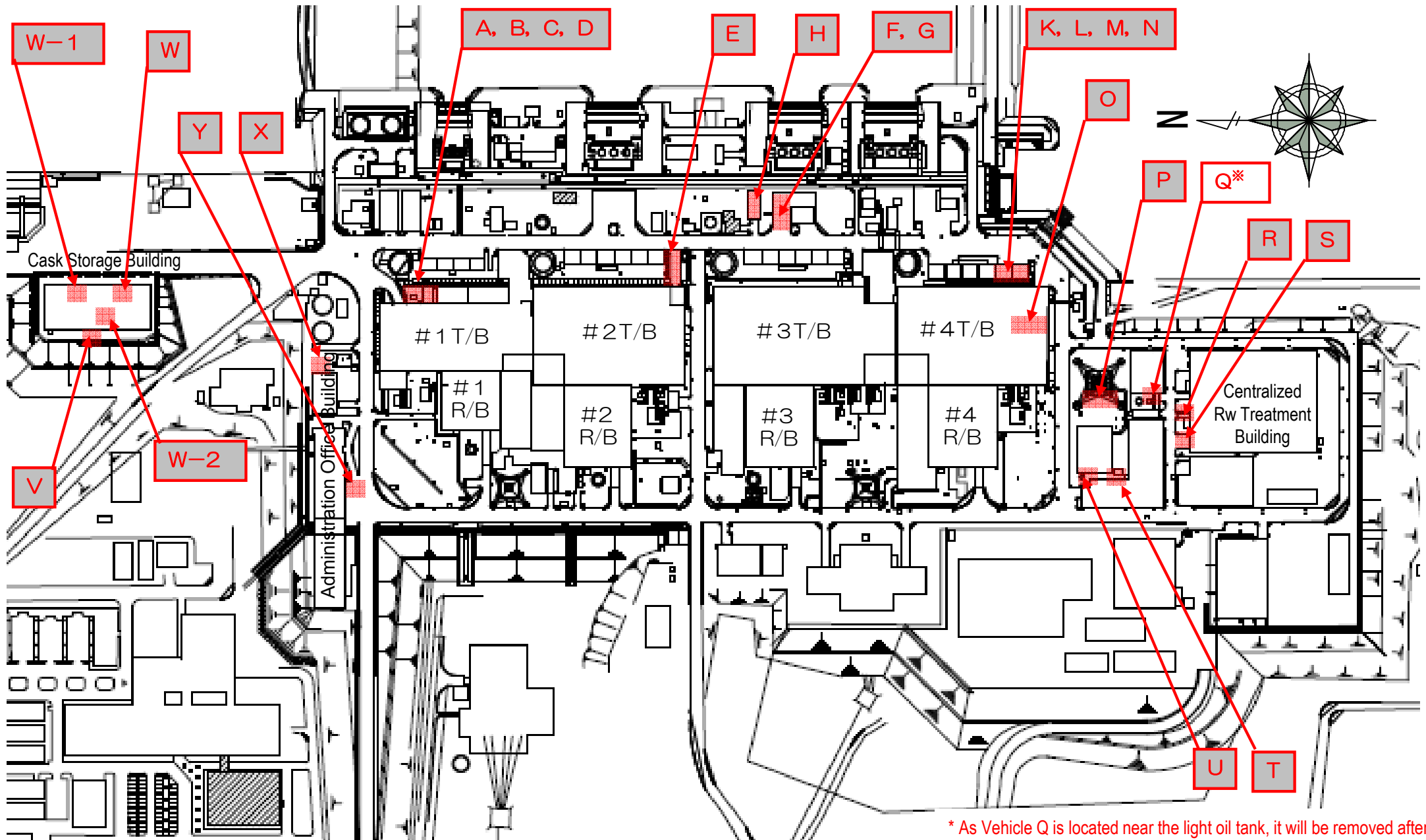
FY2014 end (estimated)



FY2015 end (estimated)



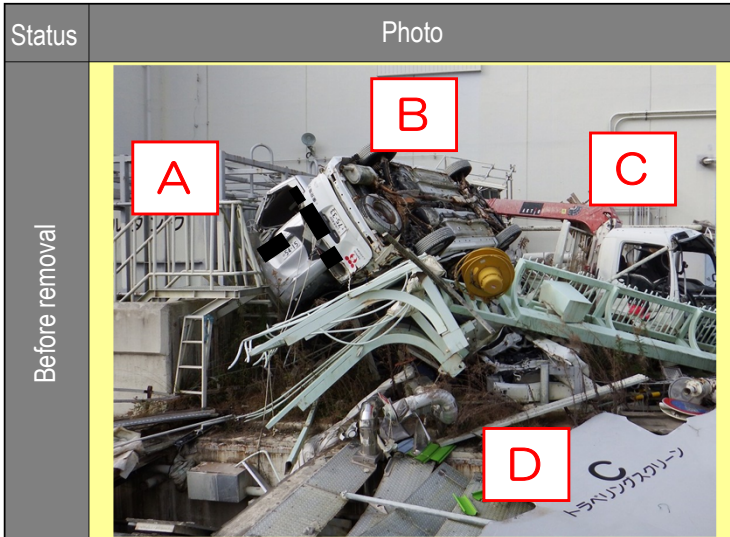
## 2. Status of rubble removal on the sea side (1/7)



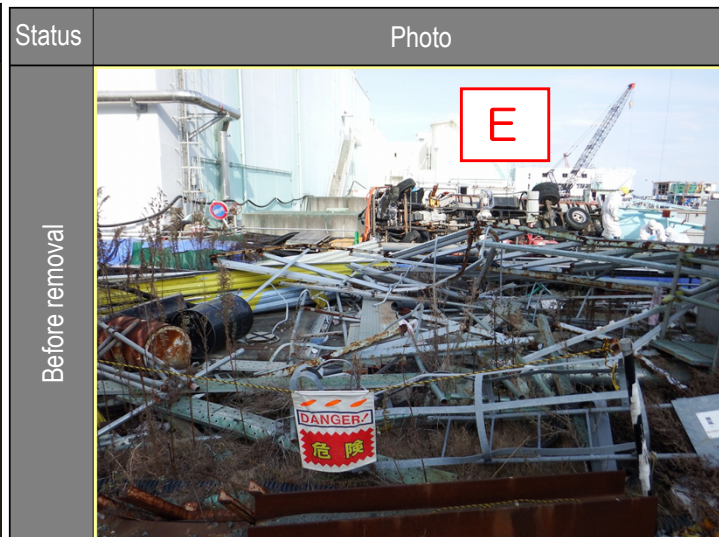
● Removal completed: **24/25 vehicles**  : Removal completed

\* 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)



Removal completed on December 10

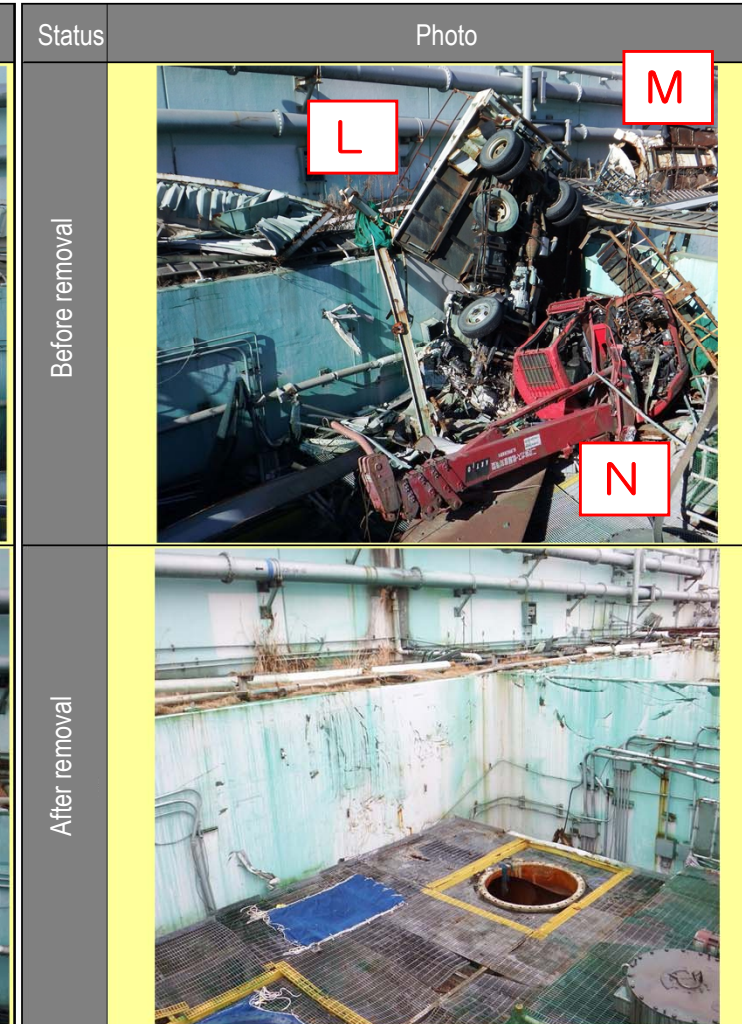
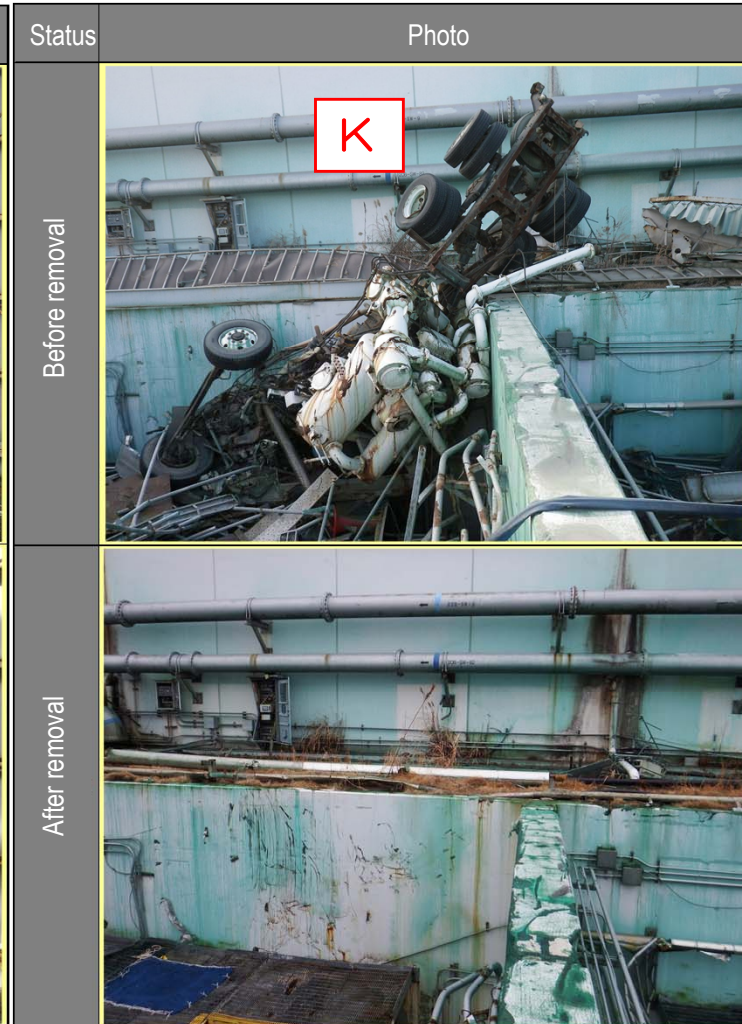
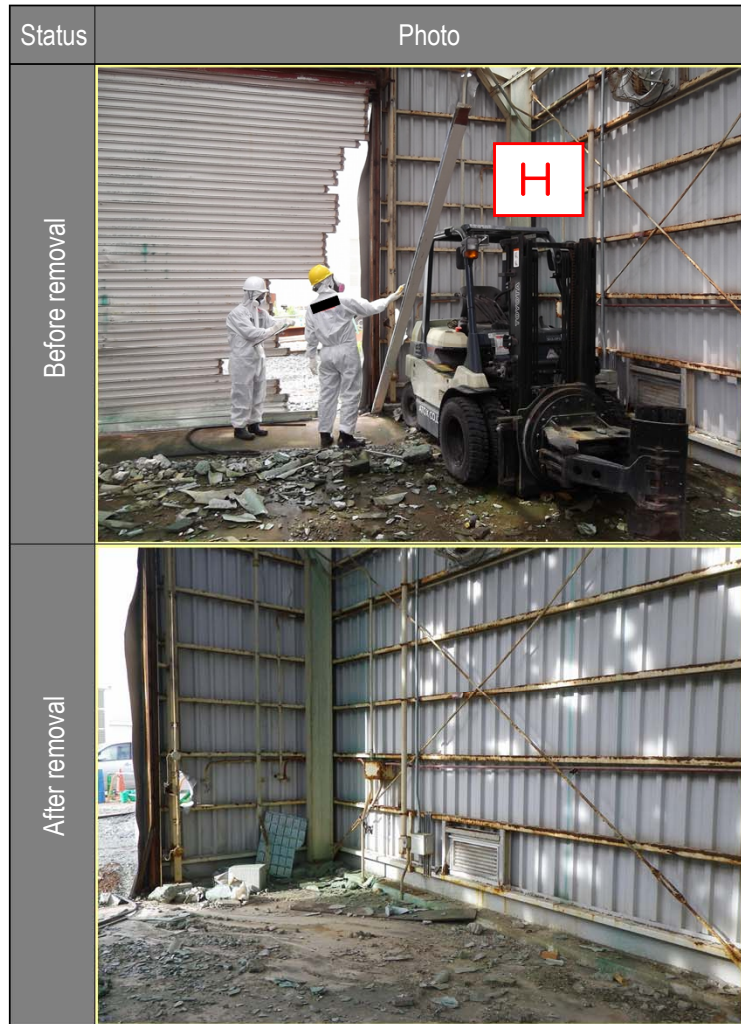


Removal completed on January 11



Removal completed on November 28

## 2. Status of rubble removal on the sea side (3/7)

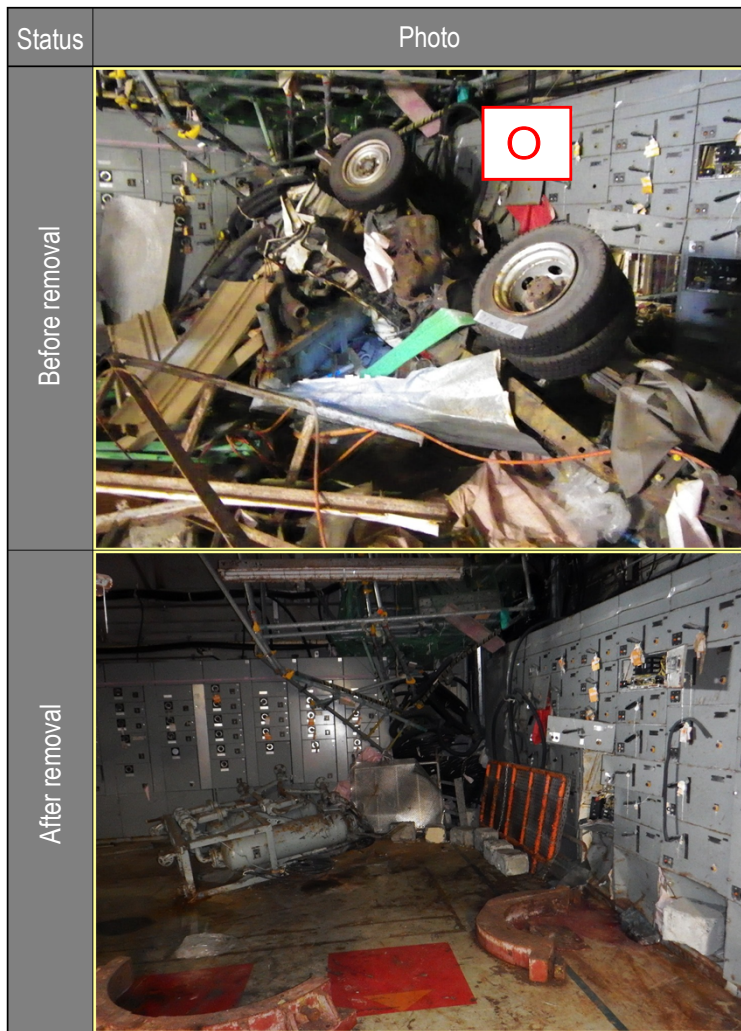


Removal completed on December 16

Removal completed on March 2

Removal completed on March 2

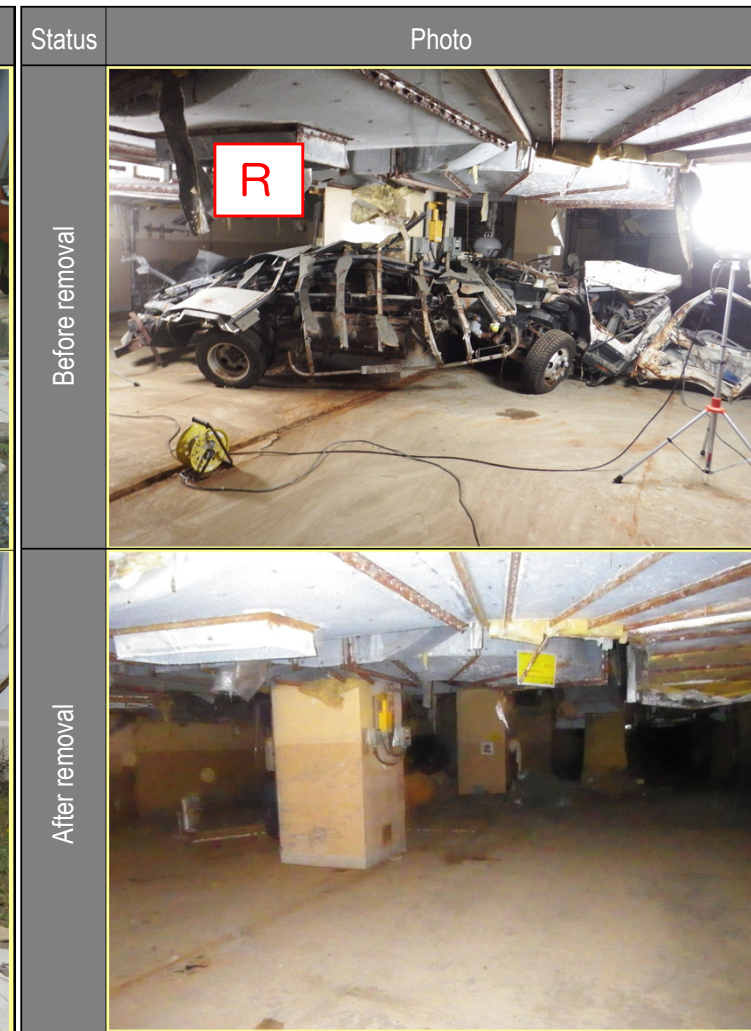
## 2. Status of rubble removal on the sea side (4/7)



Removal completed on January 11



Removal completed on December 16



Removal completed on December 16

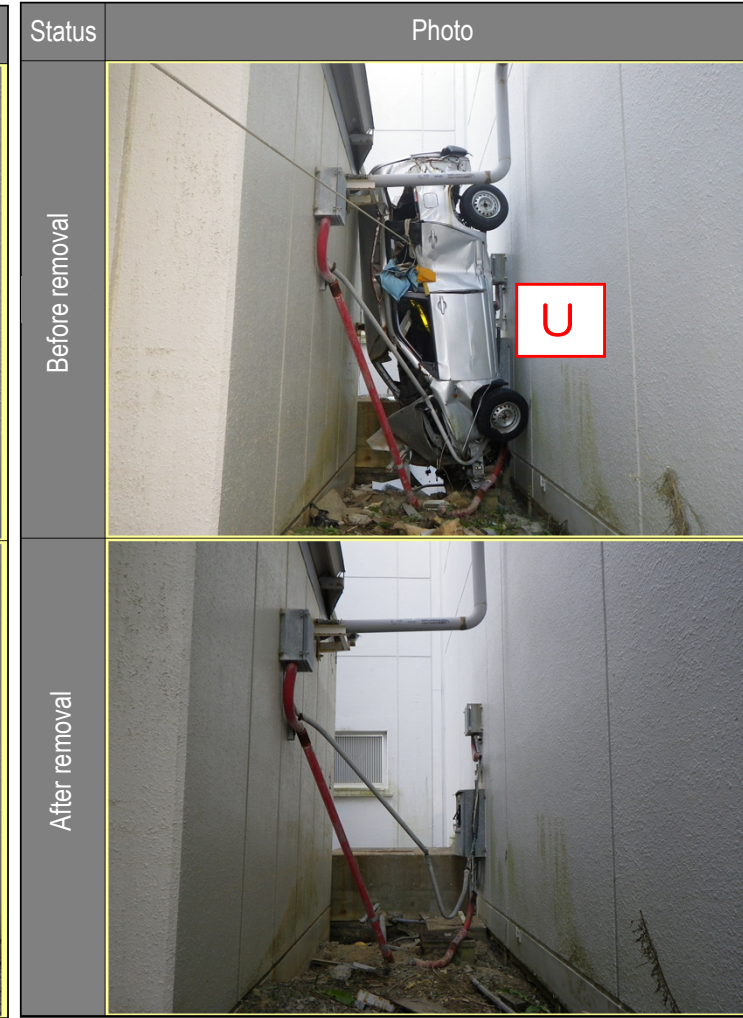
## 2. Status of rubble removal on the sea side (5/7)



Removal completed on December 16



Removal completed on December 16



Removal completed on December 16

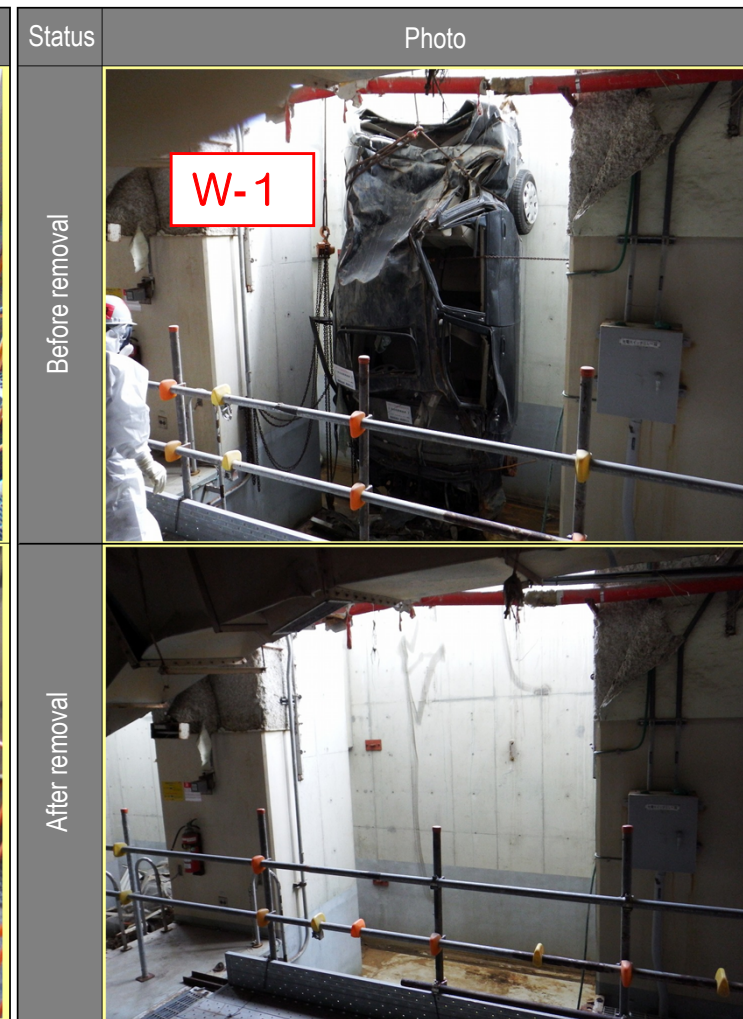
## 2. Status of rubble removal on the sea side (6/7)



Removal completed on February 18

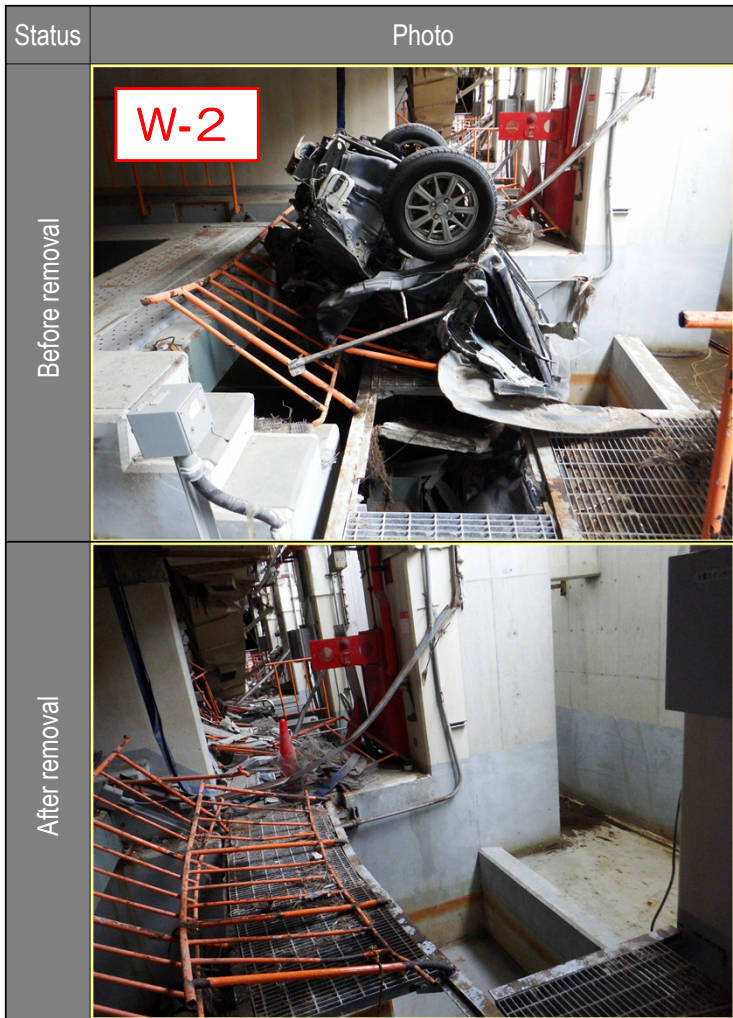


Removal completed on January 20

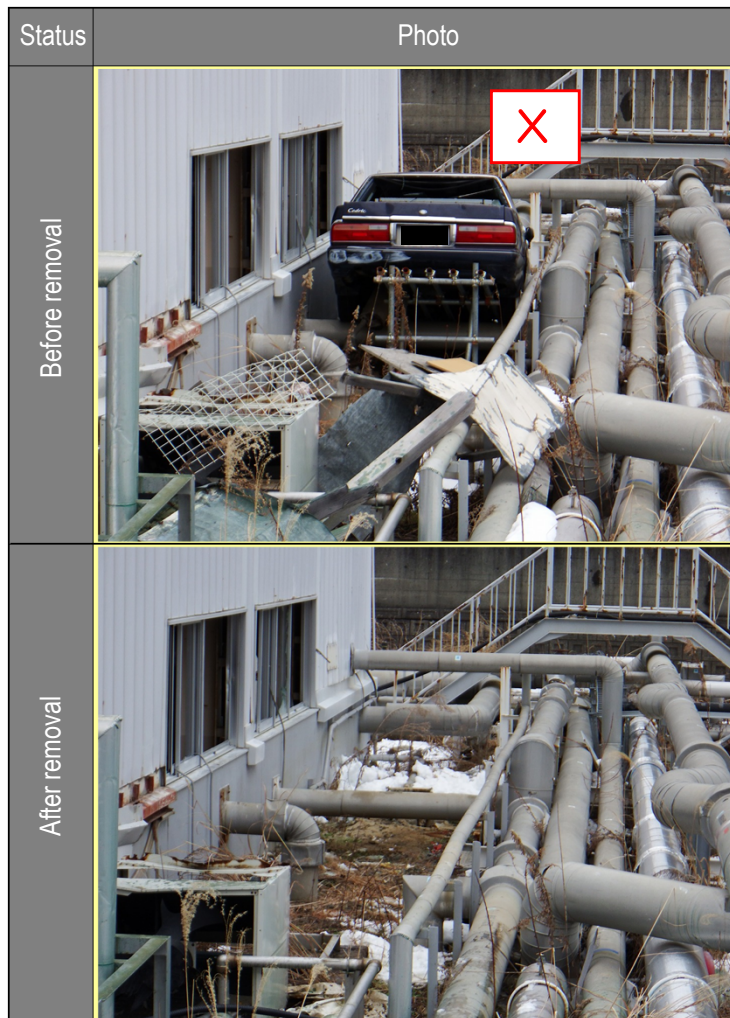


Removal completed on January 20

## 2. Status of rubble removal on the sea side (7/7)



Removal completed on January 20



Removal completed on February 17



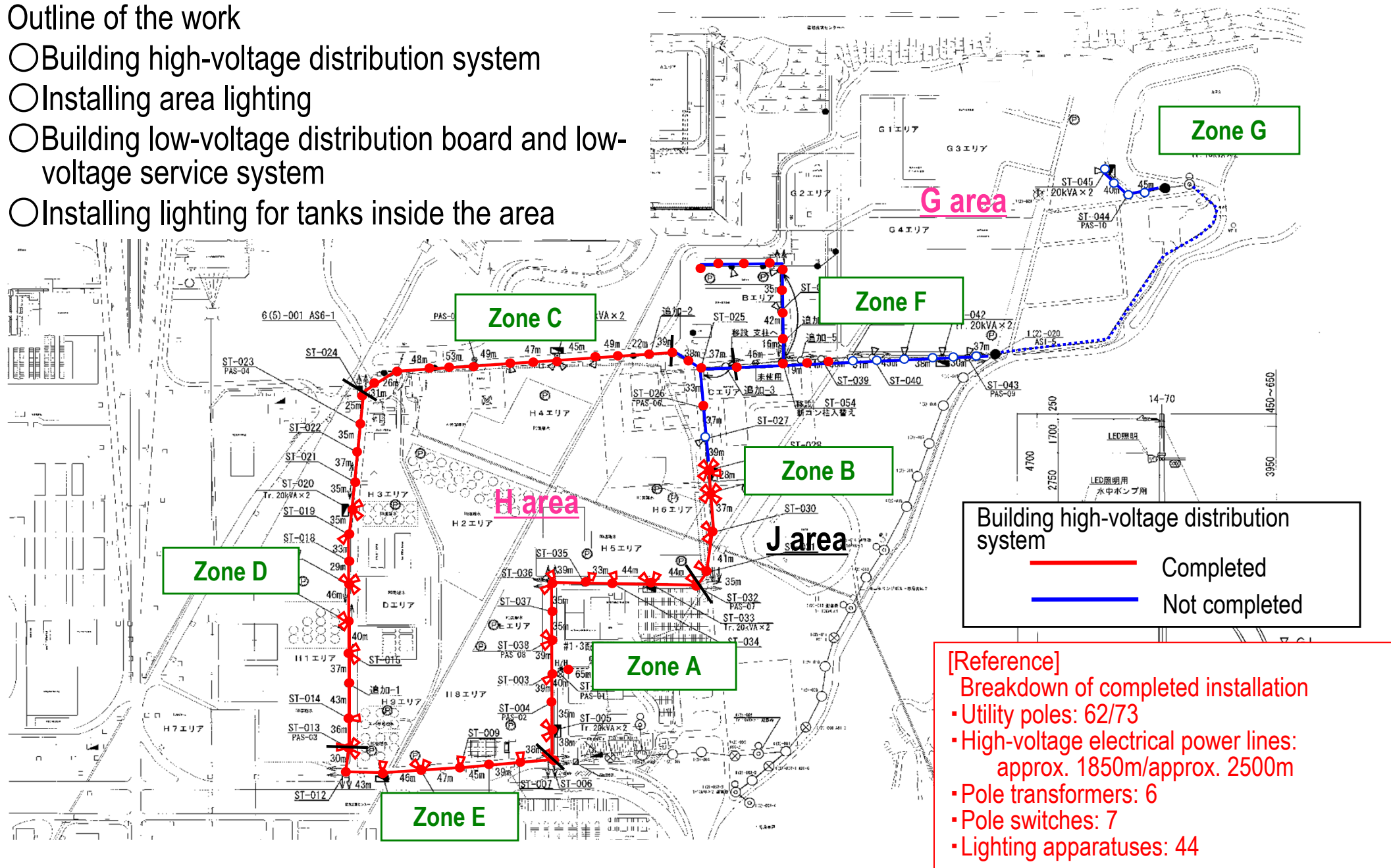
Removal completed on November 28



### 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



### 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



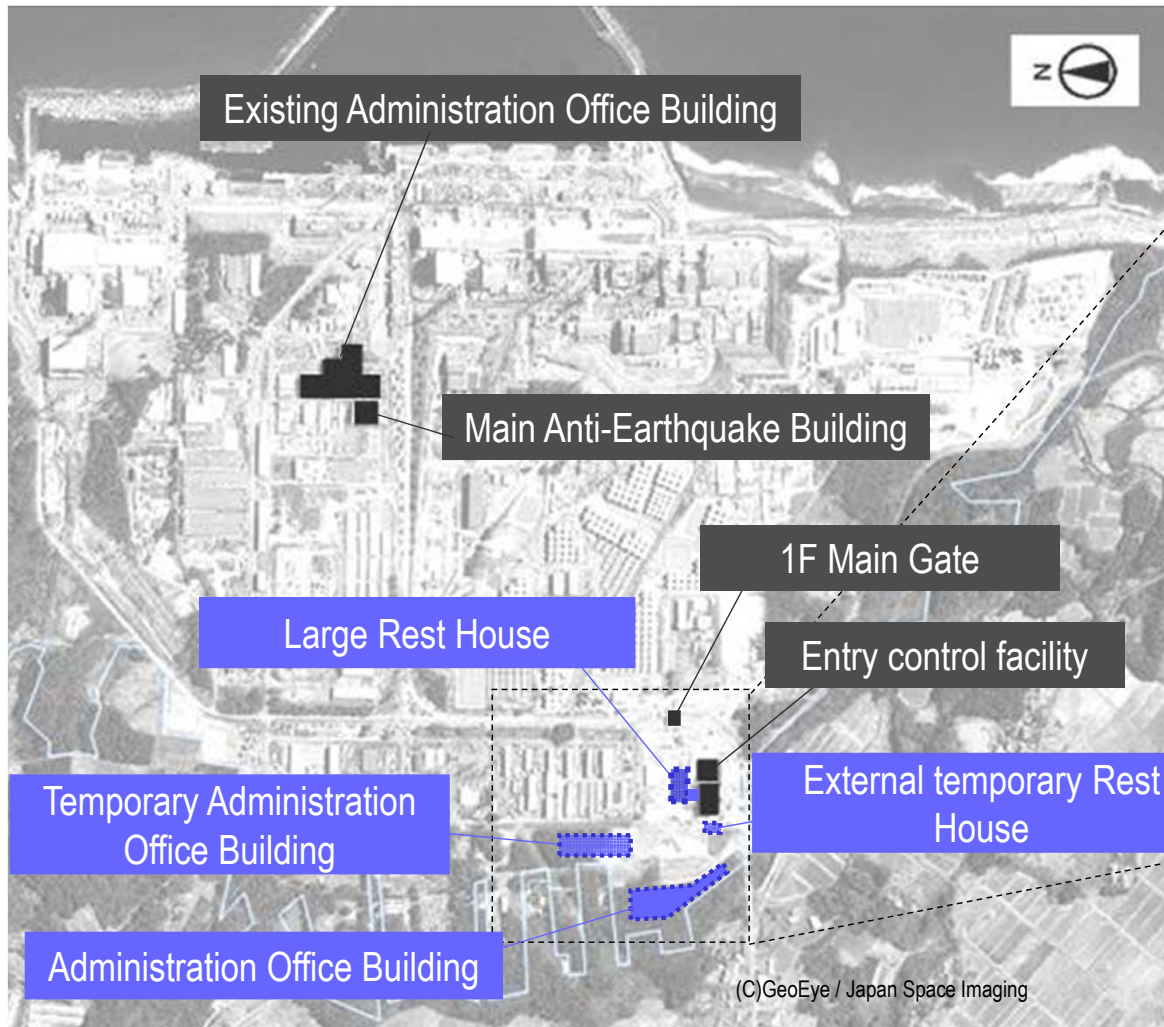
Zone D status of area lighting



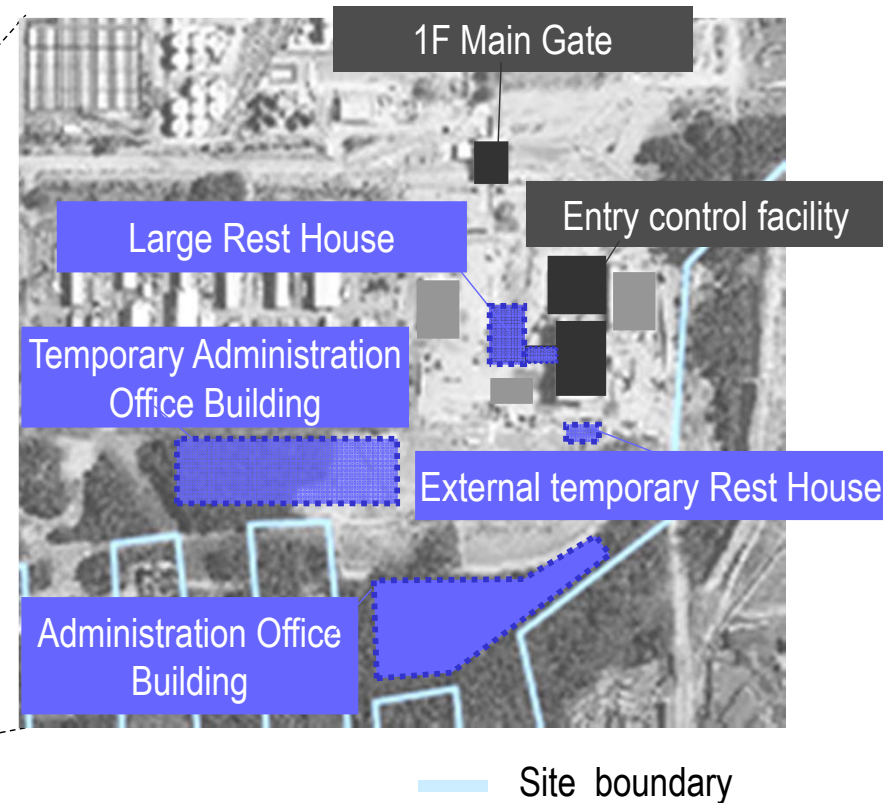
Zone E status of area lighting

# 4. Location of Administration Office Building and Rest House

## Location



Location



Location (a portion expanded)

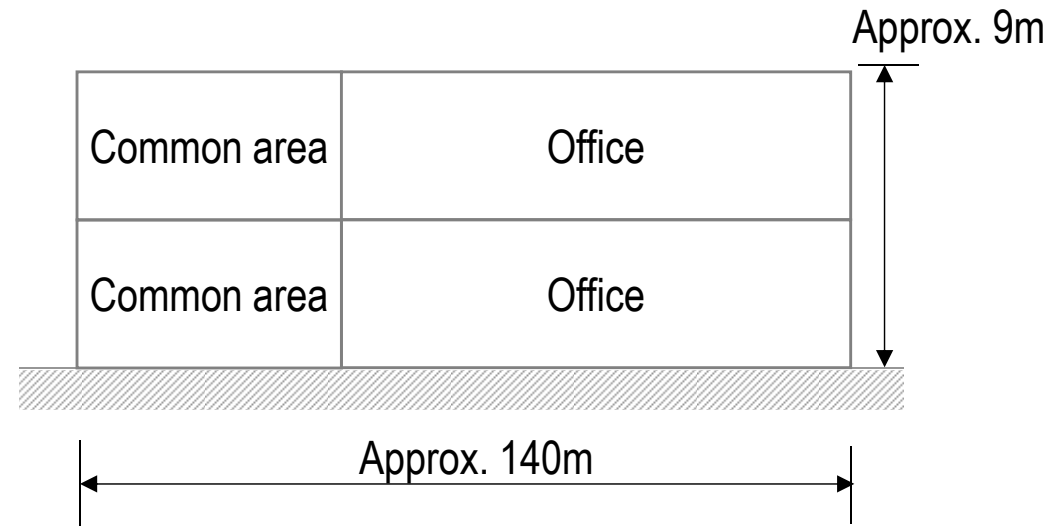
## 4.1 Establishment of temporary Administration Office Building (1/2)

### ■ Outline of the facility

Construction start: December 2013

Operation start: gradually started from July 1, 2014

Item	Planned specification
Building structure	Steel frame two-storied
Size	Total floor area: approx. 14,000m <sup>2</sup> Construction area: approx. 7,000m <sup>2</sup>
Capacity	Approx. 1,000 workers
Radiation dose inside the building	Non-controlled area



Cross-sectional image

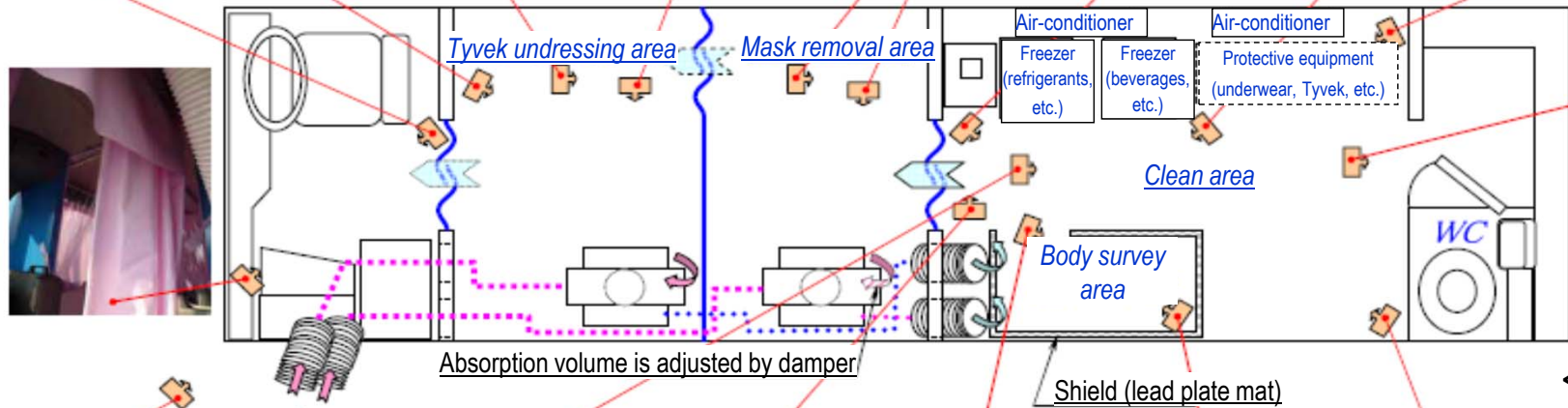
## 4.1 Establishment of temporary Administration Office Building (2/2)

Ground improvement and foundation construction are underway.



# 4.2 Mobile Rest House

## Outline of mobile Rest House



- <Major specifications>**
- 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
- <Operation start>**
- January 14, 2014

## 4.3 External temporary Rest House

### ■ Outline of the facility

Construction start: December 2013

Operation start: gradually started from early April, 2014

Item	Planned specification
Building structure	Steel frame three-storied (prefabricated)
Size	Total floor area: approx. 1,000m <sup>2</sup> x 2 buildings
Capacity	Approx. 1,000 workers



## 4.4 Establishment of large Rest House (1/2)

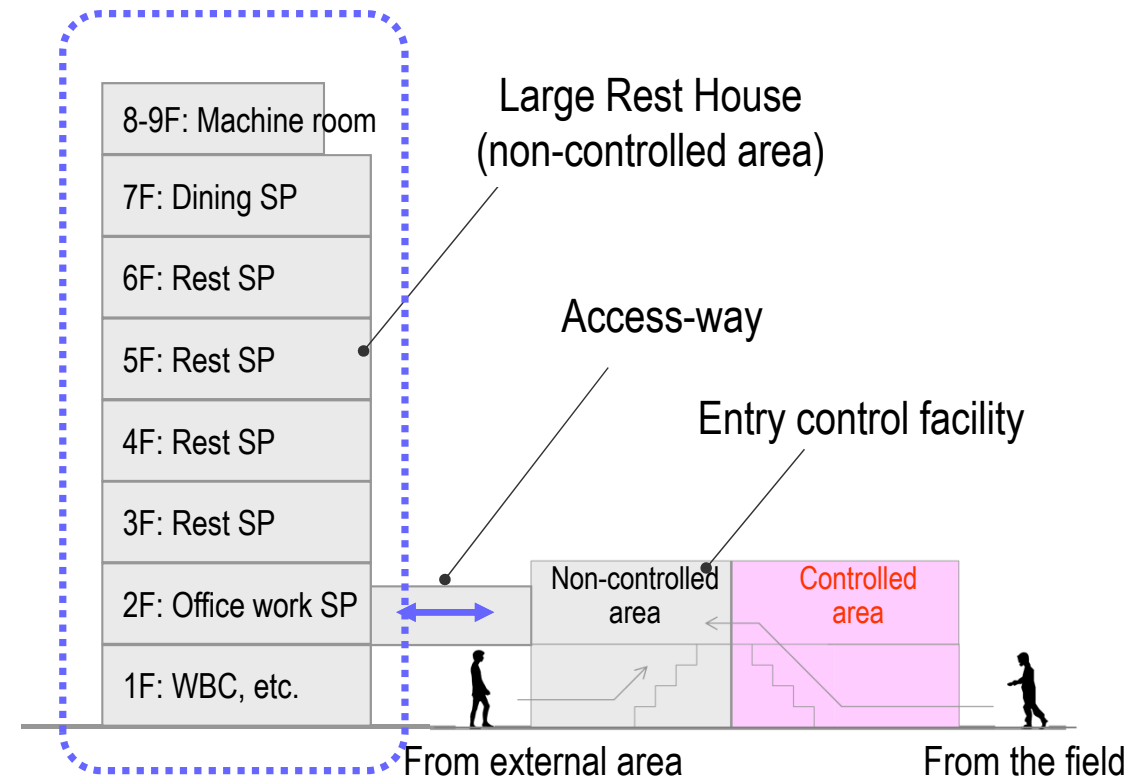
### Outline of the facility

Construction started : January 27, 2014

Construction completed: scheduled at the end of March, 2015

Item	Planned specification
Building structure	Steel frame
Size	Total floor area: approx. 64,000m <sup>2</sup> * Construction area: approx. 900m <sup>2</sup> *
Capacity	1,200 workers
Radiation dose in Building	Non-controlled area

\* Excluding the access-way



Relation of entry control facility and Large Rest House  
Image



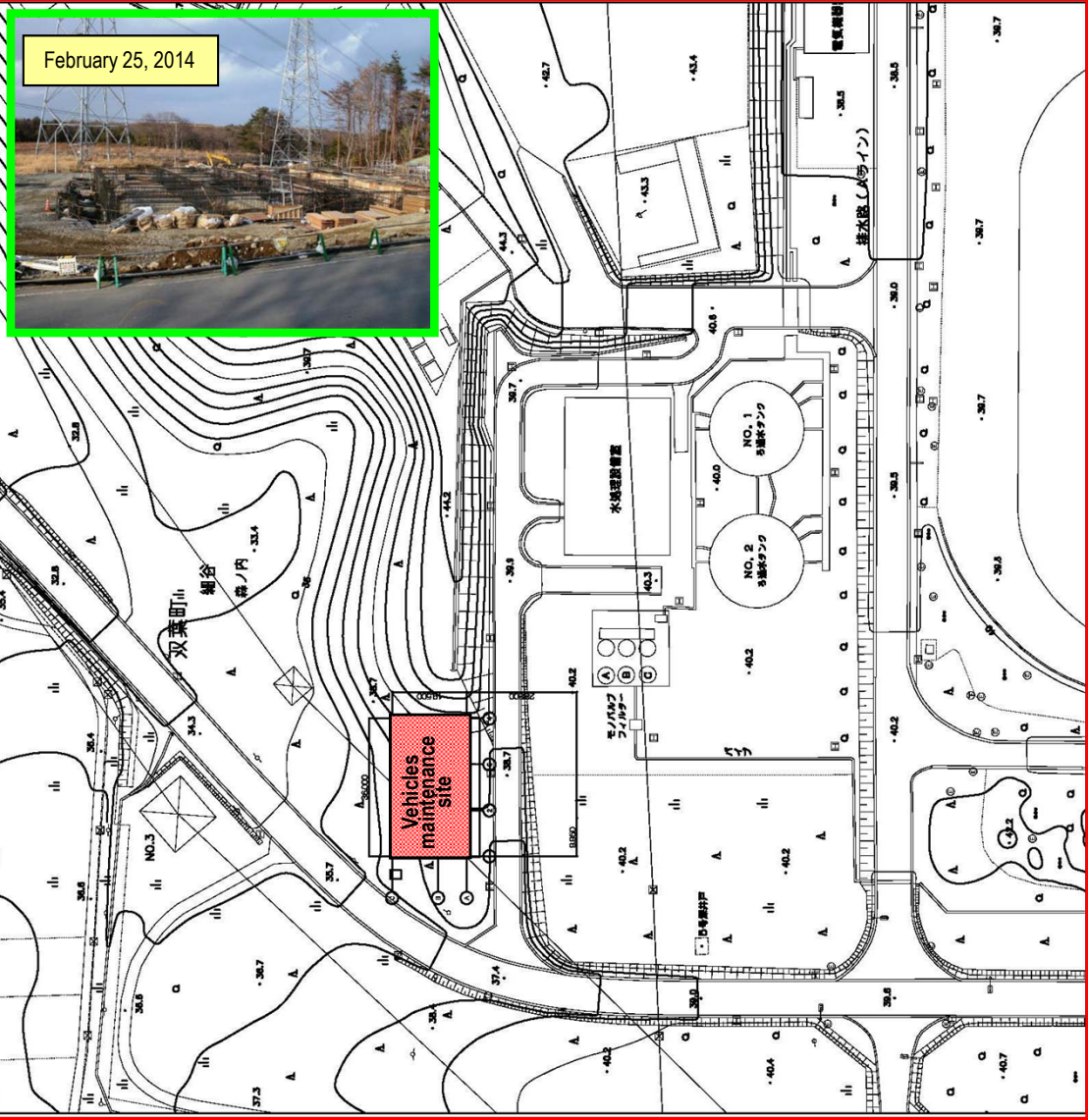
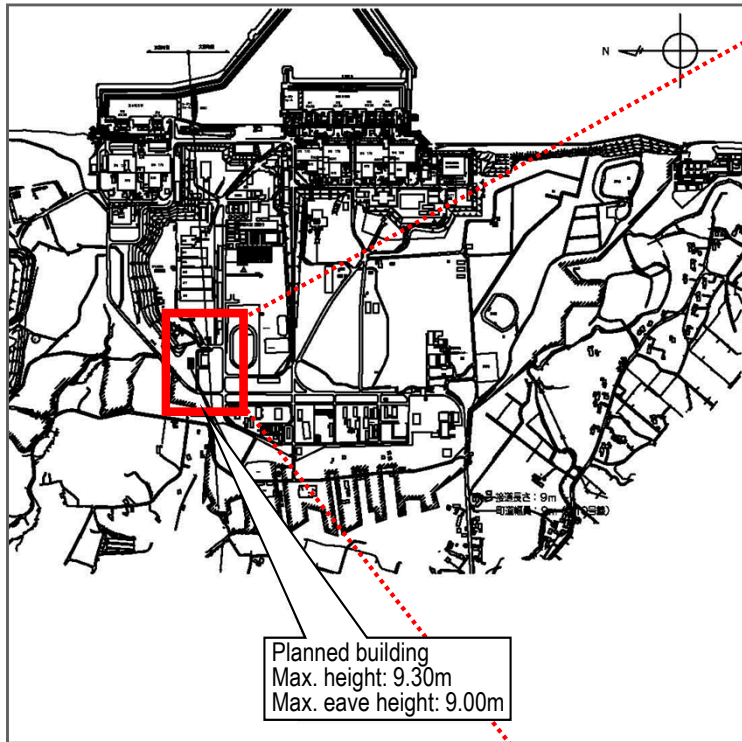
# 4.4 Establishment of large Rest House (2/2)

Foundation construction underway (including piling)



# 5. Establishment of vehicles maintenance site (1/2)

## Location

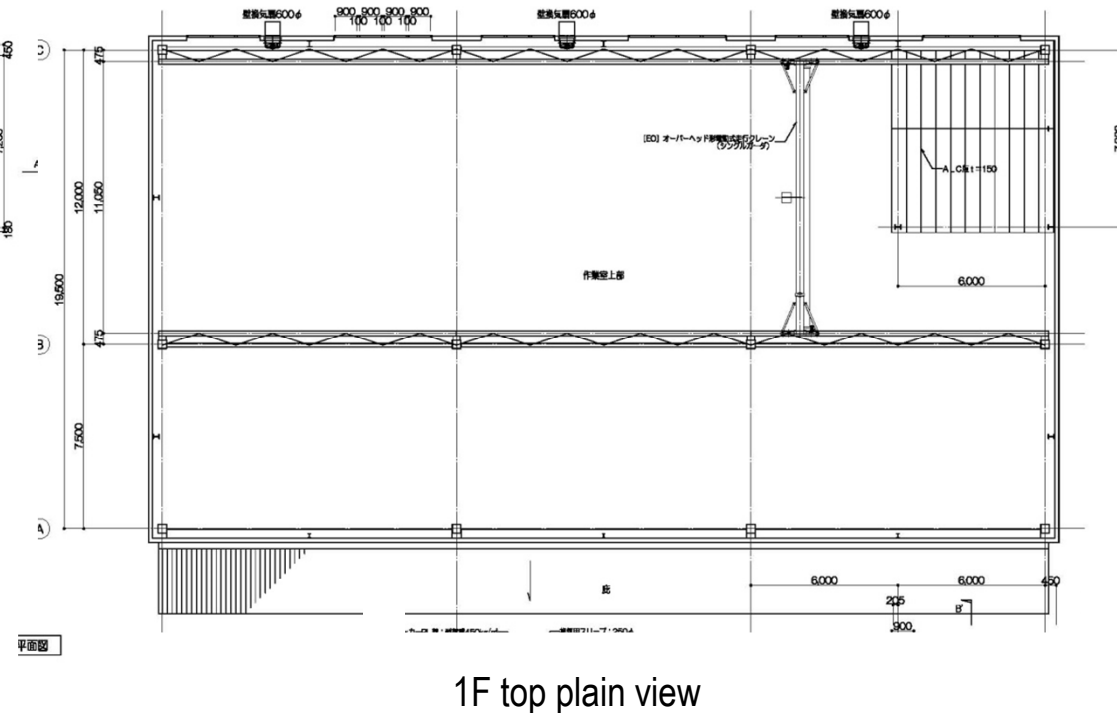
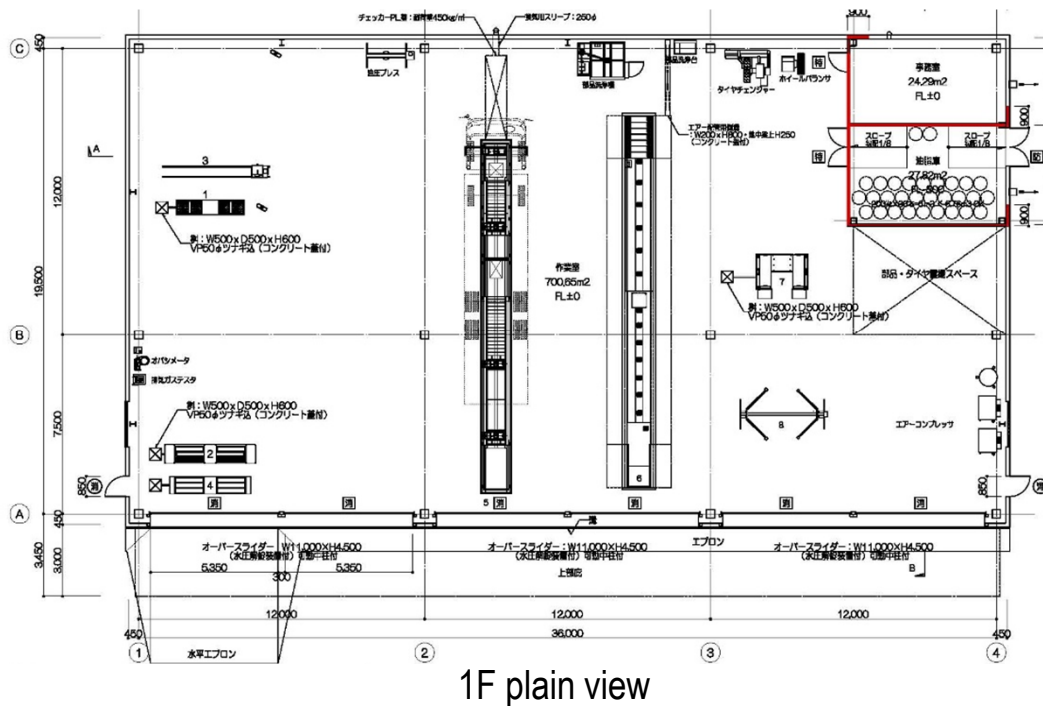


Construction start : August 2013  
Operation start: scheduled in May 2014

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

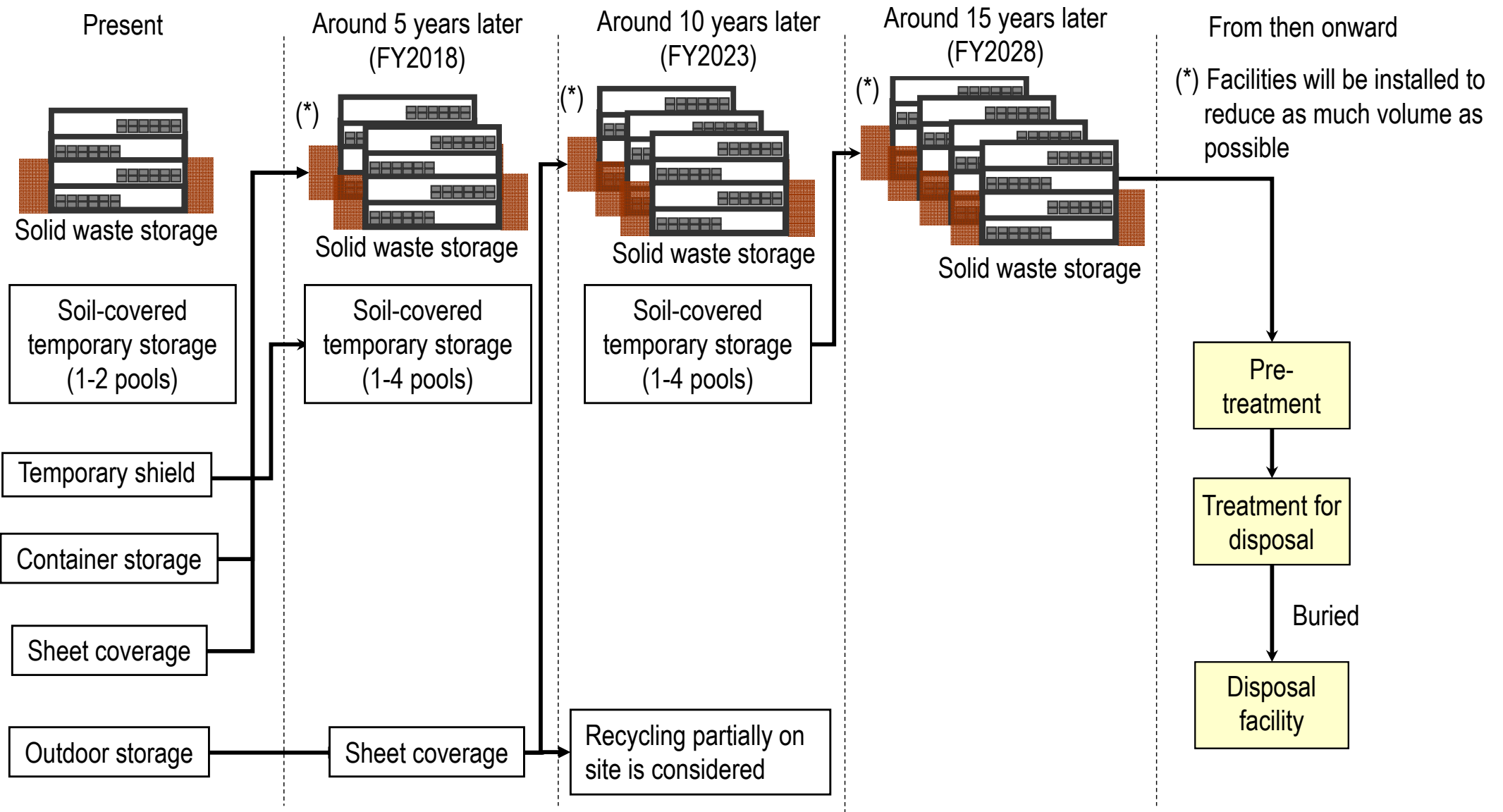
#### ● Scheduled operation start

- May 2014

#### ● Usage inside the building

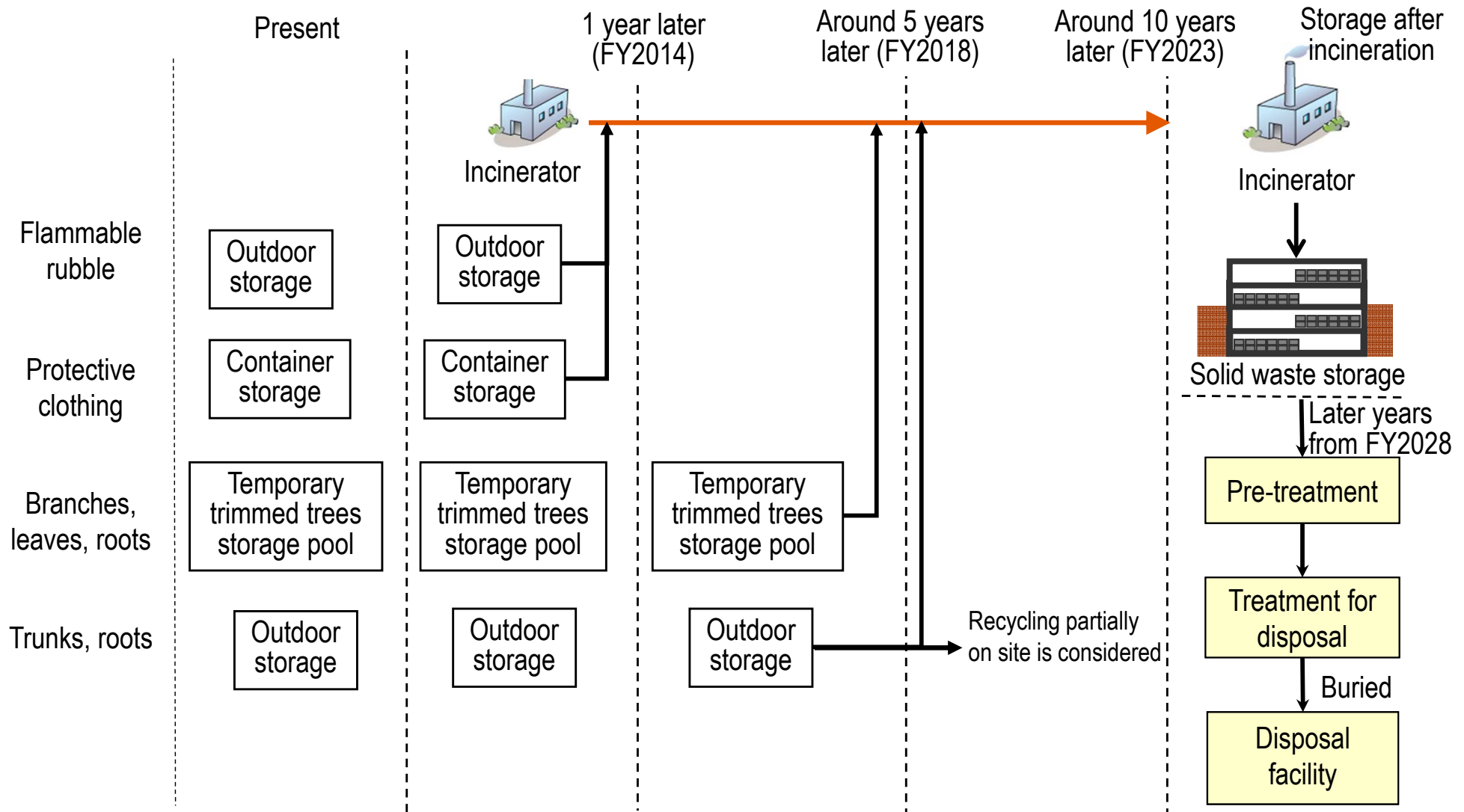
- Work room (700.65m<sup>2</sup>): inspection and maintenance of vehicles
- Office room (24.29m<sup>2</sup>): administration work related to inspection and maintenance
- Grease storage (27.82m<sup>2</sup>): [Temporary hazardous materials storage]  
\* Temporary storage of grease generated during inspection and maintenance

# 6. Image of waste treatment and storage (1/2) (rubble)

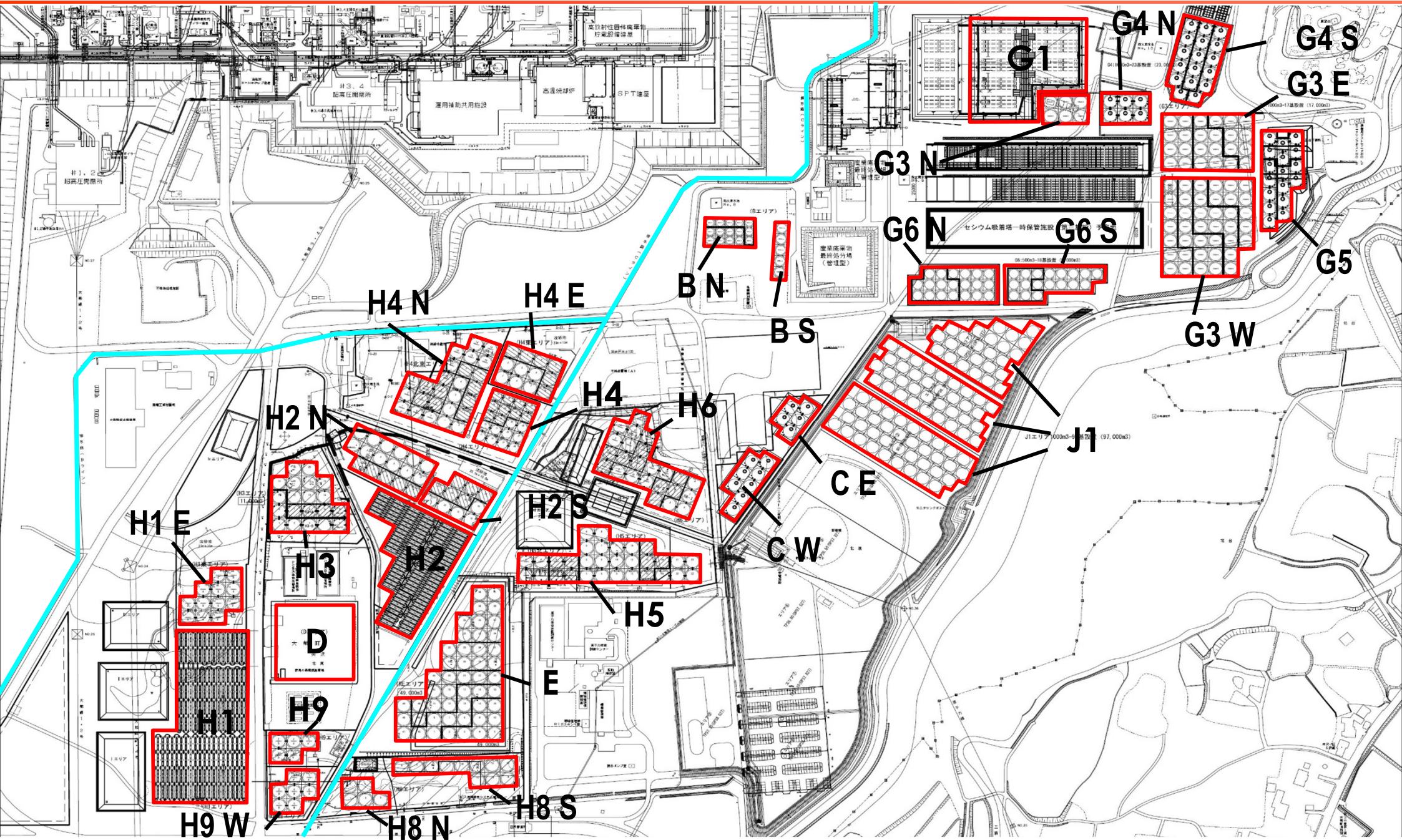


# 6. Image of waste treatment and storage (2/2)

(flammable materials, protective clothing, trimmed trees)



# 7. Location of tanks



# 8. Measures to prevent overflow (raising fence height by steel plates)

<Rainwater prevention measures>

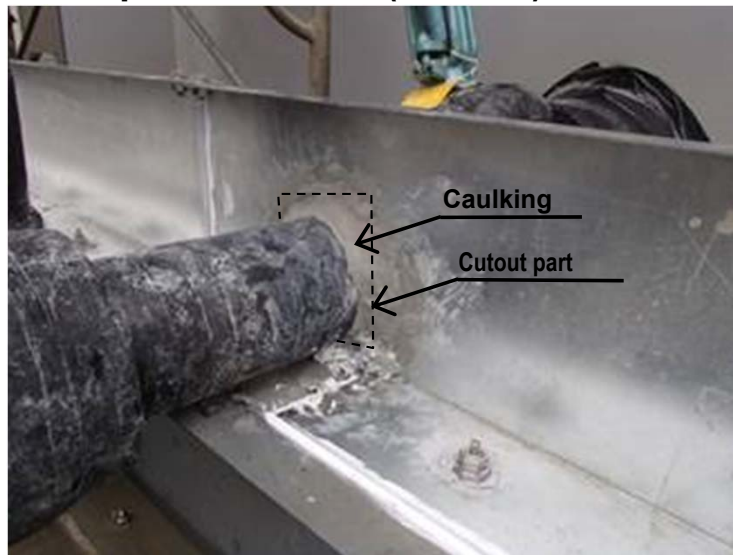
General area (outside)



General area (inside)



Pipe connection (outside)



Pipe connection (inside)



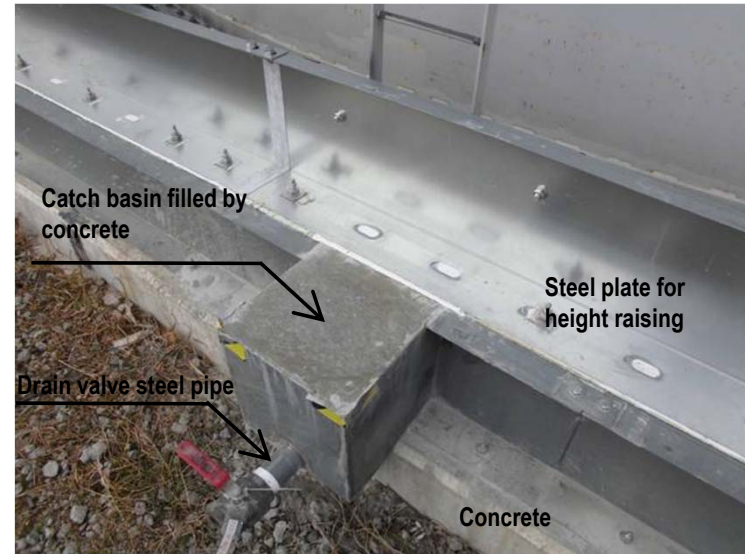
# 9. Measures to prevent overflow (raising fence height by steel plates)

<Rainwater prevention measures>

Catch basin before closure (outside)



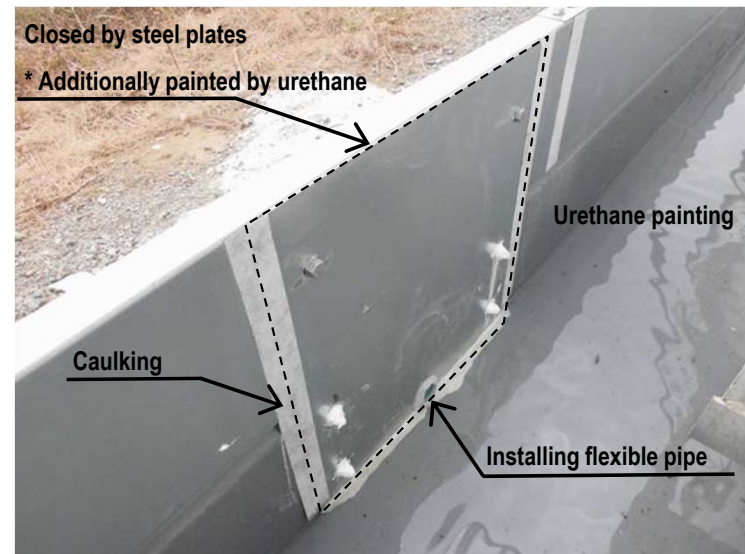
Catch basin after closure (outside)



Catch basin before closure (inside)



Catch basin after closure (inside)





# 10. Measures to prevent inflow (installing rain gutters (1))

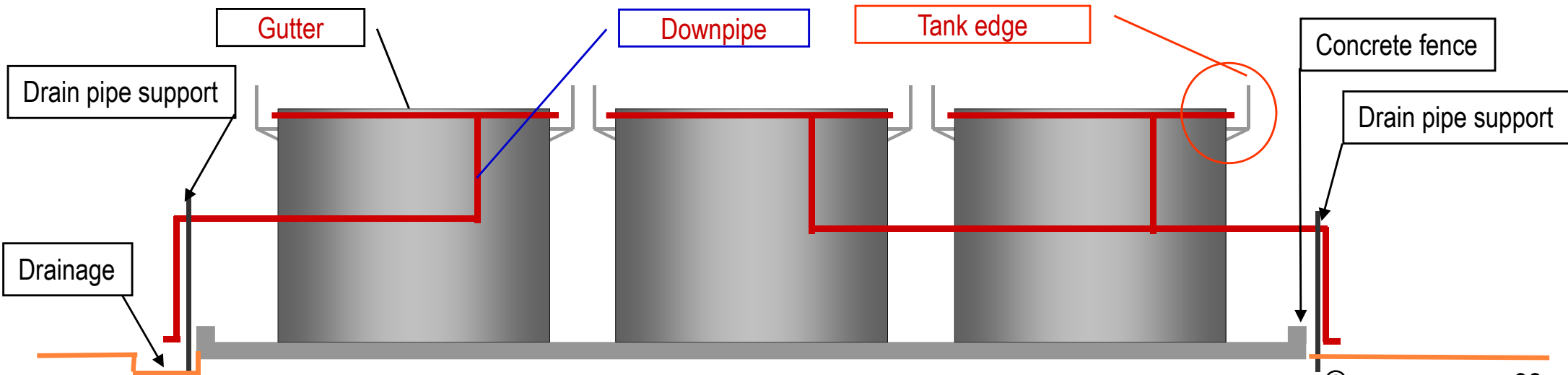
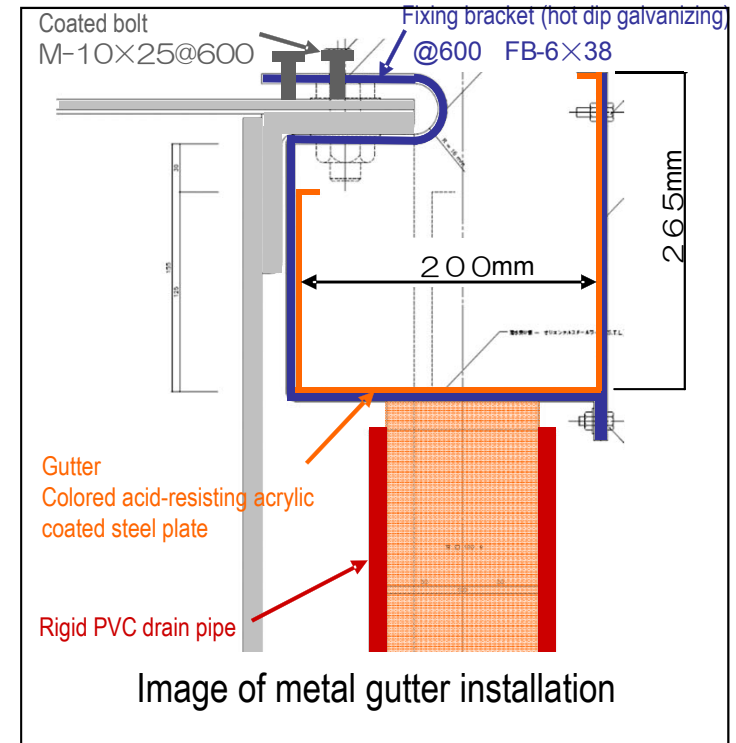
Priority: Priority to implement measures is placed on areas with higher level of contamination

## 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.



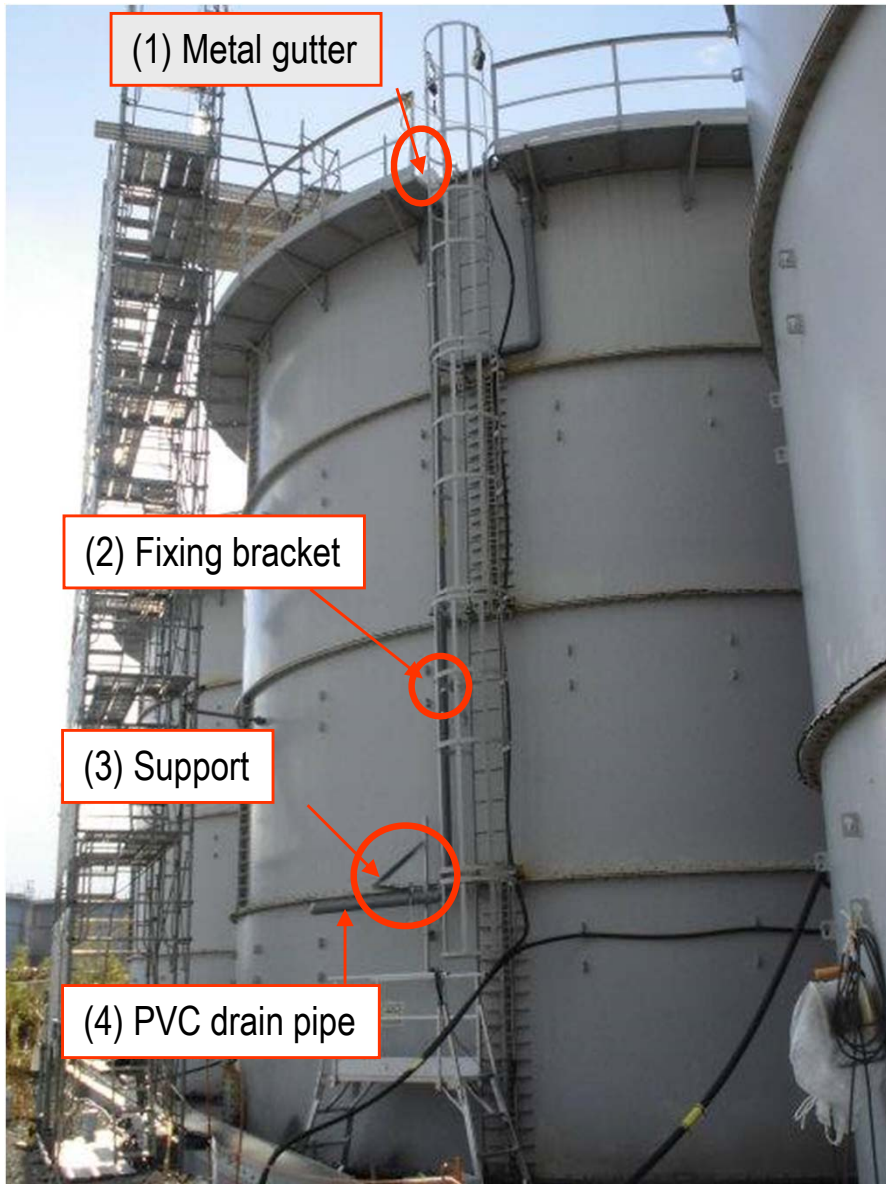
Image of rain gutter installation



\* To prevent ingress of rainwater from the side, gutter are installed

# 10. Measures to prevent inflow (installing rain gutters (2))

<Rainwater prevention measures>



Mockup of H2 south side tank

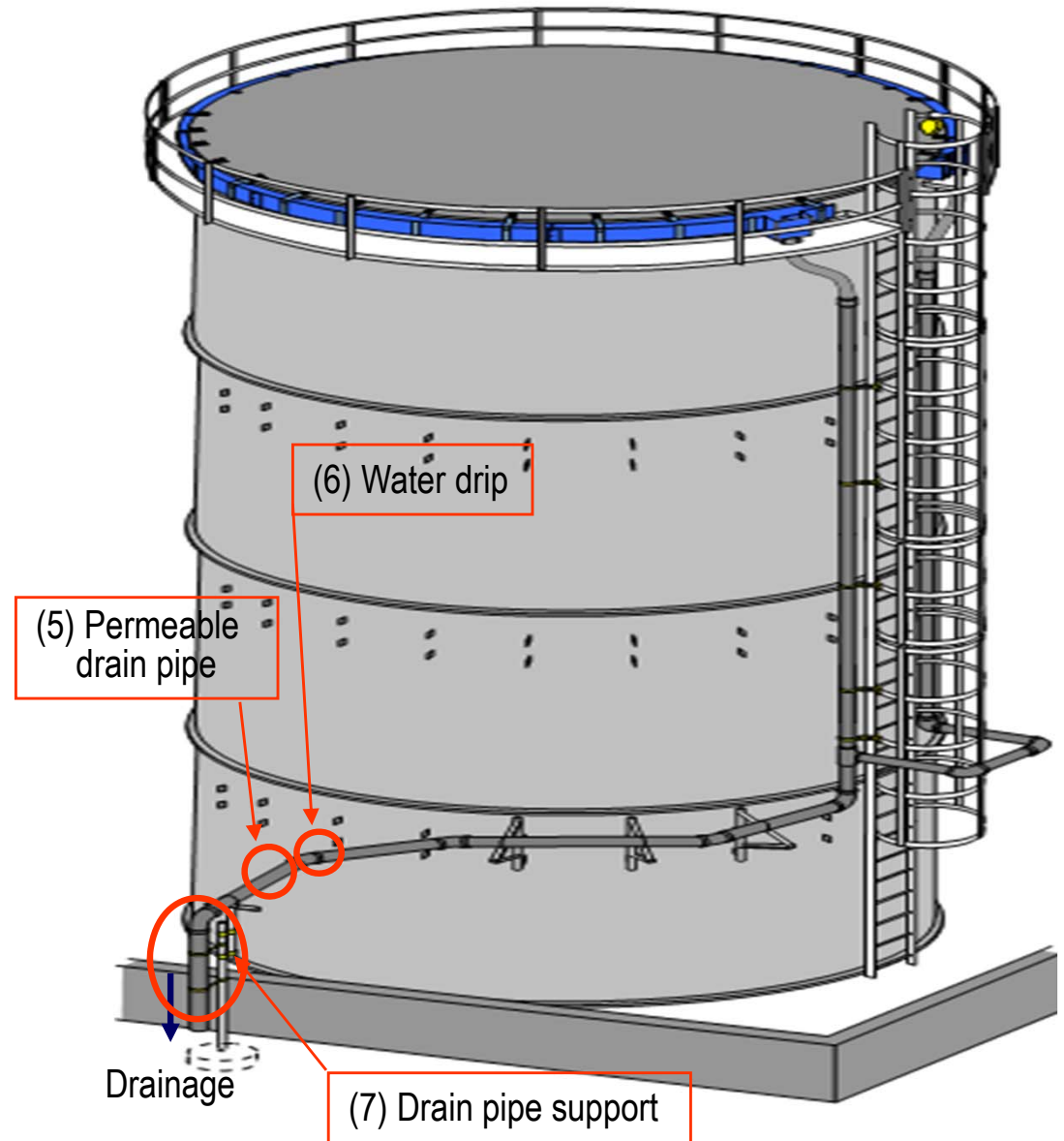
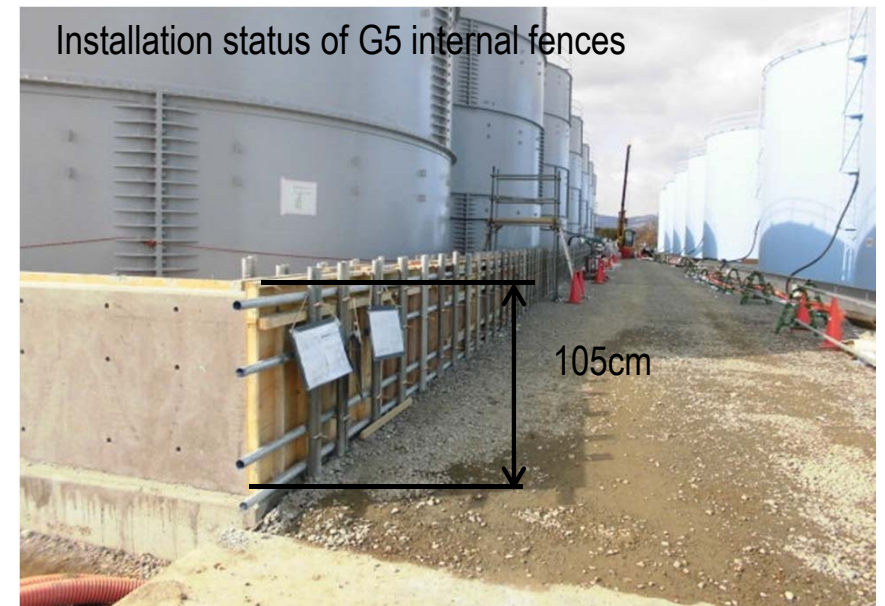


Image after water drip

# 11. Underground seeping prevention measures and further height raise



# 12. Drainage inflow prevention measures

<Rainwater prevention measures>

(coverage over B drainage (1))

## ● Drainage coverage

- Buried pipe type → **Double pre-stressed pipe  $\Phi 1000-1100\text{mm}$ : 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

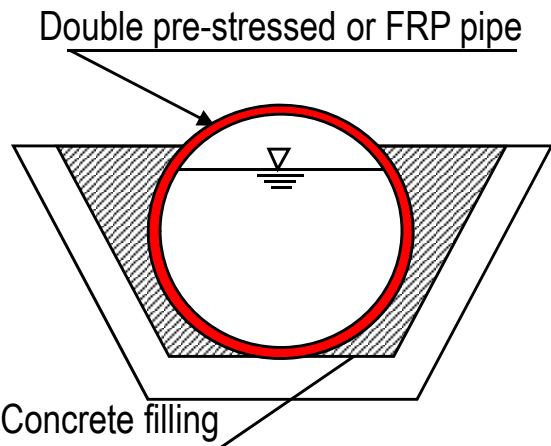


Fig. 1: Buried pipe type covered drainage

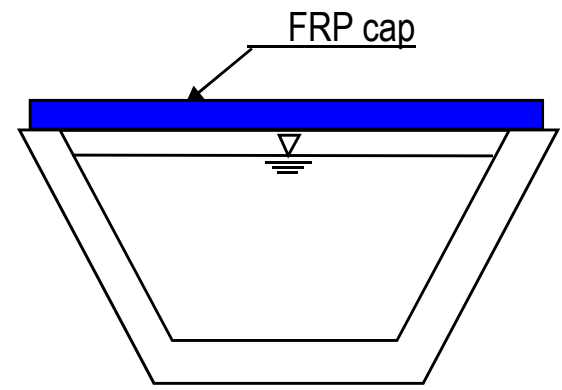
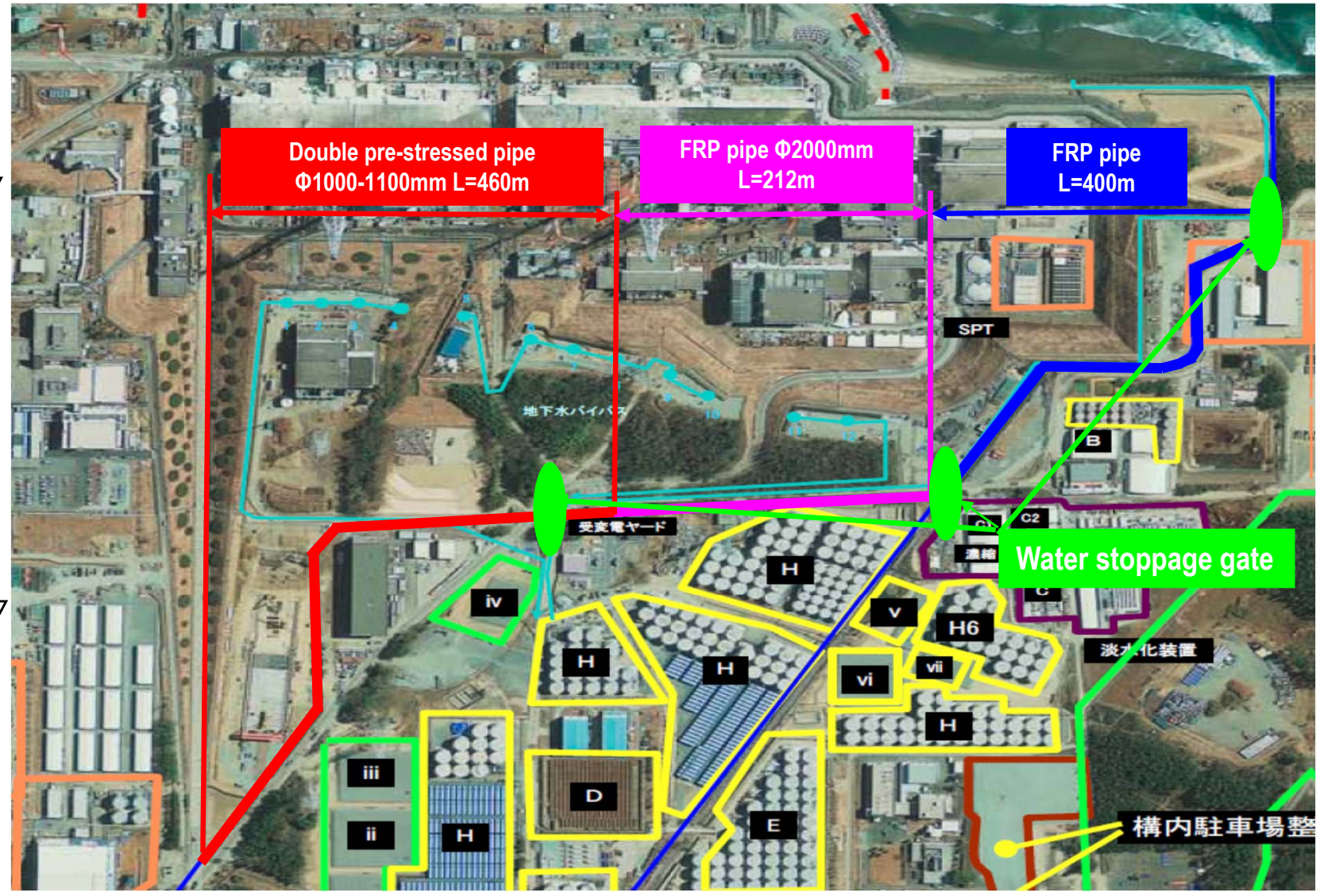


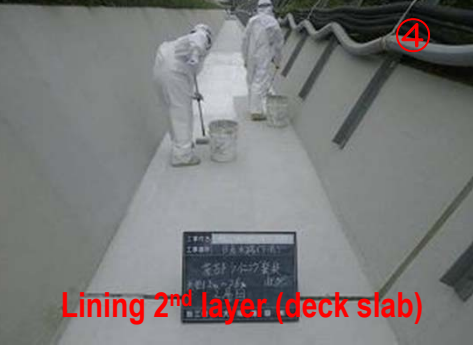
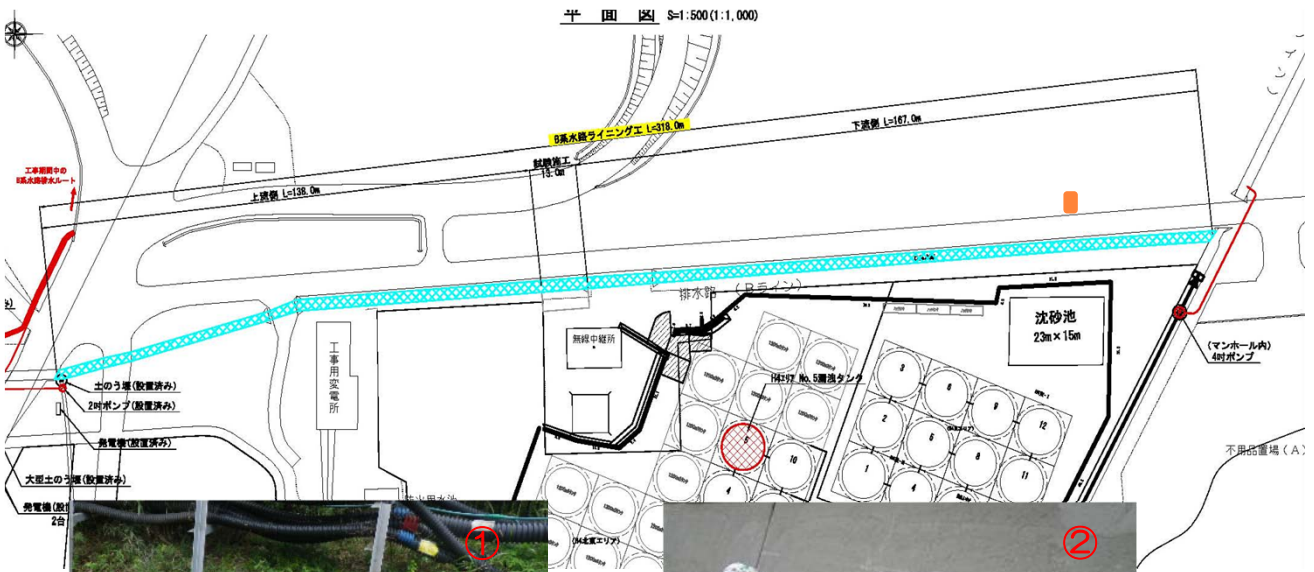
Fig. 2: Cap type covered drainage



# 12. Drainage inflow prevention measures

(coverage over B drainage (2))

<Rainwater prevention measures>



# 13. Measures to increase capacity of temporary storage tanks for rainwater inside the fences

<Rainwater prevention measures>

Capacity increase of temporary storage tanks is underway.  
At present, 9 tanks were installed. Additional 5 tanks will be installed.



New tanks 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).



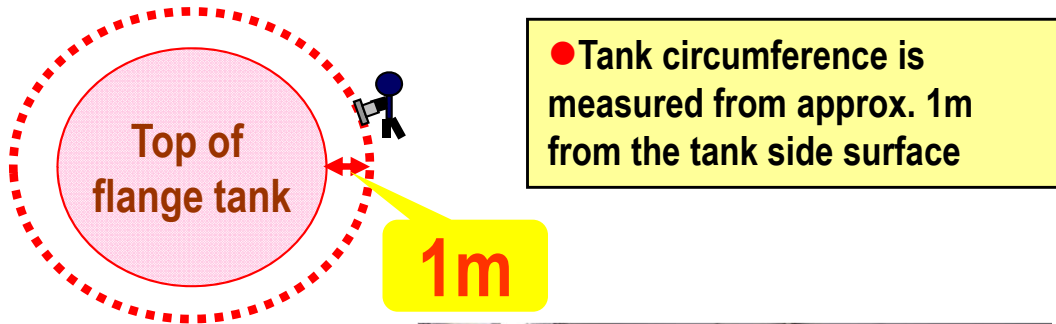
Implementation status of actual tank

# 15. Patrol enhancement for flange type tanks

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

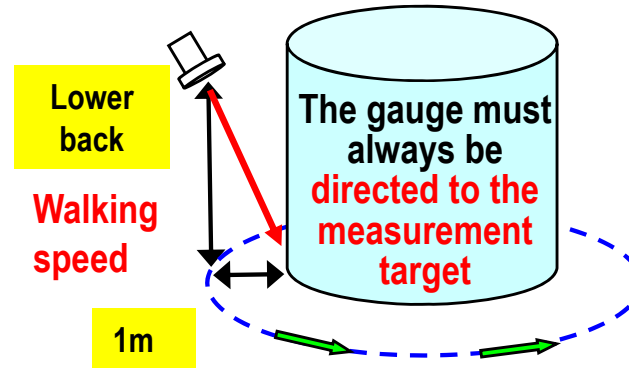
- **Unifying measurement distance:** Need to reduce variation of measured values due to minor difference in measurer's route, and distance [refer to the image below]
- **Unifying measurement direction (unifying direction (direction and location of measurement equipment)):** Need to reduce variation of measured values due to direction and location of measurement equipment
- **Ensuring time constant:** Need to prevent accuracy shortage due to minor 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

## ■ Unifying measurement distance



Marking of route to the field

## ■ Ensuring time constant



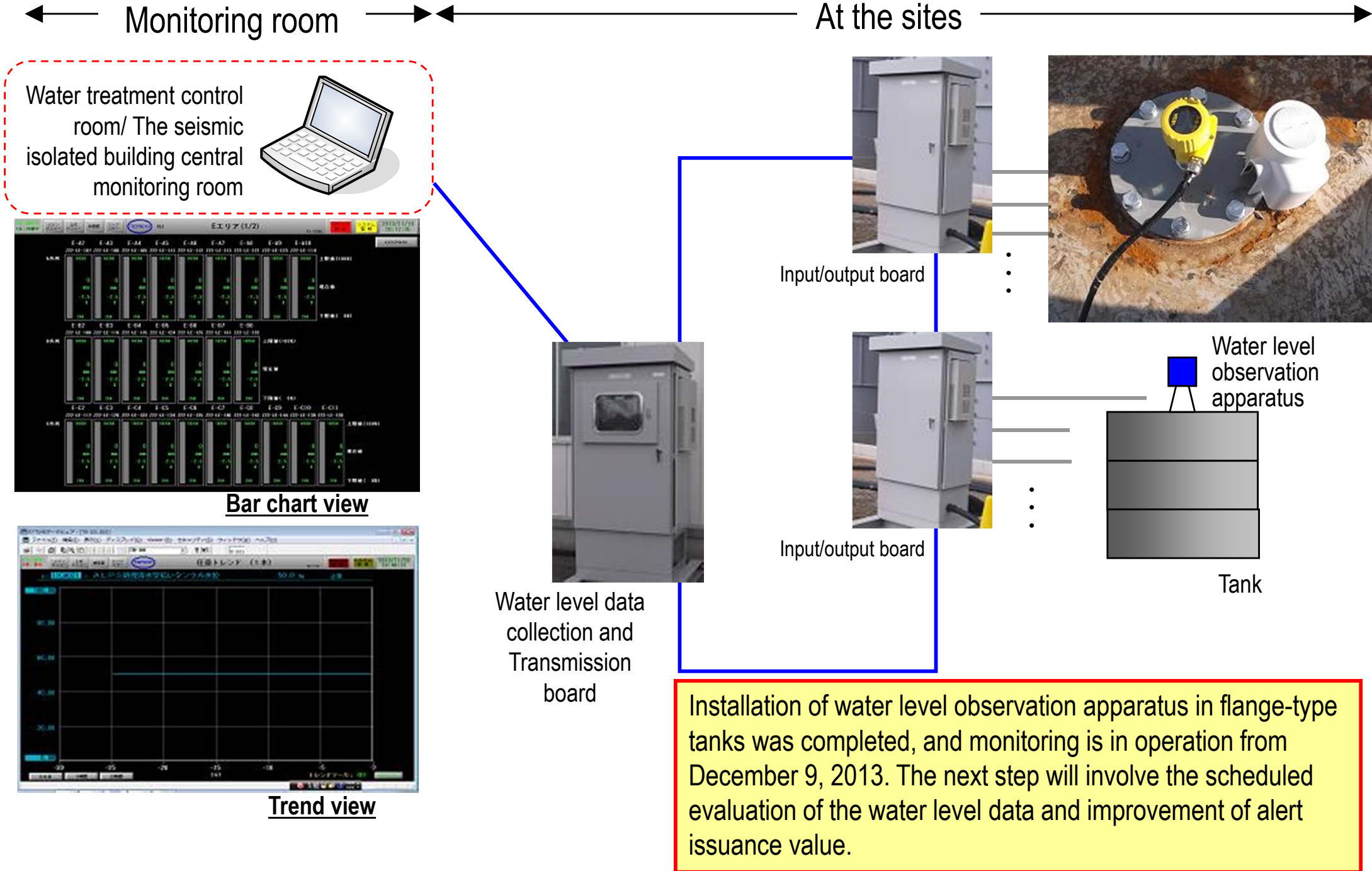
● Regarding the drop phenomenon from G6 south C3 tank (November 15, 2013), by tentative survey, the drops (one drop/4 second) were detected from the top in the situation where water was accumulated inside the fences.



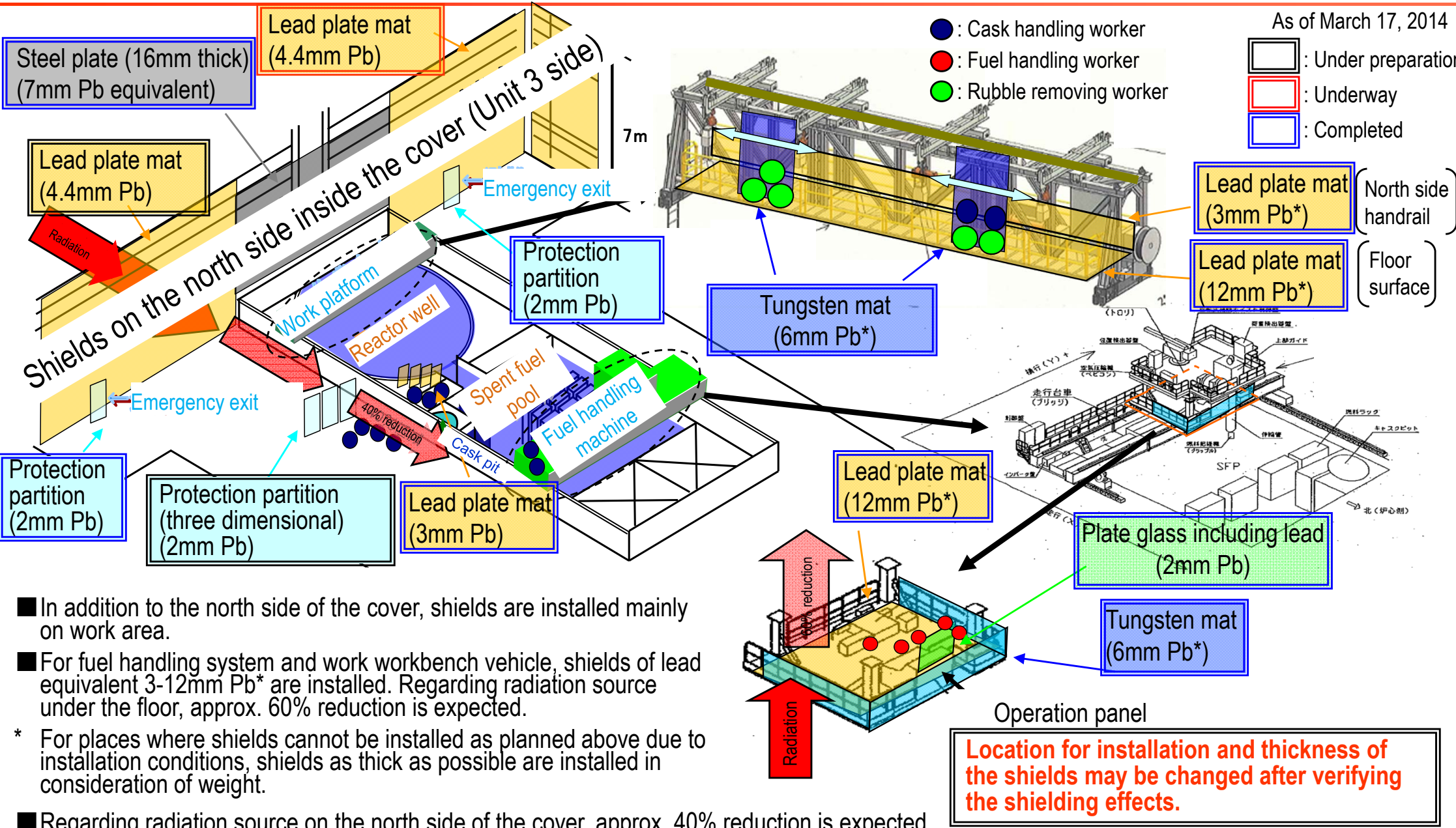
Leak point



# 16. Installation of water level observation apparatus in flange-type tanks



# 17. Work environment improvement for fuel removal from Unit 4 spent fuel pool (1/4)

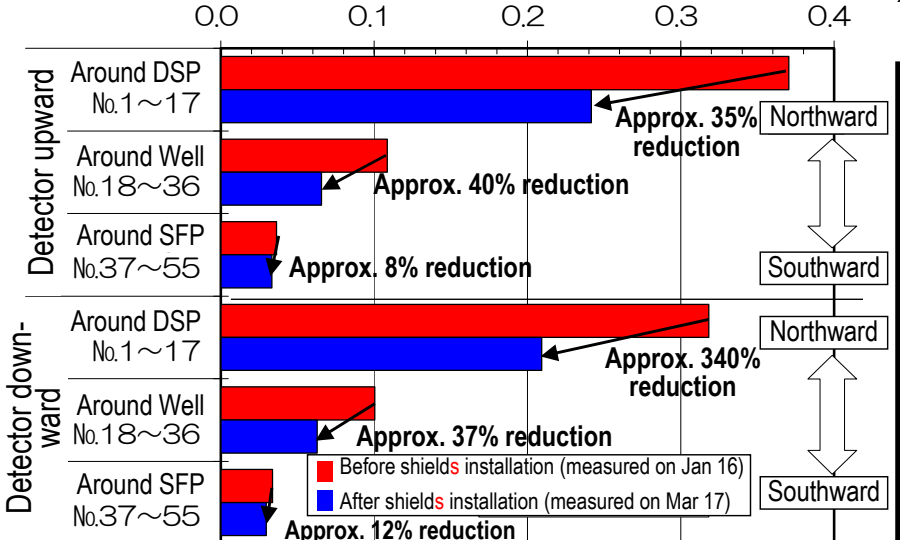


- In addition to the north side of the cover, shields are installed mainly on work area.
- For fuel handling system and work workbench vehicle, shields of lead equivalent 3-12mm Pb\* are installed. Regarding radiation source under the floor, approx. 60% reduction is expected.
- \* For places where shields 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.

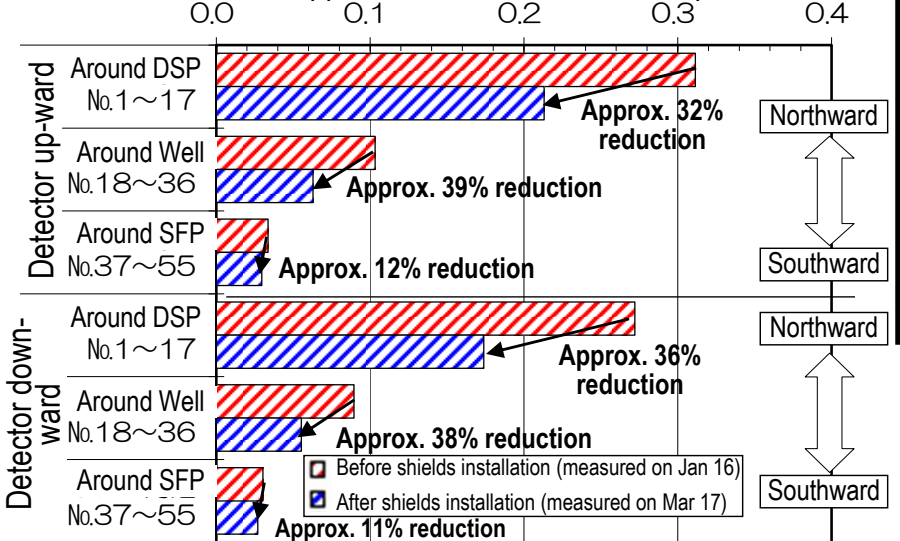
# 17. Work environment improvement for fuel removal from Unit 4 spent fuel pool (2/4)

Dose rate was measured on operating floor before and after the installation of shields.

Comparison of average geometric dose rate before/after shields installation at approx. 100cm on measurement point (mSv/h)

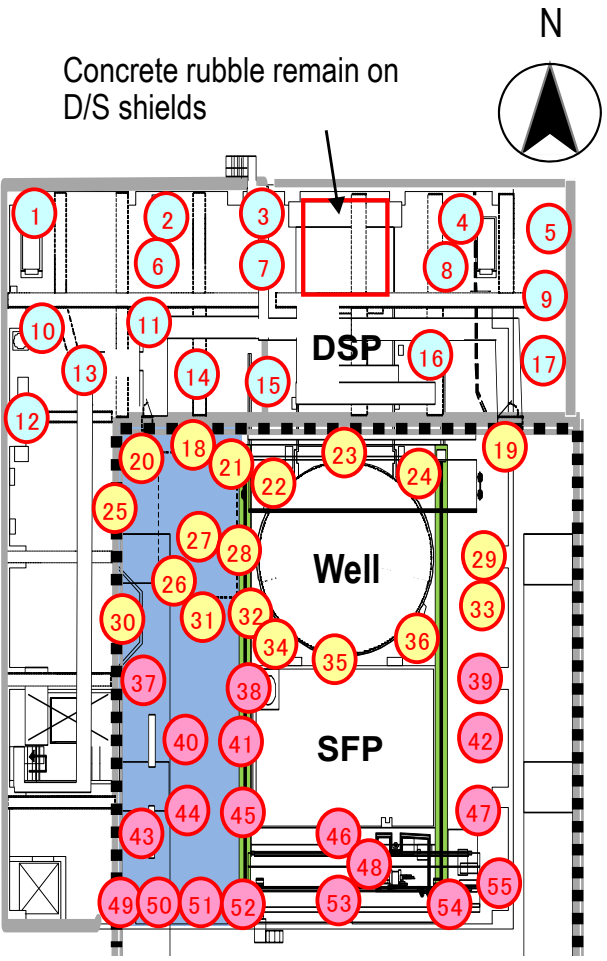


Comparison of average geometric dose rate before/after shields installation at approx. 30cm on measurement point (mSv/h)



Operating floor measurement result

- 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.

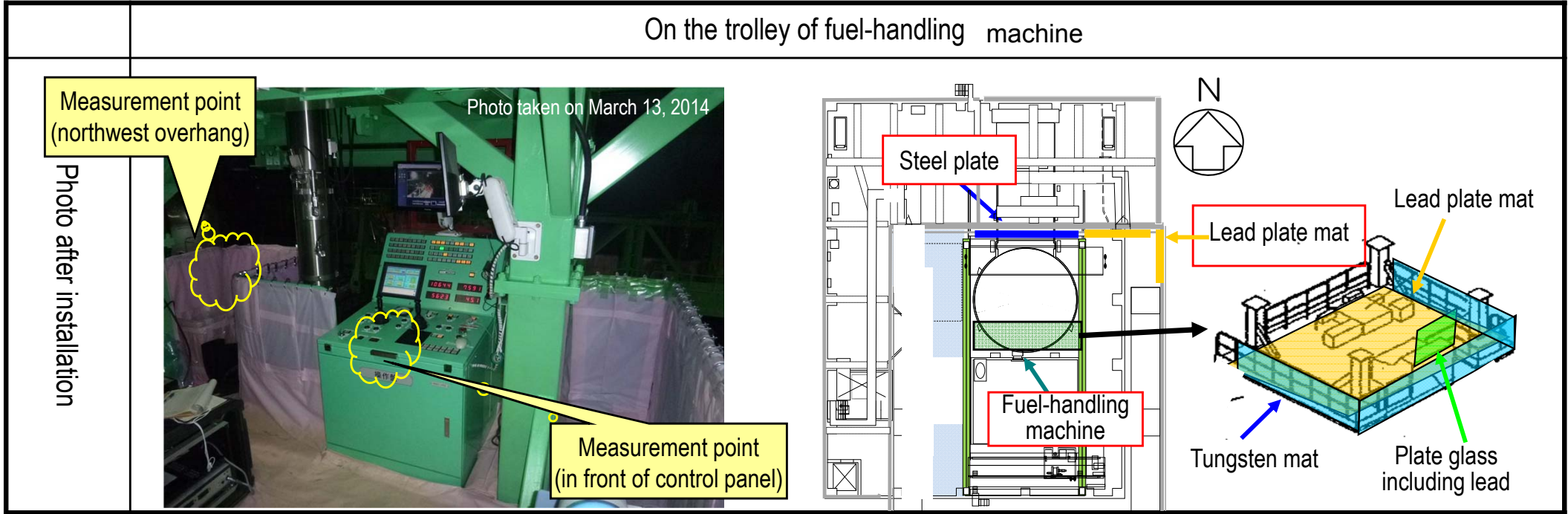


□ : Dryer/ separator (D/S) shield  
 ○ : Cover for fuel removal

Measurement points on operating floor

# 17. Work environment improvement for fuel removal from Unit 4 spent fuel pool (3/4)

## Example of shields installation status



## Example of shields installation effect

Measurement point	Measured on March 17, 2014	Measured on March 17, 2014
	On the trolley of fuel-handling machine In front of control panel    Approx. 1m high	On the trolley of fuel-handling machine Northwest overhang    Approx. 1m high
Installation effect	Before installation: 0.055mSv/h After installation: 0.025mSv/h (Approx. 55% reduction)	Before installation: 0.080mSv/h* After installation: 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.	

# 17. Work environment improvement for fuel removal from Unit 4 spent fuel pool (4/4)

■ 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<sup>nd</sup>-5<sup>th</sup> casks): approx. 0.098mSv/worker-group
- Average exposure dose during initial period of shields installation (average of 13<sup>th</sup>-18<sup>th</sup> casks): approx. 0.055mSv/worker-group (approx. 44% reduction)
- Latest average exposure dose (average of 21<sup>st</sup>-23<sup>rd</sup> casks): approx. 0.043mSv/worker-group (approx. 56% reduction)

