Tsunami Protection Countermeasures Implementation at Kashiwazaki-Kariwa Nuclear Power Station

June 22, 2012

Tokyo Electric Power Station

Kashiwazaki-Kariwa Nuclear Power Station

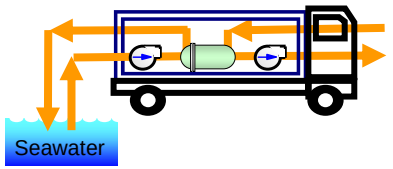
TEPCO 東京電力

Outline of Tsunami Protection Countermeasures Implemented at Kashiwazaki-Kariwa Nuclear Power Station

1. Seawall Construction
Seawalls are being built against the coast line to prevent impact from Tsunami and protect the facilities (such as the gas oil tank) and buildings in the power station.

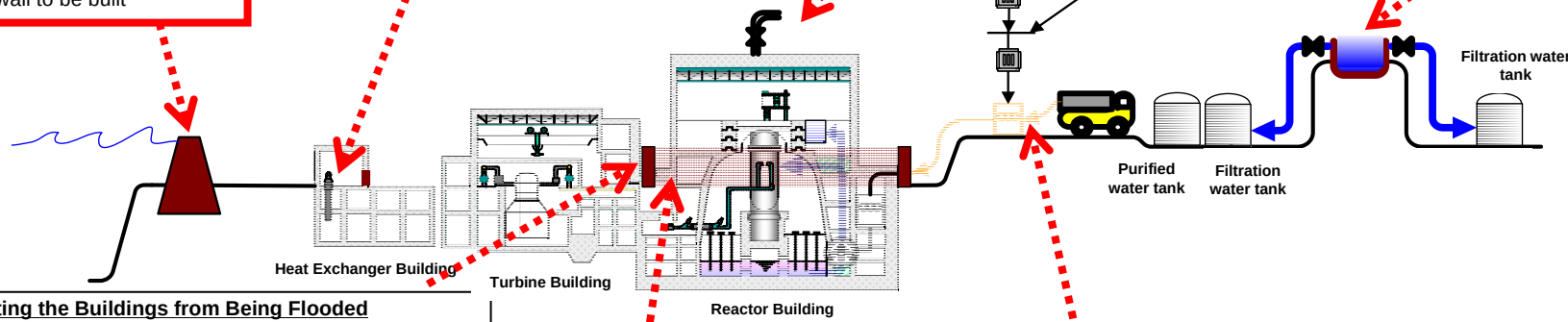
Seawall to be built

3. Strengthening the Heat Removal/Cooling Functions
(4) Installation of alternative underwater pumps and alternative seawater heat exchanger facility
Alternative underwater pumps are installed to allow the operation of residual heat removal system in the case that the seawater system cooling function is disabled.

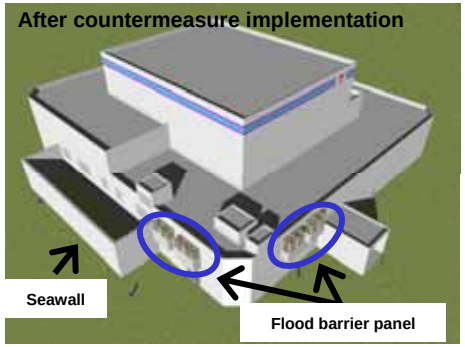


3. Strengthening the Heat Removal/Cooling Functions
(5) Top vent system installation at the Reactor Building
A top vent system is installed to prevent hydrogen retention in the Reactor Building.

3. Strengthening the Heat Removal/Cooling Functions
(1) Water source installation
Freshwater storage is installed as a water source to secure stable cooling water supply to the reactor and the spent fuel pool in case of emergency.



2. Preventing the Buildings from Being Flooded
(1) Seawall construction
Seawalls are built along the Reactor Buildings to protect facilities and equipments crucial for ensuring safety (power facilities, emergency diesel generators, etc.).



Seawalls/Flood barrier panels

2. Preventing the Buildings from Being Flooded
(2) Watertight doors at the Reactor Building, etc.
Adopting watertight doors at the Reactor Building, Turbine Building and Heat Exchanger Building prevents the equipments and facilities in the building from being flooded.

3. Strengthening the Heat Removal/Cooling Functions
(7) Equipments/Materials storage built on high ground for emergency
The equipments/materials storage is built on high ground to allow access to necessary equipments and materials in case of Tsunami emergencies.

3. Strengthening the Heat Removal/Cooling Functions
(2) Additional deployment of air-cooled gas turbine power supply cars
Large capacity gas turbine power supply cars are additionally deployed to secure power supply allowing the stable operation of residual heat removal pumps in the case of station blackouts.

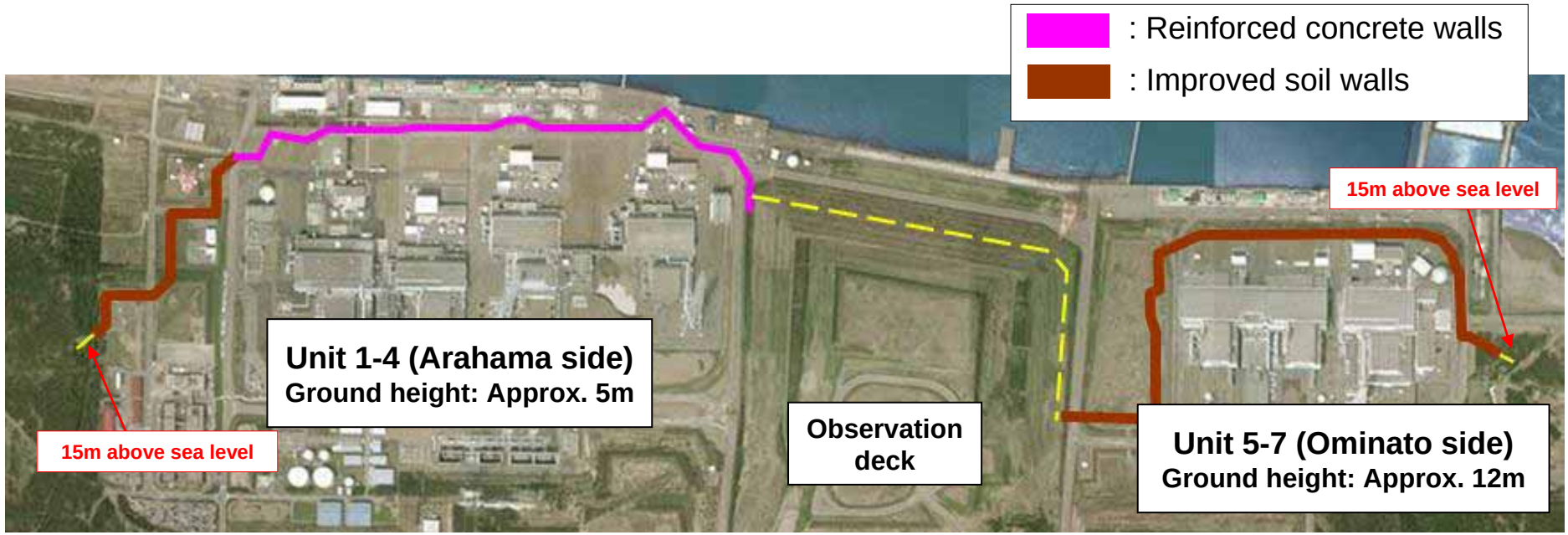
(3) Installation of emergency high-voltage switchboards and the permanent cables in the Reactor Building
By installing emergency high-voltage switchboards and permanent cables in the Reactor Building, stable power supply to facilities such as the residual heat removal system pumps can be secured at station blackouts.

3. Strengthening the Heat Removal/Cooling Functions
(6) Strengthening the environment monitoring equipments
In order to be well prepared for information gathering in case of emergencies, additional monitoring cars are deployed to allow continuous radiation dose measurements in the surrounding area of the power station.

Tsunami Protection Countermeasures Implemented at Kashiwazaki-Kariwa Nuclear Power Station

Seawall Construction

The construction of the seawalls started in November 2011. Seawalls (15m above sea level) are being built along Unit 1-4 (Arahama side) and Unit 5-7 (Ominato side). Along with an observation deck, these constructions that surround the entire power station will prevent Tsunami from flowing into the power station site. In consideration of the ground heights, the seawalls built along Unit 1-4 are made of reinforced concrete and those built along Unit 5-7 are made of improved soil.



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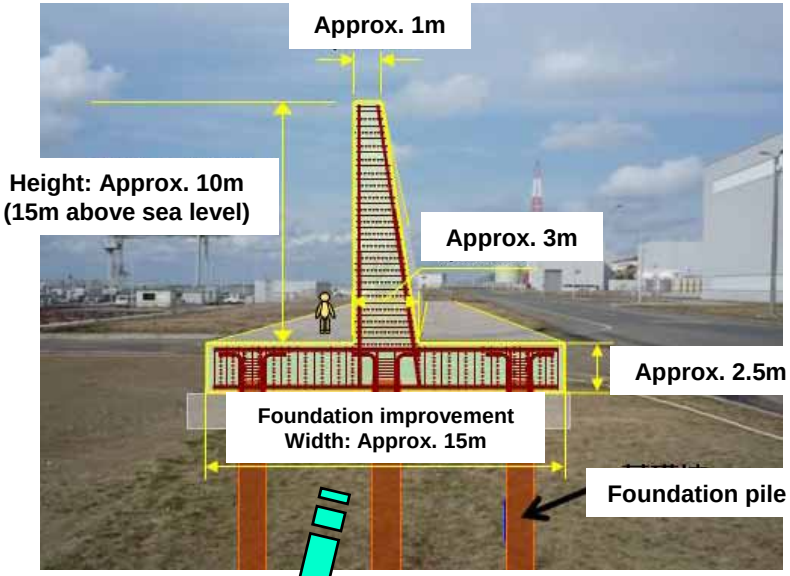
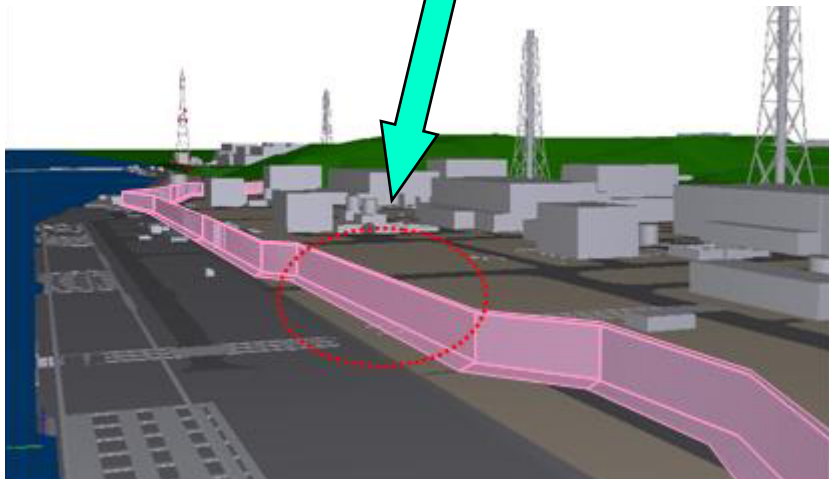
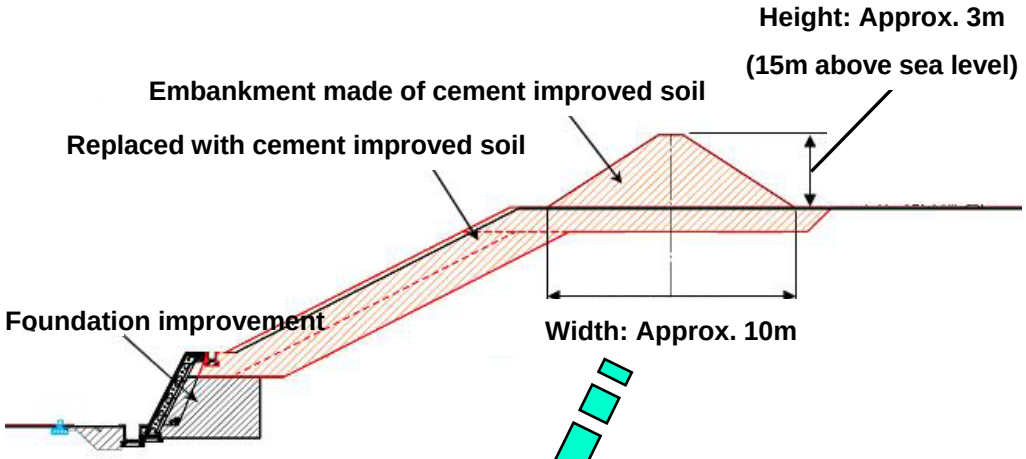
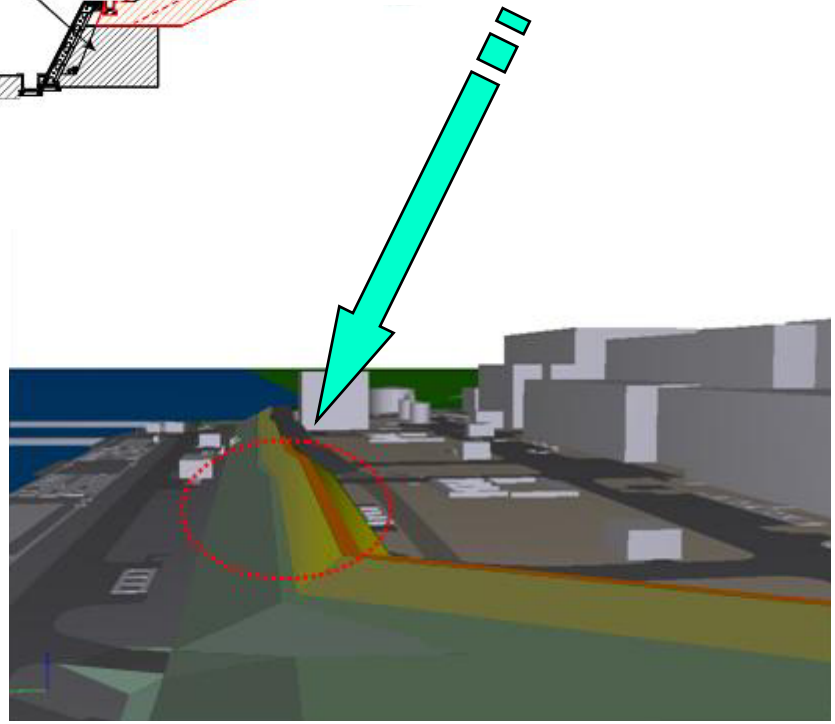
Seawall Construction





Unit 1-4 (Arahama side)





Unit 5-7 (Ominato side)

Tsunami Protection Countermeasures Implemented at Kashiwazaki-Kariwa Nuclear Power Station

Progress Status of Seawall Construction

Photo taken on June 18, 2012

Photo taken on June 18, 2012

Seawalls along Unit 1-4 (Arahama side)

Foundation pile construction: Approx. 460 piles installed as of the end of May 2012

The entire seawalls construction: Approx. 30% completed as of the end of May 2012

Tsunami Protection Countermeasures Implemented at Kashiwazaki-Kariwa Nuclear Power Station

Progress Status of Seawall Construction


Photo taken on June 18, 2012


Photo taken on June 18, 2012

Seawalls along Unit 5-7 (Ominato side)

Embankment construction using cement improved soil: Approx. 80% completed as of the end of May 2012

Tsunami Protection Countermeasures Implemented at Kashiwazaki-Kariwa Nuclear Power Station

Outline of the Freshwater Reservoir and the Water Transfer Pipes

Freshwater Reservoir

-Freshwater transfer from the reservoir to the tank is done based on gravity flow requiring no power, in order to allow water transfer even in the case of station blackouts.

-The freshwater reservoir must be built on the flat ground at approx. 45m above sea level to prevent impact from Tsunami.

-In order to secure necessary amount of freshwater even after an earthquake, a drilling operation is done on the ground and an embankment using cement improved soil is built. An impermeable liner is installed on the inner surface of the freshwater reservoir to prevent water leak in the case of an earthquake. The reservoir height is set high enough to secure necessary amount of freshwater, taking into account the overflow due to the sloshing phenomenon at the time of an earthquake.

-The capacity of the freshwater reservoir is approx. 20,000m^3 which is equivalent to the freshwater storage amount in the existing tank. With the new reservoir, the stored freshwater amount is increased twice as much.

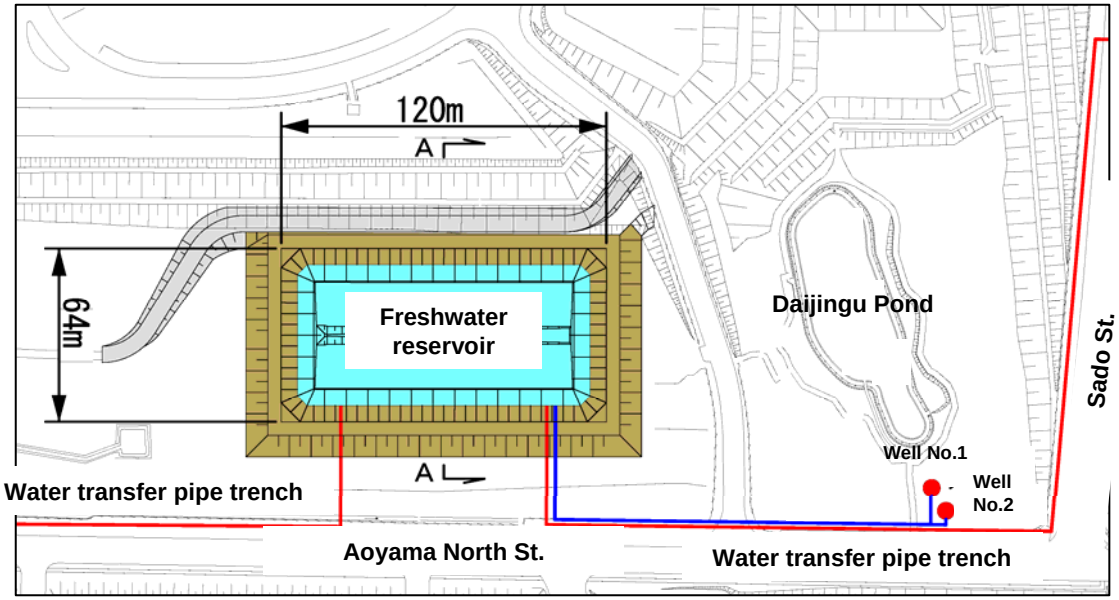
Water Transfer Pipes

-“Pressure-resistant/abrasion-resistant hose" with flexible structure design is used, to be able to withstand earthquakes and minimize the impact of earthquakes.

-The water transfer line has a double structure allowing the pressure-resistant/abrasion-resistant hose inside to be protected even when the outer layer is damaged.

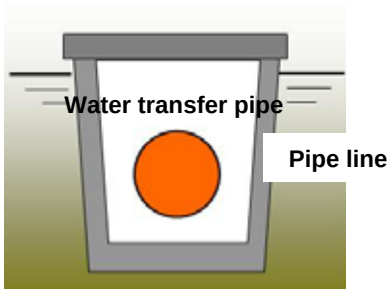
Tsunami Protection Countermeasures Implemented at Kashiwazaki-Kariwa Nuclear Power Station

Freshwater Reservoir

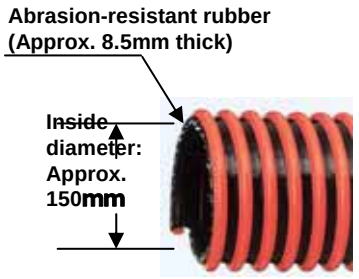


Freshwater reservoir and the wells

Water transfer line
Water supply line



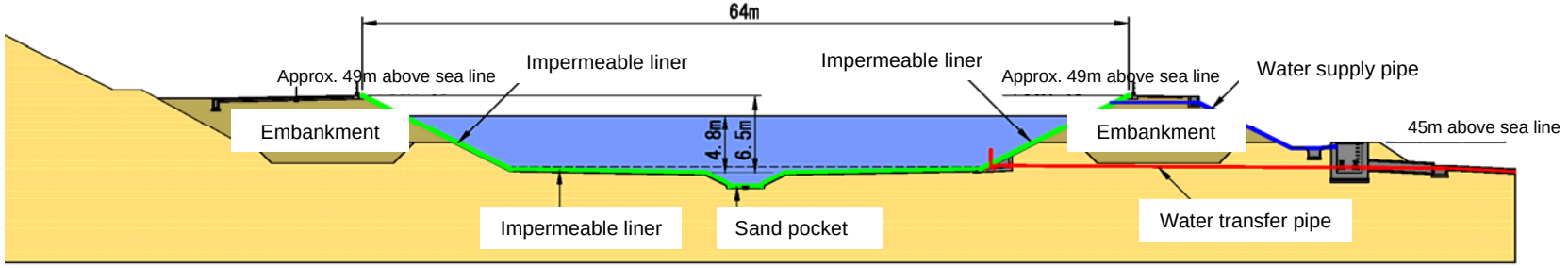
Water transfer pipe



Pressure-resistant/abrasion-resistant hose

Freshwater reservoir
Size: 64m (Length) x 120m (Width) x 6.5m (Depth)
The maximum water depth: 4.8m
Capacity: Approx. 20,000m^3 (Effective capacity:18,000m^3)

Water transfer pipe
Material: Abrasion-resistant rubber (Approx. 8.5mm thick)
Inside diameter: Approx. 150mm



Freshwater reservoir (A-A Cross section)

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Progress Status of Freshwater Reservoir Construction

Drilling operation

Freshwater reservoir (Full view)

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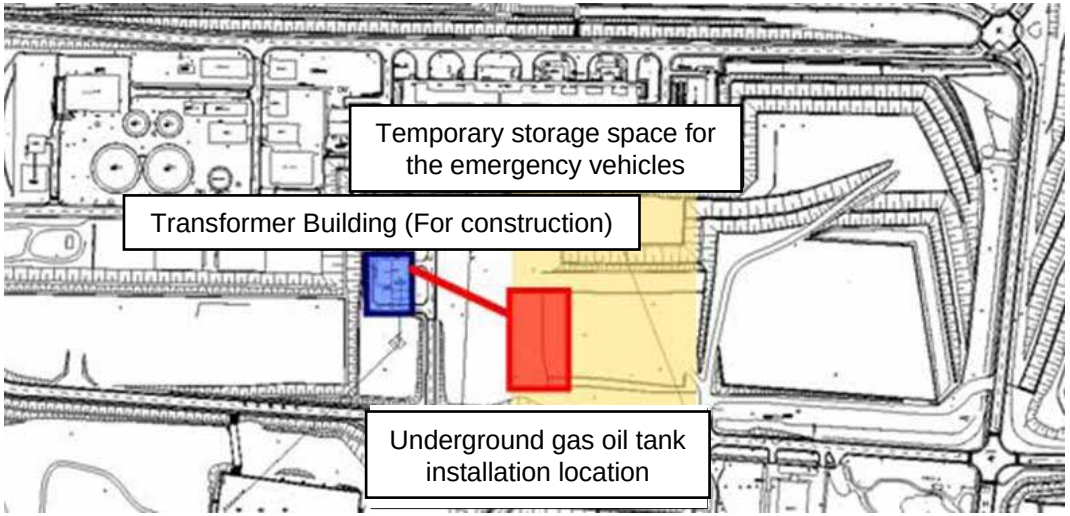
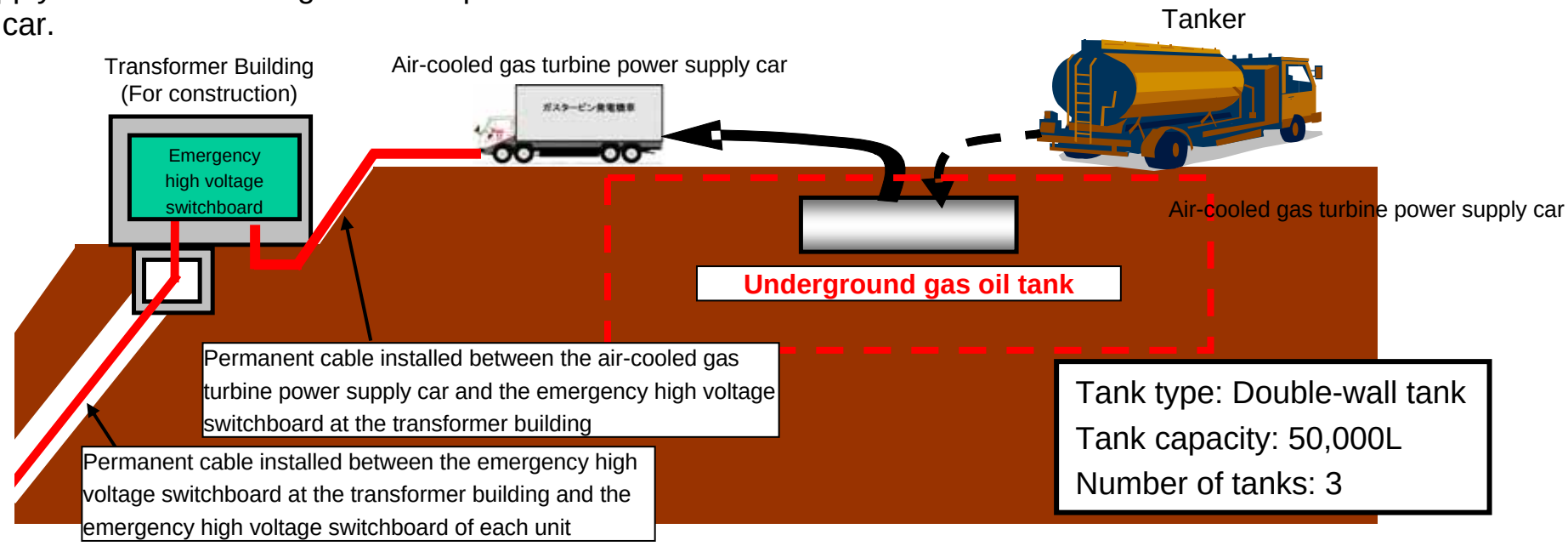
Underground Gas Oil Tank

-For backup power supply line for emergency, the permanent cable is installed between the emergency high voltage switchboard at the transformer building and the emergency high voltage switchboard of each unit.
-Permanent cable is installed between the air-cooled gas turbine power supply car and the emergency high voltage switchboard at the transformer building.
-Underground gas oil tank is installed to allow stable fuel supply to the air-cooled gas turbine power supply car.





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Installation of the Underground Gas Oil Tank and Air-cooled Gas Turbine Power Supply Cars

Underground gas oil tank installation completed

2 air-cooled gas turbine power supply cars have been deployed

Progress Status of Tsunami Protection Countermeasure Implementation at Kashiwazaki-Kariwa Nuclear Power Station

As of June 21, 2012

Countermeasure	Overall Schedule
	FY 2011 / FY 2012 / FY 2013 (▼June 21, 2012)
1. Seawall Construction	Design; Construction commenced in November 2011; Will be completed in the 1st qtr. of FY 2013
2. Preventing the Buildings from Being Flooded	
(1) Seawall/Flood barrier panels installation	Commenced in April 2011; Will be completed in the 2nd half of FY 2012
(2) Watertight doors at the Reactor Building, etc.	Design; Commenced in September 2011; Will be completed in the 2nd half of FY 2012
3. Strengthening the Heat Removal/Cooling Functions	
(1) Water source installation	Design; Commenced in February 2012; Will be completed in the 1st half of FY 2012
(2) Additional deployment of air-cooled gas turbine power supply cars	Preparation commenced in July 2011; Completed in March 2012
(3) Installation of emergency high-voltage switchboards and the permanent cables in the Reactor Building	Design/ Manufacture; Commenced in August 2011; Completed in April 2012
(4) Installation of alternative underwater pumps and alternative seawater heat exchanger facility	Design; Commenced in August 2011; Will be completed in the 2nd half of FY 2012
(5) Top vent system installation at the Reactor Building	Design; Commenced in October 2011; Will be completed in the 1st half of FY 2012
(6) Strengthening the environment monitoring equipments, additional deployment of monitoring cars	Design/ Preparation; Completed in October 2011
(7) Equipments/materials storage built on high ground for emergency	Design; Plan to be commenced in July 2012; Will be completed in the 1st qtr. of FY 2013

Progress Status of Tsunami Protection Countermeasure Implementation at Kashiwazaki-Kariwa Nuclear Power Station

As of June 21, 2012

Countermeasure	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
1. Seawall Construction	Under construction				Under construction		
2. Preventing the Buildings from Being Flooded							
(1) Seawall/Flood barrier panels installation	Completed	Under construction	Under construction	Under construction	No opening under 16m above sea level		
(2) Watertight doors at the Reactor Building, etc.	Completed	Under design	Under design	Under design	Completed	Completed	Completed
3. Strengthening the Heat Removal/Cooling Functions							
(1) Water source installation	Under construction						
(2) Additional deployment of air-cooled gas turbine generator trucks	Completed						
(3)-1 Installation of emergency high-voltage switchboards	Completed						
(3)-2 Installation of permanent cables in the Reactor Building	Completed	Completed	Completed	Completed	Completed	Completed	Completed
(4) Installation of alternative underwater pumps and alternative seawater heat exchanger facility	Completed	Under design	Under design	Under design	Completed	Will be deployed at the next inspection	Completed
(5) Top vent system installation at the Reactor Building	Completed	Under design	Under design	Under design	Completed	Completed	Completed
(6) Strengthening the environment monitoring equipments, additional deployment of monitoring cars	Completed						
(7) Equipments/materials storage built on high ground for emergency	Under design						

: Under design/preparation : Under construction : Completed

*We will continue implementing necessary Tsunami protection countermeasures to further enhance the reliability of nuclear power station.