Implementation of additional measures against Severe Accident learnt from the accident at Fukushima Daiichi Nuclear Power Station in 2011
(Report on the status of implementation)

June 14, 2011

The Tokyo Electric Power Company, Incorporated

Contents

1. Summary

We are causing significant concern and inconvenience to the general public from the accident at Fukushima Daiichi Nuclear Power Station initiated by the tsunami arising from Tohoku-Chihou-Taiheiyo-Oki Earthquake Occurred on March 11, 2011. We are working jointly with the government, municipalities and other related organizations to contain the calamity.

As to Kashiwazaki Kariwa Nuclear Power Station, on March 30, 2011, we received a directive from the Minister of Ministry of Economy, Trade and Industry (" METI ") "Regarding the Implementation of Emergency Safety Measures for the Other Nuclear Power Stations considering the Accident of Fukushima Dai-ichi and Dai-ni Nuclear Power Stations in 2011 (Directions)" (March 28, 2011 Nuclear Number 7). As per that directive, on April 21, 2011 and May 2, 2011 (supplement), we reported the status of implementation of the urgent safety measures in order to prevent damages to Reactor and Spent Fuel, contain release of radioactive substances and recover the cooling capacity for Reactor Facilities in the event that three functions (supply of AC, cooling Reactor Facilities by seawater and cooling Spent Fuel Pool) are lost. Nuclear and Industrial Safety Agency, Ministry of Economy, Trade and Industry evaluated that those urgent safety measures are adequately implemented.

As for Fukushima Daini Nuclear Power Station, on April 21, 2011, we received a directive from Minister of METI "Regarding the Implementation of Emergency Safety Measures for Fukushima Dai-ni Nuclear Power Station in 2011 (Directions)" (April 20, 2011 Nuclear Number 20). As per that directive, on May 20, 2011, we reported the status of implementation of the urgent safety measures in order to prevent damages to Reactor and Spent Fuel, contain release of radioactive substances and recover the cooling capacity for Reactor Facilities in the event that three functions (supply of AC, cooling Reactor Facilities by seawater and cooling Spent Fuel Pool) are lost. Nuclear and Industrial Safety Agency, METI is evaluating those urgent safety measures to confirm adequateness.

Nuclear Disaster Countermeasures Headquarters for the Accident of Fukushima Dai-ichi and Dai-ni Nuclear Power Stations in 2011 collated the report on the Accident and identified issues in endeavoring to restore the Accident (measures against Severe Accident). As these measures to counter the Severe Accident in an expeditious manner have been sorted

out, on June 7, 2011, Minister of METI issued a directive "Regarding Implementation of Preparatory Measures for Severe Accidents in Other NPSs Taking into Account the 2011 Accident at Fukushima Dai-ichi NPS (Direction)" (June 7, 2011 Nuclear Number 2) to work on matters listed below and report the status of the implementation.

1. Secure the working environment at the Main Control Room
   In order to secure the working environment (protection from radiation etc.) at the Main Control Room in the event of emergency, to keep the emergency ventilation air conditioning facility (recirculation) by electricity supply from a generator truck when all AC sources are lost.

2. Secure the communication channel in the power station in the event of emergency
   In order to ensure the smooth work in the power station in the event of emergency, to undertake necessary measures to secure the communication channel in the power station when all AC sources are lost.

3. Stock necessary equipments such as high radiation protective garments and increase manpower for radiation management
   In order to ensure the radiation protection and radiation management of workers in the event of emergency, to undertake necessary measures to avail high radiation protective garments, individual dosimeter etc. including sharing between nuclear reactor operators. Also, to increase manpower for radiation management.

4. Prevent hydrogen explosion
   In order to prevent destruction of facilities by hydrogen explosion as a result of core damage etc., to undertake measures to prevent substantial accumulation of hydrogen in the Reactor Building in the event of emergency.

5. Deploy heavy equipments to clear rubbles
   In order to expedite works in the power station in the event of emergency, to deploy heavy equipments such as wheel loaders to clear rubbles as a result of tsunami etc.

This report summarizes our status of implementation on five items above as instructed by Minister of METI.

2. The status of implementation of additional measures against Severe Accident

2.1 Secure the working environment at the Main Control Room

(1) The lesson learnt from The Accident at Fukushima Daiichi Nuclear Power Station

At the time of this Accident, the radiation level in the Main Control Room became high so much so that plant operators could not enter. Currently, the radiation level is too high to stay and work long hours. So, in order to secure the working environment (protection from radiation etc.) at the Main Control Room in the event of emergency, we have to keep the emergency ventilation air conditioning facility (recirculation) operational by electricity supply from a generator truck etc. when all AC sources are lost.

(2) Our measures

The air conditioning at the Main Control Room stops when all AC sources are lost. That does not mean that the working environment will be instantaneously jeopardized if there are radioactive substances at the surrounding areas.

However, in order to respond to the Accident in a continuous manner for a long time, we will keep the working environment in the Main Control Room by the following measures:

After all AC sources are lost, we will receive electricity supply from generator trucks.

Open dampers electrically for Fukushima Daini Nuclear Power Station and manually at Kashiwazaki Kariwa Nuclear Power Station.

Start the Main Control Room Recirculation Fan and Main Control Room Fan and, filter and circulate air in the Main Control Room.

As for temperature rise and carbon dioxide increase in the Main Control Room, we filter and introduce fresh air to the Main Control Room in order to account for (Attachment-1).

We set out the above measures and allocated generator trucks and confirmed that the generation capacity satisfies the necessary load as follows:
Fukushima Daini: on top of the five generator trucks (including the one at the waste treatment building) we allocated as the emergency safety measures, we added three generator trucks
Kashiwazaki Kariwa: on top of the four generator trucks we allocated as the emergency safety measures, we added six generator cars and increased capacities of two generators (Attachment-2)

2.2 Secure the communication channel in the power station in the event of emergency

(1) The lesson learnt from The Accident at Fukushima Daiichi Nuclear Power Station

At this Accident, All AC sources are lost because of earthquake and tsunami. There was serious deterioration of communication channel in the power station that caused significant difficulty in responding to the Accident. Therefore, to ensure the smooth work in the power station in the event of emergency, we have to secure the reliable communication channel in the power station when all AC sources are lost.

(2) Our measures

At this moment, the communication channel in the power station is paging and PHS. As to the other areas, we are using mobile radio and satellite phone additionally.
At Fukushima Daini Nuclear Power Station, the mobile radio building (mobile radio base station and emergency electricity source are located in this building) is situated at a place relatively safe from the tsunami (O.P 47.9m + basement 0.3m). As for Kashiwazaki Kariwa Nuclear Power Station, the main anti-earthquake building (mobile radio base station and emergency electricity source are located in this building) is situated at a place relatively safe from the tsunami (T.P 13m + basement 0.5m)

As for paging and PHS, we have redundancy of electricity supply (two AC sources). If all AC sources are lost, we can operate these by

supplying electricity from DC battery or generator truck. (Attachment-3)

At both power stations, we confirmed that DC battery room and communication system room (paging and PHS) will not lose function by inundation.

In terms of lighting, we can secure the emergency lights for a limited duration if all AC sources are lost. If all AC sources are lost for a long duration, those emergency lights will be off. To account for this, we allocated spotlights etc.

2.3 Stock necessary equipments such as high radiation protective garments and increase manpower for radiation management

(1) The lesson learnt from The Accident at Fukushima Daiichi Nuclear Power Station

During this Accident, as the matters propagated far beyond the assumed level, radioactive substances scattered within the boundary of the power station and in the buildings. As such, the air dose rate became extremely high and exposure dose of workers in charge of stabilization works became extremely high. This became a major issue in doing works smoothly.

Also, at the initial stage of the Accident, several issues were identified:

There were insufficient equipments such as APDs and full-face masks. We could not secure APDs and protective gears on an individual basis and could not undertake adequate radiation administration.

There was delay in implementation of radiation management such as measurement of aerial radioactive substances. This increased the risk of internal exposure dose.

To mitigate the risk, it is useful to stock protective garments that shield high radiation working environment (“HR Garments”), APDs etc. Also, to account for the radical increase of radiation management workload, it is useful to establish a framework under which persons other than radiation management staffs can assist so that radiation management staffs can concentrate on the inherent works.

(2) Our measures

Based on lessons learnt, we stock ten sets of HR Garments at each power station. The storage space is at the main anti-earthquake building. (planned deployment: July 2011)

Also, we confirmed with other nuclear operators to share equipments not listed on the nuclear operators cooperation treaty at the time of nuclear accidents such as HR Garments, APDs and full face masks by "treatment of equipments such as HR Garments per the directive from Minister of METI (June 9, 2011)".

As to radiation management staffs in the event of emergency, in order for them to execute the inherent works such as exposure management of workers, contamination management of workers and instruction on the work plan, we established the assistance framework and workforce that will assist in the accessory works such as contamination measurement of workers, radiation measurement of the site, administration of equipments etc. (Attachment-4)

Also, in order to keep radiation management staffs in the event of emergency, we completed the course for radiation management to 250 TEPCO employees. We are continuing the same.

2.4 Prevent hydrogen explosion

(1) The lesson learnt from The Accident at Fukushima Daiichi Nuclear Power Station

At this Accident, at the R/B, explosion because of hydrogen leaked from PCV occurred and worsened the Accident.

In order to prevent destruction of facilities by hydrogen explosion, we have to undertake measures to prevent substantial accumulation of hydrogen in the R/B.

(2) Our measures

In order to drill holes to the R/B as have been done at Fukushima Daiichi Nuclear Power Station, we deployed necessary equipments to the main anti-earthquake building as for Fukushima Daini Nuclear Power Station and to the roof of R/B as for Kashiwazaki Kariwa Nuclear Power Station. We also established the procedure.

As a mid term and long term measure, at Kashiwazaki Karuwa Nuclear Power Station, we will install a top vent facility to the R/B and

hydrogen detector. (planned completion is during the former half of FY 2012) (Attachment-5)

2.5 Deploy heavy equipments to clear rubbles

(1) The lesson learnt from The Accident at Fukushima Daiichi Nuclear Power Station

At the time of this Accident, after tsunami, there were driftage and rubbles scattered in the power station. Also, as there were damages to the surrounding areas, we could not mobilize the rescue team to assist the accident management quickly and sufficiently. As such, driftage and rubbles were the obstacles in responding to the Accident.

In order to expedite our work in the power station in the event of emergency, we have to deploy heavy equipments to clear rubbles by tsunami etc. quickly.

(2) Our measures

If all AC sources are lost, we have to use (i) the generator trucks for electricity supply and (ii) fire engineers to supply water to Reactor and Spent Fuel Pool. In that instance, there is a possibility that we have to clear obstacles for these vehicles.

We deployed two heavy equipments to each power station as below:

Power Station	type	maximum breakout force	Date of deployment
Fukushima Daini	wheel loaders	6.4t / 14.5t	March 12, 2011
Kashiwazaki Kariwa	wheel loaders	12t / 12t	April 7, 2011

We also stored broken rocks to repair dent to the road.

(Attachment-6)

As to the operation of wheel loaders, three non-TEPCO employee operators at Fukushima Daini Nuclear Power Station and two non-TEPCO employee operators at Kashiwazaki Kariwa Nuclear Power Station will be in charge in the event of emergency.

Also, at Kashiwazaki Kariwa, we are planning to add two wheel loaders and three loading shovels (planned completion is during the former half of FY 2012)

3. Measures to be implemented

Measures set out in this report are based on knowledge identified to date. In the future, after analysis of the entire Accident and additional knowledge will be identified in the course of analysis of the cause and evaluation, we will undertake necessary measures.

4. List of attachments

Attachment 1: Secure the working environment at the Main Control Room

Attachment 2: Required capacity of electricity source

Attachment 3: Secure communication channel in the power station in the event of emergency

Attachment 4: Stock necessary equipments such as high radiation protective garments and increase manpower for radiation management

Attachment 5: Prevention of hydrogen explosion

Attachment 6: Deployment of heavy equipments to clear rubbles

Attachment 7: The schedule for additional measures

Maintain the working environment at the Main Control Room

Prepare air ventilation at Main Control Room

- Secure electricity source for recirculation fan, fan, air extractor by generator trucks etc.

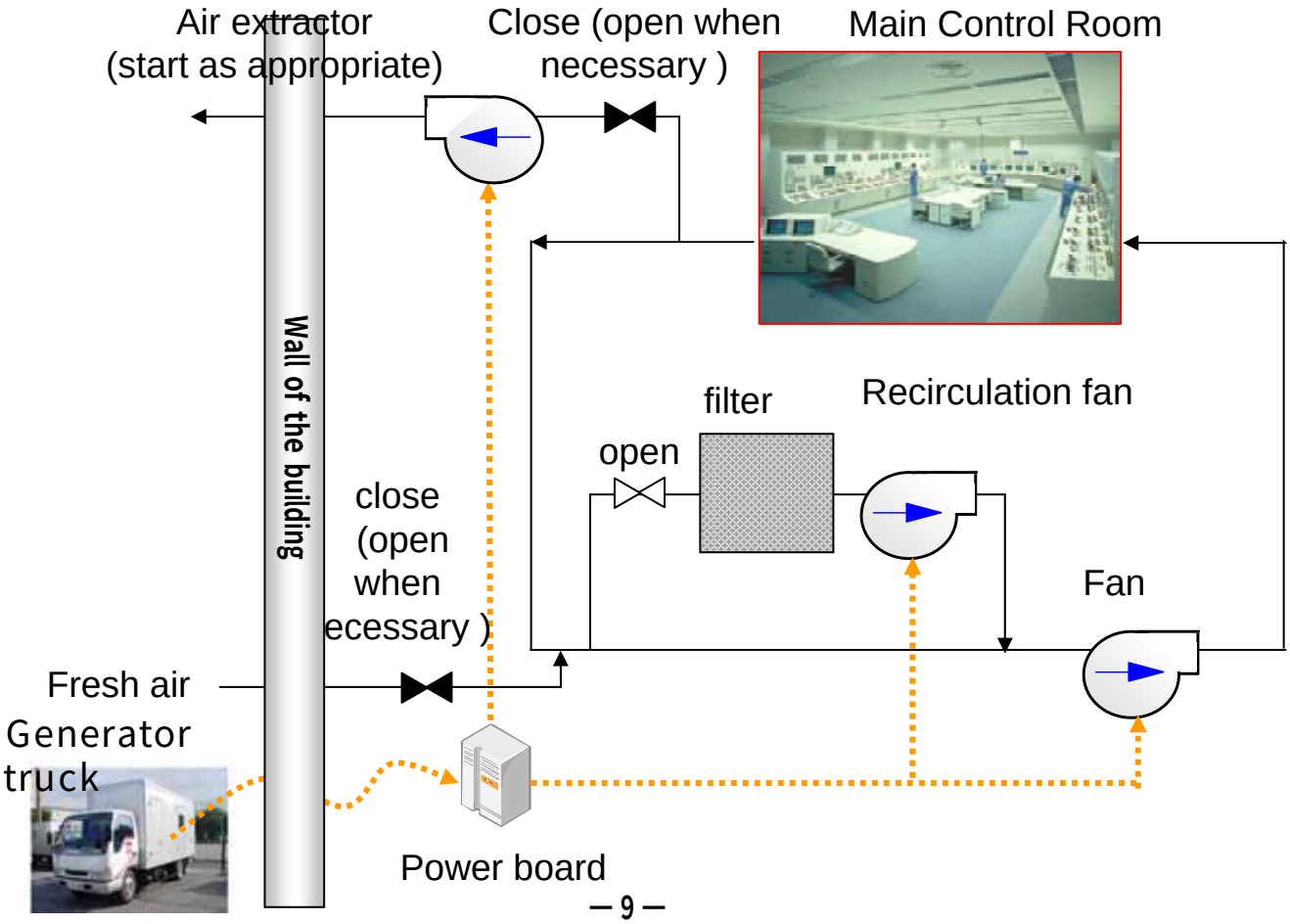
Establish the ventilation line

Start the recirculation fan and fan

Contain CO2 density increase

- intake the fresh air
- start the air extractor

Maintain the working environment at the Main Control Room



Required electricity supply capacity for Kashiwazaki Kariwa Nuclear Power Station

In the event of emergency, we need water injection / cooling capacity for the following equipments.

① For Units 1, 3, 5-7 with fuel loaded in the Reactor: Reactor and Spent Fuel Pool

② For Units 2 and 4 without fuel in the Reactor: Spent Fuel Pool

We also need air conditioning for the Main Control Room. We have to satisfy the electricity supply capacity for loads above.

Below are the required capacities for each function, each unit.

Alternative water injection to Reactor and Spent Fuel Pool

Aggregate load of Condensate Water Supply Facility, Spent Fuel Pool Cooling and Purification System and Main Control Room Air Conditioning

unit / load(kW)	1	2	3	4	5	6	7
Emergency safety measures	370	130※1,2	275※3	145※1	298	306	313
Main Control Room air conditioning	153	89	104	94	127	184	150
Total	523	219※1	379※3	239※1	425	490	463

※1 During periodic maintenance, no fuel in the Reactor

※2 We changed the communication equipment from sharing between Units 1 and 2 to Unit 2 independent. Increase by 30 kW from the time of reporting.

※3 During periodic maintenance, fuel loaded in the Reactor

The deployed electricity supply capacity is as below: (power factor: 0.8)

unit / load(kVA)	1	2	3	4	5	6	7
Sum of required load	654	274	474	299	532	613	579
Generators deployed	1000 (500kVA generator truck x 2)	350 (350kVA generator)	1000 (500kVA generator truck x 2)	350 (350kVA generator)	1000 (500kVA generator truck x 2)	1000 (500kVA generator truck x 2)	1000 (500kVA generator truck x 2)
Before enhancement	(500kVA generator truck)	(195kVA generator)	(450kVA generator)	(195kVA generator)	(500kVA generator truck)	(500kVA generator truck)	(500kVA generator truck)

Note: in order not to exceed the capacity of generators deployed, when there is rush current such as starting pumps, we consider the load.

The capacity of generators deployed to each unit satisfies the required capacity.

Required electricity supply capacity for Fukushima Daini Nuclear Power Station

In the event of emergency, we need water injection / cooling capacity for the following equipments.

① For Units 1-4 with fuel loaded in the Reactor: Reactor and Spent Fuel Pool

We also need air conditioning for the Main Control Room. We have to satisfy the electricity supply capacity for loads above.

Below are the required capacities for each function, each unit.

Alternative water injection to Reactor and Spent Fuel Pool

Aggregate load of Condensate Water Supply Facility, Spent Fuel Pool Cooling and Purification System and Main Control Room Air Conditioning

(we rounded up below 1)

unit / load(kVA)	1	2	3	4
Emergency safety measures	296	295	313	306
Main Control Room air conditioning	170	221	213	199
Total	466	516	526	505
Generators deployed	500 (500kVA generator truck)	1000 (500kVA generator truck x 2)	1000 (500kVA generator truck x 2)	1000 (500kVA generator truck x 2)
Before enhancement	(500kVA generator truck)	(500kVA generator truck)	(500kVA generator truck)	(500kVA generator truck)

The capacity of generators deployed to each unit satisfies the required capacity.

Secure communication channel in the power station in the event of emergency

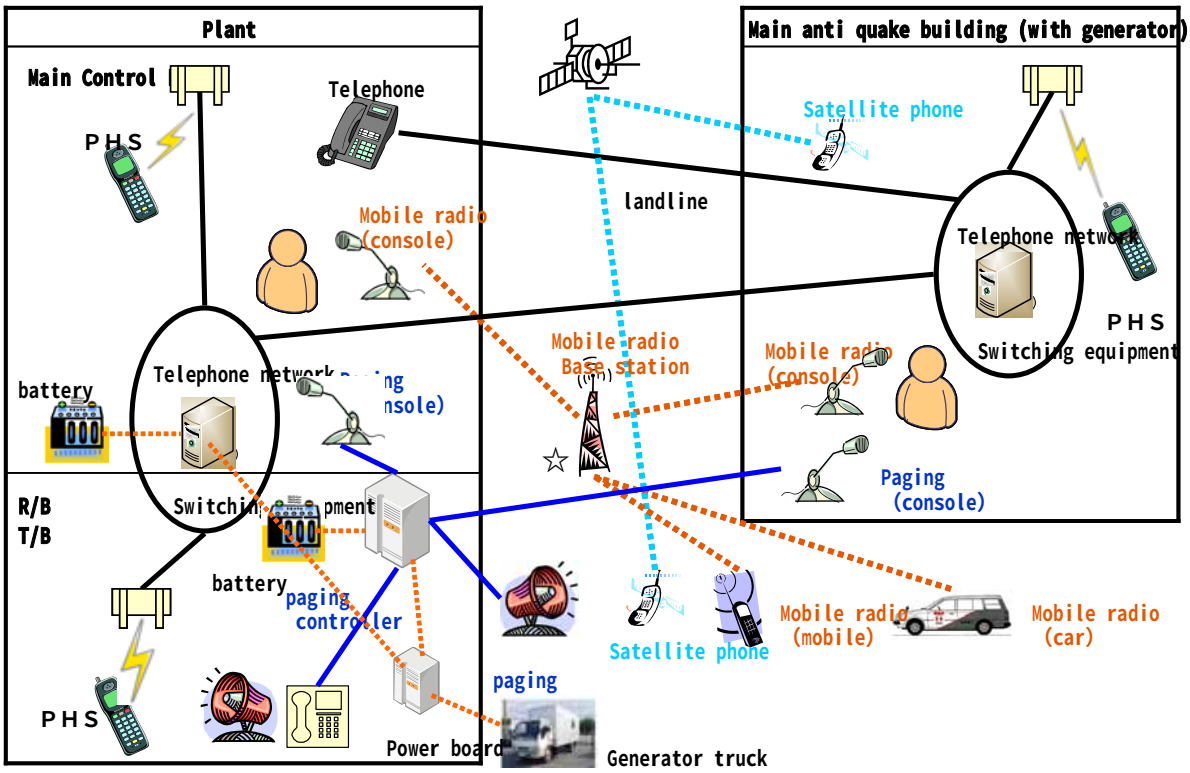
We allocated below communication equipments

○ Satellite phone KK: 5 units, 2F: 4 units

○ Mobile radio KK: 9 mobile units, 8 car units, 7 at console

2F: 9 mobile units, 3 car units, 2 at console

○ Telephone (PHS), paging



For reference, Kashiwazaki Kariwa Nuclear Power Station

Attachment-4

Stock necessary equipments such as high radiation protective garments and increase manpower for radiation management

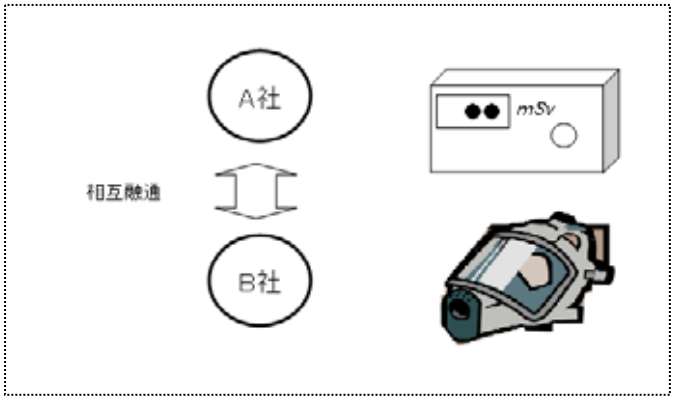
○To work at high dose areas at the time of accident, stock ten sets of high radiation protective garments(with Tungsten) at each of Kashiwazaki Kariwa Nuclear Power Station and Fukushima Daini Nuclear Power Station (planned completion: July 2011)

○As to APDs and full face masks, on top of stocks, we established a framework to share with electricity utility companies and related agencies.

high radiation protective garments

○ Protective vest
○ Weight: 18kg
○ Ability to shield: equivalent to 2mm of lead

APDs and full face masks



Sharing of equipments such as high radiation protective garments with electricity utility companies and related agencies.

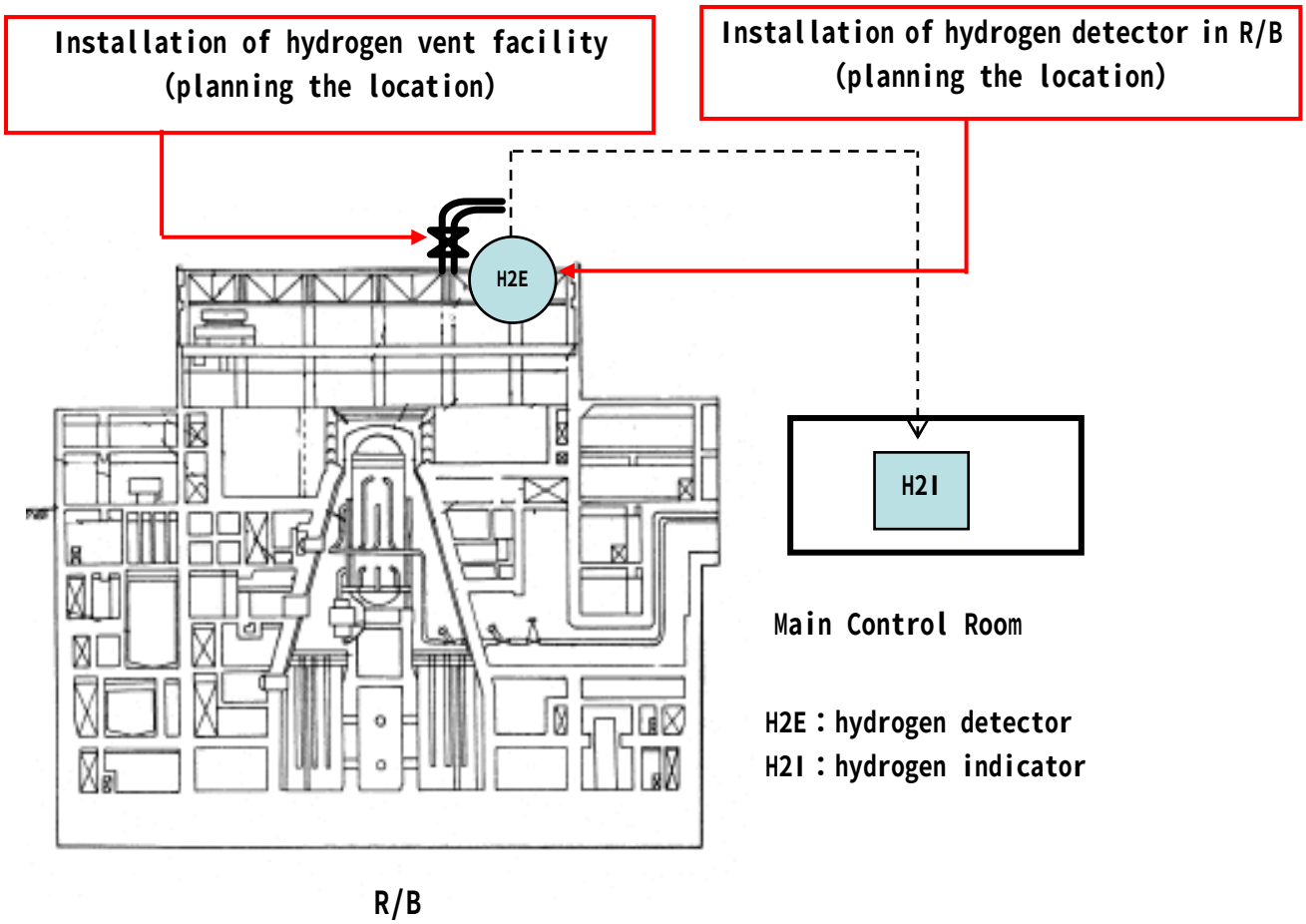
Prevention of hydrogen explosion

○ Prepare necessary equipments to drill holes to R/B with ease and establish the procedure (done)

【equipment】

○ At Kashiwazaki Kariwa Nuclear Power Station, we install openings to the top of R/B and install the vent facility. (planned completion is the former half of FY2012)

○ At Kashiwazaki Kariwa Nuclear Power Station, in order to monitor the density of hydrogen leaked from PCV, we will install the hydrogen detector around the ceiling of R/B and add the monitoring function from the Main Control Room (planned completion is the former half of FY2012)



Deployment of heavy equipments to clean rubbles

○After tsunami, in order to clean rubbles on the access roads, we deployed two wheel loaders and crush stone to each of Fukushima Daini and Kashiwazaki Kariwa.
Fukushima Daini: March 12, 2011
Kashiwazaki Kariwa: April 7, 2011

○Wheel loaders etc. are kept at places out of reach from tsunami.
Fukushima Daini: O.P.４７m
Kashiwazaki Kariwa: T.P.３６m

○We are keeping heavy equipments with full fuel tank. If we have to refill, from the tanker etc. We are storing fuel at the light oil tank. At Kashiwazaki Kariwa, we have over 5,426 kl. At Fukushima Daini, we have over 2,278 kl.

Kashiwazaki Kariwa

Closer heavy equipment, far heavy equipment
length ：７．２m, ７．５m
width ：both ２．７m
height ：３．３m, ３．５m
weight ：１２．５t, １２．９t
capacity of bucket： both ２．３m^3
maximum breakout force： both １２t
continuous operation time： both１２hours
size of fuel tank：both ２００ l

Fukushima Daini

Left heavy equipment, right heavy equipment
length ：５．９m, ９．５m
width ：２．３m, ２．９m
height ：３．１m, ３．０m
weight ：６．５t, １９．８t
capacity of bucket：１．３m^3, ０．７m^3
maximum breakout force：６．４t, １４．５t
continuous operation time：7 hours, 15 hours
size of fuel tank：１２０ l, ４００ l

Schedule for implementation of additonal measures at Fukushima Daini Nuclear Power Station

item		content	schedule	
			FY 2011	FY 2012
1. Secure the working environment at the Main Control Room	a.	Establish procedures	6/14 ▽ done	
	b.	Deploy additional generator trucks	done	
2. Secure the communication channel in the power station in the event of emergency	a.	Deploy mobile radios and satellite phones	done	
	b.	Against inundation work for PHS and paging equipments	done	
3. Stock necessary equipments such as high radiation protective garments and increase manpower for radiation management	a.	Establish framework for sharing equipments between electricity utility companies	done	
	b.	Stock high radiation protective garments	planned in July 2011	
	c.	Increase manpower for radiation management for emergency	continue	
4. Prevent hydrogen explosion	a.	Establish procedures to drill holes to the top of R/B, stock equipments	6/14 ▽ done	
5. Deploy heavy equipments to clear rubbles	a.	Deploy heavy equipments	done	

Schedule for implementation of additonal measures at Kashiwazaki Kariwa Nuclear Power Station

item		content	schedule	
			FY 2011	FY 2012
1. Secure the working environment at the Main Control Room	a.	Establish procedures	6/14 ▽ done	
	b.	Deploy additional generator trucks	6/13 ▽ done	
2. Secure the communication channel in the power station in the event of emergency	a.	Deploy mobile radios and satellite phones	done	
	b.	Against inundation work for PHS and paging equipments	done	
3. Stock necessary equipments such as high radiation protective garments and increase manpower for radiation management	a.	Establish framework for sharing equipments between electricity utility companies	done	
	b.	Stock high radiation protective garments	planned in July 2011	
	c.	Increase manpower for radiation management for emergency	continue	
4. Prevent hydrogen explosion	a.	Establish procedures to drill holes to the top of R/B, stock equipments	6/13 ▽ done	
	b.	Install hydrogen detector and R/B vent facilities		planned completion former half of FY2012
5. Deploy heavy equipments to clear rubbles	a.	Deploy heavy equipments	additional deployment (former half of FY2011) ▽ done	