Tentative Translation
(21 Oct. 2011)

Document

Status of Efforts Made at Nuclear Power Plants

October 3, 2011

The Federation of Electric Power Companies

Outline of the Accident at Fukushima Dai-ichi NPS

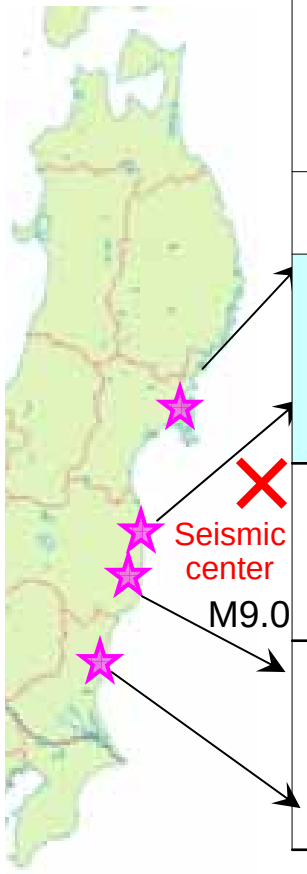
【Before the tsunami】

- All reactors automatically shut down as required following the earthquake (March 11).
- Although off-site power was lost due to a landslide around the offsite transmission tower, all emergency diesel generators automatically actuated, and all components necessary for cooling the reactors functioned properly.

【After the tsunami 】

- Flooding of the power supply system, including emergency diesel generators and distribution boards, cut all AC power, which could not be restored for a long time. As a result, all cooling functions were lost, causing a serious situation with severe damage to the fuel.
- As a result of severe damage to the nuclear fuel, explosions probably due to hydrogen occurred in the reactor buildings.
- Significant amounts of radioactive materials were released into the environment during the accident.

Effects of Great East Japan Earthquake



○: Under periodic inspection	Earthquake			Tsunami					Fuel damage
	Power supply		Cooling function	Height (m)	Ground level (m)	Power supply		Cooling function	
	Off-site	Emergency	Seawater pump			Offsite	Emergency	Seawater pump	
Onagawa 1, ②, 3	○	○	○	13	13.8	○	○	○	Sound
Fukushima Dai-ichi 1, 2, 3, ④ ⑤, ⑥	×	○	○	15.5 (Flooding height)	10 (Units 1-4) 13 (Units 5 & 6)	Earthquake ×	Units 1-5 × Unit 6 ○	Units 1-4 × Units 5 & 6 ×→○ (Several days later)	Units 1-3 (Damaged) Units 4-6 (Sound)
Fukushima Dai-ni 1, 2, 3, 4	○	○	○	14.5 (Flooding height)	12	○	Units 1 & 2 × Units 3 & 4 ○	Units 1, 2, 4 ×→○ (Several days later) Unit 3 ○	Sound
Tokai Dai-ni 1	×→○ (Several days later)	○	○	5.3	8	Earthquake ×→○ (Several days later)	○	○	Sound

Earthquake

- The reactors automatically as required.
- All components required for cooling the reactors functioned properly as emergency DGs automatically actuated in spite of the loss of off-site power.

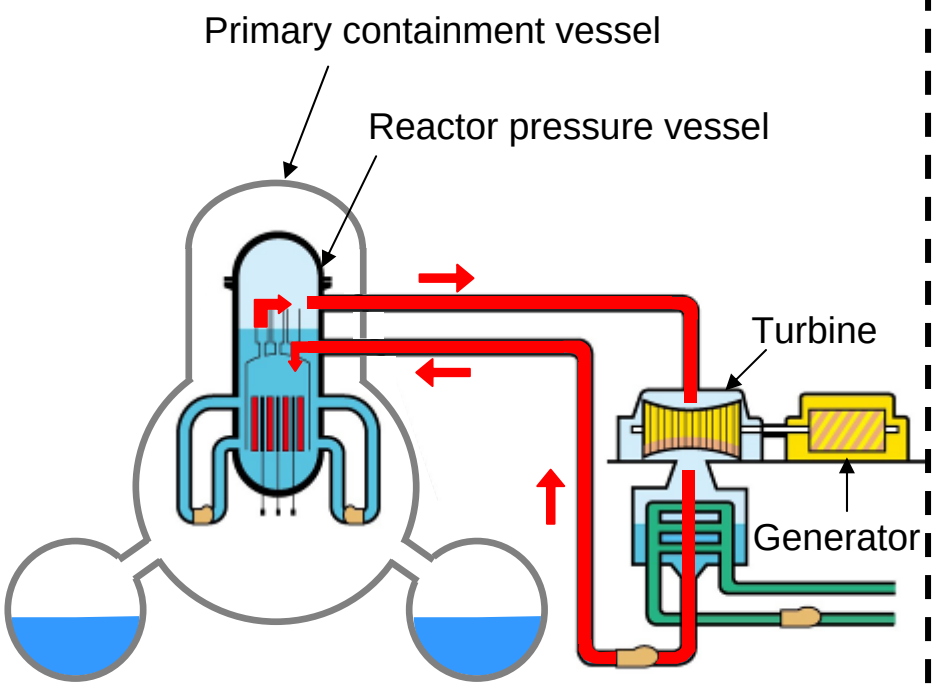
Tsunami

- Loss of power and cooling function resulted in serious conditions including severe fuel damage.
- Additionally, explosions probably due to hydrogen occurred in the reactor buildings.
- Large amounts of radioactive materials were released into the environment .

Characteristics of nuclear reactors

Boiling water reactor (BWR)

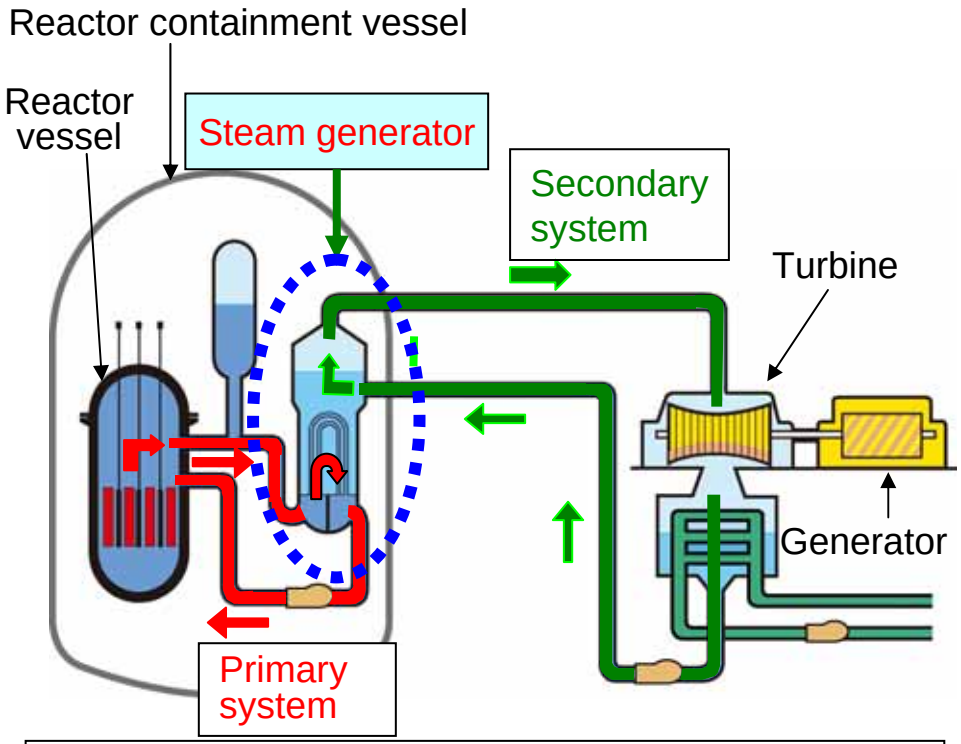
(Fukushima Dai-ichi NPS, etc.)



Steam is produced in the reactor and directly transferred to the turbine.

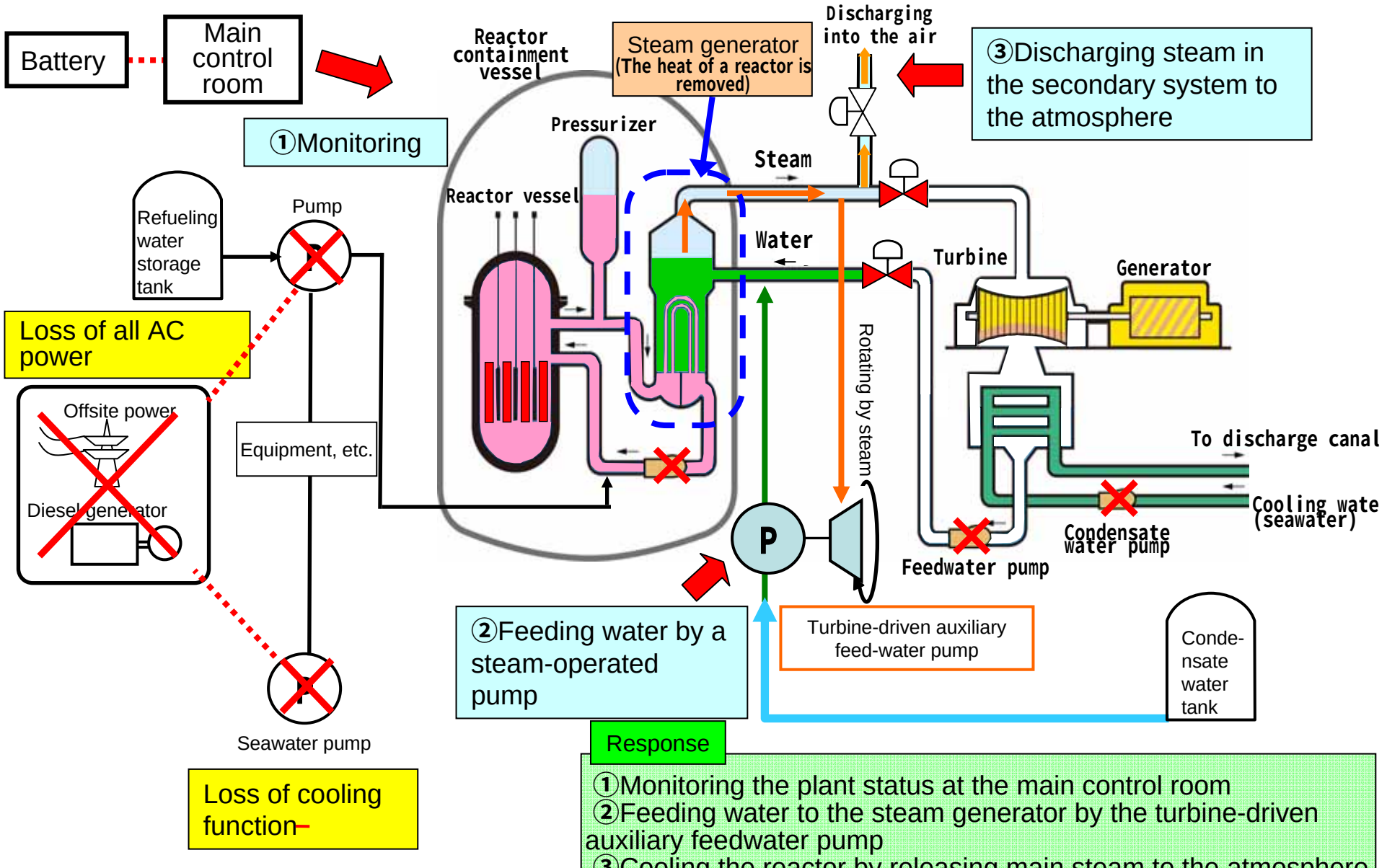
Pressurized water reactor (PWR)

(Mihama NPS, etc.)



Highly pressurized hot water produced in the reactor is transferred to the steam generator where it converts the water flowing through the secondary system into steam. Then, the steam is fed to the turbine.

Response in the Event of Loss of All AC Power and Cooling Functions (PWR)



Response

①Monitoring the plant status at the main control room
②Feeding water to the steam generator by the turbine-driven auxiliary feedwater pump
③Cooling the reactor by releasing main steam to the atmosphere

Implementation of Safety Assurance Measures

Critical components for safety assurance in case of an event similar to the Fukushima Dai-ichi accident

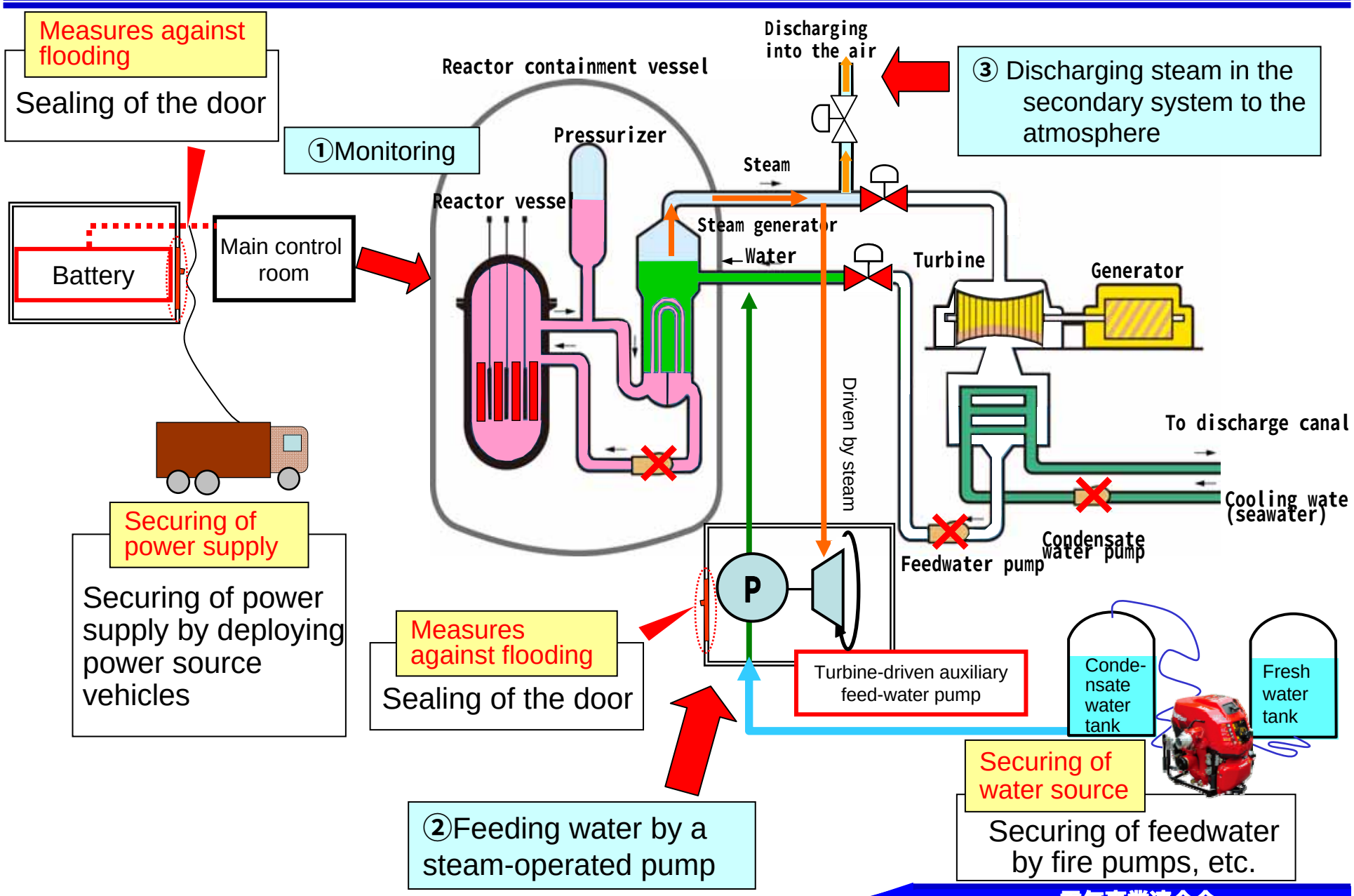
① Batteries and metal clad switchgears (distribution boards) required for plant monitoring at the control room.

② Pumps and their water source for feeding water into SGs

Implementation of safety assurance measures to protect ① and ②.

- Securing power supply: Securing of power supply at the main control room etc. by deploying power generating vehicles, etc.
- Securing water source: Securing water injected into the reactor and steam generator by deploying fire pumps
- Measures against flooding: Deployment of batteries and metal clad switchgears (distribution boards), prevention of flooding of pumps

Safety Assurance Measures (PWR)



Securing Power Source (Example of the Kansai EPCO Ohi NPS)

Tangible measures (Completed)

Power supply for expanding the means to cool down the reactor core

- Boric acid pump
- Residual heat removal system, etc.

Increasing the margin by securing more power sources

- Motor-driven auxiliary feedwater pump

Power supply to monitoring equipment, etc.

- Main control room

4 power source vehicles were deployed
(3 backup vehicles were also deployed)

3 additional power source vehicles were deployed

8 emergency air-cooled generators were installed

○Simplification of connection

Cables are installed in advance in order to supply power from the power source vehicles installed at a location higher than 30 m above sea level, where a tsunami is not expected to reach, to the main control room and feedwater pumps.

Intangible measures (Completed)

For rapid connection of power source vehicles to appropriate points:

○Establish the system

Out-of-hours	6 members are always on standby

○Prepare manuals

○Emergency drills

(Contents of drills)

- Deployment of power source vehicles
- Connection of power supply cables
- Driving of power source vehicles
- Refilling gasoline to power source vehicles

Number of drills conducted so far

Drills on weekday	10
Drills at nighttime	3
Drills on holidays	2

○Feedback on drills

- Wearing headlamps for nighttime work
- Improving the shape of connection terminals for ease of work, etc.

Installation situation of Air-cooled mobile power Generator
(Example of the Kansai EPCO)

Location higher than 30 m above sea level

Air-cooled mobile power generators

Connection board

Installation of cables (when the lid of the tray is open)

Securing Water Sources (Example of the Kansai EPCO Ohi NPS)

Tangible measures (Completed)

Capacity to supply cooling water

Securing means for cooling
- Core cooling (at high temperature)
- Fuel pit cooling

25 fire pumps were deployed

Further cooling of the core
- Core cooling (at low temperature)

28 additional fire pumps were deployed

Diversification of power sources

Cooling of diesel generator

30 mobile engine-driven seawater pumps were deployed

Total of 88 fire pumps were deployed (including 35 backup pumps)

Total of 32 seawater pumps were deployed (including 2 backup pumps)

Intangible measures (Completed)

For rapid installation of the deployed fire pumps, etc. at the appropriate points:

◯Establish the system
◯Prepare the manuals
◯Conduct practice drills:

(Contents of drills)
- Installation of pumps
- Installation of hoses
- Operation of pumps
- Refilling oil to pumps

Number of drills conducted so far

Drills for feeding water into SG	20
Drills for feeding water into SFP	12
CSD drills	4

SG: Steam generator
SFP: Spent fuel pit
CSD: Cold shut down

Drill for pumping seawater

Drill for installing hoses

◯ Feedback on drills
- Points where pumps should be installed were marked.
- Radios were deployed for close communication, etc.

Measures to protect from flooding (Example of the Kansai EPCO)

Sealing for the door

Sealing for pipe penetration part

Effectiveness of the seal has been proofed by manufacturer's tests.

Measures against flooding are implemented to protect the facilities from tsunami.

○Facilities required for supplying power to the main control room
(battery room/metal clad switchgear room)

○Facilities required for supplying water to the steam generator
(pump room/metal clad switchgear room)

Steps for Ensuring Effective Emergency Safety Measures (Example)

Various steps required for securely accomplishing measures have been taken in order to ensure the emergency safety measures are effective, reflecting opinions directly collected from those who experienced the Fukushima Dai-ichi Accident.

Work environment	On-site communication	Radiation control	Prevention of hydrogen explosion	Rubble removal
• Procedure was prepared for stably operating the ventilation system (air re-circulation system) at the control room in case of accident.	• Transceivers • Mobile communication units • Satellite phones	• High-dose-resistant protective clothing • System for mutually exchanging equipment and materials among operators	• Procedure was prepared to ensure reliable ventilation from the annulus* (in case of accident at PWR). • Facilities such as catalytic hydrogen recombiner, etc. are planned to be installed (PWR). • Procedure was prepared to drill a hole into the reactor building (BWR).	• Wheel loaders 

* The annulus is an airtight annular space between the reactor containment vessel and the reactor building.

Measures to Increase the Safety Margin (Example of the Kansai EPCO)

Reinforcement of measures to secure power sources

【Addition of permanent emergency power supply units】
(response in the medium- to long-term)

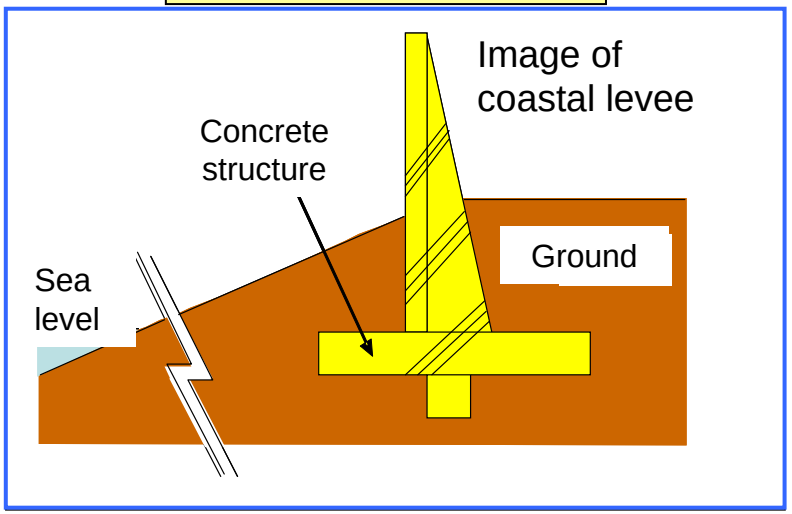
【Reinforcement of transmission lines】
(response in the medium- to long-term)

Reinforcement of measures to secure water sources

【Deployment of a large-capacity temporary seawater pumps】
(scheduled to be deployed in December 2011)

【Deployment of a backup seawater pump motor 】
(scheduled to be deployed in March 2012)

Reinforcement of measures against flooding



【Construction of coastal levee】
(response in the medium- to long-term)

○Measures against flooding including switchyard
(response in the medium- to long-term)

(Other measures)

○ Improvement of access roads to the plant
(response in the medium- to long-term)

○ Construction of a new seismically isolated office building (response in the medium- to long-term)

Comprehensive Evaluation of Safety Including Emergency Safety Measures (Stress Test)

Collective opinion of the Japanese government (July 11)

- Concerning nuclear power plants, safety is confirmed pursuant to the current laws and regulations. Moreover, emergency safety measures have been implemented following the Fukushima NPS Accident. Therefore, greater safety than ever has been confirmed.
- Although some people express understanding of the safety confirmation activities carried out by the Nuclear and Industrial Safety Agency for restarting the nuclear power plants where the periodic inspections have been completed, many people question their policy and activities. Sufficient understanding of the Japanese people, especially those living near nuclear power plants, has not yet been obtained. Therefore, safety evaluations based on new procedures and rules are to be implemented to reassure the Japanese people, making reference to stress tests conducted in European countries.

Contents of the stress test

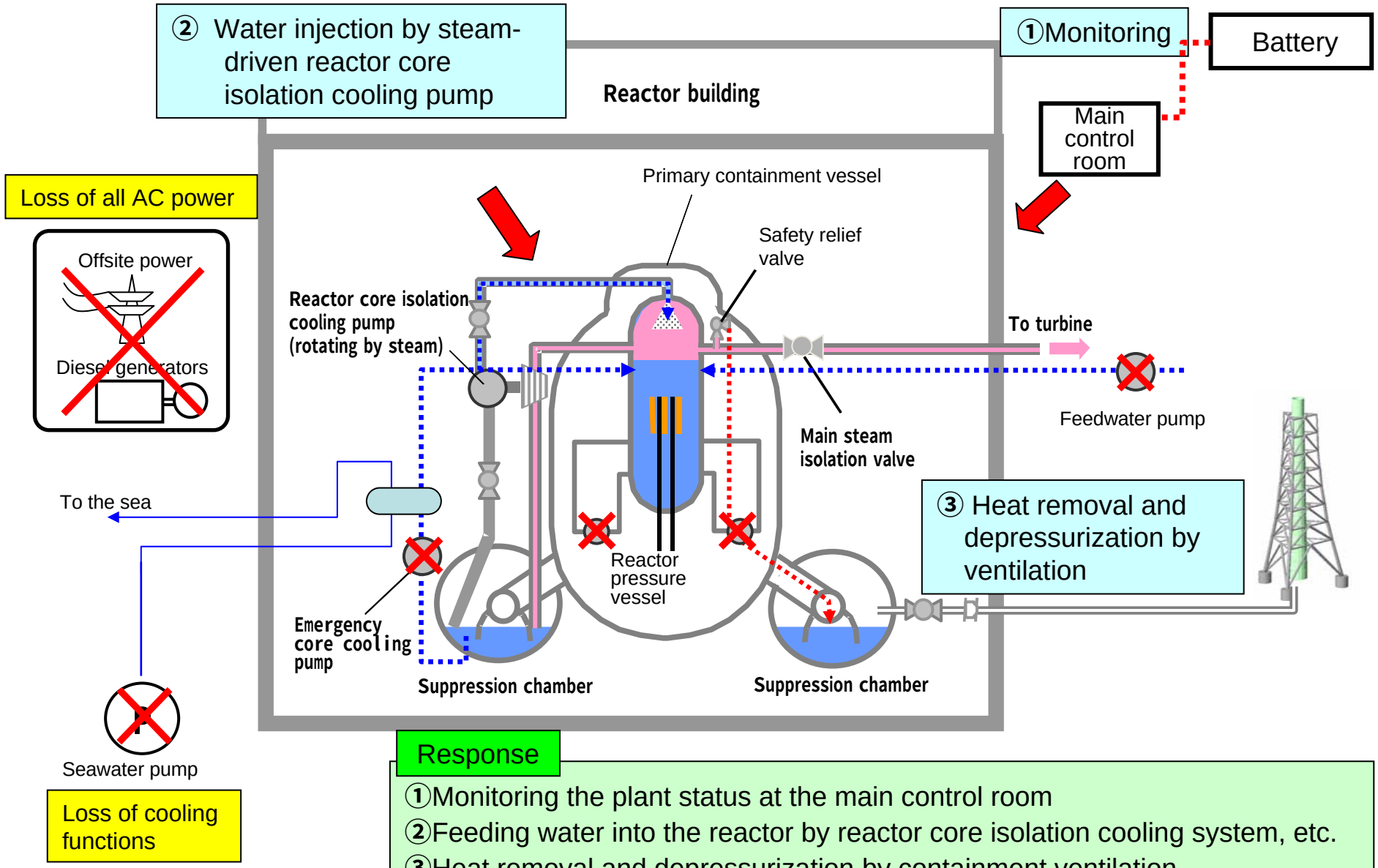
- Primary evaluation (to be conducted at NPPs under periodic inspection where preparations for startup are complete)
  - Evaluate the safety margin against events exceeding the design assumptions. Also, quantitatively evaluate the effects of emergency safety measures and use the results for making a decision on re-startup.
- Secondary evaluation (to be conducted at NPPs that are currently operating or subject to primary evaluation)
  - Carry out comprehensive safety evaluations making reference to stress tests in European countries and the status of examinations by the Investigation Committee on the Accident at the Fukushima Nuclear Power Station of TEPCO.

Conclusions

- As operators of the nuclear power plants in Japan, we have seriously taken the Fukushima Dai-ichi accident as an accident that must never happen again.
- After the accident, we immediately took emergency safety measures to confirm the safety of nuclear power plants in Japan. We are now conducting comprehensive safety evaluations (stress tests) of plants and continue to check their safety margin.
- We will continue to take various measures to increase the safety margin even further.
- We will actively introduce additional safety measures as investigations of the causes of the accident progress.

Reference 1

Response in the Event of Loss of All AC Power and Cooling Function (BWR)



Response

①Monitoring the plant status at the main control room
②Feeding water into the reactor by reactor core isolation cooling system, etc.
③Heat removal and depressurization by containment ventilation

Safety Assurance Measures (BWR)

Reference 2