Reference 1

Matters Addressed at the Hamaoka Nuclear Power Station in Light of the Tohoku-Pacific Ocean Earthquake

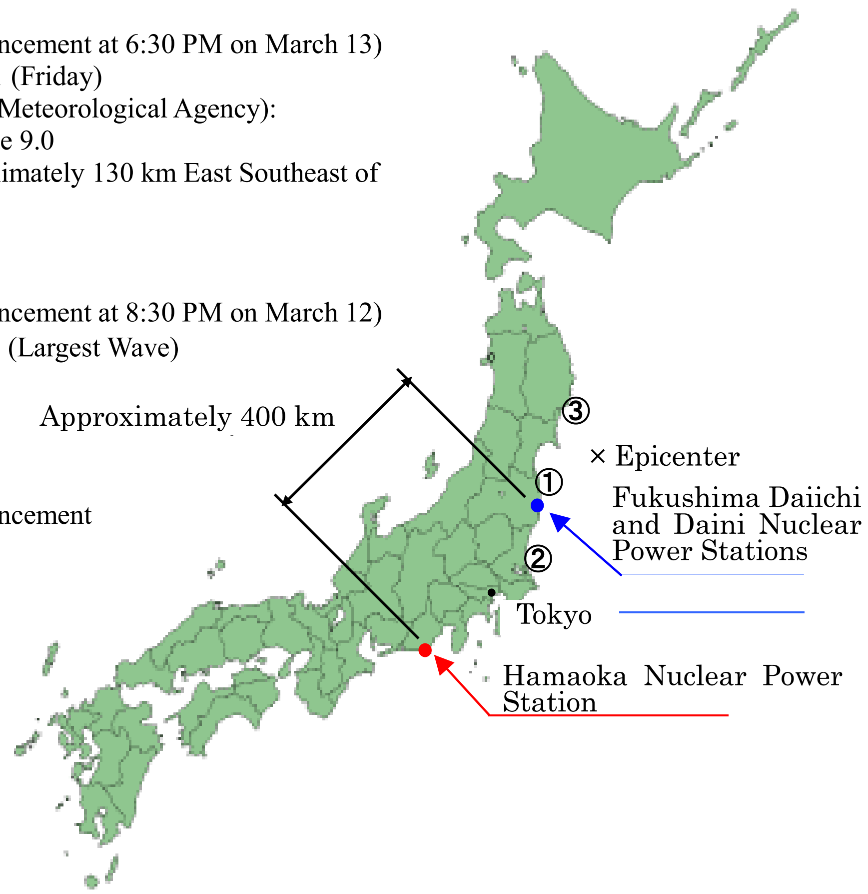
Chubu Electric Power Co., Inc.
March 23, 2011

Overview of the Earthquake

(Reference: Japan Meteorological Agency announcement at 6:30 PM on March 13)
Time of Occurrence: 2:46 PM on March 11, 2011 (Friday)
Earthquake Data (provisional values from Japan Meteorological Agency):
Earthquake scale: Magnitude 9.0
Epicenter location: Off the Sanriku coast (approximately 130 km East Southeast of Oshika Peninsula)
Earthquake focal depth: Approximately 24 km

(Reference: Japan Meteorological Agency announcement at 8:30 PM on March 12)
◆Height of Tsunami at Main Observation Points (Largest Wave)
①Soma: 7.3 m or more
② Oarai: 4.2 m
③ Ofunato: 3.2 m or more

(Reference: Japan Meteorological Agency announcement at 3:01 PM on March 11)
Status of Earthquake in Shizuoka Prefecture
Omaezaki City: Seismic intensity 3
Makinohara City: Seismic intensity 4
Kakegawa City: Seismic intensity 3
Kikugawa: Seismic intensity 3



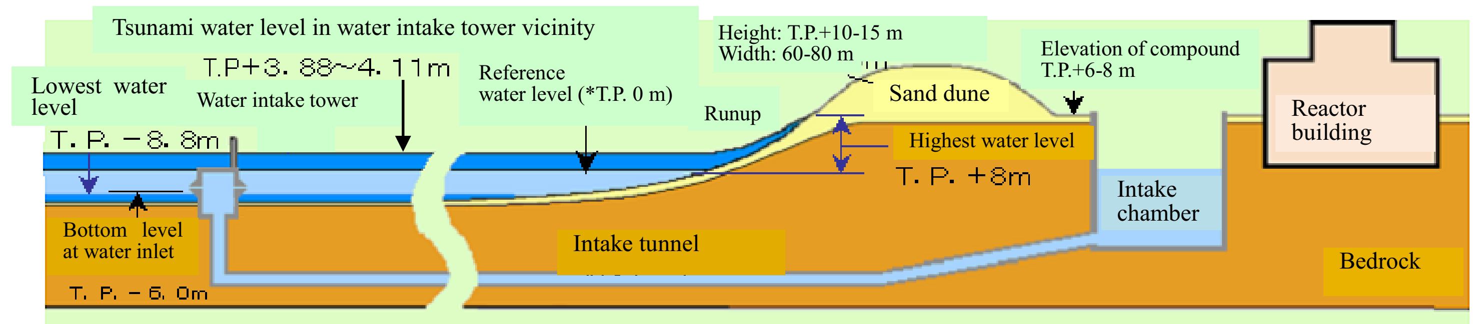
Status of the Hamaoka Nuclear Power Station

	Unit No. 1	Unit No. 2	Unit No. 3	Unit No. 4	Unit No. 5
Plant status	Decomissioning underway	Decomissioning underway	Undergoing periodic inspection	In operation	In operation
Observed acceleration	12 Gal		13 Gal	12 Gal	10 Gal

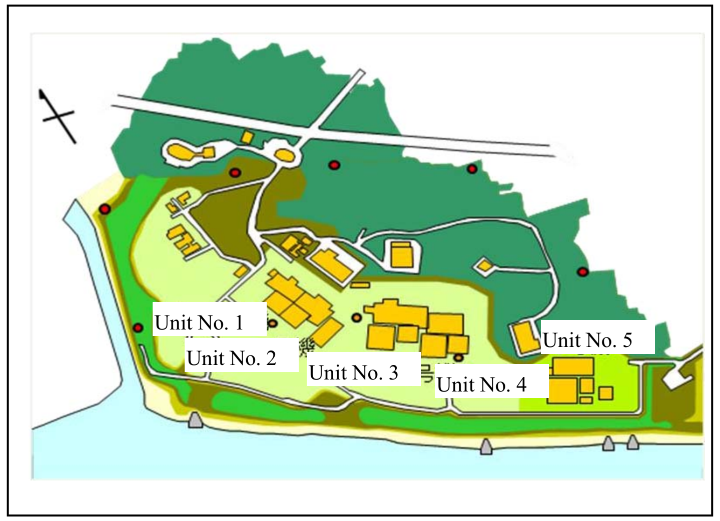
[Post-Earthquake Inspection Results]

- ●Patrols instituted inside the power plant and all units were checked to make certain there were no irregularities due to the earthquake.
- ●The exhaust stack monitors, water outlet monitors, monitoring posts, and other radiation monitors showed levels within the normal range, confirming that there were no irregularities.
- ●Changes in the tide level were found in the intake chambers for Units No. 3 to No. 5 (from approximately +1 m to approximately -0.5 m), and were confirmed not to have any effect on operation.)

Tsunami water level in water intake tower vicinity



*T.P. : Tokyo Bay mean sea level



The sand dunes, with their wave dissipating blocks, plantings, and so on, serve as an embankment possessing both height and width, and function as protection against tsunamis.
At the seismic back-check deliberations concerning the sand dunes, evaluation of their soundness was carried out with consideration of soundness evaluation at the time of an earthquake, sand movement, and other effects of a tsunami.

Legend
- Area of compound height T.P.+8 m
- Area of compound height T.P.+6 m
- Hill behind power station T.P.+20 m or more
- Sand dunes, etc. T.P.+12 m or more
- Sand dunes, hill behind power station T.P.+10 m or more
- Sand dunes, etc. T.P.+5 m or more

Tsunami Assumptions and Projections (Contrast with Assumptions at Fukushima Nuclear Power Station)

■ Tsunamis in Nearby Areas
- Earthquake tsunamis in 684, 887, and 1096
- Meio earthquake tsunami in 1498 (Tokai, Tonankai)
- Keicho earthquake tsunami in 1605 (Tonankai)
- Hoei earthquake tsunami in 1707 (Tokai, Tonankai, Nankai)
- Ansei Tokai Earthquake tsunami in 1854 (Tokai, Tonankai)
- Tonankai Earthquake tsunami in 1944 (Tonankai)

Etc.

■ Tsunamis in Distant Areas
- Kamchatka Earthquake tsunami in 1952
- Chile Earthquake tsunami in 1960 Etc.

■Tsunamis Caused by Marine Active Faults
- Fault zone on west edge of Senoumi Basin
- Senoumi-tai Bank fault zone
- Fault zone in western part of Omaezaki Spur
- Fault along Tenryu Submarine Canyon
- Enshu Fault System Etc.

↓

Even taking the triple sequence of the Hoei earthquake tsunami in 1707 into account, it is thought that the Ansei Tokai earthquake tsunami of 1854 (tsunami mark height of approximately 6 m) would have had the greatest impact on the compound.

* Detailed study has been made of tsunami mark heights in the vicinity of the compound from the Ansei Tokai earthquake tsunami, and the mark heights from other earthquake tsunamis are at a similar or greater height.

↓

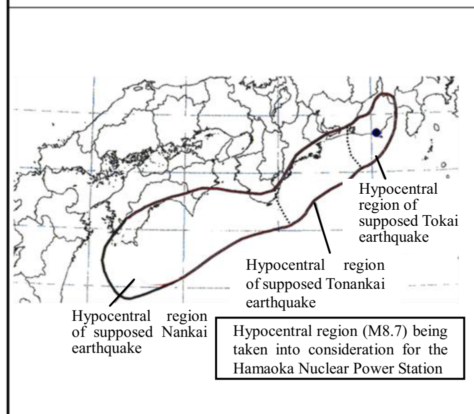
Numerical simulations of the Tokai-Tonankai earthquakes that are supposed to define the hypocentral region of the Ansei Tokai earthquake were conducted, taking uncertainty into account.

Main Uncertainties
- Segment combinations
- Fault slip amount, slip angle
- Link with marine active faults
- Consideration of asperities Etc.

↓

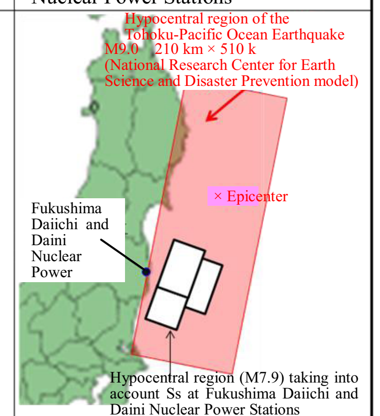
Tsunami height: About 8 m

Hamaoka Nuclear Power Station



Seismic back-check indicates an evaluated tsunami height of no more than about T.P.+8 m, even taking the triple-sequence Hoei earthquake tsunami in 1707 into account.

Fukushima Daiichi and Daini Nuclear Power Stations

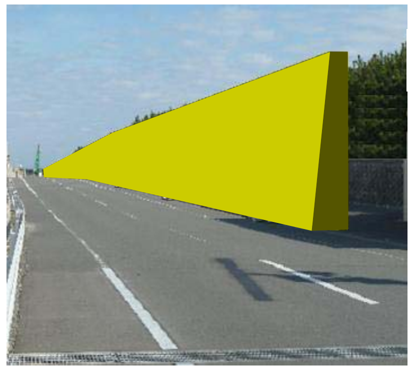


Tsunami evaluation in seismic back-check is under consideration

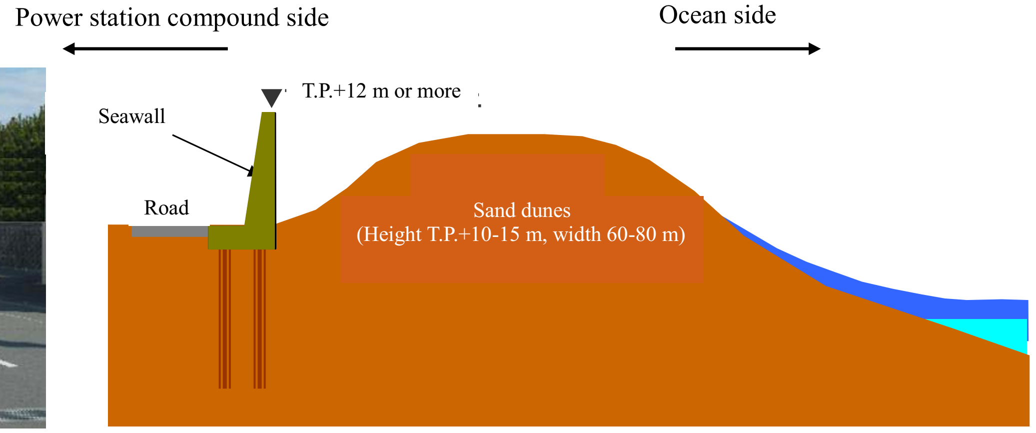
Responses in Light of the Fukushima Nuclear Power Station Incident

Countermeasures Against Tsunami Flooding Within the Compound

[Purpose] Seek to increase tolerance with respect to tsunami (prevent flooding inside power station compound by tsunamis).
[Content of Implementation] Emplace seawalls made of concrete at least T.P.+12 m in height on portions of the back and side surfaces of sand dunes on the ocean side of the power station.



Conceptual Image of Seawall



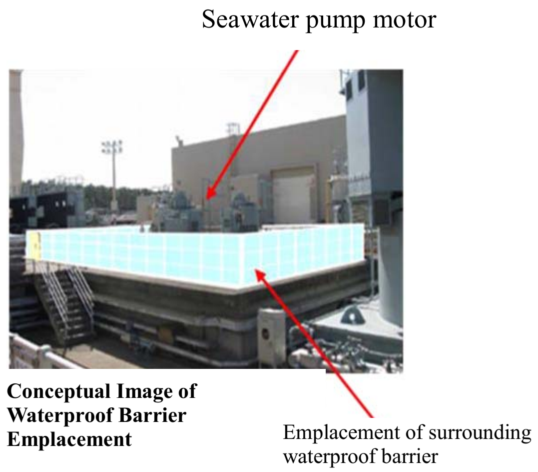
[Conceptual Image of Increased Tolerance with Respect to Tsunamis]

Countermeasures Against Projected Tsunami Flooding Within the Compound

■ Emplacement of Waterproof Barrier in Seawater Pump Area
[Purpose] Prevent the submersion under water of seawater pumps installed outdoors and secure the seawater required to cool the nuclear reactor, etc.
(Fukushima Daiichi: Function was lost due to submersion of seawater pumps by the tsunami)
[Content of Implementation] Surround the pumps with enclosures made of sheet metal approximately 1.5 m high and 8 cm thick.

■Secure Spares for Seawater Pump Motors
[Purpose] Shorten the time when seawater pump motors are unable to function because of water exposure and secure the seawater necessary to cool the nuclear reactor, etc.
(Fukushima Daini: Motors were air-shipped from the manufacturer's plant)
[Content of Implementation] Secure spares for seawater pump motors. Spares for Units No. 3 and No. 4 have been secured, and that for Unit No. 5 is being arranged.

■Confirmed the Soundness of Waterproof Doors and Reinforced Their Reliability
[Purpose] Prevent the submersion in water of diesel generators and other such equipment inside the reactor buildings and secure the power supplies and equipment required to cool the nuclear reactor, etc.
(Fukushima Daiichi: Seawater flooding the reactor building interior caused loss of function of diesel generators)
[Content of Implementation] Soundness of waterproof doors was verified. Approaches to reinforce reliability will be considered.



Conceptual Image of Waterproof Barrier Emplacement

Waterproof door

Measures for Emergency Readiness

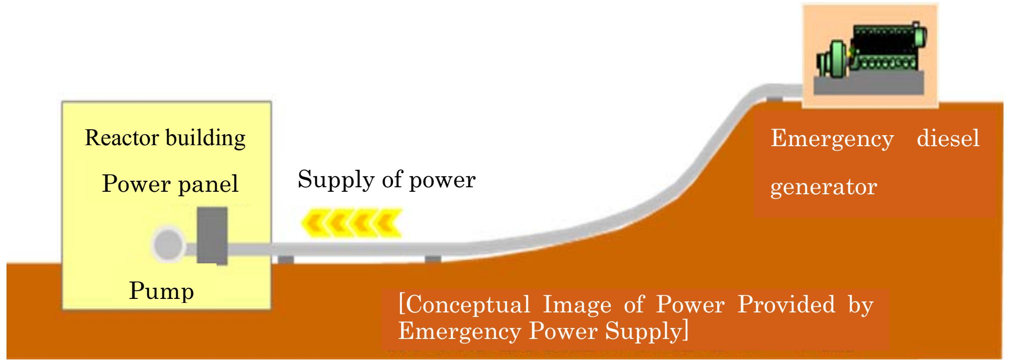
■ Securing Generator Vehicles, Portable Generators, Securing Backup Storage Batteries
[Purpose] In preparation for conditions in which external power sources and diesel generators cannot be used, extend the period of use of storage batteries to power nuclear reactor cooling systems.
(Fukushima Daiichi: Loss of DC power source caused loss of the nuclear reactor cooling function.)
[Content of Implementation] Two generator vehicles and three portable generators have been secured as power sources for battery charging equipment. Spare storage batteries will be secured in the future.

Generator vehicles

Portable generators

Storage batteries

■ Emplacement of Emergency Power Supplies
[Purpose] In preparation for conditions in which external power sources and diesel generators cannot be used, rapidly provide power sources for emergency core cooling systems and other such equipment and facilities.
(Fukushima Daiichi: It required a long time to bring in new outside power sources.)
[Content of Implementation] Emergency diesel generators will be installed on high ground within the power station compound where they will not be affected by a tsunami.



[Conceptual Image of Power Provided by Emergency Power Supply]

■ Secure Spaces for Emergency Core Cooling Systems, etc.
[Purpose] Secure the necessary spares to prepare for the eventuality of failure of equipment required to cool the nuclear reactor, etc., and thus prevent loss of cooling of the nuclear reactor, etc., for an extended period of time.
(Fukushima Daiichi: Malfunction of equipment in the emergency core cooling systems has not been confirmed.)
[Content of Implementation] The necessary spares for emergency core cooling systems, equipment cooling systems, seawater systems, and other such equipment will be secured. On the assumption that seawater pumps that are installed outdoors will be difficult to approach after a tsunami, replacement submersible pumps will be secured for backup.

■ Set up Storehouse for Emergency Equipment and Materials
[Purpose] Store the spares and backup equipment above in a dedicated storehouse so they can be put to use rapidly in case of emergency.
[Content of Implementation] A dedicated storehouse will be emplaced on high ground within the power station compound where it will not be affected by tsunamis.

■ Implement and Reinforce Emergency Preparedness Training
[Purpose] Training in emergency countermeasures adapted to the actual circumstances of their implementation will be conducted and efforts will be made to further improve response capabilities.
[Content of Implementation] On the assumption that damage (loss of electric power supply, loss of seawater pump function, etc.) will be caused by a tsunami, training will be implemented on-site and by simulation with attention to the below points. Areas for improvement found through training will also be applied promptly.
- Training in prompt restoration of electric power supply (training in splicing in power using generator vehicles and other such equipment, drafting plans to bring in outside power sources, etc.)
- Training in restoration of malfunctioning equipment, including replacement with spares
- Training in emergency operations for replacement water infusion to the nuclear reactor and spent fuel pool, containment vessel venting, seawater infusion, and other such procedures