

The effects of the Kumamoto earthquakes on Sendai Nuclear Power Station

The Federation of Electric Power
Companies of Japan

Tremor at the Sendai NPS due to the Kumamoto earthquake

- ◆ When detecting a tremor larger than a set value, the nuclear power station is designed to automatically shutdown. This value at the Sendai NPS (at the foundation) is 160gal.
- ◆ The tremor recorded (at the foundation) during the main shock of the Kumamoto earthquake (seismic intensity 7, M7.3) on April 16 (Friday) 1:25 is **8.6gal***.

Time of occurrence	Seismometer at Meteorological Agency (Nakago, Satsumasendai-shi)	Lowest floor of the auxiliary building (foundation)	Auxiliary building roof (1F)	Ground surface
4/16 Around 1:25	Seismic intensity 4	8.6 gal	12.6 gal	30.3 gal
Around 1:46	Seismic intensity 2	2.5 gal	3.0 gal	5.3 gal
Around 3:55	Seismic intensity 1	0.8 gal	–	1.2 gal
Around 9:48	Seismic intensity 2	1.4 gal	1.7 gal	2.4 gal

<Reference> Design basis seismic ground motion and set value for automatic shutdown (measured by seismometer set at the ground foundation)

	Design basis seismic ground motion	Lowest floor of the auxiliary building (foundation)
Horizontal direction <Vertical Direction>	620 gal <324 gal>	160 gal <80 gal>

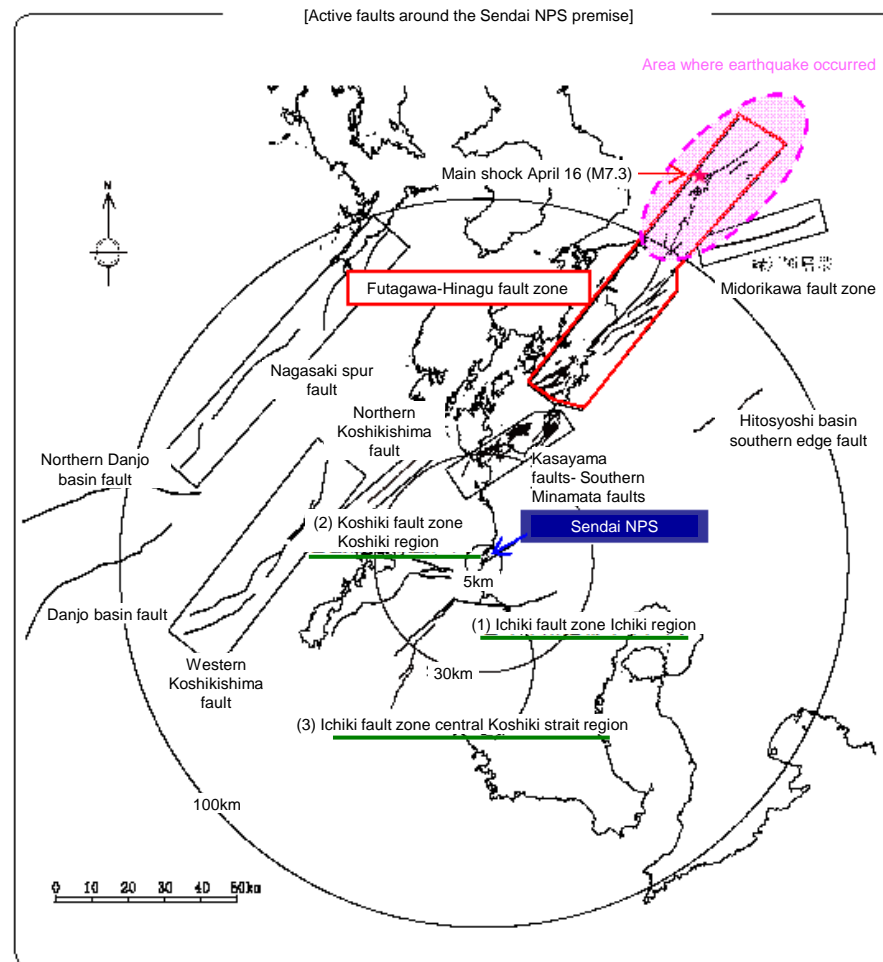
<Reference> Automatic shutdown of reactor
The reactor is designed to automatically “stop” when equipment malfunction, operator error, earthquake and other emergencies are detected by inserting all control rods.

*Gal : A unit indicating the acceleration of the seismic motion, which is the change in speed during one second, and 1gal is equivalent to an acceleration rate of 1cm/second.

For example, when a vehicle starts rolling, the shorter the time it takes to reach a certain speed, the larger the acceleration.

Regarding design basis seismic ground motion established according to the new regulatory requirements

- ◆ The design basis seismic ground motion of the Sendai NPS (620gal) was established based on earthquakes that are assumed to occur closer than the seismic source of Futagawa-Hinagu fault, which is expected to affect the site greatly. (Green line in the diagram below)
- ◆ The tremor of the main shock recorded on April 16 (Friday) 1:25 could be assessed as being adequately small in relation to the design basis seismic ground motion anticipated at the plant.

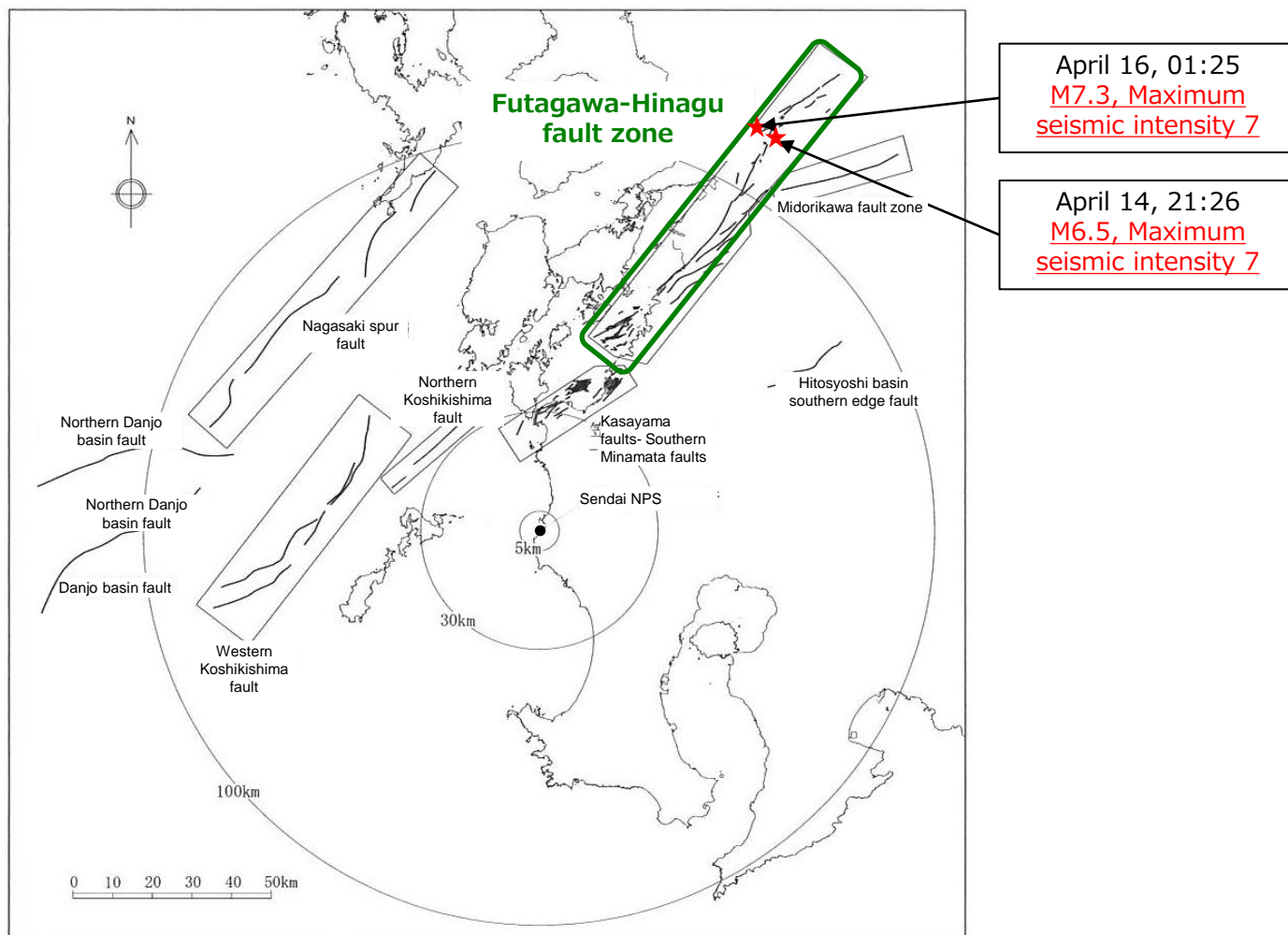


(Reference) Added notes to document created by Kyushu Electric Power Company

Evaluation of the Futagawa-Hinagu fault zone

◆ The design basis seismic ground motion for Futagawa-Hinagu fault zone (fault length 92.7km) was assessed as “magnitude 8.1”. The seismic motion at Sendai NPS was estimated to be approx. 100 gal., and below the design basis seismic ground motion of the plant.

(Note) The main shock on April 16 measured M7.3. The government’s earthquake survey committee believed that the northeastern side of the Futagawa fault zone shifted.



(Reference) Documents from April 18, 2016 Nuclear Regulation Authority

(Reference) Relationship between the tremor exceeding 1000 gal at Mashiki point and design basis earthquake ground motion of the Sendai NPS

- ◆ When the large tremor exceeding 1000 gal was observed on the ground surface, the maximum tremor at the foundation of the same point was about 250 gal.
- ◆ A large tremor was observed on the ground surface since the soft surface foundation significantly amplified the tremor.
- ◆ Since nuclear power stations are situated directly on hard foundation, the tremor is unlikely to be amplified. (Furthermore, the tremor was attenuated due to the distance from the seismic source.)
- ◆ Since the design basis earthquake ground motion is a ground motion (tremor) set based on the surface of the rock foundation (free rock surface*), it cannot be simplistically compared with tremors observed on ground surfaces on top of the foundation.

*Free rock surface: Rock surface that is unaffected by foundation above or motion of buildings

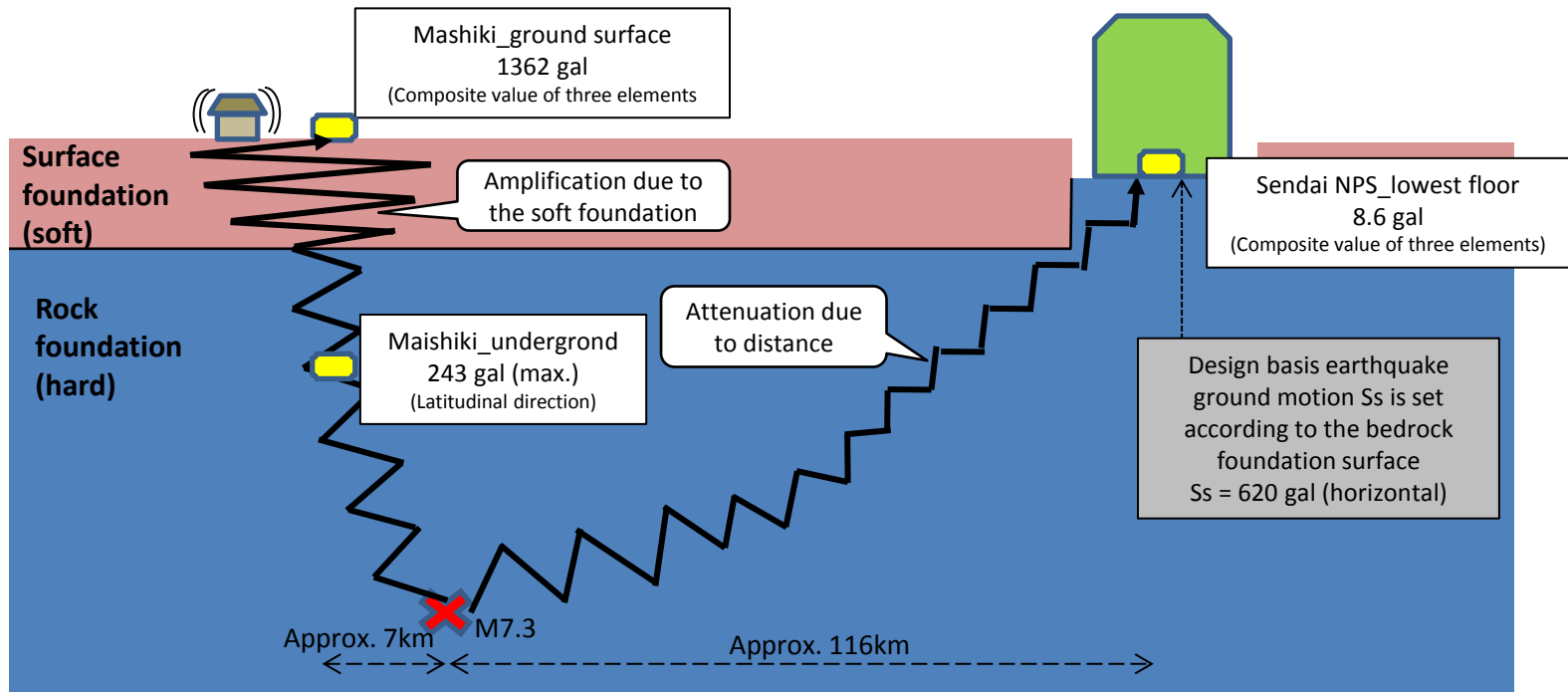


Illustration of the main shock at April 16 1:25AM