

# Results of tsunami deposit study on premises and in vicinity of the Hamaoka Nuclear Power Station

## 1 . Study objective

The study was conducted to confirm details about tsunami that have occurred on the premises and in the vicinity of the Hamaoka Nuclear Power Station.

## 2 . Study location and period

The field study was conducted between August 2012 and March 2013 at 34 sites on the western and eastern sides of the Hamaoka Nuclear Power Station and the surrounding area (the Osa, Niino, and Kiku river basins).

## 3 . Study method

Bore hole samples were taken from mud layers deposited under calm environmental conditions. Event deposits were extracted by observation and analysis of samples.

Specifically, observation of the samples obtained by boring found traces of deposits carried from the sea (e.g., mixes of sand and pebble layers) and traces of strong flows (e.g., the way geological layers had been carved). Researchers furthermore used radiocarbon dating with  $^{14}\text{C}$  to determine age, and fossil diatom analysis<sup>1</sup> to evaluate and examine the layers in light of the environment of the estimated era of deposit. From this, the researchers extracted the event deposits.

## 4 . Study results

### (1) Study site on west side of premises

Event deposits were confirmed at elevations between 6 and 10 m, which radiocarbon dating with  $^{14}\text{C}$  determined were from about 6,000 years ago.

### (2) Study site on east side of premises

Event deposits were confirmed at elevations between 5 and 13 m, which radiocarbon dating with  $^{14}\text{C}$  determined were from about 6,000 years ago.

### (3) Study site on Osa River basin

No event deposits were confirmed.

### (4) Study site on Niino River basin

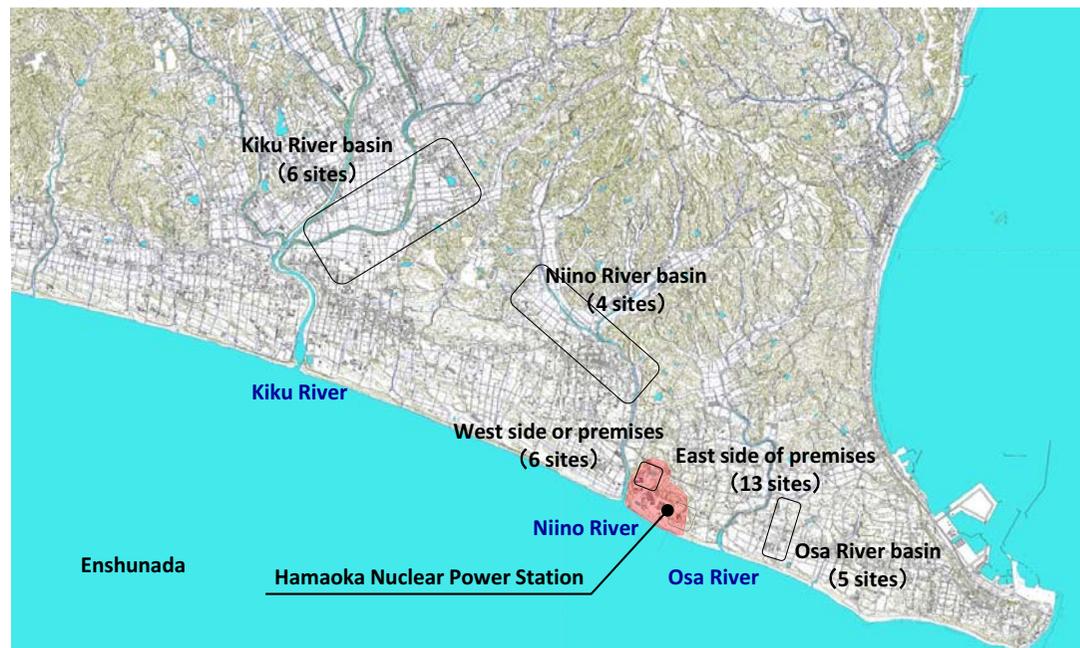
No event deposits were confirmed.

### (5) Study site on Kiku River basin

Event deposits were confirmed at study sites close to the sea at elevations between 3 and 4 m, which radiocarbon dating with  $^{14}\text{C}$  determined were from about 2,000 years ago or later. The age of these deposits could not be identified because of human changes to the environment, and their relationship with earthquakes in historical records could not be confirmed. Additionally, at points deeper than these deposits, event deposits were confirmed at elevations between 1 and 3 m, which radiocarbon dating with  $^{14}\text{C}$  determined were from about 3,000 years ago or earlier.

## 5 . Evaluation

- The recent study did not confirm any deposits distinguishable from earthquakes found in historical records.
- In eras with largely the same coastal topography as now, no event deposits were confirmed on the power station premises or in the Osa or Niino river basins. They were only confirmed at study sites close to the sea in the Kiku River basin, which is larger than the other rivers and which a tsunami could have entered relatively easily. Therefore, the study did not result in any findings suggesting giant tsunami larger than those indicated in historical records, such as tsunami caused by the Ansei-Tokai earthquake and Hoei earthquake. The fact that these deposits were not confirmed on the power station premises or in the Osa and Niino river basins, all of which are behind beach-ridge ranges<sup>2</sup> and are unlikely to be reached by tsunami, agrees with past tsunami deposit study results for the Enshu Sea coast, which found no traces of tsunami giant enough to overcome multiple beach-ridge ranges.
- In eras with different coastal topography than now, event deposits were confirmed on the power station premises from about 6,000 years ago and in the Kiku River basin from about 3,000 years ago or earlier. Factoring in that the sea level at the time of deposit was higher than now and the coastline was farther inland than at present, the height of those deposits above sea level at the time they occurred was about 0 - 8 m on the power station premises and 1 - less than 3 m in the Kiku River basin. Here again, no results were confirmed that suggested a giant tsunami.



Map of study location

Notes added to 1:25,000 scale Geospatial Information Authority of Japan map

## Results of study

	Presence or not of deposits distinguishable from earthquakes found in historical records	Presence or not of event deposits		Height of deposits above sea level at the time they occurred (Figures in parentheses indicate present elevation)	Era of deposits
		Eras with largely the same coastal topography as now	Eras with different coastal topography than now		
West side of premises	×	×	○	Approx. 1 - 5m <sup>※3</sup> (Approx. 6 - 10m)	About 6,000 years ago
East side of premises	×	×	○	Approx. 0 - 8m <sup>※3</sup> (Approx. 5 - 13m)	About 6,000 years ago
Osa River basin	×	×	×	—	—
Niino River basin	×	×	×	—	—
Kiku River basin	×	○		Approx. 3 - less than 4m <sup>※4</sup> (Approx. 3~4m)	About 2,000 years ago or later
		—	○	Approx. 1 - less than 3m <sup>※4</sup> (Approx. 1 - 3m)	About 3,000 years ago or earlier

※1 : Fossil diatom analysis : Diatoms are unicellular phytoplankton with glassy shells. Different varieties have different habitats, such as ocean, land, or brackish water. Using this fact, fossil diatom analysis analyzes the varieties of fossil diatoms found in a location to estimate the environmental conditions that existed when a geological stratum containing diatoms was deposited.

※2 : Beach-ridge range : Forces such as waves form ridges of sand, pebbles, and the like several meters high on the landward side of beaches. These ridges form into lines largely parallel to the coastline. When the coastline recedes, they may remain as a range of ridges.

※3 : Calculations accounted for the fact that the sea level about 6,000 years ago was at the present elevation of about 5 m, as based on sources including the literature.

※4 : Based on sources including the literature, the sea level about 6,000 years ago was at the present elevation of about 3 m, and then subsequently it slowly fell to the present level. Therefore it is believed that the height of deposits above sea level at the time they occurred was lower than their present elevation.