Seismic safety of the Hamaoka nuclear power plant in Shizuoka Prefecture, Japan

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The Chubu Electric Power’s Hamaoka nuclear power plant in Omaezaki city, Shizuoka Prefecture, on the Pacific coast of central Japan, is situated directly above the interplate megathrust between the subducting Philippine Sea plate and the overriding lithosphere of the Tokai district. On this plate interface the M 8-class Tokai earthquake or the M 9-class Nankai trough earthquake including the Tokai event are anticipated to occur in the near future. However, when the Hamaoka NPP was first established in 1970, plate tectonics and the fault-origin theory of earthquakes were not applied in this region, and therefore, Chubu Electric Power did not imagine a great earthquake originated just beneath Hamaoka at all. When I proposed in 1976 a hypothetical fault model of the Tokai earthquake extending beneath Shizuoka Prefecture and its offing, Hamaoka NPP’s Unit 1 had just started commercial operation and Unit 2 was under construction, whose design basis earthquake ground motion (DBGM) was 450 Gal (horizontal peak acceleration) for both units. After they knew that the Hamaoka site was completely within the source region of a probable great earthquake, Chubu Electric Power continued construction of Units 3, 4 and 5, though their DBGM was slightly increased to 600 Gal. In 2007, following the revision of the Nuclear Safety Commission’s Regulatory Guide for Reviewing Seismic Design of NPPs, Chubu Electric Power increased the DBGM to 800 Gal. As for Units 1 and 2, they were permanently shut down in 2009 by reason that the cost of their reinforcement was unprofitable. After the catastrophic Fukushima nuclear accident in 2011, in order to meet the New Regulatory Requirements of the Nuclear Regulation Authority, Chubu Electric Power formulated the Standard Seismic Motion (same as DBGM) with horizontal peak acceleration of 1200 Gal for ordinary ground condition in Hamaoka site. In the end of 2015 they completed a 1.6 km-long tsunami protection wall as high as 22 m above sea level on the supposition that the maximum tsunami height would be 21.1 m. They are also preparing other various countermeasures against huge tsunami and emergent severe accidents. The anticipated Tokai or Nankai trough earthquakes will bring about long-lasting short-period and long-period strong ground motions, large-scale vertical crustal deformation, huge tsunami, successive large aftershocks to the Hamaoka NPP for a few days or more. It is not guaranteed that the maximum ground motion is less than 1200 Gal nor the height of tsunami is lower than 22 m. Strong ground motion of longer duration than the DBGM and a large-scale coseismic crustal uplift may well destroy the tsunami protection wall. The combination of sea bed uplift and large amount of backwash of tsunami may cause loss of function of sea-water intake towers distinctive in Hamaoka NPP, which can lead to a severe accident. To begin with, it is doubtful that the reactor facilities originary designed and constructed for DBGM of 600 Gal can be completely reinforced against 1200 Gal seismic motion. Thus, it is merely a dangerous optimism that the Chubu Electric Power’s countermeasures against an underfoot great earthquake and severe accidents are reliable and enough to prevent serious nuclear disaster. Still, Hamaoka NPP is producing a great fear of “Genpatsu Shinsai” (earthquake-nuclear combined disaster) which I have been warning since 1997.

Keywords: Hamaoka NPP, Tokai earthquake, Nankai trough earthquake, seismic safety, tsunami

