Active structure and capable faults in Oma Nuclear Power Plant, Aomori, northern Japan

*Mitsuhisa Watanabe[1]

1. Faculty of Sociology, Toyo University

Tectono-geomorphic investigations clarify that submarine active fault has played important roles in the acute uplift of the northwestern part of Shimokita peninsula. The Oma Nuclear Power Plant is under construction in this seismo-tectonically active area. There are many capable faults in the site of the plant. The S-10, S-11, cf-1, E29, and E33 faults cut and deform marine terrace sediments (MIS 5e to MIS 5c in age). Such unstable area is not the right ground for nuclear power facilities. Following scientific on-site safety inspections, we should build the facilities with engineering safeguard against the possible incidents.

Keywords: tectonic landform, submarine active fault, capable fault, Shimokita penisula, Oma Nuclear Power Plant

Problems on the volcanic hazard simulation for safty evaluation of the nuclear power plant site

*Nobuo HAMADA[1]

1. none

Japanese electric power companies(EPCs) have been submitting materials for safety reviews of their nuclear power plants(NPPs) to the National Regulatory Authority(NRA). Among the submitted materials, we are able to find volcanic hazard assessment results for NPP sites based on the applications of volcanic hazard simulation programs and models. Among them, Titan2d is a program for pylocrastc flow simulation and Tephra2 is a simulation program for fallout of volcanic ejecta from a volcanic column. Mogi’ s model is an assessment formula for ground deformation induced by internal stress change of magma reservoirs. However, applications of the programs and formula by EPCs show inappropriate or wrong use of them when physical process and boundary conditions for them are concerned and resultant volcanic hazard assessments must be almost meaningless for safety review of NPPs.

Keywords: Titan2d, Tephra2, Mogi's Model

Can we identify all possible source faults?

*Manabu Hashimoto[1]

1. Disaster Prevention Research Institute, Kyoto University

I have been devoted to study of crustal deformation with space-borne synthetic aperture radar during recent years. The lessons I learned in this study is that earthquake source fault is complex.For example, source faults in the sequence of earthquakes in New Zealand since 2010 are its representative. Parallel faults rutptured during the April 2010 Iwaki, Fukushima earthquake. Furhtermore, the lower bound of M6.4 above that surface rupture appears may be questionable for practical use. We detected clear discontinuities in phase in interferogram that covers source region of the northern Ibaraki earthquake (M6.1) on March 19, 2011. Considering pattern of observed crustal deformation, it is reasonable that rupture reached the Earth's surface. Furthermore, we observed similar crustal deformation during an earthquake of M6.3 on December 28 in the same area. Discontinuity in phase were also identified at the almost same location. It is obvious that earthquakes of similar size recurred at a shorter interval than 6 year in such a narrow area. Based on these experience, I am skeptical about the rationality on the calculation of ground motion with limited number of sources.

It is easy to reject these observational facts as exceptions. Earthquake science has developed probably by seeking universality that are common in many examples and sophisticating it; i.e. finding law by focusing average in probability distribution. However, is it OK for discussion on construction of nuclear power plants in which people must consider long tail distribution? On the other hand, to what extent we should consider "exceptional" events mentioned above or events that have not occurred? It is regrettable that I do not have answer to these questions. I expect discussion among community of earthquake science today.

Keywords: source fault, crustal deformation, nuclear power plant

Predictability in earthquake science and its uncertainties

*Takeshi Sagiya[1]

1. Disaster Mitigation Research Center, Nagoya University

Prediction of future seismic phenomena with a reasonable accuracy is one of the important goals of seismology. However, in recent years it becomes a general agreement in the seismological community that accurate prediction of location, time, and size of large earthquakes is impossible at least for now.
In addition, the 2011 Mw9.0 Tohoku-oki earthquake revealed that long-term forecast of seismic activities also have large uncertainty. Under such circumstances, the emergency act against the large earthquake along the Nankai Trough is now being discussed in a governmental working group and the emergency response based on earthquake prediction shall be changed. It should be rigorously questioned if there is any information available before the occurrence of a big earthquake. These experiences brought us important lessons about the nature of seismic hazard that predictability of earthquake science in present-day is highly limited and that it is of essential to take such a large uncertainty into account in protection of important facilities such as nuclear power plants. It should be also noted that the degree of uncertainty is often underestimated as long as such evaluation depends on our limited experience.

Keywords: earthquake, predictablity, uncertainty

Interaction and Gap between Science and Engineering in Risk Governance: Perspectives of Science and Technology Studies

*Kohta Juraku[1]

1. Tokyo Denki Univ.

It has been discussed how to deal with the incertitude of expertise regarding the risks of natural disasters and complex artifacts. We have recognized the limit of our knowledge and humble attitude for these risk is now appreciated, while we cannot stop the best effort to protect our people and society from those risks. We have to face this ambivalent to utilize our expertise to decision-making and practice of risk-management, which is to be kept as fine states –that is the goal of risk governance.

In this context, science (scientists) and engineering (engineers) could collaborate each other, but could have tension between them at the same time, because they have different mission and purpose: science (scientists) define their mission as knowledge production itself, while engineering (engineers) have to solve the problem and show the solution for their clients.

If their expertise suggests any warning of risks such as disaster risk, scientists may try to share their concern with other stakeholder in society. In this case, their advice could often include risk avoidance strategy to deal with that risk. Engineers, on the other hand, they understand that their mission includes risk management by nature of engineering, and would not try to exclude other options of risk treatment: risk reduction, sharing and retention. It is optimization problem for them to deal with risk, with all of four options of risk treatment, and the risk avoidance is sometimes the least priority option for them, because the choice implies their defeat, in a sence.

Also, on the effect of engineering measures, engineers understand that it is a combination of their efforts and external conditions to reduce risk under the tolerance level, but scientists tend to think the best pair of maximum anti-disaster engineering measures and the preferable external condition could result in the least risk for us.

These fundamental differences in their principles to face the disaster risks could be amplified through complex interactions in risk governance mechanism and could lead serious miscommunication among them. It could result in the unacceptable dysfunction in society.

In this presentation, some perspectives of science and technology studies (STS) on this topic will be introduced taking the cases of controversy on seismic risk of nuclear facilities including the topic of “basis ground motion” and other to discuss the interactions and the gap between science (scientists) and engineering (engineers). The ideas to solve/mediate the issue and prevent further social dysfunction would be suggested.

Keywords: Science (Scientists), Engineering (Engineers), Risk Governance, Social Dysfunction

History of design basis earthquake ground motion for nuclear power plants in Japan

*Daisuke Suetsugu[1]

1. Department of Deep Earth Structure and Dynamics Research, Japan Agency for Marine-Earth Science and Technology

I would review a history of design basis earthquake ground motion (“the design ground motion” hereafter) for nuclear power plants in Japan. The first official guidelines of design ground motion established in 1978, when a number of nuclear power plants had already been constructed or in operation. The plants were designed in 1960s without the earthquake risk evaluation based on the plate tectonics theory.
In the 1978 guidelines, the design ground motion S1 expected by strongest possible nearby earthquakes and the design ground motion S2 expected by unrealistically strong earthquake with consideration of earthquakes in the last 50,000 years. The facilities of class A should be in an elastic deformation by the S1 motion and those of class As should maintain its safety. Updates of the 1978 guidelines had not been initiated until we experienced the devastating Kobe earthquake in 1995. The guidelines were updated in 2006. While a basic policy of the 2006 guidelines was not much different from the 1978 guidelines, the design ground motion is unified to Ss from S1 and S2 in the 1978 guidelines. An earthquake fault model was introduced to evaluate ground motion. Estimation period of fault activity was elongated from 50,000 to 130,000 years. Surprisingly a tsunami risk was introduced for the first time in the 2006 guidelines in spite that the tsunami disaster had occurred frequently by great thrust earthquakes in Japan. The power companies had a duty to examine whether existing plants fit to the 2006 guidelines and to reinforce when necessary. The 2011 Tohoku giant earthquake led to the severe accident of the Fukushima Daiichi power plant, for which the power companies stated “totally unexpected” . The accident strongly indicated that further and severer update was required. In 2013, new guidelines were defined. Although the government and power companies emphasize that the new guideline is severer in the world, there are still debates whether the new guidelines are reasonably severe for the nuclear power plants in Japan, where earthquake activity is extremely high in the world.

Keywords: Nuclear power plant, design basis earthquake ground motion

