Abstract
In South Korea, probabilistic seismic hazard analysis (PSHA) of nuclear power plant (NPP) site has been conducted since 1990s, and national seismic hazard map has been published twice since 1997. Although experts understanding of PSHA has been improved continuously through such a process, reliable input data for PSHA have not been sufficiently established yet.

In years, geologic characteristics have been mainly considered when setting seismic source model in South Korea. One of the most important factor to be considered when setting seismic source model is seismological characteristic such as seismicity, and geophysical characteristic that can affect that is also important factor. In order to derive seismological characteristics for seismic source model, earthquake catalogues with spatial-temporal completeness and unified magnitude scale should be presented, but not fully prepared yet. It is necessary to consider all the seismic sources affecting a site within a certain radius of that site. However many experts have been still considering seismic sources within near to national border when setting seismic source model.

Only several ground motion prediction equations (GMPEs) have been developed over 1990s and early-mid 2000s due to the lack of earthquakes with moderate or above magnitude in South Korea. However many experts have been still only considering seismic sources within near to national border when setting seismic source model.

5.8 (M = 5.5) was calibrated input data for PSHA should be established that can reduce uncertainty and increase standard deviations, that requires continuous research.

Korea. Early 1990s, since 1997. Many experts have been still only considering seismic sources within near to national border when setting seismic source model.

Seismic Source

- Seismogenic Source
A seismogenic province (or zone of diffuse seismicity) is usually treated as seismic source, it should be based on seismological characteristic preferentially, but geologic characteristics have been mainly considered when setting such seismic source model.

- Capable Tectonic Source
It has been directly used as a linear source in PSHA. Whether including active fault, quaternary fault and etc. as linear sources of PSHA or not is under debate, especially PSHA of NPP site.

Earthquake Catalogue
Korea has several historical earthquake catalogues over about 2000 years, but many events have large discrepancies in location and magnitude with each other.

South Korea has established compact and dense seismicological stations since late 1990s. But there is no overall accepted instrumental earthquake catalogue yet with unified scale and location.

Range of Seismic Source to be Considered
It is necessary to consider all the seismic sources affecting a site within a certain radius (320 km for NPP site and can be extended depending on their significance) of that site.

However, many experts have been still only considering seismic sources within near to national border when setting seismic source model.

Probabilistic Seismic Hazard Analysis (PSHA) in South Korea

PSHA of Nuclear Power Plant (NPP) site
Since 1990s, PSHA has been performed mainly at NPP site in South Korea. PSHA of NPP site can be conducted separately from national seismic hazard map through consultation with the head of relevant governmental administration.

National Seismic Hazard Map
The map has been published twice (1997, 2013).

From 2009, the validity of the map shall be reviewed every five years from the date of publication, and it can be changed if necessary.

Seismic Source

- Seismogenic Source
A seismogenic province (or zone of diffuse seismicity) is usually treated as seismic source, it should be based on seismological characteristic preferentially, but geologic characteristics have been mainly considered when setting such seismic source model.

- Capable Tectonic Source
It has been directly used as a linear source in PSHA. Whether including active fault, quaternary fault and etc. as linear sources of PSHA or not is under debate, especially PSHA of NPP site.

Earthquake Catalogue
Korea has several historical earthquake catalogues over about 2000 years, but many events have large discrepancies in location and magnitude with each other.

South Korea has established compact and dense seismicological stations since late 1990s. But there is no overall accepted instrumental earthquake catalogue yet with unified scale and location.

Range of Seismic Source to be Considered
It is necessary to consider all the seismic sources affecting a site within a certain radius (320 km for NPP site and can be extended depending on their significance) of that site.

However, many experts have been still only considering seismic sources within near to national border when setting seismic source model.

Ground Motion Prediction Equation

Because of past poor seismic stations, low seismicity and absence of strong ground motion data in South Korea, most of GMPEs were derived by the regression analysis of simulated ground motions using stochastic methods. In recent years, some GMPEs using earthquakes with less than moderate magnitude have been presented. Therefore, it is not easy to select independent seismic GMPEs that reflect seismic uncertainities for PSHA.

Foreign GMPEs developed in regions where seismic characteristics is considered to be similar to that of South Korea have been applied. However, there are no substantial studies showing that such regions (especially central and eastern United States) and the Korean Peninsula are similar seismological characteristics with each other.

When a large fault and a site are close to each other, it is necessary to develop GMPEs with such near fault effect. GMPEs used in PSHA of NPP site should be expressed for entire frequency range (up to 100 Hz) required by engineering analysis for site-specific response spectra.

Site Effect

- Compared to Japan, the depth of bedrock in South Korea is known to be very shallow. The information of V_s80 may not be meaningful, and another criteria may be developed.

- Many seismic stations in South Korea do not have (or do not share) the information (e.g., shear wave velocity profile) to know site effect in detail.

- Since intensity and damage by ground motions recorded in historical documents originated at plain, basin or soil foundation where people lived in the past, it can be said that those records include site effects. In this case, site effect may be included in PSHA in the form of overestimation of ground-motion magnitude. Therefore it is probable that PSHA can be overestimated because PSHA is applied to rock outcrop again and not to plain, basin or soil foundation.

- The site of NPP in South Korea is mostly composed of solid bedrocks, and the amplification of seismic waves is not expected. It is reasonable to apply GMPEs irrespective of seismic wave transmission characteristics.

The development of GMPEs with site effect seems to be necessary in South Korea, if possible.

Future Plan for PSHA in South Korea

The government shall review the validity of national seismic hazard map every five years from the date (2013) of publication and can change if necessary. Since Gyeongju earthquake occurred in 2016, the map is likely to be revised in 2018.

Geological survey of a fault (including Yangsan fault, Ulsan fault) nearby NPP site and research) will be carried out by the end of 2021. The quality of input data for PSHA is expected to be improved, which can reduce uncertainty and increase reliability of PSHA in South Korea.