Probabilistic Seismic Hazard Analysis (PSHA) and Scenarios

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Scenarios or Deterministic Seismic Hazard Analysis (DSHA) approach has been used in the United States since the creation of the US Atomic Energy Commission (AEC) in 1947 [succeeded by Nuclear Regulatory Commission (NRC) in 1974] to promote and regulate atomic energy for peaceful purposes. California has been actively involved in this program but the public also demand that the atomic energy sites be designed to be safe from anticipated earthquakes. The DSHA approach has been used extensively in all other applications for engineering in California, particularly following the 1971 San Fernando earthquake in the Los Angeles metropolitan area of southern California.

The Probabilistic Seismic Hazard Analysis (PSHA) was formulated by the late A. Cornell but was not used for engineering until it was promoted by the National Research Council in their 1988 Panel report. There was no debate on PSHA and misinformation on DSHA was widespread from powerful proponents of PSHA. In particular, the concept and application of the Maximum Credible Earthquake (MCE) has been wrongly argued by PSHA proponents as being too rare and unlikely during the design life of structures and so must be abandoned. In fact, MCE can happen at any time and is most dangerous for the public, and so must always be considered as in California.

The pros and cons of DSHA and PSHA must be discussed to find out the strength and weakness of each approaches. The recent applications of PSHA at the highest level at the Yucca Mountain project in Nevada and the PEGASOS project in Switzerland were examined and it was found that PSHA lost its credibility because of unrealistic results. In contrast, DSHA has demonstrated that it is reliable and realistic as continuously used in California for over 30 years. Therefore, it is time to use DSHA in place of PSHA. DSHA can be enhanced by using uncertainty or variability analysis in an appropriate manner. The newly developed Neo-DSHA can also be used where realistic earthquake source models are possible in conjunction with DSHA.

Seismic risk analysis is required for Nuclear Power Plants for which PSHA as well as DSHA (Klugel and others, 2006) can be used.