PANEL DISCUSSION 1 *(Smr2142, May 12, 2010, 16:00 to 17:00 pm.)*
DSHA and PSHA

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Summary of Panel Discussion – Panel 1

Participants:

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The panelists were asked to discuss the following questions:

PSHA limitations;
DSHA limitations;
Alternative methods for SHA;
Relevance of the advanced science to SHA;
Physically based approach…

Results of Discussion:

The panelists underlined the importance of a clear definition of terminology. Different people have a different understanding of the terms DSHA and PSHA. The understanding of the US american consultants industry on DSHA is that DSHA is focussing on a limited amount of individual earthquake scenarios for which ground motions are computed and a design basis ground motion is selected which may correspond to different fractiles (median, 84% fractiles) of the distribution of the computed ground motion time histories or response spectra. It was clarified that this is a too narrow definition of the term DSHA. In the scientific community the term DSHA or neo-DSHA is understood in a broader sense –as a physics based approach to seismic hazard analysis which is based on an increasingly deeper understanding of the relevant physical phenomena and on data. The term DSHA as used in science shall not be mixed with regulatory approaches prescribing a specific procedure for performing a "deterministic" seismic hazard analysis. In a similar way the understanding of the term PSHA shall not be limited to the current level of regulations as they are in use in some countries Traditional PSHA – Cornell-McGuire PSHA). Much of the criticism found in the published literature and discussed by the panel is associated with the practcie of traditional PSHA and the use of unifom hazard spectra. PSHA in general provides a flexible framework where different models and approaches can be used. Actual large scale PSHA projects as in the CEUS are moving towards physical modeling of earthquake ground motions due to the lack of data. As well a tendency is observed that Uniform Hazard Spectra are replaced by

probabilistic earthquake scenarios as the main (most important) result of traditional PSHA. In a similar way a tendency is observed that DSHA or neo-DSHA are aiming at including all possible seismic sources into their analysis as the starting point for deriving scenarios for seismic events controlling the seismic hazard. Therefore, both methods at the final end lead at to a scenario-based approach. Deterministic physical models which are based on waveform modeling and probabilistic methods have different objectives and serve different applications. While detailed deterministic physics-based methods allow to explain the response of objects (structures, components) on an individual scale, probabilistic methods are aiming at predicting the risk associated with the occurrence of future earthquakes for larger sets of objects (regional scale) or at quantifiying the residual risk associated with the operation of critical infrastructures. Therefore, to some extent both methods have the potential to complement each other. A majority of panelists does not see any need to use probabilistic methods to develop a reliable design basis for general purpose structures or even critical infrastructures.

There was a common agreement among the panelists that regional probabilistic hazard maps or the world-wide global hazard map (GSHAP) have to be used with great care and are not recommended to be directly used for design purpose. To many cases of exceedances of predicted by observed ground motions have been observed in the recent past and to many simplifying assumptions are used for the development of these maps.

The panelists observed large differences in the application of probabilistic methods in different countries. Due to past experience countries with an high exposure to seismic hazard do not accept probabilistic approaches as a part of their national regulations. Furthermore, in many countries there isn’t any definition of an acceptable level of risk. In other countries a risk informed approach is applied for critical infrastructures like nuclear installations to obtain a quantitative understanding of the residual risk allowing to be compared with probabilistic safety objectives.

An actual issue in the development of physics based waveform models consists in the development of realistic modeling input parameters taking into account possible correlation effects and observable empirical constraints. This is especially valid for dynamic source models while kinematic models have achieved a significantly higher level of maturity.