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Secretary Looking for a Good Engineer

When:

January 10, 2006 5:45 PM Social time (with food)

6:15 PM KGEG Meeting and Presentation

Where: Kentucky Engineering Center, Frankfort, Kentucky

Topics: Seismic Hazards of Kentucky

Zhenming WANG, Ph.D, Adjunct Professor of Geology, U of K Speaker:

In Kentucky, the questions are not "do we have seismic hazard or risk?" but "what level of the hazard or risk is?" The answers for the questions are difficult ones in Kentucky, as well as in the central United States, because they not only depend on our knowledge of geology and seismology, but also on how the hazard and risk being defined. In this presentation, I will talk about: 1) the basic understanding of geology and seismology in and around Kentucky; 2) how to characterize seismic hazard and risk; and 3) some policy implications, such as building codes.

Except in the New Madrid Seismic Zone, where earthquakes concentrate along the active faults, earthquakes occur in a quite large area and do not associate with any specific zone or fault in and around Kentucky. The earthquake source mechanics are still not well understood. The exact boundary of the New Madrid Seismic Zone is still difficult to define, even though it is the most active and well studied in the country. The biggest historical earthquake to have occurred was the 1811–1812 New Madrid events. The estimated magnitude ranges from about M7 to M8—a large range, though it has been well studied. Earthquakes are also infrequent, especially large earthquakes that have significant impacts on buildings. Recurrence intervals for the large earthquakes are quite long, ranging from about 500 years in the New Madrid Seismic Zone to ten of thousands of years in other zones. How fast the seismic wave attenuates is not well defined. Although there are several ground motion attenuation relationships available in the area, the relationships were developed based on numerical modeling and sparse strong-motion records from small earthquakes. All these make assessing seismic hazard and risk difficult in Kentucky.

What are the seismic hazard and risk? Seismic hazard and risk are fundamentally different. They are often treated as the same, however. For example, the ground motion with 2 percent probability of exceedance in 50 years is seismic risk by definition, but has been said as seismic hazard. Seismic hazard is earthquake of a certain magnitude or the phenomena generated by the earthquake, such as surface rupture, ground motion, ground-motion amplification, liquefaction, and induced-landslide that have potential to cause harm. On the other hand, seismic risk is likelihood (chance) of experiencing a level of seismic hazard for a given time exposure. The relationship between seismic hazard and risk is complicated and must be treated very cautiously. Seismic hazards are natural occurrences and can be evaluated from instrumental, historical, and geological records (or observations). Seismic risk depends not only on seismic hazard and time exposure, however, but also on the models (i.e., time-independent [Poisson] and time-dependent ones) that could be used to describe the occurrences of earthquakes. High seismic hazard does not necessarily mean high seismic risk, and vice versa. Currently, probabilistic

seismic hazard analysis (PSHA) has been widely used for assessing seismic hazard and risk. Our studies show that use of PSHA may not be appropriate because it inherits some intrinsic drawbacks.

Ground-motion amplification (secondary hazard) can occur under certain conditions: strong ground motion (primary) from earthquakes and soft soils overlying hard bedrock. Amplified ground motion can cause excess damage, even to sites very far from the epicenter. For example, the damages in downtown Maysville, Kentucky, were caused by the amplified ground motions during the 1980 Sharpsburg earthquake. The amplification hazard can be evaluated based on the input ground motions and soil properties (i.e., shear-wave velocity or SPT).

The implications of the seismic hazard and risk assessments for Kentucky, such as KBC-2002 and KRC-2002 and seismic safety regulations at Paducah Gaseous Diffusion Plant, will also be discussed.

ORVSS PLANNING:

After the meeting, ORVSS planning committee will meet. We are looking for volunteers to help with this years ORVSS meeting. Please, you are invited to stay and help with the initial planning.

KGEG Members:

Memberships expired in October. Please bring your \$10.00 annual dues to the meeting or maill to Kip Anderson at the address listed above.

CEU Documentation: If you are licensed in a state with continuing education requirements, bring this announcement, which indicates the qualifications of the speaker, material covered, and date, to the meeting and have a KGEG officer validate your attendance and duration of the presentation.