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## CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

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### TRIP REPORT

**SUBJECT:** Annual Meeting of the Seismological Society of America  
Administrative Items 20.06002.01.061.461

**DATE/PLACE:** April 13-16, 2004  
Palm Springs, California

**AUTHOR:** John A. Stamatakos

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### BACKGROUND AND PURPOSE OF TRIP:

The Seismological Society of America held its annual meeting in Palm Springs, California from April 13–15, 2004. The meeting was hosted by the Southern California Earthquake Center. The Seismological Society of America is one of the lead professional societies and their annual meeting attracts a broad range of disciplines and interests.

The meeting included 15 technical sessions given over the 3 day conference period. Session contents covered the spectrum of seismological subjects, from probabilistic seismic hazard assessment to solid crustal structure and plate tectonics. Many of the sessions included presentations that directly relate to ongoing or recent seismological work at the Center for Nuclear Waste Regulatory Analyses (CNWRA). The session entitled "Probabilistic Seismic Hazard Assessment at Low Probabilities, the Ergodic Assumption, Precarious Rocks, and Shattered Rocks," directly addressed questions about how best to interpret probabilistic seismic hazard assessment results with low annual exceedence probabilities. The meeting concluded with a half-day field trip in which Dr. J. Brune showed the attendees examples of precarious rock sites near Palm Springs, California and related how his analyses of these sites constrain probabilistic seismic hazard assessment results for this region of Southern California.

### SUMMARY OF PERTINENT POINTS:

Earthquake Predictions. A number of papers presented new approaches to earthquake prediction. Many of these focus on the increased seismic moment release in the vicinity of a fault that has accumulated stress and the related dynamic and static changes in crustal stress after large earthquakes. In one series of papers, researchers in Canada and the Pacific northwest identified what has been termed "slow slip events" on the Cascadia Subduction zone. These slow slip events are characterized by a systematic displacement of continuous Global Positioning Satellite stations over a one to two week period in a direction opposite to the long-term elastic strain accumulation. The new research shows that the slow slip events occur on the subduction zone approximately once every 14 months. The researchers conclude that they signify periods of elevated earthquake risk. For example, the research models show that during the two weeks of a slow slip event, the probability of a great earthquake occurring during the week is about 50 times higher than the probability of a great earthquake during nonslip weeks.

be established for Yucca Mountain due to limitations in the amount of slip nearby faults can accommodate coupled with stress constraints in the rocks. Dr. Whelan showed examples of delicate secondary minerals housed in lithophysal cavities within the Exploratory Studies Facility and Cross Drift at Yucca Mountain show that the Mountain has not experienced significant ground shaking since these minerals grew (many more than 10 million years ago).

Additional support for limiting ground motion estimates comes from Dr. Brune's work on precariously balanced rocks, which are naturally occurring formations of large boulders that are nearly ready to topple down a hill slope or cliff face. Dr. Brune's analysis of these formations provides an estimate of the amount of ground acceleration necessary to topple the precariously balanced rocks and an estimate of when erosion of the hill slope or cliff face caused the rocks to become precariously balanced. These data then constrain the upper bound ground motion at the site. For example, a precarious rock site formed by erosion during the past glacial epoch (~20,000 years ago) in which 0.50 g of ground acceleration would cause the rocks to topple indicates that the site has not experience 0.50 g of ground motion in the last 20,000 years. Dr. Bruhn showed several well-documented examples of precariously balanced rocks in the region near Palm Springs, California, during a field trip held in the afternoon of April 16, 2004. Precariously balanced rocks at Yucca Mountain have been proposed as one possible geologic constraint on the upper bound ground motions at Yucca Mountain.

Other Site-Specific Seismic Studies of Interest. In addition Yucca Mountain, several sessions contained information directly related to ongoing CNWRA work at other U.S. Nuclear Regulatory Commission (NRC) regulated facilities throughout the United States. These included papers on the (i) 2003 San Simeon earthquake in central California, which occurred near the Diablo Canyon Nuclear Power Plant; (ii) Cascadia subduction zone seismicity, which impacts the hazard estimates at the Humboldt Bay Nuclear Power Plant, (iii) Wasatch Range seismicity, which is important to the seismic hazard estimates for the proposed Private Fuel Storage facility in Skull Valley, Utah; and (iv) recent advances in understanding intra-plate earthquakes, such as those in New Madrid or Charleston, which impact seismic hazard estimates for NRC regulated facilities at Paducah, Kentucky and Savannah River, South Carolina. Abstracts for all presentations were published in the 2004 March and April issue of Seismological Research Letters.

### References

Anderson, J.G. and J.N. Brune. "Probabilistic Seismic Hazard Analysis without the Ergodic Assumption." Seismological Research Letters. Vol. 70. pp 19–28. 1999.

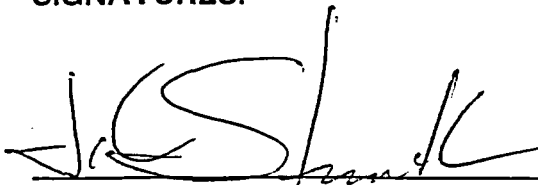
Brune, J.N. "Precarious Rocks Along the Mojave Section of the San Andreas Fault, California: Constraints on Ground Motion From Great Earthquakes." Seismological Research Letters. Vol. 70. pp 29–33. 1999.

Bommer, J.J., N.A. Abrahamson, F.O. Strasser, A. Pecker, P.-Y. Bard, H. Bungum, F. Cotton, D. Fäh, F. Sabetta, F. Scherbaum, and J. Struder. "The Challenge of Defining Upper Bounds on Earthquake Ground Motions." Seismological Research Letters. Vol. 75. pp 82–95. 2004.

### **SUMMARY OF ACTIVITIES:**

On April 14, 2004 I attended sessions on Seismic Hazards, Ground Motion Attenuation and the San Andreas Fault System. On April 15, 2004 I attended sessions on the Northridge

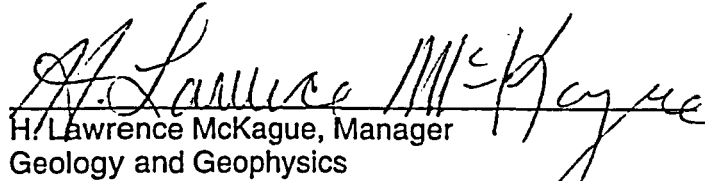
**SIGNATURES:**



John A. Stamatakos  
Principal Research Scientist

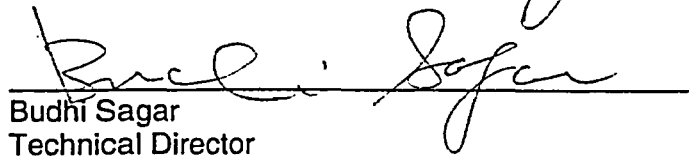
07/29/04  
Date

**CONCURRENCE:**



H. Lawrence McKague, Manager  
Geology and Geophysics

07/29/04  
Date



Budhi Sagar  
Technical Director

7/29/04  
Date