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BEFORE THE
SUBCOMMITTEE ON ENERGY AND NATURAL RESOURCES
COMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES

JANUARY 20, 2010

## INTRODUCTION

Chairman Costa, Ranking Member Lamborn and members of the Subcommittee, thank you for inviting me to testify on the reauthorization of the National Earthquake Hazards Reduction Program (NEHRP) and the National Hazards Risk Reduction Act of 2009. I speak today on behalf of the Seismological Society of America (SSA), an international scientific society devoted to the advancement of seismology and its applications in understanding and mitigating earthquake hazards. SSA was founded to promote research in seismology, the scientific investigation of earthquakes and related phenomena, to promote public safety by all practical means, and to enlist the support of the people and the government in the attainment of these ends. SSA is the largest and most respected society of seismologists in the world and is aligned with other scientific and engineering organizations to promote earthquake risk reduction worldwide.

As we have seen in the tragic aftermath of the January 12 earthquake that devastated Haiti, earthquakes possess the ability to take thousands of lives and cause extraordinary damage especially in urban areas. The rapid availability of scientific information following the Haitian earthquake was made possible by the robust seismic instrumentation, monitoring, and seismic research that NEHRP supports. Timely earthquake information provides situational awareness that governments, relief agencies and citizens can use to efficiently allocate resources and aid in the recovery efforts.

NEHRP was established by Congress in 1977 to "reduce the risks to life, property from future earthquakes in the United States" and is based on the knowledge that earthquakes are inevitable and will occur without warning. However, there is much that can be done to minimize their impact. Haiti is another grim reminder that we cannot afford to let our guard down. Without a strong NEHRP research and implementation program, fatalities and economic losses could escalate dramatically. The substantial improvements that we have made to building codes, building practices and community preparedness have been instrumental in reducing the loss of life in recent Californian earthquakes. We should not, however, be lulled into a false sense of security that we have solved the problem, nor that earthquakes are no longer a risk. Future earthquakes can result in a significant loss of life coupled with widespread and serious economic losses, especially in regions of the United States outside of California that have historically paid less attention to seismic issues.

Many of the changes in the NEHRP program since the last Reauthorization (PL108-360) have created greater levels of commitment and communication at the agency level, and have served to rekindle a sense of community at the end-user level. These changes included naming the National Institute of Standards and Technology (NIST) as the lead agency, directing the creation of the Interagency Coordination Committee (ICC) and creating the external Advisory Committee on Earthquake Hazards Reduction (ACEHR). SSA recognizes the excellent role that NIST has played in the leadership and coordination of the NEHRP Program. The coordinated planning undertaken by the ICC,

along with creation of the ACEHR and the Scientific Earthquake Studies Advisory Committee (SESAC), serves as a model for other multi-agency programs.

SSA is pleased with the tremendous work that has gone into the Natural Hazards Risk Reduction Act of 2009 (H.R. 3820), which includes the reauthorization of NEHRP, and we are, in general supportive of its objectives. We are concerned, however, about the reduction in the authorization levels of the included agencies, in particular, the United States Geological Survey (USGS). As it is currently written, H.R. 3820 would only authorize $70 million for the USGS, a reduction of $19 million from their authorized level in FY2009. The reduction in authorization is problematic on two fronts. First, if authorizations are reduced, and appropriations stay fixed with respect to FY2009 levels, there is limited leeway in the budgets to handle unforeseen emergencies during the fiscal year. Second, we note that the annual appropriations for USGS during the last few years have consistently been 60 to70% of authorization amount. If this precedent is followed, the likely result of a $19 million reduction in the USGS authorization is a $12 million decrease in appropriations from FY2009 levels. The resulting appropriation would be less than the USGS received in real dollars at the beginning of the NEHRP program 30 years ago. Rather than slash the authorized amounts, efforts should be made toward increasing appropriations for these programs. A reduction in authorized amounts indicates a lack of support by Congress for this crucial program. SSA supports increasing the authorization level in H.R. 3820 to FY 2009 levels with small increases in the out years to account for expected inflation.

A potential budget reduction of this magnitude is significant not only for NEHRP and the USGS, but for the Nation as well. We have come to rely on the timely availability of USGS information for earthquake risk and emergency management. Further reductions in funding would jeopardize the availability of these information products when they are needed the most. As the applied earth science component of NEHRP, the USGS is responsible for reporting on earthquakes; developing National and Urban Seismic Hazard maps, as well as other mapping products; building public awareness of earthquake hazards; and supporting targeted research to improve monitoring and assessment capabilities. USGS carries out these responsibilities through partnerships with the other NEHRP agencies, State and local governments, university researchers, and the private sector.

Under the Disaster Relief Act of 1974 (PL 93-288) and NEHRP, the USGS has the assigned Federal responsibility for monitoring and notification of seismic activity in the United States. The USGS fulfills this requirement via the Advanced National Seismic System (ANSS), a national network of seismic instruments designed to provide rapid delivery of high quality earthquake data. ANSS is a flagship program of the USGS. It was ranked highest by the Department of Interior (DOI) Investment Review Board in 2007 and 2008 for business value to the mission of the USGS and DOI. The National Research Council study on the Economic Benefits of Improved Seismic Monitoring demonstrated the potential for the large net benefit of seismic monitoring to the nation. The annualized cost of improved seismic monitoring is less than 2% of the annualized risk (i.e., building and building-related losses) currently estimated for the United States

($96 Million v. $5.6 Billion). Despite these facts and the recommendations of the SESAC and ACEHR, ANSS has never received full funding.

While the 2009 American Recovery and Investment Act support for the USGS included funding for the modernization of ANSS components by replacing older instruments with state-of-the-art, robust systems across the highest earthquake-hazard areas of the nation, there is still more work to be done to achieve the full national potential of ANSS. Currently, there are approximately 820 stations deployed, with the goal of 7,100 total installations required to complete ANSS. Additionally, only five of the 26 identified high risk major metropolitan areas have sufficient instrumentation and monitoring. At the current rate of funding, many believe ANSS will be obsolete before it is completed. Further reductions in funding will only serve to jeopardize the progress we have made to date.

The ANSS is the foundation for many of the information products provided by the USGS for the end-user community and has helped to reduce the uncertainty in addressing earthquake issues. Continued seismic monitoring has lead to the improvement of the National Seismic Hazard Maps which are referenced in the model building codes. By specifying seismic hazards in terms of engineering-based parameters instead of intensity, structures can be designed and constructed with appropriate strength and durability. The Urban Seismic Hazard Mapping Program is used to reliably predict patterns of ground motion amplification in urban areas, and thus identify locations that are especially vulnerable, as well as those that are not, to strong ground shaking. This level of specificity can help to significantly reduce earthquake losses and guide rational urban development.

Both ShakeMap and the Prompt Assessment of Global Earthquakes for Response (PAGER) provide rapid estimates of strong ground shaking and the populations exposed to that shaking. The USGS delivers that information to emergency managers, first-responders and other organizations and agencies that handle response activities. The availability of these products is not a luxury, they are critical components to the decision-making efforts of communities, states and countries as they evaluate how best to respond to an earthquake and keep the disaster from becoming a catastrophe. The Pacific Gas and Electric Company, for example, has used USGS ShakeMap data to help identify areas for utility inspections and monitoring following the recent magnitude 6.5 earthquake in Eureka, California. Other Federal, state and local government, as well as private and public sector, organizations have incorporated near real-time shaking intensity and ground motion information from ShakeMap into their emergency management programs and expect these data to be available following significant damaging earthquakes. Further reductions in funding will only reduce the capability to provide this information when it is needed most.

With more than 25 million people at risk from earthquakes along the southern San Andreas Fault near Los Angeles and the Hayward Fault near Oakland and San Francisco, the concept of Earthquake Early Warning (EEW) represents a new and promising strategy for public safety and mitigation. Much like the Tsunami Warning System, EEW seeks to alert communities prior to the arrival of potentially destructive seismic waves so

they can take protective actions. Prototype earthquake early warning tests are currently being conducted in California by member institutions of the California Integrated Seismic Network (CISN), a regional component of the ANSS. The Bay Area Rapid Transit District is an early adopter of this technology and is the process of evaluating the potential benefits of EEW in their emergency response program. The CISN institutions are also looking into the application of EEW for the proposed California high-speed rail system.

While EEW systems are currently being tested in California, the societal benefits may be even more pronounced in other earthquake-prone parts of the country. In the central and eastern U.S., strong ground motions are felt over significantly larger areas than in California, enabling both a larger warning area and longer lead times for alerts ahead of strong shaking. Since these areas are less prepared to earthquake shaking, such alerts become more important for loss reduction. However, a significant increase in the instrumentation density in that region would be required for early alerts to become a reality.

Currently, the EEW initiative is ranked a lower priority than other USGS research and assessment efforts, due to budget limitations. Improvements to the ANSS will benefit all aspects of earthquake information collection and dissemination, including EEW. It is also worth noting that EEW can be viewed as an emerging technology to provide rapid warnings for many other types of emergencies. While the details of EEW are specific to earthquakes, the operation of sensor networks, real-time data analysis, and rapid notification can be expanded to cover other natural and man-made emergencies that fall within the USGS mission.

In addition to earthquake warning and response, the USGS plays a critical role in earthquake preparedness and planning by working with communities to develop earthquake scenarios and exercises. Earthquake scenarios provide a means to visualize community impacts from earthquakes without actually having the event occur. The integration of USGS hazard data with FEMA's Hazards US (HAZUS) loss estimation program is one of the major NEHRP success stories. Incorporating the latest scientific, engineering and societal knowledge about a region's seismic hazard, local soil characteristics, building types, lifelines, and population characteristics, creates a compelling and accurate picture that members of the local community can use to prepare for future events. Scenarios provide a basis for communities to define their own level of acceptable level of risk and develop risk-reduction policies. Scenarios help answer questions like "Have we done enough?" and enable communities to identify appropriate actions to reduce their level of risk.

The 2008 Great ShakeOut exercise was the largest earthquake drill in U.S. history and demonstrated the long-term impacts of a magnitude 7.8 earthquake on the complicated social and economic interactions that sustain southern California society. Other earthquake simulations are being developed and used by communities in the Pacific Northwest and New Madrid regions of the country as well as California. The New Madrid Catastrophic Planning Initiative is being developed for the 200$^{th}$ anniversary of the 1811/1812 New Madrid earthquakes and involves four FEMA regions and 400

counties in eight states (Alabama, Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee). The project created new, regionally comprehensive soil characterization maps, new ground motion maps for scenario events, updated transportation and utility networks models for Memphis, TN and St. Louis, MO, and methods to quantify the uncertainty in various impact model results.

## CONCLUSION

NEHRP is an investment in the Nation's future. The return on this investment, as summarized in the three major goals of the NEHRP Strategic Plan:

1. to improve the understanding of earthquake processes and impacts;
2. to develop cost-effective measures to reduce earthquake impacts on individuals, the built environment and society; and
3. to improve the earthquake resilience of communities nationwide

requires a long-term commitment at all levels of our society.

As lead agency, NIST has accomplished much and appears capable to continuing the success of NEHRP. As a program, NEHRP is an excellent example of diverse agencies, organizations and individuals collectively working toward a common goal. Any reduction in the authorization for NEHRP places the programs mentioned above in jeopardy. Consequently, it places the Nation in jeopardy. Rather than slash the USGS authorization to $70 million, as is currently written in H.R. 3820, every effort should be made to maintain the authorization at FY 2009 levels, and if possible, increase the level of support in the out years. This level of commitment is critical to maintain the progress towards achieving a disaster resilient Nation.