

**National Earthquake Hazards Reduction Program  
Advisory Committee on Earthquake Hazards Reduction  
National Institute of Standards and Technology  
Gaithersburg, Maryland  
March 10–11, 2011**

**Meeting Summary**

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**Advisory Committee Members:**

Chris Poland, Chair	Degenkolb Engineers
Walter Arabasz	University of Utah
James Beavers	University of Tennessee
Jonathan Bray	University of California, Berkeley
Richard Eisner	Fritz Institute
James Harris	J. R. Harris and Company
John Hooper	Magnusson Klemencic Associates
Michael Lindell	Texas A&M University
Jack Moehle	University of California, Berkeley
Thomas O'Rourke	Cornell University
Susan Tubbesing	Earthquake Engineering Research Institute
Anne vonWeller	Chief Building Official, Murray City, Utah
Brent Woodworth	Global Crisis Services, Inc.

**NEHRP ICC Member-Agency Representatives and NIST Support:**

Patrick Gallagher	NIST Director
Chuck Romine	NIST Acting Associate Director for Laboratory Programs
Shyam Sunder	NIST EL Director, <i>Designated Federal Official</i>
Tammy Dickinson	OSTP
William Grosshandler	NIST, EL Deputy Director for Building and Fire Research
Jack Hayes	NIST, NEHRP Director
Steve McCabe	NIST, NEHRP Deputy Director
Eric Letvin	NIST, Disaster and Failure Studies Program Director
Marc Levitan	NIST, NWIRP Leader
David Applegate	USGS
John Filson	USGS Emeritus, NEHRP Secretariat
William Leith	USGS
Mike Mahoney	FEMA
Joy Pauschke	NSF
Jeff Dragovich	NIST
Matthew Speicher	NIST
Kevin Wong	NIST
Steve Cauffman	NIST
Sadek Fahim	NIST
Robert Chapman	NIST
Tina Faecke	NIST, NEHRP Secretariat
Michelle Harman	NIST, NEHRP Secretariat
Anna Lang	NIST
Francoise Arsenault	BRI, NEHRP Secretariat

**Guests:**

Mary Ellen Hynes	DHS
Annie Kammerer	NRC (U.S. Nuclear Regulatory Commission)
Ed Kavazanjian	Arizona State University
Nico Luco	USGS
Anita Epstein	DHS
Sara Jones	DHS

***Note: The M9.0 Great Tohoku, JP, Earthquake occurred during the two-day time span of this meeting of the ACEHR!***

**Summary of Discussions****I. Welcome and Opening Remarks**

Chris Poland, Chair of the Advisory Committee on Earthquake Hazards Reduction (ACEHR), welcomed everyone to the meeting and reviewed the meeting agenda. Shyam Sunder also welcomed the members and reported that Chuck Romine, Acting Associate Director for NIST Laboratory Programs, has been designated as the point of contact for policy issues with ACEHR. Romine was on a business trip away from NIST but joined the meeting by phone.

**II. Non-NEHRP Agency Activities Related to Earthquake Safety****A. Earthquake R&D Activities at the U.S. Nuclear Regulatory Commission**

Hayes introduced Annie Kammerer, Senior Seismologist at the U.S. Nuclear Regulatory Commission (NRC). She coordinates the seismic and tsunami program at the NRC.

Kammerer opened by providing a brief history of the NRC and nuclear plant building in the U.S., which essentially came to a standstill after the 1979 accident at Three Mile Island. There are now 104 operating reactors in the United States, with plans to construct up to 35 new reactors, primarily in the Eastern U.S.

Kammerer discussed the work of the NRC Seismic Research Program. NRC is updating its research plan for 2011 through 2016. Present funding for NRC seismic research is about \$4 million. Research is primarily conducted in-house and via contract, with a very small number of occasional grants. A key part of the research program is stakeholder interaction with organizations such as the Electric Power Research Institute (EPRI).

New NRC research projects are addressing source characterization, which is also co-funded by the Department of Energy (DOE), and EPRI; ground motion prediction equations, in progress for about 2 years, also co-funded by NRC, DOE, EPRI, and the USGS; and Probabilistic Seismic Hazard Assessment (PSHA) process guidance, which has been the subject of about 8-10 studies. The guidelines being developed will be available in draft for public comment this year.

Current NRC research projects address site response; seismic isolation; small modular reactors, which have a number of benefits, including the ability of a utility to pay for these out-of-pocket; Soil-Structure Interaction (SSI) modeling of Nuclear Power Plants (NPPs) under non-traditional loads, a project at the University of California, Davis; correlated seismic performance, a project conducted by the Lawrence

Berkeley National Laboratory which will be finished in 2012; and technology-neutral performance-based risk-informed framework for seismic design and review. New research topics will include dynamic earthquake pressures on deep foundations and testing and modeling of multi-directional cohesionless soils.

Potential future research topics include fully probabilistic SSI analyses; true dispersion of SSC response; ground motion selection for NPPs; fully randomized geologic profiles; response of deep soil sites (guidance must be updated); next generation seismic probabilistic risk assessments, a cooperative program with EPRI; improved plant-level fragility; and High Consequence/Low Probability of Failure (HCLPF) assessments.

Kammerer noted there is cross-over in its work with the work of agencies such as the USGS, where there is significant cooperation with USGS in the hazards area. For example, the NRC is developing a massive database with the USGS to answer tectonic questions. On the engineering side, the NRC will look at extreme events and their impact on safety and the need for additional guidance on probabilistic risk assessment (PRA).

An ACEHR member asked about NRC plans for leveraging work to address planned budget cuts. Kammerer stated that NRC will address cuts through a number of strategies: trying to find more funding within NRC; asking consultants to reduce costs; conducting new work in-house; and searching for partnering on projects. An ACEHR member asked about NRC work with the Advanced National Seismic System (ANSS). Kammerer stated that NRC funded a project to investigate information-sharing with the ANSS. NRC also supports state geologists and is very excited about the Nuclear ShakeCast program. NRC will try to roll out a beta version for the National Level Exercise 2011 (NLE 2011) in May.

In response to a question about the NRC international role, Kammerer reported that the NRC participates on the International Atomic Energy Agency (IAEA) and partners with the Japan Nuclear Safety Energy Organization (JNES). NRC also strives to ensure that non-native English speakers understand its guidance.

An ACEHR member commented on the relevance of FEMA Performance-Based Seismic Design (PBSD) project work to NRC work. He asked if NRC has considered working with agencies other than the USGS. Kammerer answered that the NRC Seismic Research Program has been in existence for only about 4 years. There are many opportunities, but NRC has not yet reached the point where it can take advantage of all of them. She added that NRC works with the National Oceanic and Atmospheric Administration (NOAA), in addition to the USGS and EPRI.

Sunder mentioned the Nuclear Energy Standards Coordination Collaborative (NESCC), which is updating standards. The NRC, DOE, and NIST serve on the NESCC. To date, some work has been done on tornado requirements. Over time, there will be more interaction. Hayes added that the NIST-funded project with the NEHRP Consultants Joint Venture that addresses SSI also involves the NRC.

## **B. Earthquake-Related R&D Activities at the Department of Homeland Security**

Mary Ellen Hynes, Director of Research for the Infrastructure Protection and Disaster Management Division of the DHS Science and Technology (S&T) Directorate, reported that DHS is not currently performing earthquake-related research. In 2009, the S&T Directorate hosted a colloquium to identify priority areas for research in geotechnical earthquake engineering. Highest priority areas included validation of analytical procedures, soil-water-structure interaction; and capturing field performance from extreme events.

Hynes informed the members that the DHS S&T Directorate has undergone a significant cut in funds. She offered to report back to ACEHR on research once funds are made available.

The proceedings of a resiliency summit will be released soon on the National Institute of Building Sciences (NIBS) website. DHS, working with NIBS, is developing benchmarks for hazards and will eventually develop standards for construction. A demonstration of an owner performance requirements tool for all hazards should be available on the NIBS website in a few months.

An ACEHR member asked about DHS work in resiliency. Hynes stated that funds are available for this area. To an extent, earthquakes are part of this work. The proceedings of a high level summit on resiliency will be released soon on the National Institute of Building Sciences (NIBS) website at [www.nibs.org](http://www.nibs.org). DHS, working with NIBS, is developing benchmarks for hazards and will eventually develop standards for construction. An owner performance requirements tool for all hazards has been developed and a demo version should soon be available on the NIBS website.

An ACEHR member also asked about how the DHS S&T Directorate interacts with FEMA. Hynes stated that she works at the level of Dr. Sandra Knight, the Deputy Assistant Administrator for the FEMA Federal Insurance and Mitigation Administration (FIMA). She works to some extent with Mike Mahoney and to a greater extent with Paul Tertell in the FEMA Building Science Branch. A goal of DHS is to pursue cooperation, especially internal cooperation.

### **III. NEHRP Legislative Update**

Hayes reported that the authorized funding levels for the NEHRP agencies expired on September 30, 2009. Versions of a reauthorization bill are under consideration in both the House and Senate, but no information has been received from Congress on plans to complete the reauthorization legislation.

Poland reviewed ACEHR recommendations for the NEHRP reauthorization from May 2009; these included supporting work with lifelines, OSTP organizing support for NEES among Federal agencies, interdisciplinary research, multi-hazard projects at USGS, and changing agency responsibility for post-earthquake investigations to NIST.

The members discussed enhanced collaboration on lifelines and a workshop was suggested. Sunder stated that NIST can support an ACEHR-sponsored workshop on lifelines through the Secretariat.

### **IV. NEHRP Agency Mid-Year Updates**

#### **A. NEHRP Update**

Hayes reported on ACEHR membership. Paul Somerville's vacancy will be filled soon. Walter Arabasz has resigned, effective after this meeting, and Jonathan Bray's and James Harris' terms expire in April. Hayes thanked all three for their contributions and extraordinary work on behalf of ACEHR and NEHRP.

Hayes reviewed NEHRP developments, including: the annual report (FY2010); post-earthquake studies of the Christchurch, NZ, earthquake; and NEHRP agency budgets.

Hayes introduced Steve McCabe, the new NEHRP Deputy Director, who will join NIST on April 11 with primary responsibility for the NIST research program. Hayes also reported that Tina Faecke has been given assignments to support Disaster and Failure Studies, the National Construction Safety Team Act, and wind research activities, in addition to NEHRP support.

Hayes also noted the addition of the Disaster and Failure Studies Program to the NIST Engineering Laboratory, the National Research Council report on a 20-year U.S. earthquake resiliency implementation roadmap (release delayed until March 30, 2011), the re-engagement with the Interagency Committee on Seismic Safety in Construction (ICSSC) to update ICSSC RP-6, *Standards of Seismic Safety for Existing Federally Owned or Leased Buildings*, and a meeting of the U.S.-Japan Cooperative Program in Natural Resources (UJNR) Panel on Wind and Seismic Effects held February 3-4, 2011.

Hayes reported that he is working to finalize NEHRP agency responses for the 2010 ACEHR white paper on achieving national disaster resilience, the 2010 ACEHR report, and the 2010 ACEHR statement on the 200<sup>th</sup> Anniversary of the New Madrid Earthquakes.

### **B. NIST Earthquake Mitigation Research Update**

Hayes reviewed budget requests for NIST earthquake research in FY 2011/2012. He reported on activities by ATC and the Consortium of Universities for Research in Earthquake Engineering (CUREE).

### **C. NSF Earthquake Research Programs Update**

Joy Pauschke reported on NSF's response to two recommendations from the 2010 ACEHR report. Regarding the recommendation on post-earthquake studies, the Engineering and Geosciences Directorates are reviewing Rapid Response Research (RAPID) proposals for the February 2011 New Zealand earthquake. NSF supported the dissemination of 2010 Haiti and Chile earthquake RAPID award findings through two workshops coordinated by the Earthquake Engineering Research Institute (EERI) available on the EERI website.

Regarding the recommendation on the sustained availability of large-scale experimental facilities, NSF is supporting two separate studies on the "Future of Earthquake Engineering Research Infrastructure Beyond 2014". The studies are being conducted by the National Academy of Sciences and the Science & Technology Policy Institute.

Pauschke reviewed NSF NEHRP highlights and the NSF total budget request for FY 2012; she provided a link to the agency budget request. In response to a question about RAPIDs, Pauschke stated that successful RAPID projects must pose a research hypothesis before undertaking field work. Pauschke noted that formal coordination is not required among individual RAPID investigators but many participate in post-event coordination calls.

### **D. USGS Earthquake Programs Update**

David Applegate reported USGS project updates. He noted that the USGS is providing support to the Arkansas Geological Survey on the recent earthquake swarm in that state. Seismologists at the University of Memphis argue that the fault structure involved could cause a 5.7 magnitude earthquake.

Applegate discussed a new National Academy of Sciences panel, which will consider induced seismicity and the impacts it could have on U.S. energy source development.

In partnership with FEMA, the Central U.S. Earthquake Consortium (CUSEC) and others, USGS recently completed a new version of *Putting Down Roots in Earthquake Country* in time for the New Madrid Seismic Zone (NMSZ) Bicentennial. The new publication was distributed this February in St. Louis at the Bicentennial Kick-Off. To date, more than 1 million people have registered for the Great Central U.S. ShakeOut preparedness exercise taking place on April 28, 2011.

The National Earthquake Prediction Evaluation Council (NEPEC) has convened an independent expert panel to study the NMSZ earthquake hazard that will meet in Memphis on March 14-15. NEPEC will meet

in April 2011 to consider the panel recommendations. USGS is supporting FEMA's National Level Exercise (NLE) 2011, based on a catastrophic Central US earthquake.

Applegate reported that work funded under the American Recovery and Reinvestment Act (ARRA) must be completed by October 1, 2011. The upgrades to seismic stations funded under the ARRA are on schedule going well, as is the project with the Veterans Administration to instrument their facilities with strong-motion sensor arrays.

### **E. FEMA Mitigation Earthquake Programs Update**

Mike Mahoney updated members on staffing changes at FEMA. Mahoney reported that FEMA publication E-74, *Reducing the Risk of Non-Structural Earthquake Damage*, is almost complete. Other new FEMA earthquake publications scheduled for completion in FY 2011 include FEMA 439B, *Blast Resistance Benefits of Seismic Design*, and FEMA P-807, *Cost-Effective Seismic Retrofit of Soft-Story Wood-Frame Buildings*. The new Catalog of FEMA Earthquake Resources, FEMA P-736A, is available.

Mahoney reported that Puerto Rico adopted the 2009 International Building Code (IBC) and the International Residential Code (IRC). FEMA has conducted three courses on building codes in Puerto Rico since the adoption.

Mahoney reviewed proposed FEMA funding for NEHRP projects for FY 2011, which includes a reduction in state earthquake assistance funds and elimination of Phase III of the PBSO project at the Applied Technology Council (ATC).

## **V. NIST Disaster and Failure Studies Program Overview**

Hayes introduced Eric Letvin, Director of the Disaster and Failure Studies Program who provided an overview. The Program is authorized under the National Construction Safety Team Act (PL 107-231). Letvin reviewed five program objectives and the types of disaster and failure studies anticipated. He also discussed a planned multi-hazard data repository. The goal is to make the repository operational, populated with selected historical events, and available to the public through the NIST website by FY 2014/2015. A pilot study based on the earthquake in Chile is scheduled to be completed in FY 2012.

## **VI. Trends and Developments in NEHRP-Related Fields**

### **A. Issues Related to Soil Interaction During Earthquakes**

Tom O'Rourke provided the members with a brief background on the recent concerns and controversies related to the current state-of-the-art in soil liquefaction analysis. The Earthquake Engineering Research Institute (EERI) convened an *ad hoc* Committee on Soil Liquefaction During Earthquakes to review the technical issues involved in the dispute and advise the EERI Board of Directors. That committee's primary recommendations were to convene a forum to discuss alternate views and develop consensus, to hold a third major liquefaction workshop, and to develop a report through the National Academies.

At the invitation of ACEHR, Ed Kavazanjian, Chair of the National Research Council Committee on Geological and Geotechnical Engineering (COGGE), discussed the National Research Council (NRC) proposal for addressing this controversy. The NRC plan is to hold a community workshop of about 80-100 participants, which would be funded partly by the Pacific Earthquake Engineering Center (PEER). A follow-up, smaller workshop and two to three Committee meetings will be held. Kavazanjian also discussed the peer review process for the final report and the budget for the study. He asked the ACEHR for a

statement of support for the initiative.

Poland asked if the controversy is appropriate to ACEHR consideration for NEHRP, given that his perception is that the focus of the study is on large earthen dams instead of buildings. Kavazanjian responded that earth dam issues are not the entire focus; utilities and lifelines also are part of the issue and there is an application to buildings. Some ACEHR members agreed that the issue is important but not within the purview of NEHRP and ACEHR; others stated that the issue is related to buildings and appropriate for consideration by ACEHR.

Sunder commented that ACEHR can acknowledge a controversy on an issue and advise whether NEHRP should become involved in addressing it.

Poland reiterated his concern over ACEHR's making recommendations on issues not related to NEHRP. He asked if ACEHR can write to the NRC but not address the issue in the ACEHR annual report. Sunder stated that NIST will advise if ACEHR can do this.

## **B. USGS Development of Risk-Targeted Earthquake Ground Motions**

Nicolas Luco, Research Structural Engineer with USGS, reported via conference call on the development of new risk-targeted earthquake ground motions for use in ASCE-7. Previous uniform-hazard probabilistic ground motions resulted in spatially-variable collapse risk due to variations in hazard curve shapes, and considered only a single selected frequency on hazard curves. The new risk-targeted probabilistic ground motions address these shortcomings.

## **VII. ACEHR 2011 Annual Report**

### **A. Discussion of Issues**

The Committee identified and discussed the following issues to be raised in the 2011 report:

**NEHRP Agency Budgets:** There was agreement that FEMA has lost critical mass for its implementation capacity for NEHRP as a result of cuts.

**Lifelines:** The language on lifelines in H.R. 3820 is still valid.

**Expansion of NEHRP:** The members discussed expanding NEHRP to include other agencies. Sunder advised the members to focus on the synergies needed rather than the mechanisms for accomplishing them.

**Establishment of an Interagency Working Group:** The members reaffirmed this 2010 recommendation.

**Continued Focus on ANSS:** Capturing seismic data such as provided by ANSS continues to be a priority.

**Instrumentation:** This issue continues to be important. The Department of Defense and the General Services Administration should be brought into the discussion, to determine whether they can provide instrumentation in buildings they own.

**Resilience:** This was an overarching theme in the 2010 report and continues to be important.

**Post-Earthquake Investigations:** This area has become less coordinated. The members agreed that NIST should take the lead.

**USGS External Grants Program:** This area continues to be important.

**NEHRP Reauthorization:** The members reaffirmed the need for Congress to reauthorize NEHRP as soon as possible.

**Multi-hazard Initiatives:** These initiatives, which were greatly successful, are now on the wane. Emphasis continues to be needed in this area.

**NIST Extramural R&D:** This area also continues to be important.

## **B. Review of 2010 ACEHR Report**

Poland asked authors for the 2010 annual report to provide updates to their sections. The ICC will consider the 2010 report at their April 27 meeting. A short letter report format was agreed for the 2011 report..

### ***Introduction and Agency Recommendations***

**Resilience:** Poland stated that this section is still current.

**NEHRP Management:** Susan Tubbesing stated that ACEHR should acknowledge increased coordination between the NEHRP agencies and the increase in NIST staffing levels. The NEHRP Office has done an outstanding job in these areas.

**FEMA:** Rich Eisner stated that the recommendations for FEMA are still relevant.

**NIST:** Jim Harris stated that the recommendations for NIST are still valid. The report should say that ACEHR compliments NIST on the expansion of the internal and external programs and that it is time to evaluate NIST's long-term effectiveness.

**NSF:** Jack Moehle stated that NSF is addressing both ACEHR recommendations from 2010. He noted that there appears to be a shift at NSF away from the EERI Learning From Earthquakes (LFE) Program. Pauschke noted that LFE is an EERI program and EERI can submit an unsolicited proposal to NSF to continue it.

**USGS:** Walter Arabasz stated that the three recommendations for USGS and the four recommendations for SESAC are still applicable. Work by the USGS in the NMSZ deserves kudos. The most significant impacts are the reduction in external funding and the effects of reduced funding on the multi-hazard initiative.

### ***Trends and Developments***

**Social Sciences:** Lindell remarked that the 2010 report is essentially unchanged, except for the results from the comparison of the Haiti and Chile earthquakes in terms of economic impacts and casualties.

**Earth Science:** Arabasz stated that all of the observations in the 2010 report are still valid.

**Geotechnical Engineering:** Jonathan Bray reported that observations in the 2010 report for geotechnical engineering are still valid.

**Structural Engineering:** John Hooper stated that this section is still appropriate with minor revisions.

**Building Codes and Quality Assurance:** Anne vonWeller stated that this section is timely and relevant. The PBSD project, strong implementation, and performance-based code initiatives all are needed.



**Lifelines Engineering:** O'Rourke stated that this section is still appropriate. He will tie in the issue of the loss of implementation capacity at FEMA. O'Rourke agreed to send Tubbesing language to add to her section on the NEHRP Office concerning the controversy on liquefaction.

**Disaster Preparedness, Response, and Recovery:** Eisner stated that this section is mostly unchanged and noted a new focus on exercise planning and earthquake early warning by FEMA. Eisner will include language stating that emergency response capacity must continue to be expanded.

### **C. Consensus on 2011 Report and Schedule for Completion**

The members decided to reaffirm all of the recommendations from the 2010 report. The 2011 report will make specific note of efforts by NIST to increase coordination among the NEHRP agencies and their partners and efforts to expand its NEHRP staff. ACEHR will encourage reauthorization of the NEHRP legislation (H.R. 3820). Within the context of the reauthorization, ACEHR will emphasize the importance of greater coordination in post-earthquake response, with NIST taking the lead in this area.

The 2011 report will address the loss of NEHRP implementation capability resulting from budgetary cutbacks and the need for a greater focus on lifelines. ACEHR formed a lifelines working group (Poland, O'Rourke, Eisner, and Woodworth) to consider options for the area, including the convening of a colloquium. ACEHR will express its continued support for the establishment of an interagency working group with non-NEHRP agencies to foster better building practices and building codes.

Poland asked the authors to submit their sections to him by March 25. The draft will be compiled, formatted, edited and returned for review by the Committee within a week of receipt of all of the sections. The draft report will be discussed during the next ACEHR conference call meeting on April 25.

## **VIII. Meeting with NIST Director**

Dr. Gallagher greeted the members and thanked them for their work. He reported that his testimony before the House Committee on Science, Technology, and Space on the NIST FY 2012 budget proposal appeared to be well received. His testimony was the first exposure of many new members in Congress to NEHRP. Gallagher remarked that this is an important time for NEHRP given the week's events in Japan and the recent release of the National Research Council report on the Nation's tsunami preparedness. He asked the members for their questions and thoughts on the future direction of NEHRP.

In response to a question about the white paper on achieving national disaster resilience, Gallagher stated that the white paper was transmitted to the Special Assistant to the President for Homeland Security and Senior Director for Resilience Policy. The ICC will discuss the white paper at the April meeting.

Regarding the December 2010 Bicentennial Statement, Gallagher stated that there should not be a problem with ACEHR releasing statements under its name. Poland mentioned ACEHR discussions on the need for an interagency working group among NEHRP and non-NEHRP agencies and asked whether ACEHR should recommend including the working group in the NEHRP reauthorization. Gallagher advised against asking Congress to establish a statutory interagency committee.

Poland also acknowledged the dedication and efforts of Sunder, Hayes, and all of their staff, and congratulated NIST for increasing its NEHRP staff. Gallagher concluded by noting the strong synergy between human and natural threats and safety of structures. Sunder and his staff have important tasks ahead of them in addressing the many cross-cutting issues that will arise. He thanked the Committee members for their contributions.

## **IX. Public Comments**

There were no public comments.

## **X. Upcoming ACEHR Meetings**

The next ACEHR conference will be a call and not a formal meeting. The conference call will be held on April 25 from 1:00 to 4:00 ET. The primary focus of this will be the ACEHR's 2011 recommendations to NIST Director Gallagher.

## **XI. Adjournment**

Poland thanked the members and adjourned the meeting at 3:30 p.m. on March 11, 2011.