

**National Earthquake Hazards Reduction Program
Advisory Committee on Earthquake Hazards Reduction
Pacific Earthquake Engineering Research Center
Berkeley, California
December 17–18, 2008**

Meeting Summary

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
Ronald Hamburger	Simpson Gumpertz & Heger, Inc.
James Harris	J. R. Harris and Company
Howard Kunreuther	University of Pennsylvania
Michael Lindell	Texas A&M University
Thomas O'Rourke	Cornell University
Paul Somerville	URS Corporation
Anne vonWeller	Chief Building Official, Murray City, Utah
Yumei Wang	Oregon Department of Geology and Mineral Industries
Sharon Wood*	University of Texas at Austin
Brent Woodworth	Global Crisis Services, Inc.
Mark Zoback*	Stanford University (SESAC ex-officio liaison)

*not in attendance

NEHRP ICC Member-Agency Representatives and NIST Support:

Shyam Sunder	NIST, Building and Fire Research Laboratory Director, ACEHR Designated Federal Official
Jack Hayes	NIST, NEHRP Director
Edward Laatsch	FEMA
Dennis Wenger	NSF
David Applegate	USGS
William Leith	USGS
Tina Faecke	NIST, NEHRP Secretariat
John Filson	NEHRP Secretariat
Brian Garrett	NEHRP Secretariat

Guests:

William Anderson	National Research Council
Jay Berger	NEES Consortium, Inc.
Yousef Bozorgnia	Pacific Earthquake Engineering Research Center
Stephen Mahin	Pacific Earthquake Engineering Research Center
Ronald Mayes	Simpson Gumpertz & Heger, Inc.
Jack Moehle	Pacific Earthquake Engineering Research Center
Stuart Nishenko	Pacific Gas and Electric Company
William Petak	University of Southern California
Susan Tubbesing	Earthquake Engineering Research Institute
Stuart Werner	Seismic Systems and Engineering Consultants

Summary of Discussions**I. Welcome New Members, Review Meeting Goals and Agenda**

Chris Poland, Chair of the Advisory Committee on Earthquake Hazards Reduction (ACEHR), welcomed attendees to the meeting and introduced Jack Moehle, director of the Pacific Earthquake Engineering Research Center (PEER). Moehle welcomed everyone to PEER and the University of California, Berkeley, and noted that PEER staff and facilities were available to assist the committee as needed during its deliberations. Poland then introduced two new members of ACEHR, Michael Lindell and Brent Woodworth, who briefly described their backgrounds and affiliations.

Poland reviewed the materials provided under the “References” tab in the meeting notebooks, which included the current NEHRP authorization legislation and ACEHR’s first report on NEHRP effectiveness, which the committee submitted to the NEHRP Interagency Coordinating Committee (ICC) in May 2008. He noted that he would like the committee to submit these reports annually, and suggested that ACEHR prepare a relatively brief report in 2009 and a more comprehensive document in 2010. Poland then reviewed the meeting agenda.

II. Welcome and Opening Remarks

Shyam Sunder welcomed the committee members and provided an update on recent developments at the National Institute of Standards and Technology (NIST). The agency is presently without a director. Its last director, William Jeffrey, left about a year and a half ago and his acting replacement, James Turner, recently moved to the National Oceanic and Atmospheric Administration. The new NIST Deputy Director, Pat Gallagher, has temporarily assumed all of the NIST Director functions. Sunder indicated that the incoming Obama administration could appoint a new NIST director as early as April or May of 2009.

ACEHR’s May 2008 report was well received by the ICC, which discussed the document at its August meeting. The recommendations contained in the report are being carefully considered by the NEHRP agencies and the ICC is currently preparing a formal response to the report. The next ICC meeting is scheduled for January 2009.

Regarding the NEHRP agencies' budget appropriations for fiscal year (FY) 2009, Sunder reported that the Federal Emergency Management Agency (FEMA) has received its funding for the year, while the other NEHRP agencies are operating at FY 2008 budget levels under a congressional continuing resolution currently set to expire on March 6, 2009. He noted that the Obama transition has been proceeding relatively quickly, so there is reason to hope that appropriations for the remaining NEHRP agencies may be determined early in the next congressional session. The Obama transition team completed its visit to NIST within 2 to 3 weeks after the election. Team members appeared interested in bold ideas, which NIST has provided.

Before turning to the next topic on the agenda, Chris Poland asked all committee members and guests in attendance to introduce themselves.

III. Meeting Logistics

Jack Hayes announced that the committee would later be escorted to the Faculty Club for lunch, after which there would be an opportunity to tour some of the seismic retrofit sites on campus.

IV. NEHRP Program Update

A. Presentation

NEHRP Director Jack Hayes presented an overview of recent program activities. He spoke on the following topics: major findings and outputs from the four workshops sponsored by NEHRP over the past 18 months; the new NEHRP strategic plan for FYs 2009–2013 released in October 2008; progress on the next NEHRP annual report, which is being assembled by John Filson with contributions from the NEHRP agencies; the status of the ICC's response to ACEHR's May 2008 report on NEHRP effectiveness; and development of the management plan that is required by statute to guide implementation of the NEHRP strategic plan. The PowerPoint slides that Hayes used to address these topics were included in the meeting notebooks provided to committee members, and were posted on the NEHRP website at http://www.nehrp.gov/pdf/ACEHRDec2008_NEHRP.pdf.

B. Discussion

Several ACEHR members inquired about the ICC's reaction to the recommendations made by ACEHR in its May 2008 report. Sunder stated that although information about the ICC's response is limited pending its formal release to ACEHR and the public, the NEHRP agencies have signaled broad support for the recommendations on the whole. He noted that, regarding the recommendation about transferring responsibility for post-earthquake investigations, USGS is currently directed by statute to coordinate these investigations.

A member asked about the composition and role of NEHRP's Program Coordination Working Group (PCWG). Hayes and Sunder identified the current members of this group and explained that they are responsible for implementing, within their respective NEHRP agencies, the policies established by the ICC.

The members discussed whether and how ACEHR should try to further progress on the seismic rehabilitation of existing buildings, which was the focus of one of the workshops that Hayes

described in his presentation. A member suggested that the executive summaries from the two reports that emerged from this workshop (ATC-71 and ATC-73) be photocopied and distributed to ACEHR members, and this was done. Members cited cost as a significant impediment to rehabilitation and acknowledged that existing grant assistance, including that currently available through FEMA's Pre-Disaster Mitigation (PDM) Grant Program, is insufficient. It was suggested that additional funding could perhaps be obtained by aligning seismic rehabilitation needs with the incoming Obama administration's desire to stimulate the economy through spending on renewal of the Nation's infrastructure.

A member noted that the new NEHRP strategic plan emphasizes cooperation among the NEHRP agencies and asked whether the management plan will specifically address how this cooperation is to be implemented. Hayes confirmed that this will be addressed in the management plan.

V. Setting ACEHR Next Steps

Chris Poland led the first of two planning sessions focused on how ACEHR should proceed after issuing its first annual report on NEHRP effectiveness in May 2008. The second planning session was held at the close of this 2-day meeting (see section XIII, Future Meeting Planning).

Poland reiterated his recommendation that the committee's 2009 report be structured as a relatively brief update to the May 2008 report, and that ACEHR wait until the 2010 report to provide a comprehensive evaluation of NEHRP. There was general support among the members for this approach.

Poland invited comments about what should be addressed in the 2009 report to be submitted next spring. Members agreed that the report should contain "a response to their response," that is, it should respond to the ICC's forthcoming feedback on the recommendations made by ACEHR in its 2008 report. There was also general agreement that the report should go beyond this response to address the upcoming NEHRP reauthorization and other timely matters.

Members talked about how to take advantage of the incoming administration's push to stimulate the economy through infrastructure projects. It was argued that in planning such projects, the new administration should give due consideration to incorporating applicable mitigation measures and improving disaster (and seismic) resiliency in communities at risk. It was also agreed that, given its role within NEHRP, FEMA would be the most appropriate agency through which to implement such work.

Following are other topics suggested for inclusion in ACEHR's 2009 report:

- How mitigation measures could be coupled with insurance or incentive programs to improve seismic resilience.
- The positive impact on the economy that could be derived from boosting seismic mitigation efforts.
- The continuing need for additional mitigation grant assistance for States.
- A recommendation about allocating a small percentage of the Federal funds authorized for use under the Stafford Act to collaborative research aimed at documenting lessons learned in disasters.

VI. FEMA Update

A. Presentation

Ed Laatsch provided an overview of recent NEHRP-related activities at FEMA. Subjects addressed included the agency's new QuakeSmart business-preparedness initiative; its ongoing support for building code development and adoption, including FEMA's memorandum of understanding with the International Code Council; progress in developing next-generation performance-based seismic design procedures and standards; earthquake program staffing at headquarters and in the regional offices; earthquake program funding for FY 2009; and the new assistance program for State earthquake programs. A detailed outline of the presentation was included in the meeting notebooks and was posted on the NEHRP website at http://www.nehrp.gov/pdf/ACEHRDec2008_FEMA.pdf.

B. Discussion

Laatsch noted that FEMA had used the last of the funds it had designated for support to the American Lifelines Alliance to sponsor, in collaboration with NIST, the NEHRP Post-Earthquake Information Management System (PIMS) Workshop held in July 2008. He commented that FEMA is looking forward to more NEHRP-related collaboration with NIST, and that as NIST increases its involvement in applied earthquake-related research, the focus of FEMA's earthquake programming will shift more toward implementation and outreach activities.

There was some discussion about the sources and adequacy of the grant funding currently available for State mitigation efforts. FEMA's new State assistance program is being funded at about half its former level (before it was absorbed into the Emergency Management Performance Grant [EMPG] program a number of years ago). A member asked whether the additional funds that formerly were allocated to the FEMA program are still available in the EMPG program, and Laatsch said they are. Laatsch added that FEMA has encouraged States to use the PDM and EMPG multi-hazard funds for earthquake-related projects, but noted that last year and again this year, Congress has earmarked about half of the PDM funds for specific projects. A member asked whether FEMA will require State matching funds under the new assistance program, as it formerly did under the old program. Laatsch responded that it is not yet clear whether this and other former requirements will carry over to the new program.

A member inquired about the International Code Council's interest in providing more support for FEMA in post-disaster settings (e.g., by mobilizing groups of building officials to serve as volunteer building safety and damage inspectors). Laatsch explained that although the Council's desire to do this is documented in the memorandum of understanding with FEMA, before such arrangements can be implemented, the Stafford Act will need to be amended to extend Good Samaritan liability protections to such volunteers. A member commented that such legislation has been enacted by the State of California.

VII. NSF Update

A. Presentation

Dennis Wenger, filling in for Joy Pauschke, presented an overview of recent NEHRP-related activities at the National Science Foundation (NSF). He reviewed the activities supported by NSF's Directorate for Geosciences (GEO), which included the Incorporated Research Institutions for Seismology (IRIS), the Southern California Earthquake Center (SCEC), EarthScope, and fundamental research. Activities supported by the Directorate for Engineering (ENG) were also discussed, including post-earthquake reconnaissance programs, the Natural Hazards Center, fundamental research arising from unsolicited proposals, and the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES). The PowerPoint slides that Wenger used to address these topics were included in the meeting notebooks and were posted on the NEHRP website at http://www.nehrp.gov/pdf/ACEHRDec2008_NSF.pdf.

B. Discussion

A member commented that IRIS is primarily interested in the Earth's structure rather than earthquakes and their effects, and consequently the studies undertaken by IRIS have limited relevance to NEHRP. Another member inquired about the amount of NEHRP funding allocated to IRIS for such studies. David Applegate of the U.S. Geological Survey (USGS) responded that NEHRP funding provided to IRIS is for the maintenance of seismic monitoring networks and data management rather than for research studies.

A member asked why NSF support has been diminishing for the Earthquake Engineering Research Institute's (EERI) Learning From Earthquakes (LFE) program. Wenger responded that to his knowledge this diminishment has not resulted from any perceived weakness in LFE or any feeling that the program has lessened in importance. Rather, it is the consequence of a largely flat budget combined with the emergence of NEES.

One member, noting that NSF lacks a formal, uniform mechanism for disseminating its research findings, asked whether that has been identified as a problem within NSF, and Wenger replied that to his knowledge it has not. Although researchers' final reports are not currently made available through the NSF website, it was pointed out that unless researchers disseminate their NSF-supported findings through peer-reviewed journals and important conferences, they are unlikely to win further grant support from NSF. Also, findings from smaller research efforts that are less amenable to dissemination through those mechanisms are sometimes aggregated in books compiled by third parties. Wenger noted, for example, that the Natural Hazards Center produced compilations on Small Grants for Exploratory Research (SGER) projects pertaining to the Hurricane Katrina and September 11 disasters. A member recommended that for each grant that NSF provides, a report on the resulting findings should be prepared and made publicly available on the NSF website.

The committee inquired about how the NSF budget will fare in the transition to the new administration. Wenger said that Congress is currently funding the agency through a continuing resolution and it is still uncertain what funding will emerge from the congressional budget process.

VIII. USGS Update

A. Presentation

David Applegate reviewed recent developments relating to the USGS Earthquake Hazards Program (EHP), which is the USGS component of NEHRP along with the Global Seismographic Network, which is joint with NSF. Topics covered included the heavy use of USGS earthquake information products following the disastrous May 2008 Wenchuan quake in China; the first-ever congressional oversight hearing on the EHP held in May 2008; the Advanced National Seismic System (ANSS); the national seismic hazard maps; the first statewide earthquake forecast issued in California; the Seattle urban hazard maps; the Great Southern California ShakeOut exercise held in November 2008; the EHP and GSN budgets for FY 2009; and the development of a 5-year plan for the EHP. The PowerPoint slides that Applegate used to address these subjects were included in the meeting notebooks and were posted on the NEHRP website at http://www.nehrp.gov/pdf/ACEHRDec2008_USGS.pdf.

B. Discussion

A member commented on the ShakeOut preparedness exercise, reporting that USGS tools were successfully applied to generate extremely useful post-event damage modeling data and remote-sensing damage validation data. This has generated a lot of interest in these technologies among participants, and a number of follow-up activities are under way involving ongoing, cooperative planning among emergency-response agencies and utilities in southern California.

IX. NIST Update

A. Presentation

Jack Hayes described recent progress made in strengthening NIST's role within NEHRP through further development of the agency's problem-focused earthquake research program. Topics addressed included the budget and staffing for this program and the intramural and extramural research in progress or being planned for the program. The PowerPoint slides that Hayes used to address these subjects were included in the meeting notebooks and were posted on the NEHRP website at http://www.nehrp.gov/pdf/ACEHRDec2008_NIST.pdf.

B. Discussion

Noting that the only two staff members hired for the program to date are structural engineers, a member asked about NIST's plans for developing multidisciplinary expertise within the earthquake research program. Hayes and Sunder explained that their approach has been to first work toward building an adequate workforce within the program's core competencies. As time goes on and budgets permit, they anticipate expanding staff expertise into geotechnical engineering and economics. The expertise in economics may be developed through further cooperation with the Building and Fire Research Laboratory's Office of Applied Economics, which is leading the ongoing intramural project on the development of a searchable database of NEHRP-funded earthquake research.

A member asked how NIST's ongoing project with the National Research Council (NRC) came about. The objective of this project is to develop a roadmap that identifies and estimates the costs of the applied research that must be conducted over the next 20 years to accomplish the broad

technical objectives included in the new NEHRP strategic plan. Hayes and Sunder stated that NIST initiated the project because the last such roadmap to be produced is now 5 years out of date, does not extend out 20 years into the future, and does not contain robust, validated, and defensible costs.

X. Social Sciences Research and Implementation

A. Presentations and Discussion on NRC Report

ACEHR member Michael Lindell and guest panelist William Anderson gave presentations on the NRC report entitled *Facing Hazards and Disasters: Understanding Human Dimensions*. This report, sponsored by NSF, was prepared in 2006 by the NRC's Committee on Disaster Research in the Social Sciences: Future Challenges and Opportunities; Michael Lindell served as a member of this committee and William Anderson was among the personnel from NRC's Division on Earth and Life Studies who provided staff support to the committee. Copies of the report were distributed to ACEHR members and the report summary was posted on the NEHRP website at http://www.nehrp.gov/pdf/ACEHRDec2008_NRC.pdf. (The full, 408-page report is available from the National Academies Press at <http://www.nap.edu/catalog/11671.html>.)

Lindell provided an overview of content from Chapter 3 of the report, "Social Science Research on Hazard Mitigation, Emergency Preparedness, and Recovery Preparedness." He discussed key concepts underlying hazard vulnerability (hazard exposure, physical vulnerability, and social vulnerability) and components of the conceptual model of societal response to disaster. Under this model, extreme events are associated with disaster impacts (physical and social), which are associated with pre-impact interventions (hazard mitigation practices, emergency preparedness practices, and recovery preparedness practices) and post-impact responses (emergency and recovery activities). Lindell also described a household hazard-adjustment model that links behaviors to intentions, which, in turn, are influenced by perceptions shaped by exposure to, attention to, and interpretations of hazard-related information.

Lindell concluded by reviewing the following research recommendations contained in Chapter 3:

- Refine the concepts and methods involved in hazard vulnerability analysis.
- Examine the dynamics of hazard vulnerability, particularly social vulnerability, and identify better interventions.
- Assess the effectiveness of existing programs for hazard mitigation and emergency preparedness.
- Develop better models of the adoption of mitigation and preparedness measures.
- Develop better models to guide decisions about hazard operations and protective actions in emergencies.
- Assess the extent to which hazard- and disaster-related research findings are being implemented.
- Examine the effectiveness of procedures used for conducting training exercises.
- Identify factors that promote the adoption of more effective disaster preparedness and recovery programs.

William (Bill) Anderson began by acknowledging one of the conclusions cited in the NRC report, that the United States has become a world leader in research on the social and economic aspects of earthquakes. Due to the funding provided for such research by the NEHRP agencies, particularly NSF, much progress has been made in recent years. Anderson stated that the main focus now should be on implementing the 38 research recommendations provided in the report. Three contextual realities that will inevitably affect this implementation are (1) the limited resources available for social science research; (2) the division of labor among NEHRP agencies, which leaves NSF with the major responsibility for this research; and (3) the continuing funding emphasis on “the hazard of the day,” which since 2001 has been terrorism.

Anderson identified attributes of NSF in general and of SBE in particular that may also affect implementation of the NRC recommendations. These included, for NSF, fluid leadership at policy and program levels, competition between grant programs for available funds, pressure to allocate funds to areas attracting the most proposals, frequent reorganization within ENG, and congressional involvement in ENG programming. For SBE, they included the wide range of social science research supported by the directorate as well as its highly opportunistic culture and organizational location outside of NEHRP’s traditional home base in NSF. Anderson noted that SBE has been cooperative with ENG, but that the level of such cooperation has generally depended on the interpersonal relationships that have or have not existed across the directorates.

Other factors that Anderson cited as possibly having an effect on implementation of the report’s recommendations included the following: graduation of the earthquake engineering research centers (EERCs) from the NSF engineering research centers program; termination of the NSF-wide Human and Social Dynamics grant program, which has supported multidisciplinary research in the social, physical, and natural sciences and engineering; establishment of the Civil, Mechanical and Manufacturing Innovation (CMMI) Division within ENG; the pending departure of Susan Tubbesing from EERI; and the Natural Hazards Center’s struggle for ongoing support. Anderson’s suggestions for facilitating implementation of the NRC recommendations were as follows:

- Add a permanent position to ENG’s staff for an earthquake hazards program director focused on social science research.
- Establish a formal mechanism (e.g., a joint appointment) that links social science research within ENG to that within SBE.
- Find places for social science research within the NEES program, perhaps in relation to technology transfer or the economics of mitigation.
- Market—to policy makers at NSF and FEMA and to the public—the value of social science-oriented earthquake research.
- Develop a strategy for involving DHS more directly in the work of NEHRP.

Regarding the suggestion about NEES, a member asked whether Anderson was recommending that a center for social science research be added to the facilities that currently make up NEES. Anderson said no; rather than a separate research facility, he was recommending further integration of social science research into the projects undertaken at existing NEES facilities. Dennis Wenger commented that efforts are under way to do this by building into such projects more reporting about the impacts of the research conducted at NEES facilities. He also reported

that bridges are being built between ENG and SBE, although this remains challenging due to SBE's traditional focus on theoretical rather than applied research.

A member commented that earthquake-related research in the social sciences has great relevance for other hazards, including terrorism, and that that provides a potentially persuasive rationale for attracting greater NEHRP involvement from DHS. Anderson agreed, noting that DHS is already working with social scientists, such as those at the National Consortium for the Study of Terrorism and Responses to Terrorism (START) headquartered at the University of Maryland, who are applying findings from natural hazards-related research to terrorism.

B. Presentations and Discussion on EERI Earthquake Risk Reduction Report

Guest panelists William Petak and Ronald Mayes gave presentations based on the EERI white paper entitled *Earthquake Risk Reduction: Addressing the Unmet Challenges—The Need for an Interdisciplinary Research Approach*. This report, sponsored by NSF, was issued in January 2008 by an EERI working group that was chaired by Petak and included Mayes. The document is available on the EERI website at

http://www.eeri.org/site/images/free_pubs/InterdisciplinaryResearch_white_paper.pdf.

Petak identified the intended audiences for the recommendations made in the report. These include NSF and other potential funders of interdisciplinary research on earthquake risk reduction, policy makers in executive and legislative branches of government, universities and academic researchers, and professional societies that support the earthquake risk reduction community. Petak then described in detail each of the 13 recommendations contained in the white paper (see section 6, Recommendations), and presented the authors' concluding statement, which reads as follows: "By working together to build strategies that promote problem-focused research, the earthquake research community, funding agencies, practitioners, and policy makers can move forward to reduce earthquake risk. Encouraging collaboration among the many disciplines and defining research activities around critical problems are important steps in this direction. The earthquake community must continue to work together to address the complex challenges that remain to be solved."

Mayes began by discussing major challenges confronting the earthquake risk reduction community, identified in the report as improving understanding of the following: the social and economic consequences of earthquakes and other hazards; how stakeholders make decisions about hazard mitigation and preparedness; how to motivate desired risk-reduction behaviors among individuals and organizations; nonstructural damage mitigation; and how to use the data provided by advanced performance sensors installed in buildings and infrastructure. Mayes identified some of the examples of effective interdisciplinary research described in the white paper, including the development of HAZUS multihazard loss-estimation software and pioneering performance-based earthquake engineering procedures, the NEES grand challenge projects, and the large-scale testbed projects carried out by the NSF-supported EERCs. Mayes concluded his presentation by discussing the building rating system that has begun to be developed by the Structural Engineers of Northern California. The objective is to create a system that rates the seismic performance of buildings, which can serve as a tool for communicating seismic risk to non-engineering stakeholders and that ultimately spurs mitigation. Rather than replacing any existing tools, the idea is to integrate available tools into a quantitative assessment

process that results in simple qualitative ratings. It is hoped that these ratings could then be voluntarily and routinely referenced in real-estate sales transactions.

A member commented that the building-rating-system concept is not new, although it remains a potentially useful tool. The issue, which must be addressed through social science research, is how to get the Nation to value and use such concepts. Mitigation efforts will not succeed on the scale needed until social science researchers determine how to effectively spur demand for mitigation. NSF should focus more on funding social science projects that study how to make mitigation happen. Instead of shoehorning social science into earthquake engineering projects, it would be more productive for NSF to shoehorn earthquake engineering into social science projects.

Another member observed that it has been challenging to get the best social scientists to want to work in the area of earthquake risk reduction. There is a better chance of doing that today, however, since social scientists know more about behavioral principles and are better positioned to shape effective policies that acknowledge these principles. A member noted that there are many State seismic safety commissioners who are trying to communicate with decision makers regarding the need for greater seismic risk reduction efforts, and they need help from social scientists on how to reach this audience.

One member contended that it should be possible to leverage additional funding for social science research at NSF by getting SBE more involved in earthquake risk reduction research. He asked how researchers could be encouraged to propose such projects to SBE and how SBE could be persuaded to provide more support for such work. Dennis Wenger responded that ENG and SBE are now reviewing some of each other's proposals, but that given their differing proposal submission schedules, it is difficult to do a lot of that. He suggested that NSF needs to find a way to extend the Human and Social Dynamics solicitation, which was focused on social science projects. In response to a suggestion that ENG and SBE synchronize their proposal timetables, Wenger noted that these schedules are set at the directorate level.

Members and guests suggested a number of avenues through which social scientists could become more involved in earthquake risk reduction. These included participation in field studies (e.g., documenting the impacts of scenario-based preparedness exercises or the lessons learned from projects such as the Community Action Plan for Seismic Safety [CAPSS] in San Francisco) or in projects focused on hazard vulnerability, disaster resilience, sustainability, risk communication, the cost-effectiveness of nonstructural damage mitigation, motivating the seismic rehabilitation of existing buildings, or individualizing seismic risk (e.g., through building rating systems).

C. Presentation and Discussion on EERI Earthquake Engineering Report

ACEHR member Thomas O'Rourke spoke about the EERI report entitled *Contributions of Earthquake Engineering to Protecting Communities and Critical Infrastructure from Multi-hazards*. This report, sponsored by FEMA, was issued in August 2008 by the steering committee of the EERI Workshop on Contributions of Earthquake Engineering, Seismology, and Social Science. O'Rourke chaired this committee. Copies of the report were distributed to ACEHR members and the report is available on the EERI website at <http://www.eeri.org/site/images/stories/news/contribee.pdf>.

O'Rourke stated that this report is about added value. It provides a distillation of earthquake engineering contributions to public safety and protection against multiple hazards, and through the examples it presents, shows how investments in NEHRP have yielded benefits far beyond earthquake risk reduction. The report was written for the earthquake community, to help it understand its continuing role in an increasingly multi-hazard world, as well as for the public and government representatives, who also need to understand this role in order to support it. It educates and encourages peripheral vision among these audiences, so that earthquake engineering is viewed in association with multiple threats. In addition to its educational function, the report is intended to encourage the leadership needed to define and advance the role of the earthquake community.

O'Rourke stated that the report should be of use to those involved in the upcoming reauthorization of NEHRP. He noted that during the last reauthorization process, NEHRP was aided by the perception that the program was of value to the emerging National Windstorm Impact Reduction Program. Shyam Sunder reported that in the reauthorization bill introduced this fall for the wind program, the proposed structure of the program is modeled upon NEHRP. He added that given the similarities between the two programs, legislators might be tempted to combine them. O'Rourke indicated that, whatever happens, earthquake engineering research has proven to be an effective incubator for widely beneficial ideas, and the earthquake community needs increasingly to define itself in terms of its value for other hazards as well as earthquakes.

XI. Lifelines Research and Implementation

A. Presentation and Discussion on the Historical Perspective

Stuart Nishenko gave a presentation on the historical development of lifeline earthquake engineering. He began by defining lifelines and their relationship to critical infrastructure. He identified some distinguishing characteristics of lifeline systems, which included being subject to multi-jurisdictional regulatory oversight, having designs that are based on system performance, having owners and operators who have special knowledge, and having different earthquake engineering requirements than buildings.

Nishenko then presented a chronological review of milestones in the evolution of lifeline earthquake engineering design and standards. Among the many developments that he cited were establishment of the following organizations: the American Society of Civil Engineers Technical Council on Lifeline Earthquake Engineering (TCLEE), NEHRP, the EERCs, and the American Lifelines Alliance (ALA). He noted the productive public-private partnerships and industry-directed research that have characterized PEER and the ALA. He described how the ALA worked to identify and fill gaps among the national guidelines for lifelines, including guidelines relating to hazards other than earthquakes. He also cited the impact that the September 11, 2001, terrorist attacks had in shifting government support for infrastructure protection away from natural hazards toward terrorism.

Nishenko discussed several current issues related to lifeline mitigation. These included the need to work with DHS to bring natural hazards back within the purview of infrastructure protection; the need to update the ATC-25 report; the need to standardize public and private lifeline loss-estimation modeling; the need for further study of lifeline interdependencies; and the need for

more comprehensive, systematic collection of post-event lifeline performance data relating to earthquakes and other hazards. Nishenko commented that while PIMS offers a promising start for the collection of post-earthquake performance data, it should be expanded to other hazards.

There was discussion about whether it is realistic to expect lifeline operators to fully share their performance data. Nishenko advised that it may be best to start by working to gather data from publicly owned lifeline systems. A member agreed, noting that efforts are currently under way in DHS to develop protocols on what and when performance data can be shared. These efforts arose out of a post-Katrina shift in focus at DHS, from protection of critical infrastructure to community resilience. Nishenko added that a strategy that emerged among utilities following Katrina was enterprise risk management, which calls for the consideration of all relevant hazards.

Nishenko proposed that the next steps taken to advance lifeline mitigation should include advocating for the inclusion of lifeline rehabilitation among the infrastructure improvement projects considered for the Obama administration's economic stimulus package, as well as promoting the use of existing lifeline standards and guidelines. Longer-term objectives should include developing a consensus on the level of seismic hazard that must be considered in lifeline design, and developing and implementing PIMS. A member asked whether existing lifeline standards are good enough to warrant their promotion. Nishenko responded that although lifeline standards and guidelines are continually being improved, it is worthwhile to take advantage of what is currently available. Another member stated that rather than a consensus on the seismic hazard level, what needs to be agreed upon is the level of performance required for lifeline systems.

Ed Laatsch reported that over the last 4 to 5 years, visits to the ALA website have numbered in the thousands, but that due to a lack of funding, the ALA has not been able to follow up much on its earlier accomplishments. A member commented that when it comes to lifeline mitigation and data sharing, market incentives can stifle rather than encourage cooperation among competing utilities. Another member who attended the ALA's 2007 workshop on data collection noted that attendees emphasized the need for a central repository of multi-hazard data and the need to modify the Stafford Act to fund multi-hazard research.

B. Presentation and Discussion on the Practitioner's Perspective

Stuart Werner gave a presentation on the concerns and needs of lifeline earthquake engineering practitioners. He reviewed the factors affecting the seismic performance of lifeline systems and how the seismic risks applicable to lifelines are analyzed. He identified several areas in which further research is needed to improve system risk analyses. These included developing improved models for lifeline loss estimation and for component damage states and repair requirements; establishing better databases containing relevant component attributes and data on past system and component performance; investigating the factors that affect system resilience; creating methods and strategies that enable quicker repair of lifelines; and developing case histories, databases, guidelines, and oversight structures relating to lifeline interdependencies. Werner also pointed out the need for a more consistent understanding of risk communication across disciplines, and for increased collaboration among practitioners who are focused on different hazards.

C. Roundtable Discussion on Lifelines Research and Implementation

Following the presentations by Nishenko and Werner, members and guests engaged in a wide-ranging discussion about what ACEHR could and should do to help advance lifeline mitigation. There was general acknowledgement of the differences between lifelines and other parts of the built environment. Lifelines are both publicly and privately owned and operated in the United States. Although they are regulated, the types and levels of regulation under which they operate, and the entities responsible for regulating them, vary by type of lifeline and by lifeline location. Unlike for buildings, the design and construction of lifelines has generally not been subject to (or advanced by) the ongoing development of mandatory building codes. Considerable progress has been made in the development of voluntary design standards and guidelines through the work of the ALA, the EERCs, and others. However, it has generally been left up to lifeline owners and operators to choose whether to implement these standards, influenced by market forces, enlightened self-interest, or other factors, and consequently their implementation has been uneven. In general, private lifeline owners and operators have been somewhat resistant to mandatory, code-based regulation and to sharing system vulnerability and performance data.

Some members questioned whether existing standards are adequate and whether utilities should be allowed to self-regulate their adherence to these standards. It was suggested that some form of independent, external review (e.g., peer review, regulatory oversight) may be needed to monitor and verify progress in implementing lifeline standards. There was uncertainty about whether such oversight should be implemented at the Federal level. One member suggested that, to better understand what may be possible from a regulatory standpoint, it would be useful to survey lifeline systems to find out how they are currently regulated.

Several examples of successful regulatory efforts were mentioned. This year in Oregon, the Public Utilities Commission brought energy companies together with legislators and state officials and informed the companies that they will need to do seismic vulnerability studies and create long-term mitigation plans, work that they will be allowed to support through rate increases. It was suggested that developing case histories on such examples might be a useful way to learn how to move forward. One member observed that private lifeline operators may be more amenable to regulatory efforts now, in the post-Katrina era, if there is an overriding public interest at stake. Others advised the committee to distinguish, in any recommendations it may make, between the public and private lifeline sectors, and observed that standards may be less threatening than codes. The Interagency Committee on Seismic Safety in Construction (ICSSC) was suggested as a possible avenue into the public lifeline sector.

It was noted that the new NEHRP strategic plan focuses on the development and implementation of standards and guidelines. A member suggested that perhaps such work should be preceded by a full assessment of overall lifeline vulnerability, to better define the problem before promoting specific solutions. Stuart Nishenko agreed, noting that the last such assessment, documented in the ATC-25 report *Seismic Vulnerability and Impact of Disruption of Lifelines in the Conterminous United States*, is nearly 20 years old and should be redone.

At this point the discussion turned toward what the committee should recommend in the near future concerning lifelines. There was general agreement that the committee should take advantage of the attention being given to infrastructure revitalization in the context of the

economic stimulus package. ACEHR needs to send the message that lifelines are an area of exceptional opportunity for infrastructure rehabilitation, and that any such work should be done in accordance with data on multi-hazard vulnerability and lifeline interdependencies as well as applicable standards and guidelines. The committee should also recommend that a small group of experts be assembled to develop recommendations on lifeline-related work that could and should be undertaken first (e.g., anchoring all high-voltage transformers), and that a separate committee be established to identify best practices for use in lifeline rehabilitation and advise on protocols for data collection. A member suggested that the latter committee should perhaps become a permanent oversight body, and asked where such a body should reside within the Federal Government. One person suggested that it should reside within DHS, another said it should be an interagency committee, and a third observed that it would be valuable to have a presence (perhaps a lifeline “czar”) as close as possible to the President.

XII. PEER Overview

A. Presentation

PEER Director Jack Moehle presented an overview of PEER developments and accomplishments during and following its decade-long tenure as an NSF-supported EERC. Photocopies of the PowerPoint slides used in this presentation were distributed to ACEHR members.

Moehle described how PEER has evolved from a west-coast entity supported by NSF and the State of California to a center with a nationwide presence and a broadened base of support. The mission of the center has not changed, however, and is still to “advance performance-based earthquake engineering to meet the needs of various stakeholders.” Moehle outlined some of PEER’s major contributions to performance-based earthquake engineering (PBEE). In addition, he discussed some of the projects completed by PEER that required the multidisciplinary, multi-institutional environment provided by the EERCs. These projects, which could not have been completed by any one institution or investigator, included PEER’s Next Generation Attenuation (NGA) research that produced improved models of earthquake ground motions for the western United States, and the development of the Open System for Earthquake Engineering Simulation (*OpenSees*), which was adopted by NEES as one of its major simulation tools.

Moehle reviewed the major projects that have been continued, started, or planned at PEER since the center’s recent graduation from the NSF engineering research centers program. The loss of NSF EERC support has meant that most of the center’s student programs will not be able to be continued, and while there is still some social science and public policy involvement in PEER projects, it is much lower than before. Moehle discussed some of the research that remains to be done—on seismic hazards, buildings, lifelines, and community resiliency—and that can be done best in multidisciplinary research centers. Such centers are unique and important resources that can provide the opportunity and critical mass needed for multidisciplinary study, as well as shared tools, community vision, trusted research infrastructure for handling large projects, shared vision and resources for technology transfer and implementation, and a “village” environment for mentoring students. Moehle concluded his talk by noting that he is stepping down as PEER director and by introducing his successor, Stephen Mahin of the University of California, Berkeley.

B. Discussion

A member asked about how PEER may be impacted by the new administration in Washington. Moehle and Mahin responded that this could open up new possibilities for PEER, not only in regard to infrastructure but also perhaps in the area of community resilience. Another member asked whether PEER's funding from sources other than NSF is stable. Moehle replied that he expects PEER's State funding to remain intact despite the budget pressures facing the State. Other funding can be preserved through sustained business development efforts, but Moehle noted that these funds are largely for problem-focused work and will not support educational activities or the center's infrastructure.

Noting that the NSF EERCs had multiple core institutions, a member asked Moehle whether that was a good structure for such centers. He replied that although this structure has been more challenging to manage than would be a center housed at a single university, it has proved beneficial for PEER in fostering ongoing inter-institutional collaboration and in making available a wider range of expertise than any one school could muster. He also noted that having several California schools in the center has made it easier to obtain State funding. Moehle was asked whether he thought NEHRP would be justified in recommending that EERCs continue to be funded as they were under the NSF program. He responded that there is a place for at least one such center in the United States. Others commented that NEES is not doing what the EERCs did, and that perhaps EERCs should be mentioned and supported in NEHRP's authorizing legislation as is NEES. It was suggested that any language adding them to the legislation should explain that they are needed for applied research and to strengthen implementation and workforce development. A member also pointed out that NSF's remaining engineering research centers are geared toward applied research conducted through industry collaboration, and observed that perhaps that type of center is needed for improving the Nation's civil infrastructure.

XIII. Future Meeting Planning

Chris Poland led a second planning session that followed up on the initial discussion held earlier in the meeting (see section V, Setting ACEHR Next Steps). He organized this discussion around notes he had written on a chalkboard in the meeting room. These notes, shown on the following page, were intended to summarize the main points that ACEHR members had made during the meeting about what the committee should recommend in its reporting over the coming months. The notes are organized under two reporting mechanisms: an official letter from ACEHR to the NIST Director about the upcoming NEHRP reauthorization legislation; and ACEHR's second annual report on NEHRP effectiveness, to be completed on or about May 1, 2009.

Summary Notes Prepared by Chris Poland

Possible reports → monthly conference calls?

Reauthorization letter (2/1/09, Chris)

LFE leadership

Add executive summary items

Add lifeline czar to ICSSC

DHS et al: DOT, DOE, EPA, USACE

Not NEHRP agencies—need another committee (call interagency working group)

Delete designated funding for PBEE?

Add EERCs

5/1/09 report

① Program status—reinforce recommendations

① Refine NIST workforce recommendation (HK)

① Response to their response (All)

① Comments on management plan

② NSF: SBE—Engineering (ML)

② Stimulating interdisciplinary collaboration (ML)

② Recommend social science projects: building rating system, documenting CAPS, role of economics (HK)

③ Identify regulatory framework for lifelines (JH)

③ Setting performance goals for infrastructure (TO)

③ Centralized data on lessons learned and research—public and private (JB)

④ Centers—focus on unique contribution beyond traditional grant and grand-challenge process (TO, JH, PS, ML)

MAE, MCEER, PEER, SCEC

University of Delaware, Texas A&M, Boulder Natural Hazards Center

NEES

ANSS

Scenarios (RH)

Field studies (RE)

Redo ATC-25 (JH)

Jobs (ML)

In discussing possible content for the reauthorization letter, several attendees agreed with the desirability of getting DHS and potentially other agencies more involved in the work of NEHRP. However, they contended that it may not be appropriate to involve these agencies as NEHRP agencies alongside NIST, FEMA, NSF, and USGS. Rather, they suggested the creation of an adjunct, interagency working group through which these agencies could be involved, at least initially. Another member advised against referencing additional agencies in the letter, and recommended that the letter focus on what should be done rather than who should do it.

There was some discussion about whether the requirement that a specified percentage of NEHRP funding be devoted to PBEE should remain in the legislation. One member argued that if something has made it into the legislation, and remains worth doing, why remove it.

With respect to recommendations about EERCs in the reauthorization letter to the NIST Director and the May report, a member noted that if a recommendation is to establish new centers, those centers could end up competing with the legacy centers. An alternative would be to recommend refunding the legacy centers rather than establishing new centers. Other members suggested that it may be best to endorse the idea of having one or more such centers, rather than promoting particular centers. Other ideas were to talk about the types of research that are needed and the types of organizations best suited to generate such research, or to simply state that there is a role for centers in NEHRP and without them, certain needs will not be addressed. A member noted that the EERCs were different from other centers, and it is important to carefully identify what has been lost since their graduation from NSF support and why those things are still needed. Ten years, which was the length of time the EERCs were supported by NSF, can be characterized as an appropriate period for getting such enterprises started, and to effectively shut them down as soon as they are established does not make sense.

Poland stated that he would like to schedule monthly ACEHR conference calls for January, February, and March, and then convene the next meeting in April. The members tentatively scheduled the first conference call for Friday, January 23, 2009, from noon to 2:00 p.m. eastern time. The main purpose of this call will be to review and finalize the reauthorization letter.

XIV. Adjournment

Chris Poland thanked the members for their attendance and contributions to this meeting. The meeting was adjourned at 4:30 p.m. on December 18, 2008.