

Advisory Committee on Earthquake Hazards Reduction
National Earthquake Hazards Reduction Program

April 25, 2011

The Honorable Patrick D. Gallagher
Director
National Institute of Standards and Technology
Building 101, Room A1134
100 Bureau Drive
Gaithersburg, MD 20899-1000

Dear Dr. Gallagher:

We are pleased to submit our annual report to you and the Interagency Coordinating Committee (ICC) on the effectiveness of the National Earthquake Hazards Reduction Program (NEHRP), as stipulated in our committee charter and Public Law 108–360.

Earthquakes over the past 16 months in Haiti, Chile, New Zealand, and Japan graphically remind us of the devastating impact earthquakes can have on the lives and economic stability of millions of people worldwide. The events in Haiti continue to show us how a complete lack of planning and governance leads to long-term chaos. The steady recovery of Chile shows that modern earthquake planning, proper construction, and mitigation facilitates rapid recovery. The earthquakes in New Zealand underscore the need to add resilience—the ability to recover quickly—to the goals of urban development, land use planning, and earthquake preparedness. Events in Japan, the most prepared of nations, remind us of the developing nature of our understanding of major earthquakes and the consequences of compounding events.

While our Nation is quick to extend sympathy and assistance in response to these worldwide disasters, the unfortunate truth is that we are not prepared to face similar earthquakes in the United States. We must always be conscious of uncertainties in our state of knowledge. We



must continue to learn from earthquakes, reduce our risks through mitigation, and be prepared to respond when an earthquake strikes. America's policymakers have largely ignored widespread vulnerabilities, including overstressed critical infrastructure, and neglected the importance of advancing our own preparedness.

NEHRP was originally established in 1977 to address our Nation's vulnerabilities to earthquakes and, through research and implementation activities, develop and deliver programs, tools, and financial resources that will secure the Nation from catastrophic damage. Essential elements of NEHRP have included the integration of improved understanding of earthquake hazards (USGS) with advances in design and in the assessment of engineered systems performance (NSF and NIST) for use in mitigating existing hazards and improving design for new construction (FEMA).

Even though NEHRP has been funded at a steadily decreasing pace, it continues to deliver significant advancements in earth science, earthquake engineering, and preparedness planning. Current efforts are proceeding under the direction of the 2009–2013 NEHRP strategic plan, which is a well-organized, collaborative, conscientious road map of what needs to be done to achieve resilience, the 21st century goal. The plan has been widely accepted by the earthquake professional community as an appropriate statement of vision, mission, goals, objectives, and expected outcomes. It links the needed work with the statutory requirements of each NEHRP agency and avoids duplication of effort. The recently published, NEHRP-commissioned study by the National Research Council (NRC)¹ provides a detailed road map of the programs and projects needed to implement the strategic plan. The NRC study calls for a significant increase in the pace of implementation.

The 2010 annual report of the Advisory Committee on Earthquake Hazards Reduction (ACEHR) provided a complete assessment of NEHRP in keeping with the committee's statutory responsibilities to assess and report on program-related trends and developments in science and engineering; the program's effectiveness in performing its statutory activities; the management, coordination, and implementation of the program; and the need for program revisions. The report included 12 recommendations, which we understand are being given serious consideration by each of the NEHRP agencies.

We followed our usual process this past year by convening two meetings, one in Memphis, Tennessee, and the other at NIST headquarters in Gaithersburg, Maryland. At these meetings, we received briefings on the status of each NEHRP agency's program as well as presentations from a number of invited non-NEHRP agencies with significant earthquake programs. These latter agencies included the Army Corps of Engineers, the Federal Highway Administration, the

¹ National Research Council, *National Earthquake Resilience: Research, Implementation, and Outreach* (Washington, DC: National Academies Press, 2011), http://www.nap.edu/catalog.php?record_id=13092.

Department of Energy, the Department of Homeland Security, and the Nuclear Regulatory Commission. While in Memphis, we spent one full day considering the region's earthquake hazard assessment and mitigation programs and received testimony from a broad range of researchers and stakeholders about the disagreements and confusion that have developed surrounding the earthquake hazard in that region.

After considerable deliberation, we have determined that our 2010 annual report and its recommendations remain sufficiently current and do not need to be repeated or embellished. The Executive Summary from that report is enclosed for easy reference. We are encouraged with the progress that the NEHRP agencies have made to date in response to that report and look forward to hearing about more in the coming year.

Although we consider our 2010 annual report to still be on message, at our March 2011 meeting, we determined that a few new issues had surfaced that require comment. They include our growing concern over the pace of implementation, the recent funding reductions at FEMA that have neutralized its implementation ability, the need for immediate action on a lifelines program, the need for a holistic and fully coordinated approach to the seismic risk in the New Madrid area, the funding levels being proposed in Congress for the reauthorization of the program, and our response to a SESAC report that postdated our 2010 report. During this meeting, the magnitude 9.0 Tohoku (Japan) earthquake disaster occurred. Although we did not discuss NEHRP's role in the Tohoku earthquake, we ask the NEHRP agencies to consider producing a comprehensive report on this disaster.

The Pace of Implementation

The activities carried out by NEHRP, such as shaping building codes, make a big difference. NEHRP activities can reduce earthquake casualties and shorten the time it takes for stricken communities to heal. The 2009–2013 NEHRP strategic plan stands as a comprehensive statement of what needs to be done in the near term to provide the information and tools needed for the Nation to build toward resilience. Unfortunately, given the slow pace at which NEHRP is currently able to implement its strategic plan, our vulnerability to earthquake hazards is steadily increasing as the Nation continues to head toward certain disaster. Human suffering will be intense, enormous losses will occur (from direct physical damage as well as from the cascading economic impacts of lifeline disruptions), and recoveries will be prolonged unless a more aggressive rate of plan implementation is enabled.

In Presidential Policy Directive PPD-8 of March 2011, the White House has made achieving national resilience to man-made and natural disasters a near-term priority. We believe that implementation of the NEHRP strategic plan according to the road map provided in the NRC study is what must be done to achieve resilience related to earthquakes. We do not believe,

however, that the current pace of implementation is consistent with the President's near-term prioritization of such work.

FEMA's Attention to Mitigation

NEHRP is a unique collaboration of federal agencies that brings together into a comprehensive program of earthquake risk reduction: knowledge of the earth sciences and of design and performance; investigations of building performance and failures; and development of standards, codes, and guidance for design professionals. The Federal Emergency Management Agency plays the critical role of translating earthquake knowledge and community mitigation into practice by earthquake professionals (structural and geotechnical engineers, architects, community planners, and risk and emergency managers) at the state and local levels. FEMA is the interface between advancements in knowledge and the application of that knowledge.

FEMA's role has included providing guidance and incentives for states to initiate and maintain preparedness, mitigation, and response capabilities for earthquake disasters. The agency has also supported the development of design standards, seismic codes incorporating national hazard maps produced by USGS, and training and guidance for design professionals. To a great degree, the progress made in the last three decades in reducing America's earthquake risk through the adoption of building codes and the promotion of seismic design practices is the result of FEMA initiatives.

Unfortunately, in the past decade, FEMA's capacity for and role in earthquake risk reduction has declined at an alarming rate. The staffing for and prominence of FEMA's participation in NEHRP has withered. Internal programs to support mitigation, earthquake engineering, and preparedness, as well as grants to states to support federal-state partnerships, have been slowed to a near stop. These changes are noted in Table 1 below.

Table 1: Changing Capacity of FEMA's NEHRP Participation

NEHRP Activity at FEMA	1990	2010
Visibility and Role of NEHRP	Managed in a separate office with responsibility for NEHRP activities.	Located within the Building Science Branch of the Risk Reduction Division of the Federal Insurance and Mitigation Administration.
Management Level	Managed by a Senior Executive Service appointee who was part of directorate-level management.	Managed by a GS-15 employee who is responsible for three separate programs and is not part of directorate-level management.
Funding Structure	Specific line-item appropriation.	Competing for funding from Management and Administration budget, without specific budget line in appropriations bill.
Funding Amount	Funding of \$20 million for state grants, staff, and mitigation support projects.	Funding of ~\$7 million in FY 2011 and ~\$6 million in FY 2012. Proposed cuts for FY 2012 will impact the regional earthquake consortia, guidance projects, and support from FEMA staff to the states.
NEHRP Staffing	47 FTEs authorized.	Cannot be determined (cannot identify FTEs authorized by NEHRP).

The table above illustrates a continuing erosion of support for FEMA’s critical role as the “implementing interface” of NEHRP. In our 2010 annual report, ACEHR made three critical recommendations for FEMA. These recommendations urged (1) revitalization of the state earthquake programs and provision of leadership in earthquake risk reduction with at-risk states; (2) development and promotion of improved guidance to enhance emergency management; and (3) development and maintenance of improved guidance that will heighten the cost-effectiveness of mitigation for new and existing structures. The following specific program changes are in conflict with these recommendations, do not achieve the objectives of the legislation that currently authorizes NEHRP, and have severely impacted FEMA’s capacity to promote and support risk reduction:

- FEMA’s role as a partner to the states has been severely undermined as earthquake grants to at-risk states were reduced and then subsumed as part of a general grant allocation program to the states for emergency preparedness without an earthquake hazard

emphasis. In high-risk states (e.g., California, Oregon, and Washington) funding was cut by more than 50 percent.

- FEMA’s termination of support to promote lifeline mitigation and reduce risk to critical infrastructure, including utilities and transportation, has undermined mitigation efforts. The impact of cascading failures of utilities during earthquakes has been clearly illustrated in the recent Tohoku earthquake in Japan and is creating enormous challenges to recovery in the second New Zealand earthquake. Utility, transportation, and communications lifeline damage has continued to severely hamper response and relief operations weeks after the Japan earthquake, and the damage to the Fukushima nuclear facility has threatened to exacerbate the earthquake’s devastation (as of March 27, 2011).
- FEMA has taken the lead in developing standards and building code provisions for Performance-Based Seismic Design (PBSD). Unfortunately, after investing \$10 million in developing PBSD, FEMA does not have funding for the development of associated guidance and training programs for earthquake design professionals, and must therefore abandon implementation of this major improvement in structural design codes and practice. The loss of capacity in FEMA’s “implementation interface” will have a negative ripple effect on the effectiveness of NEHRP partners in other federal agencies, in state emergency management and hazard mitigation programs, and in the earthquake design professions.

It is the assessment of ACEHR that FEMA’s capacity to perform its critical responsibility for knowledge transfer to mitigate America’s earthquake risk has lost “critical mass.” Without a robust implementation element that includes guidance and training, NEHRP will not continue to be effective and will not have the capability to achieve the goals of NEHRP’s authorizing legislation, namely, strong national, state, and local resilience to earthquake disasters.

Lifelines Performance Objective

To protect society against catastrophic earthquake-induced losses, NEHRP must make lifelines a top priority. Modern nations depend on their lifelines—energy, transportation, water, and communications—both on a daily basis and in post-earthquake environments. The interruption of any of these lifeline services following an earthquake can produce severe economic losses, harm quality of life, and disrupt citizens’ livelihoods. Furthermore, the complex interdependencies that exist among lifelines can generate many unforeseen and potentially catastrophic consequences that are likely to compound economic losses and hardships.

Lifeline resilience is compromised by the damaging and dramatic effects of liquefaction, as evinced by recent earthquakes in Haiti, Chile, New Zealand, and Japan. Studies under way to

improve the methodology for predicting the occurrence and consequences of liquefaction are vitally important for the protection and performance of U.S. lifelines as well as the many, diverse buildings that are served by lifeline networks. A comprehensive program to improve lifeline performance needs to address and mitigate the consequences of liquefaction and ground failure.

Presently, the United States is at high risk because there is no adequate effort to understand lifeline resilience and no development of performance-based design, construction, and renovation of lifeline systems. To achieve resilient lifeline services, the tasks outlined in the NEHRP strategic plan need to be implemented so that the investments needed at national, state, and local levels can be undertaken.

The American Society of Civil Engineers reports that more than \$2 trillion needs to be invested in our Nation's aging infrastructure over the coming decades to support our high standard of living and economy. The President's 2012 budget request included \$556 billion for surface transportation with \$50 billion to be spent in FY 2012. Ongoing investments in infrastructure at this level should incorporate seismic resilience; at present, they do not. Year in and year out, we miss the least-costly opportunity to improve the resilience of our lifeline systems by ignoring resilience in the design of those systems. For reasons that have not been made clear to us, no funding is being planned related to lifeline systems in the near term. We plan to hold our own colloquium next year to better understand what needs to be done and refine our recommended actions for you.

New Madrid Seismic Risk

At the fall ACEHR meeting in Memphis, Tennessee, we dedicated a day to understanding the seismic hazard in the New Madrid region and how it is being addressed in and around Memphis. We learned that there are a number of controversial issues that deserve the continuing attention of the NEHRP agencies including justification of new building code requirements recently introduced for adoption, development of programs that will allow the region to achieve a proper level of resilience, emergency planning based on both likely and worst-case scenarios, and outreach programs aimed at motivating owners and their design and construction professionals to implement needed changes.

We prepared a NEHRP statement for the New Madrid bicentennial observances and sent it to the ICC for consideration and incorporation into the ongoing activities of NEHRP. We have included this statement as an enclosure to this report. We request that the ICC adopt it as the official position of NEHRP, and urge each NEHRP agency to use it in their efforts to support the bicentennial commemoration.

Reauthorization Levels for NEHRP

Significant cuts to authorized funding levels for NIST and FEMA were proposed in the Natural Hazards Risk Reduction Act of 2010 (H.R. 3820), which passed in the U.S. House of Representatives in the last Congress. This legislation has been reintroduced in the House and Senate (H.R. 1379, S.B. 646) in the same form and may be enacted quickly because of the concern over the continuing “Pacific Rim” earthquakes.

Six years ago, Congress assigned to NIST the responsibility of functioning as NEHRP’s lead agency and the new reauthorization legislation transfers responsibility for post-earthquake coordination from USGS to NIST. Additional funding has never been provided to NIST for its significant leadership responsibilities and as best we can tell, none is being proposed to support the many duties that will accrue to NIST for post-earthquake coordination. Cutting NIST’s authorized NEHRP funding in half, as is proposed in the reauthorization legislation, sends the message that these activities are not of critical importance. ACEHR strongly disagrees.

Comprehensive post-earthquake investigation is a key objective of the NEHRP strategic plan that needs expanded attention. The NEHRP Office at NIST will be responsible for ensuring a smooth and effective federal response following future earthquakes. This will require the office to engage in advance planning, to identify the latest information and communication technologies, to develop access protocols in seismic areas, and to establish and maintain contacts with other agencies and organizations that play a role in multidisciplinary post-earthquake research investigations. It will also fall to the NEHRP Office to ensure broad dissemination of field observations, to identify areas where findings have code implications, and to report on code-modification outcomes to Congress.

For reasons already described, the advisory committee is concerned that the proposed cuts to FEMA’s authorized funding levels will cause the recent erosion of the agency’s earthquake risk reduction capacity to continue to the extent that FEMA will never be able to carry out its responsibilities under the NEHRP strategic plan. In our 2010 report we applauded FEMA for resuming partial funding for state earthquake programs, which is providing incentives for state participation in earthquake risk reduction. We are gravely concerned to learn that this program is once again on the chopping block, at a time when states are facing historic economic challenges.

It is FEMA's responsibility to promote earthquake risk reduction and to transfer mitigation technologies to state and local governments and the professional community. This work forms the critical link between research and practice, translating new knowledge into new building codes and standards. As we struggle to achieve resilience as a nation, the proposed authorization reductions send a message that these vital functions are unimportant. Here too, ACEHR strongly disagrees.

ACEHR calls on Congress to return authorized funding for FEMA and NIST to the levels in Public Law 108–360, the legislation that authorized NEHRP through 2009.

SESAC Report to the U.S. Geological Survey

ACEHR is instructed in its charter to consider recommendations made to USGS by the agency’s congressionally created Scientific Earthquake Studies Advisory Committee (SESAC). A SESAC report² was submitted to USGS in July 2010, after the completion of our 2010 annual report. Although we are not attempting in this report to systematically develop new recommendations for each of the four NEHRP agencies, we briefly describe the SESAC recommendations for the following reason: they illustrate compelling needs that now collide with what USGS expects to have to cut in FY 2012 as a result of reductions in its NEHRP funding.

SESAC’s four priority recommendations, in paraphrased form, urge USGS to do the following: (1) work toward full funding of the Advanced National Seismic System (ANSS) and at the same time support research and development on earthquake early warning systems, which require that state-of-the-art earthquake monitoring infrastructure (i.e., ANSS) be in place; (2) expand the USGS Multi-Hazards Initiative, beyond its successes in southern California and initial implementation in the Pacific Northwest, to other high-risk areas of the Nation; (3) develop a comprehensive monitoring, analysis, and research program to study and understand the significance of what is referred to as ETS (for episodic tremor and slip) as it relates to the timing and characteristics of future megathrust earthquakes in Cascadia (which will resemble the recent massive earthquakes in Japan and Chile); and (4) address through hiring and direct support the steady decrease in the number of research scientists actively engaged in critical mission components of the agency’s Earthquake Hazards Program.

Of great concern to ACEHR, the following describes some of what USGS expects to cut in its Earthquake Hazards Program for FY 2012 in order to absorb a 9 percent reduction from its FY 2010 enacted funding level:³

- Elimination of an FY 2010 congressional increase for a Multi-Hazards Initiative together with a Multi-Hazards Initiative proposed in FY 2011. These cuts would greatly impact earthquake hazard studies, training for emergency managers, and the addition of seismic instrumentation in the Pacific Northwest and southern California (stopping, for example, the development of an earthquake early warning prototype system), and they would eliminate a planned expansion of the Multi-Hazards Initiative to Alaska.

² *Report for 2008–2009 of the Scientific Earthquake Studies Advisory Committee to the Director of the U.S. Geological Survey, July 2010* (online at <http://earthquake.usgs.gov/aboutus/sesac/reports.php>).

³ Based on details presented to ACEHR on March 10, 2011, and in information prepared for the Congress (http://www.usgs.gov/budget/2012/greenbook/greenbook_2012.pdf) as part of the President’s FY 2012 budget request.

- Elimination of one-third of funding for external research grants and cooperative agreements with state governments, the academic community, and the private sector, thereby scaling back—and possibly eliminating—in high-risk areas of the Nation important activities such as earthquake hazard mapping, airborne imaging of active faults using LiDAR (Light Detection and Ranging), and targeted research and development aimed at earthquake loss reduction.

For what NEHRP is trying to achieve in terms of information and tools for building resilient communities and regions and a resilient nation, the above steps are clearly in the wrong direction.

Consequences of the Status Quo

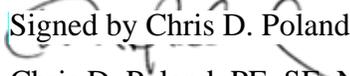
The advisory committee is not blind to the current financial situation of the country and the vigorous debate about the federal budget. We are aware that there are hard choices to be made in all areas of discretionary spending and understand that our focus on earthquake preparedness and resilience is just one of many urgent needs.

We are pleased that NEHRP has grown to develop and embrace resilience through a multiagency strategic plan that encourages interagency solutions and avoids duplication of efforts. In our 2010 report and this follow-on report, we have attempted to point out what is not being done and express our concern about the pace of implementation, the opportunities to achieve low-cost mitigation that are being lost, and the choke point that has developed in delivering the program's products to the public through state-level activities and the development of codes and standards.

We urge the ICC to reconsider the pace of implementing the NEHRP strategic plan, to align that pace with the President's priorities, and to strive to at least minimize the occurrence of lost opportunities for achieving progress toward earthquake resilience at lower cost.

We appreciate the opportunity to speak openly with you about NEHRP, and we stand ready to work with you in finding the proper pace for its continuing implementation. Please contact me if you have any questions or comments or need additional information about this report.

Sincerely,


Signed by Chris D. Poland

Chris D. Poland, PE, SE, NAE
Chair

Advisory Committee on Earthquake Hazards Reduction
National Earthquake Hazards Reduction Program

Enclosures

Effectiveness of the National Earthquake Hazards Reduction Program

A Report from the Advisory Committee on Earthquake Hazards Reduction May 2010

Executive Summary

The Advisory Committee on Earthquake Hazards Reduction (ACEHR) of the National Earthquake Hazards Reduction Program (NEHRP) is deeply concerned about inevitable catastrophic earthquakes in the United States and their potential to cause severe economic losses (e.g., topping \$100 billion) and prolonged human suffering. Despite being a strong nation, we are not well prepared. Entire regions will be seriously damaged and permanently impaired, and will take decades to recover. Large gaps exist between current and desired levels of seismic risk because much infrastructure was built long before we understood the underlying earthquake hazards and our communities were not constructed to recover from the resulting damage.

The 2010 earthquakes in Haiti (magnitude 7.0) and Chile (magnitude 8.8) are stark reminders of the value of earthquake preparedness and the importance of building codes. More than 200,000 people died in Haiti where building codes do not exist. In contrast, fewer than 1,000 deaths occurred in Chile where modern seismic building codes have existed since the 1960s. Where does the United States stand? Our communities in seismic regions that span 30 states have implemented seismic building codes to widely varying degrees and at widely varying times over the years. If an earthquake occurred today, we would expect many more deaths in communities that have only recently or have not yet adopted seismic building codes. And we would expect recovery to be slow in most communities due to low levels of resilience.

The activities carried out by NEHRP, such as shaping building codes, make a big difference. NEHRP activities can reduce earthquake casualties and shorten the time it takes for stricken communities to heal. The 2009–2013 NEHRP strategic plan stands as a comprehensive statement of what needs to be done in the near term to provide the information and tools needed for the Nation to build toward resilience. Unfortunately, given the slow pace at which NEHRP is currently able to implement its strategic plan, the Nation's vulnerability to earthquake hazards is steadily increasing and our Nation continues to head towards certain disaster. Human suffering will be intense, mega-losses will occur (from direct physical damage as well as from the cascading economic impacts of lifeline disruptions), and recoveries will be prolonged unless a more aggressive rate of plan implementation is enabled.

To protect society against catastrophic earthquake-induced losses, NEHRP must make lifelines a top priority. The American Society of Civil Engineers reports that more than \$2 trillion needs to be invested in our Nation's aging infrastructure over the coming decades to support our high standard of living and economy. Ongoing investments in infrastructure should incorporate

seismic resilience. Modern nations depend on their lifelines—energy, transportation, water, and communications—both on a daily basis and in post-earthquake environments. The interruption of any of these lifeline services following an earthquake can produce severe economic losses, harm quality of life, and disrupt citizens' livelihoods. Furthermore, the complex interdependencies that exist among lifelines can generate many unforeseen and potentially catastrophic consequences that are likely to compound economic losses and hardships. Presently, the United States is at high risk, because there is no adequate effort to understand lifeline resilience and no development of performance-based design, construction, and renovation of lifeline systems. To achieve resilient lifeline services, the tasks outlined in the NEHRP strategic plan need to be implemented so that the investments needed at national, state, and local levels can be undertaken.

Leveraging the accomplishments of NEHRP requires immediate and universal access to the scientific information generated through those accomplishments. A national earthquake resource library is needed to preserve and disseminate the vast body of knowledge on earthquake science, engineering, social science, and preparedness. This library should include new field and analytical data collected after each major earthquake (which are in essence full-scale field tests of community resilience). Fundamental research findings are critical to advancing our knowledge. It is equally critical to transfer research findings into practice. Integrative research into the political, social, and economic circumstances that motivate society to achieve community resilience is needed to promote implementation of proven earthquake-resistant retrofit strategies.

The NEHRP strategic plan also needs to be expanded to make more effective use of the national resources focused on resilience. Over the past 5 years, the NEHRP Office, under the leadership of NIST, has made enormous progress. The office coordinates successfully with each of the participating NEHRP agencies—FEMA, NIST, NSF, and USGS—and has begun building an internal research team at NIST. Today, outreach beyond the NEHRP agencies would serve to accelerate progress toward needed levels of community earthquake resilience in the United States.

ACEHR's key recommendations are derived from areas within the strategic plan that are not being addressed and from recommendations made in ACEHR's 2008 report that need further attention.¹ They are listed below, and discussed in the body of the report.

Management, Coordination, and Implementation of NEHRP

- **Recommendation 1**—The NEHRP Interagency Coordinating Committee should work to ensure that the amount of funding requested for NEHRP in the President's Budget each year is sufficient to permit full and timely implementation of the NEHRP strategic plan. At the present pace of plan implementation, the program will likely never meet its goals of providing the information and tools needed to achieve resilience nationwide.

¹ The recommendations made in ACEHR's 2008 report are listed within the executive summary of that report, which is attached as Appendix C.

- **Recommendation 2**—The NEHRP Office should carry out its role of representing the NEHRP agencies with respect to external affairs. This includes facilitating enhanced coordination and collaboration between NEHRP and relevant non-NEHRP federal agencies and earthquake organizations. It ranges from taking advantage of the expertise and programs of the agencies that form the Interagency Committee on Seismic Safety in Construction to facilitating improved earthquake mitigation at the state level and in the private sector.
- **Recommendation 3**—A national road map is needed for developing earthquake resilience of targeted lifelines that are critical to the Nation’s security (e.g., in the energy, telecommunications, transportation, and water sectors) and community resilience. The NEHRP Office should focus on understanding and improving lifeline services during earthquakes to ensure delivery of critical resources and to support community resilience and restoration. This includes establishing performance objectives for lifelines under various seismic conditions, developing and promoting seismic guidelines for new and existing components and systems, and considering interdependencies and cascading effects.
- **Recommendation 4**—A national earthquake resource electronic library is needed. This includes a post-earthquake information management database that houses data ranging from initial field reconnaissance to detailed investigative findings. It also includes information for the public and private sectors on earthquake mitigation and preparedness.

Federal Emergency Management Agency

- **Recommendation 1**—Revitalize state earthquake programs and provide strong support and leadership to state commissions to characterize and mitigate unacceptable risk in communities, with targeted efforts on developing public policies, institutionalizing mitigation programs, and implementing pilot studies and scenarios. Leverage other relevant expertise and programs within the Department of Homeland Security to further the NEHRP strategic plan.
- **Recommendation 2**—Develop and promote improved guidance to enhance emergency management capabilities in preparedness, response, and recovery at state and local levels. Include standards of preparedness for the private sector and guidance on providing post-disaster shelter and housing.
- **Recommendation 3**—Develop and maintain improved guideline documents that will heighten the effectiveness and reduce the cost of seismic protection for new and existing buildings and lifelines, and applied socioeconomic policies for cost-effective mitigation. Promote their adoption and implementation among stakeholders, and measure the impact.

National Institute of Standards and Technology

- **Recommendation 1**—Expand internal and external programs to effectively carry out the agency’s roles in conducting applied research, in facilitating the implementation of cost-effective mitigation through codes and standards for the Nation’s broad range of new and

existing lifelines, buildings, and industrial structures, and in transferring technology for use in actual mitigation.

- **Recommendation 2**—Build multidisciplinary expertise within NIST and foster relationships with other public agencies, private-sector entities, and consultants to accomplish and manage the applied research.

National Science Foundation

- **Recommendation 1**—Commit to supporting future earthquake reconnaissance, coordination, and outreach efforts and needed additional studies for significant earthquakes occurring throughout the world; provide this support in close coordination with the NEHRP Office. Earthquakes are the primary feedback mechanism available to the earth science, earthquake engineering, and social science communities for understanding the responses of actual systems.
- **Recommendation 2**—Assess large-scale experimental facilities throughout the United States, along with the equipment sites of the George E. Brown, Jr. Network for Earthquake Engineering Simulation, to determine how best to ensure that state-of-the-art experimental capabilities for earthquake engineering are available. Experimental facilities are essential to increasing the resilience of the United States by supporting the development of performance-based design provisions for new construction and assessment procedures for existing infrastructure.

U.S. Geological Survey

- **Recommendation 1**—Ensure full implementation of the Advanced National Seismic System. Short of this goal as the first step, the Nation will not have a robust national seismic monitoring system to meet critical needs in the fields of emergency management, earthquake engineering, and earthquake science.
- **Recommendation 2**—Ensure that USGS products are shaped to meet the needs of the engineering community so that products generated under the USGS National Seismic Hazard Mapping Project satisfy needs related to performance-based design.
- **Recommendation 3**—Strive to convey important earthquake information to the public in an understandable manner, by working with social scientists and other earthquake professionals to enhance both the content and delivery of information. This pertains to communications about time-sensitive probabilities of large earthquakes (including instances of possible foreshocks), aftershock advisories, and authoritative interpretations of earthquake hazards in controversial areas such as the New Madrid region.

Call to Action

The NEHRP strategic plan recognizes that the traditional NEHRP goal of protecting lives needs to be expanded to improving resilience. It is critical for NEHRP to start addressing our aging infrastructure and to help steer the Nation toward security and resilience. Our problems will not be fixed overnight. Making progress will require long-term and dedicated efforts. However, the

consequences will be less severe if we start applying meaningful and effective efforts toward fully implementing the NEHRP strategic plan now. If we don't, the consequences could be catastrophic and entire communities may never recover.

ACEHR strongly urges that NEHRP focus on achieving community resilience, most importantly by supporting programs that implement earthquake risk-reduction measures, but also by supporting programs that advance our understanding of earthquake phenomena and that develop and evaluate cost-effective measures for strengthening resilience. Full and timely implementation of the 2009–2013 NEHRP strategic plan is the best next step.

Advisory Committee on Earthquake Hazards Reduction
National Earthquake Hazards Reduction Program

December 22, 2010

The Honorable Patrick D. Gallagher
Director
National Institute of Standards and Technology
Building 101, Room A1134
100 Bureau Drive
Gaithersburg, MD 20899-1000

Reference: ACEHR Bicentennial Statement Related to the
200th Anniversary of the New Madrid Earthquakes

Dear Dr. Gallagher:

At our fall Advisory Committee on Earthquake Hazards Reduction (ACEHR) meeting in Memphis, Tennessee we dedicated a day to understanding the seismic hazard in the New Madrid region and how it is being addressed by that community. We learned that there are a number of issues that deserve the continuing attention of the National Earthquake Hazards Reduction Program (NEHRP) agencies and have summarized our findings and recommendations in the enclosed bicentennial statement.

We hope that you and the NEHRP Interagency Coordinating Committee (ICC) find these recommendations compelling and will incorporate them into the ongoing activities of the Program. Further, we believe that these recommendations will be useful to those working to achieve earthquake resilience and request that they be shared broadly with that region and beyond.

We appreciate your support for NEHRP and your leadership of the ICC. I would like to have the opportunity to represent ACEHR at the next ICC meeting, and to participate in the discussions related to our 2010 Annual Report on the Effectiveness of NEHRP and this bicentennial statement. Please contact me if you have any questions or comments.

Sincerely,

Signed by Chris D. Poland



Chris D. Poland, SE, NAE
Chair
Advisory Committee on Earthquake Hazards Reduction
National Earthquake Hazards Reduction Program

Enclosure

cc: Charles H. Romine



National Earthquake Hazards Reduction Program (NEHRP) Bicentennial Statement

*Offered for the Kickoff of the
200th Anniversary of the New Madrid Earthquakes
February 11, 2011
by the NEHRP Advisory Committee on Earthquake Hazards Reduction (ACEHR)*

Major earthquakes have occurred in the past—and will continue to do so in the future—not only in the western but also in the central and eastern United States. Two hundred years ago, some of the nation's largest historical earthquakes occurred in the New Madrid seismic region, which affects portions of Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee. The expected size and frequency of earthquakes throughout the United States, including the New Madrid region, have been assessed in a formal way using the results of comprehensive earth science studies, and this information forms the basis for risk mitigation and preparedness activities.

The National Earthquake Hazards Reduction Program (NEHRP) was enacted by the Congress of the United States in 1977 to coordinate earthquake programs for preparedness, mitigation, response, and recovery. In the subsequent 33 years, significant investments have been made through NEHRP in earth science and earthquake engineering, resulting in building codes and technologies that can prepare and protect us from future earthquakes. The NEHRP Advisory Committee on Earthquake Hazards Reduction (ACEHR) congratulates those who have advocated for creating earthquake resilience in the New Madrid region. In addition to the continuation of earthquake-related monitoring and research in this region, the Committee recommends the following:

1. Use the bicentennial to spark collaborations and inaugurate new programs that engage the public agencies and private entities responsible for seismic safety in the New Madrid region.

There is clear geologic evidence for the recurrence of large and damaging earthquakes in this region every few hundred years, which makes this a region of high seismic hazard that demands our attention. The bicentennial is a singular opportunity to draw the attention of policy makers, scientists, engineers, and the general public to the need to increase preparedness for the next large earthquake in the region. Disasters do not discriminate and will affect all aspects of society, the economy, the environment, and infrastructure. Addressing the challenges of earthquakes requires an open and honest exchange of information combined with collaboration among all stakeholders. Dedicating ourselves to doing what is necessary to identify risks, save lives, minimize losses, and protect the best interests of the communities in which we live is a responsibility that must be shared and addressed in a nonpartisan, factual, and collaborative manner.

At the November 9, 2010 ACEHR meeting, concerns were expressed by members of the Memphis engineering community and representatives of the Kentucky Geological Survey about the high levels of hazard embodied in U.S. Geological Survey (USGS) maps for the New Madrid region and the potential design and construction costs associated with design-level earthquake ground motions. ACEHR acknowledges the local community concerns, and assigns a high priority to addressing the issues raised about the high hazard levels and attendant costs. It appears that the effects of New Madrid hazards on structural design and associated construction costs are not clearly understood by many design professionals. ACEHR therefore encourages educational programs, including workshops on current and forthcoming building codes, with an emphasis on their implications for the New Madrid area.

2. Develop a plan to achieve earthquake resilience.

Earthquake resilience starts at the local level, with individuals, families, businesses, and earthquake program managers working together. Many of the tools and procedures needed to create disaster-resilient communities exist and are continually being refined. Achieving resilience, however, requires a new, more collaborative approach than currently exists. Adoption and implementation of current building codes, alignment of diverse lifeline systems around common performance objectives, and strong community support for adopting policies that foster resilience are needed.

3. Base resilience plans on a clear and defensible statement of current risk and targeted resilience goals, with broad scientific and engineering professional acceptance.

The New Madrid region has a high seismic risk because of the known potential for large earthquakes combined with the many high-occupancy, collapse-prone buildings in areas vulnerable to strong ground shaking. The appropriate level of potential earthquake shaking has been debated among earth scientists, and the most appropriate minimum design standard has been debated among engineers, and some differences of opinion exist. However, there is broad scientific consensus among earthquake professionals that large-magnitude earthquakes have occurred and will continue to occur in this region and that they could produce significant damage. The NEHRP Advisory Committee recommends that the NEHRP agencies engage other earthquake professionals in making a clear and defensible statement of current seismic risk and goals for reducing that risk in the New

Madrid region. In addition, it will be advantageous to examine the high hazard levels in USGS maps via an independent review for the New Madrid area and explore ways to improve communication of the hazards and their effects on structural design.

4. Adopt the latest model building codes and standards as a fundamental step toward achieving resilience in the building stock.

For decades NEHRP has been a valuable resource for introducing new construction techniques and innovative design methods to improve the resistance of buildings to earthquakes. The most effective way to transfer that considerable, accumulated knowledge into broad practical application is through adoption of the model building codes and national standards. Hundreds of national experts assist in developing these codes and standards, and literally thousands of others review them, ensuring that they include the best information for prudent design, construction, and rehabilitation of the building stock. The latest editions of the most widely adopted building codes and standards (2009 IBC and ASCE/SEI 7-10) represent the most efficient and cost-effective safety regulations available for new buildings; ASCE/SEI 31-03 and ASCE/SEI 41-06 provide the same for existing buildings.

The new national seismic hazard design value maps found in ASCE/SEI 7-10 are recommended for use in the New Madrid seismic zone. The previous national design value maps have specified a design value based upon the level of ground motion at one level of probability, which is only a first-order approximation of the risk presented by the seismic hazard at a location. The new, risk-targeted design maps are a closer measure of the anticipated risk. One result of these risk-targeted maps is that the design values are reduced from those shown on the previous editions of the national design value maps in the mid-Mississippi Valley.

5. Base disaster preparedness plans on both likely and worst-case earthquake scenarios.

While there is the possibility of a recurrence of the 1811–12 sequence of earthquakes for which some disaster planning would be prudent, disaster preparedness should focus on more likely moderate to large earthquakes that are expected to occur in the next several decades, a period when most currently occupied structures will be in use. The inventory of vulnerable structures, constructed with inadequate consideration of earthquake effects, is immense and includes many hospitals, schools, armories, commercial and residential structures, and lifelines. Disaster planning should include community preparedness, government coordination, and participation of the private and nonprofit sectors in building the capacity to respond to and recover from a disaster. States should enhance their mutual aid systems to move local resources to communities in need. Local governments should partner with community service organizations and faith sectors to provide vital services for vulnerable populations.

6. Participate in national efforts to demonstrate cost-effective implementation of the latest building codes.

The National Institute of Standards and Technology is undertaking a cost-benefit analysis of codes and standards for earthquake-resistant construction in the Midwest. The NEHRP Advisory Committee endorses this study and recommends that it be undertaken with strong input from local practicing engineers.

7. Motivate owners, architects, engineers, and contractors to recognize that enforcement of building codes, including special inspections where required, is essential to achieving the performance objectives of the codes.

Business and facility owners expect their investment in buildings, inventory, and human capital to be protected from the damaging effects of an earthquake if their facilities meet local building codes. This requires not only adoption of the latest building codes, but also code enforcement, peer reviews on special projects, and implementation of appropriate quality control programs.

Even though ACEHR recommends adoption of the current earthquake standards, it is also recommended that a dialogue be established among community members on what constitutes acceptable levels of risk and appropriate technologies for reducing risk in new and existing buildings and infrastructure in the Midwest. Further, ACEHR urges earthquake professionals nationwide to cooperate, collaborate, determine the best path toward mitigation, and speak with a common voice before all levels of government and private industry. ACEHR strongly supports all of the excellent New Madrid bicentennial activities that are being undertaken to protect the public and communities from earthquakes.

