

National Earthquake Hazards Reduction Program (NEHRP)
Advisory Committee on Earthquake Hazards Reduction (ACEHR)
National Institute of Standards and Technology (NIST)
April 12-13, 2021
Virtual Meeting Summary

Meeting Participants

ACEHR Members

Glenn Rix, Chair	Geosyntec Consultants, Inc.
Lucy Arendt, Vice Chair	St. Norbert College
Ann Bostrom	University of Washington
Robert Carey	Utah Division of Emergency Management
Gregory Deierlein	Stanford University
Susan Dowty	International Code Council
Robert Ezelle	Washington Military Department
Thomas Heausler	Consulting Structural Engineer
Ryan Kersting	Buehler
Anne Meltzer	Lehigh University
Danielle Mieler	City of Alameda
Jonathan Stewart	University of California, Los Angeles
Douglas Wiens	Washington University in St. Louis

Invited Speakers

Michael Angove*	National Weather Service, National Oceanic and Atmospheric Administration (NOAA)
Ian Timothy Sears*	National Weather Service, NOAA
Stephanie Ross*	United States Geological Survey
Nathan J. Wood*	United States Geological Survey

NIST Management, Staff, and NEHRP Representatives

Charles Romine*	Acting Chief of Staff, NIST
Joannie Chin	Acting Director, Engineering Laboratory
Jason Averill	Chief, Materials and Structural Systems Division (MSSD)
Judith Mitrani-Reiser	Associate Chief, MSSD
Steven McCabe	NEHRP Director, MSSD
John (Jay) Harris	Acting NEHRP Deputy Director, MSSD
Sissy Nikolaou	Group Leader, Earthquake Engineering Group (EEG), MSSD
Jazalyn Dukes	Research Structural Engineer, EEG, MSSD
Matthew Speicher	Research Structural Engineer, EEG, MSSD
Katherine Johnson	Earthquake Risk Mitigation Policy Analyst, EEG, MSSD
Tina Faecke	Designated Federal Officer for ACEHR
Emina Herovic	Research Social Scientist, MSSD
Linda Acierito*	Deputy Director, Congressional and Legislative Affairs

*Attended Monday only

NEHRP Representatives from Partner Agencies

Luciana Astiz	National Science Foundation
Jacqueline Meszaros	National Science Foundation
William Blanton	Federal Emergency Management Agency
Michael Mahoney	Federal Emergency Management Agency
Gavin Hayes	United States Geological Survey
Michael Blanpied*	United States Geological Survey
John Filson*	United States Geological Survey, Emeritus

Registered Guests

James Lawson	United States Government Accountability Office
Gregory Beroza	Stanford University
Benina S. Cerno**	Dine Development Corporation
Megan Flanagan	EditSprings
Michael J. Riley	Bonneville Power Administration
Mat Heyman*	NIST contractor

*Attended Monday only

**Attended Tuesday only

I. Welcome

As Designated Federal Officer (DFO) for the Advisory Committee on Earthquake Hazards Reduction (ACEHR), Ms. Tina Faecke called the meeting to order at 1:00 pm ET, took roll call, and introduced Dr. Charles Romine, NIST Acting Chief of Staff.

Romine thanked everyone for participating in the virtual meeting and sharing thoughts about the National Earthquake Hazards Reduction Program (NEHRP or Program). He stated that NIST and the other NEHRP agencies are very appreciative of the Committee's work to reduce seismic risk in the United States and that its assessment reports and recommendations have been very valuable. Romine said that this kind of federal advisory committee is very important to NIST, which relies on the variety of technical disciplines they contribute. He noted that the Committee would hear about efforts focused on supporting the functional recovery report published in January, the nearly complete updated NEHRP strategic plan, the General Accounting Office's (GAO) ongoing review of the Program, and major steps regarding implementation of the earthquake early warning system. Romine told the Committee that NIST looks forward to receiving their biennial report and reaffirmed NIST's commitment to reducing earthquake damage to life and property. Romine asked Committee members if they had any questions. There were none.

II. Meeting Goals

Committee Chairperson Dr. Glenn Rix thanked Romine and welcomed members and guests. Rix reviewed the goals and outlined the agenda for the two-day meeting:

- Preparation of the Committee's Biennial Report due September 30, 2021
- Receive presentations related to the National Tsunami Hazard Mitigation Program
- Receive NEHRP agency activity updates since the November 2020 meeting
- Receive a briefing on the status of the Disaster Research Grants Program

III. National Tsunami Hazard Mitigation Program (NTHMP) Presentations

Dr. Jay Harris, Acting NEHRP Deputy Director, introduced the presentation by the representatives of the NTHMP. Harris discussed the importance of understanding the role of the tsunami program since NEHRP has a focus area on advancing the science of subduction zone earthquakes. Harris further emphasized an effort by NEHRP to evaluate possibilities for inter-programmatic coordination and collaboration with other relevant federal programs—the NTHMP is one of those programs.

The first presentation was given by NOAA's National Weather Service (NWS) speakers, Mr. Michael Angove, Tsunami Program Lead, and Mr. Ian Sears, Tsunami Program Coordinator. Their presentation, *An Overview of the National Weather Service Tsunami Program and the National Tsunami Hazard Mitigation Program*, is available at: https://nehrrp.gov/pdf/1-NTHMP-NOAA%20role_ACEHR_April2021.pdf.

Angove classified NOAA's work in this arena into two categories: tsunami forecast and warning capabilities, and response via mitigation. Most, but not all, of their tsunami work relates to earthquake-generated events. He described the end-to-end tsunami warning system with local, national, and regional elements and noted NOAA's role in the U.S. Tsunami Warning System – including a National Data Buoy Center, the National Center for Environmental Information, a NOAA Center for Tsunami Research, two National Tsunami Warning Centers, Coastal Water-Level Stations, and the Deep-Ocean Assessment and Report of Tsunami (DART) System.

Sears noted that NOAA partners with the Federal Emergency Management Agency (FEMA) and the U.S. Geological Survey (USGS) and explained the overall NTHMP program's mission (*mitigate the impact of tsunamis through public education, community response planning, hazard assessment, and warning coordination*) and vision (*reduce loss of life and property when a tsunami strikes any U.S. state or territory and resilient communities that are prepared for tsunami hazards*). Angove noted the statutory basis for this work and described approaches to tsunami hazard and risk assessments as well as education and preparedness efforts, mitigation and recovery strategies, and alert warning and response activities.

The second presentation was given by USGS. USGS's tsunami-related activities were described by Dr. Nathan Wood, Supervisory Research Geographer, USGS Western Geographic Science Center and Ms. Stephanie Ross, Geophysicist and Tsunami Scenarios Coordinator, USGS Pacific Coastal and Marine Science Center. Their presentation, *Role of the USGS in the National Tsunami Hazard Mitigation Program*, is available at: https://nehrrp.gov/pdf/2-NTHMP-USGS%20role_ACEHR_April2021.pdf.

Wood said USGS works in a support role to NOAA regarding tsunamis. He noted that tsunami warning centers use USGS data. There is no single USGS tsunami research program; rather, USGS conducts a combination of efforts across USGS science centers and programs. Wood told the Committee that it was beneficial to work as part of the NTHMP, especially in helping USGS to work with states and localities. USGS provides data, develops new insights, organizes workshops, and serves as both technical advisor and trainer to others regarding tsunami-related information and tools it provides. Ross described how USGS contributes to the NTHMP regarding warning guidance, mitigation, and hazard assessment and noted that the agency plays multiple roles.

The third and final presentation was given by FEMA. The committee heard from Mr. Michael Mahoney, Senior Geophysicist in FEMA's Earthquake and Wind Programs Branch, Federal Insurance and Mitigation Administration. His presentation, *FEMA's Role in Tsunami Mitigation*, is available at: https://nehrrp.gov/pdf/3-NTHMP-FEMA%20role_ACEHR_April2021.pdf.

Mahoney described FEMA's role in tsunami mitigation, emphasizing that this work involves a variety of programs related not just to the NTHMP but also to NEHRP, National Flood Insurance Program (NFIP), Hazard Mitigation Grant Programs (HMGP), FEMA's Building Resilient Infrastructure and Communities (BRIC) program, and FEMA's response and recovery efforts. He explained that FEMA works with other agencies and with states and localities, especially regarding planning actions. Mahoney noted that several states have developed required mitigation plans which include tsunami hazards. He further described FEMA's role in reducing risks and noted that some tsunami-related planning and mitigation projects can be funded under FEMA's all-hazard grant programs, both pre- and post-disaster. Mahoney reviewed several FEMA-funded emergency exercises in states and territories and noted how the NFIP and risk assessment programs address tsunami considerations. Mahoney offered updates on how tsunami considerations are taking into account in building codes and noted that FEMA staff, with NOAA support, had played a helpful role in advancing code changes. Mahoney also described a publication that was jointly funded by FEMA/NEHRP and NOAA/NTHMP, *Guidelines for Design of Structures for Vertical Evacuation From Tsunamis* (FEMA P-646) that provides guidance for the design, construction and operation of vertical evacuation refuges to address both a near-fault earthquake loads and the resulting tsunami loads when there is insufficient time for the at-risk population to evacuate to high ground.

Question and Answer Discussion

The Committee then engaged with the NTHMP representatives. Rix moderated the discussion.

Dr. Jonathan Stewart asked NOAA representatives about elements of the agency's tsunami warning system which rely on sensors designed to detect movements related to earthquakes and how they worked when a tsunami is caused by a seafloor landslide versus an earthquake. Angove said that these sensors do not work well in these cases and that reliable indicators are not available when the tsunami is caused by off-shore landslides.

Dr. Douglas Wiens inquired about the reliability or uptime of the DARTS pressure sensors. Angove noted that buoy systems are operating in the open ocean. The agency's target uptime is 80% for the DARTS network as a whole. Instruments are deployed everywhere across the Pacific and NOAA does not have a way to handle outages one-off. Rather, it schedules maintenance on an annual cycle. Wiens followed up by asking if there are certain aspects of the network that NOAA maintains more reliably than others. Angove said that it was really important that New Zealand deploy instruments in difficult-to-get to locations. They are working with Chile, New Zealand, Ecuador, and Colombia, which allows NOAA to focus more tightly on the Cascadia and the Aleutian subduction zones.

Dr. Ann Bostrom said that it appeared NOAA has a great strategy and international cooperation is very helpful. She asked what was next with the new generation of DARTS? Angove expects to soon see data from New Zealand that was generated by newer devices. That will give NOAA a chance to see how these advances and sensor placements will contribute to faster, more accurate forecasts.

Dr. Gregory Beroza asked if NOAA has considered deploying long-period seafloor acoustic sensors for near-field tsunami? Angove responded that he focuses on the fidelity of techniques and whether they can give faster, more accurate information. Wood noted that unless sensors provide meaningful additional survival time, perhaps the appropriate course is to have someone watching current devices closely in order to give immediate warnings.

Ms. Danielle Mieler said that she is involved with local mitigation planning in Alameda, CA, which has been identified as a high-risk tsunami community. They are undertaking efforts relating to sea level rise to remove some of their communities from the FEMA flood zone. She asked if there is any guidance or information for communities like Alameda as to whether those projects also could benefit by tsunami mitigation? Mahoney responded that FEMA's BRIC mitigation grant program guidance is just coming out now. One of their key focus areas is sea level rise and mitigating risk to communities, especially disadvantaged communities.

Stewart asked if tsunami hazard products provided by USGS models are expressed solely in the form of inundation maps or if there are other metrics provided that may have importance for the performance of structures (e.g., flow velocities)? Wood said that those kinds of outputs (like velocities and depths) are used in USGS modeling, but it is up to the states to issue the official maps with hazard zones for inundation.

Bostrom asked about the rationale for NFIP not including tsunami inundation zones in recent flood insurance rate maps. Mahoney said that legislation required them to use a one percent probability and that tsunami probabilities disappeared when mapped that way. However, FEMA flood maps do include tsunami when that is the predominate hazard, such as in Hawaii.

Rix asked Wood if he was aware of the agent-based model developed by the U.S. Army Corps of Engineers called HEC-LifeSim, which is intended to model the warning and evacuation process for dam safety applications. Wood replied that he is very aware of that agent-based modeling, which is very scenario-specific. USGS has been using the least-cost distance modeling for the bulk of its work. Agent-based modeling works well for dams, for example, but it has limited utility for larger areas.

Rix thanked the speakers for their presentations.

IV. Program Activity Updates

Rix noted that these will be the last agency updates before ACEHR prepares its report.

Dr. Steven McCabe, NEHRP Director, Materials and Structural Systems Division, Engineering Laboratory, NIST, moderated Program activity updates from each of the NEHRP agencies since the November 2020 ACEHR meeting. He began by reviewing the Committee's endorsement of the NEHRP Office's recommendation to update the Committee on implementation of the Strategic Plan at a programmatic rather than agency level. That approach offers better reporting, versus having a siloed view from each agency. Programmatic activity details were provided via email prior to the meeting, and one or two activities were selected to be highlighted during the meeting. Focus areas are characterized as either legislatively defined or programmatic.

McCabe reviewed NEHRP's legislative obligations and the status of NEHRP's reports to Congress for FY 18-19 (in final review) and FY 20-21 (which will begin this fall). The revised version of the NEHRP Strategic Plan is nearing completion after the Interagency Coordinating Committee approves it. Then NEHRP will begin working on a five-year management plan. USGS reports that the ANSS five-year management plan is at OMB. GAO has interviewed the NEHRP agencies for their assessment report that was required in the 2018 reauthorization. GAO's report on USGS activities related to the earthquake early warning system was published and other GAO reviews are in process. McCabe's *NEHRP Update Overview* is available at: https://nehrp.gov/pdf/4-NEHRP%20Update%20Overview_McCabe_April2021.pdf.

Mahoney provided FEMA updates. He highlighted the submittal of the functional recovery report to Congress in January 2021 after receiving approval by FEMA, the Department of Homeland Security (DHS), NIST, the Department of Commerce, and OMB. FEMA is modifying two task orders with the Applied Technology Council (ATC) to look at work recommended in the report. The first is a project to support the seismic design of buildings. The second aims to improve the nation's lifeline infrastructure to achieve seismic resilience. FEMA is coordinating closely with NIST on this activity. Mahoney's presentation is available at: https://nehrp.gov/pdf/5-FEMA_Highlight_ACEHR_April2021_mm.pdf and here: https://nehrp.gov/pdf/5a-ACEHR%20Update%20list-FEMA_April%202021.pdf.

NSF updates were given by Dr. Luciana Astiz, Program Director, Earth Science Division, Geoscience Directorate and Dr. Jacqueline Meszaros, Science and Technology Advisor, Natural Hazards, Disasters and Resilience, Division of Civil, Mechanical and Manufacturing Innovation, Directorate for Engineering. Earthquake-related awards have been given by multiple NSF directorates. Many proposals have to do with new methodologies and big data sets, ontologies, and machine learning. NSF is funding a novel approach to large earthquake analysis in Nevada with potential applications that are broader. Meszaros noted the ongoing update to the large shake table at UC San Diego, which is expected to come online in October. NSF has been funding a six-university consortium to begin the first structure test on the upgraded table.

NSF is also funding CONVERGE at the Natural Hazards Center, University of Colorado Boulder. It convenes the leaders of rapid research around the country to identify shared problems and lessons learned to make them all more effective. Training has and will be spun up by CONVERGE that is useful for disaster researchers. Most recently, the program offered a training on ethical considerations for hazards-related researchers and another training on collecting and sharing perishable data. Meszaros said that agencies are looking forward to how that might help them to get their research coordinated. Also, a private foundation gave CONVERGE funding to be offered to research groups (\$1K each) to encourage them to form a working group for research related to the pandemic. A number of projects are relevant to seismic research (e.g., risk communications in compound hazards and disasters; extreme weather and geohazards). She said that research communities can coordinate better even though they are working via highly decentralized enterprises. NSF Program activity highlights are available at: https://nehrp.gov/pdf/NSF-ACEHR%20Update%20list_April%202021.pdf.

Question and Answer Discussion

The Committee then engaged with representatives from the federal agencies and Committee Vice Chairperson Dr. Lucy Arendt moderated the session.

Stewart asked whether ACEHR would be able to review the GAO reports? McCabe said that he would share a link with ACEHR to the final GAO reports once they are publicly available. The GAO has a December 2021 deadline for completing its final report on NEHRP. Rix inquired whether it is part of GAO's charge to also look at the integration of the agencies' work. McCabe said that he assumes so. NIST received a number of questions about NEHRP as a whole. The USGS report looked primarily at early warning issues and did a deep dive on both technical and management issues.

Mr. Ryan Kersting asked if FEMA is thinking that the Seismic Code Support Committee (SCSC) will participate in other Standards Development Organizations or other International Code Council (ICC) processes beyond the code change proposals submitted for the ICC Group A codes. Mahoney confirmed that FEMA would be very active in the next set of codes. He told the Committee that the Group A codes are not the main building codes; rather FEMA will be devoting even more attention to the main codes, which fall into Group B. He explained that other FEMA code activities related to NEHRP provisions for new buildings feed into ASCE 7, which is then adopted within the International Building Code by reference. Similarly, for existing buildings, a FEMA project, ATC 140, develops recommendations that feed into ASCE 41 for existing buildings and then adopted by reference under the International Existing Building Code. Most of FEMA's work involves monitoring other proposed changes to those codes. In Group A, the agency is involved with the International Property Maintenance Code and the ICC performance code which he said needs a lot of work; FEMA is coordinating with the American Institute of Architects regarding those changes. FEMA participates in other standards, including ASCE-7 and particularly ASCE-41. The agency does not get into the materials standards because it does not have the resources that would be needed.

Arendt noted the work FEMA and NIST is doing concerning the functional recovery report, saying that she really appreciates that the work is continuing while NEHRP agencies are waiting to hear from Congress.

Dr. Gregory Deierlein referred to the NEHRP strategic plan and said that it would be useful for ACEHR to have that plan when preparing its report. Harris noted that the primary aspects of the plan was presented previously to the ACEHR and that the NEHRP Office has had some subject matter experts review an enhanced outline of the plan. This outline will be sent out again to ACEHR members. He noted that the Program is now using "focus areas" instead of "priorities" in the updated strategic plan to address Program activities. At this point, the team is simply rounding out the rest of the document based on the enhanced outline.

Rix asked with the new administration on board, will NEHRP be able to maintain the momentum for the Interagency Coordinating Committee meetings? McCabe expressed optimism, noting that the Interagency Coordinating Committee has met for two years in a row and had productive meetings. Directors for the White House Office of Science and Technology Policy (OSTP) and NIST are not yet in place. Nothing has yet been scheduled, although the NEHRP Office is looking at August 2021 for a possible Interagency Coordinating Committee meeting. There was good attendance during the August 2020 meeting, which was held virtually.

Rix asked how often the Program Coordination Working Group meets? Harris responded that they met at least once a month, and sometimes more regularly if needed. McCabe noted that they have had excellent, productive meetings among the four agencies.

V. Closing Remarks

Rix reviewed the agenda for the second day and noted that ACEHR members can still volunteer to contribute to the Committee's report on specific topics. Arendt stressed that everyone on ACEHR will be involved in writing the report.

VI. Adjournment for the Day

Faecke thanked the ACEHR members for submitting their financial disclosure forms. The meeting adjourned at 3:45 pm EST.

ACEHR VIRTUAL MEETING SUMMARY – Day Two April 13, 2021 (1:00-4:00 pm, EST)

I. Opening Remarks

As DFO for ACEHR, Faecke called the meeting to order at 1:00 pm EST, took roll call, and turned the meeting over to Rix.

Rix reviewed the agenda for the day, noting that the last item is devoted to the discussion of the ACEHR biennial report and that writing assignments and milestones for working on that report would be made.

II. Public Input Period

Faecke reported that no one from the public registered to speak.

III. Program Activity Updates (continued)

Federal agency representatives resumed Program activity updates for the Committee, moderated by McCabe.

Dr. Gavin Hayes, Senior Science Advisor for Earthquake and Geologic Hazards, provided the USGS update. Hayes described updates to the earthquake early warning system, with details about statewide ShakeAlert rollouts in California, Oregon, and Washington. He then reviewed the national seismic hazard model, which is the basis for building codes affecting construction costs of more than \$1 trillion annually. Hayes noted that the USGS is updating the National Seismic Hazard Model for the conterminous 48 states. The model and associated maps, last produced in 2018, will next be updated in 2023, including updated models for Alaska and Hawaii. He then highlighted key USGS Program activity updates consistent with NEHRP strategic goals. His presentation is available at: https://nehrp.gov/pdf/USGS_Highlight_ACEHR_April2021.pdf and here: https://nehrp.gov/pdf/6a-ACEHR%20Update%20list-USGS_April%202021.pdf.

An update for the Earthquake Engineering Group (EEG) at NIST was provided by Dr. Sissy Nikolaou, EEG Group Leader, Materials and Structural Systems Division, Engineering Laboratory. NIST is taking a look at how it learns from earthquakes and its preparedness for post-earthquake investigations. This includes evaluating the group's standard operating procedures, including monitoring of events and developing a post-earthquake investigation plan with a focus on data collection and analysis to support EEG projects. NIST is interested in collaborating with others to gather data on functional recovery or resilience and learning from failures as well as from good behavior. EEG aims to

strengthen its interactions with relevant organizations that may be deploying teams after an event, including engineering societies, standards developing organizations, government agencies, and others. This effort supports Goal 4 of the pending updated NEHRP Strategic Plan.

Harris reported that EEG has completed a multi-year steel beam-column testing that supports its research on the seismic behavior of deep, slender wide-flange steel beam-columns. Test results were used to advance seismic assessment provisions for steel columns in various steel standards, with additional applications expected. Nikolaou's and Harris' presentations are available at: https://nehrrp.gov/pdf/7-NIST%20EEG_Highlight_ACEHR_April2021.pdf.

Harris offered an update on the work by the NEHRP Office at NIST regarding the efforts by the Interagency Committee on Seismic Safety in Construction (ICSSC). The ICSSC's goal is to enhance risk reduction strategies for federal agencies. With the increased emphasis from Executive Order (EO) 13717, there is a need to advance efforts by the ICSSC to implement state-of-the-art guidance that promotes risk reduction measures by federal agencies for buildings that they own or lease either whole or in part. Harris also said that the ICSSC needs to be restructured to support agencies implementing risk reduction policies and strategies. Due to the federal government's vast real estate holdings, the federal government can be very influential in promoting state-of-the-art guidance.

Harris noted the NEHRP Office is working with federal departments and agencies to complete their compliance report. Many agencies do not own structures, although leased space is also relevant to the EO. The NEHRP Office has completed the first stage of a mapping exercise to determine which agencies should participate in the ICSSC. Harris said that there could be varying levels of membership depending upon their interests – whether they produce recommended practices or just need to know about the compliance requirements for federally owned and leased buildings. In addition, NIST has completed the review draft of *Standards of Seismic Safety for Existing Federally Owned and Leased Buildings*, ICSSC Recommended Practice (RP) 10, which contains recommended practices for evaluating existing federally-owned and leased buildings. Harris said that the draft will be sent to the ICSSC agencies for consensus review. Harris' presentation is available at: https://nehrrp.gov/pdf/8-NIST_Highlight_ACEHR_April2021.pdf.

Question and Answer Discussion

The Committee then engaged with representatives from the agencies, with Arendt moderating.

Stewart asked USGS what the hurdles are (if any) for the remaining 30% of the earthquake early warning system rollout? Are the hurdles related to funding, the need to still deploy instruments, or further work on developing algorithms? Hayes reported that USGS has funding for some of the remaining stations; 300 of the 500 stations pending set up, are funded. Considerable activity is needed in algorithm development, which is especially relevant to very large Pacific Northwest earthquakes. Current funding for USGS ShakeAlert is less than what the 2018 implementation plan stated was needed.

Deierlein questioned the extent to which data from so-called physics-based earthquake simulations (e.g., Cybershake) are influencing USGS seismic hazard models and maps. Hayes noted that data from the simulations inform treatment of basins within hazard maps. The agency is involved in relevant

evaluations and in coordinated ground motion simulations and technical assessments within the Southern California Earthquake Center (SCEC).

Beroza requested updates on the false alarms and failures to warn the public. Hayes reported that since public alerting rolled out in October 2019 in CA, there were three missed alerts (events for which there should have been warnings but none were generated). There also were two false alerts for offshore events which were mislocated. Also, one warning that went out through wireless emergency alerts was not associated with any earthquake but, instead, associated with errors in how the system was configured. Procedures have been put in place to make sure those errors don't happen again.

Wiens inquired about the USGS response to the GAO report on the earthquake early warning system, and any changes being considered in response to the report. Hayes noted that USGS worked closely with the GAO over 18 months and concurred with all recommendations in part or in full. Strategic planning recommendations are already in place and staff are now working with the budget office to put in place proper performance metrics. Also, USGS is working on the ShakeAlert side to define everything that has been used within the budgetary component of ShakeAlert to describe the work breakdown structure. USGS will create a schedule of milestones for ShakeAlert as it completes its buildout. USGS plans to publish the ShakeAlert communication, education, and outreach plans (called out by GAO) this summer. The agency is working on its final formal response to the GAO report.

Bostrom inquired about plans for further developing and validating large-scale earthquake simulations. Hayes said they had a lot of interactions with SCEC through their Cybershake efforts. USGS also has coordinated internal projects related to 3D simulations and dynamic simulations and how they are incorporated into seismic hazard maps. As part of that mapping update process, USGS has workshops to coordinate with the community to understand how the results of those simulations should be incorporated into hazard maps.

Regarding offshore earthquakes, Wiens asked if there is some long-term strategy for trying to deal with the lack of data, either involving seafloor stations or any other type of technology. Hayes said that the system now being built was based on previous technical implementation plans that did not include a requirement or funding for offshore efforts. But USGS recognizes that this is a significant problem that needs to be addressed. He said arrays may help and USGS was looking into offshore technologies. Funding would need to be addressed in the future. Astiz noted that NSF had funded a marine GPS test station deployment. Hayes said that there are several GPS monuments funded by NSF, USGS, and other sources and that they needed to figure out ways to address offshore monitoring without requiring a huge increase in funding.

Stewart remarked that ICSSC appeared to have a similar scope to the Building Seismic Safety Council (BSSC) and asked whether a merger had been considered. Harris responded that there is no overlap; ICSSC will be giving guidance to agencies to adopt the International Building Code. Mahoney added that the ICSSC consists of federal agencies only, while the BSSC is mostly made up of companies from the private sector. They are similar in some ways but vastly different in their makeup and audiences. Harris noted that ICSSC is a member organization of the BSSC.

Harris further said that the ICSSC is responsible for the standard to retrofit and evaluate federally owned or leased buildings. The ICSSC link refers to ASCE 41 and the International Existing Building

Code so they are not writing the building codes; rather, they write the policy about how to use the codes.

Kersting inquired about plans for considering functional recovery performance requirements in the next version of the ICSSC seismic standards. Harris said that there is not enough information available to produce time targets for functional recovery yet, and that is one of the things the ICSSC will be paying attention to. There are some implicit targets that can be adopted based on ASCE 41 and FEMA P-58.

Ms. Susan Dowty wanted to know how she can best stay up to date regarding collaboration in real time, including memberships, activities, and reviewing drafts for public comment. Harris described plans to have an ICSSC folder on the NEHRP.gov website which would have key documents available. Dowty inquired about access to the RP-10 draft document; Harris said that he would need to check on the NIST requirements for a 30-day public review period. Regarding the EEG, Nikolaou said that her focus has been more about NIST's own internal operating procedures to improve networking with others. Dowty would like to be involved in the tabletop exercise if there is an opportunity. She also expressed interest in functional recovery activities. Dr. Judith Mitrani-Reiser said that USGS was updating Circular 1242. She explained that the NIST Disaster and Failure Studies document includes standard operating procedures and a rubric to follow in evaluating every major event in the U.S. and is used in determining whether NIST should send out an investigation team. She explained that the EEG seeks to enhance integration with these well-established procedures. Bostrom inquired about the availability of those documents; Mitrani-Reiser said that both were accessible online. The USGS Circular 1242 is available at <https://pubs.usgs.gov/circ/1242/>, and the Disaster and Failure Studies material is available at <https://www.nist.gov/topics/disaster-failure-studies/about-disaster-and-failure-studies-program>.

Disaster Resilience Research Grants Update

Mr. Jason Averill, Chief Materials and Structural Systems Division, Engineering Laboratory, NIST and Meszaros provided background and an update on the joint NSF-NIST Disaster Resilience Research Grants (DRRG) program. Their presentation is available here: https://nehrp.gov/pdf/9-DRRG%20Slides-ACEHR%20Overview_April%202021.pdf.

Averill described the establishment of the collaborative NIST-NSF grant program, including areas of focus, funding, and the solicitation process. He cited the most recent DRRG grants symposium featuring grant recipients, which attracted over 700 participants online. Meszaros covered the proposal review criteria and process. Four review panels were seismic-related, reflecting the large number of proposals from the field.

Rix complimented NSF for its active participation in NEHRP over the previous two years and cited the joint research program with NIST as an example of how NSF can work with other agencies while still accomplishing their mission of supporting fundamental research. Deierlein agreed with that observation. Dr. Anne Meltzer asked whether there are specific programmatic criteria that look to assess or address inequities in community resilience. Meszaros responded that many of the proposals include issues relating to vulnerable portions of the community, and two review panels are focusing on that aspect. Bostrom agreed with Rix regarding the collaboration between NIST and NSF. She inquired about the anticipated funding rate and whether there would be a backlash if that rate was very low.

Meszaros said that it would, in fact, be a low funding rate considering only \$3.1 million is available for the program and a large number of proposals were received. She was expecting the rate to be lower than 30 percent. Meszaros said that NSF was emphasizing the importance of ensuring that every review is helpful and constructive, so that even if a proposal is not funded, the proposer's science would be better going forward. Any time NSF starts something new they receive a lot of proposals that may have been prepared for another purpose and the two agencies may be dealing with some of that now. Averill told the Committee that being able to partner with NSF has brought more resources for this opportunity. Even if the funding is low, it is twice what it would have been if the agencies had not been collaborating, he pointed out.

Deierlein asked whether there is interest and enthusiasm for this program among senior officials of the agencies? Averill noted that the NIST-NSF Memorandum of Understanding is for five years, which provides the freedom and flexibility to run the program again. Future commitments are always subject to budgets, but NIST is enthusiastic about the program, considers it as providing value, and would look forward to running it again. Meszaros was positive about the program but noted that conversations would need to take place at NSF in terms of budget. Deierlein noted that any future White House infrastructure proposals need to be sound when it comes to resilience and believes that this program is very synergistic with that goal.

IV. 2021 ACEHR Biennial Report Discussion

Rix discussed the ACEHR biennial report which is due in September. He noted that the next meeting is May 24th. In advance of that meeting, Rix and Arendt will look at all draft input and will prepare a rough draft of the report. They would like a really good set of raw material to work on through the summer and into August. After the May 24th meeting, there may be follow-up writing assignments. The following ACEHR meeting will be on August 10th, prior to the end of September deadline to submit the biennial report. The Committee can only reach consensus on items and make recommendations in a public meeting, meaning the report must be completed during the August 10th meeting.

Rix reminded the Committee that the report needs to be succinct with the main body and no longer than about 10 pages. The goal is to make the report a concise, to-the-point document. He encouraged members to make their points as strongly as they wish, but if the Committee as a whole believes that the point should be omitted or instead included in an appendix, he requested that members consent to accept that.

Rix reviewed initial assignments, based in part on members' selections, as the Committee discussed the outline of the structure and content of the report. He said that the report will address the implications of the pandemic on earthquake preparedness and significant lessons learned from this past year.

He said it was important that the Committee assess agency progress over the past two years and anticipated future activities. He also suggested that the report should acknowledge: the GAO reports of agencies' work; the Interagency Coordinating Committee's role; and the effectiveness of ACEHR meetings focused on the strategic plan and progress toward goals rather than a description of the agencies' activities. Rix also said that the document should address what agencies have done to address

implementation gaps, the next NEHRP strategic plan, and similar topics – as well as the process used to engage ACEHR.

Rix suggested that the next section of the report would address key initiatives where there is already some traction and a need to double-down and endorse further investment in pursuing those initiatives. Near the top of that list is the continued focus on functional recovery and community resilience. ACEHR, he said, wants to acknowledge and leverage the NIST-FEMA functional recovery report and work to make the report's recommended options actionable. Rix suggested that lifelines is another key initiative to focus on in the report with an emphasis on getting lifelines "caught up" with existing building structures in terms of seismic risk mitigation and resilience. Another key initiative to be addressed is earthquake early warning and social science research, from both the technical and social aspects.

Rix also would like the Committee to acknowledge and identify what it considers the emerging topics and issues in earthquake hazards. Those include multi-hazard approaches and the role of climate change if there is enough interest among the Committee. In response to a question from Deierlein, Rix said that both technical and social science issues could be included in this section. The DRRG program likely would be appropriate for inclusion in the section on agency progress.

Meltzer asked how the Committee viewed climate change as directly relevant considering that it certainly has hazard implications. Bostrom noted that tsunami modeling does not take into account sea level rise as an issue. She also singled out research efforts looking at ice melt and what that means for volcanic and other events and said that there appear to be some interesting emerging areas of research between the two. Deierlein added that as cities, states and other organizations look at and address sea level rise, adaption, and wildfires, federal, state, or local programs that are going to fund modernization or improvements of the infrastructure should consider seismic upgrades at the same time. When funding is going to be spent on infrastructure, it is key to think of all these hazards in parallel. Wiens mentioned that changes in rainfall or large storms would have implications for landslides triggered by earthquakes.

Rix emphasized that each member is welcome to suggest other topics. Meltzer inquired about inclusion of induced seismicity, which led to a brief discussion on how it was addressed in previous ACEHR reports. Rix said he would add it as a potential topic.

Rix offered that the appendix was a section of the report for individual members' specific issues. Those could include: understanding of earthquake processes and fundamental improvements; research coordination (networking across disciplines); and the framework for support of research following extreme events. Under that last category, Mr. Robert Carey had suggested addressing consortia and other earthquake partners. He said that there had been changes in NEHRP funding that might be worthwhile evaluating in terms of the broader program managers' community. Rix also noted that open data publication and sharing had been suggested as a potential topic under the framework for supporting research following events.

Kersting inquired about inclusion of specific topics – such as structural engineering beyond functional recovery in terms of building design, codes and standards, and structural research. Rix suggested that if they are fairly narrow issues, placing these topics in an appendix might be appropriate. If an issue is broad enough, it could be placed under emerging topics.

Bostrom noted that NOAA had commissioned a report by the National Academy of Sciences to examine integrating social and behavioral sciences. She asked whether there has been an assessment of this need and how it is being addressed across the NEHRP agencies.

Beroza reinforced that it is important to keep the text narrowed down and suggested that the length of sections could be set in advance. He suggested considering focusing on things that are not being done by the agencies but that ACEHR needs to raise awareness about. For example, in structural research there might not be large gaps, whereas there may be a greater need for singling out social science issues. Rix agreed that it was appropriate to try to find things that are not common knowledge or already underway. Meltzer suggested that under basic research the Committee could identify emerging areas that hold promise – and greater specificity may be better than general statements.

The Committee discussed target length for sections of the report. Rix said that recommendations needed to be included with very succinct statements. Agencies are obligated to respond to these recommendations in future meetings. ACEHR tries to have carefully worded, succinct recommendations so that there is no misunderstanding about the Committee’s intent. Wiens requested more guidance about the length of individual sections and Rix suggested that members look at the 2019 report.

Mr. Thomas Heausler asked how much of the document will look like the 2019 report? Rix reviewed the history of the 2017 and 2019 reports. The 2019 report was written shortly after NEHRP was reauthorized and the Committee wanted to endorse the change in focus on the earthquake community from life safety to functional recovery and resilience issues. ACEHR wanted to ensure a solid NEHRP strategic plan is in place and will reinvigorate the Interagency Coordinating Committee. The Interagency Coordinating Committee is seen as an important group of people who could help coalesce the agencies around this new focus on functional recovery and resilience to overcome the traditional stove-piping. With the 2021 report, the agencies have made significant progress on many of the issues required under the legislation. This report can focus more on assessing agency progress. Regarding key initiatives for which the Committee should “double down.” ACEHR can look at other important areas such as lifelines and early warning.

Meltzer asked if there are items in the 2019 appendix that should be carried forward in the context of continuity? Beroza suggested items could be included under the title “instrumentation and data-driven models.” Bostrom agreed and suggested combining that area to take into account data from many different sources as well as artificial intelligence and machine learning. She suggested using the previous report’s topic of advances in instrumentation and monitoring. Wiens said that ACEHR might want to have a separate topic on offshore data sources. Bostrom suggested including it under instrumentation and monitoring. Following an exchange about not being able to include all topics in the report, Meltzer said that induced seismicity, which was discussed earlier, could be a bullet point under another item in the appendix. Wiens pointed out that Hayes suggested that induced seismicity could be touched on under climate change due to the possible relationship of carbon capture and storage as well as geothermal energy.

Deierlein discussed the value of NEHRP agencies promoting open data sharing, noting that some data is not being shared, and that the biggest problem relates to models. Meltzer suggested that this item could be added to the section under machine learning.

The Committee discussed topics in the 2019 report in the context of its current report preparation, focusing on trends and developments in the science and engineering of earthquake hazards reduction. Rix opined that report became a laundry list of topics in the past and recommended instead that ACEHR identify where new developments and trends in the members' disciplines can contribute to the broader NEHRP objectives of functional recovery and community resilience.

Wiens suggested that a criterion for inclusion might be whether items are potentially revolutionary opportunities. Rix expressed agreement about focusing on underappreciated topics. Beroza suggested that topics could be selected that were both underappreciated and poised to make a difference. As an example, Deierlein noted that functional recovery was a major pivot in earthquake engineering approaches. It is not just that there are opportunities, but that if NEHRP agencies redirected their programs in a particular direction, it can make a big difference.

Reflecting an earlier point made by Deierlein, Rix requested that NIST get early copies of the draft NEHRP Strategic Plan to the Committee so they don't have to wait two years before reviewing the plan. McCabe said that NIST will try to do that within proper protocols. Harris noted that an enhanced outline of the strategic plan had been sent out previously to the Committee. He noted an important change related to "priorities," were renamed "focus areas" – including legislatively defined and technical program areas. Faecke will email the revised draft strategic plan outline to ACEHR.

Rix proposed that the May 24th meeting focus on developing a detailed annotated outline of the sections to which people have been assigned to avoid time spent unnecessarily writing text. That outline can then be turned into paragraphs. There was no opposition among the Committee members. Groups will self-organize to discuss sections with a May 17th deadline for submitting materials to Faecke. He also suggested using callout boxes to cite examples. Deierlein requested clarification about the audience for the report. McCabe explained that the report goes to the NIST Director, as Chair of Interagency Coordinating Committee, and it is also shared with Congress. Rix stressed that the report should be written with the intent that interested, but non-expert, people will read it.

Rix said that he and Arendt would update the outline and have Faecke email it to everyone.

V. Closing Remarks

Faecke reiterated that she would send to members the updated copy of the NEHRP strategic plan outline along with the updated ACEHR report outline and links to key documents that were shared with members during the meeting.

McCabe thanked everyone for their time and efforts, including ACEHR members, speakers, and GAO representatives, saying that this was a very productive meeting. Faecke also thanked everyone.

Rix inquired about the potential for holding an in-person meeting in November. McCabe and Faecke said that they did not know about the prospects for that to take place.

VI. Adjournment

The meeting was adjourned at 3:53 pm EST.