

August 21, 2015

Ralph Archuleta, Chair, SESAC
William Leith, Earthquake Hazard Coordinator, USGS
Mark Petersen, Chief, National Seismic Hazard Mapping Project

Dear Ralph, Bill, Mark,

Attached is a summary of the discussions and recommendations of the National Seismic Hazard and Risk Assessment Steering Committee meeting in Menlo Park on August 18-19, 2015.

This is a rather long report, so I would like to call your attention to a few points that our committee sees as most important. The first is that the NSHMP group is very hard-working and productive. They have a large number of responsibilities and a limited number of personnel to work on their many projects. Three particular stresses that have been added in the most recent two years are dealing with induced seismicity, the need to modernize their software, and the need to compress the time interval between release of the 2014 and 2020 maps in order to meet the needs of the engineering community to keep the national seismic design criteria as current as possible. Induced seismicity is a new phenomenon that has required development of new products in collaboration with a new user community, and will require annual updating of these new products. Completion of the 2014 maps was delayed due to factors beyond their control: late delivery of UCERF3 and NGA-West-2. New software is required by the major change in source representation imposed by UCERF3 in addition to normal maintenance. These are superimposed on regular activities, including publication of reports on the 2014 maps, updating the Hawaii map, interactions with users, and ongoing research projects required to keep the national maps at the state-of-the-art.

In this context, Mark Petersen, Chief of the National Seismic Hazard Mapping Project, requested that our committee help them to set priorities for the next two years on the assumption that their budget will be static. Our advice separates projects into two categories: projects that definitely need to be done with the highest priority, and projects that are still important but should be done if manpower is available. The following is our list of projects in the most urgent category. The order of listing within these categories is not meaningful.

- Definite
 - Updating the code base and web site. This is an extremely high priority, because many elements of the 2014 map that are used heavily by the engineering community are not yet available on the web.
 - Code training. Assure that all NSHMP personnel are skilled at using the new codes.

- NGA-East. Evaluate the impact of this major overhaul of ground motion prediction equations promptly after the model is completed and communicate results to the engineering community.
- Project 17. Interact with the Building Seismic Safety Council throughout this project on the methodology and input needed for optimal seismic resistant design of structures, and implementing the forthcoming suggestions as possible.
- Induced seismicity. Completion of initial maps of induced seismicity impact on the national hazard, and then following through with annual updates.
- Hawaii: update the seismic hazard map, since the present map (1998) is over 16 years old, our understanding of the seismic sources and ground motions has changed significantly, and there are no major products in the pipeline that would cause a new map to quickly become obsolete.
- Quantify and present the effects of uncertainties in the National Seismic Hazard Model.
- Finalize a timetable for development of the 2020 National Seismic Hazard Map and initiate planning for workshops and other activities as needed for the map to be largely completed and documented, and submitted for internal and peer review early in 2019.

Most of the topics given in this list were discussed during our meeting, so further details can be found in the complete report. The NSHMP personnel are marginally sufficient to complete these activities, although our committee is concerned with some lack of redundancy among the scientists leading the efforts, especially in the field of code development.

Along with Mark Petersen, the SHAR committee is concerned that the NSHMP personnel are being forced, by the time pressures of these essential products, to emphasize the implementation of outside research models without having the time to continue any internal research. Internal research is seen as essential in order for them to be able to better assess research of others, in order to advance the state-of-the-art on essential topics that may not be supported in the external research program, and also essential for positive USGS performance evaluations. Another tool that Mark mentioned that could help NSHMP achieve its goals is a regular source of funding to support contracts, outside of the annual USGS External Research Program Request for Proposals, that would support specific researchers who have developed helpful new concepts in hazard analysis to work with NSHMP to implement those concepts.

The SHAR committee also recommended that the NSHMP explore within USGS leadership if there is support for a new initiative within the hazard model project. The central motivation is to reduce uncertainties, with the expectation that the effect will be to save the building industry, and thus the entire US economy, the costs of overdesign or underdesign imposed by the uncertainties. There are new

advancements in every field of seismology, geology, and geophysics that impact the input to the hazard model, and a major initiative accompanied by substantial resources could greatly accelerate their impact for improving the national seismic hazard model with a consequent reduction of uncertainties.

Sincerely yours,

John G. Anderson
Chair, National Seismic Hazard and Risk Assessment Steering Committee

National Seismic Hazard and Risk Assessment Steering Committee Committee Report to SESAC September 1, 2015

The National Seismic Hazard and Risk Assessment Steering Committee met in Menlo Park on August 18-19, 2015. The agenda is given in Appendix 1. In this summary, the committee acronym is SHAR committee, selecting the underlined letters in the full name.

Committee Members Present

Norm Abrahamson (by telephone), John Anderson (Arrived 8:55), Ken Campbell, Martin Chapman, Michael Hamburger, Niles Shome, Ray Weldon, Chris Wills (arrived at 12:15 on Tuesday)

Committee Members Absent

William Lettis

USGS Personnel Present

Mark Petersen, Ned Field, Nico Luco, Jill McCarthy, Morgan Moschetti, Chuck Mueller
USGS personnel participating by phone:

Michael Blanpied, Art Frankel, Kathy Haller, Susan Hoover, Peter Power, Sanaz Rezaeian, Chuck Williams

Participants for parts of the meeting:

Ron Hamburger

Art McGarr, Andy Michael, Justin Rubenstein, Andrea Llenos, Bill Ellsworth, all at USGS

Meeting Summary

Mark Petersen. Budget, achievements of the National Seismic Mode Project (NSHMP) in the past year, and plans for the coming year:

Budget:

The NSHMP personnel consist of 12 scientists. The budget is \$2.05 million/year, consisting of \$1.89 million in salary and benefits, and \$160,000 for travel, workshops, computers, page charges, steering committee meetings, and other operating expenses.

Summary of achievements in the past year:

- Induced seismicity: Nov, 2014 workshop and 2015 Open-file report released (April 23, 2015 at the SSA annual meeting). Time-line developed for final products with end-date March, 2016.

- Earthquake Spectra special issue: 11 papers submitted on the U.S. National Seismic Hazard Models and impacts.
- UCERF3 California source model: time-dependent model released.
- Operational Earthquake Forecasts: Powell center meeting held on “Potential Uses of OEF”.
- Building Codes: Maps based on NSHM cleared highest remaining hurdle for adoption by ASCE-7 design standard, via resolution of significant objections (May 2015). Corresponding USGS “U.S. Design Maps” web tool being overhauled to accommodate large increase in number of users.
- Project 17: Collaborative planning with Building Seismic Safety Council for next cycle of national maps.
- New Hazard Model products: maps for 0.3s SA, earthquake catalog for CEUS.
- Hawaii hazard map update: Discussions with engineers, scientists. Prepared seismicity based hazard models. Time-line: about December, 2016.
- Computer and Website improvements: Work on new computer codes for hazard calculations, unified hazard tool (hazard curves, deaggregations), implement new ground motion models for NGA-East (summer). Hold training on new computer codes (summer).
- Outreach: Work with SAFRR to meet with county in Southern California and government officials in Dallas, Texas to discuss Seismic Risk Web Tool (see below). Develop public hazard map based on MMI.
- Engineering Risk Assessment Project: QA of Seismic Risk Web Tool for public release. Continued leadership of SCEC Ground Motion Simulation Validation (GMSV) Technical Activity Group.
- User-needs workshop: Preparation for meeting on Sep 21-22, 2015.
- Meetings: National Seismic Hazard and Risk Assessment Steering Committee meetings (Nov. 2014, August 2015); Geodetic modeling (Aug 2015).

Plans for next year and beyond

- Induced seismicity: Complete 2015 induced seismicity maps (by March, 2016), Begin development of 2016 version of induced seismicity model.
- Hawaii hazard maps: Continue development of Hawaii hazard maps, hold workshops with end-users and scientists (final model ~December, 2016).
- Earthquake Spectra: Complete special issue about December, 2015).
- NGA East: Evaluate impact of NGA East on National Seismic Hazard Map (begin when final model is available ~Dec 2015, about 1 year)

Over next two years

- Project 17: Anticipate that this project will ask for the following added products:
 - Quantify uncertainty
 - Develop additional maps for different periods and soil types.
 - Continue development of a basic basin model for conterminous U.S.
 - Continue developing urban hazard models for CA (with SCEC), PNW, UT.

- Continue overhaul of “U.S. Design Maps” web tool.
- Continue assessment of NGA-East – develop simulations that use physically reasonable inputs that can be compared with NGA-East epistemic uncertainty analysis.
- Continue update of the Quaternary fault and fold database.
- Explore interest establishing WUS working groups whose function is to jointly assess proposed changes to the NSHM fault sources, geodetics, urban hazard, induced seismicity, ground motions, etc.
- •Develop new GPS models for on-fault and off-fault earthquake rates. Begin development of new NSHMP14-consistent scenarios.
- Continued OEF development.
- Outreach efforts: Continue working with SAFRR on reaching out to government and end-users. Help users utilize UCERF3, especially those with a statutory requirement to conduct deterministic analyses.
- Codes and webtools: Develop and test new webtools and computer codes, including NGA-East and adapting historical models to new codes.
- Engineering Risk Assessment: Further develop and disseminate Seismic Risk Web Tool, in coordination with ShakeCast. Continue leadership of SCEC GMSV TAG.
- Meetings: Steering Committee meetings, working group meetings
- Continue USAID efforts to improve seismic hazard models for South America and Southeast Asia.
- Work with Pacific NW and Coastal and Marine Geology Program projects to improve model for the rates of large earthquakes on the Cascadia Subduction Zone.

Mark Petersen asked the SHAR committee for our recommendations on priorities for these potential future efforts. He also asked our committee how the NSHMP group can maintain its scientific edge. He is concerned that the NSHMP personnel are being forced, by the time pressures of essential products, to emphasize the implementation of outside research without having the time to continue any research. Internal research is seen as essential in order for them to be able to better assess research of others, in order to advance the state-of-the-art on essential topics that may not be supported in the external research program, and also essential for positive USGS performance evaluations. Another tool that Mark mentioned that could help NSHMP achieve its goals is a regular source of funding to support contracts, outside of the annual USGS External Research Program Request for Proposals, that would support specific researchers who have developed helpful new concepts to work with NSHMP to implement those concepts. Examples of projects that might benefit from this mechanism include EUS site factors, updating of the Quaternary Fault and Fold Database, implementing SAMMON’s maps for GMPEs in all regions, and deaggregating the UCERF3 source model.

John Anderson

In addition to welcoming and thanking the meeting participants, John Anderson summarized the committee charter, and the committee's relationship to SESAC. One goal of the meeting is to prepare a report for SESAC. The following statements are quoted from the committee charter.

- The National Seismic Hazard And Risk Assessment Steering Committee is established to critique and review efforts to assess seismic hazard and risk in the United States and its territories. To this end, the Committee oversees the work of the National Seismic Hazard Mapping Project as well as other efforts supported by the Earthquake Hazard Program to assess hazard and quantify risk.
- The National Seismic Hazard And Risk Assessment Steering Committee is a subcommittee of the Scientific Earthquake Studies Advisory Committee (SESAC).
- "The National Steering Committee shall issue its reports to the chief of the National Seismic Hazard Mapping Project, for inclusion in the documentation of the National Seismic Hazard Maps, to the Earthquake Hazard Program Coordinator, and to the Chair of the SESAC."

Induced Seismicity

USGS has a congressional request for modified hazard maps that incorporate induced seismicity, and has promised a product by the end of March 2016. To meet this deadline the report needs to be in internal review sometime early this fall. There are decisions to be made on the parameters to be used to develop input to the hazard models. The proposed reference model would use the following parameters:

- $M_{min}=2.7$
- $M_{max}=6.0$
- $b=1.0$
- 12 month catalog, not declustered, for the smoothed seismicity model, which would be the dominant contribution to the hazard
- 20 km smoothing
- CEUS ground motion model used for the 2014 National Seismic Hazard Model

The map would be prepared and labeled as having a 1-year lifetime, because the industrial processes that induce seismicity are temporal. Maps to be produced will include ground motion amplitudes at various probabilities, and also maps where the ground motions are converted to Modified Mercalli Intensity to better communicate to the general public and emergency response community the likelihood of various levels of damage and rates of nuisance shaking.

There was a wide-ranging discussion. Some of the key recommendations and observations that emerged are:

- The produced maps would have a 1-year lifetime, and the NSHMP anticipates that they will need to produce new maps on an annual basis representing the changing locations and rates of induced seismicity.
- It is essential to present the uncertainties – perhaps just giving the range but not even presenting a “preferred” hazard estimate. Uncertainties include varying all of the parameters in the reference model, including the use of different start times for the 12 month catalog and available NGA-East results (i.e. the “seed models”).
- There is not a clear sense of who the users will be or how the new maps will be used. The main users are expected to be government, regulators, state departments of transportation, emergency responders, the insurance industry, state seismic safety commissions, and the general public. It is not expected that these maps will be used for building codes because of the transient nature of induced seismicity. There was a sense that the path forward is to produce maps under the above input parameters, and be prepared to be flexible in future years as users emerge and their needs become clear.

California: Uniform California Earthquake Rupture Forecast (UCERF) and Operational Earthquake Forecasting (OEF)

Ned Field led the discussion of UCERF and OEF.

UCERF has produced a time-dependent model. They recognize the need to provide simplified models for users and to create deterministic models and to develop ways for users to add or subtract faults in detailed regional studies. Various approaches are being investigated by non-USGS projects (e.g. Pacific Gas and Electric, Glenn Biasi). For the next update of the NSHMP, there is a need to rerun the grand inversion with new information developed in recent studies, but major changes in results are not anticipated. The discussion noted that UCERF3 is dependent on SCEC and its IT support, and on a small number of key personnel; without these UCERF is not maintainable.

OEF is aiming to revamp present products giving quick estimates of aftershock rates and probabilities of larger events, and to develop new products that forecast the probability of triggering earthquakes (including potentially larger earthquakes) on specific faults considering changes in the stress field, the UCERF estimates of earthquake potential, and the history of past earthquakes on the faults. Added products could include ground motions from potentially triggered earthquakes and associated risk. The OEF project was encouraged by a Powell Conference; at this meeting, potential users felt that the results could be very helpful.

Computer Code Development and Web Interface with Users

Peter Powers led this discussion. The NSHMP is behind in pushing out products related to the 2014 map because of the need to modernize the computer codes. They anticipate that this fall, a new web interface will become available that is far better than what was available in the past. Issues with previous codes that will be corrected: lack of a single code base for all calculations, lack of version control, different regional approaches to input definition, unnecessary complexity. The committee appreciated the progress report and emphasizes that it is very important work that NSHMP needs to expedite as much as possible.

Next Generation Attenuation Models for Eastern US (NGA East)

Sanaz Rezaeian gave a report on the NGA East, presenting slides prepared for her largely by Christine Goulet. Models are for the median and standard deviation of PSA from 0.1 Hz to 100 Hz (0.01 s to 10 s) for sites on hard rock ($V_{s30}=3000$ m/s, $\kappa=0.006$ s, for M4.0 to 8.2, distances 0-1500 km. So far there are 8 PEER publications. The project participants generated 30 candidate models, of which 18 passed various tests to qualify as seed models. The seed models are currently available. The seed models are being used to generate SAMMON's models which will aim to represent the distribution of the models in a multi-dimensional model space that can be collapsed to two dimensions. All of the models will be provided in tables, and some are also given in a functional form.

The developers of the seed models largely overlap developers of models used for the 2014 National Map, and these developers are unanimous that the new models supersede their previous models. The committee emphasizes that USGS needs to critically evaluate the impact of the new models for the national map applications – the process will probably take a year or more. The difference between the seed models and the SAMMON's map needs to be understood and evaluated carefully since this is a new approach. This is an area where USGS needs internal expertise. Some SHAR committee members would like to see NSHMP produce a report with a target date sometime ~2017 that just explains the impact of NGA East on the national maps, with all other inputs held constant. In the discussion held on the next day, Ron Hamburger indicated that such a report would be appreciated by the engineering community.

Urban Hazard Maps/ Scenarios/ Basin Models

Brad Aagard (USGS, Menlo Park) joined the meeting to show status of his work in simulating ground motions. At long periods, his model uses a finite-difference solution, in collaboration with the large computers at Lawrence Livermore National Lab. At high frequencies, he adds a stochastic contribution in collaboration with Rob Graves. Dr. Aagard showed simulations for the 1906 San Francisco earthquake

on the San Andreas fault (M~8) and simulations for various source scenarios on the Hayward fault. The emphasis, in this presentation, is on sensitivity to various source parameters such as hypocenter location (directivity) and source variability. A long range goal would be to generate ground motion hazard maps using an approach similar to SCEC, but he lacks records of small earthquakes to verify and improve the velocity model. The effort at present is focused on generation of scenarios. However he is interested in working with NSHMP in the future for studies leading to urban hazard maps.

Project 17

Ron Hamburger () joined the meeting for most of the morning to discuss Project 17. Project 17 is a continuation of a series of collaborative projects between the Building Seismic Safety Council and NSHMP. Ron summarized the history (Project 97, Project 07) and the evolution and process of use of the USGS seismic hazard maps in the building codes.

Project 17 is considering several requests for changes in NSHM products:

- Changes in the way design values are delivered to the user, from minor (e.g. rounding) to very substantive (e.g. making the USGS web the authoritative source for the design spectrum).
- Additional or alternative exceedance rates for seismic design
- Multi-period spectra, alternative damping, alternative site conditions
- Use of deterministic caps
- Site-specific procedures, possibly including site conditions and basin effects, delivered electronically.

The USGS hazard maps are a crucial element of the current US building code (International Building Code). At present the USGS web site is not the “authoritative” source of building design spectra – the maps published by IBC play that role. However, unofficially engineers throughout the country assume that the values obtained from the USGS web site are the same as what would be inferred from the IBC maps, which are very difficult to read. Thus it cannot be overemphasized that maintaining the USGS web site, and responding to the needs of the construction industry, must be a high priority to USGS.

Future directions: NSHMP FY2017-2018

NSHMP schedule

The first discussion topic is that it is essential for NSHMP to set a schedule for future maps. A previously announced deadline for input to the next national update is Dec. 31, 2017. This is accelerated by over a year from the schedule used for the 2014 map, and based on a recommendation of the SHAR committee in 2013 to set a

closing date for new information, and then to enforce that deadline strictly. There needs to be such a deadline so that the NSHMP personnel have time to carefully implement the new models, understand their effects, and be sure that there are no surprise unintended consequences. Ron Hamburger made it clear at this SHAR committee meeting that it is essential, for the seismic code community, for future maps to be prepared with a much greater lead time than the 2014 map, so that the engineering community can give the new maps a similar level of scrutiny. The discussion in the SHAR committee focused on whether a closing date at the end of 2017 is enough time or not. Two models were discussed:

1. Option 1. Maintain the Dec. 2017 deadline for input, giving NSHMP about 1.5 years to produce, review, and publish a map with a 2019 date for the engineering community after the cutoff date for new models. Because the engineering community wants to know what is coming with as much advanced notice as possible, NGA-East would be dealt with by a report on "Impact of NGA-East on the National Seismic Hazard Map", which would be prepared thoughtfully but as soon as possible after the completion of the NGA East project. This approach would tentatively set a precedent for future major projects with broad impact on the hazard estimates. Recent projects in this category would be NGA-West-2 and UCERF-3. After NGA-East, the next major products that are anticipated are NGA-Subduction and improved geodetic models. There is no chance that NGA-Subduction will be completed before Dec 2017. No timeline is available for the next geodetic model, but it is possible that the geodetic community has the Dec. 2017 date as a target for future products.
2. Option 2. An alternative that was discussed is to make a complete interim update with a closing date for new input of Dec. 2016. This would assure that studies of geology, geodesy, etc. completed in the next year would be included in case the schedule described in Option 1 is not achieved for a complete update.

The SHAR committee charges NSHMP to come up with a schedule immediately in time to include in this report.

The following is the schedule that they submitted:

<place holder>

This is my suggestion in case I don't get a schedule on time - JGA

The SHAR committee did not formally reach a consensus recommendation on this timing issue, but the sense of the chair of the SHAR committee is that the first option would probably be recommended by a majority of the committee. The committee was skeptical about the feasibility of implementing the second option given available manpower and budget.

Fault and Fold Database

Kathleen Haller introduced the Quaternary Fault and Fold Database. This is presented on the USGS web site (<http://earthquake.usgs.gov/hazards/qfaults/>).

The current version is becoming out of date. NSHMP sees it as important to update. Kathy Haller and Jill McCarthy reviewed the current status of efforts to update it. The work is being performed in collaboration with experts in each western state, and there is activity in nearly every western state. Several members of the SHAR committee had suggestions. These included:

- Form a committee to evaluate what information is needed most in the updated database.
- All available information should be identified at least even if it does not satisfy NSHMP quality standards (basically publication, or at least evidence of a rigorous peer review). The current review policy may exclude theses, field trip guide books, and industry reports, for example, but these are a large and significant source of additional information.
- There should be a record of which faults, and which reports, have been considered.
- Faults that have been included in the database in the past, and subsequently removed, should be identified.
- The NSHMP is encouraged to consider crowdsourcing with NSHMP review of proposed additions as part of the solution to expanding the database and keeping it current.

NSHMP Priorities

In response to Mark Petersen's question of "what should NSHMP not do", the committee classified several projects into two categories. The first is "definitely do this" and the second is "if manpower is available". The committee sees value in all of the potential activities identified by Mark in his initial presentation. The following is the SHAR committee classification. The order of presentation within categories was not discussed by the SHAR committee, and has no significance.

- Definite
 - Updating the code base and web site. This is an extremely high priority, because many elements of the 2014 map that are used heavily by the engineering community are not yet available on the web.
 - Code training. Assure that all NSHMP personnel are skilled at using the new codes.
 - NGA-East. Evaluate the impact and communicate its impact to the engineering community.
 - Project 17. Interacting with BSSC throughout the project, and implementing the forthcoming suggestions as possible.
 - Induced seismicity. Completion of initial maps of induced seismicity impact on the national hazard, and then following through with annual updates.

- Hawaii: update the seismic hazard map, since the present map is over 10 years old and there are no major products in the pipeline that would cause a new map to quickly become obsolete.
- Quantify and present the effects uncertainties in the National Seismic Hazard Model.
- If Manpower is Available
 - Update the Quaternary fault and fold database
 - Improve geodetic models
 - Development of urban hazard maps
 - Update the hazard maps for Puerto Rico and Alaska. These two maps will be sensitive to the results of the NGA-Subduction model when it is completed, so it is good for NSHMP to work towards having updated seismicity models and to be prepared to implement NGA-Subduction as soon as that model is completed finish the maps.
 - UCERF4. It is clear that eventually new input, and new ideas that address some of the weaknesses of UCERF3, will necessitate a new model.
 - Basin models and incorporation of sediment thicknesses.
 - Operational Earthquake Forecasting.

“Next Generation Seismic Hazard Maps”

The SHAR committee recommended that the NSHMP explore the support for a new initiative in support for hazard model project. The central motivation is to reduce uncertainties, with the expectation that the effect will on average be to save the building industry, and thus the entire US economy, the costs of overdesign or underdesign imposed by the uncertainties. There are many new advancements in every field of seismology, geology, and geophysics that impact the input to the hazard model. These include:

- Geology: Lidar images of all active faults
- Seismology: Precision locations of earthquakes. Better use of earthquake catalogs?
- Geodesy: Optimize use of geodetic data now that it is “mature”.
- GMPE: Earthscope data to develop more sharply regionalized ground motion models
- GMPE: New instrumentation, including crowdsourcing to take advantage of accelerometers built into pc’s and cell phones, and new ideas for dense instrumentation in urban areas.
- Computation: Capability to model low frequency ground motions better than by using GMPEs is now “almost” proven in So. Cal.

Dealing with Critics of PSHA

Several members of the SHAR committee are concerned that criticism of PSHA in the Earth Science / Geophysics communities are not being countered. Committee members asked that we communicate internally about this more uniformly informed, and possibly resulting in committee members taking a more active role than they have. Some committee members are already taking active roles, but more may be needed.

Appendix 1. Agenda

National Seismic Hazard and Risk Assessment Steering Committee

August 18-19, 2015

Nevada Room (Room 3-235), USGS Offices Menlo Park, California

Agenda

Tuesday, August 18

8:15 AM Meet and Greet

8:30 Welcomes. Overview of Agenda Anderson, others

8:45 Update on NAT activities. Also include responses to previous Steering Committee reports and recommendations. Allow time for discussion. Will include update on Hawaii, user needs workshop, government interactions, SAFFR, etc. Petersen

10:00 Break

10:15 Induced Seismicity Petersen, others

12:00 Lunch (walk to cafeteria on USGS campus)

1:00 California: UCERF products, simplified model. Operational earthquake forecasting.

2:00 Computer codes, website improvements, user comments, status and next steps.

Powers

3:00 Break

3:15 PM NGA East Rezaeian

4:00 PM Urban Hazard Maps/ scenarios/ basin models Aagard

5:30 Adjourn

Wednesday, August 19

8:15 AM Meet and Greet

8:30 Building Code: BSSC, ASCE7, Project 17, update cycle. Hamburger

9:45 Break

10:00 Future directions: NSHMP FY2017-2018 Directions, priorities & resources needed, Q-faults, Alaska, Puerto Rico (2 hour) Petersen

12:00 Lunch (walk to cafeteria on USGS campus)

1:00 Committee discussion Committee

3:00 Adjourn