

ATC-35 Project

Development and Facilitation of Tabletop Exercises
in support of the
Plan to Coordinate NEHRP Post-Earthquake Investigations

NEHRP Plan Exercises
FINAL REPORT

Prepared for the
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Abstract

Three Exercises of the **NEHRP Plan to Coordinate NEHRP Post-Earthquake Investigations** were developed and implemented from 3rd quarter 2003 to 1st quarter 2004, in order to (a) to test the Plan itself via realistic scenarios, and (b) for the NEHRP agencies to learn how to coordinate postearthquake investigations. The three Exercises were selected so as to cover the range of seismic activity, consequences and NEHRP agency, state and local experience envisioned in the Plan. The Exercises were based on the following Scenario Earthquake events: (1) a Hayward M_w 7 event without foreshocks; (2) a New Madrid M_w 7 event with foreshocks, and (3) a Puerto Rico M_w 8 subduction event on the Puerto Rican Trench accompanied by a tsunami affecting the eastern seaboard of the US. Each Scenario event was detailed in terms of the season and time of day at the time of the earthquake occurrence, the prevailing weather and other relevant conditions, and data on possible resulting consequences. The consequences were hypothetical, but realistic. Preparation for the Exercises included interviews of NEHRP agencies, and sessions to instruct Participants in the procedures for the Exercises. Each Exercise consisted of a four-hour telephone conference call enhanced with a web-based electronic link which permitted real-time transmission of figures and text. The three Exercises were held on Dec. 19, 2003, and Jan 9 and Feb. 10, 2004, respectively. Each Exercise was *ex post facto* evaluated and the evaluation shared with NEHRP agencies prior to the next Exercise. Implementation of the Plan, and Participant performance, improved with each Exercise. Evaluation of the Exercises found (a) the Plan to be adequate, with no major problems or omissions, and (b) the Exercises to be very effective, with Participant feedback entirely positive. Based on the lessons learned from the Exercises, the following Recommendations are provided:

1. **Plan Maintenance:** NEHRP agencies should meet regularly to communicate the status of each agency's NEHRP related activities. Within USGS a NEHRP Postearthquake Investigations Plan Coordinator (NPIP) should be designated, who would be the Plan's 'keeper,' a procedural resource to the NEHRP agencies during implementation of the Plan in an actual event. The NPIP would be responsible for maintaining (1) the Plan, (2) a list of candidate NICs, and (3) other Plan-related infrastructure (eg, data archive. The NPIP would be the Plan Coordinator, and not necessarily the NEHRP Investigation Coordinator (NIC) for any particular postearthquake investigation.
2. **Plan Exercises:** Exercises of the Plan should occur annually, and include a process for orientation in the Plan, for NEHRP agency and other interested parties. The NPIP or other persons in USGS should conduct these Exercises, so as to institutionalize the Plan and in general postearthquake investigations within the agency charged with that task (ie, USGS). Future Exercises should move about the country, using regions such as the Pacific NW, Utah, the Northeast, Alaska and Hawaii, before returning to the regions already exercised.
3. **Communication:** A NEHRP Electronic Link should be created and maintained, for use in actual earthquakes and perhaps other NEHRP agency business.
4. **Data:** Coordination of data collection, preservation, archiving and dissemination should be greatly improved. Formal procedures and tools for sharing of data and information should be developed. A centralized (eg, web-based) data archive should be developed and maintained.

This report summarizes the development and implementation of the Exercises. Further detail is provided in an enclosed CD disk.

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Numerous personnel at the **NEHRP agencies** participated in the development and implementation of the Plan Exercises - the efforts of **USGS** personnel Mike Blanpied, William Leith, David Applegate, Harley Benz, Lisa Wald, Bill Ellsworth, Ross Stein, Jack Boatwright, Mary Lou Zoback, Buddy Schweig, Lucy Jones, Joan Gomberg, Jill McCarthy, Mark Petersen, Pedro Diaz, Steve Walter, Tony Crone, Butch Kinerney, Howard Bundock, Dave Russ, and Steve Walter; **NIST** personnel Shyam Sunder and Steve Cauffman; **FEMA** personnel Mike Mahoney, Jeff Lusk, Elizabeth Lemersal, Joe Rachel, Marshall Mabry, and Marie Gonzalez; **NSF** personnel G. Ulsoy, Dennis Wenger, Steve McCabe, Rick Frangaszy, Cliff Astill and Priscilla Nelson; and **EERI** staff and/or members Susan Tubbesing, Marjorie Greene, Gabe Mulford, Jay Love, Kurt Edwards, Nesrin Basoz, Lynn Janney and Louise Valesquez, are all gratefully acknowledged.

Lastly, numerous additional persons participated in the Exercises, too many to list here but who are listed in the Appendix corresponding to each Exercise – their participation and assistance is greatly appreciated. If any persons are inadvertently omitted, apologies are certainly in order.

1 Introduction

Congress via the National Earthquake Hazards Reduction Program (NEHRP) has tasked the Federal Emergency Management Agency, US Geological Survey, National Science Foundation, and National Institute for Standards and Technology (the “NEHRP agencies”) with understanding and mitigating earthquakes and their risks. As part of the Program, the USGS was tasked to organize a post-earthquake investigations program to learn from each earthquake experience. Recently, the 2001-2005 NEHRP Strategic Plan directed the USGS to develop a plan to coordinate NEHRP post-earthquake investigations. In support of this, the Applied Technology Council (ATC) via the ATC-35 project assisted the USGS in the development of a Plan to Coordinate NEHRP Post-Earthquake Investigations (the “Plan”), which has been published as USGS Circular 1242 (USGS, 2003). This Report completes a project which had as its purpose the development of a reasonably assured capability on the part of selected NEHRP agency personnel to coordinate postearthquake investigations in accordance with the Plan.

To accomplish this purpose, this project had the following objectives: (1) to develop Exercises of the Plan; (2) to conduct these Exercises; (3) following each Exercise, to evaluate that Exercise and, on the basis of that experience, to provide feedback to the Participants and/or modify subsequent Exercises as appropriate; and (4) at the conclusion of the Exercises, to provide a written report documenting the Exercises, Lessons Learned, and Recommendations as appropriate. This Final Report addresses objective number (4).

1.1. Organization of the Project and this Report

The USGS Project Officer for this Project was Thomas L. Holzer (USGS, Menlo Park). Other personnel included: ATC Project Executive (Christopher Rojahn), Project Manager and Project Facilitator (Charles Scawthorn), Exercise Scribe (Bernadette Mosby) and Project IT Manager (Peter Mork). A list of Participants attending each Exercise can be found in the Technical Memoranda documenting each Exercise, which are provided on the enclosed CD.

This report begins with an Introduction to the Project, NEHRP and its Plan to coordinate post-earthquake investigations. This is followed sections which describe the Exercises of that Plan including the design of the Exercises, selection of the regions, details of the Scenarios for each Exercise, and the implementation of the Exercises, evaluations, and lessons learned, as well as recommendations arising from those Exercises. The main body concludes with a glossary references and several Appendices. Much more extensive information is provided on an enclosed CD, which fully documents the process by which the regions and scenario earthquake events for each Exercise were selected, details the scenario earthquake events, discusses the interviews of NEHRP agencies and other preparations that occurred for the Exercises, and documents each Exercise and its evaluation. The documentation of each Exercise includes a list of Participants attending each Exercise, a full recitation of the Scenario Earthquake, the Actions occurring in the Exercise versus the Plan’s required Actions, a transcription of the full four hours of dialog, the full chat board written record and all graphics transmitted via the electronic link. The Evaluation of each Exercise is also included in the documentation for each Exercise.

1.2. The National Earthquake Hazards Reduction Program (NEHRP)

The following description of the National Earthquake Hazards Reduction Program (NEHRP) is excerpted from FEMA 383 (2003):

The National Earthquake Hazards Reduction Program (NEHRP) is the Federal government's coordinated approach to addressing earthquake risks. NEHRP was established by Congress in 1977 as a long-term, nation-wide program to reduce the risks to life and property in the U.S. resulting from earthquakes. NEHRP comprises the Federal Emergency Management Agency (FEMA), the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF), and the United States Geological Survey (USGS). The premise of the Program is that while earthquakes may be inevitable, earthquake disasters are not.

The NEHRP agencies work jointly and in cooperation with other Federal and state agencies; local governments; private companies; academic institutions; and regional, voluntary, and professional organizations to improve the Nation's understanding of earthquake hazards and to develop methods to reduce their effects. Underpinning earthquake risk reduction is research that develops new knowledge about, and understanding of, 1) the earthquake hazard, 2) the response of the natural and built environment to that hazard, and 3) techniques to mitigate the hazard. The foremost challenge facing NEHRP is encouraging the use of knowledge to foster risk reduction among local and state agencies and private entities.

Statement of the program's mission provides strategic guidance:

The mission of the National Earthquake Hazards Reduction Program is to develop and promote knowledge and mitigation practices and policies that reduce fatalities, injuries, and economic and other expected losses from earthquakes.

The four NEHRP agencies each contribute their own unique set of skills and capabilities to the combined NEHRP mission: FEMA has primary responsibility for overall planning and coordination of the NEHRP program.

FEMA works to translate the results of research and technology development into effective earthquake loss reduction measures at state and local levels of government. It supports public-private partnerships to develop disaster-resistant communities, helps state and local government decision-makers by providing estimates of potential losses due to earthquake hazards, develops earthquake risk-reduction tools and measures, prepares technical guidance aimed at improving the seismic safety of new and existing buildings and lifelines, and prepares and disseminates information about building codes and practices. FEMA also develops and supports public education to increase awareness of earthquake loss reduction measures.

NIST is responsible for problem-focused research and development in earthquake engineering aimed at improving building codes and standards for both new and existing construction and advancing seismic practices for structures and lifelines. This work is focused on removing technical barriers, evaluating advanced technologies, and developing measurement and prediction tools underpinning performance standards needed by the U.S. design and construction industry.

NSF supports a broad range of basic research covering the geoscience, engineering, economic, and social aspects and impacts of earthquakes. NSF supports basic research into the causes and dynamics of earthquakes, plate tectonics, and crustal deformation. It funds research on geotechnical, structural, architectural, and lifeline systems and expands the Nation's earthquake engineering research capabilities. NSF supports research on the social, behavioral, and economic aspects of earthquake hazard mitigation. It also supports the education of new scientists and engineers, the integration of research and education, and outreach to professionals and the general public.

The USGS conducts and supports basic and applied earth science investigations that increase knowledge about the origins and effects of earthquakes, produces national and regional assessments of seismic hazards, and carries out engineering seismology studies of ground shaking. USGS also has primary responsibility for monitoring earthquake activity in the U.S. and for coordinating post-earthquake reconnaissance investigations. USGS supports an external research program and works with a number of partners and stakeholders to transfer its earthquake-related products into practice.

1.3. The NEHRP Plan and its Exercise

USGS Circular 1242 presents the Plan to Coordinate NEHRP Post-Earthquake Investigations (the "Plan"). The Plan's purpose is the coordination of domestic and foreign post-earthquake investigations supported by the National Earthquake Hazards Reduction Program (NEHRP) – that is, the NEHRP agencies and their partners. Most of the emphasis of the Plan is on domestic US earthquakes. The Plan is a framework for coordination of the NEHRP agencies, and identification of responsibilities for postearthquake investigations, in various time frames ranging from hours to years after an earthquake.

Any plan, such as the topic of this project, is preparation for actual actions. When the time comes to take those actions, time and circumstances typically don't permit reference to the plan so that, to be effective, the plan's objectives and elements must be known beforehand by the parties who are responsible for acting. Additionally, any plan if not tried in some manner may have flaws. Thus, one or more "Exercises" or mock role-playing of a plan are an essential part both of validating the plan, and preparing Participants for the future events that the plan addresses. Toward this purpose, exercising of the NEHRP Plan was deemed a necessity by the Plan's authors, and the NEHRP agencies. The exercising of the Plan was not intended to involve all possible aspects of an investigation, nor all persons and agencies that would eventually perform postearthquake investigations. Rather the Exercises were bounded in the following manner:

1. **Purpose of Exercises:** the Exercises were not about the technical aspects of the investigations, or even about what should be investigated. Rather, the purpose of the Exercises was (a) to test the Plan itself via realistic scenarios, and (b) for the NEHRP agencies to learn how to coordinate postearthquake investigations.
2. **Participants:** the Exercises were limited to assuring familiarization of the Plan on the part of key NEHRP agency personnel and their primary partners, who would be the persons coordinating postearthquake investigations and responsibilities. This is a key point – while many other personnel participated in the three Exercises, and all persons involved in the Exercises are collectively referred to as Participants, the Exercises were focused on NEHRP personnel (and EERI) only – all other Participants would hopefully benefit from their participation, but were not the focus of the Exercises.

3. **Timeframe:** Learning from earthquakes is a never-ending process, and the Plan reflects this in its contemplation of a five-year timeframe, Figure 1. However, the Plan also recognizes that this five year timeframe will have three distinct phases: Phase 1 (immediate to several days), Phase 2 (several days to 1 month), and Phase 3 (1 month to 5 years). Phases 2 and 3 allow time for thoughtful consideration and conferencing, but Phase 1 is the period during which key decisions made under time and other pressures set the path for subsequent phases. Thus, Phase 1 was the focus of the Exercise of the Plan.

In Phase 1, a careful reading of the Plan indicates a number of Actions are called for, which are summarized in Table 1. The accomplishment of these Actions as called for by the NEHRP Plan thus became the standard for the Plan's Exercise. That is, the Exercise served as both a test of whether the NEHRP agencies accomplished these Actions, and a device for the agency personnel to learn how to accomplish these Actions.

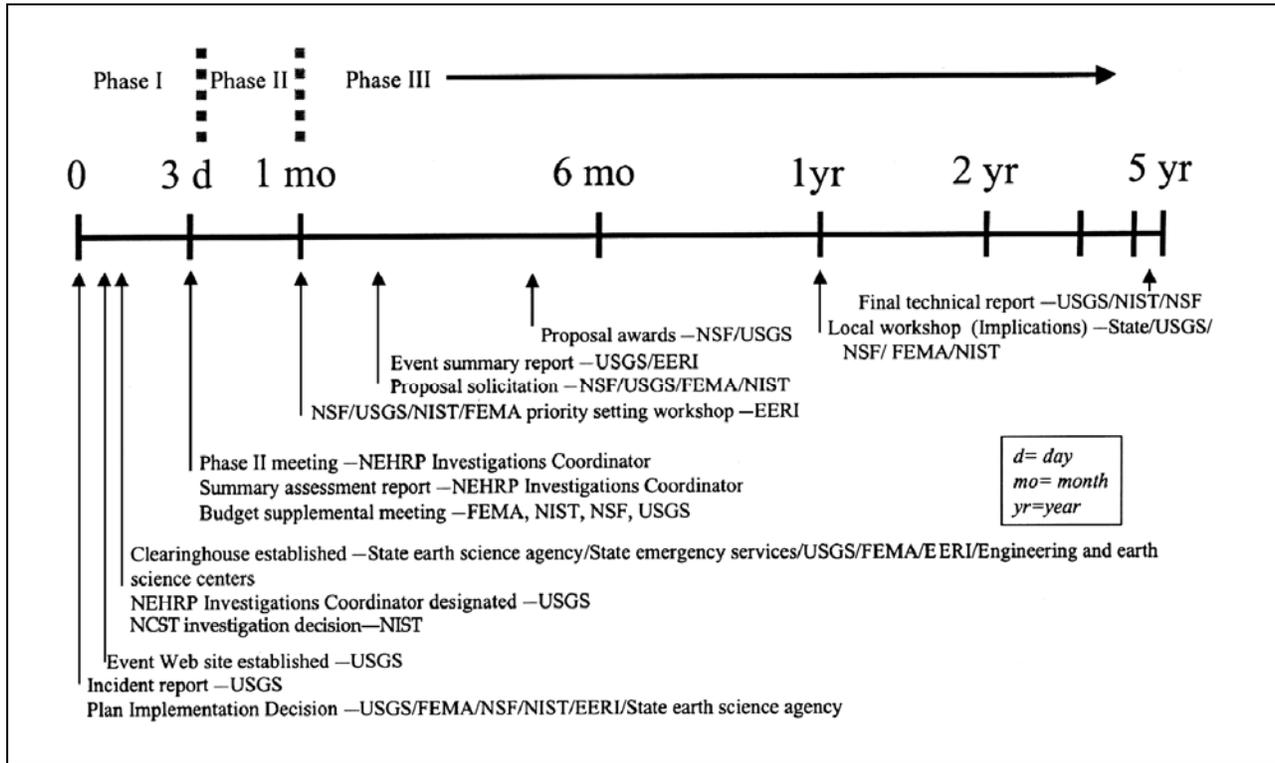


Figure 1 Activities timeline for NEHRP Post-Earthquake Coordination Plan—Domestic earthquakes. (USGS, 2003)

Table 1 Actions called for during Plan Phase 1

No	Time since EQ	Resp.	Action	Explanation of Action
1	Few minutes	USGS	Notify emergency managers, NEHRP agencies, state geological surveys.	For domestic earthquake.
2	Few hours	USGS	Convene Conference call NEHRP agencies, state geological surveys and EERI to determine if earthquake is significant.	Significant defined as (a) Presidential Disaster Declaration or (b) considered by NEHRP agencies to provide an opportunity to learn.
3	Few hours	USGS/ all	Decide whether to implement all or part of Plan	USGS in consultation with NEHRP agencies.
4	Few hours	USGS/ State GS	If Plan is implemented, inform emergency managers of this decision.	USGS in collaboration with state geological surveys (SGS)
5	Few hours	USGS	Establish event Web site (URL posted on http://earthquake.usgs.gov) and EERI Web site.	Links to other Web sites.
6		NEHRP agencies	Instruct grantees who establish Web sites to inform USGS of URL.	Only required if grantee establishes Web site.
7	1 day	USGS, FEMA, EERI	Establish Clearinghouse (CH) (multiple sites may be necessary - communication and proximity to DFO important.)	State entities may be given major portion of responsibility, if capable.
8	1 day	USGS	Designate NEHRP Investigations Coordinator (NIC)	List of candidates prepared in advance. NIC full-time on short notice for minimum 1 month.
9	2 days	NIST/all	Decide to form NCST or not.	NIST in consultation with NEHRP agencies. Need to define scope of investigation (what buildings or building types?).
10	3-7 days	NIC	Convene Ph II meeting to identify investigation opportunities and needs.	Attendees: field leaders, USGS, FEMA, NIST, NSF, EERI, EERCs, IRIS, UNAVCO, earth science centers, state agencies, multi-state consortia, and others (see Plan).
11	1 day after Ph II meeting	NIC	Written summary of meeting	Summary identifies major findings, opportunities for further investigation.
12	ca. 10th day	All	If funds available, SOO posted on USGS, EERI and NSF Web sites	SOO = Statement of Opportunity, for urgent investigations, with rapid funding decision.
13	Few days	All	Consider Budget supplement request	
14	On-going	All	Keep NIC informed.	
15	On-going	NIC	Identify duplication and gaps	

2. Design of the Exercises

Design of the Exercises involved deciding a number of parameters, such as how many Exercises should there be, how should each Exercise be conducted, what should the time interval be between Exercises, who should participate in the Exercises, etc? This section summarizes the factors entering into and decisions by the project management team (USGS Project Officer, the ATC Project Executive, and the Project Manager) for the design of the Exercises.

1. **Number of Exercises:** As noted above, Exercise(s) should serve both as a test of whether the NEHRP agencies accomplished the Plan Actions, and a device for the agency personnel to learn how to accomplish those Actions. In order to allow opportunity for Participants to learn the Plan, accomplish its Actions, and demonstrate this ability, more than one Exercise is needed. Based on the consideration that (1) the first Exercise would probably identify gaps in Participant knowledge and ability and that this identification would therefore teach Participants what they did not know, (2) that a second Exercise would permit Participants to correct most errors and omissions, but that some might still exist, and (3) that a third Exercise would confirm Participants had corrected any errors and omissions identified in the second Exercise, the project management team decided that three Exercises were the minimum necessary to accomplish the project purpose. Another factor in the decision for three Exercises was that this allowed several regions to be Exercised, covering the range of seismic activity, consequences and NEHRP agency, state and local experience envisioned in the Plan.
2. **Participants** in the Exercise included representatives from NEHRP agencies, EERI, and whoever these five entities invited. That is, the NEHRP agencies and EERI were encouraged to invite participation by state and local agencies, academics, professionals and any other entities or persons who they thought would be key to Phase 1 of a postearthquake investigation. Collectively, all persons participating in an Exercise are referred to as Participants, although in certain contexts Participants may refer only to the representatives of the NEHRP agencies and EERI.
3. **Conduct of Exercises:** Given that each Exercise might involve numerous personnel from NEHRP agency headquarters and regional offices, EERI, local officials and others from the region forming the subject of the Exercise, and lastly the Project Officer and Exercise Facilitator, it was decided on the basis of project resources that each Exercise would be conducted via telephone conference call, supplemented by an electronic link. Each Exercise would be led by the Project Facilitator (C. Scawthorn). The electronic link consisted of a website facility which permitted all Participants to log on to a website, read and write to a 'chat board', and see and mark up graphics posted by the Facilitator. The electronic link permitted real time display of maps and other figures, and also real time written communication among Participants. The specific facility employed for the Exercises is furnished by MCI, but similar facilities are available from numerous other vendors. Given time zone differences and other factors, it was decided that four hours would be an appropriate duration for each telephone conference call Exercise. The four hours would represent Phase 1 – that is, a period of several days.
4. **Time Interval between Exercises:** The minimum time interval between Exercises was governed by the fact that following an Exercise (a) that Exercise needed to be documented and evaluated, (b) that the evaluation of the Exercise needed to be communicated to Participants, and (c) that the script and details of the next Exercise might need to be modified based on the evaluation of the preceding Exercise. Given these considerations, it was

determined that the minimum interval to allow these tasks to be accomplished was one month. Also, since earthquakes requiring postearthquake investigations can occur at any time, the project should be accomplished in as timely a fashion as possible, so that it was decided that the three Exercises would be conducted at one month intervals.

5. **Selection of Scenario Earthquake Events:** For the purpose of this project, Scenario Earthquake events were earthquake events of such significance as would engage the NEHRP agencies in the consideration, and possibly the implementation, of the Plan. While foreign earthquakes are considered in the Plan as warranting investigation, only domestic US events were considered for the purpose of this project¹. Based on this definition, the project defined three criteria for selection of Scenario Earthquake events:

- That there is sufficient likelihood for a domestic US earthquake event of such significance.
- That should such an event occur, it would have effects warranting data collection and research likely to lead to an improved understanding and mitigation of earthquakes and their risks.
- That the events are selected, within the limitations of the project's resources, so as to cover the varying tectonic, built environment, organizational, governmental and other conditions likely to be encountered during actual implementation of the Plan.

Based on these criteria, a simple algorithm was developed which considered the likelihood and severity of earthquakes, and the emergency response experience and capability, in most parts of the US. The algorithm and its implementation are presented in Technical Memoranda provided on the enclosed CD. Ten possible earthquake events were selected for analysis using this algorithm, which resulted in a grouping of the ten possible events into three categories:

- two California events, representing a situation where a major earthquake will very likely be a very significant investigation opportunity, and where the NEHRP agencies will be coordinating with a state and 'locals' very experienced and capable of organizing and sustaining a post-earthquake investigation.
- New Madrid and the Pacific Northwest events, representing a situation intermediate between California, and
- Utah, Charleston, Boston, Anchorage, Guam and Puerto Rico, where the earthquake risk is somewhat lower than the two major California population centers, and where the NEHRP agencies may in some cases have to be more involved in organizing and sustaining a post-earthquake investigation.

One event was selected from each group, as the basis for Plan Exercises to be developed. The three Scenario Earthquake events selected were:

- (1) a Hayward M_w 7 event;
- (2) a New Madrid M_w 7 event, and
- (3) a Puerto Rico M_w 8 subduction event on the Puerto Rican Trench.

The sequence of the Exercise events was considered, and it was decided that they be Exercised in the order of Hayward, New Madrid and Puerto Rico.

¹ The domestic US is defined as the 50 states, Guam and Puerto Rico.

3. Scenario Earthquake Events

Scenario Earthquake events were defined as earthquake events of such significance as would engage the NEHRP agencies in the consideration, and possibly the implementation, of the Plan. While foreign earthquakes are considered in the Plan as warranting investigation, the degree of proposed coordination is less. Thus, only domestic US events were considered for the Exercises. Based on this, the project defined three criteria for selection of Scenario Earthquake events:

- That there is sufficient likelihood for a domestic US earthquake event of such significance.
- That should such an event occur, it would have effects warranting data collection and research likely to lead to an improved understanding and mitigation of earthquakes and their risks.
- That the events are selected, within the limitations of the project's resources, so as to cover the varying tectonic, built environment, organizational, governmental and other conditions likely to be encountered during actual implementation of the Plan.

3.1. Selection of Scenario regions

Based on the above criteria, a simple algorithm was developed which considered the likelihood and severity of earthquakes, and the emergency response experience and capability, in most parts of the US. The algorithm and its implementation are presented in Technical Memorandum No. 2, on the enclosed CD. Ten possible earthquake events were selected for analysis using this algorithm, which resulted in a grouping of the ten possible events into three categories:

- two California events, representing a situation where a major earthquake will very likely be a very significant investigation opportunity, and where the NEHRP agencies will be coordinating with a state and 'locals' very experienced and capable of organizing and sustaining a post-earthquake investigation.
- New Madrid and the Pacific Northwest events, representing a situation intermediate between California, and
- Utah, Charleston, Boston, Anchorage, Guam and Puerto Rico, where the earthquake risk is somewhat lower than the two major California population centers, and where the NEHRP agencies may in some cases have to be more involved in organizing, leading and sustaining a post-earthquake investigation.

One event was selected from each group, as the basis for Plan Exercises to be developed. The three Scenario Earthquake events finally selected are presented in Table 2, and are summarized below.

- **Hayward M_w 7 event**, resulting from a rupture of the northern and southern Hayward fault segments as defined in USGS OF 99-517. This was selected over a southern California event due to (a) it being perhaps the most likely event in California; (b) the presence of the fault on the Berkeley campus of the University of California; (c) the proximity of the fault to major infrastructure such as the BART (including its tunnels through the East Bay Hills and under San Francisco Bay), major highways, the Port of Oakland, and EBMUD and other water supply facilities; (d) the potential for major fires following the earthquake, as evidenced by 1906 San Francisco earthquake and the 1991 East Bay Hills fire; and (e) because it affects EERI, who is a key player in the NEHRP

Plan. A ShakeMap for this event developed by USGS is shown in Figure 2 (Note: the figure is for a M_w 6.9 event).

- **New Madrid M_w 7 event**, similar to the Dec. 16, 1811 event. This was selected over the Pacific Northwest event because it affects a region of the US with a larger population, where many people have not experienced earthquakes. It was also thought to be a good test of the Plan where the Scenario involved coordination across three to perhaps five or more state boundaries. The detailed Scenario included several foreshocks. A ShakeMap for the main event developed by USGS is shown in Figure 3.
- **Puerto Rico M_w 8 event**, on the Puerto Rican Trench, similar to the 1787 event. This was selected over the other events in the third category based on many factors, including (a) very poor soils and numerous high rise buildings in San Juan being affected by a distant large event (similar in some ways to the 1985 Mexico City earthquake, which resulted in numerous high-rise collapses); (b) the possibility of a tsunami, particularly in the Atlantic, where there is very little experience, and where it could affect the eastern seaboard of the US, as well as other localities; (c) lack of familiarity by most US investigators, with Puerto Rico; and (d) logistical and to some extent cultural and linguistic obstacles for US investigators, thus resembling in some ways a foreign earthquake. A ShakeMap for this event developed by USGS is shown in Figure 4.

Table 2 Scenario Earthquake Events

Scenario Earthquake event	M_w	PGA 10% in 50 yrs	Affected Popul. (millions)	Hist. Max M_w / year	Comment
Hayward (N+S)	M_w 7	0.6	6.8	7.7 / 1906	Similar to USGS OF 99-517.
New Madrid	M_w 7	0.4	7.7	7.8 / 1812	Similar to Dec 16, 1811 event.
Puerto Rico	M_w 8	0.22	3.8	8.1 / 1787	Similar to 1787 event: subduction on Puerto Rican Trench.

All three events have historical precedent. The sequence of the Exercise events was based on an increasing organization challenge to the NEHRP agencies, and it was decided that they be exercised in the order of Hayward (M_w 7), New Madrid (M_w 7) and Puerto Rico (M_w 8).

3.2. Detailed Scenario Events

Detailed definitions of the three Scenario Earthquake events and possible resulting consequences, as background for detailed Plan Exercise scripts based on these events, were developed, and are described here and completely detailed in technical memoranda provided on the enclosed CD. Each Scenario event was detailed in terms of the season and time of day at the time of the earthquake occurrence, the prevailing weather and other relevant conditions, and data on possible resulting consequences. The consequences were hypothetical, and based on a

combination of information in the literature on possible consequences resulting from these or similar scenarios, as well as experience in other earthquakes. As an example, Exercise 1 was based on a Hayward M_w 7 event, and is fully described in the next subsection. The scenarios for Exercises 2 and 3 are summarized in succeeding subsections, and are fully detailed in technical memoranda provided on the enclosed CD.

3.2.1. New Madrid M_w 7 event

*The first Scenario is based on a **Hayward M_w 7 event**, resulting from a rupture of the northern and southern Hayward fault segments as defined in USGS OF 99-517. A ShakeMap for this event developed by USGS is shown Figure 2. Specific attributes of this Scenario Earthquake, and possible resulting consequences include:*

- a. *The earthquake occurs at 12 noon on Saturday Oct. 25 of some year in the near future, without warning. The Hayward fault ruptures from near the Alameda-Santa Clara county border, to San Pablo Bay, a length of approximately 87 km, see figures. It is a bright sunny day with strong offshore foehn winds, as occur in that season in the Bay Area, resulting in a Very High Fire condition, and the Homeland Security Threat Level is Elevated (ie, third of five levels).*
- b. *Violent ground shaking (0.6g) occurs throughout the East Bay, and lesser but still damaging levels of ground shaking (>0.1g) occur at greater distances, see figures.*
- c. *Areas susceptible to liquefaction sustain widespread ground failure, particularly along the East Bayshore. Numerous landslides occur in the East Bay Hills (particularly Oakland and Berkeley Hills).*
- d. *Housing impacts include (ABAG, 2003):*
 - i. *Over 155,000 housing units are made uninhabitable.*
 - ii. *Almost 360,000 people are forced from their homes.*
 - iii. *Over 110,000 people require publicly-provided shelter.*
- e. *Numerous commercial and industrial buildings are damaged, throughout the Bay Area, mostly in the East Bay, but also in San Francisco, the Peninsula and the South and North Bay. Several dozen older high-rise buildings in Oakland and San Francisco collapse, some of which are apartment buildings, and a number of newer high-rise buildings are red-tagged, including the 1111 Broadway building in Oakland, which is a 24 story steel frame building completed in 1990 and which, the press reports, was the Region IX headquarters of FEMA. Since it is a pleasant Saturday, occupancy and loss of life is much lower than during a workday, or at night.*
- f. *Infrastructure impacts include:*
 - i. *The Incline section of the San Francisco-Oakland Bay Bridge, east of Yerba Buena Island, collapses². Numerous motorists are killed.*

² Author's interpretation of statements in Ch. 7, Maroney, EERI, 1996. Note that this interpretation applies to the existing (at the time of writing) of the original Incline section, built in the 1930's.

- ii. *The transportation system is crippled by over 1,600 road closures (ABAG, 2003)*
- iii. *Under its current condition, BART sustains about \$1 billion in damage (BART, n.d.) including:*
 - 1. *BART aerial structures (ie, elevated portions, on single columns) suffer some collapsed segments, and overall permanent displacements and misalignments along its Richmond to Fremont line, such that these portions of the system are out of service for several months.*
 - 2. *BART submerged tunnel, beneath San Francisco Bay, suffers permanent displacements near its San Francisco terminus, resulting in partial flooding, and loss of service for about 2 years. Riders manage to evacuate the tunnel without loss of life.*
 - 3. *BART's tunnel through the East Bay Hills, which intersects the Hayward fault, is sheared, but can be restored to service in about 6 months.*
- iv. *Port of Oakland sustains extensive liquefaction, but is partially operational within one week.*
- v. *EBMUD water and sewer service are out of service due to numerous pipe breaks, with extended outages in some areas, but are generally operational within several weeks;*
- vi. *Landline and mobile telephone service loses dial tone and service immediately, and is largely unusable for the first 72 hours.*
- vii. *Electric power fails immediately in the entire Bay Area, but is restored in the North Bay and Peninsular by the following day. In the East Bay, most areas have service restored within about one week.*
- viii. *Gas lines sustain some breaks in areas of ground failure. Tens of thousands of houses sustain service or in-building gas line damage, resulting in a number of fires, and tens of thousands of household gas valve closures. Weeks are required to restore service in many areas of the East Bay.*
- g. *The Berkeley campus of the University of California sustains major damage to about a dozen buildings on campus (UC, 2003). Due to it being a Saturday, the campus is sparsely populated and not many casualties occur. However, a football game is about to start in the California Memorial Stadium, which is actually intersected by the Hayward fault. The approximately 6 ft of offset within the stands of the stadium result in a partial collapse of the west side of the stands (of 1920s vintage reinforced concrete frame construction), with several hundred fatalities (many fans were still entering the stadium, and were under the stands) and thousands of injuries³.*

³ For readers who think this is improbable, recall that the 1989 Loma Prieta earthquake occurred during the World Series.

- h. Immediately after the earthquake, and for the rest of the day, fires occur throughout the affected area, for a total of about 150 ignitions. Fanned by the hot dry offshore winds, similar to those during the 1991 East Bay Hills fire, several of these ignitions result in:*
- i. Three major conflagrations in the East Bay, one each in Hayward, Oakland, and Berkeley. Each conflagration begins high in the hills, and burns about 2,500 buildings before winds abate late in the afternoon⁴.*
 - ii. Additionally, a number of fires break out in the eastern portion of San Francisco, particularly on Russian Hill. One of these results in a 100 block conflagration on the east slopes of Russian and Nob Hills, destroying about 4,000 buildings and causing several hundred fatalities. A smaller conflagration, still covering dozens of city blocks, destroys about 1,000 buildings in the Mission. Flying brands from these conflagrations cause numerous fires in the Western Addition and Richmond neighborhoods, resulting in loss of another 2,000 buildings.*
- i. Key personnel in EERI, which is a key player in the NEHRP Plan and is headquartered in Oakland, are unable to participate in the NEHRP Plan, for personal reasons as well as lack of telecommunications.*
- j. Key personnel in several other earthquake research organizations, particularly UC Berkeley Seismological Laboratory, the Pacific Earthquake Engineering Research Center (PEER) and the Consortium for Research in Earthquake Engineering, all of which are headquartered in the East Bay, are similarly impaired, both for personal reasons and due to lack of telecommunications.*
- k. USGS Menlo Park is not particularly impacted and is functional, although telecommunications are occasionally problematic.*

From Plan and Exercise point of view, key aspects of this Scenario included:

- The event occurred in a relatively small area (major damage 20 miles by 100 miles), so that one Clearinghouse should suffice.
- The region has previously experienced earthquakes, and has a plan for establishment of a Clearinghouse.
- There are a number of major earthquake institutions in the epicentral area, including EERI, PEER, UC Berkeley, Stanford, SJSU, CUREE, LLNL, SSA, USGS Menlo Park, EQECAT and RMS.
- EERI, one of the Plan Actors, is headquartered in the area, and the Script called for them to be initially out of operation, so that they must exercise their backup plan.
- The Disaster Field Office (DFO) is set up in Oakland Federal Building, so that either the State Office Building, or a site on the UC Berkeley campus (which has many recently retrofitted buildings, undamaged) could be chosen for Clearinghouse.

⁴ Similarly, recall that the 1991 East Bay Hills fire destroyed approximately 3,500 buildings in about 12 hours, without an earthquake.

Key aspects of these other two Scenario Events are summarized below, and are completely detailed on the enclosed CD.

3.2.2. New Madrid Mw 7 event

- A small earthquake in the New Madrid area initiated the Event. Scripted effects should result in a Plan Conference Call, but not implementation of the Plan.
- A second moderate earthquake occurs within 24 hours, in the Wabash Valley region, several hundred miles away. This should again result in a Plan Conference Call, but scripted effects will not justify implementation of the Plan.
- A third, major, earthquake, which should then result in implementation of the Plan.
- Epicentral area is relatively sparsely populated (near New Madrid), but effects occur at distance, in Memphis, Little Rock, St. Louis and Cincinnati,
- Fatalities in hundreds, widespread building damage, mostly moderate, some collapses.
- Very large areas of liquefaction, spread over 7 states, resulting in:
 - Enormous damage to roads, railroads, airports and pipelines.
 - Widespread damage (sloughing, settlement, cracking) to levees of the Mississippi River and its major tributaries. Event is in mid-February, and high water is expected in 10 to 15 weeks.
 - Major resulting economic impacts, due to disruption of transportation
- Large scale failures in levees of the Mississippi River and major tributary bluffs, resulting in damage to blufftop developments, particularly downtown Memphis, and hindrance to navigation.
- No particular damage to selected building types, so that NCST may not be warranted. However, NCST might focus on collapse of Mississippi river crossing bridge (overlap with DOT?), or damage to Mississippi navigational structures, esp. locks (overlap with USACE?).
- Major damage to infrastructure, as noted above
- Large economic loss, variously estimated \$20~100 billion.
- From a Plan point of view:
 - The event covers a very large area (200 mile radius, covering 7 states), so that multiple Clearinghouses are probably required. Opportunity for leveraging these via IT (eg, NEESgrid) exists.
 - The Homeland Security Threat Level is *Severe* (highest of five levels).
 - The region has not recently experienced significant earthquakes, but is developing a plan for establishment of a Clearinghouse, which will involve many players.
 - There are some earthquake institutions in the area, including CUSEC, some state geological surveys, the Mid Americas Earthquake (MAE) Center, Washington

Univ. (St. Louis), Memphis State U., U. Illinois, Purdue, etc. However, other players, such as MCEER, PEER, CUREE, TCLEE et al will also be involved.

- EERI has a chapter in the region.

3.2.3. Puerto Rico Mw 8 event:

- A very large offshore earthquake initiates the Script, which should result in implementation of the Plan.
- Widespread damage throughout the island of Puerto Rico as well as in the Virgin Islands and other locations. Hundreds of fatalities in US possessions, widespread building damage, mostly moderate, some collapses including a concentration of high-rise collapses in central San Juan (Hato Rey district).
- Major tsunami, affecting all coasts of Puerto Rico and Virgin Islands, as well as Hispaniola, Cuba and the Antilles. Damage in Puerto Rico due to tsunami is significant.
 - Significant areas of liquefaction, and landsliding across Puerto Rico.
 - Significant resulting economic impacts, due to disruption of transportation
- Damage to one building type (high-rises in Hato Rey) as well as to residential construction, so that NCST may be warranted. However, NCST might focus on collapse at Arecibo Observatory, which is a major economic loss.
- Collapse of the Arecibo Observertory (world's largest radio telescope, operated for NSF by Cornell University; very high profile facility due to its use in several Hollywood moves)
- The tsunami's scripted effects include, several hours later, a major tsunami inundation along the South Carolina coast (South Carolina personnel will be participating, as described below, but will not have been warned of this potential).
- From a Plan point of view:
 - The event covers a large area on several islands so that logistics are difficult and multiple Clearinghouses may be appropriate. Opportunity for leveraging these via IT exists.
 - The region has little experience responding to significant earthquakes.
 - There is a lack of familiarity for many US investigators with Puerto Rico, and logistical and to some extent cultural and linguistic difficulties for Mainland visitors (analogous to difficulties Plan implementation may encounter in foreign earthquake investigations). These difficulties create obstacles for the implementation of the Plan. They also are opportunities for research, particularly in the social sciences.
 - There are some earthquake institutions in the area, including the U. Puerto Rico and the Puerto Rico Seismic Network (PRSN), which have good capabilities, but limited resources. Other players, such as MCEER, PEER, CUREE, TCLEE et al will probably be involved.
 - EERI has a number of members on the Island.

- USGS has a Water Resources office on the island.
- large economic loss, variously estimated \$5~20 billion.

It should be emphasized that the choice and details of all Scenario events was kept strictly confidential, so as to incorporate a real element of surprise in the Exercises. However, due to the necessity to involve the appropriate state and local personnel, it was necessary to provide some general indication as to what region would be the subject of an Exercise. This is discussed further below.

4. Preparation, format and conduct of the Exercises

Before an Exercise could be conducted, a significant amount of work had to be accomplished. The preparation consisted of Interviews with NEHRP agencies, development of detailed Exercise Scripts, development and provision of Instructions to participants, and Communications Checks. Each of these activities is discussed next.

4.1. Interviews with NEHRP agencies

In preparation for the Exercises, a structured interview was conducted with each NEHRP agency and EERI, for the purpose of obtaining their views on the NEHRP Plan and the planned Exercises, understanding their current state of knowledge of the Plan, identifying what they hoped to learn from the Exercises, etc. The meetings were conducted by the Project Facilitator, and lasted one to two hours. The outcome of the Interviews was:

- It was confirmed that the agencies had previously reviewed and approved, and had a general familiarity with, the Plan. Scheduling the Interviews had typically caused them to renew their familiarity with the Plan.
- It was clarified that the Exercises were to be of the post-earthquake investigation *coordination only*, and not of either the detailed technical content of the post-earthquake investigation, or the entire Federal response to a major earthquake. This purpose of the Exercises was an initial point of confusion, and considerable relief was afforded when this point was clarified.
- The Schedule, Instructions and protocols for the Exercises were reviewed and accepted by the agencies.
- The key NEHRP agency personnel and the Project Facilitator met in person, which is always an advantage for subsequent conference calls.
- How each agency would function in an earthquake emergency, and their roles and responsibilities for the Plan in particular, were reviewed.

4.2. Development of detailed Exercise Scripts

Once the Scenario Events for each Exercise were identified, detailed Scripts were written. Each script consisted of a minute-by-minute series of communications that the Facilitator would verbally announce during the Exercise's telephone conference call and, in many cases, also accompany with a figure transmitted via the electronic link. In order to introduce an element of surprise similar to an actual earthquake, participants in each Exercise were told that the event would occur in one of two possible regions, with participants not knowing beforehand if the Exercise would affect their region, or not. That is, representatives of two regions were invited to participate in each Exercise, as follows:

- Exercise 1: Northern and Southern California
- Exercise 2: Central US and Utah
- Exercise 3: South Carolina and Puerto Rico

Participants were instructed: *If persons from the regions not the topic of an Exercise have been invited to participate, they will be recused from participating, but invited to listen in, and provide comments following the conclusion of the Exercise.*

Actions required by the Plan were tabulated, and identified in the Exercise Scripts. For each Exercise a table was prepared that laid out actual timing for the Script, simulated time during the incident (eg, 90 minutes into the Exercise might represent noon of the second day of the Scenario event), information for the participants to be Announced by the Exercise Facilitator, and Actions which the Exercise planners believed the participants should take to implement the NEHRP Plan. Participants were required to state Actions they take during the Exercise. That is, participants were advised that only identifiable Actions by participants constituted implementation of the Plan, and that they had to specifically identify actions as *Actions*, when they took them. Comparison of Actions Taken versus Actions required by the Plan would show whether the NEHRP agencies fulfilled, exceeded, or failed to implement the Plan. An example of the first few minutes of the Script for Exercise 1 is presented in Table 4. Complete final Scripts, which averaged about a dozen pages per Exercise, are presented Technical Memoranda provided on the enclosed CD.

4.3. Participation in and Instructions for each Exercise

Several weeks prior to each Exercise, Instructions were sent to the four NEHRP agencies and EERI, with the express instruction that *these entities were encouraged to invite any organization or entity to participate in any of the Exercises, as they felt appropriate.* This aspect had been reviewed with the agencies during the Interviews, and concerned who would participate in each Exercise. More specifically, for each Exercise, the NEHRP agencies (including EERI) could choose to have regional employees (eg, FEMA or USGS personnel from the appropriate region) and other representatives (eg, State geological agencies, State emergency management agencies, Pacific Northwest Seismographic Network, the California Clearinghouse, Utah SSC, CUSEC, South Carolina Seismographic Network, the Puerto Rico Seismic Network, etc) participate. It was the responsibility of that agency to notify those parties and obtain their participation in the Exercise. At the beginning of each Exercise, the Initial Announcement would identify the Earthquake and the affected region. If there were non-NEHRP agency participants who had been invited to participate who were from that region, they would participate per their arrangement with their host NEHRP agency. If there were non-NEHRP agency participants who had been invited to participate who were NOT from that region, they would NOT be able to participate in the Exercise, BUT would be invited to push their mute button and listen into the Exercise. Additionally, their comments and critique would be encouraged, in writing following the end of the Exercise.

The Instructions were four pages in length, and detailed the protocol for conducting the Exercise, covering such items as Purpose, Participants, Schedule, Communications, Communications Check, Electronic Link, Region, Exercise Agenda, Auditors, Speaker Identification, Recording, Cell Phones and Beepers, Participation, Announcements, Actions, and Breaks. The complete Instructions are provided in Appendix C, and are summarized here:

Each Exercise will begin with all participants signed onto the voice telecon and electronic link at 12:45 pm EST. Fifteen minutes will be used for a roll call and review of the Instructions. Each Exercises will begin with an Initial Announcement of an Earthquake somewhere in the world. The specifics of the Exercise Earthquake will not be available prior to the Exercise. The Announcement and subsequent information will

follow a prepared script, in a compressed timeframe. That is, the duration of the Exercise will be four hours clock time, representing approximately the first week following the Earthquake. Time during this first week is referred to as “Earthquake Local Time”, and will be stated in the time zone of the epicenter of the earthquake. The Exercise will address Phase I of the Plan, which is of three days duration, and the initial stages of Phase II. Beginning with the initial Announcement of the Exercise Earthquake, the Exercise will follow a Script, which at periodic intervals will present the participants with an unfolding earthquake incident. An example is a communication from the Exercise Facilitator at the 10th clock minute of the Exercise, stating “It is now 10:30 pm Earthquake Local Time, and a Presidential Disaster has been declared”. In between such announcements, participants are expected to implement the NEHRP Plan to Coordinate NEHRP Post-Earthquake Investigations. Statements of Actions they are performing should demonstrate their implementation of the Plan. Each Action should be identified as such. In between each statement of an Action, the participants are free to confer and discuss the situation, their options, etc in any manner, including using the electronic link to share data, figures, thoughts and other information. All discussions and communications shall be open to all participants⁵, and will be recorded both via a voice recording of the entire telecon, and on the electronic link. The Exercise will conclude at the end of four hours clock time (ie, at 5pm EST). Following each Exercise, participants are encouraged to communicate written comments and a critique.

WHO: *Each Exercise is directly for the NEHRP agencies, and the Earthquake Engineering Research Institute (EERI). Each NEHRP agency and EERI has the responsibility of involving other participants, as appropriate. That is, if the Exercise Earthquake occurs in the state of Oregon, as an example, one or more of the NEHRP agencies may feel that the Dept. of Geology and Mineral Industries (DOGAMI), as an example, should be a participant of the Exercise. If that is the decision of a NEHRP agency (including EERI), it will be the responsibility of that agency to (a) notify DOGAMI and obtain their participation in the Exercise, and (b) notify ATC, to arrange the logistics for DOGAMI, in this example, to participate. Under these conditions, the NEHRP agencies need to have some idea before each Exercise, as to the region of the world in which the Exercise Earthquake will be Announced. Conflicting with this is the desire to maintain an element of surprise, as to the Exercise Earthquake and Scenario. To reconcile these needs, the following procedure is being adopted:*

For Exercise 1, the Exercise Earthquake will affect one of the following regions: the Pacific Northwest, California, or the New Madrid region.

For Exercise 2, the Exercise Earthquake will affect one of the following regions: California, Utah, or the New Madrid region.

For Exercise 3, the Exercise Earthquake will affect one of the following regions: the Pacific Northwest, South Carolina, or Puerto Rico.

For each respective Exercise, the NEHRP agencies (including EERI) can choose to have regional employees (eg, FEMA or USGS personnel from the appropriate region) and other representatives (eg, State geological agencies, State emergency management agencies, Pacific Northwest Seismographic Network, the California Clearinghouse, Utah

⁵ If anyone can anticipate a situation in which privy communications should occur, please contact T. Holzer.

SSC, CUSEC, South Carolina Seismographic Network, the Puerto Rico Seismic Network, etc) participate. As noted above, it will be the responsibility of that agency to (a) notify those parties and obtain their participation in the Exercise, and (b) notify ATC, to arrange the logistics for their participation.

Thus, at the beginning of each Exercise, the Initial Announcement will identify the Earthquake and the affected region. If there are non-NEHRP agency participants who have been invited to participate who are from that region, they will participate per their arrangement with their host NEHRP agency. If there are non-NEHRP agency participants who have been invited to participate who are NOT from that region, they will NOT be able to participate in the Exercise, BUT are invited to push their mute button and listen into the Exercise. Additionally, their comments and critique will be encouraged, in writing following the end of the Exercise.

4.4. Communications Check

About a week prior to each Exercise, a pre-Exercise telecom, referred to as a Communications Check (*Comm Check*) was held, for purposes of checking communications, and reviewing the procedures for the Exercises. NEHRP agencies were expected to inform any other participating personnel of these dates. The Comm Check telecon was scheduled for one hour, and consisted of confirming that all parties could dial into the voice telecon, and that all parties could access the electronic link. Instructions for the Comm Check are contained in Appendix D.

4.5. Conduct of Exercises

The actual Exercises were conducted according to the following schedule:

Exercise 1: December 19, 2003

Exercise 2: January 9, 2004

Exercise 3: February 10, 2004

Each Exercise was scheduled for 1pm EST (10am PST), and was of four hours duration, with breaks about every hour. The three Exercises involved 29, 43 and 43 participants, respectively, and generally followed the Script with no major departures and with the great majority of participants attending during the entire Exercise. Disruptions were virtually nil, due to several factors: the Comm Checks had eliminated telecom and Electronic Link difficulties, the general tone (of a serious group of professionals) had been set by the Comm Checks and Instructions, and participants were asked to mute their telephones except when speaking. Each Exercise began with a roll call and Initial Announcement of an Earthquake somewhere in the world, followed by additional Announcements at periodic intervals that presented the participants with an unfolding earthquake incident. An example was a communication from the Exercise Facilitator at the 10th clock minute of the Exercise, stating “*It is now 10:30 pm Earthquake Local Time, and a Presidential Disaster has been declared*”. In between such Announcements, participants were instructed that they were expected to implement the *NEHRP Plan to Coordinate NEHRP Post-Earthquake Investigations*. Statements of Actions they were performing should demonstrate their implementation of the Plan. Each Action should be identified as such. Otherwise, participants were free to confer and discuss the situation, their options, etc in any manner, including using the electronic link to share data, figures, thoughts and other information. All discussions and communications were open to all participants, and were recorded both via a voice recording of

the entire telecon, and on the electronic link. Examples of several of the numerous maps, photos and 'breaking news messages' from *ENN – the Earthquake News Network*, transmitted over the Electronic Link, are presented in Figure 5 to Figure 10. Table 5 provides an example of the text messages sent via the 'chat' facility of the Electronic Link during Exercise 2.

The Exercise concluded with a second roll call at the end of four hours clock time (ie, at 5pm EST), which variously represented about the 7th day of the Scenario event. Following the formal conclusion of each Exercise, a few minutes were allocated during the telecom for immediate verbal comments and feedback, and participants were also encouraged to communicate written comments and a critique. Verbal comments were almost entirely positive, and almost no written comments were subsequently received. Full audio recordings, and written transcripts taken from those recordings, are included on the enclosed CD. A one page sample transcript of the Audio recording of Exercise 2 is presented in Table 6.

4.6. Evaluation of each Exercise and feedback to Participants

Following each Exercise, the Exercise was evaluated by the Facilitator, and the evaluations for Exercises 1 and 2 provided to the NEHRP agencies and EERI for their information and comment. Exercise 3 was also evaluated, but that evaluation was not circulated. Evaluations of all three Exercises are contained in the Technical Memorandum documenting each Exercise, which are provided on the enclosed CD.

5. Evaluation of the Exercises and Participant Performance

This section discusses the criteria by which each Exercise was evaluated and, in a general manner, the effectiveness of each Exercise and performance of the participants.

Evaluation Criteria: While a number of criteria exist for evaluation of an Exercise of a Plan, the primary criteria for evaluation was based on the purpose of the Exercise, which is that the Exercises are of the NEHRP agencies implementation of the Plan only, not of the NEHRP or other agencies response neither to the entire emergency, nor of the investigation by others of the event. Based on this, the primary criteria was whether or not the Actions called for in the NEHRP Plan were effectively implemented during the Exercise. Other criteria for Evaluation included:

- **Effectiveness of the Exercise:** was the Exercise realistic, did it engage and hold the participants' attention, address all relevant aspects of the Plan, and educate and prepare the participants for an actual incident? How should future Exercises differ?
 - **Performance of the Participants:** did the participants understand and follow the Plan?
 - **Integrity of the Plan:** was the Plan itself satisfactory, addressing all aspects of the hypothetical incident? Were the participants able to understand and follow the Plan, or does the Plan need to be modified?
6. **Exercise effectiveness and Participant Performance:** Exercises 1 and 2 were evaluated prior to the next Exercise, and Exercise 3 evaluated following that Exercise, based on the above criteria. While the performance of the participants varied in each Exercise, in terms of their understanding and reactions to the unfolding Scenario, and their ability to implement the Plan vis-à-vis the Scenario, the Exercises were found to be generally successful. More specifically:
- **Effectiveness:** All three Exercises were felt by Participants to be very realistic, and their attention was engaged for the entire four hours. Only positive comments were received following each Exercise, with the exception by one Participant that perhaps three Exercises was excessive.
 - **Participant Performance:** As might be expected, NEHRP agency performance improved significantly between Exercises 1 and 2, and somewhat less in Exercise 3 (ie, the 'learning curve' was being climbed, and a point of diminishing returns was being reached).

Exercise 1 was perhaps the simplest, in that it covered a relatively localized area, and involved the California Clearinghouse (which has developed its own investigations Plan) and other persons experienced in investigating actual earthquakes. An interesting aspect was that Exercise 1 on Dec. 19 was closely followed by the San Simeon earthquake on Dec. 20, Figure 11. Participants in the Exercise subsequently reported that Exercise 1 had been very useful in their response to the actual earthquake (W. Leith, S. Tubbesing, M. Greene, personal communications).

Exercise 2 posed more difficulties to the Participants, as it covered a broad multi-state area, and the non-NEHRP agency Participants were considerably less experienced than in

Exercise 1. Exercise 2 also had several ‘surprises’, such as foreshocks, which realistically represented a CUS earthquake scenario. These confused the response of some Participants, but in general the NEHRP agency performance (which was the focus of the project) was significantly improved over Exercise 1, implementing actions in a timely manner.

Exercise 3 was perhaps the most complex (the Exercises had been designed to be increasingly complex), involving Puerto Rico and then having the ‘surprise’ of a South Carolina tsunami. The Participants generally did not give the initial Puerto Rico tsunami enough consideration, and were somewhat surprised when the Exercise South Carolina tsunami ‘occurred’. Exercise 3 also extended the NEHRP Plan by incorporating a request by the President’s Science Advisor for a briefing. This is not called for in the Plan, but is quite realistic, and the NEHRP agencies did not adequately come together for the requested briefing. Overall, however, training and preparedness of the NEHRP agency personnel, and all other Participants, was significantly enhanced by the three Exercises.

- **Integrity of the Plan:** The Plan itself was found to be quite adequate, although a number of actions or tasks, detailed below, were identified as desirable to further enhance NEHRP agency response.

6. Resources Required to Conduct Plan Exercise

This section discusses the resources required to conduct the Exercises as described in this report, in order to serve as guidance in planning for future Exercises. The full Work Plan for the Project is provided on the enclosed CD. Table 3 summarizes the effort by task on the part of the Facilitator, from which it can be seen that the total effort was approximately 1.5 person-months, equivalent to 25% effort by one professional over the six-month⁶ duration of the project.

Table 3 shows that 40% of the effort was spent in developing the Exercises, about 30% in conducting the three Exercises (ie, about 10% per Exercise), about 10% each in evaluating and documenting the Exercises, and 10% in project management. A significant part of the Exercise development effort, perhaps half, was spent in meeting with the NEHRP agencies, primarily in Washington DC (that trip accounted for the bulk of the direct expenses). The importance of the meetings with the NEHRP agencies cannot be over-emphasized. The meetings focused the attention of the key personnel on the Exercises, clarified for them the purpose for the Exercises, elucidated how the Exercises would be conducted and the resulting benefits, and developed a rapport among participants which greatly enhanced the effectiveness of the four hour telephone Exercises.

Points to be noted regarding resource expenditures include:

- Table 3 represents the effort for three Exercises – in the future, if only one Exercise is to be conducted, the effort would be somewhat reduced, but certainly not to one-third of the effort. Compensating for this is that this report can serve as a template for future Exercises, so that there is a significant savings in development work.
- Utilizing one senior professional for the project, who had expertise across most aspects involved in the Exercises, provided significant efficiencies. These aspects included direct knowledge of each of the various regions, their seismicity, infrastructure and building practices, and also in general the earthquake performance of facilities, and the issues of emergency response and data collection. If personnel with lesser experience are utilized, more personnel and relatively more effort will probably be required.
- Table 3 does not include clerical support, nor project oversight by ATC and USGS personnel. Clerical support consisted primarily of transcribing each of the four-hour long recording of the three Exercises, which was a non-trivial task. This task might be simplified by the use of voice-recognition software for future transcriptions⁷. Project oversight consisted primarily of attending the meetings indicated in Table 3. That is, project oversight required approximately an additional 100 hours, on the part of ATC and USGS personnel.
- Table 3 does not include the resources committed to the Project by the NEHRP agencies, primarily in the form of personnel time, but also including use of a meeting room at USGS

⁶ The actual project duration was closer to ten months, but there was a hiatus of about 4 months, due to non-project reasons.

⁷ The first two Exercises were recorded on traditional analog tape (ie, a cassette) and converted to digital. The third Exercise was directly digitally recorded. Digital records permitted the recordings' quality to be noise-reduced and otherwise greatly enhanced, with little effort. The resulting digital recordings were of good audio quality, probably sufficient for the use voice-recognition, which is currently emerging as a viable technology.

for each of the Exercises. The personnel time commitment of each of the NEHRP agencies, aside from the USGS oversight discussed above, is estimated to have averaged two professionals each for the initial meeting, at least one Comm Check, and then each of the Exercises. This equates to a minimum of 60 person-hours per agency, or 240 person-hours total for the four agencies. This estimate does not include preparation time on their part, which is not known to the Project.

- Similarly, Table 3 also does not include resources committed to the Exercises by other participating agencies and personnel, which was again primarily in the form of personnel time. Aside from NEHRP agency and Project Personnel, each Exercise involved a minimum of a dozen or more state and local agency and other persons, each of whom would have participated in a minimum of one Comm Check and the Exercise, for a minimum of five hours – that is, for the three Exercises together, conservatively a minimum of 180 person-hours.
- Lastly, Table 3 does not reflect the cost of the telephone conference calls – each Exercise was 4 hours duration, involving about 15-20 hook-ups calling in to the ‘toll-free’ number (actually, paid for by the project), and also linking in to the Electronic Link. The charges for these communications for the three Exercises and associated Comm Checks, totaled approximately \$8,000.

In summary, total resources committed to the three Exercises were 1.5 person-months by the Facilitator for the design, implementation and documentation of the Exercises, and at least twice this time-commitment on the part of participants. Direct costs and in-kind contributions (non-personnel) totaled several thousand dollars.

Table 3 Professional Resources Required to Design, Conduct and Document the Exercises

Task	Professional Effort (hrs)	% by Task
1. Project Initiation and Management	10	4%
2. Work Plan	12	6%
Meetings	4	
3. Develop Exercises	64	40%
Meetings	42	
4. Conduct Exercises	54	28%
Meetings	21	
5. Evaluate Exercises	16	9%
Meetings	8	
6. Final Report	25	13%
Meetings	8	
Total	264	100%
Direct Expenses	\$2,000	

7. Lessons Learned and Recommendations

A number of lessons were learned from the Exercises, which led to several recommendations. This section first discusses the lessons, and then presents the recommendations.

7.1. Lessons Learned

- a) **Plan Adequacy:** The Plan itself served quite well in the Exercises – no major problems or omissions in the Plan were identified.
- b) **Plan Maintenance:** Maintenance of the Plan is an on-going need. Within USGS a NEHRP Postearthquake Investigations Plan Coordinator (NPIPC) should be designated, who would be the Plan’s ‘keeper,’ a procedural resource to the NEHRP agencies during implementation of the Plan in an actual event. The NPIPC would be responsible for maintaining (1) the Plan, (2) a list of candidate NICs, and (3) other Plan-related infrastructure (eg, data archive. The NPIPC would be the Plan Coordinator, and not necessarily the NEHRP Investigation Coordinator (NIC) for any particular postearthquake investigation.
- c) **NEHRP Agency Implementation and Plan Exercises:** The specific NEHRP agency personnel involved in the Exercises had some familiarity with the Plan prior to the Exercises, and those personnel are now knowledgeable in the Plan, and in the needs and opportunities related to post-earthquake Investigations in general. Note that this has the added benefit of being almost equally applicable to other natural and technological post-event investigations.

While specific NEHRP agency personnel involved in the Exercises are now knowledgeable, the NEHRP agencies in general need more formal training and exercising in the Plan, and probably in NEHRP overall. Regarding the Plan, despite three Exercises, specific actions were not clearly implemented on schedule. These included for example:

- *Within 1 day of the event, USGS must convene a teleconference call in which Participants confer and USGS appoints a NEHRP Investigations Coordinator (NIC) from a pre-screened list.* These telecons were not clearly announced, or didn’t occur, in several of the Exercises.
- *Within 2 days of the event, NIST should consult with NEHRP agencies in Acting to appoint NCST teams.* NIST typically was clear in appointing an NCST team, but did not consult. Consultation between agencies was in general haphazard and not formal, even though they were all on the telecon together.
- *Within 7 days of the event, NIC convene a Ph II meeting, with an agenda-based consideration of investigation opportunities and needs.* The agenda was not clearly developed by the NIC during the Exercises.
- All NEHRP agencies should be on the NEIC Notification Checklist. This suggestion has been made, but whether this will occur is unclear. This is an example of no centralized NEHRP or Plan responsibility.

With time and changes in personnel, this familiarity in the Plan within the NEHRP agencies will fade. Exercises of the Plan should occur annually, and include a process for orientation in the Plan, for NEHRP agency and other interested parties. While these Exercises might be conducted by consultants, as these first three have been, we recommend that they be conducted by the NPIPC or other persons in USGS, so as to institutionalize the Plan and in general postearthquake investigations within the agency charged with that task (ie, USGS). This documentation of the three Exercises can serve as a template for whoever facilitates future Exercises. Future Exercises should move about the country, using regions such as the Pacific NW, Utah, the Northeast, Alaska and Hawaii, before returning to the regions already exercised

- d) **Communication:** The Electronic Link employed in the Exercises was new to many participants, who found it quite useful. Many assumed it was a permanent feature of NEHRP, and didn't realize it would not exist following the current project. Virtually all participants thought a Electronic Link NEHRP should be created and maintained, for use in actual earthquakes and perhaps other NEHRP agency business.
- e) **Data Coordination:** The Plan stipulates that *All NEHRP agencies making earthquake-related grants issue an instruction to all current grantees, and a similar instruction be made part of all future grantees, that they should inform the USGS of their URLs in the event of a relevant earthquake. USGS to provide information as to who to be informed.* This Action was not adequately addressed during by the agencies in the Exercises, and should probably be pre-implemented, and automated, to the maximum extent possible.
- f) **Data Archiving:** There is no plan for archiving of data collected as part of NEHRP postearthquake investigations. This gap was clearly identified and the subject of a major Recommendation in the Plan (USGS, 2003). The Exercises emphasized this need once again.
- g) **NEHRP agency coordination.** NEHRP agencies would benefit from meeting regularly to communicate the status of each agency's NEHRP related activities.

7.2. Recommendations

Based on the experience of this project, the following Recommendations are provided:

1. **Plan Maintenance:** NEHRP agencies should meet regularly to communicate the status of each agency's NEHRP related activities. Within USGS a NEHRP Postearthquake Investigations Plan Coordinator (NPIPC) should be designated, who would be the Plan's 'keeper,' a procedural resource to the NEHRP agencies during implementation of the Plan in an actual event. The NPIPC would be responsible for maintaining (1) the Plan, (2) a list of candidate NICs, and (3) other Plan-related infrastructure (eg, data archive. The NPIPC would be the Plan Coordinator, and not necessarily the NEHRP Investigation Coordinator (NIC) for any particular postearthquake investigation.
2. **Plan Exercises:** Exercises of the Plan should occur annually, and include a process for orientation in the Plan, for NEHRP agency and other interested parties. The NPIPC or other persons in USGS should conduct these Exercises, so as to institutionalize the Plan and in general postearthquake investigations within the agency charged with that task (ie, USGS). Future Exercises should move about the country, using regions such as the Pacific NW, Utah, the Northeast, Alaska and Hawaii, before returning to the regions already exercised.

3. **Communication:** A NEHRP Electronic Link should be created and maintained, for use in actual earthquakes and perhaps other NEHRP agency business.
4. **Data:** Coordination of data collection, preservation, archiving and dissemination should be greatly improved. Formal procedures and tools for sharing of data and information should be developed. A centralized (eg, web-based) data archive should be developed and maintained.

Glossary

ANSS	Advanced National Seismic System
ASCE	American Society of Civil Engineers
ATC	Applied Technology Council
BSSC	Building Seismic Safety Council
CA OES	California Governor's Office of Emergency Services
COSMOS	Consortium of Organizations for Strong Motion Observation Systems
CREW	Cascadia Region Earthquake Workgroup
CUREE	Consortium of Universities for Research in Earthquake Engineering
CUSEC	Central U.S. Earthquake Consortium
EERC	Earthquake Engineering Research Centers
EERI	Earthquake Engineering Research Institute
EMPG	Emergency Management Performance Grant
EOC	Emergency Operations Center
EQNET	Earthquake Information Network
FEMA	Federal Emergency Management Agency
GPS	Global Positioning System
HAZUS	Hazards U.S.
IBC	International Building Code
ICC	Interagency Coordination Council
ICSSC	Interagency Committee on Seismic Safety in Construction
InSAR	Interferometric Synthetic Aperture Radar
IRC	International Residential Code
IRIS	Incorporated Research Institutions for Seismology
MAE	Mid-America Earthquake Center
MCEER	Multidisciplinary Center for Earthquake Engineering Research
NASA	National Aeronautics and Space Administration
NEES	Network for Earthquake Engineering Simulation
NEHRP	National Earthquake Hazards Reduction Plan (PL 95-104 as amended by PL 101-614; note that On Wednesday, October 1, 2003 the U.S. House of Representatives passed by voice vote HR 2608, Reauthorizing the National Earthquake Hazards Reduction Program and establishing the National Institute of Standards as the new

lead agency and providing increased funding for research and applications. Senate action on the reauthorization is not expected until early 2004).

NEHRP agencies	Federal Emergency Management Agency, US Geological Survey, National Science Foundation, and National Institute for Standards and Technology
NEIC	National Earthquake Information Center
NESEC	Northeast States Emergency Consortium
NETAP	National Earthquake Technical Assistance Program
NFPA	National Fire Protection Association
NIC	NEHRP Investigations Coordinator – not the same as the NPIPC, this is the person selected to coordinate the postearthquake investigation for a particular earthquake. The NIC can be from government, academia or industry, and should have some familiarity and training in the Plan. A list of pre-screened NIC candidates should be maintained by the NPIPC.
NISEE	National Information Service for Earthquake Engineering
NIST	National Institute of Standards and Technology
NPIPC	NEHRP Postearthquake Investigations Plan Coordinator – not the same as the NIC, this is the person within USGS who oversees the Plan and its maintenance, and serves as a resource to the NIC in a particular event. In certain circumstances, the NPIPC may serve as the NIC.
NSF	National Science Foundation
NSMP	National Strong Motion Program
PCC	Policy Coordination Council
PDD	Presidential Disaster Declaration
PEER	Pacific Earthquake Engineering Research Center
PGA	Peak ground acceleration
Plan	Plan to Coordinate NEHRP Post-Earthquake Investigations, published as USGS Circular 1042
SCEC	Southern California Earthquake Center
Scenario Earthquakes	Domestic US earthquake events of such significance as would engage the NEHRP agencies in the consideration, and possibly the implementation, of the Plan.
TCLEE	Technical Council on Lifeline Earthquake Engineering (a Technical Council of the American Society of Civil Engineers)
USGS	U.S. Geological Survey
WSSPC	Western States Seismic Policy Council

References

FEMA 383 (2003) *Expanding and Using Knowledge to Reduce Earthquake Losses: The National Earthquake Hazards Reduction Program Strategic Plan 2001 – 2005*, Federal Emergency Management Agency, Washington DC.

USGS (2003) *Plan to Coordinate NEHRP Post-Earthquake Investigations*, Prepared in Coordination with the Federal Emergency Management Agency, National Science Foundation, and National Institute of Standards and Technology. Developed with the assistance of the Applied Technology Council under agreement 1434-WR-97—AG-00015, ATC-35. Circular 1242, U.S. Dept. Interior, U.S. Geological Survey, Reston VA 20003.

Table 4 Example Exercise Script – Exercise No. 1 Hayward Event

NEHRP Plan Exercise No. 1 Script - Hayward Event

<u>Exercise Time (mins)</u>	<u>EQ LOCAL TIME</u>	<u>Exercise Announcement</u>	<u>ACTIONS BY NEHRP AGENCIES, ANTICIPATED BY EXERCISE PLANNERS</u>						<u>Action taken during Exercise?</u>
			USGS	FEMA	NIST	NSF	OES	EERI	
Announce start of Exercise									
-		It is Saturday Oct. 25 of some year in the near future. The Homeland Security Threat Level is <i>Elevated</i> (ie, third of five levels). At any time, any participant should feel free to state an Action they are taking.							
0.30	Oct 25 12 noon	An earthquake has occurred, but only people feeling the event are aware of it.						self-anncmt	self-anncmt
1.00	1200.30	USGS NEIC (Golden) and S. Calif. Mgmt Center, Padadena, detect an event.							
1.30	1203	via DOD channels, the White House situation room is informed of a major earthquake in the San Francisco Bay Area, where it is a bright sunny day with strong offshore winds. Fire conditions are Very High.							
2.00	1203	rumors are heard at the NY Stock Exchange and in Washington of something happening on the West Coast.							
2.30	1204	First analysis by S. Calif. Mgmt Center, Padadena indicates a Mag 7 event centered near Oakland CA							

NEHRP Plan Exercise No. 1 Script - Hayward Event

<u>Exercise Time (mins)</u>	<u>EQ LOCAL TIME</u>	<u>Exercise Announcement</u>	<u>ACTIONS BY NEHRP AGENCIES, ANTICIPATED BY EXERCISE PLANNERS</u>						<u>Action taken during Exercise?</u>
			USGS	FEMA	NIST	NSF	OES	EERI	
3.00	1205	Rapid earthquake information (REI) is automatically transmitted by SCMC via pagers and web to selected persons.							
3.30	1206	SCMC tries to telephone OES, Sacramento with REI, but can't get through.							
4.00	1207	CNN and networks interrupt regular schedule to report a major earthquake in the San Francisco Bay Area							
4.30	1208	FEMA is alerted by the White House, and also picks up TV broadcasts. A pager alert is broadcast to key staff.							
5.00	1210	USGS Golden has a Preliminary Determination of Epicenter (PDE), showing a M 7 event in or near Oakland CA							who gets calls at each NEHRP agency?
5.30	1211	Golden receives a call from FEMA, and reports the PDE.							
6.00	1212	Golden calls the USGS Program Coordinator and reports a M7 event rupturing the full length of the North and South segments of the Hayward fault, from near the south end of San Francisco Bay to San Pablo Bay.							if possible, transmit a figure showing rupture length on road map,

Table 5 Chat Record of Exercise 2
NEHRP PLAN EXERCISE 2
Jan. 9, 2004
Written Messages

08:46:44 AM from FACILITATOR to All Participants	WELCOME TO THE 2nd NEHRP PLAN EXERCISE
09:10:27 AM from FACILITATOR to All Participants	- It is Tuesday Jan 9 of some year in the near future. The Homeland Security Threat Level is HIGH (ie, highest of five levels). At any time, any participant should feel free to state an Action they are taking.
09:10:57 AM from FACILITATOR to All Participants	0.30 Jan 9, 0900 An earthquake has occurred, but only people feeling the event are aware of it.
09:11:09 AM from FACILITATOR to All Participants	1.00 0903 via DOD channels, the White House situation room is informed of an earthquake in the Memphis area, where it is a bright sunny day with temperatures in the 20s (F).
09:11:45 AM from FACILITATOR to All Participants	2.00 0907 ENN and networks interrupt regular schedule to report an earthquake in the midwest
09:12:34 AM from FACILITATOR to All Participants	2.30 0908 FEMA is alerted by the White House, and also picks up TV broadcasts. A pager alert is broadcast to key staff.
09:12:54 AM from FACILITATOR to All Participants	3.00 0910 USGS Golden has a Preliminary Determination of Epicenter (PDE), showing a M6.2 event south of Cape Girardeau MO
09:13:17 AM from FACILITATOR to All Participants:	0911 Golden receives a call from FEMA, and reports the PDE.
09:13:55 AM from FACILITATOR to All Participants:	0912 Golden calls the USGS Program Coordinator and reports a M6.2 event south of Cape Girardeau MO
09:14:06 AM from USGS J. Gomberg, B. Schweig to All Participants:	USGS Memphis calls CUSEC, Bob Bauer and Norm Hester
09:16:34 AM from FACILITATOR to All Participants:	USER NAME npe PASSWORD reston
09:18:48 AM from FACILITATOR to All Participants:	0920 Golden continues analysis, initiates Notification Checklist, making calls to USGS offices, White House, DOD, TN/IL/AR OES, EERI, MCEER, MAE, PEER, USACE
09:19:08 AM from FACILITATOR to All Participants:	1000 By now, all four NEHRP agency persons responsible for the Post-earthquake investigation coordination have seen TV footage, and made telephone calls, but have not yet conferred. None of them have been able to identify specific cases of major damage.

Table 6 Part of Exercise 2 Audio Recording Transcript

Part of Exercise 2 Audio Recording Transcript:

- CS: It is 10:15. Radio stations have live interviews with New Madrid, Cape Gerardo, and Memphis fire chiefs. All provide similar reports, which is that it shook real good and have had a number of calls and runs but have not found much damage. This is News Anchor Strong Temblor; we have first pictures of earthquake damage in this morning's magnitude 6.2 earthquake north of Memphis. We see here damage to Farmer Brown's chimney, and here cracks in a levy on the Mississippi near Madrid. This is Strong Temblor, ENN News Anchor.
- Unk.: I'll take the action to call Lucy Jones at home in Southern California and ask her to evaluation the likelihood of this being a foreshock.
- CS: It's 10:30, FEMA Sitrep 1 is sent to all four NEHRP agencies - M6.2 earthquake occurred, TN, MO and Arkansas activated EOCs, hospitals in Memphis and Cape Girardeau activated emergency plans, several houses and farm buildings collapsed; MODOT reports two highway bridges with significant cracking; Memphis and many smaller communities report water main breaks. And I see that Jim Wilkinson has sent a message here, to people, I'm just calling attention to it.
- JW: Call received from Susan Tubbesing from EERI. Action - CUSEC is gathering reports from its member states on damage to infrastructure. CUSEC has notified Association of CUSEC State Geologists to begin activation of regional post earthquake investigation plan.
- Unk: According to our plan for postearthquake technical information clearinghouse, it will be activated with earthquakes greater than 5.5 magnitude; therefore we have contacted the state surveys and the state emergency management agencies, the state DOTs in several states to get input for the selection of the sites.
- BB: This is Bauer in Illinois. We'd be contacting our Emergency Management Agency to say that we want to be associated with their forward command, where we'd most likely set up a clearinghouse.
- CS: It's 10:45. St. Louis radio station KROK broadcasts reports that seismologists are warning of possible large earthquakes in next few days, and that an army convoy with supplies, including 10,000 body bags, has left St. Louis headed towards Memphis.
- JH: This is John Hill, Indiana Geological Survey; I'm confused about the location of the earthquake. There seems to be conflicting information on the USGS web site. One topographic map site shows it near Blytheville, the other map shows it up near Sikeston.
- CS: You can see the information there and I'm trying to get the shake map on the web facility. Okay, here's the shake map for the time being.
- JK: This is Jack Kuehn from the MAE Center. <cut out>
- CS: This is the facilitator. Okay, I've pasted the shake map into a white board on the left-hand side of your screen in the chat facility. Do people see that?
- JK: Yes.
- CS: You can now look at that as much as you wish at that scale. Sorry about that.
- DA: This is USGS Reston, following a complication on the phone call with the other NEHRP agencies. We've collectively taken the action to select Buddy Schweig as the NEHRP investigations coordinator for this event.

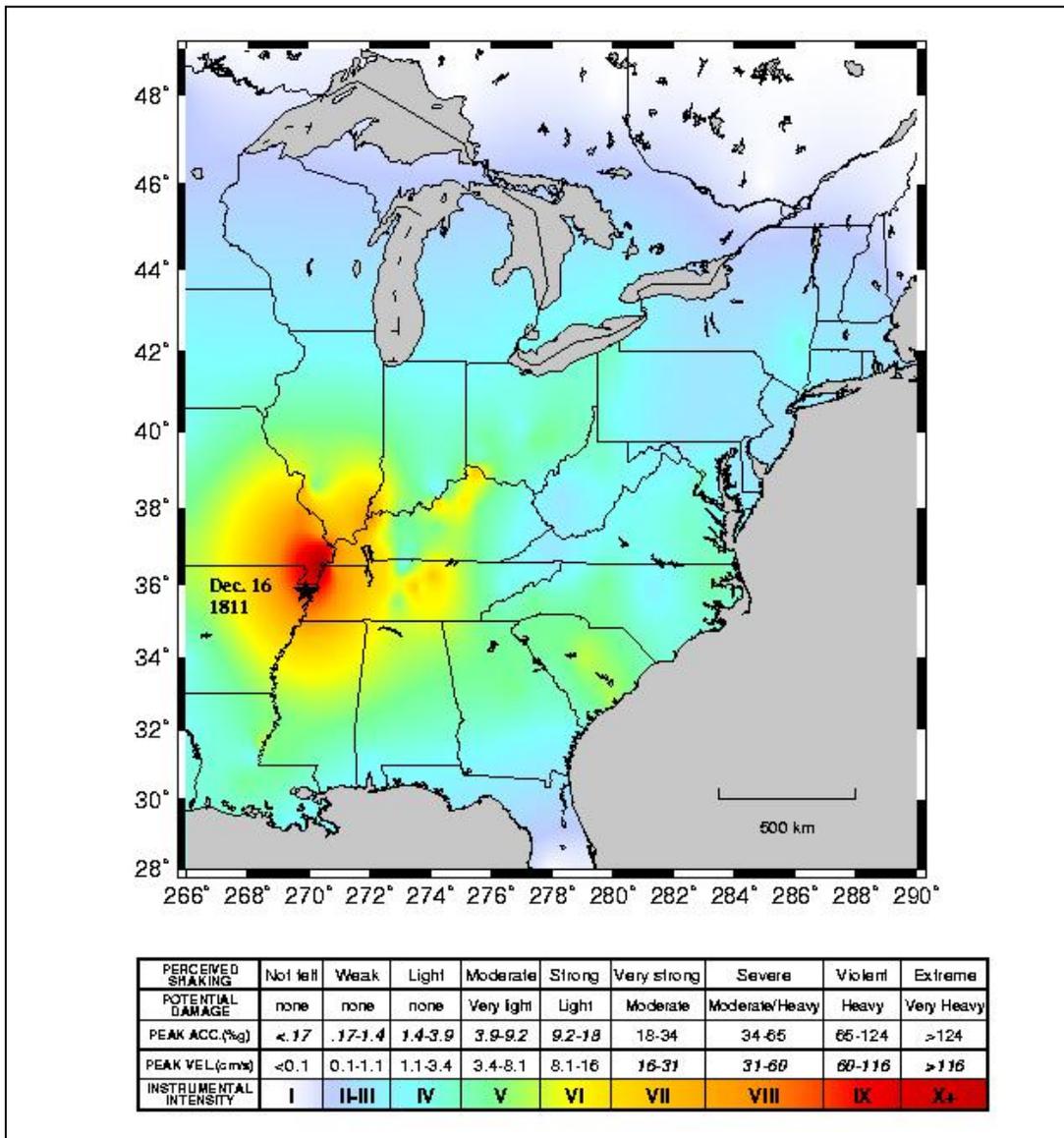


Figure 3 Scenario 2: Event 2 - New Madrid M_w 7 Earthquake (Source: USGS)

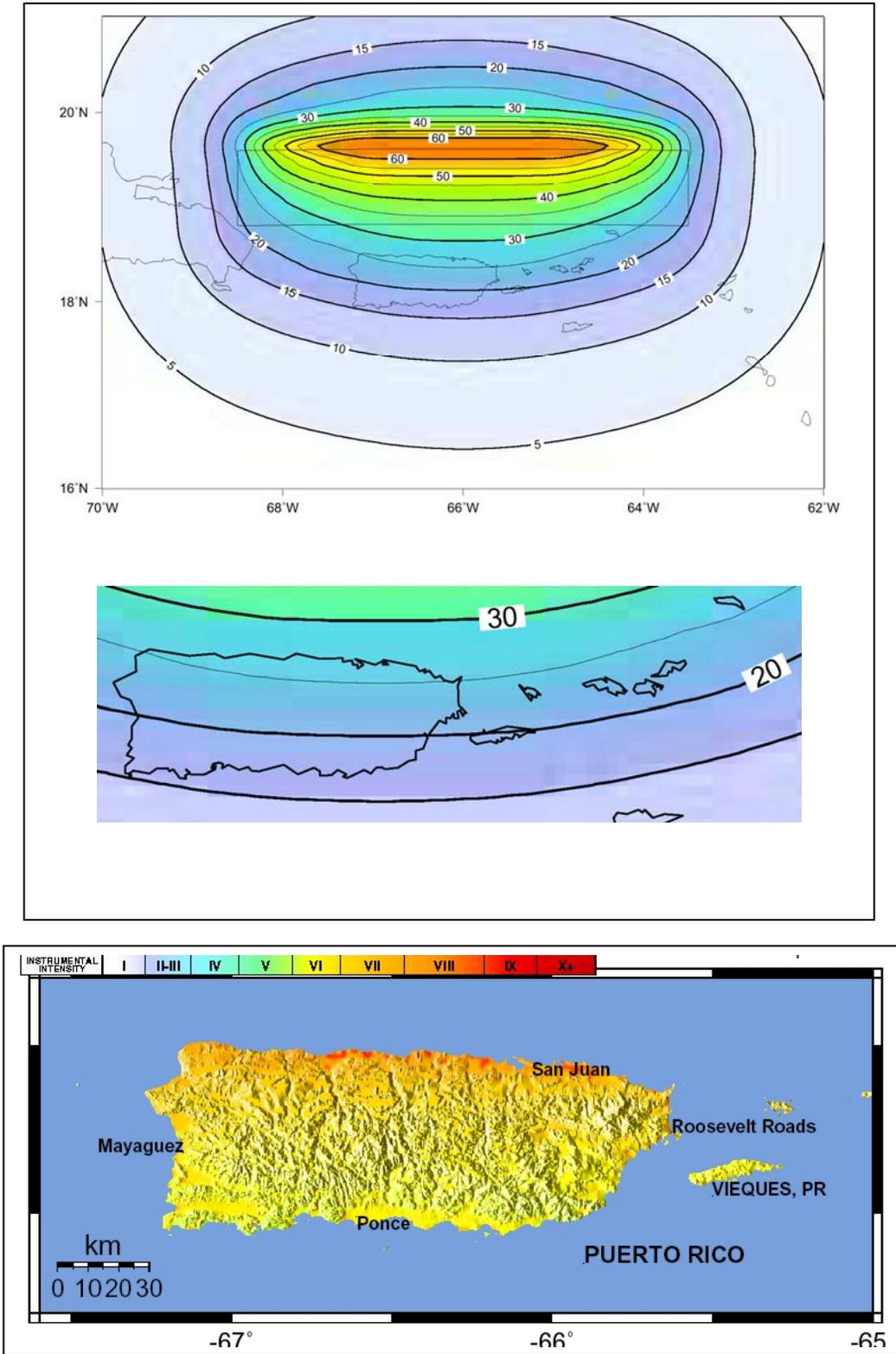


Figure 4 Scenario 3: Puerto Rico M_w 8 Earthquake (t) overview of region and source, with PGA contours, and (b) detail of Puerto Rico (Source: USGS)

BREAKING NEWS

We interrupt our regular broadcasting.



We take you to ENN News Anchor *Strong Temblor*:

Temblor: *We are just receiving reports of a major earthquake in North California, possibly in the San Francisco Bay Area...*

Voiceover: *Strong, we apologize for interrupting, but we have local affiliate KSHK on the line:*

Voiceover: *This is KSHK's Happi Center, in Modesto – confidential sources inform us they've just picked up radio traffic from commercial airline pilots, saying they're being diverted to Los Angeles, due an earthquake in San Francisco. Furthermore, other sources are picking up traffic on police scanners, similarly talking of a huge earthquake in San Francisco.*

Temblor: *Thank you Happi. More at 1pm. This is Strong Temblor, ENN News Anchor.*



Strong Temblor



Figure 5 Exercise 1 Mockup Breaking News, from ENN – the Earthquake News Network.

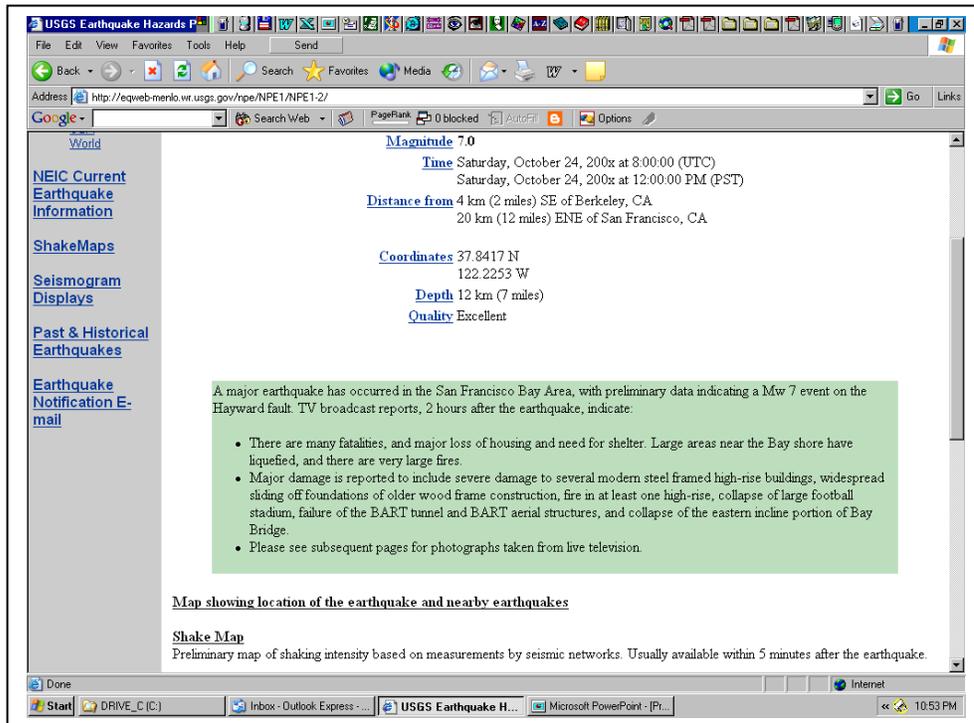
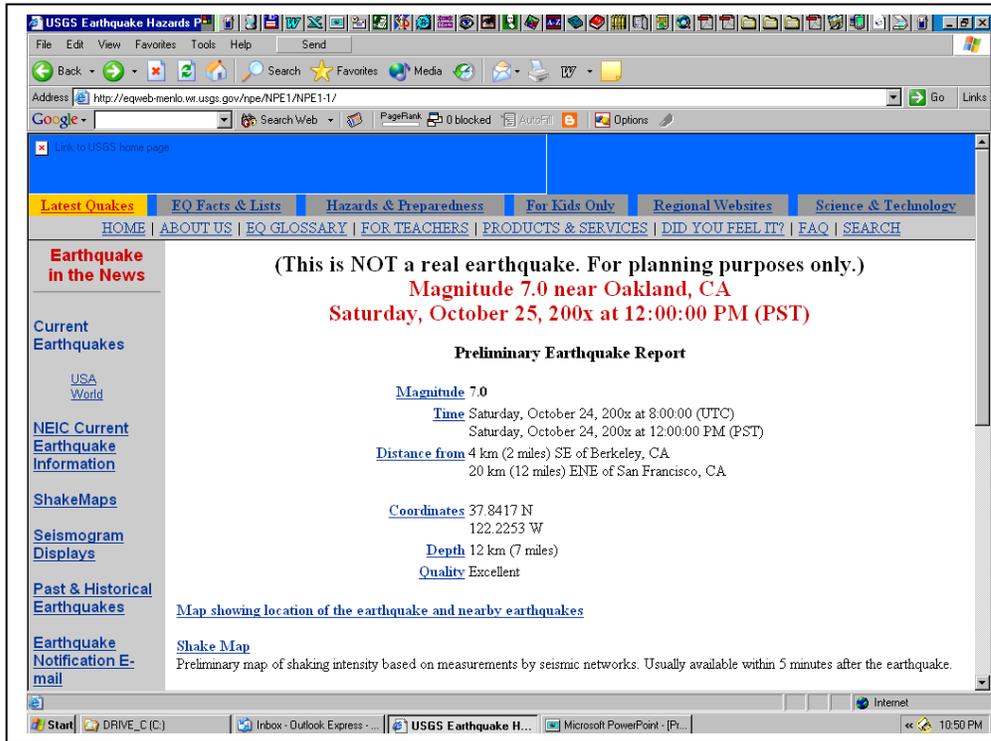


Figure 6 Exercise 1 Mockup Initial USGS Website
(courtesy L. Wald, USGS, Golden CO)



Figure 7 Exercise 1 Mockup First Televised Aerial Photo, and ENN Reporter “Strong Temblor”
(original photo: C. Scawthorn)

We take you to ENN News Anchor *Strong Temblor*:

Temblor: We now have first pictures of earthquake damage in this morning's M8 earthquake north of Puerto Rico... Unfortunately, earlier reports of light damage appear to have been wrong, and we are now finding many collapsed buildings. I draw your attention to three areas in particular – Santurce, an older area of high-rises, where numerous older concrete buildings have collapsed; also Hato Rey, the trendy business center of modern San Juan, where numerous more modern highrises have collapsed; Old San Juan, surprisingly, has apparently had little damage.



Strong Temblor

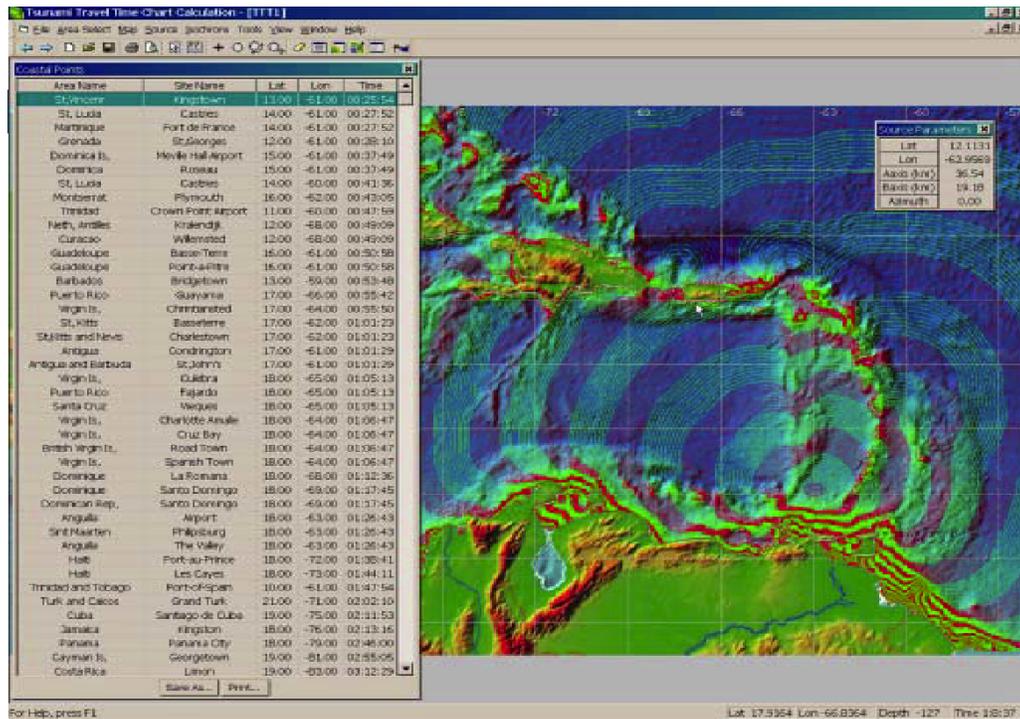
ENN.com

Temblor: This is *Strong Temblor*, ENN News Anchor.



© C. Scawthorn, 1985. Used with permission

Figure 8 Exercise 3 Mockup Televised Photo, and ENN Report



We take you to ENN News Anchor *Strong Temblor*:

Temblor: We now reports of damage at the Arcibo Radio Telescope Observatory, in northwestern Puerto Rico. The Arcibo dish is the world's largest, and is well-known to people everywhere due to its being featured in James Bond moves, as well as the Jodie Foster movie about searching for extra-terrestrial intelligence. We understand that one of the towers collapse, dropping the 1000 ton suspended Gregorian structure 500 ft. to the dish below. Fortunately, no one appears to have been killed in the collapse. The dish is operated by Cornell University, for the National Science Foundation, by the way. This is Strong Temblor, ENN News Anchor.



Strong Temblor



Figure 9 Exercise 3 - selected messages

We take you to ENN News Anchor Strong Temblor:

Temblor: We interrupt regular broadcasting to announce that we have reports of large waves, perhaps due to this morning's Puerto Rico tsunami, striking the shoreline of South Carolina. The city of Charleston appears to have been particularly hard hit – actually, damage appears confined to a number of marinas, and some low-lying areas. However, we have reports of many people being washed out to sea, due to no warning being issued for the east coast of the US.



Strong Temblor



Figure 10 Exercise 3 - selected messages

USGS Earthquake Hazards Program

Latest Quakes | EQ Facts & Lists | Hazards & Preparedness | For Kids Only | Regional Websites

HOME | ABOUT US | EQ GLOSSARY | FOR TEACHERS | PRODUCTS & SERVICES | DID YOU FEEL IT? | FAQ | SEARCH

Earthquake in the News

Current Earthquakes

USA World

NEIC Current Earthquake Information

ShakeMaps

Seismogram Displays

Past & Historical Earthquakes

Earthquake Notification E-mail

Magnitude 6.5 - CENTRAL CALIFORNIA
2003 December 22 19:15:56 UTC

Preliminary Earthquake Report
 U.S. Geological Survey, Menlo Park, California
 U.C. Berkeley Seismological Laboratory, Berkeley, California

A strong earthquake occurred at 19:15:56 (UTC) on Monday, December 22, 2003. The magnitude 6.5 event has been located in CENTRAL CALIFORNIA. The hypocentral depth was estimated to be 8 km (5 miles). (This event has been reviewed by a seismologist.)

Magnitude 6.5

Date-Time Monday, December 22, 2003 at 19:15:56 (UTC)
 = Coordinated Universal Time
 Monday, December 22, 2003 at 11:15:56 AM
 = local time at epicenter

Location 35.706°N, 121.102°W

Depth 7.6 km (4.7 miles)

Region CENTRAL CALIFORNIA

Distances 11 km (6 miles) NE (49°) from San Simeon, CA
 17 km (10 miles) N (356°) from Cambria, CA
 20 km (13 miles) W (260°) from Lake Nacimiento, CA

Source U.S. Geological Survey, Menlo Park, California
 U.C. Berkeley Seismological Laboratory, Berkeley, California

Event ID nc40148755

Felt Reports Two people killed and about 40 buildings collapsed or severely damaged at Paso Robles. At least 40 people injured in the Paso Robles-Templeton area. Buildings damaged and small fires occurred at Cambria and Morro Bay. The airport at Oceano was closed due to cracks in the runway. More than 10,000 homes and businesses were without power in the Paso Robles area. Felt (VII) at Atascadero, Bradley, Cambria, Cayucos, Creston, Lockwood, Los Osos, Morro Bay, Nipomo, Oceano, Paso Robles, San Miguel, San Simeon, Shandon and Templeton; (VI) at Arroyo Grande, Beverly Hills, Grover Beach, Guadalupe, Pismo Beach, San Luis Obispo, Santa Margarita and Santa Maria; (V) at Avenal, Danville, Filmore, Inglewood, King City, Lompoc, Santa Inez, Santa Monica, Solvang, Taft and Wasco; (IV) throughout west-central California; (III) from San Francisco and Santa Rosa to Los Angeles and Oceanside. Felt in much of central California and at Bullhead City, Arizona.

Figure 11 Information on Dec 22, 2003 Central California (San Simeon) earthquake

Appendix A Contents of the Enclosed CD

Enclosed with this report is a compact disc (CD) containing the following materials:

- Project Work Plan
- TM1: Selection and Sequencing of Scenario Earthquakes
- TM2 Scenario Earthquakes
- TM3 NEHRP Plan Exercise Scripts
- TM4 Exercise 1 Implementation and Evaluation
- TM5 Exercise 2 Implementation and Evaluation
- TM6 Exercise 3 Implementation and Evaluation
- Audio Recordings of the Three Exercises

Appendix B Example NEHRP Agency Interview Form

Five interviews were performed, as follows:

- EERI: Oct. 27, 2003 at EERI offices, Oakland CA (S. Tubbesing and M. Greene, EERI)
- FEMA: Oct. 29, 2003 at the USGS offices in Menlo Park (M. Mahoney and J. Lusk, FEMA)
- NSF: Nov. 13, 2003 at NSF offices in Arlington VA (NSF CMS: G. Ulsoy, D. Wenger, R. Frangasz, C. Astill; NSF GEO: K. Shedlock)
- USGS: Nov. 13, 2003 at USGS offices, Reston VA (M. Blanpied, USGS)
- NIST: Nov. 14, 2003 at NIST offices, Gaithersburg MD (S. Sunder and S. Cauffman, NIST)

Interview forms were completed for three of the interviews (NSF, USGS, NIST). This Appendix provides the completed interview form for NSF as an example.

=====

NEHRP agency meetings

Agency:	NSF
Date:	13 NOV 03 – 9AM – 1020AM
Attending:	CMS: G. Ulsoy, D. Wenger, R. Frangasz, C. Astill GEO: K. Shedlock

Discussion Points	Response / Notes
PLAN: Do you have a copy of the Plan?	
What do you think of the Plan?	DW: bit idealistic in sense that Plan implies Feds control researchers, which isn't actually the case. KS: (1) Plan not realistic, in that earth science decisions are made in first 12 hrs (deployment of instruments, remote sensing flyovers, etc); no one with earth science responsibilities seems to have been involved in writing the Plan (2) for Denali, NSF has informed others (USGS) of all funding and other actions, but has not been informed by others (USGS) of any of their actions – NSF has not received any report.
How do you see your Agency implementing the Plan?	GEO: first 12 hrs (see above) ENG: EERI, SGER; PIs will be calling Plan ok for supplemental funding NSF would encourage PIs to contact clearinghouse.

	KS emphasizes that local 'power centers' will emerge
Who is the POC for the Plan, in your Agency?	Priscilla Nelson (Special Asst. Dir Engg); its suggested that Ulsoy be backup
Who would be the decision-maker(s) within your Agency?	See above
What other responsibilities would your agency have in an emergency?	none
Beyond the NEHRP agencies, who else would you be interacting with, in implementing the Plan? (eg, Calif. Clearinghouse?). Should they be involved in the Exercise?	Funded investigators, but otherwise NSF unclear on who they might interact with. CRS suggests examples of who they might have involved in the Exercises (CGS, ERCs, etc)
What are some post-earthquake Investigation and Research needs, and priorities?	KS: depends on event, but Remote sensing (INSAR, LIDAR, aerial photo) ENG: remote sensing less used by CMS PIs,
Do you foresee problems with implementing the Plan?	EERI not funding geotechs
Do you think IT will be sufficiently, and efficiently used, in the next post-EQ Investigation?	DW: social sciences – no; engg, maybe RF: EERI effort with Palm / Frost / Accela should be fruitful
Are there other technologies that might be better used in the next post-EQ Investigation?	Not asked
How could the Plan be better?	Not asked (see above)
EXERCISES: Did you receive a copy of the Project Work Plan?	
What do you think of the idea of the Exercises? Are they a nuisance, or a positive step?	Seen as valuable in the sense that it gets agencies working together. Why 3? (CRS explains that 3 were thought required to cover the variables of high/low seismicity, high/low experience, high/low capabilities, etc; also that first is seen as 'rocky', so at least 2 needed, and that feedback will be encouraged and perhaps the 3 rd might not be needed, or a 4 th might be required)

Review the Instructions, and how the Exercises will be conducted.	CRS does this, in outline
What do you think of the Instructions, and the Exercise format? Schedule?	CMS on retreat Dec. 2,3 so that date ng. Suggest Dec. 4 th , but Boulder Oversight Meeting in DC on 4 th (Mahoney likely there), so 5 th is suggested. (NB: Tom H ng on 5 th).
What would be some good Regions, for an Exercise? Why?	Regions of infrequent seismicity, such as Washington, New York, Boston. Case of upper NYS EQ which received lots of attention is cited.
What would you like to see in an Exercise?	DW: one thing might be a situation where the locals take over (usurp) the event (not his words, but something like this)
How do you hope to benefit from the Exercises?	Better understanding of how the other agencies work.
At the completion of the three Exercises, what would you like to see achieved?	See above
If there are lessons from the Exercises, what do you think they might be? How might they best be captured? Communicated?	Not asked

Other:

1. Priscilla Nelson, who is the NEHRP rep in NSF, could not attend due to last minute meeting on cyber infrastructure. CRS hung around hoping to catch her.
2. KS emphatic that she would be in touch with local earth scientists very fast, and moving very fast. CRS asked if she thought she'd be able to be in contact with Craig Weaver in the event of a large PNW event, for example. KS responded that UW internet site is hardened, and communications highly assured. Wasn't so sure about Caltech or Menlo Park/UC Berk seismo. (CRS should check with Lind Gee and Tom Holzer re telecom reliability of these sites).

Appendix C Participant Instructions

The following Instructions were provided to the NEHRP agencies and EERI, for the guidance of Participants:

INSTRUCTIONS EXERCISES OF THE NEHRP POST-EARTHQUAKE INVESTIGATION PLAN

Revision History

No.	Date	Substance of Revisions
1	30 Nov. 2003	Para. 1: emphasis added Para. 3~6: Change in schedule, and information re Comm Checks Para. 7: Pacific NW deleted from Exercise 1.

These are the Instructions on how the NEHRP Plan Exercises will be conducted. Please review these carefully prior to each Exercise. These Instructions are being sent to:

- USGS: William Leith, and Michael Blanpied
- FEMA: Michael Mahoney, J. Lusk
- NIST: S. Sunder
- NSF: G. Ulsoy, P. Nelson, J. Whitcomb and K. Shedlock
- EERI: S. Tubbesing, M. Greene

It is the responsibility of the above addressees to distribute these Instructions to other personnel in their agencies, and invitees (described further below).

If you have any questions, please don't hesitate to contact the USGS Project Officer, Tom Holzer (650-329-5637) or the Exercise Facilitator, Charles Scawthorn (510-528-0780). Questions should be submitted as early as possible, but at least one day prior to an Exercise. These Instructions will be reviewed at the start of each Exercise, but you are asked to be familiar with them by that time.

1. Purpose: The purpose and overall project for the Exercises is described in the project Work Plan, which you have been provided a copy of. **The Exercises are of the NEHRP Post-earthquake Investigations Plan only – they are not an exercise of the overall emergency.**

2. Participants: The Exercises are directly for the NEHRP agencies, and the Earthquake Engineering Research Institute (EERI) only. These parties may invite others to participate, as explained below. The NEHRP agencies and their invitees are referred to as the participants. Additional to the participants will be the Exercise Project Office (T. Holzer), and the Exercise Facilitator (C. Scawthorn).
3. Schedule: The schedule for the preparatory activities and the three Exercises is:

Date	Day	Time (EST)	Activity (Region)
Dec. 4, 2003	Thursday	1~2 pm	Communications Check
Dec. 18, 2003	Thursday	1~2 pm	Communications Check (repeat)
Dec. 19, 2003	Friday	12:45~4pm	Exercise No. 1 (California)
Jan 9, 2004	Friday	12:45~4pm	Ex. No. 2 (Utah or Central US)
Feb. 10, 2004	Tuesday	12:45~4pm	Ex. No. 3 (S. Carolina or Puerto Rico)

Each Exercise will begin at 1pm EST (10am PST), and will be of four hours duration. Participants are to call in at 12:45pm EST, in order to review these Instructions and receive late information. Please note that times are East Coast (EST) and that participants in other time zones should adjust accordingly. Several breaks will be scheduled during the Exercise.

4. Communications: Each Exercise will be conducted via a telephone conference call, which participants will call into. The number and password will be sent to you by the Applied Technology Council (ATC). The Project Officer and Exercise Facilitator will be at the USGS in Menlo Park, and any participants are welcome to those facilities to participate in person, rather than by telephone.
5. Communications Check: Prior to the first Exercise, a telecon or Comm Check will be held for all participants, as shown in the above schedule (the telecon will be repeated, as is also shown, for those unable to attend the first Comm Check, or still having questions). The purpose of the Comm Check is for participants to check their access to adequate communications, and to review the procedures for the Exercises. This is a one hour session, in which participants call in to a "800" telephone number, and may optionally log onto an internet MCI chat room site.
6. Electronic Link. Two forms of electronic link are being used for the Exercises:
 - A USGS website, and
 - An MCI "chat room" website

URLs for both sites will be forwarded to shortly.

The USGS website will be analogous to USGS websites created after recent earthquakes. At an appropriate time during the Exercise, it will display the typical ShakeMap and parameters for the hypothesized event for that

Exercise. Thus, participants should plan on having web access for the Exercise.

Additionally, an MCI “chat room website” is being employed for the Exercises. Use of this chat room is optional for participants, but is encouraged. The site allows participants to receive text and graphics additional to those being shown on the USGS website. Participants will be able to receive a text version of the Exercise Script as it is being spoken, and also be able to receive maps and other graphics during the Exercise. A tutorial on the use of the MCI chat site will be provided during the Comm Check one hour session. Note that downloading of some software for using the MCI site is required, and that this has been successfully performed at the USGS in Menlo Park already, so that downloading to federal and other sites hopefully will not be a problem. The download and installation is performed during the tutorial, and only takes a few minutes (assuming a DSL or equivalent connection speed).

7. Region: Each NEHRP agency and EERI has the option of involving other parties, as appropriate⁸. Under these conditions, the NEHRP agencies need to have some idea before each Exercise, as to the region of the world in which the Exercise Earthquake will be Announced. Conflicting with this is the desire to maintain an element of surprise, as to the Exercise Earthquake and Scenario. To reconcile these needs, the following procedure is being adopted:
 - For Exercise 1, the Exercise Earthquake will affect an urbanized region of **California**.
 - For Exercise 2, the Exercise Earthquake will affect one of the following two regions: **Utah, or the New Madrid** region.
 - For Exercise 3, the Exercise Earthquake will affect one of the following two regions: **South Carolina, or Puerto Rico**.

For each respective Exercise, the NEHRP agencies (including EERI) can choose to have additional employees, including regional employees (eg, FEMA or USGS personnel from the appropriate region) and other relevant persons (eg, State geological agencies, State emergency management agencies, and consortia such as the California Clearinghouse, Utah SSC, CUSEC, South Carolina Seismographic Network, the Puerto Rico Seismic Network, NEES, etc) participate. As noted above, it will be the responsibility of that agency to (a) notify those parties and obtain their participation in the Exercise, and (b) notify ATC, to arrange the logistics for their participation.

⁸ For example, if the Region for the Exercise has been identified as the Pacific Northwest, one or more of the NEHRP agencies may feel that the Oregon Dept. of Geology and Mineral Industries (DOGAMI), should be a participant in the Exercise. If that is the decision of a NEHRP agency (including EERI), it will be the responsibility of that agency to (a) notify DOGAMI and obtain their participation in the Exercise, and (b) notify ATC, to arrange the logistics for DOGAMI, in this example, to participate.

8. Exercise Agenda: Following a review of these Instructions and a roll call, each Exercise will begin at 1pm EST, with an Initial Announcement. In the initial part of the Exercise, the Facilitator will continue to make succeeding Announcements, which will be informing the participants of an unfolding incident. Each Announcement will begin with a bell or other distinctive sound, and a statement of the time in the epicentral area. This time will progress faster than real time, so that the four hours of the Exercise will represent about a week's duration.
9. Auditors: If there are non-NEHRP agency participants who have been invited to participate who are from that region, they will participate per their arrangement with their host NEHRP agency. If there are non-NEHRP agency participants who have been invited to participate who are NOT from that region, they will NOT be able to participate in the Exercise, BUT are invited to push their mute button and audit the Exercise. The Initial Announcement will identify who should recuse themselves. However, the comments and critique of Auditors are encouraged, in writing following the end of the Exercise.
10. Speaker Identification: Each time a person speaks, they are asked to identify themselves, such as "Smith here: I am Acting to...". Please try to remember to do this.
11. Recording: Each Exercise will be audio recorded. Please speak clearly, loudly and slowly, but not unnaturally so, during the Exercise.
12. Cell Phones: Participants are requested to silence cell phones and pages for the duration of the Exercise, with the exception of those participants who required to have cell phones or pages accessible due to emergency responsibilities.
13. Participation: During each Exercise, due to the Scenario Earthquake, certain participants may not be able to participate in the initial hours of the Scenario event, because the hypothetical Scenario Earthquake affects them. If that is the case, the Exercise Facilitator will so stipulate the first time such a participant attempts to Act, or others attempt to contact that participant. At a later time, the Script may allow that that participant is no longer impaired, and can Act, and the Facilitator will so stipulate.
14. Announcements: There are two kinds of Announcements which will be made by the Facilitator: (i) informational, such as the Initial Announcement at the start of the Exercise, or the occurrence of a TV broadcast, etc, which simulate what the participants would likely be experiencing, and (ii) correctional. The latter are either to correct a misunderstanding of the participants (eg, they are told it is 7am but misunderstand and act as if it is 7pm) or, in certain circumstances, to remind or prompt the participants as to what the Plan requires. For example, a key part of the Plan is that the USGS in consultation with the NEHRP agencies shall appoint an Investigations Coordinator. If that doesn't occur, the Exercise will likely be thrown off track. If the USGS and NEHRP agencies don't act to appoint an Investigations Coordinator, the Facilitator at some point will remind them this is a key step in the Plan. Presumably, although this may occur during the first Exercise, the participants should not need prompting in later Exercises.

While the first few minutes of each Exercise will primarily consist of the Facilitator making a series of Announcements informing the participants of an unfolding

- incident, this pattern will tail off, and the Facilitator will say less and less. It is anticipated that the participants will gradually but quickly assume their natural roles, and begin implementing the Plan. While any manner of discussion, caucus or conferring is permitted during the Exercise, all such communications should be ‘open’ – that is, no off-line discussions should occur.
15. Actions: While the participants can engage in any manner of discussion, etc during the Exercise, these discussions do not constitute implementation of the Plan. Only identifiable Actions by participants constitute implementation of the Plan. Therefore, participants are requested to identify Actions by statements such as “Smith here: I am Acting to schedule...”. Statements of Actions should be as detailed, but concise, as possible, so as to demonstrate the credibility of accomplishing the Action.. The Exercise Facilitator may ask for details on how an Action is being taken, such as ‘who is being called?’
16. Breaks: As noted earlier, there will be several breaks during the Exercises – about 15 minutes each hour. These breaks should be used for refreshment, but can also be used by participants to plan their next Actions. However, if participants wish to confer during the break, they should do so on the telephone conference call.

Each Exercise is an ‘open’ Exercise – that is, each Exercise is intended not as a test, but rather as a learning experience. If participants are unclear as to what Actions to take, or the intent of the Plan, they should make such comments during the Exercise (or later, if they wish), and then continue to implement the Plan as best they can. As a team, the participants bring an enormous amount of talent and experience to this task. Identifying gaps and weaknesses in the Plan is the purpose of the Exercise.

Again, if you have any questions, please don’t hesitate to contact the USGS Project Officer, Tom Holzer (650-329-5637) or the Exercise Facilitator, Charles Scawthorn (510-528-0780).

Appendix D Communications Check Instructions

The following Communications Instructions were provided to the NEHRP agencies and EERI, for the guidance of Participants:

COMMUNICATIONS CHECK INSTRUCTIONS AND COMMUNICATIONS DATA

(re Exercises for NEHRP Plan to Coordinate Post-earthquake Investigations)

This memo provides instructions for the Communications Check (“Comm Check”) for the Exercises of the NEHRP Plan to Coordinate Post-earthquake Investigations (the “Plan”). The Comm Check is being held 1-2pm EST (10-11 PST) Thursday Dec. 4, and also the same time on Dec. 18, in preparation for Exercise 1 (Ex. 1 takes place 1-5pm EST Dec. 19, Friday).

Communications for the Exercises has two dimensions: voice and electronic net conferencing.

AUDIO: The voice or audio access is via a toll free number, provided below under Participant Access. Participants should call into that telephone number and gain access using the passcode, by the appointed time.

When a Participant joins the telecon, please announce your arrival by stating your name and affiliation. A roll call will be held at the 5th minute of the telecon. Late arrivals should announce their name and affiliation, and will have to ‘catch up’ regarding other Participants, etc.

The Audio telecon is currently limited to 30 Participants, which should suffice. If a caller is denied access due to the maximum being exceeded, that caller should call Bernadette Mosby at the Applied Technology Council (650-595-1542), who will assist the caller in getting onto the telecon.

NET CONFERENCING: Following the roll call, Participants will be ‘walked through’ logging onto the MCI. The instructions are provided below, including the passcodes, etc. If a Participant is unable to log onto the Net Conference, it is not the ‘end of the world’ – Participants will still be able to participate via the Audio link only. The Net Conference capability simply enhances the Exercise⁹.

WEBSITE: Additional, and also a partial alternative, to the Net Conferencing will be the posting of some information and maps at the USGS website which is used to post real earthquake

⁹. One point that may prove a bit confusing in the Net Conferencing aspect is that the “Host” of the Telecon will be shown as “Bernadette Mosby”, an ATC staff member, even though the Exercise Facilitator (Scawthorn) will actually be serving as the Host. The MCI Net Conferencing capability was set up by Bernadette, and it has not yet proven possible to change it, although we’re still trying.

information: <http://earthquake.usgs.gov> . This Website will be used during the Exercises and also in real events, and Participants should bookmark it on their browser.

EXERCISE INSTRUCTIONS: Following the Communications Check, the Instructions for the Exercise will be reviewed (Participants have received these already). In the time remaining, any remaining questions will be fielded, although questions can also be sent to the Exercise Facilitator at any time at cscawthorn@att.net.

PARTICIPANT ACCESS

AUDIO PARTICIPANT ACCESS:

Toll Free Number: 877-696-8055

Press 1 for representative

Participant Passcode: xxxx

NET CONFERENCING:

CLOSE ALL APPLICATIONS, especially e-mail and Outlook!!

<https://e-meetings.mci.com>

Under “Join Events” on the left hand side, select “Join Net Conference”

Net Conference/Meeting Number = xxxx

Conference/Meeting Passcode (case sensitive) = xxxx

press the **Proceed** button

A form will appear, in which you should enter your name, email etc. Enter this info, check all boxes (agreeing to MCI terms etc), and press the **Proceed** button

A message, **Preparing Meeting Manager**, will appear and a progress bar will indicate the progress of the software download and setup. This may take as long as 5 minutes the first time the site is accessed.

A window will then open called “Worldcom Meeting Center”, indicating that a meeting is in progress. Leave this window open! (However, you may minimize it.)

Another window will open called **WebEx Meeting Manager**. This is the window that will be shared among participants.