



2016 South Carolina Full-Scale Earthquake Exercise – ‘Shaken, Not Stirred’

After-Action Report/Improvement Plan

May 31, 2016

The After-Action Report/Improvement Plan (AAR/IP) aligns exercise objectives with preparedness doctrine, including the *National Preparedness Goal* and related frameworks and guidance. Exercise information required for preparedness reporting and trend analysis is included.

EXERCISE OVERVIEW

Exercise Name	2016 South Carolina Full-Scale Earthquake Exercise – ‘Shaken, Not Stirred’
Exercise Dates	March 14-16, 2016
Scope	Integrate Federal, State, Regional and Local capabilities necessary to save lives and protect the public and their property following an earthquake. Extent of play involved response and decision making over two full days and an additional day of near- and intermediate-term recovery activities.
Mission Area(s)	Response and Recovery
Core Capabilities	Planning, Operational Coordination (Response), Situational Assessment, Public and Private Services and Resources, Operational Communications, Public Information and Warning, Mass Search and Rescue Operations, Operational Coordination (Recovery), Economic Recovery, Health and Social Services, Housing, Infrastructure Systems (Recovery)
Objectives	The full-scale exercise objectives are defined on pages 3-4 and the tabletop objectives are defined on pages 14-15.
Threat or Hazard	Earthquake
Scenario	South Carolina experienced a major earthquake that occurred without warning. The state sustained extensive transportation, communication, energy, and medical infrastructure damage. Portions of the populations in the most affected areas were isolated. Local and state resources were exceeded and federal assistance was required.
Sponsor	South Carolina Emergency Management Division (SCEMD)
Participating Organizations	SCEMD, the State Emergency Response Team (SERT), and 23 counties in South Carolina (see Appendix B for the complete list).

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ANALYSIS OF CORE CAPABILITIES

Aligning exercise objectives and core capabilities provides a consistent taxonomy for evaluation that transcends conducting individual exercises to support preparedness reporting and trend analysis. Table 1 includes the exercise objectives, aligned core capabilities, and performance ratings for each core capability as determined by the evaluation team during exercise observation.

Table 1. Summary of Core Capability Performance

Core Capability / Functional Area	Objective(s)	Performed without Challenges (P)	Performed with Some Challenges (S)	Performed with Major Challenges (M)	Unable to be Performed (U)
Planning	<ul style="list-style-type: none"> • Coordinate and execute the Incident Action Plan (IAP) process • Exercise the document management system within SCEMD 	X			
Operational Coordination (Response)	<ul style="list-style-type: none"> • Utilize State Emergency Operations Center (SEOC) Operations Staff Augmentation Integration (South Carolina National Guard and/or County Emergency Management Department volunteers) • Integrate the Air Branch (Emergency Support Function [ESF] 1) into response and recovery operations 		X		
Situational Assessment	<ul style="list-style-type: none"> • Maintain situational awareness with the Emergency Management-Common Operating Picture/Esri Flex Viewer • Create and publish one operational SEOC Situation Report per day 		X		
Public and Private Services and Resources (Logistics & Finance)	<p>Logistics:</p> <ul style="list-style-type: none"> • Demonstrate the ability to communicate and coordinate with counties regarding point of distribution operations (supplies, burn rates, and resupply missions) • Evaluate the ability to track costs with ESF-7 • Evaluate the ability to expeditiously and efficiently manage resource requests for State and Local agencies <p>Finance:</p> <ul style="list-style-type: none"> • Evaluate cost tracking and other incident management related expenses • Exercise the process of catastrophic disaster financing 		X		
Operational Communications	<ul style="list-style-type: none"> • Demonstrate the ability to use alternative forms of communication (Satellite, LGR, 800 MHz) to effectively coordinate with county Emergency Operation Centers 		X		

Core Capability / Functional Area	Objective(s)	Performed without Challenges (P)	Performed with Some Challenges (S)	Performed with Major Challenges (M)	Unable to be Performed (U)
Public Information and Warning	<ul style="list-style-type: none"> • Manage a Joint Information System/Center, including information gathering, generation, flow, coordination, and planning • Coordinate, manage and facilitate press briefings and/or news conferences • Coordinate, manage and disseminate information utilizing social media • Validate the Public Information Officer (PIO) augmentation process/procedures 		X		
Mass Search and Rescue Operations	<ul style="list-style-type: none"> • N/A 		X		
Operational Coordination (Recovery)	<ul style="list-style-type: none"> • Validate Recovery plans and supporting documents to ensure accuracy and currency • Conduct Recovery Seminar to address short and intermediate recovery with interagency • Integrate damage assessment reports and conduct analysis to determine recovery resource requirements • Leverage live training to work process and systems (Damage Assessment) • Utilize Hazus to support extent of damage as part of the Declaration Process • Leverage imagery and remote sensing through Air Branch to conduct damage assessments and verify infrastructure damage • Develop assessment areas for Joint Advance Evaluation Team 	X			
Housing	<ul style="list-style-type: none"> • Validate Recovery plans and supporting documents to ensure accuracy and currency • Conduct Recovery Seminar to address short and intermediate recovery with interagency 	Not evaluated; summary of discussions included in the body of the report.			
Health and Social Services					
Economic Recovery					
Infrastructure Systems (Recovery)					

Core Capability / Functional Area	Objective(s)	Performed without Challenges (P)	Performed with Some Challenges (S)	Performed with Major Challenges (M)	Unable to be Performed (U)
<p>Ratings Definitions:</p> <ul style="list-style-type: none"> • Performed without Challenges (P): The targets and critical tasks associated with the core capability were completed in a manner that achieved the objective(s) and did not negatively impact the performance of other activities. Performance of this activity did not contribute to additional health and/or safety risks for the public or for emergency workers, and it was conducted in accordance with applicable plans, policies, procedures, regulations, and laws. • Performed with Some Challenges (S): The targets and critical tasks associated with the core capability were completed in a manner that achieved the objective(s) and did not negatively impact the performance of other activities. Performance of this activity did not contribute to additional health and/or safety risks for the public or for emergency workers, and it was conducted in accordance with applicable plans, policies, procedures, regulations, and laws. However, opportunities to enhance effectiveness and/or efficiency were identified. • Performed with Major Challenges (M): The targets and critical tasks associated with the core capability were completed in a manner that achieved the objective(s), but some or all of the following were observed: demonstrated performance had a negative impact on the performance of other activities; contributed to additional health and/or safety risks for the public or for emergency workers; and/or was not conducted in accordance with applicable plans, policies, procedures, regulations, and laws. • Unable to be Performed (U): The targets and critical tasks associated with the core capability were not performed in a manner that achieved the objective(s). 					

The sections on the following pages provide an overview of performances related to each exercise objective and associated core capability, highlighting strengths and areas for improvement.

RESPONSE (DAYS 1&2)

1. Planning

Strengths

The full capability level can be attributed to the following strengths:

Strength 1.1: The SCEMD Plans Section effectively developed and distributed two IAPs using recently-formalized procedures. During the 2015 South Carolina flood response, the SCEMD Plans Section modified and formalized their procedures for developing and distributing IAPs. These procedures were used effectively during the exercise to develop and distribute two IAPs. The Plans Section also used the exercise as an opportunity to identify further refinements to the procedures.

Strength 1.2: The Draft 2016 South Carolina Earthquake Plan effectively guided SCEMD and SERT activities. At the beginning of the exercise, the Earthquake Program Manager announced that the updated draft earthquake plan and associated checklists had been posted on the SCEMD share drive. During the exercise, many participants referenced and leveraged the draft earthquake plan to guide their operations. Some participants noted the checklists were especially useful. The exercise was also used as an opportunity to identify any required changes to the draft plan.

2. Operational Coordination (Response)

Strengths

The partial capability level can be attributed to the following strengths:

Strength 2.1: SCEMD continued to improve SERT-wide meetings. During previous exercises and real-world responses, many have noted needed improvements for SERT-wide meetings. For example, the length and number of meetings have been frequent areas for improvement. During the earthquake exercise, participants noted significant and continued improvements to the meetings. For example, during the shift-change briefs, ESFs and SCEMD sections lined up at the front of the room to expedite the brief. In addition, the individuals that briefed provided concise and relevant information.

Strength 2.2: SCEMD leadership, in coordination with the SERT, identified and implemented priorities of support for the response. At the beginning of the exercise, SCEMD leadership recognized the need to establish priorities of support for the response, including functional and geographic priorities. SCEMD established, and the SERT executed, communications and transportation as the functional priorities and Charleston, Dorchester, and Berkeley Counties as the geographical priorities. In addition, SCEMD anticipated scrutiny and contention regarding the priorities (as they noted always occurs when priorities are established), but understood the need to establish priorities for decisions regarding limited resources. SCEMD also discussed coordinating their recommended priorities with the Governor.

Strength 2.3: The SERT coordinated effectively and continued to strengthen and develop working relationships. During the exercise, there was continuous and effective coordination in the SEOC. Participants noted increased comradery between the ESFs, improved coordination to address cross-ESF issues, better engagement between military and civilian entities, and overall strong collaboration among participants. As such, with this exercise the SERT continued to foster the working relationships that were developed and strengthened during the 2015 flood response and recovery and previous SEOC activations.

Areas for Improvement

The following areas require improvement to achieve the full capability level:

Area for Improvement 2.1: SCEMD needs to continue to improve the content and structure of the county calls.

Reference: N/A

Analysis: During the 2015 South Carolina flood response, SCEMD received criticism regarding the length of the county calls. The county call on the first day of the exercise was also long in duration. On the call, ESFs briefed on their activities, which many noted seemed to be a repeat of the morning shift-change brief and which included a significant amount of information that was not relevant to the counties (e.g., administrative items). Counties also presented some information that was not necessary or relevant and additionally neglected to provide some critical information.

On the second day of the exercise, SCEMD leadership tested a different format for the county call. Prior to the call, each ESF provide a list of one or two items regarding their activities to the Operations Section Chief who compiled and distributed those items to the counties in advance of the call. During the call, ESFs presented “by exception only” meaning only new and critical information was discussed. Additionally, counties presented first on the call.

Overall, participants understood and discussed the purpose of county calls which is to get information from the counties, especially unmet needs, to inform the state’s support to the counties and to get updated information from the counties in preparation for briefing the Governor. However, even with the improvements on the second day of the exercise, participants noted the county calls still require additional work and suggested the following:

- Record the shift-change brief and make it available to counties for them to view at their convenience so that the information does not need to be repeated on the county calls;
- If not already provided, distribute the Situation Reports to the counties in advance of the county calls;
- Develop a list of critical information the counties should provide on the calls to include estimated number of casualties and fatalities, hospital status, communication network status, transportation status, power outages, sheltering activities, and unmet needs;
- Add the above list to the county call briefing deck to remind counties what information they need to provide on the call;
- Develop and provide a template to the counties to fill out and provide to SCEMD with the above critical information requirements; and
- Consider which ESFs, if any, need to be present on the county calls.

Area for Improvement 2.2: SCEMD needs to continue to improve the tactics meetings to meet its intended purpose.

Reference: N/A

Analysis: The tactics meeting was initiated during the 2015 South Carolina flood response to identify any anticipated issues and shortfalls for the following day's operations, identify solutions to those issues and shortfalls, facilitate required inter-ESF coordination, and identify and facilitate requests for needed resources. The SCEMD Preparedness Section continues to refine the process of facilitating and executing tactics meetings and to educate the SERT on the purpose and deliverables associated with the tactics meeting.

3. Situational Assessment

Areas for Improvement

The following areas require improvement to achieve the full capability level:

Area for Improvement 3.1: At times, the SERT struggled to identify and obtain critical information regarding the incident and associated response activities.

Reference: Draft *South Carolina Earthquake Plan* and Earthquake checklists, 2016

Analysis: Although SCEMD noted having discussed and developed essential elements of information with the SERT, some ESFs were unable to identify that they lacked critical information regarding the incident and associated response activities in their areas of responsibility. As such, without realizing there were gaps in information, ESFs did not take the appropriate steps to obtain the missing information.¹ For example, during the exercise there were no reports on the number of fatalities despite resource requests for Disaster Mortuary Assistance Teams. In another example, the SERT did not provide information on the status of high-threat dams.

Area for Improvement 3.2: SCEMD identified the need for an information and intelligence processing capability.

Reference: N/A

Analysis: In addition to the aforementioned shortfalls related to critical information gathering², during the exercise SCEMD also identified a shortfall in information processing. This was also noted during the 2015 South Carolina flood response when there were three to four stovepipes of information collection and the SERT was not sharing information appropriately. As such, SCEMD suggested identifying a responsible party and developing a standard operating procedure for collecting, integrating, and analyzing incident information from multiple sources including, but not limited to, county reports, aerial imagery, ESF reports, social media, and traditional media. This information processing unit would also assist the SERT in identifying

¹ It should be noted that this may be partially due to exercise artificiality. Specifically, the ESFs may have been waiting for exercise injects containing the missing critical information rather than reaching out through standard channels to acquire the information.

² See area for improvement 3.1 for shortfalls related to critical information gathering.

information gaps and unmet needs. SCEMD leadership noted that the South Carolina National Guard may have the resources and skills to provide this needed capability.

Area for Improvement 3.3: Aerial reconnaissance missions were not coordinated, which resulted in duplication of effort and an overwhelming amount of aerial imagery.

Reference: Draft *South Carolina Earthquake Plan* and Earthquake checklists, 2016

Analysis: During the exercise, multiple entities conducted aerial reconnaissance missions and these missions were not coordinated. This resulted in multiple aerial images of some areas. In addition, some of the aerial images were likely not necessary as there were already responders on the ground that could have provided the required damage information. Finally, without coordination between all entities conducting aerial reconnaissance, there was no way to prioritize the aerial missions to ensure high-priority areas were addressed first. Overall, the duplication and lack of prioritization of aerial missions led to an overwhelming amount of aerial imagery—beyond the amount the state has the ability to process.

SCEMD leadership noted that the earthquake plan used to include “high-priority targets” for reconnaissance and suggested revisiting this in the current draft plan. In addition, they noted this might also be necessary for other scenarios beyond an earthquake.

Area for Improvement 3.4: Hazus data needs to be used in conjunction with, and validated against, incident data.

Reference: Draft *South Carolina Earthquake Plan* and Earthquake checklists, 2016

Analysis: During the exercise, Hazus data on the projected damage from the earthquake was used to inform the SERT’s response. As such, Hazus estimates were included in the Situation Reports. As the event progressed, participants noted that reports of actual damage should replace the Hazus estimates. If Hazus data and incident data are to be included in the Situation Reports, the source of the data needs to be identified. Finally, participants noted that actual damage reports should be used to validate the accuracy of the Hazus models. Finally, the SCEMD Hazus modeler and the earthquake expert from the College of Charleston noted that Hazus estimates are usually conservative and actual numbers may be much higher.

4. Public and Private Services and Resources (Logistics & Finance)

Strengths

The partial capability level can be attributed to the following strengths:

Strength 4.1: SCEMD and the SERT coordinated and “leaned forward” to request and order Emergency Management Assistance Compact (EMAC) resources. At the beginning of the exercise, SCEMD suggested that the SERT should “lean forward” and preplan for resources that might be needed from EMAC partners. SCEMD further indicated that ordering and not using EMAC resources was preferred over having resource shortfalls and that resources should be brought into the state and pre-staged even if it was not yet clear where they should be deployed.

During the response, ESFs requested EMAC resources as suggested—in total Operations Support received and processed 33 EMAC resource requests (e.g., bridge and road inspection

teams, ambulances, structural collapse teams, damage assessment teams, and law enforcement officers) from numerous ESFs. To manage these requests Operations Support had a designated EMAC coordinator. In the field, an EMAC liaison was sent to each county receiving EMAC support and all EMAC resources were deployed through ESF-19's Joint Reception, Staging and Onward Integration process.

Strength 4.2: The SCEMD Finance and Administration Section and ESF-7(Finance and Administration) continuously estimated and monitored incident costs. ESF-7 identified and tracked incident costs for:

- Personnel;
- Purchase orders;
- Emergency contracts;
- EMAC resources;
- Individual and Public Assistance;
- County cost share; and
- Federal cost share.

In addition to managing these costs in the WebEOC database, ESF-7 maintained an internal tracking sheet to ensure the database was correct. Participants noted that ESF-7 was successful in performing these activities due to strong leadership, constant training, clear roles and responsibilities, and effective shift-change procedures.

Strength 4.3: The SCEMD Logistics Section managed and processed a large number of resource requests. Over the course of the exercise, the Logistics Section managed 298 resource requests. These requests were processed in a timely manner and in accordance with the Logistics standard operating procedure. Many participants noted that the management of resource requests was significantly improved over previous exercises.

Areas for Improvement

The following areas require improvement to achieve the full capability level:

Area for Improvement 4.1: The SERT waited for resource requests to provide support rather than proactively identifying needs.

Reference: Draft *South Carolina Earthquake Plan* and Earthquake checklists, 2016

Analysis: Although the SERT “leaned forward” with identifying the need for and requesting EMAC resources³, they usually did not take this approach with other needs and resources. Instead, the SERT tended to wait for resource requests from counties and others before responding with internal and external resources. In a few situations, this was detrimental to the response.⁴

Alternatively, some participants suggested that the ESFs should have been more proactive with their response by at least minimally identifying in their plans expected support needs and requests. In some situations, participants suggested that the ESFs should provide support even

³ See Strength 4.1 for more information regarding EMAC resource requests.

⁴ See Area for Improvement 7.1 for one such instance.

before it is requested to address life safety issues (e.g., search and rescue). Participants also noted that identifying expected assistance requests should extend to identifying the resources available to meet those requests, including resources from external entities, if required. FEMA participants further indicated that there were instances of unmet needs that could have been satisfied with federal resources and that FEMA intends to work on how they can better support the state with identifying available federal support. SCEMD leadership suggested developing time-phased deployment lists (similar to those included in military plans) for specific scenarios (e.g., earthquakes, hurricanes) for each ESF.

Area for Improvement 4.2: There were a few instances of participants bypassing steps in resource request process.

References: *South Carolina Emergency Operations Plan*, April 2015; *SC Emergency Operations Plan (EOP), Attachment A: Logistical Operations Plan*, April 2015

Analysis: During the exercise, there were times when participants did not accurately follow the resource request process. This may have been due to a misunderstanding of the resource request process for internal ESF resources, or a lack of recent experience on the request process. Additionally, often requests were for a specific resource rather than for a capability, which precludes the ability of participants to identify other, potentially better, resources that could also be used to fulfill the mission.

5. Operational Communications

Strength

The partial capability level can be attributed to the following strength:

Strength 5.1: In anticipation of communication network outages and resultant difficulties dialing into the county calls, SCEMD tested an alternative protocol for accessing the county call using satellite phones. During the exercise, SCEMD noted that it may be difficult for some counties to participate in the county calls as the calls use traditional communication networks and internet-based virtual meeting software, which may not be accessible following an earthquake due to communication network outages. Because of this, SCEMD suggested and tested accessing a conference call using satellite phones. Through the test, SCEMD learned that the Inmarsat phones cannot dial into a 1-800 number. A workaround was identified for this—if Inmarsat users called a “standard” number at the State Warning Point, the State Warning Point could forward the call to the 1-800 number. In addition, the iridium phones could dial into the 1-800 number. The test was primarily internal to SCEMD and one county tested the backup protocol.

Area for Improvement

The following area requires improvement to achieve the full capability level:

Area for Improvement 5.1: The Communications Annex in the State Incident Response Plan does not accurately reflect or differentiate the responsibilities between the SCEMD Situation Unit (tactical communications with the counties) and ESF-2 (Communications) (state-wide communications infrastructure and systems) in the effort to develop the

situation or inform the Common Operating Picture regarding communication infrastructure in disaster areas.

References: *South Carolina Catastrophic Incident Response Plan*, April 2015; *SC Earthquake Plan, Annex 2, ESF-2 Communications*, December 2014; *Draft SC Earthquake Plan, 2016*

Analysis: Following the earthquake, ESF-2 must synchronize their effort to determine operational status of state-wide communication systems with the SCEMD Situation Unit's effort to determine tactical communication status through county EOCs. The outcome of this information will better inform the State Common Operating Picture and facilitate a more timely and accurate deployment of required resources. However, if counties were having communication issues and required communication support from the State (i.e., state communication teams to re-establish communications with affected county Emergency Operation Centers and Operational Areas), it may be difficult or impossible for them to contact SCEMD.

6. Public Information and Warning

Strength

The partial capability level can be attributed to the following strength:

Strength 6.1: ESF-15 effectively used the PIO augmentation procedure to increase public information capabilities at the SEOC. To provide the needed public information response capacity, ESF-15 executed the PIO augmentation procedure and requested, and numerous state agencies and partner organizations provided, support staff for the Joint Information Center. The augmented staff effectively performed public information duties, due in large part to the preplanning of SCEMD PIOs. Specifically, prior to the exercise, SCEMD PIOs developed press release templates, advisories, and talking points to guide augmented personnel. In addition, SCEMD PIOs provided just-in-time training on the draft *South Carolina Earthquake Plan* to those at the Joint Information Center.

Area for Improvement

The following area requires improvement to achieve the full capability level:

Area for Improvement 6.1: Participants noted a few shortfalls in SCEMD's public information response.

References: N/A

Analysis: Participants noted the following shortfalls regarding SCEMD's public information response:

- Some critical information was missing from press briefs. For example, social media, donations, and multi-language support were not mentioned at the first press briefing.
- During SERT briefings, ESF-15 provided information on the number of public information messages disseminated rather than focusing on the content of the messages.
- ESF-15 could not automatically post information from the new WebEOC ESF-15 board to the State Significant Events board.

- The stage craft of the news conferences could use some improvement. Specifically, those briefing did not enter and leave the room as a cohesive group (i.e. foster visual cues of operational unity) and speakers were not introduced prior to beginning the briefs.

7. Mass Search and Rescue Operations

Area for Improvement

The following area requires improvement to achieve the full capability level:

Area for Improvement 7.1: The scenario required a more robust and proactive search and rescue (SAR) response than was provided by the SERT.

References: *SC EOP, Annex-9, ESF-9 Search and Rescue*, April 2015; *SC Earthquake Plan, Annex-9, ESF-9 Search and Rescue*, December 2014; *Draft South Carolina Earthquake Plan*, 2016

Analysis: As previously mentioned in Area for Improvement 4.1, ESFs often waited to respond until they received a request for resources or support from a county, rather than proactively anticipating needs. One of the most critical areas where this occurred was provision of SAR support. During the response, many participants voiced concerns that the number of SAR resources that was requested and reported in the SEOC was insufficient for the earthquake scenario response. In addition, since SAR is a life-saving response, participants noted that those ESFs with SAR resources should not wait for requests to provide support. For example, it wasn't until the middle of the second day of the exercise that ESF-9 reported a large SAR response was required on the barrier islands. In a real-world incident, the one and a half day delay in provision of SAR resources could have tragic consequences.

8. Operational Coordination (Recovery)

Strength

The full capability level can be attributed to the following strength:

Strength 8.1: ESF-14 effectively acquired damage assessment data to inform the disaster declaration requests. ESF-14 gathered damage assessment information from counties, ESFs, and federal sources on public and private infrastructure (e.g., hospitals, water and wastewater systems, roads, bridges, other critical facilities, and residences). ESF-14 also coordinated with ESF-17 to gather information on animal issues including livestock, pets, and potential for disease. Finally, they used Hazus to support extent of damage estimates. Joint federal/state preliminary damage assessments were managed well after discovering and working out roadways and logistics/travel issues. As a result, the initial and add-on disaster declaration requests for federal assistance occurred in a timely manner.

RECOVERY (DAY 3)

On the third day of the exercise, SCEMD held a recovery seminar focused on near and intermediate-term recovery and the emergency restoration of critical social service infrastructure to support follow on recovery. The objectives of the seminar were:

- Identify priorities for immediate recovery.
- Identify resources required or resource shortfalls to short-term recovery.
- Capture gaps in the *State Recovery Plan* to address specific resource and planning considerations across the four major recovery functions.
- Inform stakeholders of the nuances associated with earthquake recovery and solicit input on potential solutions and resources.

During the exercise, participants convened for two group presentations including:

1. South Napa Earthquake Recovery Lessons Learned presented by the California Office of Emergency Services; and
2. New Madrid Exercise and Virginia and Christchurch Earthquake Lessons Learned presented by the Central U.S. Earthquake Consortium (CUSEC).

After each group session, players separated into four functional groups by Recovery Support Function to discuss recovery events 90 days post-earthquake and recovery 90 days to six months post-earthquake. The objectives of the individual breakout groups are provided in the table below.

Seminar Objective	Breakout group/RSF
Identify priorities for sustained emergency restoration across the social service infrastructure (i.e. medical, financial, education, and food services)	All
Identify shelter and temporary housing options that will support a large number of displaced survivors.	Housing
Identify priorities for the emergency and interim restoration of key infrastructure (i.e. airports, rail, energy, water and waste water, communications).	Infrastructure
Identify resources requirements from the private sector to assist with recovery; Identify the priorities of restoration across the private sector (transportation, medical, financial, utilities, food services, retail)	Economic Recovery
Identify critical components of the healthcare system that must be reconstituted to support needs beyond emergency care	Health and Social Services

Overall, participants noted that the recovery seminar was a great addition to the full-scale exercise and recommended including recovery seminars as a component of future state-wide exercises. Provided below is a summary of the key takeaways from the seminar.

South Napa Earthquake Recovery Lessons Learned

The Assistant Director for Recovery of the California Office of Emergency Services, presented on lessons learned from the 2014 South Napa Earthquake. The earthquake was a 6.0 magnitude earthquake causing 2 deaths, 300 casualties, and damage to nearly 2000 structures. Following the earthquake, there was a shallow slipping of the earth (i.e., “after slip”) that further complicated the response. A few notable aspect of California’s response included:

- Bringing in over 100 emergency managers from other counties through California’s Emergency Management Mutual Aid;
- Dispatching recovery staff the first day of the response;
- Leveraging the California Disaster Assistance Act to allow full reimbursement of counties (i.e., 100% reimbursement covering normal county cost share portion); and
- Leveraging a portion of the vast number of California’s trained safety inspectors.

Key lessons learned from the earthquake are provided below.

Infrastructure:

- Damage to bridges demonstrated the long-term benefits of the state highway bridge earthquake strengthening program.
- Natural gas transmission and distribution systems and water and wastewater systems are vulnerable to earthquake-related ground failures.

Debris management:

- A lack of debris management plans and training resulted in improper disposal of debris at the beginning of the response.

Damage assessments:

- Fly-by damage assessments were insufficient to estimate damage caused by the earthquake. Internal inspections of structures were required to identify the true amount of damage.
- Waiting for local entities to be prepared for preliminary damage assessments would have saved a lot of money. There needs to be a balance between rapid response for damage assessments and readiness of counties to support.

Federal assistance:

- It took FEMA a long time to make the decision to amend the disaster declaration to include assistance to individuals and households.
- The Small Business Administration waited until the president made a decision on individual assistance to provide assistance to small businesses, which significantly and unnecessarily delayed the recovery.
- Local entities needed a lot of help with and training on the federal disaster assistance process and California is now focused on providing this training in advance of a disaster.

External affairs:

- Keeping Congress constantly informed throughout the response and recovery limited the time and energy required to respond to Congressional briefings and inquiries.

Survivor assistance:

- Many impacted residents had major issues with home insurance and many others were underinsured. California Office of Emergency Services is now working with the Department of Insurance and state agencies to change the process and regulations to force insurance agencies to work closely with survivors and impacted communities.
- Impacted residents were confused regarding the difference between California's local assistance centers managed by county local officials and the disaster recovery centers managed by FEMA.
- It was important to have disability integration advisors at the assistance centers.

New Madrid Exercise and Virginia and Christchurch Earthquake Lessons Learned

The CUSEC Earthquake Coordinator presented on lessons learned from the 2014 New Madrid Exercise; the 2011 Mineral Virginia Earthquake; and the 2011 Christchurch, New Zealand Earthquake. The Virginia earthquake was a 5.8 magnitude earthquake and the Christchurch earthquake was a 6.3 magnitude earthquake.

Key lessons learned from the exercise and earthquakes are provided below.

New Madrid Exercise:

- Private sector integration was critical and the Virtual Business Emergency Operations Center was leveraged during the exercise for information sharing with the private sector.
- Geographic information systems are critical for situational awareness, but there can be too much information to manage.
- Rapid visual inspections for safe occupancy can expedite recovery. These inspections would be conducted following preliminary damage assessments (2nd or 3rd wave of responders).
- Volunteer inspectors or engineers can assist with building inspections, however, only some states have liability and workers' compensation coverage for EMAC volunteers.⁵
- CUSEC has an algorithm to estimate the required number of building inspectors needed following an earthquake. This algorithm estimates a two-member inspection team can inspect 32 buildings a day.

Mineral, Virginia Earthquake:

- The general population was unprepared for an earthquake as they had no idea an earthquake could occur in that area of the country.
- Earthquake insurance coverage in the area was very low.
- The disaster declaration process took a very long time.

⁵ Participants noted that South Carolina has a volunteer legislation for architects and engineers that protect them from liability.

Christchurch, New Zealand Earthquake:

- Ground liquefaction was a “complete game-changer” for the response.⁶ It affected transportation into the area and a significant amount of underground infrastructure. Additionally, liquefaction led to sewer line breakage, prohibiting waste water treatment, leading to infection of water with fecal coliform bacteria, and finally leading to tourism problems with contaminated beaches.
- Due to the impacts of the initial earthquake and estimated 14,000 aftershocks that have occurred since, residents have experienced significant mental health impacts that are now referred to as “quake brain.”
- The government had to develop land-use zones to prevent and prohibit rebuilding in high-risk liquefaction areas. To do this, they had to buy out private property.
- The *Canterbury Earthquake Plan*, which was a five-year recover plan, gave local government the authority they needed to develop and execute recovery plans.
- Unreinforced masonry was a big problem.⁷
- Temporary retail establishments (e.g., “ReSTART Mall”) helped economic recovery.

The CUSEC Earthquake Coordinator also noted that South Carolina is one of the CUSEC associate member states with voting privileges and discussed some of the recent actions CUSEC is taking to improve earthquake response and recovery. Some of these actions include:

- Developing mission ready package templates;
- Creating a safety assessment application;
- Working with the National Emergency Management Association to create national model mission ready packages for post-earthquake building inspectors;
- Working with the California Office of Emergency Services’ Safety Assessment Program for standards for inspectors;
- Working to get all member states to have liability protection, workers’ compensation, and inspectors that can be deployed through EMAC; and
- Developing an application and operational dashboard for real-time entry and aggregation of building inspection data.

Economic Recovery

Restoration priorities:

- Employment (sustained workforce), transportation, banks (financial), supply chain services, and peripheral support were identified as restoration priorities to facilitate economic recovery.
 - Understanding how to restore the supply chain will require the support of academic experts and private sector distribution services.
- The state cannot prioritize support to some businesses without harming other businesses. Therefore, the only industry priorities will be those that support life, health, and safety (e.g., utilities). Some prioritization may have to be provided to large businesses over

⁶ The earthquake expert from the College of Charleston estimated that in South Carolina wide-spread liquefaction would result from a magnitude 6.0 and above earthquake. However, ground saturation levels will affect liquefaction potential.

⁷ This would also be a major issue for South Carolina especially in Charleston.

small businesses because of the number of people they employ. However, larger businesses have more capacity to manage recovery on their own.

Private sector:

- As the private sector can provide a number of services that the government cannot, recovery is affected by available private sector services and support.
- Participants identified the need to engage the private sector in the recovery planning process and develop relationships with private sector coordinating structures and networks.
- Incentives will likely be required to engage the private sector in the recovery and rebuilding process. This can be done by:
 - Communicating infrastructure status (e.g., open roads) and estimates for restoration;
 - Expediting the movement of commodities;
 - Investigating using federal lands for businesses;
 - Permitting and supporting open store fronts following a disaster; and
 - Providing waivers.
- Private sector resilience is also critical to recovery. To help increase private sector resilience the state can:
 - Provide training and education on business recovery and continuity planning;
 - Make continuity planning a requirement for insurance (although this is not usually well received);
 - Leverage private sector and peer to peer organizations to change the culture around continuity planning; and
 - Work on private sector relationships before a disaster occurs.

Workforce:

- Workforce unemployment, skills transition (i.e., fast-tracking those persons who can migrate to other related lines of work), technical training, wrap-around services, social service networks, and U.S. Department of Labor Dislocated Worker Grants are all ways to stabilize the workforce and retain workers locally during reconstruction.
- The South Carolina Fiscal Accountability Authority may also be able to help with contracts to hire locals to help with restoration rather than out of state. This would also help prevent additional housing shortages as local workers would not fill up area hotels.

Health and Social Services

Re-establishing healthcare facilities:

- Recovery partners need to understand local codes and what is required to repair facilities.
- It is expected that health services recovery will leverage non-profit organizations to help with rapid repairs.
- Restoration of healthcare facilities requires supporting infrastructure (e.g., housing, food, utilities). As such, restoration of healthcare services would be supported by priority inspection and restoration of life support services, power, water, roads, and public health facilities.

- Pharmacies may be damaged and out of service; recovery planners should bring in temporary pharmacy resources and look to the private industry to get pharmacy services restored.

Medical records:

- Following a disaster, patients may need to be re-evaluated because medical records were lost in the disaster or medical providers do not have access to the patient's records (e.g., due to relocation).
- The South Carolina Hospital Association can coordinate available backup databases to retrieve health records, if possible.

Healthcare recovery support services:

- Mental health support will be a key component of recovery; additional services will be needed for the aftershocks as well.
- Recovery efforts should leverage federal, state, local, EMAC, and voluntary agency mental health resources to help provide these services.
- Public messaging needs to clearly communicate what assistance systems are available, especially if FEMA cannot provide assistance, and that recovery is not a quick process. The messaging should also help link people with unmet needs to available support systems and resources.
- It is expected that numerous non-profit organizations will be actively working in the state to help with healthcare system recovery.
- First responders will experience fatigue and burn out and they will have their own care needs for themselves and their families.

Housing

Earthquake resilience:

- Recovery begins and ends at the community level. Counties will need to set recovery priorities—local resource and personnel limitations and political climate may be an issue. As such, counties should have the discussions to prepare for recovery as much as possible in advance of a disaster (e.g., identify available housing, rebuilding codes, roles and responsibilities, who will be involved in making decisions after an event, local processes). Even unaffected counties need to be prepared to support the recovery as displaced individuals could move into their counties.
- A large percentage of the buildings in South Carolina are not built to earthquake codes as the codes were not put in place until the 1970s. In addition, hurricane codes are the predominant codes in coastal areas and some of the requirements for hurricanes are contrary to what is needed for earthquakes.
- Residents need to be more aware of the earthquake risk and increase personal preparedness for earthquakes.

Temporary housing and relocation:

- There is a lack of permanent access and functional needs accessible housing in the area and in the state. There is also a lack of temporary housing and what is available is not accessible.

- Residents of South Carolina will try to stay in their homes unless there is very compelling evidence that they should leave. This will be a challenge for local governments.
- Having to relocate residents is a significant concern and relocation of residents should be viewed as the lowest priority option, but it should still be included in plans.
- Relocation decisions rest with elected officials.
- Relocating residents may take them away from their support services (e.g., family, jobs) and tracking relocated families for provision of disaster support services will be challenging.
- Once relocated, residents may never return to their original locations and counties receiving citizens will have to provide support services to the incoming citizens.
- Short, intermediate, and long-term temporary and permanent housing plans need to consider supporting infrastructure (e.g., water, sewer, electricity, schools, and transportation).
- Options exist for quick and durable temporary housing (e.g., CONEX boxes, modular construction, trailers); counties need to determine which options are best for their communities.

Housing inspections:

- Housing recovery will require a large number of inspectors for both initial safety assessments and rebuilding inspections.
- South Carolina has a state-wide mutual aid agreement for professional services (e.g., inspectors) that also applies to counties, but participants were unclear about liability coverage for professional services provided through mutual aid and EMAC agreements. Engineers provided through state guard have liability protection.
- In advance of a disaster, counties need to develop specifications for what inspector qualifications and certifications are required to work in the county.

Public Information:

- Expectation management will be critical for a successful response and will need to be supported through public messaging and community-driven efforts.
- Public information will have to consistently and clearly explain the housing process including available resources, potential obstacles, and estimated duration.
- Community meetings and engagement will be vital to exchange information and identify what the community needs for housing support.
- It is important to engage political leaders as soon as possible to communicate the situation and process; otherwise, politics can be a hindrance to recovery efforts.

Available support:

- There is a patchwork of funding sources and available resources that can be used to help the affected households. Integrating and appropriately leveraging all of these systems will be a challenge. The state will also have to look at duplication across the support package.

Infrastructure Systems (Recovery)

Priorities:

- Debris removal and utilities were identified as infrastructure restoration priorities.

- Knowledge of critical infrastructure and key resources will also help establish infrastructure recovery priorities.

Infrastructure restoration:

- Currently, wastewater systems across the state are in various conditions and it may take a long time for these services to be restored.
- Temporary repairs do not meet a “one size fits all” model. Temporary repairs need to consider what type of infrastructure needs to be repaired, the duration the repair should last, and how a temporary fix might impact the longevity of the infrastructure.
- Participants lacked knowledge of available technology options for mitigation during rebuilding and suggested leveraging academic and research institutions to identify mitigation options to rebuild stronger and more resilient infrastructure.

Debris management:

- Counties need debris management plans in advance of a disaster, including how to manage debris considering health regulations (e.g., debris with asbestos, water contamination).
- Having on-call contracts in place with contractors that provide debris management support has saved the state millions of dollars. Costs for on-call contracts are incurred only when the contracts are executed.

Building restoration and re-habitation:

- It was unclear if both temporary and permanent repairs could be funded through FEMA or if temporary repairs preclude funding for permanent repairs.
- Temporary repairs can be damaged by aftershocks and land resettling.
- Some buildings may not be habitable due to a lack of utilities even if the building is deemed structurally sound.
- There will be a continual structural assessment requirement as buildings may have to be re-inspected due to aftershocks and resettling. This will be time consuming and require additional manpower.

APPENDIX A: IMPROVEMENT PLAN

This Improvement Plan has been developed specifically for South Carolina as a result of the 2016 South Carolina Full-Scale Earthquake Exercise conducted on March 14-16, 2016.

Core Capability	Area for Improvement	Corrective Action	Capability Element ⁸	Primary Responsible Organization	Organization POC	Start Date	Completion Date
2. Operational Coordination	2.1 SCEMD needs to continue to improve the content and structure of the county calls.	Develop a mechanism to provide ESF information to the counties that does not involve all ESFs briefing on the county calls.	Planning	SCEMD Operations	Tim Murphy	21 Mar 16	23 Sep 16
		Develop a list of critical information the counties should provide to SCEMD.	Planning	SCEMD Operations	Tim Murphy	21 Mar 16	Complete
		Develop a template for counties to fill out with the critical information.	Planning	SCEMD Operations	Tim Murphy	21 Mar 16	23 Sep 16
	2.2 SCEMD needs to continue to improve the new tactics meetings to meet its intended purpose.	Develop a process for the tactics meeting to help achieve the intended purpose of the meeting.	Planning	SCEMD Preparedness	Ken Braddock	21 Mar 16	Complete
		Continue to exercise the tactics meetings in future exercises.	Exercises	SCEMD Preparedness	Ken Braddock	21 Mar 16	Ongoing
3. Situational Assessment	3.1 At times, the SERT struggled to identify and obtain critical information regarding the incident and associated response activities.	Develop a list of critical information requirements per ESF and vet these lists with the ESFs.	Planning	SCEMD Operations	Mike Russell	21 May 16	23 Sep 16

⁸ Capability Elements are: Planning, Organization, Equipment, Training, or Exercise.

Core Capability	Area for Improvement	Corrective Action	Capability Element ^s	Primary Responsible Organization	Organization POC	Start Date	Completion Date
	3.2 SCEMD identified the need for an information and intelligence processing capability.	Investigate and test the ability of the National Guard to provide the needed information processing capability.	Planning & Exercises	SCEMD Preparedness	Pat Miller	21 Mar 16	23 Sep 16
	3.3 Aerial reconnaissance missions were not coordinated, which resulted in duplication of effort and an overwhelming amount of aerial imagery.	Identify a responsible entity and develop a procedure to coordinate and prioritize aerial reconnaissance missions.	Planning	SC DOT (Air Operations Branch)	Tom Johnson	21 Mar 16	23 Sep 16
		Consider identifying key infrastructure types for reconnaissance prioritization.	Planning	SCEMD Preparedness	Dave Harbison	21 Mar 16	23 Sep 16
	3.4 Hazus data needs to be used in conjunction with, and validated against, incident data.	Validate Hazus data against incident reports.	Exercises	SCEMD Operations (Situation Unit)	Mike Russell	21 Mar 16	Complete; to be further implemented in future exercises
		Ensure situation reports contain real-world damage reports.	Planning	SCEMD Operations (Situation Unit)	Mike Russell	21 Mar 16	Complete; to be further implemented in future exercises
		Include the source of damage estimate data in Situation Reports.	Planning	SCEMD Operations (Situation Unit)	Mike Russell	21 Mar 16	Complete; to be further implemented in future exercises

Core Capability	Area for Improvement	Corrective Action	Capability Element ^s	Primary Responsible Organization	Organization POC	Start Date	Completion Date
4. Public and Private Services and Resources	4.1 The SERT waited for resource requests to provide support rather than proactively identifying needs.	Use the critical information requirements (area for improvement 3.1) and the intelligence processing capability (area for improvement 3.2) to identify situations where ESFs should respond prior to receiving requests for support.	Planning	State Emergency Response Team	Specific POC N/A	21 Mar 16	Ongoing
		Investigate developing time-phased or condition-based deployment lists for specific scenarios for each ESF.	Planning	SCEMD Operational Support	Melissa Potter	21 Mar 16	31 Dec 16
	4.2 There were a few instances of participants bypassing steps in resource request process.	SCEMD Logistics conduct just-in-time training on the resource request process at the beginning of all SEOC activations.	Training	SCEMD Operational Support	Melissa Potter	21 Mar 16	Complete (Planned in all Player Training events)
5. Operational Communications	5.1 ESF-2 did not establish contact with affected counties immediately following the earthquake. NOTE: <i>This is not an ESF-2 responsibility</i>	Ensure the <i>South Carolina Earthquake Plan</i> and associated ESF-2 checklists differentiate responsibilities between ESF-2 and SCEMD Situation Unit on roles during response and recovery following an earthquake event in the effort to inform the Common Operating Picture.	Planning	SCEMD & SC Dept. of Admin. (Division of Technology Operations)	George Crouch	21 Mar 16	Ongoing

Core Capability	Area for Improvement	Corrective Action	Capability Element ⁸	Primary Responsible Organization	Organization POC	Start Date	Completion Date
6. Public Information and Warning	6.1 Participants noted a few shortfalls in SCEMD's public information response.	Develop a list of key information requirements for press conferences.	Planning	SCEMD Public Information Office	Derrec Becker	21 Mar 16	Complete
		Work to integrate the ESF-15 WebEOC board with the state significant events board.	Equipment	SCEMD Public Information Office	Derrec Becker	21 Mar 16	23 Sep 16
		Work to improve the stage craft of press briefs in future exercises.	Exercises	SCEMD Public Information Office	Derrec Becker	21 Mar 16	Complete (Techniques Implemented)
7. Mass Search and Rescue Operations	7.1 The scenario required a more robust and proactive search and rescue (SAR) response than was provided by the SERT.	See area for improvement 4.1	Exercises	SC Dept. of Labor, Licensing, and Regulation	Tim Wozjik	21 Mar 16	Complete; (to be implemented in next scheduled exercise)

APPENDIX B: EXERCISE PARTICIPANTS

Participating Organizations		
Federal		
FEMA Region IV	National Weather Service	U.S. Coast Guard
U.S. Army Corps of Engineers	Civil Air Patrol	Department of Health and Human Services
State		
Governor's Office	South Carolina Emergency Management Division	South Carolina Army National Guard
South Carolina Air National Guard	South Carolina State Guard	SC Department of Transportation
Department of Administration, Division of Technology Operations	State Fiscal Accountability Authority (Office of State Engineer)	SC Department of Labor, Licensing, and Regulation (Fire and Life Safety)
SC Department of Social Services	SC Department of Health and Environmental Control (PHP)	SC Department of Mental Health
SC Department of Health and Human Services	SC Department of Health and Environmental Control (EQC)	SC Office of Regulatory Staff
SC Law Enforcement Division	SC Department of Probation, Parole and Pardon Services	SC Parks, Recreation & Tourism
SC Department of Natural Resources	SC Department of Corrections	SC Department of Public Safety
Clemson University Livestock - Poultry Health	Department of Administration, Division of Procurement Services	Department of Administration, General Services Division
SC Department of Commerce	Department of Employment and Workforce	Department of Education
SC Department of Insurance		
County		
Aiken	Beaufort	Berkeley
Charleston	Cherokee	Chester
Chesterfield	Dillon	Dorchester
Edgefield	Hampton	Horry
Laurens	Lee	Lexington
Marion	Marlboro	Oconee
Orangeburg	Pickens	Saluda
Spartanburg	Union	York
Non-Governmental Organizations		
American Red Cross	The Salvation Army	SC Baptist Disaster Relief
Harvest Food Bank	United Way Association of SC	

APPENDIX C: ACRONYM LIST

Acronym	Term
AAR/IP	After-Action Report/Improvement Plan
CUSEC	Central U.S. Earthquake Consortium
EMAC	Emergency Management Assistance Compact
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
ESF	Emergency Support Function
FEMA	Federal Emergency Management Agency
HSEEP	Homeland Security Exercise and Evaluation Program
IAP	Incident Action Plan
PIO	Public Information Officer
POC	Point of Contact
SAR	Search and Rescue
SCEMD	South Carolina Emergency Management Division
SEOC	State Emergency Operations Center
SERT	State Emergency Response Team
WebEOC	Web Emergency Operations Center System