

**Final Technical Report  
February 2010**

**Support Meeting: Reconnecting and Revitalizing the Partnership**

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**Abstract**

Over the past 18 years the Association of the State Geologists of the Central U.S. Earthquake Consortium (CUSEC-SG) has been working on projects related to earthquake hazard issues that are aligned with state and federal priorities through coordination of the eight states activities. With the many position changes amongst the state and federal geological surveys, it was felt that a review of accomplishments, numerous tasks that remain and how they might be addressed collectively would be of benefit to various programs. The grant provided funds for a workshop to openly discuss the various issues related to agreement on the remaining tasks, carrying out responsibilities, developing milestones, making commitments and review accomplishments. The ultimate goal was to lay out a preliminary road map for tasks/activities for the next 5 to 10 years. Funds allowed for the workshop in the fall of 2008 and a follow up meeting in the summer of 2009.

## Introduction

Over the past 18 years the Association of the State Geologists of the Central U.S. Earthquake Consortium (CUSEC-SG) has been working on projects related to earthquake hazard issues that are aligned with state and federal priorities through coordination of the eight states activities. With position changes amongst the state and federal geological surveys and priorities, it was felt that a review of accomplishments, current priorities, numerous tasks that remain and how they might be addressed collectively would be of benefit to various programs. The grant provided funds for a workshop to openly discuss the various issues related to agreement on the remaining tasks, carrying out responsibilities, developing milestones, making commitments and review accomplishments. This workshop was held in New Harmony, Indiana on Oct. 21-23, 2008. The goal was to lay out a preliminary road map for tasks/activities for the next 5 to 10 years. Funds allowed for this workshop and an extension of the grant allowed for follow up meetings of the CUSEC-SGs. This report summarizes the fall 2008 workshop (page 4), a follow up August 2009 meeting (page 44), meetings of the CUSEC State Geologists with U.S. Geological Survey at the four FEMA Regional meetings of the New Madrid Catastrophic Planning Initiative (page 46-53) and assembled priorities (page 56).

## **Workshop Oct. 21-23, 2008 in New Harmony, Indiana**

This section is a summary of the workshop of the representatives of the Central U.S. Earthquake Consortium (CUSEC), the Association of CUSEC State Geologists and the U.S. Geological Survey held over a 3 day period (Oct. 21-23, 2008) in New Harmony, Indiana. The meeting reviewed past Association history and earthquake related accomplishments and discussed plans for future directions. The CUSEC State Geologists represent 8 states in the Central U.S. (Alabama, Arkansas, Illinois, Indiana, Kentucky, Missouri, Mississippi and Tennessee) and the CUSEC organization represents the state emergency managers of each state. Since 1992, the CUSEC State Geologists' Association has been coordinating mapping, information and outreach to address earthquake issues that affect the CUSEC states.

The first half day was a meeting of the CUSEC organization and CUSEC State Geologists (Agenda - Appendix A and Attendees - Appendix B) to Look Back at the history and accomplishments of the Association (Appendix C) along with a review of the funding situation and in kind support by the Association members. The review of the Current Outlook and Future Efforts discussed the commitment to continue forward and reviewed what the Surveys bring to the CUS including earthquake response (Appendix D). Discussion also included development of long-range plans, possible projects (Appendix E) and workshops that would help solicit research ideas and priorities which are produced in similar workshops of Northern California (<https://sslearnquake.usgs.gov/regional/nca/workshop/>), the Utah seismic hazards working groups (<http://geology.utah.gov/ghp/workgroups/index.htm>) and the Great Basin seismic hazards working group (<http://www.seismo.unr.edu/wbrcvm/>). Future Efforts covered the 2011 National Level Exercise (Appendix F) for the New Madrid area and testing of the Surveys' operational response plans and also potential New Madrid Bicentennial related activities.

### Summary of the first days' issues and findings are below:

- Discussion and presentations of CUSEC-SG past activities and current status. A good sense of where we've been and where we are, helped in determining where we want to go.
- From here, we went into a discussion of the future of the Association starting with a renewal of commitment to the Association from the State Geologists and the State Surveys—there was a unanimous show of support for continuing on, as all draw the strength and benefits of a regional approach to EQ in the Central U.S.
- Further agreed that the State surveys, working together, have a unique role that can provide substantial benefit in addressing earthquake threat and response, and have far reaching contacts throughout the state through the emergency managers from the state to county to the local level.
- Also agreed that the effort of the Association would be difficult, if not impossible, to sustain without external funding to support activities such as meetings, travel, certain work efforts, etc.

- However, with funding to support these types of activities, the Surveys are in a position to bring substantial in-kind contributions (average in kind 450% of NEHRP funding) to the table that will provide leverage to external funds.
- We discussed the role of the association and the areas where we feel we are best positioned to make the most significant contributions through Association activities:
  - both pre-EQ and post-EQ some of our real strengths are:
    - Education and Outreach
      - Compiling information and research into region specific formats for various audiences with varying levels of sophistication
    - Non-scientist oriented presentations, town hall, etc.
    - State Survey role to play in development of post-EQ clearinghouse
      - Planning, coordination with SEMA and set-up
      - Help PIO with standard format and language of messages
      - Vetting and credentialing of post-EQ scientific/engineering community that will be deployed in the area
      - CUSEC-SGs' clearinghouses provide a benefit of information gathering that can be used by SEMA and relieve SEMA of general tracking of investigators
    - Post-EQ response (even if remote Clearinghouse is not activated)
      - CUSEC-SGs provide boots-on-ground and data collection
      - CUSEC-SGs provide scientific input for SEMA & media.
- We feel that there is a strong role for the Association in the New Madrid Bicentennial activities. We would like to discuss this further as the meeting progresses: Education and Outreach, media info, participation in the 2011 exercise, final development of State Survey operation response plans
- We are strongly supportive of a follow-up Workshop that brings together the Central U.S. earthquake community at large to discuss activities and needs in a facilitating forum. We feel that this would also provide an opportunity to bring the EarthScope initiative to the table and discuss personnel needs that might be addressed, as well as the benefits and issues surrounding the “adoption” of EarthScope sites.
- We want to discuss on day two & three, our strong opinion that this Association cannot be really effective without a Technical Director or Coordinator. This position provides continuity and direction to the activities of the Association in a way that may not be possible in context of volunteer individual contributions from the various Surveys.
- We are, however, very open to discussions how, specifically, this individual would be tasked. We are aware that there has been some criticism in the past, and we would agree that careful thought should be given to the job description and performance criteria for this position.

- We feel that it is critical to the success of the Association that resources be available to facilitate at least two face-to-face meetings a year. In the past, we have been able to do this at a relatively low cost by choosing meeting sites that are centrally located and off the beaten path.
- If USGS chooses to partner with us, this would also provide the opportunity for USGS/CUSEC-SG to get together, make sure that common goals & objectives and activities are being pursued and to make course corrections as needed.
- We generally agreed that doing research projects of a complex nature are generally beyond the scope or ability of the Association and best left to the researchers under NEHRP funding or other mechanisms. This does not preclude individual surveys or group of surveys undertaking these kinds of projects as appropriate.

Summary of the second and third days' issues and findings are below:

CUSEC-SG Chairman, Dr. Nick Tew presented a summary of CUSEC Association meeting from previous day – summary above.

Dr. David Applegate presented:

- Overview of Earthquake Hazard Program
- Earthquake Notification and Warnings, Did You Feel It? and Pager
- NEHRP – loss reduction and understanding effects on communities, structures and lifelines
  - mostly infrastructure
  - characterize hazard
  - improve forecasting
  - moving toward presenting risk
- ANSS & monitoring structures
- Build on Southern Calf. Multi-hazard demonstration
- \$150,000 support to Central U.S. by funding Missouri University of Science & Technology for St. Louis Urban Hazard Mapping Project
- Discussed what was known about FY09 potential USGS/EQ budget
- ShakeOut
- Utah, Nevada, and Northern California – USGS supported workshops for presenting NEHRP supported projects and collecting research ideas for potential use in NEHRP RFP
- EarthScope support of LIDAR on a project
- NRC – asking USGS to examine future seismic instrument locations

Current USGS Central Region Activities - Dr. Robert A. Williams and Dr. Oliver Boyd

- St. Louis and Evansville Urban Hazard Mapping Projects
  - Wave propagation
  - Seismic velocities
  - Site response
- Source characteristics of Intra-Plate earthquakes

- Paleoseismicity
- Physical properties of deep sediments (Miss. Embayment)
- Long-Term Deformations – various transects across rift being gathered/completed
  - Blytheville Arch & Crowley’s Ridge Post-Eocene deformations - 30 km profile and 10 km profile near Jonesboro, AR
- Interested in products that transfer results

Ms. Elizabeth Lemersal presented Internal/External Funding by USGS & NEHRP

The National Earthquake Hazards Reduction Program

- Develop effective measures for earthquake loss reduction
- Promote their adoption
- Improve the understanding of earthquakes and their effects on communities, buildings, structures, and lifelines

The USGS role in NEHRP

- Provide earthquake monitoring and notifications
- Assess seismic hazards
- Conduct research needed to reduce the risk from earthquake hazards nationwide

External funding is a key component of the USGS Earthquake Hazards Program

- Approximately 25% of core program funds (\$13.6M in FY08)
  - Competitive grants (\$4.3M)
  - Non-competitive agreements (\$2.2M)
  - Seismic & Geodetic monitoring operations (\$6.8M)
- Gives flexibility and adds breadth of expertise to program
- Supports other state and federal agencies, and universities, and develops partnerships

External grants

- Authorized by Congress in NEHRP authorizing legislation (1978)
  - Agencies can provide grants only if authorized by Congress; must be competitive
  - EHP issues contracts for non-research activities to support internal projects; must be competitive
- Competitive peer-review process, primarily by external scientists
- Support 75 to 105 grants per year
- Targeted research focused on priorities of the 7 regional and topical areas of EHP

External grants: Focus areas

- Central & Eastern U.S.
- Intermountain West
- Pacific Northwest & Alaska
- Northern California
- Southern California
- National
- Topical areas:

- Earthquake Effects
- Earthquake Physics

External grants: Annual process

- Annual update of Research Priorities to be included in ‘RFP’ developed by Regional/Topical Coordinators with input from regional specialists (January)
- Annual announcement of grant opportunity available on Grants.gov, open for 2 + months (March-May)
- Announcement describes:
  - application requirements
  - regional and topical priorities of EHP
  - peer review process
  - evaluation criteria
  - timeline for review and fund/no-fund decisions
- News Release sent to membership organizations when application period opens
- Proposals and budgets must be submitted through federal government-wide Grants.gov
- Panels meet in July/August to review and rank proposals
- With decision letter, PI receives summary of panel comments and any budget reductions to be made (October)
- Holds often needed until federal budget is established (January, this year March)
- Awards are made based on PI-requested start time
- Most grants are for a 1-year term
- Deliverable is final technical report due 90 days after award ends

External grants web site

- All grant and cooperative agreement awards 2000 to present are listed and searchable
- Final reports and journal publications are searchable for awards 2000 to present
- PIs are encouraged to submit journal publications; citations added to web site
- Older award reports are searchable through USGS Library and available through interlibrary loan

External grant awards to State Surveys

- California Geological Survey
- Colorado Geological Survey
- Central U.S. Earthquake Consortium, CUSEC State Geologists
- Illinois State Geological Survey
- Kentucky Geological Survey
- Missouri Geological Survey
- Nevada Bureau of Mines and Geology
- Oregon Department of Geology & Minerals Industries
- Utah Geological Survey

## General discussions covered:

- Community velocity models
- Land use Portfolio models for Risk assessment
- EarthScope Instruments, deployment and adoption
  - Oregon & Washington States' EarthScope experiences and list produced of Gots Yous – USGS will supply list to CUSEC-SGs
  - IRIS – first do no harm to schedule of deployment
  - Monitoring is through IRIS
  - Regional coordination
- Technical Clearinghouses – PostEarthquake Response
  - USGS role in area has to be expanded beyond USGS Circular 1242. Expanded role can be worked on in FEMA Regional workshops along with CUSEC SGs in FEMA region
  - CUSEC SGs need to complete Clearinghouse plans and Operational Plans with input of their state emergency managers
  - Work with Public Information Officers (PIOs) on pre-scripted messages for post-earthquake response
  - National Incident Management System (NIMS) training
  - CUSEC SGs work on MOAs within their state for clearinghouse sites
  - Pre-scripted mission assignments with FEMA for reimbursement for clearinghouse, GIS specialists, remote imagery specialists, etc.
  - Use of a data management system such as PIMS or ROVER for standardized data collection
  - GIS coverage across state lines
  - Training in clearinghouse activities from successful operators
- Workshops
  - Gather of scientific needs of Central U.S.
  - EarthScope coordination
  - Successful clearinghouse operation
- Coordination of CUSEC-SG activities and planning through twice yearly meetings.
  - in past, one such meeting per year was gathered at another regional meeting
- Support of activities of CUSEC Coordinator – travel (outside support required to go out of state) for coordination with CUSEC related groups – USGS - FEMA, national activities in CUS, and requested CUS presentations.

## Items discussed concerning New Madrid Bicentennial:

- Brochures
- Earthquake trail
- Congressional staff trips through NMSZ
- Traveling Museum
- Putting Down Roots publication for CUS – various languages
- Possible use of pre-existing CUS earthquake video programs
- EQ 101 PowerPoint presentation products – stand alone or with presenters

- Town Hall Meetings
- CUSEC SGs participate in NLE-11 with possible setting up Clearinghouses
- Test Regional (USGS/CERI) Clearinghouse function – the individual state clearinghouse is a satellite which is responding to their state’s needs. Regional clearinghouse can collect information from individual state clearinghouse to form a regional perspective.
- National Earthquake Conference

Summary

CUSEC State Geologist’s Coordinator/Technical Director Position - The Illinois State Geological Survey Director will support Robert Bauer’s time for this position, which will curtail the use of external funds for any salary support for this position. In order to fulfill tasks under this position, it is asked that some funds only be made available for travel, communications, and supplies.

Many potential action items were discussed during the meeting but only one was proposed with a specific calendar based schedule which is the development of a follow up workshop with the larger earthquake community whom has interests in the Central U.S. The rest of the items in the Short Term and Long Term action plans need a schedule to be developed by the potential contributors whom continue to provide most of the products through in kind contributions. A few items in the Short Term plan have already been started and need to be guided along and a number of items will need some financial support to be accomplished.

The CUSEC SGs propose, as was the practice in the past, to have two meetings per year of the Association to coordinate activities and product development across the CUSEC states. This practice was instrumental in producing the many maps, publications and outreach items of the Association as shown in Appendix C. One of these Association meetings was typically held in conjunction with another regional conference or meeting to save some time and money.

Short Term (next year)

- Develop workshop with larger earthquake community whom have interest in CUS review of accomplishments and areas of needed research – proposed for February-March 2009
  - Asked to work with Rob Williams & Oliver Boyd for setting up workshop
- EQ101 PowerPoint products
  - Draft of presentation exists. Jim Wilkinson will secure & pass onto CUSEC-SG
- CUSEC SGs complete Clearinghouse plans and Operational Plans with coordination of their state emergency managers
  - Draft of state geological survey’s plans are to be presented at FEMA Cat Planning Regional Workshops in February through May 2009
  - Continued work with state emergency managers to finalize plan for inclusion in state plans.

- EarthScope
  - Instrument deployment is coming soon to CUS. If want to have some sites adopted by industry, need to start contacting potential supporters & working with IRIS for sites selection and configuring of electronics for acceptance of strong motion instruments later.
- Draft a scope of work based on discussions with CUSEC SGs concerning short and long term action items and any accompanying costs.

#### Long Term (2-5 yrs)

- Bicentennial
  - Putting Down Roots type publication for CUS – various languages
  - Brochures
- Clearinghouse & Response Plans
  - Develop pre-scripted mission assignments with FEMA for reimbursement for clearinghouse, GIS specialists, remote imagery specialists, etc.
  - Training in National Incident Management System (NIMS) for CUSEC-SGs' earthquake response integration into states response
  - CUSEC SGs work on MOAs within their state for clearinghouse sites
  - Work with Public Information Officers (PIOs) on pre-scripted messages for post-earthquake response to produce similar messages across CUS
  - Test response plans during National Level Exercise – 11 in May, June, July 2011.

**Appendix A**  
**Meeting Agenda**

Association of CUSEC State Geologists  
&  
U.S. Geological Survey  
Workshop Agenda  
October 21-23, 2008  
Rapp Granary - David Dale Owen Laboratory  
New Harmony, Indiana

**Day One – 1:00 p.m. – 5:30 p.m. - Association of CUSEC State Geologists Meeting**

Welcome and Overview of Meeting

Nick Tew  
Jim Wilkinson

Looking back on:

Reasons behind formation of the Association  
Association Accomplishments  
Creation of the Technical Director's Position

Bob Bauer / Jim Wilkinson

Current outlook

Funding situation  
Commitment to push forward  
Share/report survey operational plans  
April 18<sup>th</sup> Earthquake Assessment  
Development of Long-Range Plans  
Technical Director  
Project Ideas

Bob Bauer –group discussion

Future efforts

Bicentennial  
1. 2011 Exercise – test operational plans  
2. Earthscope- projects, region coordination  
and Seismograph purchase  
4. Neotectonics of the WVSZ  
5. Liquefaction Susceptibility Map  
6. Continue and Expansion of Earthquake Hazard Assessment Maps

Nick Tew –group discussion

Prepare for day two

Summary of discussion

Nick Tew – group discussion

Group Dinner – Rapp Granary - 6:00 p.m. – 8:00 - Association members, USGS participants, and guest

Day Two – 8:00 a.m. – 5:00 p.m. - Combined USGS / Geologist Association Meeting

Rapp Granary

Welcome and Introductions

Nick Tew

David Applegate

Meeting Purpose

Nick Tew

David Applegate

Jim Wilkinson

Overview of day one – Association Priorities

Nick Tew

USGS Expectations

David Applegate

Current USGS Central Region Activities

Rob Williams/Oliver Boyd

Group Discussion

Group Discussion

- 1) Regional priorities (e.g. lifeline hazard mapping)
- 2) Bicentennial activities (e.g. education and outreach, specific research objectives, workshops and conferences, ...)
- 3) A plan for earthquake response. If there were large earthquake in the region and requests for proposals were issued soon after, multi-year research objectives and budgets should be in place.
- 4) Lead organization(s) for each priority effort (items 1–4) and possible avenues for funding (USGS, States, FEMA, others)
- 5) Avenues for broader collaboration (workshops, proposals, ...)

Funding Situation

Elizabeth Lemersal

External / Internal

What fits the partnership?

Group Discussion

Group Dinner – Rapp Granary - 6 p.m. – 8 p.m.

Short dinner presentation on the April 18<sup>th</sup> Earthquake Damages

**Day Three – 8:00 a.m. – 12:00 p.m. Combined USGS / Association Meeting Continued**

Develop road map for next 5 years

Nick Tew / David Applegate –  
group discussion

Short term proposal (8 months)

Follow-up workshop with larger eq. community

Mapping

Operational / strategic plan development /2011 exercise

Bicentennial

Long term proposal discussion (1-5 years)

Bicentennial

GIS products – overlays

Improving instrumentation coverage

Earthscope

Meeting summary / closing comments

Nick Tew /David Applegate

Close meeting

**Appendix B**  
**Attendees List**

Association of CUSEC State Geologists  
&  
U.S. Geological Survey  
Workshop Agenda  
October 21-23, 2008  
Rapp Granary - David Dale Owen Laboratory  
New Harmony, Indiana

Day One, Two & Three Attendees:

Alabama Geological Survey  
Nick Tew  
Sandy Ebersole

Arkansas Geological Survey  
Scott Ausbrooks

Central U.S. Earthquake Consortium  
Jim Wilkinson  
Peggy Young

Illinois State Geological Survey  
Don McKay  
Bob Bauer

Indiana Geological Survey  
John Steinmetz

Kentucky Geological Survey  
John Kiefer

Mississippi Geological Survey  
Mike Bograd  
John Marble

Missouri Geological Survey  
Joe Gillman  
David Gaunt

Tennessee Geological Survey  
Ron Zurawski

Day Two & Three Additional Attendees:

U.S. Geological Survey  
David Applegate  
Jill McCarthy  
Elizabeth Lemersal  
Rob Williams  
Oliver Boyd

## **Appendix C**

### **History and Accomplishments of CUSEC State Geologists**

## Highlights of CUSEC State Geologists' History

Association of CUSEC State Geologists established (1992)

CUSEC Earthquake Prediction Evaluation Council established (1994)

First product – 1:2 million scale 8 state map (1995 & revised 1999 with USGS-Mid-Continent Mapping Center)

Bibliography of articles and publication on Seismic Zonation and Earthquakes (47 pages)

Central United States Earthquake Map Catalog & Reference Guide

The CUSEC-SG and USGS entered into a Memorandum of Agreement to better coordinate efforts to guide federal and state funded earthquake research in the CUSEC region based on each others strengths (1998)

Memorandum of Agreement signed with the Institute of Business and Home Safety (1998)

Memorandum of Agreement signed with the Mid-America Earthquake Center (1998)

Earthquake ground motion amplification map for the Paducah Quadrangle 1:250,000 scale (1998)

Press Release - CUSEC State Geologists express concern that a recently published article (Science Magazine, 4/23/99 – Slow Deformation and Lower Seismic Hazard at the New Madrid Seismic Zone)

Twelve – 1 x 2 degree quadrangles – Soil Site Class map completed (1999)

HAZUS & Use of CUSEC SG Maps Brochure (~2000)

Central U.S. Earthquake Consortium State Geologists – Brochure (2000)

Helped put together the CUSEC State Transportation Task Force

CUSEC – DOT state emergency routes map & bridge status (2001)

Third product – 6 cities at 1:24,000 scale – Soil Site Class Map

- Evansville (Eggert et al., 1995, 1996, 1997a,b,c,d and Hill, 2003)
- Cape Girardeau and Poplar Bluff, Missouri (Hoffman, 2001, 2004)
- Carbondale, Illinois (Bauer, 2002)
- West Memphis, Arkansas (McFarland, 2002) and
- Louisville, Kentucky (Wang, et al., 2004)

CUSEC works with USGS to set Magnitude of earthquakes on NMSZ for exercises (2005)

Central U.S. Earthquake Consortium State Geologists – Brochure (2006)

National consultants using CUSEC SG maps and databases:

- ABS Consulting (use to be EQE)
- Risk Management Solutions (RMS)
- URS Corporation
- Applied Insurance Research (AIR)
- Myriad Development
- CH2MHILL
- Human Technologies
- Geomatrix
- Polis Center
- USGS & CERI – Memphis
- Consultants for counties for DMA 2000 (Indiana & Illinois)

CUSEC SG maps requested by

- National Geospatial-Intelligence Agency
- 1<sup>st</sup> Army
- 5<sup>th</sup> Army
- NorthCom - Norad

FEMA New Madrid Catastrophic Plan – MAEC, GWU, VT, FEMA, USGS

- 8 state Soil Site Class Map
- 8 state Liquefaction Susceptibility Map
- 8 state generalized Soil Response Map

Clearinghouse plans

Individual Geologic Survey's Response Plan

Regional Response Plan through CUSEC & CERI

Many projects of opportunity:

- Perform downhole seismic survey in other projects' new boreholes
- Cased several other project boreholes to perform downhole measurements– measured and compared downhole, MASW and reflect/refract at one of these sites
- Drilling for geology and datable samples in Evansville
- Kentucky Geological Survey's database of 500+ shear wave velocity surface technique measurements performed in the past by Ron Street and Ed Woolery
- SCPT work with USGS
- MoDOT SCPT along emergency routes
- Georgia Institute of Technology subsurface & shear wave velocities in Bootheel of MO & St. Louis

CUSEC SG work benefited:

- Illinois State-Wide Comprehensive Seismic Assessment
- St. Louis and Evansville Urban Hazard Mapping Project
- FEMA New Madrid Catastrophic Planning Initiative
- PIMS – Post-Earthquake Information Management System – FEMA & U. of Illinois
- EERI Post-Earthquake investigation guidelines

- USGS Earth Hazards Program

NEHRP Funds:

- Never paid for Survey Staff salaries
- Never paid for Survey Overhead
- Never paid for Major equipment purchases - Surveys used their own equipment
- In kind matching contribution by Surveys averaged 450% of NEHRP funds (table end of this Appendix)

National Publications:

- Seismological Research Letters (1997 & 2004)
- Geotimes (1999)
- Engineering Geology (2001)

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- Wang, Z., S.J. Cordiviola and J.D. Kiefer, 2004, Earthquake Hazard Assessment for Louisville Metropolitan Area, Kentucky, Final Report Kentucky Geological Survey, pp. 15.

## CUSEC State Geologists' Talks, Posters, Invited Participations:

### **1992**

CUSEC workshop on Survey Response to EQ, Bloomington, IL  
Congressional Staff Roundtable, Washington, D.C.

### **1994**

Illinois EMA short courses  
Midwest Funeral Directors  
VA Hospital, Marion, IL  
State Farm Insurance

### **1995**

Applied Technologies Council's Post-earthquake Evaluation of Buildings, Peoria & Springfield  
Natural Disaster Awareness Day Program, Springfield, IL  
Central Chapter of the Red Cross, Peoria

### **1996**

U.S. Department of Transportation, Region 5 Office for Exercise  
CUSEC Earthquake Mitigation Workshop, Memphis - first national presentation of FEMA's  
Earthquake Loss Estimation Program  
Seismological Society of America, Annual Meeting, St. Louis - CUSEC Poster  
Applied Technologies Council's Post-earthquake Evaluation of Buildings, Carbondale, IL  
American Society of Safety Engineers, Central Illinois Chapter, Bloomington, IL.

### **1997**

Hoosier Earthquake Hazard Workshop  
Applied Technologies Council's Post-earthquake Evaluation of Buildings, Champaign  
Alton Chapter of the Red Cross, Alton, IL.

### **1998**

International Working Group - Monograph Prepared for the Workshop on Seismic Zonation, Paris

### **1999**

Alabama EMA Workshop – Overview of Earthquake Hazard  
Eastern SSA, Memphis  
Mid-America Highway Seismic Conference, St. Louis  
Earthquake Hazard Awareness for Wabash Valley Seismic Zone, Vincennes, IN  
Corp. of Engineers, Vicksburg, MS  
American Association of State and Highway Transportation Officials (AASHTO), Little Rock  
USGS Regional Hazard Map Meeting, St. Louis.  
FEMA 2<sup>nd</sup> Project Impact Summit, Washington, DC

### **2000**

New Madrid Seismic Zone Revisited, Memphis  
Earthquake Engineering Research Institutes' annual meeting, St. Louis  
Central U.S. Partnership, KY  
Post-Earthquake Highway Response & Recovery, St. Louis  
AEG Annual Mtg., St. Louis  
USGS Central and Eastern United States Hazard Map Workshop, St. Louis

**2001**

National Association of Insurance Commissioners – Earthquake loss estimation models review

**2002**

North Central/Southeastern Sections of Geological Society of America, Lexington, KY  
EQ Awareness & Damage Mitigation Workshop, Owensboro, KY  
CUSEC EMA Board Mtg., Nashville, TN  
Western States Seismic Policy Council Annual Mtg., Denver, CO

**2003**

AASHTO Ground Motions Workshop, Collinsville, IL  
Reviewing EQ Hazard in SE Missouri, Cape Girardeau

**2004**

Applied Technologies Council's Post-earthquake Evaluation of Buildings, Mt. Vernon, IL  
Applied Technologies Council's Post-earthquake Evaluation of Buildings, Carbondale, IL  
Illinois Emergency Management Agency Conference, Springfield, IL  
National Earthquake Conference, St. Louis, MO  
St. Louis Science Center for EQ Preparedness week - Poster

**2005**

Reviewed Seattle Fault Scenario Report for the Washington State Emergency Management  
ATC-35 Seminar Memphis, TN  
St. Louis Science Center for EQ Preparedness week - Poster

**2006**

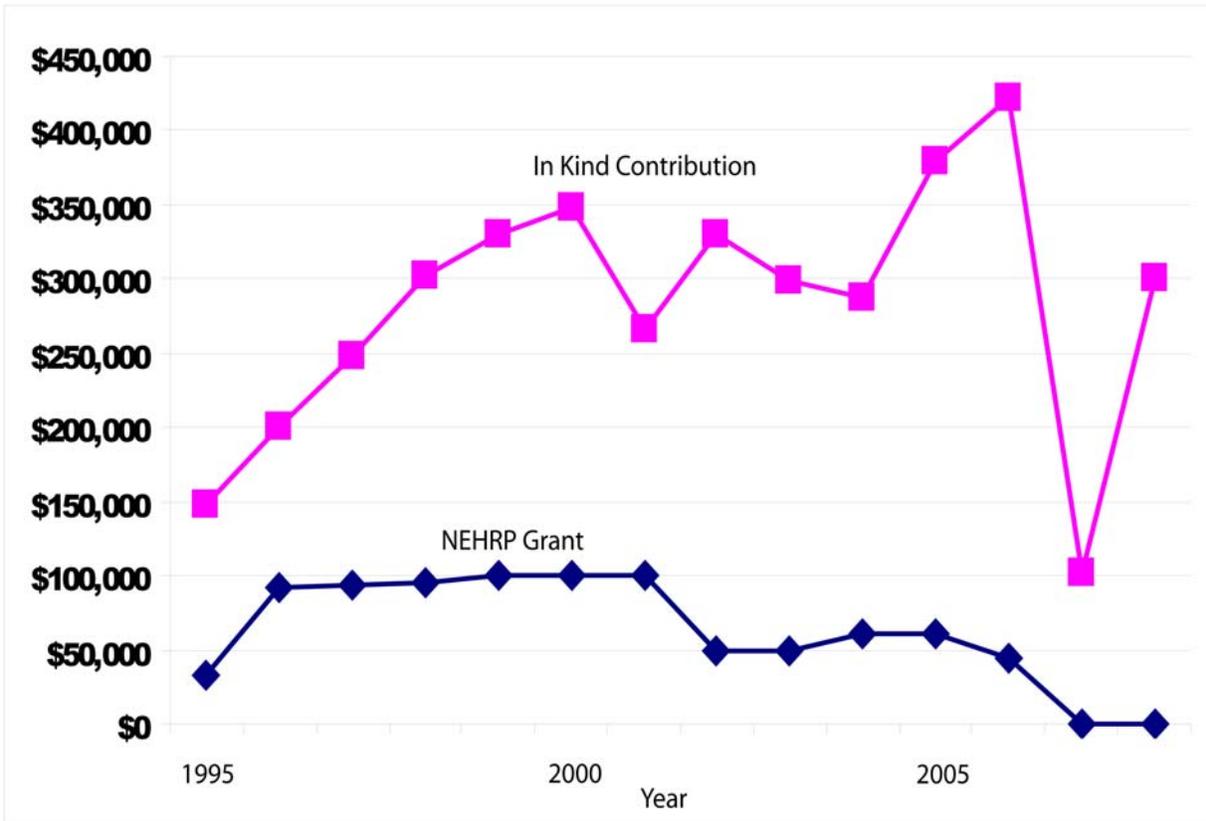
Delta Regional Authority Mtg., St. Louis, MO  
FEMA CAT PLAN Coordination Mtg., Chicago  
USGS Central and Eastern United States Hazard Map workshop, Boston  
CUSEC SG Soil Site Class map published in St. Louis Post Dispatch  
St. Louis Science Center for EQ Preparedness week - Poster

**2007**

SON-07 presentations to USEPA; IL, KY & IN EPAs, Coast Guard  
Borehole Geo-Observatory Workshop, Memphis  
Long-Term Deformation in Central U.S., Memphis  
St. Louis Science Center for EQ Preparedness week - Poster

**2008**

FEMA CAT PLAN Coordination Mtg., Chicago  
EERI New Madrid Scenario Project  
Scientific Needs Workshop, Rolla, MO  
PIMS – Post-Earthquake Information Management System, Chicago  
EERI Post-Earthquake Guidelines, San Francisco  
FEMA Region V Earthquake Conference, Indianapolis



**Appendix D**

**Report of State Geological Surveys' April 18, 2008 Mt. Carmel Earthquake Response**

**Summary of  
State Geological Surveys' Responses  
to the April 18, 2008  
Mt. Carmel, Illinois Earthquake**

**Compiled by Robert A. Bauer  
Technical Director CUSEC State Geologists  
Illinois State Geological Survey**

**Dec. 2008**

## **Introduction**

**The April 18, 2008 Mt. Carmel 5.2 magnitude earthquake caused reported damage in four states Illinois, Indiana, Kentucky and Missouri. The damage prompted some level of response from the state geological surveys within these four states and a response in a fifth state due to requests for information from their emergency managers and press. The State Geological Surveys are working on earthquake response plans which include setting up technical clearinghouses in their individual states. Also the Central U.S. Earthquake Consortium (CUSEC), U.S. Geological Survey (USGS) in Memphis and the Center for Earthquake Research and Information (CERI) at the University of Memphis along with the State Surveys are working on a regional technical clearinghouse at CERI/USGS. The response to the April 18, 2008 Mt. Carmel, Illinois earthquake was a good learning experience and as such, we crafted this questionnaire to capture the CUSEC State Geologists' responses and lessons learned that could be used to benefit future responses. The April 18, 2008 earthquake main shock occurred at 4:37 am Central Time or 5:37 Eastern Time.**

**Alabama Geological Survey's Response to the April 18, 2008 Mt. Carmel Earthquake  
(main shock at 5:37 am Eastern Time for Alabama)**

**1. Did your Survey have some type of response to the Mt. Carmel Earthquake?**

Our response involved answering questions from news reporters in Alabama who wanted to know how this quake affected people in Alabama (USGS Did-You-Feel-It reports), what threat the respective seismic zone had to Alabama and what earthquakes and seismic hazards we have in our own state. At 7:00 am (ET). that morning, our state Emergency Management Agency (EMA) natural hazards program manager also wanted information on how many people in Alabama reported shaking and how strong the shaking was, where the epicenter was located, and any additional background information on the earthquake that we could provide for a morning briefing. We also put up an in-house poster by that afternoon for reference and included geology background, seismic source zone information, past seismic history of the area, maps of the region, print offs from Alabama seismographs that recorded the shaking, and a summary of reported shaking in Alabama.

**2. Did you have staff in the state's Emergency Operations Center for this event?**

No. We communicated with our state EMA via phone and email.

If yes, Was it your regular EOC assigned staff?

When was the EOC opened and when did they arrive?

What communications were available to this staff at the EOC??

Phone?

Your own assigned Computer?

Your own email account?

Internet?

GIS?

Able to display maps to the EOC?

What was your role in the EOC – what did you do in the EOC?

What files, communications or information do you wish you had at the EOC?

**3. Did you stand up a clearinghouse within your organization?**

No, but most of the emails and phone calls were directed to hazards division staff of the Alabama Geological Survey via our agency's executive secretary.

If yes, How did you communicate this to others?

When did you have information displayed on your Survey's website and what?

**4. What communications did you have with other responders from the Central U.S. and when?**

a) Universities - None

b) State DOT's - None

c) USACOE - None

5. Did you send staff into the field to document site information?

No, not required because of lack of damage.

What types of information did they gather?

What do they wish they had for their job?

When did they get to the site? Date and time.

6. Anything else you wish you had or knew during the event, etc?

Nothing else. Most of the information we needed was available on the websites of USGS, CERI, and CUSEC.

7. What could have been done better?

The CUSEC and CERI websites seemed to be down (overloaded with web users) later in the day. With this being a smaller event, it made me wonder how those sites would perform during a larger regional event and if there is any way to create either a mirror site to post the same information to (even basic background information on the seismic zone, etc.) or if there is a possibility of upgrading hardware/server capabilities to handle more traffic. For a larger, regional event, it would be great if the same information could be posted on multiple websites. This would allow the info to get out to everyone who needs it, but traffic would be divided up to multiple sites instead of just one site.

8. Outside of multiple press contacts and interviews, did you provide graphics? What were you asked to supply?

Regional maps showing seismic zones and historical earthquake epicenters as well as maps of Alabama showing earthquake epicenters. We were also asked for statistics of historical earthquakes in the region and in the state.

**Illinois State Geological Survey's Response to April 18, 2008 Mt. Carmel Earthquake  
(main shock at 04:37 am Central Time for Illinois)**

**1. Did your Survey have some type of response to the Mt. Carmel Earthquake?**

Received location and magnitude information from the U.S. Geological Survey's National Earthquake Information Center (NEIC) at 5:01am Central Time. We had staff in our main office in Champaign within a half hour, others working from their homes starting at the time of the event. Ultimately we had staff in the state Emergency Operations Center (EOC), performed clearinghouse operations of coordination from the main office in Champaign, and had staff in the field documenting damage in the towns throughout the area. Performed many press interviews from the EOC and from the main office staff. Since this was a magnitude event that was similar to previous magnitude 5.0+ in the state, we were able to call the State Emergency Management Agency's communications center at 5:05 am and list what we expected for estimated damage and how many states would feel the event. This was provided in an attempt to assure SEMA that information reported was within reason.

**2. Did you have staff in the state's Emergency Operations Center for this event?**

Yes from 9am to 6 pm on April 18<sup>th</sup>.

**If yes, Was it your regular EOC assigned staff? - Yes**

**When was the EOC opened and when did they arrive?**

Received the call at 6:30 am (CT) for activation and arrived at the EOC at 9:00 am (CT). EOC is 2 hours away.

**What communications were available to this staff at the EOC??**

**Phone?** – Yes and personal cell phone.

**Your own assigned Computer?** - Yes

**Your email?** - Yes

**Internet?** - Yes

**GIS?** – available by EMA staff in EOC

**Able to display maps in the EOC?** – Yes, electronically displayed on large flat screens.

**What was your role in the EOC – what did you do in the EOC?**

Even before arriving at EOC was reviewing text for press releases for the State Emergency Managers concerning aftershocks and what to expect while driving to EOC. At EOC, monitored information coming in through EOC staff, emails and websites. Helped write many press releases for governor's office, EMA releases, for Director of

EMA for news conference, EMA and Homeland Security websites, was one of 3 people presenting information at the state's press conference, presented maps to press of historic earthquake events throughout the state, press interviews over the phone, communicated damage to other states and CUSEC, presented briefing to EOC on historic earthquakes in the state and Central U.S. and what to expect for aftershocks, and presented PowerPoint slide information to coal industry on what to expect for damage for safety course that was to be presented the next day.

#### [What files, communications or information do you wish you had at the EOC?](#)

Had downloaded many files of our response plans, graphs, historical earthquake information, pre-scripted press releases about aftershocks and how public should respond during an earthquake event, PowerPoint talks, graphics onto a thumb drive and had them available at the EOC. The one thing I wish I had was a list of who was responding in the other states and if the Center for Earthquake Research and Information at University of Memphis (CERI/USGS) was operating some type of clearinghouse for collection of regional information compiled from each state. I responded back with reports on damage information found in Illinois to people providing reports from the other states. Later in the day I realized there were responders in other states whom I did not send information. Sent info to CUSEC office in Memphis after a communications from Paul Hogue.

Needed to just send out reports of state damage/information to an email list of all potential CUSEC responders and not wait for establishing communications.

For a much larger event would need many GIS files that I did not have.

#### [3. Did you stand up a clearinghouse within your organization?](#)

Yes. After internal communications and coordination, Tim Larson coordinated communications out of our main office with CERI and Indiana University for deployment of portable seismographs and handling many press interviews.

#### [If yes, How did you communicate this to others?](#)

Left messages on work phones about who at ISGS was responding and what tasks people were doing and left cell phone numbers of each staff member responding. Communicated same to our staff that answers our main phone number.

#### [When did you have information displayed on your Survey's website and what?](#)

By 5:20 am (CT) we had links to the USGS earthquake site on our homepage. Later in the day we had a separate panel with lists of links to other sites and information being produced at our survey including graphs and information on aftershocks recorded. Maintained site for several months. Typically have about 40 to 100 hits a day on our earthquake section website. On April 18<sup>th</sup> we had 20,315 hits.

#### [4. What communications did you have with other responders from the Central U.S. and when?](#)

##### [a\) Universities](#)

Called CERI staff on their cell phones about 6:30 am (CT) then on their office phones – left messages about who is coordinating responses in Illinois and that cell phone

and office numbers, also emailed same information to them. Later contacted Indiana University staff. Coordinated seismic equipment deployment by giving all their respective cell phone numbers and cell phone numbers of our staff in the field who were documenting damage.

b) State DOT's

Interacted with IDOT in EOC

c) US Army Corp of Engineers

Not in EOC and no communication.

5. Did you send staff into the field to document site information?

Yes, staff near affected region self deployed and were contacted by our organization to assist seismograph deployment if needed.

What types of information did they gather?

Went from town to town in Illinois and documented damage.

What do they wish they had for their job?

A way to get pictures back ASAP and reports from them ASAP. Also Survey photographic equipment. They had to pick up their own camera from home.

6. Anything else you wish you had, knew during the event, etc?

List of who was responding in other states, what they were doing and if others from a regional standpoint such as CERI or USGS Memphis had their website set up as a "clearinghouse". While working in the EOC, one didn't have the time to go searching – information has to be thrown at you through notifications such as through email!

7. What could have been done better?

Really need more prepared text for more information. Text is clipped by the Public Information Officers for press releases from various website sources. Much of it is basic information and may not be up to date resulting in "wrong" information. Had a number of pre-scripted texts on aftershocks and what to do during an earthquake event for press releases but needed more. Same thing with graphics. Had graphics in the EOC but Home office did not and people were so busy with coordination and press interviews, one couldn't make time to direct creation of graphics. Greatly slowed down info going out. Need more local information on the Survey website, not just links. Needed area on website for others responders to go to, to gain a perspective of response in state (location of clearinghouse set up, contact information, etc.)

8. Outside of multiple press contacts and interviews, did you provide graphics? What were you asked to supply?

Supplied maps of state with earthquake locations plotted for the past 213 years. Events plotted per magnitude and some had year of event next to it. Not asked for other graphics.

**Indiana Geological Survey's Response to April 18, 2008 Mt. Carmel Earthquake  
(main shock at 5:34 Eastern Time for Bloomington, Indiana)**

1. Did your Survey have some type of response to the Mt. Carmel Earthquake?

Yes. An informational announcement about the earthquake on the Indiana Geological Survey (IGS) Web site with links to USGS and Indiana University information by 7:00AM (ET). The site was updated regularly for the next two weeks. The Director, Assistant Director for Research, Information Officer, and a Senior Staff Geologist fielded telephone and e-mail inquiries for several days after the event.

2. Did you have staff in the state's Emergency Operations Center for this event?

No.

3. Did you stand up a clearinghouse within your organization?

See # 1 above. The Director issued a statement late on the first day, but for the most part IGS staff stayed informed by monitoring news services and visiting the USGS Web site.

If yes, How did you communicate this to others?

When did you have information displayed on your Survey's website and what?

4. What communications did you have with other responders from the Central U.S. and when?

a) Universities

We were in communications with seismologists from Indiana University's Department of Geological Sciences by 8:00AM (ET).

b) State DOT's

The Director participated in a FEMA-initiated briefing at noon (ET) on the day of the earthquake.

c) USACOE

5. Did you send staff into the field to document site information?

No, but Seismologists from Indiana University's Department of Geological Sciences were deployed to the field the afternoon of the earthquake. (Norm Hester (previous IGS Director) spent several days photographing damage in towns in Indiana over the first weekend).

What types of information did they gather?

Indiana University (IU), along with several other institutions, sent several teams to the region of the epicenter to monitor aftershock activity. The teams set up five Global Positioning System (GPS) instruments and six seismographs to monitor the movement of the earth's crust associated with the earthquake and aftershock activity in the days following the event. (M. Hamburger, pers. comm.)

Additionally, IU has been involved for many years in running an outreach program placing seismographs at schools throughout the region. By virtue of that network, known as the Indiana PEPP Earthquake Science Program (see <http://www.indiana.edu/~pepp>

for additional information about the program), we now have an Indiana state seismograph network that has provided high-quality scientific data with which to study the earthquake. (M. Hamburger, pers. comm.)

What do they wish they had for their job?

When did they get to the site? Date and time.

6. Anything else you wish you had or knew during the event, etc?

7. What could have been done better?

8. Outside of multiple press contacts and interviews, did you provide graphics? What were you asked to supply?

We mailed out more than 6,500 copies of a brochure entitled, "Earthquakes in Indiana," and made a PDF of the brochure available for download from our Web site at:

<http://igs.indiana.edu/earthquakes/EarthquakeBrochure.pdf>

Brochures were sent to 750 middle and high schools, and more than 500 libraries across the state. We also mailed a brochure to each state representative and senator.

**Kentucky Geological Survey's Response to April 18, 2008 Mt. Carmel Earthquake  
(main shock at 5:37 am Eastern Time for Lexington, Kentucky)**

1. Did your Survey have some type of response to the Mt. Carmel Earthquake?

Yes, held a press conference and sent one member to the state emergency operations center that was activated.

2. Did you have staff in the state's Emergency Operations Center for this event?

Yes (William Andrews)

If yes, Was it your regular EOC assigned staff? - NO

When was the EOC opened and when did they arrive?

1<sup>st</sup> situation report @ 6:39 am (ET) (est. center opened earlier). Arrived at ctr. ~ 9:30 am (ET).

What communications were available to this staff at the EOC??

Phone? YES

Your own assigned Computer? YES

Your email? NO

Internet? YES

GIS? NO

Able to display maps to the EOC? YES

What was your role in the EOC – what did you do in the EOC?

I provided background on typical seismic events (aftershocks, etc) for those in EOC. Confirmed 11:14 (ET) aftershock.

What files, communications or information do you wish you had at the EOC?

Better network/communication with prof. seismologists: relied on internet data. Logged onto our online seismic network site and were able to confirm aftershocks that had been reported.

3. Did you stand up a clearinghouse within your organization?

No, but we did host media interested in broadcasting information. We made seismograph traces available and maps of the recorded historic epicenters in the region. We fielded media requests radio, TV, Newspapers about 4 networks and 5 radio stations.

If yes, How did you communicate this to others?

The University of Kentucky Press Office coordinated the press conference and instructed the media where to go and what time. The press office also coordinated phone in requests from local radio outlets wanting experts for on air phone conversations.

When did you have information displayed on your Survey's website and what?

Yes, we had seismograph traces and later in the day we had more information posted.

4. What communications did you have with other responders from the Central U.S. and when?

a) Universities      None to my Knowledge

b) State DOT's

c) USACOE

5. Did you send staff into the field to document site information?    NO

What types of information did they gather?

What do they wish they had for their job?

6. Anything else you wish you had, knew during the event, etc?

7. What could have been done better?

Getting visual affects for the media is difficult. Had the damage been much worse we would have been hard pressed to organize our response.

8. Outside of multiple press contacts and interviews, did you provide graphics? What were you asked to supply?

We provided our online seismic network and copies of the earthquake and aftershock seismographic traces. These were the graphics on our website.

**Missouri Geological Survey's Response to April 18, 2008 Mt. Carmel Earthquake  
(main shock at 4:37 am Central Time for Missouri)**

1. Did your Survey have some type of response to the Mt. Carmel Earthquake?

Yes. The Missouri Geological Survey Program fielded telephone calls from private citizens and local (St. Louis and Kansas City area) broadcast and print media. Individuals were directed to the USGS' "Did You Feel It?" website; media outlets were granted short interviews (approximately 10-15 "general-type" earthquake questions).

The program participated in two briefings with other state agencies and responders in the eastern region. A briefing on the actual earthquake event was given by the State Geologist.

2. Did you have staff in the state's Emergency Operations Center for this event?

No. However, conference calls with SEMA, other state & local agencies, and first responders identified potential dangers and other impacts from the EQ.

If yes, Was it your regular EOC assigned staff?

When was the EOC opened and when did they arrive?

What communications were available to this staff at the EOC??

Phone?

Your own assigned Computer?

Your own email account?

Internet?

GIS?

Able to display maps to the EOC?

What was your role in the EOC – what did you do in the EOC?

What files, communications or information do you wish you had at the EOC?

3. Did you stand up a clearinghouse within your organization?

CUSEC requested that some of the member-states (Illinois, Indiana, Kentucky) prepare to "stand-up" their Post-Earthquake Technical Information Clearinghouses. Missouri did not implement the clearinghouse plan.

If yes, How did you communicate this to others?

When did you have information displayed on your Survey's website and what?

4. What communications did you have with other responders from the Central U.S. and when?

a) Universities – NONE

b) State DOT's – Missouri DOT representatives participated in morning and afternoon sit-rep conference calls with Missouri SEMA, we learned of their activities during those calls.

c) USACOE – NONE

d) CUSEC, other states – received e-mail damage reports and reports of felt shaking.

5. Did you send staff into the field to document site information?

No

What types of information did they gather?

What do they wish they had for their job?

When did they get to the site? Date and time.

6. Anything else you wish you had or knew during the event, etc?

7. What could have been done better?

Missouri's Geological Survey Program recognized the need to improve our response plan, and communications capabilities, as well as finalizing and distributing our Post-Earthquake Technical Clearinghouse plans to those staff who will be directly involved in the implementation of said plans. Additionally, we believe that the program needs to find a way to go beyond the planning stage and begin to actually prepare (i.e. by acquiring equipment, supplies, etc.) to implement our Earthquake Response Plan and Clearinghouse plans. This will likely require budgetary adjustments, work plan MOUs/MOAs with SEMA, and better coordination with our state partners.

8. Outside of multiple press contacts and interviews, did you provide graphics? What were you asked to supply?

No. On the fourth week following the April 18 earthquake event (May 12-14, 2008) a previously scheduled, state-wide catastrophic planning workshop was conducted. On the opening day of the workshop, the State Geologist and the Geological Survey Program Director gave presentations that summarized the April 18<sup>th</sup> event, including some graphics from the USGS's Earthquake web pages, and the program's clearinghouse plan, respectively.

**Appendix E**  
**Project Ideas**

## **Project Ideas**

### **Loss Estimation**

Additional products for Loss Estimation Programs:

- Landslide Hazard Maps
- Additional 1:24,000 areas (Ohio River corridor, Tunica??)

Quantify effect of detailed maps for HAZUS on loss estimates.

- California and Utah did preliminary studies to show 30 to 50% increases in damages

Calibrate the loss estimation programs to real Central U.S. Earthquakes

Outside of our expertise – fragility curves for our old unreinforced masonry buildings in CUS

### **Site Effects**

Do we have basin effects within our large river valleys?

- Do network operators see differences in alluvium sites with source location (south vs east)

Investigate amplification per soils in CUS

- Small events seeing large amplification with seismographs
- Chris Cramer thinks he sees this in the Did You Feel It data
- Does Shake91 and DeepSoil estimate CUS amplification correctly?

How investigate this?

- With existing data from mine blast seismographs?
- Proposal with portable seismographs – where set up?
- Would the EarthScope Array help with this?

What paleoliquefaction work is left in CUS?

- Better dating using Optically Stimulated Luminescence?
- Dating of sites without dates by OSL

### **Earthquake Response**

Earthquake Response safety messages for SG use and PIOs use.

- Consistent prescribed safety messages across state lines

Post-Earthquake Technical Clearinghouse.

- Continue subcommittee work under CUSEC/CERI to finalize
- Prepare for 2011 exercise
- Prepare agreement with FEMA for timely reimbursement
- MOAs with Universities and Community College systems

## **Monitoring**

Expanding the strong motion recording stations through industrial partnerships. This would be a giant step forward in the ability for the National Earthquake Information Center to provide a map in real time of the ground motion of a damaging earthquake. The benefit to the emergency response community is obvious. If the State Survey management would get involved this is doable. Through the efforts of Christine Martin, Roger Lehman and Norm Hester, they have built strong support for this program in the Evansville area.

If the right contacts are made, support from industry is easy to find; to the point where they will not only provide a matching fund <\$7000.00 for installing the equipment but also provide funds to purchase the instrument; \$9000.00. Toyota Motor Manufacturing has made this offer. In Indiana they have secured the support and help of a utility (Vectren) for the construction work required for installing present and future equipment.

## **Outreach**

Revamp Earthquake 101 general public presentation

- Norm's take was a hard copy – not any more. Set of captioned illustrations for each session and provided upon request. It will always be a “living” project.

Living with earthquakes in Central U.S.

- similar to “Putting down roots in earthquake country” CUSEC & some state hazard mitigation managers are interested in this!

## **Neotectonics of the WVSZ**

A project that combines E-W lines of LIDAR coverage, ground penetrating radar, high resolution shallow seismic refraction and trenching. The NNE-SSW lineaments expressed on topo maps and aerial photos plus John Sexton's ground penetrating radar data shows stratigraphic offset in the Holocene sediments should provide the justification for more research.

## **CUSEC State Transportation Task Force**

- They do not have “right” Team for FHWA continued support.
- Linking of emergency routes across state lines

## **Post Earthquake RFPs on the Shelf Waiting for Event**

Post Earthquake long-term investigations

- 5 months after April 18<sup>th</sup> owners still deciding on how to handle damage to structures

Long-term database for event - establish and maintain

## **Appendix F**

### **2011 National Level Exercise 11 (NLE-11) Schedule**

#### **National Level Exercise 11 (NLE – 11)**

New Madrid Catastrophic Event

OKed by White House and Congress

First non-terrorist national training exercise. There is one NLE per year.

March 09 First Steering Committee meeting

2010 Training – conduct low level exercise

May 2011 – Functional SEOC for 1 week

July 2011 – State - long term recovery exercise

Aug 2011 – Federal/State – long term recovery exercise

Sept 2011 – After Action Conference

**CUSEC State Geologists' Meeting**  
**Jackson, TN**  
**August 13-14, 2009**

Participants: Bob Bauer & E. Donald McKay (IL), Mary Parke (IN), Ron Zurawski & Mike Hoyal (TN), Sandy Ebersole (AL), Mike BE Bograd (MS), Bekki White & Scott Ausbrooks (AR), Joe Gillman, Jerry Prewett & David Gaunt (MO), Oliver Boyd (USGS), Jim Wilkinson, Brian Blake, Paul Hogue & Peggy Young (CUSEC) and Veronica Villalobos-Pogue (AR EMA – ADEM)

**Agenda Items**

- Chair of CUSEC-SG
- Overview of National Response Framework - Bauer
- Overview of FEMA Regional Workshops on New Madrid Cat Planning Project – Bauer and participants in each state
- Overview of USGS Response Plan - Boyd
- USGS Notification System Products - Boyd
- Each Survey's earthquake response plan & state clearinghouse plan – all to report
  - Where each Survey is with their plan & state acceptance
  - Communication within and outside state
    - Coordination with Public Information & Communications Officer(s)
    - Local ham radio operators
  - Plans for clearinghouse locations
  - Staffing shortfalls – how handling
  - Coordinate with SEMA's GIS committee for EOC requirements
    - Chair is John Heltzel, KY Director – waiting for funding out of work plan
- Equipment needs – Bauer
  - Field & Safety equipment
  - Data collection equipment & forms
  - Communications
  - Clearinghouse equipment
  - Clearinghouse databases - Ebersole
- Multi-State Regional Clearinghouse Plan – Mike Calvert update
- Pre-scripted post earthquake messages for surveys and state Public Information Officers
  - Aftershock projections & normally what to expect
  - Safety messages & how to help
  - Where information readily available web & radio sites
- Credentialing – all to report
  - Update progress in assembling list – CUSEC ready to go & FEMA Regions agree
  - Set date for submittal
- Training in National Incident Management System – all to report
  - Web site training
  - Level needed defined by SEMA?
- National Level Exercise – 2011 (NLE-11) - Bauer
  - Review of each state's proposed play
  - Proposed play of CUSEC SGs
- Bicentennial - Bauer
  - Activities/Products
    - Feb 2011 kick off with press releases
    - Pamphlet – insert (similar to earthquake country or S. Carolina)
    - ShakeOut maybe kick off of NLE-11 CUSEC Board wants this

- St. Jude house built with IBHS in Memphis for 2012 mtg
- Society meetings 2011-2012
  - SSA mtg – Memphis April 2011
  - National Earthquake Conf – Memphis Feb 2012
- Field trips – USGS-CERI committee leads for science
- EQ 101 products - Ebersole
- Arkansas Seismic Network – White & Ausbrooks
- Meet with PIOs and EPM for summary of work – Wilkinson & Bauer
  - Response plans but shorting coming is interaction with PIOs & communications.
- EarthScope Projects – all to report
- Potential action items and estimated budget of the short and long term items – road map for the future – all to discuss
  - Regional compilations for such items as faults?
  - October 28-29, 2009 Central and Eastern US Earthquake Hazards Meeting, Memphis, TN

## Summary of Meeting

### Chair of CUSEC-SG

Discussed the position and had nominations and voted Mr. Joseph Gillman of the Missouri Geological Survey as the new Chairman.

### Overview of National Response Framework

Bauer presented a short PowerPoint presentation about the terms, structure and responsibilities of the various Federal response centers/offices such as the National Response Coordination Center, Regional Response Coordination Center, Joint Information Center and Joint Field Office.

### Overview of FEMA Regional Workshops on New Madrid Cat Planning Project

The regional meetings were held:

Region V – Indianapolis, IN	Feb 24-26, 2009
Region VI – Little Rock, AR	April 28-30, 2009
Region IV – Atlanta, GA	May 4-6, 2009
Region VII – Jefferson City, MO	May 27-28, 2009

The FEMA Cat plan was based on a 7.7 magnitude event on all three faults of New Madrid - faults defined as the currently seismic active regions. The plan produced impacts on Direct Damage, Economic Loss and Social Impacts Assessment per affected regions counties. These workshops were held with State and Federal counter parts working to address how they were going to handle such an event in preparation for each FEMA region to produce their: Earthquake Operations & Contingency Plans

Each workshop had breakout sessions for which Jim Wilkinson, Executive Director of CUSEC arranged to have a Scientists' breakout session for the CUSEC State Geologists and USGS where each would present response plans and products produced during the response. Some FEMA regions integrated this into their overall program with either a presentation to the entire workshop and/or a report back to the whole group on a summary of the break out and other workshops did not.

### **FEMA Region V Workshops in Indianapolis**

FEMA Region V held several workshops including one in Oct. 2008 where Robert Bauer made a presentation on the Impacts for Central US, CUSEC-SG response plans and April 18, 2008 event damage to the participants of the entire workshop.

At the Regional Workshop on Feb. 24-26, 2009 the USGS gave overview of Hazard and the scientists' workshop reported back to all on their breakout session.

### **USGS/CUSEC State Geologic Survey (CSGS) Breakout for Scientists and Researchers**

- 30 Minutes** Introductions, Catastrophic Planning, and National Level Exercise 2011 (Jim Wilkinson)
- 15 Minutes** Earthquake Hazard Modeling (Dr. Theresa Jefferson)
- 50 Minutes** State Geologic Survey Response Plan, Clearinghouse, and State EMA Needs from State Surveys (known and unknown) (Bob Bauer, CUSEC Association of State Geologists and IL Geologic Survey) HANDOUT: Generic State Survey Plan

**50 Minutes** Overview of USGS Products and Services (water, soil, dams, levees, etc.) (Drs. Tish Tuttle and Michael Blanpied)

**50 Minutes** Overview of EROS (Brenda Jones, USGS)

During the breakout, the FEMA Cat plan, Hazard modeling, CUSEC-SG response & clearinghouse plans (IL & IN), USGS earthquake notification products, and EROS products were presented. The breakout provided information to participants and feedback from participants on plans and available products.

### **Breakout Participants**

<b>Name</b>	<b>Organization</b>
Jim Wilkinson	CUSEC
Brian Blake	CUSEC
Robert Goulka	HUD
Jenny Pearce	FEMA HQ Catastrophic Planning
Doug Bausch	FEMA RVIII
Tim Gress	MAE Center
Lisa Cleveland	MAE Center
Theresa Jefferson	Virginia Tech
Mary Parke	Indiana Geological Survey
Bret Robinson	USGS
George Boughton	FEMA RIV
Michael Blanpied	USGS
Holly Dockery	DHS
Tish Tuttle	USGS
David Gaunt	Missouri Geological Survey
Natasha McCallister	USGS
John Aucott	FEMA HQ
David Crisp	FEMA RIV
David Nail	USGS
Brenda Jones	USGS EROS
Bob Bauer	Illinois Geological Survey
Jim Wilcoski	USACE
Ed Laatsch	FEMA HQ
Dan Bement	FEMA RV

#### **1. What program areas should be included?**

- a. Science Advisors (SME)
- b. Public Information (Inter-Agency)
- c. Field Operations
  - a. Ground Rupture
  - b. Liquefaction
  - c. Landslide
  - d. Temporary Seismic Stations
  - e. Site Response

- f. Engineering Surveys (Structural/Geotechnical)
    - g. Geodetic Surveys
    - h. Surface Water Investigation
  - d. Geospatial
    - a. GIS Support
    - b. Web Support
    - c. Over-flight Coordinator
    - d. Maps & Air Photos
    - e. LIDAR Support
  - e. Seismology
    - a. Duty Seismologist
    - b. Regional Seismic Network Operations
    - c. Strong Motions
    - d. ShakeMap
  - f. Logistics
    - a. Communications
    - b. Personnel Tracking
    - c. Vehicle Coordinator
  - g. Administrative
    - a. Travel Coordinator
    - b. Credentialing Coordinator
    - c. FEMA Reimbursement
    - d. Procurement and Timekeeping
  - h. Other
    - a. Possible State Survey Representative
    - b. Safety Coordination

**2. Who from USGS needs to be involved?**

- a. Participation on the NRCC (National Response Coordination Center) Conference Calls
  - a. Need to designate a spokesperson, because most will be too busy to participate on regular calls
- b. Science Lead/Public Information staff for creating talking points for the media

**3. Who will need a USGS representative or assistance?**

- a. Media / Community
- b. Federal Government (Congressional and Otherwise)
- c. DHS/FEMA
  - a. General Public Information assistance
  - b. National Response Coordination Center
  - c. National Operations Center
  - d. Regional Response Coordination Center
  - e. Joint Field Office
- d. State Surveys
- e. USAR Support

- a. Potential for early warning notification to USAR teams

*\*\*\*USGS may need support from the State Survey's to a certain extent\*\*\**

**4. What triggers would cause automatic USGS response in terms of engaging agency response role?**

- a. Magnitude
  - a. Magnitude >5.0 generally have "significance"
- b. Location
- c. Impact
- d. Scientific Interest
- e. When a state EOC is activated?

*\*\*\*May be useful for USGS to provide narrative of how they responded to previous earthquakes (Wells, Nevada EQ for instance)\*\*\**

**5. What USGS teams or individuals would need to deploy and what kit or equipment would they need to carry with them?**

**Teams**

- a. Ground Rupture
- b. Liquefaction
- c. Landslide
- d. Temporary Seismic Stations
- e. Site Response
- f. Engineering Surveys (Structural / Geotechnical)
- g. Geodetic Surveys
- h. Surface Water Investigation
- i. Geospatial

**Current Equipment**

Jeep  
Satellite Phone  
Canoe  
Land Surveying Equipment  
Tripod LIDAR  
Scientific Response Vehicle  
John Boat

**Needed Equipment**

Helicopter  
Air Boat  
Hovercraft  
Boats  
HAM Radio Operator/Equipment  
Digital Data Collectors/ROVER (FEMA units)

Pre-developed templates/forms for data collections

- 6. Is there a USGS earthquake response plan from the west coast that could be used as a starting point for the USGS NMSZ response plan? If not, how could the generic state survey plan be used as an outline?**
  - a. Yes. USGS San Francisco Bay Region as a template NMSZ Response Plan
  
- 7. How will USGS Play in NLE 2011?**
  - a. Response community will be looking to USGS to provide hazard/event synopsis to kick off the NLE.
  - b. What level does the USGS want to test their NMSZ response plan as part of the NLE?
  - c. May be tasked to provide scenario descriptions during the exercise
  - d. Multi-State / National level meetings to develop NLE (what role might the USGS play in these meetings?)
  - e. Key USGS staff may observe currently planned exercises or State/Federal EOC activations where applicable/available
  - f. USGS may hold lead up exercises to prepare/test pieces of the NMSZ plans
  
- 8. Conclusion/Summary/Way Ahead**
  - a. USGS is interested in participating in lead up exercises in preparation for the 2011 NLE, as well as participating in the 2011 NLE
  - b. Will be using existing (San Francisco) template to create NMSZ response plan
  - c. Would like to observe State/Federal EOC activations of a disaster to gain familiarity with disaster operations
  - d. Would be interested in training opportunities to gain familiarity with disaster operations (NIMS, ICS, Online Training through FEMA is available)
  - e. Potential demonstration project for interested municipalities
  - f. Potential development of USGS fact sheet to let emergency management community what products are available, what roles USGS can provide when responding to disasters
    1. Front end planning information
    2. What is available online for real-time products
    3. What long term products might be available

In addition to the workshop, the ISGS has reviewed and commented on Region V's Earthquake Operations & Contingency Plans manual.

## **FEMA Region VI Workshop – Little Rock on April 28-30, 2009**

State Geologists, USGS and CUSEC briefed the senior management before the workshop.

USGS made a presentation on Hazards in Central US to the senior leadership and the next day to the full audience of the workshop participants.

During the scientists' breakout, presentations were made on the FEMA Cat plan, CUSEC-SG response & clearinghouse plans (AR), USGS earthquake notification products, and an Overview of FEMA HQ Response Structure by Scott Wells. This breakout had a small group of outside participants and made no report back to the full workshop.

### **Breakout Participants**

<b>Name</b>	<b>Organization</b>
Tom Andrews	Nuclear Regulatory Commission
Scott Ausbrooks	Arkansas Geological Survey
Bob Bauer	Illinois Geological Survey
Brian Blake	Central US Earthquake Consortium
Mike Calvert	Central US Earthquake Consortium
Dave Gaunt	Missouri Geological Survey
Larry Hultengren	Federal Emergency Management Agency
Natasha McAllister	US Geological Survey
Jill McCarthy	US Geological Survey
Jenny Pierce	Federal Emergency Management Agency
Tish Tuttle	US Geological Survey
Conner Watkins	US Geological Survey
Scott Wells	Federal Emergency Management Agency
Jim Wilkinson	Central US Earthquake Consortium

### **TOPICS OF DISCUSSION**

#### **Introductions, Overview of Catastrophic Planning, and National Level Exercise 2011**

Jim Wilkinson, Central US Earthquake Consortium

#### **Review of the Response Structure**

Scott Wells, Federal Emergency Management Agency

#### **State Geologic Survey Response Plan, Clearinghouse, and State EMA needs from State Surveys**

Bob Bauer, Illinois Geological Survey

Scott Ausbrooks, Arkansas Geological Survey

#### **Overview of USGS Products and Services**

Jill McCarthy, US Geological Survey

#### **USGS and State Survey Post-Earthquake Operational Response Discussion**

Group Discussion

Jill McCarthy: Operational is not very detailed –  
Where people will be sent  
Who will be called  
Different focus than State Surveys

Jim Wilkinson: Plan defines how USGS will function as an agency, how they will support EMA, how they perform in the field.

Jill McCarthy: USGS focused on not as comprehensive a plan, but starting within EQ division in USGS and what role they would play.

### **April 30, 2009**

Discussed the USGS hazard briefing and how to more effectively get the catastrophic nature of it across to the audience. Additional videos may be used. Getting the point across about the flooding hazard (and water depth).

The goal of the breakouts is integration. Dr. Tuttle wants to know how USGS can help with that. Jim Wilkinson will get them invitations to EOCs and JFOs and possibly FEMA RISC meetings. We will also include them in NLE2011, Exercise, and Training meetings.

### **FEMA Region IV Workshop in Atlanta on May 4-6, 2009**

USGS made a presentation on Hazards in Central US to the full audience of participants.

During the scientists' breakout, presentations were made on the FEMA Cat plan, CUSEC-SG response & clearinghouse plans (TN & AL), USGS earthquake notification products, and an Overview of NLE-11 was made by John Aucott. The scientists' breakout session had a small group of outside participants and no report was made back to the full workshop.

During the breakout a list was made of what data to collect based on time critical sensitivity.

- Liquefaction & Lateral spreading
- Landslides
- Earth ruptures
- Site response
- After shock deployment near rest of fault
- Eng. surveys – interplay between ground & structures – accelerometers
- Remote sensing – satellite, aerial (drone), Lidar (before & after), InSAR

### **FEMA Region VII Workshop in Jefferson City on May 27-28, 2009**

During the scientists' breakout, presentations were made on the FEMA Cat plan, CUSEC-SG response & clearinghouse plans (MO), USGS Response plan and earthquake notification products, and EROS products. The breakout had a small group of outside participants but they were key people and organizations.

A short overview was made to the participants of the full workshop.

In all of the workshop scientists' breakouts, the CUSEC-SG and USGS solicited ideas on their response plans in order to finalize such plans.

### **Overview of USGS Response Plan**

Dr. Oliver Boyd presented a PowerPoint presentation on the general outline of the USGS New Madrid response plan. Copies of Fact Sheet 09-3071 on latest statements on the New Madrid were provided.

## **USGS Notification System Products**

Dr. Oliver Boyd presented a PowerPoint presentation on the various USGS earthquake notification system products, emphasizing that these products present the first situational awareness for many hours following an earthquake event.

Discussion was centered on the new response triggers for response being determined by MMI damage shown on PAGER instead of using a magnitude of an earthquake event. Action item was to hold a conference call with Doug Bausch, Joe Gillman, Bob Bauer, Jim Wilkinson, Oliver Boyd and David Wald about their work on this new trigger.

## **Each Survey reported on their earthquake response plan & state clearinghouse plan**

Indiana – slowly working on plan. There is currently no Earthquake Program Manager in Indiana.

Illinois – continue working on plan. Made contact with regional amateur radio network chair. They are interested in being part of the response plan and playing a roll in the NLE-11 exercise. Probably will not have a staffing shortfall but many people need training in the plan and NIMS/ICS.

Missouri - a liaison has been set up and they are about ¼ of the way to agreement for acceptance of the plan by the state. SEMA has agreed to accept State ID cards. Amateur radio group wants to help but they don't have the equipment but are trying to secure it. Their EMAC is with Kansas and Oklahoma.

Alabama – has a strong working draft which was shared with meeting participants. Working on a MOA with state concerning plan. They are working on 1:250,000 scale state liquefaction and fault maps.

Arkansas – has a rough draft which has been shared with ADEM. Maps needed for response have been collected but are not yet on a portable drive. Ham Radio group is interested in participating in response. Working on an agreement with Oklahoma and Kansas for staff for help with response. Forward operations – clearinghouse may be at Arkansas State University at Jonesboro and GIS help may be available from the earth science department at Arkansas State University at Little Rock.

Tennessee – little change in their plan. Working with TEMA who is revisiting their operations plan. May be looking at private schools in Jackson for a clearinghouse.

Mississippi – has established contacts with SEMA and working with many of the staff on an Enhanced Hazard Mitigation Plan and is part of and Environmental Quality responses to emergencies and MS Geological Survey can be added as a module. Expect to be in EOC for Events.

Overall individual state plans should have shared verbiage with an indication of some coordination with neighboring states to paint a picture of inter connectivity.

## **Equipment needs**

Lists of equipment needs for response were provided to participants for review.

## **Multi-State Regional Clearinghouse Plan**

The latest copy of the plan was provided to participants. Updates are being made by Mr. Mike Calvert of CUSEC.

## **Pre-scripted post earthquake messages for surveys and state Public Information Officers**

Copies of messages that have been used in Illinois for exercises, from Indiana from the April 2008 earthquake and in the Alabama response plan were supplied to participants. It was agreed that uniformity is required in the overall message and this needs to be coordinated with the Public Information Officers.

This includes a statement on aftershock sequence expected. John Ebel's NEHRP report on "Analysis of Aftershock and Foreshock Activity in Stable Continental Regions: Implications for Aftershock Forecasting and the Seismic Hazard for Strong Earthquakes in the CEUS", 07HQGR0107 was provided.

### **Credentialing**

Each state survey is filling out a spreadsheet which was formatted by CUSEC for credentialing of scientist/engineers who we know will be responding to earthquake impact documentation following an event. Lists have been started and it was agreed that they would be submitted to CUSEC by the end of the calendar year.

### **National Level Exercise – 2011 (NLE-11)**

Bauer presented a summary of information from the NLE meeting of May 19, 2009 in Washington DC.

The Main Exercise will be May 16 – 20, 2011. This is the FIRST bottom driven national exercise and will be the FIRST National Level Exercise (NLE) that is a Natural Disaster.

#### Initial Response (Day One and Two)

- First 48 hours in real time
- Feds run all 48 hours, states may simcell

#### Extended Response (Day Three and Four)

- Day Three: Event plus 5 days (proposed)
- Day Four: Event plus 14 days (proposed)
- Resource Allocation

#### Short-Term Recovery (Day Five)

- Event plus 28 days (proposed)
- Possible second event

#### Long-Term Recovery part of exercise

- State Portion held within 45 days of start of exercise
- Plenary held within 90 days of start of exercise
- Takes place at event plus six months

CUSEC agreed that each state would test 5 core Objectives out of the 38 capabilities:

- Communications
- Critical Resource Logistics and Distribution
- Mass Care (Sheltering, Feeding & Related Services)
- Citizen Evacuation and Shelter-In-Place
- Emergency Public Information and Warning

Each state may added to this core list with testing other Capabilities

Alabama – 12 principal counties & 7 contingent counties, Functional Exercise, 8 hours per day with a simcell for night shift

Arkansas – 10 principal counties & 24 contingent counties, Full Scale Exercise, hours of play TBD

Illinois – 29 principal counties, Functional Exercise, 8 hours per day with simcell for night shift

Indiana – 28 principal counties & 23 contingent counties, Full Scale Exercise, 24 hours for initial 2 days & 12 hours per day for remainder.

Kentucky – 120 counties (level TBD), level of play and hours TBD

Mississippi – 6 principal counties & 20 contingent counties, Full Scale Exercise, hours TBD

Missouri – 47 principal counties, Full Scale Exercise, 24 hours for initial 2 days & 8 to 12 hours per day for remainder.

Tennessee – 40 principal counties, Full Scale Exercise, 24 hours for initial 2 days & 8 hours per day for remainder.

### **Bicentennial - Activities/Products**

Summary was provided by Wilkinson and Bauer of: Feb 2011 kick off with press releases, - Pamphlet – insert similar to earthquake country or S. Carolina (provided to participants) will be produced, ShakeOut maybe kick off of NLE-11 CUSEC Board wants this, there will be a St. Jude house built with IBHS in Memphis for 2012 mtg., various Societies are holding meetings in 2011-2012: SSA mtg – Memphis April 2011 and National Earthquake Conf – Memphis Feb 2012 along with field trips being planned by a USGS-CERI committee for science.

### **EQ 101 product – Central US is Earthquake Country**

Sandy Ebersole of the Alabama Geological Survey presented the PowerPoint presentation of this product. Sandy is working with CUSEC and Paul Hogue on for a general introduction for use by CUSEC and State Geologists as an elementary introduction to earthquakes in the Central US. Copies were distributed with a deadline of September 18<sup>th</sup> as a due date for comments for changes.

### **Arkansas Seismic Network**

The Arkansas Geological Survey was provided support by their legislature for setting up a network of seismograph stations to cover the entire state for determining location of earthquake events. This was initiated following several ongoing swarms of very minor earthquakes 40 to 60 miles north of the capital. Bekki White and Scott Ausbrooks reported on the plans and coordination with CERI on selection of station locations.

### **Meet with PIOs and EPM for summary of work**

The CUSEC State Geologists met with the Earthquake Program Managers and Public Information Officers. CUSEC SGs presented an overview of their response plans, need for coordination and acceptance of plans by the SEMA, and that many elements need work for this to succeed. These elements include communications equipment and procedures, working through PIOs with consistent messages throughout the area, technical clearinghouse locations and interaction with the EMA's forward operations centers, and predetermining lists of valuable information useful for response. PIOs and EPMs discussed role of CUSEC State Geologists as technical advisors to translate into simple terms/descriptions and what to expect.

### **EarthScope Projects**

In Arkansas, Dr. Haydar has some federal money to adopt 8 EarthScope stations. Alabama is interested in a couple of stations. Illinois is looking at ones that would help with accurately locating events in the Chicago area, but seeks funds to be able to do this.

## **Priorities Identified through workshops, meetings and coordination with participants**

### Priorities

The meetings resulted in the Association identifying priorities and action items for the CUSEC state geologists to assist states and communities to become more earthquake resilient. The efforts and products relate to seismicity of the Central U.S. and prioritize state and regional issues that can be address most efficiently by the coordinated activities of the Association.

State and Regional Priorities – The CUSEC SG will continue to incorporate and refine priorities for states and communities' needs of earthquake related science/maps/information for emergency managers, policy makers, construction practices, public safety and to support state and national earthquake related programs. Many of these activities augment already functioning programs and Bicentennial activities.

Priorities include:

- Assist in providing basic information, maps and realistic scenarios for communities developing resiliency frameworks
- Continued support of Urban Hazard Mapping
- Continued collection of shear wave velocity data of soils and development of shear wave velocity reference profiles for geomorphic provinces/settings in the Central U.S.
- Develop better methods and data to incorporate site response into production of ground motion maps in place of older soil site class and liquefaction susceptibility map incorporation methods (newer method produces more detailed maps)
- Production of Landslide Susceptibility Maps
- Produce multi-state (CUSEC) maps such as: depth to bedrock (soil thickness), earthquake epicenters, structures, etc.
- Refining dates and site characteristics of paleoliquefaction features
- In cooperation with USGS, assimilate and integrated the state's past and present NEHRP and other earthquake related products into a centralized, referenced repository that is available via on-line services
- The upcoming bicentennial of the 1811-1812 New Madrid earthquake events provides a unique opportunity to take advantage of state, regional, and national attention focused on commemorative activities including the planned National Level Exercise (NLE) in 2011.
- Post Earthquake Technical Information Clearinghouse (PETIC). Following a significant seismic event along the NMSZ or the WVSZ, it is anticipated that a contingent of scientific researchers will seek immediate and short term access to the affected areas. In order to foster coordination between the State EMAs and the scientific communities, the state geological surveys will act as local and regional PETIC administrators.
- CUSEC SG will continue to work with CUSEC and the State EMAs to refine and incorporate geological survey response plans into State/EMA Response Plans.