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EARTHQUAKE HAZARD AND ENGINEERING RESEARCH CENTERS OF THE CENTRAL U.S.

The central U.S. is home to four unique earthquake hazard and engineering research centers. Recognizing that the causes and consequences of earthquakes in the central U.S. differ from those in the western part of the country, these centers were established to address the specific earthquake research and information needs of residents in this region. Information that is gathered and studied is passed on to state emergency managers for mitigation and planning purposes and to the general public to help with pre-disaster preparedness to help make communities more disaster resistant. These centers also work closely with state geological surveys and national groups such as the Seismological Society of America (SSA) and the Earthquake Engineering Research Institute (EERI).

Below is a brief description of each earthquake center, their primary areas of focus and how their work is used to help those living and working in the central U.S. become more prepared for a major earthquake.

Arkansas Center for Earthquake Education and Technology Transfer

Dr. Haydar Al-Shukri Haydar, Director

During the past 20 years, the Arkansas Department of Emergency Management (ADEM) and the University of Arkansas at Little Rock (UALR) have established a collaborative program to assist the state of Arkansas in Hazard Mitigation Planning and Public Education. Through this program, the Arkansas Center for Earthquake Education and Technology Transfer (ACEETT) has set three distinct but overlapping tasks for its mission to make communities disaster resistant. These include (1) public education, (2) hazard mitigation and (3) scientific research.



Dr. Haydar Al-Shukri, Director of the Arkansas Center for Earthquake Education and Technology Transfer, performs a seismic monitoring instrument installation near Enola, Arkansas. The monitor is part of the Arkansas Seismic Observatory. Photo provided courtesy of Dr. Al-Shukri.

ACEETT is located on the campus of UALR and is the continuation of the Arkansas Earthquake Center that was established in 1991. Until 2003 the center was supported by the Federal Emergency Management Agency (FEMA), ADEM, and UALR with its primary mission of public education and scientific research. Its purpose is to provide a comprehensive earthquake education and technology transfer program in Arkansas and adjacent states.

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To reduce damages and loss of life during natural or man-made disasters, ADEM previously funded two mitigation projects with ACEETT. The tasks of these projects were accomplished by UALR in collaboration with several state agencies, federal agencies, and other neighboring states. The projects included developing a Hazard Mitigation Plan for Clay County, Arkansas, and establishing a seismological observatory for the State of Arkansas.

Previous and Current Scientific Projects

Broadband Seismic Station Installation - ADEM and UALR allocated matching funds and installed the first two broadband seismic stations in Arkansas in 2004. The stations are located in Enola and Batesville. These stations are called the ENAR and BTAR Stations, respectively.

Paleoseismology Research - A group of researchers from UALR and ACEETT conducted a paleoseismology study in eastern Arkansas to locate and study geological features, such as sand blows and possible surface faulting near Marianna, Arkansas. The team discovered a sand blow that believed to be the largest such feature documented at this distance (~100 km) from the New Madrid Seismic Zone.

Since 2000, the ACEETT research team has been conducting a comprehensive geological and geophysical investigation to identify and characterize specific features related to historic and prehistoric earthquakes near the southern terminus of the New Madrid Seismic Zone in eastern Arkansas.

Near Surface Geophysics - ACEETT personnel are actively involved in conducting shallow geophysical research for environmental, archeological, highways and other subsurface problems. Ground Penetrating Radar (GPR) and Electrical Resistivity methods are among the methods used for conducting this research.

Lunar Research - The Electrostatics and Surface Physics Laboratory (ESPL) at Kennedy Space Center has been actively involved in characterization of lunar dust to understand the soil properties for lunar regolith. UALR teams are collaborating with ESPL to develop models for detecting the areas with the largest concentration of ilmenite or other minerals of interest as part of this research project.

Monitoring Induced Seismicity - Induced seismicity is earthquakes that are activated or triggered by human activities. There are ample evidences that water injection affects the pore pressure and stress regime in the volume where the water is propagating, triggering small to moderate size earthquakes and earthquake clusters. ACEETT installed seven stations to monitor induced seismic activity that might occur due to water injection activity in the area. Continuous data from this network is systematically analyzed and stored in multiple copies and available for easy access.

Earthquake Monitoring in the State of Arkansas - ACEETT is adopting six US Array Transportable Stations to be installed in Arkansas to enhance the capability of earthquake monitoring in the central U.S. and the state of Arkansas. Real-time network reporting will improve earthquake detectability, and the high-quality data gained will increase our knowledge of the seismicity of the central US.

Public Education and Community Outreach

ACEETT has been heavily involved in public education and outreach since its inception more than two decades ago. The education was in the form of seminars, short courses, general lectures, public displays, publication and distribution of general educational materials, and internet websites. ACEETT also organizes visits and tours for schools and the general public.

For more information about the Arkansas Center for Earthquake Education and Technology Transfer visit their website at <http://quake.ualr.edu/>

Center for Earthquake Research and Information

Dr. Charles Langston, Director

Established in 1977, the Center of Earthquake Research and Information (CERI) is located on the campus of the University of Memphis. It receives funding from the state of Tennessee both directly and through the university, and serves the university by facilitating interdisciplinary research and education, and the public by providing authoritative scientific education and information. Through cutting-edge research, comprehensive graduate student education, operation of state-of-the-art seismic and GPS networks, and dissemination of technical and practical information, CERI seeks to be a leading center for earthquake related studies. As a founding core member of the Mid-America Earthquake Center (MAE Center), one of three national earthquake engineering research centers established by the National Science Foundation (NSF), CERI houses the Advanced National Seismic System (ANSS) Mid-America Regional Processing Center, and is involved with the West Tennessee Seismic Safety Commission (WTSSC) which was established by the governor in 2007.

CERI works to strengthen its focus on regional earthquake hazards by concentrating on its ability to quantify seismic hazard and expand its capabilities in areas such as: probabilistic ground motion assessments, loss assessments, paleoseismology and earthquake engineering. The center is also working to refocus its research endeavors in an effort to become a leading organization in continental studies. Federally funded initiatives in the earth sciences (e.g. NSF EarthScope and Continental Dynamics programs) enable CERI to work with other science organizations such as the U.S. Geological Survey (USGS) to investigate the structure and evolution of the North American continent.

The center's strategic plan revolves around the following priorities:

- *Increase faculty participation in major national research initiatives.*
- *Strengthen research capabilities in regional hazards and develop a strong research program involving continental structure and evolution.*



CERI and Arkansas Geological Survey staff complete a recent seismic monitor installation in an Arkansas State Park. The monitor is part of the Advanced National Seismic System. Photo provided courtesy Jim Bollwerk, CERI.

- *Participate in a joint effort to drill and instrument a deep borehole in the NMSZ as an anchor for a mid-continent geophysical observatory.*
- *Expand and upgrade the seismic networks and GPS network.*
- *Maintain education and outreach efforts on the local and regional levels and expand on the national level.*
- *Develop a more comprehensive website for student recruitment and one that showcases our research accomplishments.*

Current Research

With the help of the U.S. Army Corps of Engineers, scientists with CERI and the University of Texas at Austin are currently studying the soils along the Mississippi River. The Mississippi River Seismic Survey is a project aimed at revealing what lies beneath the surface of the Mississippi River between Cape Girardeau, Missouri, and Greenville, Mississippi, and between Cape Girardeau and Helena, Arkansas. Researchers are collecting data that will characterize the style of deformation and long-term history of the presently seismogenic faults in an effort to understand how this long-term deformation is partitioned among the structures buried under the Mississippi embayment. This data will also reveal the characteristic style (thrust, normal, strike-slip) among the structures buried among the Mississippi deformation of the imaged faults.

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Public Outreach and Education

The U.S. Geological Survey (USGS) has a branch office at CERI which allows scientists from both organizations to collaborate on various initiatives. This close partnership also financially benefits CERI's on-site earthquake display.

One of CERI's most effective outreach and education tools, the Public Earthquake Resource Center (PERC), is an interactive mini-museum with a goal of increasing awareness of earthquake hazards, earthquake engineering and seismology. It includes a full-scale liquefaction trench exhibit, shake tables, real-time local and global earthquake displays, hardcopy earthquake hazard information and lesson plans and classroom activities for teachers. In addition to PERC, scientists from CERI give earthquake presentations and participate in various other public events to promote earthquake awareness and preparedness.

You can learn more about CERI at <http://www.ceri.memphis.edu>

Mid-America Earthquake Center

Timothy Gress, Director

The Mid-America Earthquake Center (MAE Center) is one of three national earthquake engineering research centers established by the National Science Foundation (NSF) and its partner institutions. It is headquartered at the University of Illinois at Urbana-Champaign, consists of a consortium of nine core institutions, and is funded by NSF and each core university as well as through joint collaborative projects with industry and other affiliations. The MAE Center's mission is to develop through research, and to disseminate through education and outreach, new integrated approaches necessary to minimize the consequences of future earthquakes across hazard-prone regions, including but not limited to, the eastern and central United States. Projects fall under four general types: (a) core research, (b) stakeholder research, (c) education, and (d) outreach.

The MAE Center's core research is separated into four areas, which are: (a) Consequence-Based Risk Management Framework, (b) Engineering Engines, (c) Social and Economic Sciences, and (d) Information Technology. A thrust leader for each of these four

programs is responsible for the planning and execution of research and implementation projects.

Targeted stakeholder groups apply core research results to earthquake risk mitigation across the systems of interest to them. The targeted stakeholder groups include a diverse portfolio of interests such as state transportation departments, state emergency management agencies and utilities operators. Projects in the Education Program integrate research and education for both undergraduate and graduate students, advance earthquake curricula and outreach to pre-college students, and enhance public awareness.

Annual project agendas are developed by a Leadership Team chaired by the MAE Center Director and consisting of program thrust leaders and co-leaders. Overall direction and goals of the MAE Center are set by the Executive Advisory Board, which also approves the annual project agenda as proposed by the Leadership Team. In addition, the Industrial/Stakeholder Advisory provides guidance on future direction and opportunities.

Recently, the MAE Center was a major participant in the FEMA New Madrid Seismic Zone Catastrophic Planning Project — a project to increase national readiness for a catastrophic earthquake in the New Madrid Seismic Zone. Through the work of a Scenario Development Workgroup formed in March of 2007, the center provided FEMA and CUSEC member state emergency managers with possible credible worst case impacts concerning injuries and infrastructure damage



MAE Center field team members on a research expedition to Haiti after the January 12, 2010 M7.0 earthquake that devastated the country. Photo courtesy of Mid-America Earthquake Center

in the central U.S. after a major earthquake. Impacts of Earthquakes on the Central USA—the entire report by the Scenario Development Workgroup— can be found at <http://mae.cee.uiuc.edu> along with general information about the MAE Center.

Saint Louis University Earthquake Center Dr. Robert Herrmann, Director

The Saint Louis University Earthquake Center receives annual funding through the U. S. Geological Survey to operate a set of digital seismic stations in the region. Similar funding provides support for the Center for Earthquake Research and Information at the University of Memphis. The Saint Louis University Earthquake Center must meet the defined performance standards of the ANSS. Current funding of pays for one full-time data technician, $\frac{1}{2}$ of an electronics engineer and $\frac{1}{4}$ of a field technician in addition to field travel and equipment maintenance and minor upgrades to the field equipment. Currently, there is no funding for enhanced monitoring for the purposes of understanding the earthquake source or ground motion or to capture ground motions of engineering significance, and funding for infrastructure maintenance is ad-hoc.

Because the ANSS objective is primarily one of public safety through rapid earthquake location and impact assessment, the Saint Louis University Earthquake Center does not locate earthquakes automatically. Rather it ensures that a calibrated data stream is transmitted in real-time to the USGS National Earthquake Information Center in Golden, Colorado which is manned 24/7. Data from the Saint Louis University seismic network complement other national and international data sets to permit the U.S. Geological Survey to rapidly assess the impact of major earthquakes, and then to officially notify agencies such as FEMA, DoD, the World Bank, the Department of State and international organizations of the expected effects of the earthquake.

The Saint Louis University Earthquake Center focuses on the needs of the design and construction, planning and emergency response communities by working to ensure that these groups receive the products that they need by fostering communication between local groups and the USGS.

In addition to the network operation, the seismologists associated with the center perform research on earthquake hazard, earth structure, and on issues related to nuclear monitoring. Portable instruments are now deployed in far-western China for fundamental research.

Interaction with the Public

In 2008 a new public face for the Earthquake Center was unveiled. They now have a space for small tours, for press briefings and for small classes. Behind the wall they have a small area for testing complete systems prior to field deployment. The Earthquake Center also displays the history of the development of seismic instrumentation.

Summary

The earthquake problem here in the United States and globally is significant, which is why the Saint Louis University Earthquake Center takes its contribution to earthquake monitoring so seriously. Their monitoring and research affect life safety and property.

They are adaptable enough to address the interests and needs of sponsoring groups. More information about the Saint Louis Earthquake University Center can be obtained at: www.eas.shu.edu/Earthquake_Center/

References

The references to the ANSS plan and the performance standards are listed here since these bear on the responsibilities of the Earthquake Center.

U.S. Geological Survey Circular 1188, “Requirements for an Advanced National Seismic System” that provides the management and technical requirements for seismic monitoring in the United States. (<http://pubs.usgs.gov/fs/2000/fs075-00/>)

Technical Implementation Committee completes first report (version 1.0) on technical specifications for ANSS and additional strong motion stations are installed throughout the country. (<http://pubs.usgs.gov/of/2002/ofr-02-0092/>)

Around the Region

CUSEC Continues Earthquake Awareness and Preparedness Effort with Participation in Regional and National Events

CUSEC continued to spread the earthquake awareness and preparedness message across the central U.S. this quarter while participating in a variety of activities hosted in its member states. In activities ranging from emergency management conferences to town hall meetings, CUSEC representatives provided audiences with basic information about the earthquake hazard in the central U.S. and tips pertaining to mitigation and general preparedness. A sampling of activities hosted within the region included:

- *Emergency Management, Business and Civic Group Meetings in Arkansas, Mississippi, Missouri and Tennessee*
- *Disaster Preparedness Conferences and Workshops in Illinois, Kentucky, Mississippi, and Missouri*
- *Disaster Preparedness Safety Fairs/Expos in Alabama and Tennessee*

Also, as an official participant in National Preparedness Month, typically observed in the month of September with activities such as mitigation workshops and safety fairs hosted throughout the central U.S. that focused on individual and business pre-disaster preparedness, CUSEC highlighted major activities being planned for the New Madrid Bicentennial (NMB)—the 200th anniversary of the 1811-1812 great New Madrid Earthquakes. Major anchoring activities for the NMB include: Earthquake Awareness Week/Month, the Great Central U.S. ShakeOut, National Level (Earthquake) Exercise 2011 and the National Earthquake Conference in 2012. You can learn more about the New Madrid Bicentennial at: <http://www.newmadrid2011.org>

In addition to participation in regional events, CUSEC representatives spent time in Washington D.C. meeting with other state and federal partners to discuss activities surrounding the 2011 National Level (Earthquake) Exercise [see The Road to NLE 2011 column on page 10 to learn more about this activity], and the upcoming CUSEC Resource Allocation Workshop. In a hearing conducted by the Ad Hoc Subcommittee on State, Local and Private Sector Preparedness and Integration—chaired by Arkansas Senator Mark L. Pryor—on September 30, CUSEC Executive Director, Jim Wilkinson testified before the subcommittee on central U.S. earthquake hazards and what is being done by government and non-government organizations to help promote greater awareness and preparedness among the region's residents.

To read Executive Director Wilkinson's testimony and/or to view the entire hearing visit: http://hsgac.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_id=1bc1a3b5-1da9-437d-a714-c7f3b2cae5a3

First CUSEC-Wide Satellite Communications Test Conducted

by Paul Hogue

CUSEC Exercise/Training Officer

A test of satellite communications between the eight CUSEC state emergency management agencies (EMA's) was held in the early morning hours of Monday, August 2. The states were asked to contact the Indiana Department of Homeland Security (IDHS) by whatever satellite communication means were available between midnight and 6:00 a.m. that morning. That time was chosen since it is usually a low-traffic period for most state emergency offices.

“As far as we have been able to determine, this was the first CUSEC-wide communications test ever conducted, though there have been some multi-state communications exercises in the past,” *continued on page 8*

RECENT CENTRAL U.S. EARTHQUAKE ACTIVITY

DATE	LOCATION	MAGNITUDE
8/2/10	Clinton, Louisiana	3.0
8/2/10	Jones, Oklahoma	3.4
9/1/10	Luther, Oklahoma	3.1
9/4/10	Luther, Oklahoma	3.1
9/15/10	Luther, Oklahoma	3.1
9/16/10	Luther, Oklahoma	3.5
9/25/10	Ravia, Oklahoma	3.3
9/26/10	Oconto, Nebraska	3.0
10/1/10	Stuart, Oklahoma	3.1
10/2/10	Ashland, Virginia	3.0
10/13/10	Norman, Oklahoma	4.5
10/14/10	Guy, Arkansas	3.5
10/15/10	Guy, Arkansas	4.4
10/15/10	Guy, Arkansas	3.8
10/15/10	Guy, Arkansas	3.5
10/25/10	Rush Springs, Oklahoma	3.2

**IF YOU FEEL AN EARTHQUAKE, REMEMBER TO:
DROP, COVER, & HOLD ON FOR MAXIMUM SAFETY**



Visit <http://www.dropcoverholdon.org> to learn more ~ Image Courtesy Southern California Earthquake Center

DID YOU FEEL IT?

If you recently felt an earthquake, remember to go to the USGS website and log your experience on the “Did You Feel It?” webpage. The information you provide helps scientists understand how the ground shakes at different locations and helps show the wide reaching effects of earthquakes. Visit - <http://earthquake.usgs.gov/dyfi> for more info



continued from page 6 said Jim Wilkinson, Executive Director of CUSEC. “This is a great first step, and we know that the CUSEC Communications Officers’ Working Group wants to conduct more extensive exercises of this kind in the future.”

Don West, Communications Director at IDHS, volunteered to be the focal point for this first test since his shop also monitors the CUSEC-1 Satellite Mutual Aid Radio Talkgroup (SMART). This talkgroup, established in 2008, allows emergency managers and responders in the CUSEC states to have access to a communications system that can be of robust use following a catastrophic earthquake. The SMART system was established by the Department of Justice in 2007 to use push-to-talk satellite radio equipment by SkyTerra Communications, now called LightSquared. Most states in CUSEC use this equipment to some degree, as well as other satellite comms systems such as Iridium.

NEMA Names New President

Members of the National Emergency Management Association (NEMA), a professional association of and for state emergency managers, named Iowa DHS Administrator Dave Miller as their new president at the association’s annual conference on October 20. Miller had served as NEMA’s vice president-elect since October of 2009. He will serve as president through October of 2011, and after his term as president by serving one year as past president. Iowa is a CUSEC Associate State.

Miller’s duties as president will include leading a board of NEMA directors in providing leadership, guidance and direction for the Association, and representing the views of NEMA members to the federal government, Congress and the White House. In addition, he will preside over the development and implementation of the organization’s strategic plan, assist with training programs for newly-appointed state emergency management directors, and develop and preside over two national NEMA conferences during his tenure.

David Maxwell, State Director of the Arkansas Department of Emergency Management (ADEM) and CUSEC Board Member, was on hand at the association’s annual conference to pass Miller the torch of presidential leadership.

Maxwell served as NEMA’s president from October of 2009 to October of 2010, and will remain active in the association as an adviser to the current president.

CUSEC wishes Director Miller the best in his role as NEMA President. For more information about NEMA visit: <http://www.nemaweb.org>



CUSEC Board member David Maxwell shown here at the NEMA Conference with new NEMA President Dave Miller. Photo courtesy of Iowa Homeland Security

FEMA and ServiceMaster Partner to Deliver Earthquake Awareness & Mitigation Training

Memphis, TN - As part of its ongoing efforts to partner with the private sector to strengthen disaster readiness and prepare for all hazards, including earthquakes, representatives of FEMA’s earthquake mitigation campaign, “QuakeSmart,” participated in The ServiceMaster Company’s Employee Earthquake Awareness Week.

The week-long event, which began September 27, was designed to raise awareness of earthquake risk, provide guidance on reducing that risk and encourage employees to take action both at home and in the workplace. It was held at the company’s headquarters in Memphis, TN, located in the heart of the New Madrid Seismic Zone

“FEMA is thrilled with ServiceMaster’s commitment to training its employees on earthquake mitigation,” said Edward Laatsch, Chief of FEMA’s Building Science Branch, Risk Reduction Division, Federal Insurance and Mitigation Administration. “With their headquarters located in the heart of the New Madrid

Seismic Zone, this awareness campaign is critical to ServiceMaster's ongoing efforts to help ensure the safety of their 2,000 Memphis-based employees and their families."

The QuakeSmart campaign was developed by FEMA around the premise that no community can fully recover from a damaging earthquake until its businesses are back up and running. The purpose of the campaign is to encourage businesses and their employees to become "QuakeSmart" by maintaining ongoing earthquake mitigation efforts throughout the year.

During the week, FEMA provided a full day of training to ServiceMaster's risk management personnel with a program entitled *FEMA 74: Reducing the Risks of Nonstructural Earthquake Damage*. In addition, FEMA and CUSEC participated in employee seminars on earthquake mitigation and preparedness.

For more information on the Quakesmart program , please visit <http://www.quakesmart.org>

Member State Spotlight

Illinois State Geological Survey

Located in the Natural Resources Building on the University of Illinois at Urbana-Champaign, the Illinois State Geological Survey's (ISGS) mission is to provide the citizens and the institutions of Illinois with earth science research and information that is accurate, objective and relevant to the state's environmental quality, economic prosperity and public safety. Approximately 200 scientists and a staff of technical support work to conduct basic and applied research in geology, collect geologic maps and gather and manage the state's geological information. The survey's research programs include the following:

- *Coal*
- *Energy*
- *Environmental Assessments*
- *Geochemistry*
- *Glacial Geology*

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UPCOMING CONFERENCES, TRAINING, WORKSHOPS, ETC.

WHEN	WHAT	WHERE
November 16-17	2010 IBHS Annual Conference	Tampa, Florida
November 19	ATC20 Post Earthquake Safety Evaluation Training	Fayetteville, Arkansas
November 30-Dec. 3	NMSZ Resource Allocation Workshop	Nashville, Tennessee
December 2	CUSEC Earthquake Program Managers	Nashville, Tennessee
December 4	CUSEC Board of Directors Meeting	Nashville, Tennessee
January 20, 2011	School Earthquake Retrofit Webinar	Nationwide
January 27, 2011	ATC20 Training	Springfield, Illinois
January 28, 2011	FEMA 154 Rapid Visual Screening Training	Springfield, Illinois
February 2011	Earthquake Awareness Week/Month Observed	AR, MS, TN, KY, MO
February 1, 2011	FEMA154 and ATC-20 Training (and Webinar)	TBD Kentucky
February 2, 2011	Hospital Mitigation Workshop	Madison, Kentucky
February 17, 2011	Hospital Mitigation Workshop	Jonesboro, Arkansas
April 5-7, 2011	National Earthquake Program Managers Meeting	Boise, Idaho
April 28, 2011	Great Central U.S. ShakeOut (April 19 in IN)	Central U.S. States
May 16-20, 2011	National Level Exercise 2011	Central U.S. States

- *Hazards*
- *Mapping*
- *Mineral Resources*
- *Oil and Gas*
- *Water and Wetlands*

The survey also has an active education outreach program. Staff members distribute non-technical publications, conduct workshops for teachers, present lectures, offer full-day field trips and respond to various inquiries from the general public. Bob Bauer, head of ISGS' Engineering and Coastal Geology Geologic Mapping and Hydrogeology Center, is also Technical Director of the Association of CUSEC State Geologists. In this position, he writes proposals for the group, facilitates group meetings and works closely with other groups such as the CUSEC State Transportation Task Force to assist them with geologic projects. Dr. E. Donald McKay III was named ISGS' director in March of 2010. He is an Illinois native who began his scientific in 1971 at the survey as a research assistant. McKay is an author of several scientific publications and participates in major on-going survey projects. For more information about ISGS log on to: <http://www.isgs.uiuc.edu>



Associate Member State Spotlight

Ohio Department of Natural Resources

Established in Ohio in 1837, the Ohio Department of Natural Resources (ODNR), Division of Geological Survey—commonly known as the Ohio Geological Survey—is the state's oldest natural resources agency. Its mission is to provide geologic information and services needed for responsible management of Ohio's natural resources. The survey supports the following program areas:



- *Environmental Protection*
- *Proper Land Use Development*

- *Regulation of Fossil Fuel and Mineral Extraction*
- *Groundwater Development*
- *Mitigation of Geologic Hazards*
- *Mineral and Petroleum Exploration*
- *Economic Development*

Information from ODNR provides the framework needed to build highways, safeguard drinking water, prepare for disasters, protect wildlife, discover minerals and locate fuel sources. The survey's records and publications can be accessed at the Geologic Records Center (GRC) located at the central ODNR campus in Columbus. Staff in the GRC answer many questions from the public about Ohio's geology and offers free educational materials to teachers. Born and raised in Ohio, Sean D. Logan was appointed Director of ODNR by Governor Strickland in January of 2007. Prior to his appointment, Logan served five successive terms in the Ohio House of Representatives. During that time, he worked on assignments that included Agricultural, Natural Resources, and Economic Development, which placed him in the center of debates seeking to balance economic progress with conservation.

You can learn more about ODNR at:
<http://www.ohiodnr.com/geosurvey>

The Road to NLE 2011

By Paul Hogue
CUSEC Exercise/Training Officer

The CUSEC states continued working on planning for the Tier One National Level Exercise scheduled for May of 2011, commonly known as NLE 2011. This is a huge undertaking involving many participants, planning conferences, strategy sessions, working group meetings, lead-up and follow-on events taking place through the summer of 2011. The exercise will test local, state, and federal plans and annexes that were either modified or created as a result of the Catastrophic Planning Initiative in the CUSEC states over the last few years. To keep readers of our newsletter well-informed of these activities, this regular column lists major news and events pertaining to the exercise.



NLE 2011 MPC

The NLE 2011 National Midterm Planning Conference was held in Arlington, VA on September 21-23, 2010. There were attendees from all eight states and all four FEMA regions representing the consortium member-states. Of the state delegations, the EMA Directors from Kentucky, Mississippi, Missouri, and Tennessee also attended. The keynote address was delivered by FEMA Administrator Craig Fugate, who stressed the importance of NLE 2011 testing the “maximum of maximums” of potential damage.

After the keynote, there were briefings from Jim Wilkinson, Executive Director of CUSEC, on our multi-state planning efforts for the exercise, and from CUSEC Chair BG John Heltzel (KyEM) on the Resource Allocation Workshop planned for later this year. Dr. Keith Holtermann from FEMA’s National Exercise Division briefed on the NLE 2011 Exercise Directive. Robert Fenton, FEMA’s Assistant Administrator for Response, briefed the attendees on several important planning points, including FEMA’s intention to use a forward-deployed “Unified Area Command Group” in large responses including NLE 2011. All of the NLE 2011 Working Group leads briefed on their status and the changes in leadership in some of those groups in this year. Representatives from FEMA Regions IV, V, VI, and VII gave updates to the group on their activities for NLE 2011, and were accompanied by either their state directors or state exercise personnel in their region. Closing remarks for the first day were given by Corey Gruber, the Assistant Administrator of the FEMA’s National Preparedness Division. The second day consisted of meetings of all the national-level working groups for the exercise, including Scenario, Recovery, International, Control and Evaluation, Training, Private Sector, External Affairs, and Citizen and Community Preparedness. The Coordination Group, formerly the Steering Committee, met at the end of the day.

The third day, September 23, was billed as the National Earthquake Plans Seminar. The intention was to brief the primary national, regional, and state plans for dealing with a catastrophic seismic event on the NMSZ. Opening remarks were made by Dr. Holtermann, and the keynote was delivered by Bill Carwile, Associate Administrator for FEMA’s Office of Response and Recovery. Don Daigler, Director of the Planning Division under Bill Carwile’s office, described the “Whole of Community” approach to the planning process. Robert Demange, lead planner for the interagency planning efforts, briefed on the draft Federal Interagency Earthquake Response Plan (CONPLAN). Then, planners from the four FEMA regions in the CUSEC area each briefed their plans and the integration with their respective states’ plans. The day closed after a panel discussion with audience Q&A on the adaption of catastrophic plans concluded.

Other NLE Related Events

In this past quarter, there were several lead-up events and exercises in our states and regions. These included:

- *Region V/MO: MPC (II) in August*
- *TN: Regional Pod training in August*
- *IN: Mobilization TTX’s in August; discussion-based and full-scale exercises in September*
- *Region IV: TTX in September (including all R IV states)*
- *Region VI/AR: Rehearsal of Concepts (ROC) exercise in September*



The Great Central U.S. ShakeOut is a multi-state drop, cover, and hold on earthquake drill to be held on April 28, 2011 at 10:15AM CDT (04/19/11 in Indiana). Register to participate at <http://shakeout.org/centralus>

CUSEC Multi-State Working Groups, Lessons from 2010 Earthquakes, & Disaster Recovery

By Mike Calvert

CUSEC Emergency Planner

CUSEC Multi-State Working Group Updates

Our newly formed Public Health and Medical Services group held their initial meeting in early July. This group and four others also met once or more this quarter by teleconference: State Transportation Task Force, Geographic Information Systems, Exercise Officers, and Communications Officers. The CUSEC Association of State Geologists also met in person in Jackson TN. All groups include members from each CUSEC state.

The State Public Health Officers agreed to call their new group “Public Health and Medical Services,” which is Emergency Support Function #8 (ESF #8). It will be an association and are looking to secure funding from the Department of Health and Human Services and/or the Centers for Disease Control. Mary Riggs of U.S. Public Health Service briefed her recent deployment to Haiti. Dr. William Hacker, Chairman of the group and Commissioner of the Kentucky Department for Public Health, briefed the 2009 Kentucky ice storm; Kentucky responded better to the ice because they were able to use parts of their recently-completed earthquake plan. The ice storm hit the same area an earthquake would and did many of the same things--took out power, communications, transportation, and some other utilities. Susan Cooper of Tennessee showed a YouTube video of the May 2010 Nashville flood and spoke about its challenges. The states briefed their ESF #8 plans and there was good exchange between all members present. The ESF #8 accomplishments of each state were impressive, but what they do collectively will significantly enhance our earthquake preparedness. The group followed their initial meeting with a conference call September 2.

A brief look at the earthquakes below that occurred earlier this year will tell us where we stand compared to Haiti, Chile and New Zealand.

Lessons from 2010 Earthquakes

LOCATION	DEATHS	MAGNITUDE
HAITI	230,000	7.0
CHILE	500	8.8
NEW ZEALAND	0	7.1

A quick look at the table above for three major earthquakes, at first look, doesn't make sense. There were more deaths where the least powerful earthquake occurred. While the population affected and geology impact those figures, there are additional differences. First, Haiti is less affluent than the other nations listed. Poorer areas are usually affected more heavily. Second, both Chile and New Zealand adhere to strict seismic building codes, so their newer buildings and infrastructure are more resistant to ground shaking. And finally, Chile and New Zealand have more frequent earthquake drills and earthquakes, so they are generally better prepared.

Where does the New Madrid Seismic Zone stand compared to Haiti, Chile, and New Zealand? Most would agree that both Chile and New Zealand are better prepared than we are. While we've made great strides in the last 20 years, including the Catastrophic Planning Project, we haven't had a major earthquake in our lifetimes. As a result, we're not as concerned as those in areas with frequent major seismic activity, and our building codes are not what they should be. Some of our cities are improving their building codes, but only recently, so there is much more to do in this area.

Despite the fact that series of major NMSZ earthquakes (magnitude 7.0 or larger) may be hundreds of years apart, the U.S. Geological Survey assures us that the threat is real and we should be concerned. Buildings in major metropolitan areas like St. Louis and Memphis, bridges, levees, earthen dams, highways, communications and power infrastructure, and underground water and pipelines could be severely damaged or destroyed by a major quake and aftershocks. It could devastate our national transportation system, interrupt power to most of the population in the eastern half of the U.S., and cause severe damage to our national economy.

The FEMA-funded NMSZ Catastrophic Planning Project has helped the CUSEC states improve their earthquake response capabilities. Recovery from such devastating, catastrophic events will take years.

The CUSEC Board, accordingly, is looking ahead to Recovery issues and what we can do now to expedite long term recovery.

Disaster Recovery

Since 2009, the Departments of Homeland Security (DHS) and Housing and Urban Development (HUD) have been co-chairing a Long-Term Disaster Recovery Working Group (<http://www.disasterrecoveryworkinggroup.gov>) to develop a National Disaster Recovery Framework (NDRF) similar to the National Response Framework (NRF). The first draft of the National Disaster Recovery Framework was out in February 2010 for comment. The next version should be out soon. Prior to that, the CUSEC Board of Directors chose Long Term Recovery as one of their post-National Level Exercise (NLE) 2011 priorities and proposed a tabletop Recovery exercise, as a part of NLE 2011, to be held several weeks after the NLE to help focus on Recovery. So there's a lot going on nationally and within the CUSEC states to better prepare for Recovery from a damaging NMSZ earthquake or other catastrophic disaster.

While the NDRF defines Recovery and its components, I'll use this short, broad definition for now: Recovery is the physical (reconstruction), social, economic, and environmental "healing" of a community, a process that may take 10 years or longer. From a review of lessons learned and recovery literature, there are three points to keep in mind as the CUSEC states begin to focus on Recovery from a catastrophic disaster unlike anything we've experienced.

First, pre-disaster Recovery planning is essential. Fundamental decisions that will shape the future of your community will be made during post-disaster confusion if not decided in advance. Planning may not be the correct term; jurisdictional actions (policies, ordinances, building codes, laws, etc.) and not just plans need to be set in place before the disaster occurs. The machinery of local government may not be available post-event to make the decisions required to recover.

Secondly, city planners, housing officials, building officials, redevelopment authorities, utilities, public works and many others must engage in pre-disaster Recovery planning. Those organizations and individuals with the expertise and to plan, manage,

and direct Recovery are usually not involved until after the disaster. Consequently, mitigation and city planning considerations are often not part of Recovery planning.

Finally, as inferred above, Recovery requires a much broader range of disciplines than Response. To assume that Recovery can be planned and directed per the draft NDRF much like Response is planned and directed per the National Response Framework is trying to "fit a square peg into a round hole." Response functions will not go away during Recovery, so those jurisdictions who may expect their Response function to simultaneously manage a major Recovery effort should reconsider.

Final Thoughts

The CUSEC States, multi-state associations and working groups will continue to share ideas and strive to collectively increase preparedness for a catastrophic earthquake. We will learn from earthquakes in other areas and other types of disasters, applying those lessons in our planning and exercises. We will increase emphasis on pre-disaster Recovery planning and related actions to become more resilient. We hope you will also make individual and family preparations to reduce earthquake risks in your home and workplace.

The New Message Information about the New Madrid Earthquake Scenarios

Activity continues in the development of the New Madrid Earthquake Scenarios (NMES), led by Greg Hempen of the URS Corporation. We have included previous updates of the project in past issues of the CUSEC newsletter.

Scenarios are often used to determine how a specific earthquake will affect a community. The Executive Committee of the NMES has worked with the USGS and the University of Memphis to select appropriate scenario earthquakes. The selected scenario events resolved are "likely" earthquakes (Mw 6.3) along the New Madrid Seismic Zone and (Mw 6.0) earthquakes in the Wabash Valley Seismic Zone.

For more information on the work that is being done, contact Greg Hempen at greg_hempen@urscorp.com

The NEHRP Consortia

Strategically located in areas across the country with a moderate to very high earthquake risk, the Cascadia Region Earthquake Workgroup (CREW), CUSEC, the Northeast States Emergency Consortium (NESEC) - the only all-hazard state consortium- and the Western States Seismic Policy Council (WSSPC) are the four earthquake consortia in partnership with FEMA as a support in fulfilling both the member states and FEMA's roles and responsibilities within the National Earthquake Hazards Reduction Program (NEHRP).

After NEHRP legislation (Public Law 95-124) was enacted by Congress in 1977, the first earthquake consortium, WSSPC, was established in 1979, and was followed by CUSEC in 1983, NESEC in 1991, and CREW in 2000.

With primary funding support from FEMA and other sources, the four consortia are organized as 501(c)(3) non-profit organizations that work in partnership with the federal government and the states that are most affected by earthquakes. Adhering to the guidelines of NEHRP (most recently reauthorized by Congress in 2004), the consortia host and participate in many activities within their member states. Some of these activities may include (but aren't limited to):

- *Developing and adopting seismic policy recommendations*
- *Advocating the adoption and implementation of seismic mitigation policies*
- *Conducting national earthquake program related activities (coordinating conferences, forums, and other activities)*
- *Providing earthquake related presentations and earthquake information in support of local and state emergency management*
- *Developing and delivering earthquake related training (such as building inspection or mitigation related training)*
- *Assisting state and local emergency*

management and other interested parties in multi-state earthquake planning

- *Working with federal, state and private earthquake research and engineering organizations to increase the knowledge of seismic hazards*
- *Providing input to national, state, and local forums on earthquake risk reduction*

Each consortium is governed by a board of directors. While representation on the board of directors for CUSEC and NESEC are solely comprised of State Emergency Management directors, the board of directors for WSSPC are comprised of State Geological and State Emergency Management directors, and the board of directors for CREW are a coalition of private and public representatives. Day-to-day consortium operations are managed by an executive director who works closely with FEMA, and the board of directors to establish initiatives in addressing the earthquake risk. WSSPC also has the added function of recommending seismic policy. Three out of the four consortia's existence is tied to the states they represent. CREW does not represent member states, but partners with public agencies and private companies in planning for earthquakes in the Pacific Northwest.

While built around the NEHRP primary goals, each of the groups are structured differently according to the needs of the individual states they represent. Detailed information about each organization can be obtained on their respective website.

Cascadia Region Earthquake Workgroup

Online at www.crew.org

Central United States Earthquake Consortium

Online at www.cusec.org

Northeast States Emergency Consortium

Online at www.nesec.org

Western States Seismic Policy Council

Online at www.wsspc.org



OTHER NEWS

USGS PAGER System Earthquake Alerts to Include Estimated Economic Loss and Casualty Information

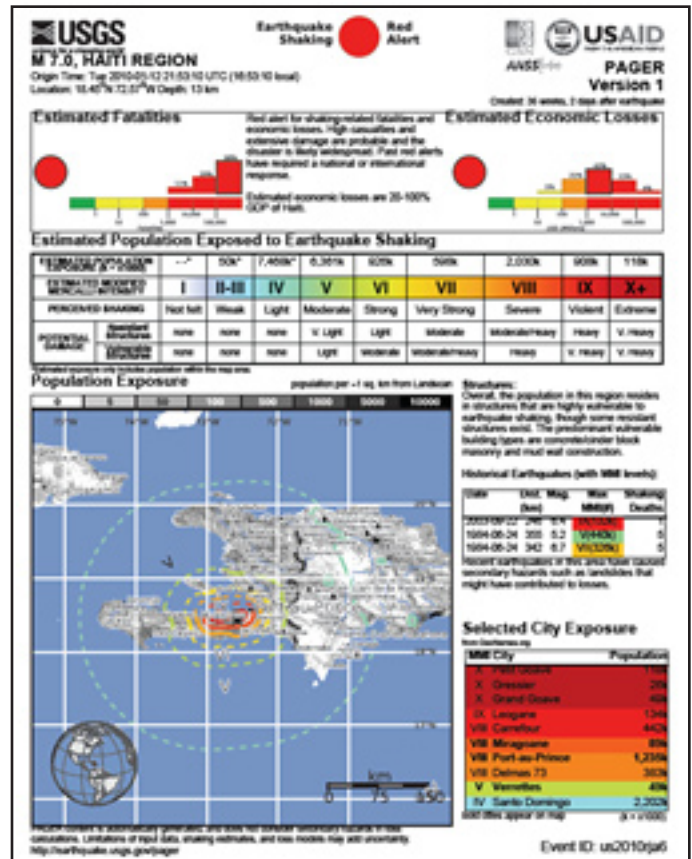
Estimated economic loss and casualty information are now included in earthquake alerts sent out by the U.S. Geological Survey (USGS) following significant earthquakes worldwide via the PAGER system. PAGER (Prompt Assessment of Global Earthquakes for Response) rapidly assesses earthquake impacts by estimating the shaking distribution, the number of people and settlements exposed to severe shaking, and now, with the latest release, provides estimates of the likely ranges of fatalities and economic losses.

The PAGER system was initially described in the Fall, 2009 (Vol. 13, No. 5) CUSEC Journal research article “New Research Tools Lead to Improved Earthquake Alerting Systems” along with other USGS earthquake information products. Now with the PAGER system fully operational, estimated losses trigger an appropriate color-coded alert which, based on past events, suggests a level of response: no response needed (green); local/regional (yellow), national (orange) or international (red).

Earlier PAGER system population exposure estimates have been widely used; now with alerts based on loss estimates they can be further utilized by emergency responders, government and aid officials, and the public to understand the scope of the potential disaster and to develop the best response. For domestic earthquakes, the USGS collaborated with FEMA using both past earthquakes and scenarios to ensure that these thresholds correspond to appropriate action levels.

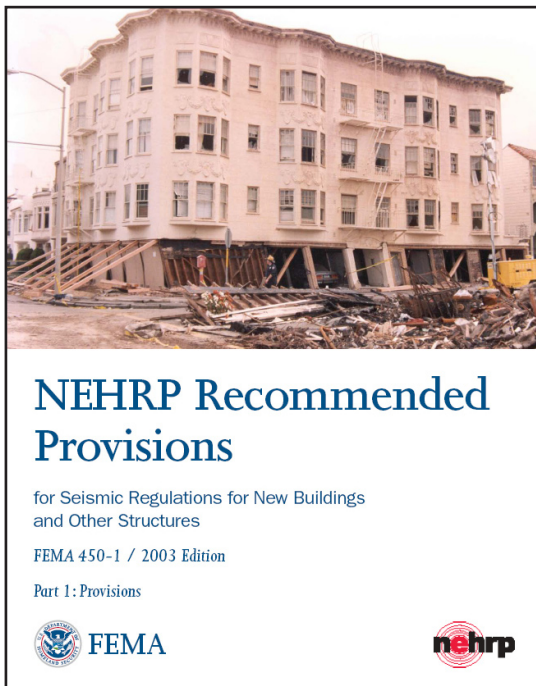
PAGER results are generally available within 30 minutes of a significant earthquake, shortly after the location and magnitude of the event are determined. PAGER also provides important supplementary information, including comments describing the dominant types of vulnerable buildings in the region, fatality reports from previous nearby earthquakes, and a summary of regionally-specific information concerning the potential for secondary hazards, such as earthquake-induced landslides, tsunamis, and liquefaction.

Products of the PAGER system are available at <http://earthquake.usgs.gov/> as well as under the individual earthquake Web pages at that site under the “Maps” tab. For PAGER Facts Sheets see <http://pubs.usgs.gov/fs/2010/3036/> or contact David Wald at wald@usgs.gov for more information on the system.



USGS PAGER Product from the January 12, 2010 M7.0 Haiti Earthquake. Image courtesy USGS

2009 NEHRP Provisions Now Available in Print and Online



The Federal Emergency Management Agency is pleased to announce that the 2009 edition of the *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures*, FEMA P-750 and FEMA P-750 CD, is now available, at no cost, from the Publications Warehouse and online from the FEMA Library.

One of the goals of the National Earthquake Hazards Reduction Program (NEHRP) is to encourage design and construction practices that reduce the seismic risk to property and life. FEMA's publication of the 2009 NEHRP Provisions, which serve as a national resource for design professionals and the standards and codes development community, is a major ongoing commitment to achieving this goal.

In a series first published in 1985, the 2009 NEHRP Provisions marks the seventh update of this key resource document. This new edition adopts by reference the national load standard, ASCE/SEI 7-05, which allows the Provisions to resume its role

as a research-to-practice resource for introducing new knowledge, innovative concepts, and design methods to improve the national seismic standards and codes. The 2009 NEHRP Provisions are presented in a new one-volume format with three parts:

Part 1) Provisions

Consensus-approved technical modifications of the seismic requirements in the reference standard. The modifications include the adoption of new seismic design maps based on seismic hazard maps issued in 2008 by the U.S. Geological Survey (USGS), along with some design-related adjustments.

RECENT CUSEC GEOCACHE COMMENTS

Geocaching, a high-tech treasure hunting game, is played throughout the world by people who try to locate hidden containers with GPS devices and then log their experiences, or "finds" online. In 2007, CUSEC placed our first earthquake geocache at our headquarters. Since then, we have placed earthquake-themed geocaches in seven of eight member states. The caches are visited regularly, with hundreds of visits during the spring and summer months. Some comments from our cache visitors this quarter include -



- AR - "Enjoyed the cache"
- IL - "Interesting to find earthquake info in Illinois"
- IN - "Really great cache...wish there were more in (the area)!"
- KY - "Really enjoyed this one"
- MO - "I've always been interested in learning more about the New Madrid Seismic Zone"
- MS - "Found on trip to (the area). Well worth the stop and museum visit."
- TN - "Found on a trip to the lake during the arts and crafts weekend" "What a great cache"

Part 2) Commentary

Completely rewritten, up-to-date commentary for the reference standard.

Part 3) Resource Papers

Series of resource papers that focus on emerging seismic design concepts and methods for exposure to and trial use by the design community and on issues that have proven historically difficult or complex to adequately codify.

The accompanying CD (FEMA P-750 CD) contains the digital version of the Provisions, the USGS Seismic Design Maps, the Provisions-based design maps proposed to ASCE7-10 and 2012 I-codes, and other supporting materials.

The NEHRP Recommended Provisions have been the primary source of seismic design requirements for U.S. model building codes and design standards since the early 1990s. To order your copy of the new provisions, call the FEMA Publications Warehouse at (800) 480-2520.

FEMA Hosting School Earthquake Retrofit Webinar in 2011

Numerous school buildings located in multiple states and U.S. territories are vulnerable to earthquake damage and losses. This includes potential:

- Death and injury of students, teachers, and staff
- Damage to or collapse of buildings
- Damage and loss of furnishings, equipment, and building contents
- Disruption of educational programs and school operations
- And inability of the community to use schools as temporary shelters

In January-March, 2011, FEMA will host three one-hour webinars for school officials, teachers, facility managers, and others interested in learning how to reduce earthquake risks and take actions to ensure school safety and continued operations. At these webinars, participants will learn the following:

- How to assess and analyze your earthquake risks

- How to develop an actionable plan to reduce and manage earthquake risks
- How to initiate an earthquake risk reduction plan for existing school buildings that were not designed and constructed to meet modern building codes
- How to secure “non-structural” elements of the school facility
- How to apply “incremental seismic rehabilitation” to protect buildings and ensure occupant safety

WHEN

- Thursday, January 20, 2011 at 3:00 pm EST
- Thursday, February 17, 2011 at 3:00 pm EST
- Thursday, March 17, 2011 at 3:00 pm EST

HOW TO REGISTER

Registration is free. Please send your preferred date to participate, name, organization, address, phone number and email address by fax at 650-593-2320 or by email at atc@atcouncil.org by Friday, January 7, 2011.



Elementary school classroom damage as a result of the M6.7 Kiholo Bay Hawaii earthquake on October 15, 2006. This classroom was one of nine damaged at the school. To learn how to prevent this type of damage, register for one of the FEMA school retrofit webinars in 2011. Photo courtesy FEMA

DATES TO MARK

200th Anniversary of the 1811-1812 New Madrid Seismic Zone Earthquakes

Ongoing throughout 2011-2012. In 2011-2012, there will be events held throughout the central United States observing the 200th anniversary of the great 1811-1812 New Madrid earthquakes. Many organizations will participate in the events, which will include national conferences, earthquake exercises, public outreach events, and more. For more information visit www.newmadrid2011.org.

The Great Central U.S. ShakeOut CUSEC

is planning a Drop, Cover, and Hold On drill for residents in the central U.S. This drill, known as the "ShakeOut", will be held at 10:15am on April 28, 2011. With a goal of one million participants, this drill will be the largest ever held in the central U.S. The ShakeOut website will be available soon at www.shakeout.org/centralus. We encourage all interested to register at www.shakeout.org/centralus.

The 2012 National Earthquake

Conference will be held in Memphis, Tennessee on April 23-27, 2012. This conference will provide national attention to earthquake hazard risk reduction and incorporate learning from historic earthquakes to protect us from future hazards. In the near future, a conference website will be established at www.earthquakeconference.org.

The Central United States Earthquake Consortium is a not-for-profit corporation established as a partnership with the Federal government and the eight member states: Alabama, Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee; and ten associate member states: Georgia, Iowa, Kansas, Louisiana, South Carolina, North Carolina, Ohio, Oklahoma, Nebraska and Virginia. The Federal Emergency Management Agency provides the basic funding for the organization.

CUSEC's purpose is to help reduce deaths, injuries, damage to property and economic losses resulting from earthquakes occurring in the central United States. Basic program goals include: improving public awareness and education, mitigating the effects of earthquakes, coordinating multi-state planning for preparedness, response and recovery, and encouraging research in all aspects of earthquake hazard reduction.

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Please send comments and suggestions to cusec@cusec.org

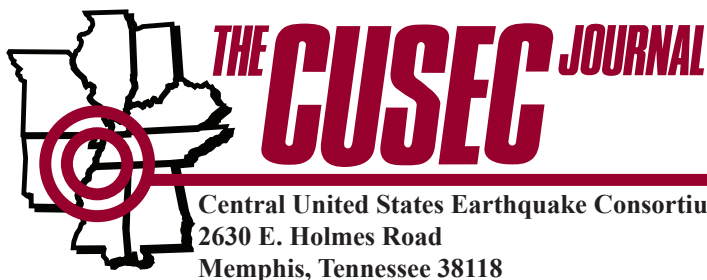
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Center for Earthquake Research and Information
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