



The National Earthquake Hazards Reduction Program

FEMA Accomplishments in Fiscal Year 2011

April 2012



FEMA



Overview

The National Earthquake Hazards Reduction Program (NEHRP), which was first authorized by Congress in 1977, coordinates the earthquake-related activities of the Federal Government. The goal of NEHRP is to mitigate earthquake losses in the United States through basic and directed research and implementation activities in the fields of earthquake science and engineering.

The four NEHRP federal agencies are the Federal Emergency Management Agency (FEMA), the National Institute of Standards and Technology (NIST), which is the lead agency, the National Science Foundation (NSF), and the United States Geological Survey (USGS). Under NEHRP, FEMA is responsible for developing effective earthquake risk reduction tools and promoting their implementation, as well as supporting the development of disaster-resistant building codes and standards. FEMA's NEHRP activities are led by the FEMA Headquarters (HQ), Federal Insurance and Mitigation Administration, Risk Reduction Division, Building Science Branch, in strong partnership with other FEMA HQ Directorates, and in coordination with the FEMA Regions, the States, the earthquake consortia, and other public and private partners.

This report describes a cross-section of selected FEMA NEHRP accomplishments (HQ and Regional), followed by highlights from the States and U.S. territories and organizations which received FEMA support for NEHRP activities in Fiscal Year (FY) 2011. Each year, FEMA provides cooperative agreement funds to eligible States and U.S. territories with moderate to high seismic risk to mitigate those risks and reduce future losses from earthquakes. In FY 2011, FEMA awarded more than \$2 million to 34 States and territories to support the effective implementation of earthquake risk reduction activities: earthquake training and awareness, seismic mitigation plans, property inventory, seismic safety inspections, building codes adoption, and the development of multi-state groups. Organizations receiving FEMA support included the four regional earthquake consortia and the Earthquake Engineering Research Institute (EERI).

The following accomplishments showcase how FEMA and its partners, working in collaboration, are continuing to make progress toward earthquake loss-reduction nationwide. Work completed in FY 2011 will have applications immediately or in the near term in reducing earthquake risk, and also will help to create a strong foundation for realizing similarly effective outcomes in future years.

FEMA Headquarters and the FEMA Regions

Building Code Adoption Tracking

One of the most effective ways to reduce the seismic risk for local communities is to adopt and implement appropriate seismic-resistant building codes. To track code adoption by local communities, FEMA, with contractor support, maintains the Building Code Adoption Tracking system. This system uses the Building Code Effectiveness Grading Schedule from the Insurance Service Organization (ISO) as the primary source to monitor building code adoption and implementation by high seismic jurisdictions. At the end of FY 2011, 48 percent of communities in the United States were being tracked (a handful of States do not participate). In the next phase of this multi-year effort, tax assessor records and HAZUS will be used to run a before and after code/no code study. This will produce actual Annualized Estimated Losses and a national picture of communities that are adopting and enforcing building codes. This project is representative of the work that FEMA NEHRP and the FEMA Building Science Branch were created to do.

Publication of Earthquake Resistant Design Concepts Guide

Understanding the basis for the seismic regulations in the Nation's building codes and standards is important to understanding how we protect the public from earthquake risk. In FY 2011, FEMA published *Earthquake-Resistant Design Concepts: An Introduction to the NEHRP Recommended Seismic Provisions for New Buildings and Other Structures*, FEMA P-749. The Guide provides a non-technical and readily understandable explanation of the intent and requirements of the seismic design criteria found in the Nation's building codes and standards. An important NEHRP goal is to encourage design and construction practices that address the earthquake hazard and minimize the resulting risk to life and property. The publication of FEMA P-749, a companion guide to the 2009 edition of the *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures*, FEMA P-750, reaffirms FEMA's ongoing commitment to achieving this goal.

ROVER: New End-to-End Software for Managing Seismic Risk

FEMA teamed with the Applied Technology Council (ATC) and private-sector partners to create a new tool to screen and evaluate buildings for seismic risk. Now available online and on CD-ROM, the *Rapid Observation of Vulnerability and Estimation of Risk (ROVER)* software automates two international standard paper-based methodologies: FEMA P-154, *Rapid Visual Screening (RVS) of Buildings for Potential Seismic Hazards*, and ATC-20, *Postearthquake Safety Evaluation of Buildings*. The FEMA 154 methodology, which has been successfully implemented in communities nationwide since 1988, uses efficient, standardized, and well-established procedures to assess and manage the seismic safety of a building stock. With the automation now provided by ROVER, inspectors no longer need to juggle papers, clipboard, and camera, and managers no longer need to transcribe paper forms. ROVER also shares data with two other tools to manage seismic risk: HAZUS-MH, developed for FEMA by the National Institute of Building Sciences (NIBS), and ShakeCast, software from the USGS.

The ROVER Server can now operate as an online service for the ROVER smartphone client and as a website for direct access by any web browser. The website service also has been optimized for the small screens found on a smartphone or on any Internet-connected tablet. The ROVER Development Partners support and enhance ROVER and maintain a user-support web page. FEMA will continue to play an important role in outreach to NEHRP customers.

Reducing the Risks of Nonstructural Earthquake Damage

During the recent earthquakes in Chile, New Zealand, Japan, and Virginia, and earlier earthquakes in California, Washington, and other parts of the United States, nonstructural failures have accounted for the majority of damage and injuries. In many cases, businesses, schools, hospitals, and other organizations had to spend significant time and dollars for the clean-up and repair caused by nonstructural failures. The failure of nonstructural components, which include architectural, mechanical, electrical, and plumbing systems, as well as furniture, fixtures, equipment, and other contents, also can impede safe evacuation, delay rescue, and cause additional hazards resulting in serious life safety issues.

In FY 2011, FEMA completed *Reducing the Risks of Nonstructural Earthquake Damage*, FEMA E-74, an electronic publication now posted on the FEMA website which replaces the third edition, FEMA 74. This new fourth edition describes the sources and types of nonstructural earthquake damage and effective methods and guidance that individuals and organizations can use to take action before the next earthquake and minimize future injuries and property losses from nonstructural risks. Webinar training on FEMA E-74 took place in regions across the United States in early FY 2012. This past year, FEMA also had FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction*, translated into Spanish and posted on the FEMA website.

Quantification of Building Seismic Performance Factors: Component Equivalency Method

FEMA completed and published *Quantification of Building Seismic Performance Factors: Component Equivalency Method*, FEMA P-795, in June 2011. This publication builds on FEMA P-695, which provides a methodology for quantifying the seismic performance factors of structural systems. FEMA P-795 presents a simplified equivalency procedure for comparing the seismic performance factors of various building components within an overall seismic system. This publication is currently being considered for adoption as an Acceptance Criteria by the International Code Council Evaluation Service for manufacturers that need to compare the seismic performance of alternate components to those contained in established seismic force resisting system.

Performance-Based Seismic Design Project

FEMA, with the ATC, continued work on the *Guidelines for Seismic Performance Assessment Methodology for Individual Buildings*, FEMA P-58, and the accompanying data calculation tool, PACT, Performance Assessment Calculation Tool. When completed in FY 2012, this performance assessment methodology will allow a designer to assess seismic performance of proposed or

existing individual buildings in future earthquakes. These products are the first phase of the development of Performance-Based Seismic Design Guidelines for New and Existing Buildings. The goal of this project is to be able to evaluate how a building is likely to perform in a given earthquake, considering uncertainties inherent in both the potential hazard and the actual building response. The project will permit design of new buildings or upgrade of existing buildings with a realistic understanding of the risk of casualties, occupancy interruption, and economic loss that may occur as a result of future earthquakes.

QuakeSmart

When disaster strikes, local businesses are often not prepared to resume operations, a critical part of a community's ability to fully recover. FEMA created the *QuakeSmart* program to help local businesses mitigate earthquake losses and get back up and running as quickly as possible after a disaster. A cornerstone of the program is FEMA's recognition that partnerships are key to raising awareness, and to making sure that businesses take action to become "QuakeSmart."

There were a number of *QuakeSmart* products and events in FY 2011. For the first time, businesses now have simple, clear, and technically sound guidance and tools, all in one package, to reduce the potential for injuries, damages, and financial losses from an earthquake. In a user-friendly, interactive format, FEMA rolled out the new *QuakeSmart Toolkit* at the end of FY 2011. *QuakeSmart: Earthquake Mitigation Toolkit for Businesses*, FEMA P-811DVD, walks users through the three-step *QuakeSmart* process: Step 1: Identify Your Risk; Step 2: Make a Plan; and Step 3: Take Action! Accompanying the guidance for each step in the *QuakeSmart* process are numerous tools that can be used by businesses as part of their mitigation process and campaign, including checklists of potential structural and nonstructural vulnerabilities; an earthquake mitigation plan template; sample press releases and media alerts; a multi-size, high-resolution *QuakeSmart* banner; and a fact sheet on how to organize an awareness campaign .

Other *QuakeSmart* activities in FY 2011 included successful partnerships between FEMA, the regional consortia, and local chambers of commerce and businesses in the New Madrid Seismic Zone (NMSZ) during the Earthquake Outreach Tour and on ShakeOut events. FEMA plans to bring *QuakeSmart* to additional at-risk communities and cities in 2012 and beyond. The program also will reach out to other government agencies, non-profit organizations, hazard mitigation product vendors, and large and small businesses that share FEMA's goal of taking action to mitigate losses from a future earthquake.

Earthquake Outreach Tour

The NMSZ Earthquake Outreach Tour, held on February 7-11, 2011, was a huge success. Many of the Outreach Tour events were jointly hosted by FEMA HQ and FEMA Region VII, the Central U.S. Earthquake Consortium (CUSEC), the Institute for Business and Home Safety, the NMSZ States, and other partners. The theme of the week was "Identify Your Risk, Make a Plan, and Take Action," which is also the motto for FEMA's *QuakeSmart* program.

The Earthquake Outreach Tour was a very high profile event. FEMA Administrator Craig Fugate attended and spoke at events on February 11, along with other FEMA and FIMA senior leadership. The week included five forums in five NMSZ communities and concluded on February 11 at St. Louis University with the Earthquake Means Business Bicentennial Kick-Off. During the Tour, more than 5,000 FEMA publications were distributed and more than 500 people were briefed.

ShakeOut!

In 2011, more than 10 million people participated in various State ShakeOut activities, due in part to direct financial support from FEMA and the very active involvement of FEMA Regional staff in Shakeout activities. ShakeOut, which was created by the Earthquake Country Alliance for California in 2008, is now the largest earthquake drill in U.S. history. A goal of ShakeOut is to provide the best motivators for preparedness actions, such as seeing and hearing consistent and frequent information about what to do, in many forms, and from many sources. ShakeOut also provides participants with the opportunity to see others like themselves getting prepared, and to talk about preparedness with their family, friends, and co-workers.

The goals for ShakeOut include participation by millions of people; shifting the culture about earthquakes; and a significant increase in readiness. On October 21, 2010, 7.9 million people participated in the Great California ShakeOut. It is estimated that more than 2 million people participated in the Great Central U.S. ShakeOut in 2011.

Updated Catalog of FEMA Earthquake Resources and Directory of Partners

In December 2010, FEMA published an updated *Catalog of FEMA Earthquake Resources*, FEMA P-736A and FEMA P-736A CD. The new Catalog includes a list of FEMA training courses and materials along with an annotated list of FEMA earthquake publications. The Catalog was distributed at many events in 2011, including the EERI Annual Conference, the 2011 Structural Engineers Association of California Annual Conference, and the National Earthquake Program Managers (NEPM) meeting. The CD version of the Catalog, which is available from the FEMA warehouse along with the print version, includes PDF versions of some of the more popular FEMA publications, such as *Are You Ready, Earthquake Safety Guide for Homeowners*, and the *Earthquake Home Hazard Hunt* poster.

Developing and strengthening partnerships for building safer communities underlies all of the initiatives and activities carried out by FEMA in support of NEHRP. In 2011, FEMA updated its *Directory of FEMA Earthquake Partners*, an online resource that supports those partnerships by providing contact information for more than 300 organizations and individuals involved in earthquake mitigation.

New Earthquake Training Courses

FEMA developed two new earthquake training courses this year, *Earthquake Basics – Science, Risk, and Mitigation*, IS-325, and a train-the-trainer course, *Home and Business Earthquake Safety and Mitigation*, FEMA P-909. *Earthquake Basics* is a 30-minute independent study course

that presents non-technical information on earthquake science, risk, and mitigation. The course also discusses techniques for structural and nonstructural earthquake mitigation. *Earthquake Basics* is targeted to many audiences, including homeowners, business owners, the private sector, government workforce at all levels, first responders, non-profit organizations, volunteers, and community-based organizations. *Earthquake Basics* resides on the FEMA Emergency Management Institute (EMI) website (<http://training.fema.gov/IS/>).

The new *Home and Business Earthquake Safety and Mitigation* course provides training on structural and nonstructural earthquake mitigation. The course has three components: a *Train-the-Trainer* course, a *Home and Business Earthquake Safety and Mitigation* course, and a *Hands-On Interactive Mitigation Demonstration*. The course will create a cadre of trainers with the ability to provide basic knowledge on earthquakes and the simple steps that can be taken to mitigate seismic risk in homes and businesses. The training consists of PowerPoint slides, hands-on demonstration instructions, supply lists, scripts, quiz (and answers), certificate, and posters. Audiences include government at all levels, emergency managers, first responders, businesses, volunteer community groups, and all others interested in leading an earthquake safety presentation.

FEMA NEHRP staff also contributed to the development of *Fundamentals of Building Science, Multi-Hazard Mitigation Design Concepts*, E312. This course, which is offered through FEMA's EMI, presents information on the impacts of wind, flood, earthquake, and wild land/urban interface fire on the constructed environment, and explains key performance and construction issues related to floods, wind, wildfires, and earthquakes. In FY 2011, the course was offered to 35 FEMA disaster workforce staff on June 6-9 at EMI's Anniston, Alabama training facility.

Webinars on School Safety

Many school buildings located across the Nation and the U.S. territories are vulnerable to earthquake losses and damage, including potential death and injury of students, teachers, and staff, damage to or collapse of buildings, damage and loss of furnishings, equipment, and building contents, and disruption of educational programs and school operations.

Through a series of FEMA-sponsored webinars based on *Incremental Seismic Rehabilitation of School Buildings (K-12): Providing Protection to People and Buildings*, FEMA 395, participants learned how to assess earthquake risks, how to develop a plan to reduce and manage earthquake risks, how to secure "non-structural" elements of the school facility, and how to apply "incremental seismic rehabilitation" to protect buildings and ensure occupant safety.

National Earthquake Technical Assistance Program

Through the National Earthquake Technical Assistance Program (NETAP), FEMA and all of the FEMA Regions support the development of training curricula on earthquake mitigation topics and provide courses for State and local officials and businesses throughout the United States.

In FY 2011, there continued to be a very high demand for NETAP training, including *Procedures for Postearthquake Safety Evaluation of Buildings*, ATC-20; *RVS of Buildings for Potential Seismic Hazards*, FEMA 154; *Earthquake Hazard Mitigation for Hospitals*, FEMA P-767; and now *Reducing the Risks of Nonstructural Earthquake Damage*, FEMA E-74. Through these and other courses, FEMA has been able to increase State and local knowledge of earthquake mitigation, which in turn supports the effective implementation of local NEHRP-funded projects.

Workshop on a Rating System for the Earthquake Performance of Buildings

On March 28-29, 2011, the FEMA Building Science Branch sponsored a workshop on Earthquake Building Rating Systems. Invitees included finance and insurance sector representatives, building owners, building managers, public officials, architects, engineers, and code officials. The topics included: the objective of a possible system to rate the earthquake performance of buildings; how to communicate seismic risk to non-engineers; how a rating system could spur action to reduce seismic risk; linkages or lessons from existing green building rating systems; how a possible system could be used by a broad cross section; and qualifications and approval process. Although FEMA's goal for the workshop was primarily to support and encourage discussion on this topic in response to a recommendation from an earlier NEHRP study on existing buildings, some parties expressed interest in supporting future work in this area.

As a result of the recommendations from this workshop, FEMA agreed to update and nationalize a simplified seismic assessment of detached single family wood frame buildings product (known as ATC-50) that was originally developed for the City of Los Angeles after the Northridge earthquake using FEMA funding. The updated version, which will keep the same title, will be referred to as FEMA P-50 and will include an updated Seismic Retrofitting Guidelines for Detached Single Family Dwellings, FEMA P-50-1. The FEMA products will be available by fall 2012.

Puerto Rico Seismic Code Training

Building Science staff organized and conducted with contractor support three seminars on earthquake building codes for Puerto Rico. The reason for the seminars was Puerto Rico's recent adoption of the 2009 editions of the International Building Code (IBC) and International Residential Code (IRC). These codes are somewhat different than the Uniform Building Code originally used by Puerto Rico, and training was considered very important to proper implementation of the new codes.

The course development and instructors were funded by the Building Science Branch under FEMA's Support Contract with NIBS – Building Seismic Safety Council. The seminars were co-sponsored with the Puerto Rico Institute of Civil Engineers and Land Surveyors in the three localities and the Puerto Rico Planning Board with funding from FEMA's Community Assistance Program. The seminars were held in Mayaguez on December 14, San Juan on December 15, and Ponce on December 16, 2010. More than 230 individuals attended the three sessions.

FEMA Earthquake Assistance to the States and U.S. Territories

Region I

Maine

Maine has five earthquakes a year, on average, with a 1-3 magnitude. Goals for the use of FY 2011 earthquake assistance funds included providing business owners and managers with education on seismic risk and risk reduction activities; updating the State database for critical facilities; enabling a Level 2 risk assessment in HAZUS-MH; and continuing outreach and awareness activities.

Vermont

On September 16, 2011, Vermont hosted non-structural mitigation training (FEMA E-74) combined with training by the State Geologist on the earthquake risk to critical facilities. Audiences included the owners of critical facilities, among others. The State Geologist also is a working group member of the HAZUS/ShakeMap Earthquake Scenario Project for New England.

Region II

New York

New York State has about 20,000 State-owned buildings but limited information on the risk to the buildings from earthquakes and other hazards. Attempts to develop an effective mitigation strategy for State-owned buildings has been hampered by the lack of understanding of those buildings that present the greatest risk and the mitigation activities that would be most effective based on the relative risk to various buildings.

To better understand the risk to State-owned buildings and to advance the State Multi-Hazard Mitigation Plan, New York used its earthquake assistance funds to support a multi-agency task force and associated work group that has been developing a State Building Inventory Plan. The effort has involved review of existing State building databases; data management and data improvement schemes; a review of risk screening methodologies; staff training in FEMA-154; and field testing of FEMA ROVER.

A preliminary State Building Inventory Plan has been developed. The work flow process envisioned by this plan is now being tested using a “walk-through” based on test case sample buildings. The work flow involves on-site data collection; risk screening calculation; integration with a prototype master building inventory database; HAZUS-based loss estimation; and a display system to present building risk screening rankings and loss estimations for executive review. The “walk-through” is being used to identify shortfalls and problems with the plan as proposed and to find workable solutions to enable moving into an operational mode.

Puerto Rico

In FY 2011, Puerto Rico successfully adopted the latest model building codes, including disaster resistant seismic provisions. With this adoption, coupled with community education and implementation of risk reduction projects, Puerto Rico is on its way to building safer and more resilient communities. In support of the code adoption, FEMA provided experts who performed nine workshops in San Juan, Ponce, and Mayaguez for local building code officials, architects, engineers, surveyors, and floodplain managers.

There is a good partnership between FEMA and the Puerto Rico Emergency Management Agency (PREMA). PREMA's Earthquake Preparedness Campaign, which ran through June 2011, included a LANTEC 2011 exercise for a 7.6 magnitude earthquake. PREMA, the National Oceanic and Atmospheric Administration (NOAA), and other organizations participated in the exercise, which was designed to improve tsunami warning systems

Training classes funded under the FEMA NETAP included FEMA-154; FEMA P-767, Earthquake Mitigation for Hospitals; FEMA 593, Seismic Rehabilitation Training for One- and Two-Family Wood-Frame Dwellings; ATC-20; and ROVER. Other training included a Puerto Rico Police Academy Workshop on June 23. The focus of this Workshop was what to do before, during, and after an earthquake. The same topic also is the focus of an annual Sacred Heart Volunteer Workshop. This Workshop typically has about 150 participants.

Virgin Islands

Earthquake funds for FY 2011 were used to create TV PSA announcements on earthquakes and tsunamis to get the word out to larger and diverse portions of population. Based on audience feedback, the PSAs were a success. Earthquake and tsunami presentations also were conducted at public and private schools, non-governmental organizations, churches, community centers, and homeowner associations.

Region IV

Alabama

Alabama participated in the Great Central U.S. ShakeOut, which was added to the earthquake curriculum for the 6th grade, and involved the business community through local chambers of commerce. Activities included the presentation of two ATC-20 courses and updating of a natural hazards curriculum; project work with the Alabama Geological Survey, a partner in the Alabama earthquake program; and participation in the National Level Exercise (NLE) 2011. A "hot wash" was held by officials after the exercise and outreach items were distributed to generate awareness of the earthquake risk throughout Alabama.

Georgia

In FY 2009, the first year of participation by Georgia in the earthquake assistance program, work was divided into three areas: response; public outreach; and multi-state coordination.

Accomplishments now include an Earthquake Response Plan, which was completed in February 2011, and an Earthquake Preparedness Guide. Goals for the use of 2011 funds included the fostering of stronger multi-state coordination and the elevation of earthquake preparedness. For earthquake preparedness, the majority of work fell under ShakeOut; the “Preparedness Piggy” videos; ReadyGeorgia; Georgia Emergency Management Agency website enhancements; an earthquake preparedness brochure; church bulletin inserts; and an NLE 2011 support workshop. Schools were the primary audience for the ShakeOut campaign, with about 94,000 students participating in drills.

South Carolina

South Carolina has focused much of its work on increasing education and awareness of the earthquake risk through the use of social media, including websites, Facebook, Twitter, YouTube, promotional videos, speaking engagements, and letters to schools and emergency management agencies. Bookmarks were used to encourage registrations for ShakeOut, which soared from 40,000 registrants to more than 100,000 after the Tohoku earthquake.

Earthquake assistance funds in South Carolina also were used to conduct workshops for local governments on seismic risk and mitigation; an exhibit on the 1886 earthquake; HAZUS training; a “Drop, Cover, and Hold On” video; reactivation of the South Carolina Seismic Safety Commission; ATC-20 and FEMA-154 training attended by more than 350 participants; printing and distribution of updated seismic hazard maps; and vulnerability assessments. Other activities included updates to the South Carolina earthquake plan, a support role in NLE 2011, regional/county earthquake exercises, partnerships with colleges, universities, and other organizations, and operation of the South Carolina Seismic Network.

Region V

Illinois

February is Earthquake Preparedness Month in Illinois. Preparedness and awareness activities were conducted during the month and throughout the year, including news releases and publication updates and distribution. In the months leading up to ShakeOut, participation in events is encouraged through mailings, personal contacts, speaking engagements, websites and social media, print and radio ads, and media events. ShakeOut registrants in Illinois numbered more than 490,000.

Two ATC-20 courses were offered in southern Illinois, which now has 218 trained inspectors in the CUSEC database. A group of architectural, engineering, and building inspection professionals from State government and the private sector continue the development of a framework for the training, equipping, and deploying safety inspection teams.

Region VI

Arkansas

The Arkansas Earthquake Program supported a wide range of activities with its earthquake assistance funds, including updates to the Earthquake Program webpage of the Arkansas Department of Emergency Management; work with CUSEC to plan and participate in the Great Central U.S. ShakeOut; and a Public Earthquake Home Mitigation Workshop at Ace Hardware in Conway, Arkansas. Other activities included entry into an agreement with Radio Disney for a public awareness campaign; in conjunction with Arkansas secondary schools, creation and airing of an earthquake awareness TV PSA; an Earthquake 101 presentation for a teacher in-service workshop in Little Rock; earthquake awareness, response, and mitigation presentations for primary and secondary school counselors (more than 600 people attended 15 presentations); and multiple ATC-20/FEMA 154 classes.

New Mexico

New Mexico used its cooperative agreement funds to conduct a seismic vulnerability assessment of 64 essential facilities (fire stations, Emergency Operations Centers, police stations, hospitals, and schools) in 8 counties in the Belen to Taos corridor. Using HAZUS-MH, an analysis was conducted to estimate the expected damage and functionality of the essential facilities. The default HAZUS database was used to run the analysis by defining a potential scenario using a historic New Mexico earthquake of magnitude 6.3. The report largely utilized default data in HAZUS because of a lack of specific data for New Mexico. For the same reason, specific liquefaction data was used for a few counties in the study. As a result of the use of so much default data, the report estimated only 1 of the 64 essential facilities would have major to complete damage from the earthquake. New Mexico Tech will follow up this report with public outreach materials on seismic risk and by conducting more rapid visual screening of essential structures to update the HAZUS software.

Oklahoma

The Oklahoma Office of Emergency Management (OEM) completed educational workbooks through the Newspaper in Education (NIE) program and preparedness ads that appeared in the Daily Oklahoma the day after the magnitude 4.7 and 5.6 earthquakes that occurred on November 5, 2011, about 50 kilometers east of Oklahoma City. The 5.6 magnitude earthquake was the largest recorded earthquake in Oklahoma history. OEM distributed more than 400 response and preparedness brochures to residents after the event. OEM also contracted with the NIE program to provide educational workbooks and teacher guides for schools to raise awareness and aid in preparedness for earthquakes and partnered with the Daily Oklahoman to produce four different earthquake safety lesson plans included as inserts in the newspaper.

During the Annual Emergency Management Conference on August 23-25, 2011, OEM distributed earthquake brochures and staff from the Oklahoma Geological Survey presented on the earthquake threat in Oklahoma and ongoing research. OEM plans to distribute 10,000

earthquake safety brochures to schools, local emergency managers, and other groups. The OEM website continues to be updated with earthquake information and now has an Earthquake Safety tab. An Oklahoma specific webpage was created within the ShakeOut website to provide up-to-date information on earthquake hazards, earthquake drills, and preparing homes and businesses for earthquakes. Jones School in Jones, Oklahoma participated in the Shake-Out in April 2010, along with representatives from the State Emergency Management, Local Emergency Management, FEMA Region VI, and FEMA Headquarters.

Texas

Outreach was conducted for numerous communities in El Paso County and Earthquake Awareness and All Hazard Community Preparedness materials were distributed to residents through community meetings of “Colonias.” There also were several presentations by the “Promotoras,” a sub-chapter of Project Vida in and outside of the City of El Paso and other rural surrounding areas within El Paso County. Regional community outreach was provided through training to members in the Rio Grande Council of Governments First Responders Preparedness Planning Group in Marfa, Texas. Officials with the City of Marfa have expressed an interest in receiving more in-depth and site-specific Earthquake Awareness Training.

Region VII

Missouri

Missouri prepared for the Great Central U.S. ShakeOut with numerous outreach and education activities, particularly those targeted to schoolchildren. The initiative was a successful learning experience. Missouri also participated in NLE 2011 (activities included ramp-up table top exercises) and collaborated with the S.A.V.E. Coalition on ATC-20 training and other projects. Each year, Missouri conducts about six to eight training classes. Work also is continuing with the Missouri State Seismic Safety Commission, which has been very involved in February Earthquake Awareness Month activities. In 2011, the Missouri Department of Natural Resources conducted “The Earth Moves under Our Feet” event at the Onondaga Cave State Park and earthquake mitigation events at the Bootheel Youth Museum.

The Bloomfield Elementary School in Missouri used assistance funds to secure its nonstructural hazards. Vending machines were affixed to walls and computers to desks because most earthquake-related injuries and fatalities result from falling objects. Lighting fixtures and bookcases also were secured, and an automatic shutoff valve was installed on the gas line.

Region VIII

Utah

More than 90 percent of catastrophic impacts (severe casualties and loss of life) result from buildings constructed with unreinforced masonry (URM). In Utah, there are a very significant number of these buildings which must be prioritized with tools such as ROVER. In FY 2011, Utah

conducted a rapid visual screening of schools using ROVER, updated the URM Guide, developed a flyer for the URM Guide, and published exercise scenarios and *Putting Down Roots in Earthquake Country: Your Handbook for Earthquakes in Utah*.

Scenario project work with HAZUS and ShakeMap was another priority. The Utah Geological Survey helped to develop a suite of maps, starting with Level I HAZUS. The maps were used to generate a dialogue about what can and cannot be accomplished. As a result of the high profile work in Utah on ShakeOut, a request was made to the University of Utah to expand the coverage area for the scenarios. The scenarios also are now used in hazard mitigation plans.

Region IX

American Samoa

American Samoa joined the FEMA earthquake assistance program in FY 2010. For its second year of participation, the focus was public outreach and education. A very successful initiative was the development and implementation of a public awareness campaign carried out primarily through the advertisement of earthquake risks in local newspapers throughout American Samoa.

Arizona

There are two primary programs underway in Arizona: the operation of broadband seismometers and public outreach and awareness. For 4 years, Arizona has been operating 10 broadband seismometers. Data is being gathered and results and outputs provided to counties in Arizona to assist in their planning. The data will be particularly important in emphasizing the risk to those counties in decreasing or curtailing their awareness activities. For outreach and awareness, there have been successes with TV, radio, YouTube, blogs, and print messaging. Interest and awareness among the public increased significantly after the Tohoku earthquake.

California

Highlights of California's program included continued development of the California Integrated Seismic Network monitoring system; participation with the University of California, Berkeley, and Caltech in Earthquake Early Warning research and development; completion and exercise of the Southern California Catastrophic Earthquake Response Plan; scenarios technical assistance for California's Golden Guardian exercises; update of the Guide and Checklist for Non-Structural Hazard Mitigation for California Schools; roll-out of an innovative social media campaign and PBS documentary, *Totally Unprepared*; and the California Enhanced Hazard Mitigation Plan.

Assistance funds also were used to support the California's Earthquake Country Alliance (ECA) "whole community" collaboration among earthquake education stakeholders and support of ECA's product, the Great California ShakeOut, an extremely important California initiative vital to enlisting support from scientists to Scout troops and corner markets to corporations.

ShakeOut drills have spread to 10 States and territories as well as New Zealand, Japan, and developing nations through the Aga Kahn Development Network. California also partnered with the California Earthquake Authority on a Messaging Project to identify the most compelling personal values in an individual's decision-making process. A series of workshops was held to roll out this research.

Guam

Guam developed new outreach materials for schools, tourists, and residents; conducted "Drop, Cover, and Hold On" drills; completed a hazard mitigation plan; and conducted ATC-20 and FEMA-154 training . For the 2011 Great Guam ShakeOut, some materials were translated into Japanese. Guam also issued a Proclamation in August 2011 on earthquake awareness.

Hawaii

In Hawaii, activities supported with earthquake assistance funds are carried out in collaboration with many partners, including the Hawaii State Earthquake Advisory Committee (HSEAC), one of the seven state seismic councils and commissions composed of seismic experts that are members of WSSPC. In FY 2011, earthquake assistance funds were used in Hawaii for technical assistance, earthquake information products, assistance with exercises, promoting the adoption of building codes, implementation of a Post & Pier project via a web-based expert system, and teacher training workshops. To assess regional hazards, Hawaii also is conducting GIS mapping of soil types for Maui County and is mapping landslide areas.

Nevada

In 2011, Nevada held the Great Nevada ShakeOut on the same day as the Great California ShakeOut. The Southern California Earthquake Center (SCEC) was very helpful in organizing the event. Other activities included the completion of a project on soil classifications in Clark County by the Nevada Seismological Laboratory, upgrades to seismic stations in Nevada with stimulus funds provided by the USGS, and improved coordination with the California Seismological Network. With its earthquake assistance funds, Nevada also is updating its epicenter map, including historical earthquakes. A new strain map using geodetic measurements went out for full scientific peer review in the summer 2011.

Region X

Alaska

A goal of the Alaska Homeland Security and Emergency Management's Earthquake Program is to educate citizens about seismic risk and preparedness actions. To support this goal, Alaska will educate local communities facing significant seismic risk by informing citizens of historical events and how to mitigate and prepare their communities.

Alaska identified three communities affected by the 1964 Alaska Earthquake and Tsunami and developed interactive kiosks to educate the citizens and visitors to Alaska of the risks they could

face. In 2011, Kodiak, Alaska initiated a risk assessment with the support of Alaska Homeland Security, University of Alaska Fairbanks, and the Alaska Seismic Safety Commission. The groups teamed up with FEMA Region X to assess the impact of two local earthquake scenarios with detailed infrastructure data from the community that will be run in FEMA's HAZUS Loss Economic Tool.

Idaho

Idaho held the Great Idaho ShakeOut in October 2011, and plans to hold a ShakeOut in 2012. Earthquake assistance funds also were used to develop a high school curriculum based on *Putting Down Roots in Earthquake Country*, soil classification mapping, planning initiatives, and exercises. The Idaho Bureau of Homeland Security helped to host the Western States Seismic Policy Council (WSSPC) and the NEPM meeting in Boise in April 2011. In addition, a technical advisory group is being reenergized in anticipation of the revision of the Idaho All-hazard Mitigation Plan.

Oregon

Oregon held the first Great Oregon Shakeout as a pilot project in one county in 2011. This successful project will grow into a Statewide "Drop, Cover and Hold On" drill in 2012. Two ATC-20 classes were held, along with an ATC-45 class. In Clackamas County, NETAP training (FEMA P-767, Earthquake Mitigation for Hospitals) was held at a local hospital. The Cascadia Road show held over 10 public education events attended by more than 1,000 people. Other activities included development of an emergency Go Kit, which includes emergency contacts, photos of family and pets, maps of the neighborhood, and information on prescriptions and insurance, and initiation of Cascadia Subduction Zone Planning efforts in coordination with FEMA Region X. Oregon continues to work with its local and federal partners in planning for a magnitude 9.0 Cascadia Subduction Zone Earthquake and Tsunami.

Washington

The Washington State Earthquake Program continued to identify methods to reduce risk and implement practical mitigation measures for deficient school structures. A pilot project was initiated to examine earthquake hazards to school buildings. Initiated by the Washington State Seismic Committee (SSC) in 2010, the *School Seismic Safety Pilot Project* assessed the seismic vulnerability of school district buildings in the Walla Walla and Aberdeen school districts – two areas with known earthquake faults. This effort produced a model process that could help the State and its cash-strapped school districts target hazard mitigation funds to those buildings most at risk.

The Washington State SSC initiated a multi-year planning effort, "*The Resilient Washington State initiative*," by engaging stakeholders who assisted the Committee assess current vulnerabilities to seismic hazards, examine critical interdependencies between and across sectors, establish performance metrics for restoration of services and infrastructure, and ultimately provide a blueprint for long-term risk reduction policy implementation to improve Washington's resilience to earthquakes and other disasters. The framework includes more

effective seismic mitigation policies and recommendations for legislation and policy changes to improve Statewide seismic safety. This effort will facilitate implementation of seismic risk reduction policies across Washington, with the goal of making the State truly resilient in 50 years.

For many years, Washington State Emergency Management has conducted regularly scheduled drills for citizens, schools, responders, businesses, and others to practice “Drop, Cover and Hold On” drills. The ShakeOut name and brand has now been incorporated into this effort, debuting in Washington State in October 2012. With Washington joining the ShakeOut effort, the entire west coast of the U.S. will now simultaneously participate in an earthquake drill that improves public safety and reduces personal vulnerability from earthquake hazards. In addition, Washington initiated the Cascadia Subduction Zone Planning efforts in coordination with FEMA Region X. State officials continue to work with local and federal partners in planning for a magnitude 9.0 Cascadia Subduction Zone Earthquake and Tsunami.

Regional Earthquake Consortia and the Earthquake Engineering Research Institute

Cascadia Region Earthquake Workgroup

The Cascadia Region Earthquake Workgroup (CREW) is a coalition of private and public representatives working together to improve the ability of communities throughout the Cascadia Region (Northern California, Oregon, Washington, and British Columbia) to reduce the effects of earthquakes and related hazards, such as tsunamis. Since the mid-1990s, CREW has created several publications, including scenarios, post-disaster recovery guides, and other educational materials accessible on CREW's website. CREW is composed of mostly volunteer representatives that help foster linkages between scientists, businesses, and government agencies on earthquake resiliency.

In 2011, CREW hosted three webinars attended by emergency managers at all levels, business partners, engineers, and the general public. The webinars are used to learn lessons from historical events for future mitigation and preparedness activities. Topics included: Post Disaster Reconnaissance of Tohoku; Tsunami Vertical Evacuation Lessons Learned from Japan; and Lessons learned from Christchurch, New Zealand Earthquake. In addition, CREW hosted a forum on Benefit Cost Analysis that identified the basics behind benefit/cost analysis from an economists' viewpoint. The forum was followed by a panel discussion on the challenges and opportunities to enhance benefit /cost analysis for community seismic mitigation projects.

CREW continues to support its partners in any earthquake-related efforts that occur in their State or province. CREW supported efforts in 2011 for Washington State's earthquake resiliency planning efforts, British Columbia's ShakeOut 2011, and FEMA Region X for the Regional Cascadia Planning efforts and the Evergreen Quake Exercise series.

Central United States Earthquake Consortium

CUSEC, in partnership with FEMA and NEHRP, was established in 1983 and includes 8 member States and 10 associate States represented in FEMA Regions IV, V, VI, and VII. The CUSEC Board of Directors includes the heads of the emergency management agencies of the eight member States: Alabama, Arkansas, Illinois, Indiana, Kentucky, Missouri, Mississippi, and Tennessee with an ex officio member represented by the Association of CUSEC State Geologists.

In 2011, CUSEC sponsored numerous awareness and education projects. These included brochures, newsletters, and pamphlets; Earthquake Awareness Week; Town Hall meetings; work with State and local groups to encourage adoption of building codes; and the 1811/1812 Bicentennial. For the 1811/1812 Bicentennial, CUSEC participated in the Kick-Off in St. Louis on February 11, 2011, and was involved in events throughout the course of the year. CUSEC coordinated and sponsored the Great Central U.S. ShakeOut, which resulted in more than 3 million participants across 11 States. CUSEC was honored by the White House for its efforts through President Obama's, Champions of Change, in addition to FEMA's Individual and

Community Preparedness Award for the ShakeOut program. CUSEC's partnership with St. Jude's Children's Hospital's Dream Home program is a highlight of its activities for the Bicentennial to demonstrate risk reduction efforts.

Mitigation activities included nonstructural training for schools, hospitals, and child care facilities; training in RVS; promoting the adoption of building codes; application of research via workshops; and post-earthquake clearinghouse planning. CUSEC also focused on multi-state response and recovery coordination with other groups. Activities in this area included the creation and or development of catastrophic earthquake response plans for all eight CUSEC States at the local and State level and validation of those plans through the NLE 2011. In association with the NLE, there were two groundbreaking efforts. One effort was a first-ever Resource Allocation Workshop that identified necessary resource requirements and developed an understanding of national capabilities, including those for the private sector. For the second effort, CUSEC States served as a model and real world test of DHS's Virtual USA project. This allowed the CUSEC States to share data and information dynamically among themselves and up to the Federal Government, effectively linking differing operating systems.

In 2011, CUSEC created EQProgram.net as an online resource for State earthquake program managers to use in their efforts to better prepare their States and the Nation against earthquakes. The website, which serves as an online repository for information exchange, document sharing, latest news, and collaboration for the group, is maintained and hosted by CUSEC.

Northeast States Emergency Consortium

The Northeast States Emergency Consortium (NESEC) was established in 1991 and is located in Wakefield, Massachusetts. NESEC develops, promotes, and coordinates comprehensive "all-hazards" emergency management activities throughout the Northeast. This includes all phases of emergency management: preparedness, response, recovery, and mitigation. NESEC's work is a vital component to planning and response for the safety and welfare of the more than 40 million people living in the Northeast. Members of NESEC include Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

Activities and initiatives in FY 2011 included participation in the production of ShakeMaps and HAZUS-MH studies for 11 earthquakes in the Northeast; Level 2 HAZUS-MH earthquake loss estimation for the City of Boston; building code awareness via a zip code online tool; reformatting and modernization of the results of a study funded by FEMA in 1992, Seismic Provisions of State/Local Building Codes utilizing GIS; and the development of a URM building inventory and mitigation strategy, which should help in raising awareness of these types of buildings and their location across the Northeast United States.

Western States Seismic Policy Council

WSSPC was established in 1979. Thirty-nine agency members of WSSPC include the directors of the geological surveys and emergency management agencies from 13 States in the western region, British Columbia, the Yukon Territory, American Samoa, Guam, and the Northern Mariana Islands, and representatives from 7 seismic councils and commissions. Affiliate members include private corporations, local governments, non-profit organizations, universities, and individuals who share the common goal of reducing losses from earthquakes.

WSSPC develops policy recommendations via three standing Committees: the Basin and Range Province Committee; the Tsunami Hazard Mitigation Committee; and the Committee for Engineering, Construction, and Building Codes. In FY 2011, a “Safe Schools Initiative” was started to focus on progress being made by the States to assess, fund, and mitigate vulnerable schools. WSSPC developed five policy recommendations: for the identification and mitigation of URM buildings; for assessing fault activity in the interior western States; for an earthquake emergency handbook for first responders and incident commanders (a recommendation based on the 2008 Wells, Nevada earthquake experience); for earthquake monitoring networks; and for support of public education for mitigation and warning procedures for distant and local tsunamis. Other policy areas include earthquake early warning, school building safety of new and existing buildings, earthquake scenarios, and recommendations for managing post-earthquake information.

WSSPC’s Tsunami Hazard Mitigation Committee prepared a white paper titled “Tsunami Hazard Mitigation and Preparedness: A Perspective from State and Territory Tsunami Programs in the High Tsunami Risk Pacific Region.” The report highlights the importance of the States’ outreach and education efforts in preparing coastal communities for great earthquakes followed by locally generated tsunamis.

Other activities include the WSSPC Awards in Excellence program; conferences and workshops, including the earthquake early warning workshop and a nonstructural mitigation workshop held in conjunction with the NEPM meeting; seismic councils and commission meetings; annual State reports on earthquake program activities; and outreach through the WSSPC website and quarterly newsletters.

Earthquake Engineering Research Institute

EERI is the Nation’s leading membership technical society dedicated to the reduction of risk from earthquakes. As such, EERI is recognized as an authoritative voice for earthquake risk reduction information in the U.S. One significant activity for the Institute is supporting federal agencies in implementing their unique NEHRP responsibilities.

With support from FEMA, EERI annually produces a technical seminar program aimed at the knowledge needs of the practicing engineer. The seminar program for 2011, presented in San Francisco, Seattle, and Los Angeles, was “Seismic Design and Performance of Nonstructural Elements.” Leading national authorities from practice and academia presented on nonstructural

performance in recent earthquakes, research by the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) on nonstructural performance, current code requirements, the new edition of *Reducing the Risks of Nonstructural Earthquake Damage - A Practical Guide*, FEMA E-74, and implementing the new requirements for equipment seismic certification. The total number of attendees to all four sessions was 235. The seminar was recorded and is now available for downloading on the EERI website.

Each year, EERI issues at least one new Oral History with FEMA support. These important publications help preserve the historical record of earthquake science and engineering and are critical to providing a sense of history to those active in the earthquake field as well as young people considering it as a career. In 2011, EERI published an oral history of William A. Anderson, a scholar-pioneer in the field of sociology. His oral history offers insight into his roles as a supportive colleague and an architect of the current U.S. science and engineering research infrastructure. Dr. Anderson's oral history is the first on a social scientist.

The NEHRP FEMA/EERI professional fellowship recipient published in 2011 his research on "Earthquake Ground Motion Simulation Using Novel Machine Learning Tools," conducted in association with CalTech's Earthquake Engineering Research Laboratory. The recipient developed a novel method of model-independent probabilistic seismic hazard analysis and ground motion simulation, which was verified using previously recorded data and machine learning.

A Ph.D. candidate in public policy at the University of California, Berkeley, was the 2010-2011 NEHRP-FEMA Graduate Fellow in Earthquake Hazard Reduction. Her work focuses on the beliefs and behavior of people and organizations that are in a position to make critical preparedness choices for their communities. Her dissertation evaluates a 2005 Berkeley law aimed at the soft-story woodframe apartment building problem and examines the influences on building owners' seismic safety investment decisions. It is the first study to compare the relative roles of individual characteristics, social influences, and economic factors on mitigation choices. The findings will be relevant to other jurisdictions struggling with how to reduce seismic vulnerabilities in their existing building stocks.

EERI's Student Leadership Council organizes and manages the Annual Undergraduate Seismic Design Competition (SDC). The competition is a fantastic hands-on learning experience and always an exciting component of EERI Annual Meetings. In February 2011, approximately 250 undergraduate students from 25 teams took part in the largest SDC competition to date.

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