WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 09-1

Earthquake Planning Scenarios

Policy Recommendation 09-1

WSSPC recommends that each member state, province, and territory establish an active program to produce Earthquake Planning Scenarios for areas with high risk of earthquake losses. WSSPC also recommends that FEMA support the production of these Earthquake Planning Scenarios through its funding resources.

Background

The U.S. Geological Survey indicates that losses to the U.S. built environment and to the U.S. economy from natural geologic hazards amount to tens of billions of dollars every year, and the cost of these losses continues to increase. A fundamental reason for this increase is the steady development of population centers and infrastructure in areas known to have significant natural hazards. Policy makers and public agencies at all levels of government must balance the desired needs for community growth and development with concerns for ensuring the safety of the citizenry. Knowledgeable professionals must provide government decision makers, community planners, and developers with factual, timely, and unbiased scientific and engineering assessments of a community's vulnerability to geologic hazards. Planning scenarios have proven to be an effective means for communicating these risks.

Earthquake Planning Scenarios have been prepared for several areas in the western U.S. over the past two decades and have resulted in numerous initiatives to reduce future earthquake losses (see Appendix 1). A planning scenario describes a realistic earthquake and the estimated resulting damage and casualties in the affected areas. It may describe the fault rupture that initiates the earthquake, expected ground motion and acceleration, secondary effects triggered by the earthquake (landslides, liquefaction, surface rupture, tsunamis, fires), expected structural losses to the building stock and lifelines (major pipelines, power transmission lines, highways, bridges, airports, harbors, hospitals, etc.), and human casualties, as well as areas and types of infrastructure least likely to be damaged or destroyed. The purpose of a scenario is to provide accurate information that can assist governments and developers in engineering, planning, and protecting vulnerable facilities from the destructive effects of a future earthquake; prioritizing emergency

relief operations in areas likely to suffer the greatest damage; or planning and conducting emergency response training exercises.

Facilitation and Communication

Geological surveys are uniquely qualified to provide scientific and engineering information and guidance to the communities they serve regarding geologic and seismic hazards. Emergency management agencies facilitate and manage available resources to lessen the impacts of a damaging earthquake through mitigation and to hasten a community's recovery. Where present, seismic safety advisory boards provide important state and local earthquake policy guidance. These WSSPC member organizations, in cooperation with other federal, state, and regional experts, are uniquely suited to combine their talents and spearhead the development and production of Earthquake Planning Scenarios for their affected populations. In addition, public-private organizations such as the not-for-profit Cascadia Region Earthquake Workgroup (CREW), which provides services to Washington, Oregon, California, and British Columbia, can assist in preparing earthquake and tsunami scenarios. Resources such as these should be examined and leveraged, where practicable.

Scenario-development activities are most effectively implemented by involving and coordinating with federal geoscience and emergency management agencies and with public/private sector organizations such as transportation departments, electric and water utilities, railroad and pipeline companies, and port authorities. This policy recommendation recognizes that FEMA is in an ideal position to support the development of earthquake planning scenarios.

Summary

Earthquake planning scenarios provide policy makers and emergency preparedness personnel with realistic assessments of the areas and types of structures and lifelines that are at most risk of damage, and estimated human casualties. Equally important, scenarios identify areas and infrastructure that are most likely to sustain little or no damage and remain functional following an earthquake.

The cost to prepare planning scenarios, and to update them regularly, is insignificant compared to the future savings from reduced losses to infrastructure, business economics, and human life when the information is used to develop effective seismic-safety policies. Minimizing future earthquake

damage through prior planning, loss-reduction measures, and providing information to facilitate quick recovery is critical for maintaining earthquake-resilient communities.

Assessment

The effectiveness of this policy recommendation will be evaluated by identifying future earthquake planning scenario efforts that culminate in production of a published scenario report. Ultimately, the effectiveness of a planning scenario will be evaluated by identifying earthquake loss-reduction actions or policies that are developed in response to the published scenario.

History

Policy Recommendation 09-1 was first adopted in 2009 by unanimous vote of the WSSPC membership at the Annual Business Meeting February 11, 2009.

Appendix 1: Completed earthquake planning scenarios

Following the devastating eruption of Mount St. Helens in 1980, President Carter requested the National Security Council to consider the implications of the occurrence of a large damaging earthquake in California. The results of this analysis were presented by FEMA in 1981. One of the major conclusions was that it was unlikely that the collective emergency response capabilities of all levels of government and the private sector would be adequate to cope with a major destructive earthquake in metropolitan areas of California.

In response, the California Governor's Emergency Task Force on Earthquake Preparedness was established in February, 1981. Some 30 committees were formed to deal with improvement of the many emergency response functions that would be needed in such an earthquake emergency: e.g., communications, search and rescue, fire services, medical services, air transport, etc. Working with the Task Force, the California Geological Survey (CGS) developed the first two earthquake planning scenarios for the San Francisco Bay Area and the Greater Los Angeles Area. These two scenarios, funded by FEMA, were readily accepted, and a demand for additional scenarios covering other California metropolitan areas resulted in the production of five more scenarios over the following decade.

The State of Washington, through its Emergency Management Division of the Military Department, and the Earthquake Engineering Research Institute, recently prepared an earthquake disaster scenario for the Seattle-Tacoma metropolitan area. This scenario describes potential

damage from the Seattle Fault, and predicts 1,600 deaths, 24,000 injured, police and fire departments overwhelmed, inadequate emergency and shelter services, nearly 40,000 buildings destroyed or rendered uninhabitable, $33 billion in damages and loss, more than 130 fires, and years of rebuilding and recovery.

In 1996, the Nevada Bureau of Mines and Geology (NBMG) produced a detailed scenario for a Reno-Sparks-Carson City earthquake. That scenario, published as NBMG Special Report 20, has been used numerous times in emergency response and recovery exercises, most recently in June 2008.

Most recently, the USGS, in collaboration with the California Geological Survey and many community agencies and organizations, has published *The ShakeOut Scenario – Effects of a Potential M7.8 Earthquake on the San Andreas Fault in Southern California* (USGS Open File Report 2008-1150; CGS Preliminary Report 25). Under this scenario, if no additional preparedness and mitigation actions are taken, the resulting damage will cause 2,000 deaths, 50,000 injuries, and $200 billion in damage along with severe, long-lasting disruptions.

Other states with earthquake potential have not prepared these types of scenarios on a formal basis. Washington, in collaboration with the USGS, universities, and others, is undertaking studies of the potential damage from a very large earthquake along the Cascadia Subduction Zone. The California Geological Survey has considered this in one of its original scenarios. In 2007, Oregon completed an initial step in quantifying structures in the state that would be susceptible to damage from an earthquake in its publication *Statewide Seismic Needs Assessment.*

There are formative plans by the States of Missouri and Illinois and their neighboring states to put together a planning scenario for a potentially very large earthquake along the New Madrid Fault Zone that runs near the City of St. Louis.

Appendix 2: Resources for scenario development

New and valuable analytical tools are available for incorporation into Earthquake Planning and Mitigation Scenarios. HAZUS is a powerful risk assessment software program developed by FEMA for analyzing potential losses from earthquakes (as well as from other types of natural hazards). HAZUS combines current scientific and engineering knowledge with geographic information systems (GIS) technology to produce estimates of hazard-related damage before or

after an earthquake. For HAZUS to be most effective, users should employ a current inventory of the built environment, including transportation and lifeline infrastructure.

Two other new analytical tools are available from the USGS; these are ShakeMap and PAGER. ShakeMap combines measurements of ground shaking (actual or modeled) with information about local geology and earthquake location and magnitude to estimate shaking variations within a geographic region. Produced maps are a valuable tool for emergency response, public information, loss estimation, earthquake planning and modeling, and post-earthquake engineering and scientific analyses.

PAGER (Prompt Assessment of Global Earthquakes for Response) is an automated system designed to rapidly estimate the number of people, cities, and regions that have been exposed to severe ground shaking by an earthquake. PAGER products can be sent automatically to affected emergency responders, government agencies, and others with information as to the estimated scope of a potential disaster.