STATEMENT OF
DR. LUCILE M. JONES
SCIENTIST-IN-CHARGE, SOUTHERN CALIFORNIA
U.S. GEOLOGICAL SURVEY
U.S. DEPARTMENT OF THE INTERIOR
BEFORE THE
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
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Mr. Chairman and Members of the Subcommittee, thank you for this opportunity to discuss the likelihood and potential effects of a worst case, catastrophic earthquake in the Los Angeles area.

The United States is subject to a variety of natural hazards including earthquakes, tsunamis, landslides, flooding, volcanic eruption, hurricanes, and wildfires. These hazards can result in considerable human suffering and billions of dollars in property and economic losses. The occurrence of these hazardous events is inevitable; however, the extent of damage and loss of life can be reduced. Accurate, scientifically based geologic hazards assessments and real-time warning systems that define the nature and degree of risk or potential damage are the foundation for preventive planning; social, economic, and engineering adaptations; and more effective post-event emergency response that are essential to hazard mitigation. At the U.S. Geological Survey (USGS), we strive to deliver the information and tools that emergency managers, public officials and the public need to prevent natural hazards from becoming disasters. The USGS has the lead Federal responsibility under the Stafford Act (P.L. 93-288) to provide notification – including forecasts and warnings where possible – for earthquakes, volcanoes and landslides. The USGS is a partner in the National Earthquake Hazard Reduction Program (NEHRP), working with the Federal Emergency Management Agency (FEMA), National Institute of Standards and Technology, National Science Foundation, and state and local government.

The USGS Earthquake Hazards Program provides the scientific information and knowledge necessary to reduce deaths, injuries, and economic losses from earthquakes by providing timely notifications of earthquake locations, size, and potential damage; regional and national assessments of earthquake hazards; and increased understanding of the cause of earthquakes and their effects. National and regional scale seismic hazard maps depict earthquake shaking hazards and are used for creating and updating the seismic design provisions of building codes used in the United States.

Of all natural hazards facing the United States, earthquakes have the greatest potential for inflicting casualties, damage, and economic loss. Although damaging earthquakes are infrequent, their consequences can be immense.

Describing a single worst case catastrophic earthquake event limits a full understanding of the earthquake risk. Southern California is home to more than 300 faults capable of producing damaging earthquakes, more than any other metropolitan area in the United States. To illustrate the range of possibilities, two events are described here: a magnitude 8 event on the San Andreas fault, and a smaller, magnitude 7 to 7.5 event on a thrust fault near downtown Los Angeles. The geologic record tells us that both events are inevitable; the only question is: when will the events occur?

A magnitude 7 to 7.5 earthquake on the Puente Hills, Santa Monica, or Hollywood faults in the Los Angeles basin will produce the greatest damage to buildings because the event would occur in an area near many older structures. A model from a FEMA study of expected losses from a Puente Hills fault earthquake predicts a loss of 18,000 lives, 300,000 displaced persons in need of housing, and financial losses of a quarter trillion dollars.

Because there are several large faults in the Los Angeles basin, one event of this type occurs every 500-1000 years. Smaller earthquakes on these faults such as the 6.7 magnitude 1994 Northridge earthquake will happen an average of more than twice per century. The Northridge earthquake resulted in 57 dead and $40 billion in losses. Earthquakes in the range of 7.0 – 7.5 will damage a large number of buildings in Los Angeles and displace hundreds of thousands of people from their homes. Severe business disruption would continue for months following the event.

A different type of disaster will be caused by the great magnitude 8 earthquake on the San Andreas fault that repeats every one to two hundred years. Earthquakes this large involve movement of 20 or more feet along at least 250 miles of the fault. Thus, every structure crossing the fault, including freeways, pipelines, power lines, and railways will be pulled apart by the fault. This would lead to significant disruption to the distribution system for necessities such as water, power, and food. Repairs to infrastructure could take months.

East of Los Angeles, the San Andreas fault dangerously traverses rapidly growing areas of the Inland Empire (San Bernardino-Riverside). In a great earthquake (magnitude 8.0 or greater) along the San Andreas fault, northern Los Angeles County and the Palm Springs area will likely be the hardest hit. Because there is a greater density of older structures in these areas, many buildings will completely collapse, potentially killing thousands. All southern California communities will be subjected to some level of damage; aid for emergency response will have to come from much farther away and will take much longer to arrive.

The level of damage in Los Angeles will likely be higher than current models predict. Existing building codes have been designed largely based on the ground shaking generated by moderate earthquakes. A recent California Institute of Technology study concluded that the energy produced in a magnitude 8 earthquake on the San Andreas fault could cause one or more high-rise buildings in downtown Los Angeles to collapse.

Just as the collapse of the levees in New Orleans turned a disaster into a catastrophe, the secondary effects of an earthquake can also be more calamitous than the earthquake event itself. Any of the major earthquakes that will strike the Southern California region could trigger a range of secondary effects depending upon the exact fault, weakened infrastructure nearby, and the weather. The potential secondary effects include:

- **Fires.** Fires have always been a major problem after earthquakes. Ruptured gas lines and failed water delivery systems combine to make firefighting very difficult. Fires destroyed much of San Francisco in 1906, and contributed to the loss of 100,000 lives in the great Tokyo earthquake of 1923. If an earthquake strikes Los Angeles during a time of hot, dry winds such as when the wildfires of 2003 occurred, firestorms could erupt throughout the City.
- **Landslides.** Landslides are another common result of earthquakes. If the earthquake happens during heavy winter rains, landslides could be widespread. One landslide triggered by an earthquake in the Soviet Union in 1957 covered a city, killing 50,000 people. There are even secondary effects from the landslides – for example, over 1,000 cases of Valley Fever, an emerging and sometimes deadly fungus infection, were caused by the dust raised by landslides during the 1994 Northridge earthquake.
- **Dam failures.** The San Gabriel Mountains, north of the Los Angeles basin contain many old dams built in the 1920s and 1930s. The failure of even one of these structures could flood tens of thousands of homes and result in significant loss of life.
- **Aftershocks.** Large earthquakes trigger other earthquakes, sometimes at significant distance away from the main shock. A large San Andreas event could easily trigger an aftershock of magnitude 6.5 – 7 in Los Angeles. Aftershocks can be even more damaging to buildings already weakened by the main shock. A

disaster similar to the 1994 Northridge earthquake could occur as a consequence of a single aftershock.

Our actions before the earthquake strikes will help to determine the losses during the event. Science can tell us the likely consequences of an earthquake and we can use that information to change the outcome. The USGS along with our partners in Federal, State, and local governments and academia have identified steps toward mitigating the earthquake hazard in southern California.

- **Lifelines.** We can reduce the vulnerability of our lifelines by adopting fault-crossing technologies that allow the fault to move without rupturing the pipelines and other transportation systems, such as was used to prevent damage to the Alaska Pipeline during the 7.9 magnitude 2002 Denali earthquake.
- **Retrofitting.** Trillions of dollars of building stock in southern California, built before adoption of modern building codes, have not been retrofitted to modern standards.
- **Rapid information systems.** Modern seismic monitoring systems can provide information about the strong shaking and probable damage within minutes to support decisions by emergency responders. In come cases, information about the probability of shaking can be delivered before the shaking begins.
- **Accurate scenarios.** An integrated picture of what will happen in a future earthquake event from rupture on the fault to shaking and damage of buildings and infrastructure is needed. In order to chart the road to full recovery from such

an event, we need to study and plan for the response at all levels of including emergency response. Such analysis requires research on all aspects of the earthquake process, including: mapping the near-surface geology in the urban region; determining the location and geometry of all hazardous faults; measuring the seismic wave speed in near-surface materials; and deploying Advanced National Seismic System (ANSS) instruments in the ground to quantify the way earthquake waves travel in the region, and in key engineered structures to better predict how they will respond to severe shaking. These results would provide a complete picture of where mitigation will do the most good. Scientific analysis can reduce uncertainty and further engineering evaluation will help reveal the actual level of vulnerability in our built infrastructure and lifeline systems and help to prioritize retrofitting.

- **Education.** Our citizens will eventually be the true first responders to the next disaster. They need to be educated on the likely consequences of earthquakes, how to recognize a safe building, the importance of retrofitting and how to respond safely. In particular, education is the only viable approach to encourage the securing of contents of buildings. Damage to contents caused $12 billion of the $40 billion in losses from the 1994 Northridge earthquake.

Southern California has one of the Nation's highest potentials for extreme, catastrophic losses from several natural hazards such as earthquakes, tsunamis, fires, landslides, and floods. Estimates of expected losses from these hazards in the eight counties of southern California exceed $3 billion per year. These numbers are expected to increase as the present population of 20 million grows at more than 10 percent per year. Recognizing this risk, the Administration has proposed an Integrated Multi-Hazards Demonstration Project in southern California as part of the President's FY07 budget request to Congress. The project would demonstrate how integrating information and products about multiple hazards improves the usefulness of this information in reducing loss of life and property from natural hazards. The Integrated Multi-Hazards Demonstration Project initiative brings the unique research and systems capabilities of USGS to bear on complex issues surrounding natural hazards events, especially those that are interrelated such as earthquakes and tsunamis. The development of integrated databases and the enhancement of information technology systems to track multiple hazards will facilitate more rapid communication and response to the user community. The USGS will work with local planners, emergency managers, and first responders to develop products and tools such as integrated hazard maps and planning scenarios and decision tools to improve communication of USGS science to communities at risk.

Natural hazard events during the past year underscore the need for timely, relevant scientific information. Our efforts in hazards monitoring and long-term data and information collection from past and present hazard events is not simply a scientific research endeavor - - it is a matter of public safety.

Mr. Chairman, thank you for the opportunity to appear before you today. I am happy to answer any questions that you and Members of the Subcommittee may have.