State of California
Seismic Safety Commission

Memo

To: Seismic Safety Commission

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Subject: Update on Survey and Evaluation of Recent Hospital Evacuations Following Damaging Earthquakes

The Seismic Safety Commission has funded disaster medical experts from the Johns Hopkins University in Baltimore through a contract with the Pacific Earthquake Engineering Research Center at UC Berkeley to survey hospitals that experienced disruptions in recent earthquakes in Mexicali (2010) and Christchurch, New Zealand (2010 and 2011). Field surveys were conducted using data collection methods developed after prior earthquakes including the Haiti and Chile Earthquakes 2010. The experiences that surveyors have documented from interviews with hospital personnel responsible for administration, facility support and medical services will help improve emergency response capabilities and our understanding of the major causes of disruption in medical care.

Here is a brief summary of major findings:

Emergency Communication: The El Centro Regional Medical Center, the Cinco de Diciembre and Mexicali General Hospitals were included in the survey. Loss of emergency communication capabilities was cited as the most consistent challenge facing hospitals after recent earthquakes. In Mexicali and El Centro experienced disruption to landlines and cellphones for under a day in the three hospitals surveyed. However disruptions to land lines extended to 5 days in New Zealand and 7 days for hospitals in Chile. Cell phones have generally been restored faster than land lines.

In the Baja earthquake, satellite phones and 800 MHz radios as well as runners were used as backup. In contrast, when Chile experienced a much larger earthquake than the Baja's, the lack of a coordinated emergency communications backup system as well as disrupted roadways resulted in hospitals that were isolated and out of communication with the country's health system headquarters for days.

Emergency Backup Power: Many hospitals experienced loss of power. While power backups worked well in Mexicali and El Centro, New Zealand experienced scattered problems with sediment clogging backup fuel intakes and interrupting backup power. Backup power worked for only three of seven hospitals in Chile.

Water and Wastewater Damage: Surveyors found that hospitals in El Centro and Mexicali do not have backup water storage on site. While they experienced no disruptions in water and wastewater, in Chile, five of seven hospitals lost municipal water. All seven of Chile's hospitals had backup water storage but they experienced problems distributing water within the hospital buildings because of damage to pumps and other water distribution components. New Zealand relies on backup pumps to access emergency water sources, but pumps were clogged due to silting caused by the earthquakes. They faced difficulty in maintaining pressure in the system for fire sprinklers in the upper floors.

Nonstructural Damage: Broken pipes, collapsed ceilings, cracks in partitions, dislodged tanks, elevators, and equipment are often the primary reasons for evacuating hospitals. All of the surveyed hospitals had experienced such damage or the fear of such damage to varying degrees. While the first impulse is to evacuate, it may be more prudent to shelter patients and staff in damaged buildings until such time that repairs or alternative hospital facilities can be obtained.

Structural Damage: While less frequent than nonstructural damage, a maternity ward and part of an intensive care unit was extensively disrupted in New Zealand. One of seven hospitals in Chile suffered severe structural damage. Other than foundation settlement of one wing of a hospital in Mexicali, those surveyed in California did not experience severe structural damage.

Summary: The vulnerable of emergency communication systems is a critical common factor among all hospital personnel surveyed. Hospitals clearly do not have to collapse or suffer severe structural damage to be rendered inoperable. Functional losses due to non-structural damage are often significant in earthquakes, but do not necessarily warrant evacuations. Vertical evacuations of patients down stairs are far more precipitous than horizontal evacuations to move patients to other less damaged portions of hospital wings. Redundancy and backup sources are essential for water, power, wastewater, and communication systems. Information about how to better manage earthquake disasters and reduce vulnerabilities between earthquakes need to be better communicated to hospital personnel and the public.