TESTIMONY OF
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Chairman Pryor, Ranking Member Ensign, and distinguished Members of the Subcommittee thank you for the opportunity to testify before your committee today regarding **"Earthquake Preparedness—What the United States can Learn from the 2010 Chilean and Haitian Earthquakes."**

First, however, as a way for further introduction, for 32+ years I served as a local emergency manager, beginning in North Carolina for Brunswick County and Durham County then to Georgia for Atlanta-Fulton County and retiring in 2007 as the emergency manager for the City of Los Angeles, CA. Now that I am in the private sector I have continued to be actively involved in emergency management. I currently serve on the Board of Directors of the Greater Los Angeles American Red Cross and I recently had the opportunity to be a part of two different teams to visit Haiti and Chile, respectively.

How a government responds after a disaster usually captures the headlines. But most often, it is the role that government plays in preparing for these types of events that can be the single biggest factor in minimizing not only the event's initial toll, but also the recovery time necessary to bring a community back to a healthy, functional state. In this regard, an examination of how the government in Chile responded during the immediate aftermath of the earthquake and related tsunamis is appropriate. I will also address how southern California differs from Haiti in its preparedness as well as its recovery capability.

Our findings reinforced the importance of our "pre-disaster" relationships with all of our governmental, non-governmental and community partners. Properly done, these relationships require an organizational commitment, as well as a significant investment of time and personnel. The number and complexity of these relationships will vary based on local nuances, but as a general rule it is vital to ensure active participation in disaster policy, planning, response and recovery activities at all levels. It was no surprise to learn that the areas in Chile that made the most effective use of its resources were the very areas where some level of interaction had been ongoing before the earthquake struck.

In the United States, our government's approach to disaster response is well defined and emphasizes a "bottom up" approach, where local government is considered as having primary

responsibility for emergency management. The National Response Framework describes the tiered approach and flow in this manner:

Even when a community is overwhelmed by an incident, there is still a core, sovereign responsibility to be exercised at this local level, with unique response obligations to coordinate with State, Federal, and private-sector support teams. Each organization or level of government therefore has an imperative to fund and execute its own core emergency management responsibilities.

There is little to suggest that Americans are willing to accept less readiness in this country, despite the significant costs associated with maintaining such a state of preparedness. As we saw in Chile and on many occasions in the U.S., the early days after a large-scale disaster will best reflect and will ultimately serve as a barometer for local community readiness.

Comparing the Chilean Earthquake to January 12, 2010 Haiti Earthquake and to Large Earthquakes on the San Andreas Fault in California

The figure below maps the distribution of intensity for three earthquakes, the February 27, 2010 M8.8 Chilean earthquake, the January 10, 2010 M7.0 Haiti Earthquake, and a hypothetical

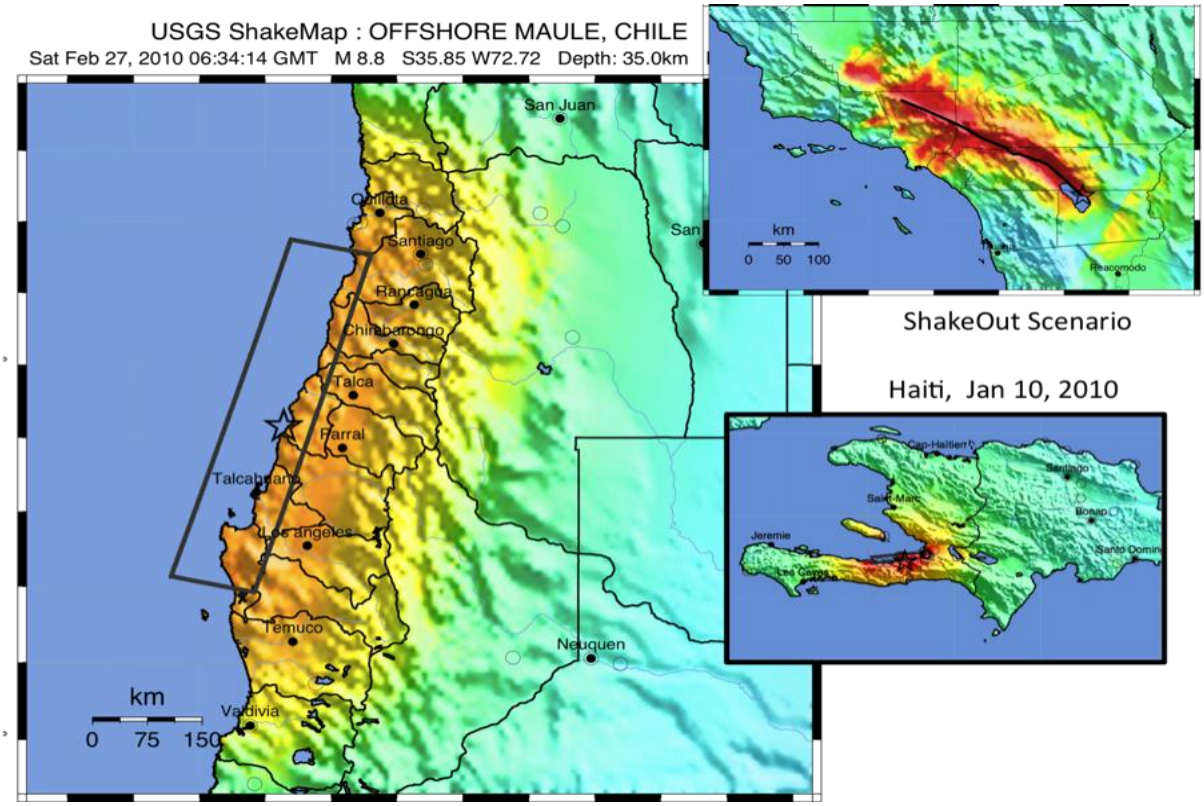

Figure 1: Maps comparing the intensity of shaking during three earthquakes: the February 27, 2010 M8.8 Chilean earthquake (left), the January 10, 2010 M7.0 Haiti earthquake (lower right), and a hypothetical southern California earthquake, the M7.8 ShakeOut scenario (upper right).

southern California earthquake, the M7.8 ShakeOut scenario. All three are shown at approximately the same scale. The ShakeOut and Haiti earthquakes are both are vertical, strike-slip faults, that reach the surface of the earth in populated areas. The Chilean earthquake occurred on a fault that was almost horizontal, that comes to the surface in the seafloor. The area of the fault determines the magnitude of the earthquake. The area of the Chilean fault is 20 times the area of the ShakeOut fault, and almost 200 times the area of the fault in Haiti. Since the Chilean earthquake began in the middle of the fault and ruptured in both directions, the duration of the rupture was shorter than if it had begun at one end. Estimates of the duration are about two minutes, which is comparable to the ShakeOut earthquake (which ruptures from one end of the San Andreas northward). The Haiti earthquake rupture lasted for about 15 seconds.

We can see that the Haiti earthquake had a lower level of shaking for a shorter period of time than either Chile or the ShakeOut. The extremely high death toll and level of damage in that earthquake is directly attributable to the poor quality of buildings in the area. The Haiti experience, therefore, does not provide a basis for comparison to either the Chilean or ShakeOut earthquakes.

Compared to the expected San Andreas earthquake in California, the Chilean earthquake occurred on a longer and wider fault, with fewer people near the fault. This means the type of damage caused by being located near the fault (from very high frequency shaking) would be more prevalent in California compared to the Chilean earthquake. The type of damage that comes from the very large, low frequency waves of a great earthquake, will dominate the Chilean damage. This is the type of damage that will be more prevalent in a big San Andreas earthquake than in other previous California events, such as the Northridge and Loma Prieta earthquakes.

These examples highlight the fact that magnitude alone does not determine what the experience of an earthquake will be. The intensity of shaking at any one moment does not grow significantly at the largest magnitudes. Rather, the duration of the shaking increases, and the area exposed to the strong shaking gets larger. The population exposed to the shaking, however, is equally important. Many of the Chilean officials interviewed by this delegation said that they were surprised by the extent of the devastation because they know they had already experienced the largest earthquake in recorded history (the magnitude 9.5 event in 1960), and they that should have be able to handle anything else that came along. However, the 1960 event was in the southernmost part of the country, which has a limited population, and did not approach to the population exposure of the 2010 earthquake, which was located near Chile's second largest city. Similarly, California should recognize that a magnitude 7.4 on a fault that extends under most of Los Angeles would be much more devastating than the same size earthquake on a fault located in a more rural area. Magnitude, proximity of population, and local soil conditions all play a role in determining the level of damage in an earthquake.

Findings and Recommendations

Volunteers in Chile tend to be very resilient. They are able to work effectively with little or no direction from National Headquarters. This has been part of the reason that they were able to respond immediately to such a devastating event.

The following recommendations for improvement in California were based on observations in Chile:

1. Emergency plans need to be flexible and include alternative options in case primary plans are unable to be executed.

    - It is imperative to have at least one backup alternative plan and to communicate disaster plans with personnel. For example, there should always be more than one meeting place, and more than one designated person fully trained in each position in case the primary person is not available.
    - Plan for technology not working; ensure that staff has access to manual volunteer databases and the paperwork needed to handle staffing.

2. All volunteer leadership, at all levels, need to know emergency plans.

    - All responders at all levels should be aware of the disaster plan.
    - Leadership should be fully trained in their role, and strongly aware of the roles and responsibilities of additional team leaders and members.

3. Exercises need to be done on regular bases with volunteers rotating in their normal roles.

    - If only a few volunteers know the plan and they are unavailable after a disaster, no one will know what procedures to follow.

4. Involve local officials in regional planning.

    - Plans should be developed in coordination with government entities.
    - Partnerships with written MOU's should be developed in advance with non-government organizations.
    - Inter-agency training is strongly recommended for entities that would work together during a disaster.

5. Perform a realistic assessment of life-essential systems, such as potable water sources and emergency medicine supplies. Preparedness on the part of the community is a key element in dealing with these issues.
6. Personnel should be trained for the probability that core services may not be available, and know how to respond and support the community in such conditions.
7. Conducting comprehensive exercises (including joint Government, private sector, NGO, emergency responder, and community exercises) before the event is paramount to surviving and thriving after a natural disaster.

    Justification. When we visited the coastal towns hardest hit by the tsunami, we were told that communities often drill at least twice a year, practicing full evacuations to higher ground. Emergency drills need to be done on a regular bases with key players actively exercising in their specific roles. It is important to exercise within one's own organization; however, it is strongly advisable for entities to work together when drilling.

8. Individual resiliency and effective networking with local partners are vital to the continued success of a community after a disaster. It is critical to empower people to be prepared.

    Justification. Most of the hardest hit areas in Chile were cut off from aid and communication with the capitol for several days following the earthquake. All of the responders in these areas cited their personal resourcefulness and local partnerships (e.g., between the

firefighters, police, emergency management and the Red Cross) as critical in their ability to help their communities in the difficult first few days. The already strong ARC partnership with state and local governments should be maintained and enhanced when possible.

9. Education about what will happen during the event is an important part of preparing for a disaster; this information can save lives during a disaster.

   Justification. Most sources in Chile cited their "culture of resiliency" as a central factor in their ability to respond. It is clear that earthquake drills are more common than in California and that earthquakes are a more visible part of their society. At the same time, lack of information about the true nature of great earthquakes and tsunamis appears to have contributed to injuries and fatalities. For example, many people were taught to head for high ground if shaking was so strong they could not stand; this appears to have saved many lives in the tsunami. At the same time, it is not clear that the occurrence of multiple waves over many hours in tsunamis was anticipated.

10. Emergency and earthquake professionals should work with representatives of the print and broadcast media before the disaster to determine how to best serve the community.

    Justification. The media played a mixed role. Only a single radio station remained on the air in Concepción immediately following the earthquake, but was very helpful since no one else had situational awareness or means of receiving information. At the same time, several people commented that some of the media, especially television, exacerbated the chaotic situation by reporting only on the worst of the disaster, as well as emphasizing the dangers from looters and the potential shortages of supplies.

11. Emergency plans need to be redundant, flexible, and detailed to handle the unexpected in very large disasters.

    Justification. Emergency plans in Chile were in place for the Chilean organizations we met with but in all cases, they were described as inadequate for the situation they faced. Deficits were especially seen in flexibility and alternate plans. For example, plans had only one meeting place that could not be accessed, or one designated person in each position who was injured or out of town.

12. Recognize the competing personal and professional demands that will be made on an organization's staff after a disaster and include this in emergency plans.

    Justification. Immediately after the Chilean earthquake and tsunami, many critical staff members stayed with their property or left work to see if their families were safe. Other staff simply could not get to work. Staffing shortages have the potential to hamper response efforts in the hours, days, and weeks following a major disaster.

13. Organizations need to plan for nonstructural damage and the potential need to evacuate even without structural damage.

    Justification. After a significant California earthquake, it must be assumed that even buildings that are structurally sound will have significant non-structural damage with supplies and some equipment on the floor, fallen ceiling tiles, and other superficial damage, but this should not be the sole reason to evacuate.

14. California must recognize vulnerabilities in our communications systems and make comprehensive backup plans to avoid complete communication collapse. It is important to do this as individual organizations, but also to team up with other organizations.

    Justification. Although most communications were re-established rapidly in Chile, initially it was very frustrating and difficult to have no communications. Health and other critical agencies and institutions need redundant communication systems to communicate situation status and resource requests within and between jurisdictional levels. Initial situation status may be impossible to determine without functional communications, which in turn makes resource allocation decisions very difficult. Emergency hand-held radios proved particularly useful for local primary responders, allowing them to coordinate initial activities.

15. Explore mechanisms to encourage building owners to adhere rigorously to existing building codes.

    Justification. In Chile, buildings performed extremely well, due to strong, well-enforced building codes. By law, if there is building damage or injuries within a building, the building owner may be liable. Both building professionals and lay people in Chile reported that this law serves as extra incentive for building owners to adhere to the building code during construction.

16. Collect all possible data about each disaster when it happens.

    Justification. Many of the consequences of the Chilean earthquake and tsunami have not yet been quantified, such as the numbers of fires or injuries caused by the events. Each disaster is a unique opportunity to learn how society is affected by the events and this information if captured can support researchers who are trying to minimize future losses.

Questions for California and the Pacific North West based on the lessons from Chile:

- It took the 1933 Long Beach earthquake to design schools to higher standards. It took the 1971 San Fernando earthquake to design hospitals to higher standards. What will it take to design tall, high occupancy buildings to higher standards?
- What is an acceptable collapse rate for new buildings and who determines it?
- Have the public and leading public figures been involved in setting safety and investment standards?