Written testimony of
John D. Schelling, MPA
Interim Mitigation & Recovery Section Manager
Washington Military Department, Emergency Management Division

Hearing on:
Earthquake Early Warning System Development and Implementation

Before the United States House Committee on Natural Resources, Subcommittee on Energy and Mineral Resources

June 10th, 2014

Good morning Chairman Lamborn, Ranking Member Holt, Congressman Hastings, and members of the subcommittee. I sincerely appreciate the opportunity to speak to you this morning about new advances in earthquake science and technology. These advances can help the broader emergency management community, along with our numerous public and private sector partners, improve public safety. They will also mitigate the impacts on private industry and our economy before, during, and after our nation's next damaging earthquake. I call your attention to the word "next." In particular, I will address how an earthquake early warning system for the United States has the potential to save lives and reduce property damage in a major earthquake.

My name is John Schelling. I am currently serving in an interim position as the Mitigation and Recovery Section Manager for the Washington Military Department's Emergency Management Division. Prior to this acting assignment, I served for the previous five years as the agency's Earthquake, Tsunami, and Volcano Programs Manager. In that capacity, I implemented a state-level geologic hazards risk reduction program by working with federal agencies, such as the United States Geological Survey (USGS), the Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA), and their state-level counterparts. We have been successful in reducing risk to people, property, the environment, and the economy of Washington State.

Earthquake Early Warning will be an Invaluable Addition to Existing Systems

Earthquake early warning systems in Japan and similar systems around the world provide timely notification within a brief, but critical, window of opportunity to populations in an area that is projected to experience earthquake ground shaking. This important notification triggers a myriad of protective safety actions in seconds. The USGS and its Advanced National Seismic System (ANSS) currently give emergency managers and the public useful products that assist disaster preparedness and response. Earthquake early warning will be integrated into this suite of products as another invaluable tool for life safety, public and private sector mitigation, and community recovery after an earthquake. Earthquake early warning may actually minimize the amount of response resources necessary following an earthquake because of its potential to reduce, or eliminate, some damaging impacts.

Integration of Earthquake Early Warning and Existing Tsunami Warning Systems will be Essential on the West Coast

The West Coast of the United States faces an earthquake and tsunami hazard similar to that of Japan, Chile, and other countries around the Pacific Rim. This means our coastal populations face a dual threat, a magnitude 9+ earthquake followed by a 30-65 foot tsunami. Tragically, we see time and again, that the tsunami takes the greatest number of victims rather than the earthquake.

Best case, the implementation of an earthquake early warning system along the West Coast can provide 3-5 minutes of lead time for coastal evacuation before the first earthquake waves even arrive. This window of time will give people precious minutes to drop, cover, and hold on, as well as a head start on evacuation. In a situation where seconds count, this is significant opportunity for improving life safety.

However, the implementation of this system should not be considered in isolation. Coastal areas that receive tsunami alerts from the U.S. National Tsunami Warning Center in Alaska and the Pacific Tsunami Warning Center in Hawaii, may also receive an earthquake early warning alert too. This means the National Oceanic and Atmospheric Administration and the United States Geological Survey must continue to coordinate closely. This will ensure beachgoers and coastal residents know precisely what protective measures to take when they receive a tsunami alert, earthquake alert, or both. Construction of tsunami vertical evacuation refuges in areas without naturally occurring high ground is another critical lifesaving priority in Washington State, so that when an alert is issued coastal residents and visitors have safe haven.

As a nation, I think we have an obligation to learn from other warning systems that are in use today. Congress commissioned the National Research Council (NRC) to conduct an assessment of the U.S. Tsunami Warning System. The report demonstrated that connected, but inconsistent public messaging and associated outreach and preparedness projects can create confusion for message recipients. To address this important finding, the National Tsunami Hazard Mitigation Program, in collaboration with the USGS, is in the process of completing an initiative to develop common, consistent, and concise safety messages. This is paramount. With the development and deployment of an earthquake early warning system, I think we collectively have an opportunity to learn from the NRC and implement a robust and nationally consistent system from the outset that also has the needed flexibility to meet citizens' safety needs.

From Alert to Action

One of the most significant components of an end-to-end earthquake early warnings system will not be technology, but public education. I think of this essentially as training, and it will be necessary on a continuing basis. Social science driven research for development of education and outreach content is being conducted by the USGS and academic institutions, such as the University of Washington. However, the development of a consistent national public preparedness and outreach strategy and associated implementation plan remains. This will be a critical component of the system for the emergency management community and our disaster preparedness partners.

The effective implementation of an earthquake early warning system for the West Coast should also be considered in the context of the broader nation. The USGS has demonstrated exceptional national leadership on the implementation of seismic monitoring and application of science for risk reduction across the country. What a boon to our public safety as a nation if they are afforded the same opportunity and resources to provide management and oversight of this new extension of their monitoring capability. Such a system may originate on the West Coast due to the number of seismic

monitoring and GPS stations that are deployed. But, the long-term strategic plan and rollout of this advanced technology across the U.S. should necessarily include the input and advice from other areas of the country in order to be most effective.

What are the Benefits and Costs Associated with an Earthquake Early Warning System?

Benefits that will be realized in the United States with the implementation earthquake early warning include: The capability to interrupt industrial processes to protect property; interrupt the flow of oil and gas through threatened pipelines; and make decisions about the electrical grid that could manage the extent of grid loss and localize power outages that might otherwise be regional. In all these examples, this system would mitigate the number of earthquake-caused fires. Fire is a major secondary hazard of earthquake. As an example, the USGS ShakeOut Scenario of a magnitude 7.6 earthquake on the southern San Andreas in California estimated that fire would double losses from $40 billion to $80 billion.

Other benefits of an early warning system include the ability to:

- stop elevators at the nearest floor and open their doors so occupants are not trapped;
- suspend work in progress to avoid injury in hazardous workplaces;
- notify people at home or work so they can move away from hazards and protect themselves;
- suspend or initiate financial or critical data transfers and save vital data;
- stop emergency and elective surgeries;
- automatically divert inbound aircraft away from an airport that might be impacted; and
- in the case of the Pacific Northwest, provide additional time to evacuate from low-lying coastal areas that could be affected by a tsunami.

But these are only a few of the benefits. One of the exciting potentials for earthquake early warning is the participation of the private sector in creation of value-added products for specific industry application, and for the public. A USGS-standardized platform of early warning data can provide a broad opportunity for private sector product innovation in the same way that government's support of communications satellites has done for GPS technology.

Washington State, like many other states, is building up its resiliency, so the effects of an earthquake on our infrastructure and economy will not be as catastrophic. However, a significant component of community resilience is ensuring that residents and businesses feel safe enough to stay after an earthquake occurs. With shallow and subduction zone earthquakes, thousands to tens of thousands of aftershocks can occur. Learning again from colleagues in Japan, their earthquake early warning system was instrumental in helping residents and survivors cope with aftershock sequences during the year following the March 2011 Great East Japan Earthquake. Even a few seconds of warning before aftershock shaking gave them a sense of control.

I personally witnessed the stress that residents of Christchurch, New Zealand were facing from more than 10,000 aftershocks following two devastating earthquakes in 2010 and 2011. In fact, they openly talked about suffering from 'quake brain' due to the sometimes near-continuous ground shaking. Providing a community with some predictability in an unpredictable situation can be empowering. It will greatly assist with short and long-term recovery so that residents will continue to live and thrive in their communities and provide the capital necessary for rapid restoration.

With the implementation of any new system, there are costs. According to the Federal Emergency Management Agency, earthquake losses for the west coast alone are annualized at more than $4 billion dollars. The USGS Implementation Plan for an earthquake early warning system for the West Coast is estimated to cost $38.3M, with additional annual maintenance and operations totaling $16.1M in addition to current ANSS expenditures. According to the FEMA's cost-benefit methodology for hazard mitigation projects, the current value of a statistical life is $6.6 million dollars. Therefore, it stands to reason that if an average of just three deaths per year are avoided considering the net present value of the system and the standard FEMA discount rate of 7 percent, the annual benefit is $19.8 million ($6.6 million x 3). And this does not account for the potentially enormous return on investment for private industry avoided losses.

It is also important to note that an earthquake early warning system does not preclude the need for earthquake or tsunami mitigation. Providing warnings to occupants of unreinforced masonry, concrete tilt up, or soft story buildings will be of little value if the building collapses. One of the challenges states like Washington are facing is the shortened performance period for the FEMA Hazard Mitigation and Pre-Disaster Mitigation Grant Programs. By reducing the amount of time available for applicant's to complete mitigation projects, it essentially eliminates any type of structural seismic retrofitting to improve the life safety of a building to protect its occupants or construction of vertical evacuation safe havens.

One last note: states are already feeling the direct effects a loss in funding from FEMA's State Earthquake Assistance Program due a lapse in authorization of the National Earthquake Hazard Reduction Program (NEHRP). They are concerned annually about proposed cuts to NOAA's National Tsunami Hazard Mitigation Program in the absence of a reauthorization of the Tsunami Warning and Education Act (TWEA).

Reauthorization of the Tsunami Warning and Education Act (TWEA) and National Earthquake Hazard Reduction Program (NEHRP) will be instrumental in an establishing an Efficient and Effective Earthquake Early Warning System

While beneficial, an earthquake early warning system should not be implemented at the expense of hazard education and preparedness activities and other mitigation programs currently in progress by the United States Geological Survey, Federal Emergency Management Agency, or National Oceanic and Atmospheric Administration.

As Congress continues to deliberate on the reauthorization of NEHRP, which has not yet been introduced, and the Tsunami Warning and Education Reauthorization Act, which has been introduced in the Senate, I hope you will consider the human value that earthquake early warning can add to enhancing public safety, reducing unnecessary impacts to our economy, protecting property, and the environment.

The time to implement an earthquake early warning system is before, rather than after, the next major damaging earthquake.

Thank you, Mister Chairman, for the opportunity to provide the Subcommittee with an emergency management perspective on this important topic.