The U.S. House of Representatives
Committee on Science Hearing
"Tsunamis: Is the U.S. Prepared?"

Rayburn House Office Building
Room 2318
January 26, 2005
10:00 a.m.

Invited Testimony

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Introduction

Good morning members of the House Committee on Science. I am honored by the opportunity to represent the State of Oregon's tsunami programs and also acknowledge our state partners, Washington, Alaska, Hawaii, and California, which participate on the National Tsunami Hazard Mitigation Program Steering Group. Although their state tsunami programs have differences from Oregon's, I wish to represent their interests at this hearing as well. It should also be noted that today's date is significant, since the last great Cascadia Subduction Zone earthquake and tsunami occurred on the fault 305 years ago on January 26th in 1700.

1. Please explain your job as the Earthquake and Tsunami Program Coordinator in Oregon Emergency Management. What are the greatest challenges you face in helping the State and localities prepare for earthquakes and tsunamis?

As the Earthquake and Tsunami Program Coordinator for Oregon Emergency Management, I represent this office and the state of Oregon on several statewide, regional and national earthquake and tsunami councils, commissions and consortia, including the National Tsunami Hazard Mitigation Program Steering Group. Much of my time is spent conducting education, technical assistance and program support to local officials regarding earthquake, tsunami and volcano risks and collaborating with state and federal counter parts on related projects and policies.

One of the greatest challenges for the State of Oregon is creating and sustaining a "culture of awareness" in the populations of coastal residents and coastal visitors, so they know instinctively that strong ground shaking at the coast is their signal to evacuate immediately to higher ground. Changing public perception on the tsunami risk - low frequency but high impact makes public education a high priority in raising awareness level and changing people's perceptions of the tsunami risk and personal actions they need to take. This also includes the buy-in from businesses in tsunami hazard zones that have to find a balance between business opportunities and also buy-in to have signage in front of businesses, materials available for the public and the training of employees on actions to take for business survival and protection of customers.

Another part of this challenge is to continue to provide guidance through tsunami inundation mapping, evacuation maps, and signs as to where the dangerous areas are and how to escape to high ground. This culture of awareness is already present in much of the Japanese population, because they have a lot of local tsunamis and undersea earthquakes to reinforce this response. It is currently not the response on the US coast and obviously not on the coast of the Indonesia where less frequent but much more devastating tsunamis can occur.

If an effective education program had been in place and if the local populace in Indonesia had accurate tsunami hazard maps, thousands of lives could have been saved, regardless of an international warning system. The same is true for the US coasts. In fact the most lives saved in the Indian Ocean were due to the educated response of a few people who recognized the signs of an oncoming tsunami.

In the instance of the US coastlines, the most cost-effective means of solving this problem is for long-term support of state tsunami hazard mapping and mitigation programs. We recommend that the National Tsunami Hazard Mitigation Program (NTHMP) be permanently funded at the level of at least $7.8 million per year in NOAA's base budget, and that $390,000 per year of this support be allocated permanently to each of the five Pacific states, Oregon, Washington, California, Alaska and Hawaii (a total of about $2 million per year) to support long-term tsunami hazard mapping, intensive education programs, and the strengthening of local emergency warning infrastructure.

Another challenge is building a strong infrastructure for warning the coastal population, local and visitor, about distant tsunami threats from places like the Aleutians and South America. Distant tsunamis will arrive four hours or more after a tsunami-generating earthquake, so the current international warning system will be effective in issuing warnings. Getting the warnings to everyone on every beach along the Oregon coast requires a comprehensive telecommunications system.

Administrative challenges include working with minimal funding and staffing to develop the tsunami education program -- from product development to its delivery to the public/private sector and coastal citizens. Also local emergency managers are over loaded with DHS requirements making it sometimes impossible to support earthquake/tsunami programs -- they must be given the funding to support resources needed in the community for the development of a tsunami ready community.

Securing coastal borders of the US should also be made a top priority of the new Homeland Security Department. One of the most effective means of achieving higher security is stationing more police and fire responders along the US coastline. These responders are our first line of defense for both natural and manmade disasters. The Oregon coast is mostly devoid of highway patrol officers, fire stations are sparsely manned (mostly by volunteers), and few National Guard are stationed at the coast; yet tens of thousands of visitors flock to the Oregon coastline from all over the US. It is appropriate that the federal government partner with the State of Oregon to secure this border and thereby facilitate meaningful emergency response to tsunamis from both distant and local sources. The State needs direct financial federal assistance to put more fire and police personnel on the coast, especially at coastal ports.

The other, almost overwhelming, challenge is making the coastal transportation system less vulnerable to catastrophic failure due to a local earthquake and tsunami. Federal Highway 101 was built in the 1930's and is now beyond its design life. Nearly all of the bridges and culverts on the coast highway are in greater or lesser stages of deterioration. Given a 10-20 percent chance that a magnitude 9 undersea earthquake and tsunami will strike the Oregon, Washington, and northern California coast in the next 50 years, the current highway will be severely damaged and many bridges destroyed, rendering emergency response nearly impossible. Federal leadership to replace key vulnerable bridges along the coast and those linking the coast to the rest of the state is a vital component in making the state more resistant to this inevitable natural disaster.

2. What is your opinion of NOAA's National Tsunami Hazard Mitigation Program (NTHMP) and of NOAA's Tsunami Ready program? Why are there so few communities that participate in the Tsunami Ready program and what can be done to increase participation?

NOAA"S National Tsunami Hazard Mitigation Program has been instrumental in increasing the capacity of the five member states to conduct tsunami run up modeling and mapping and to tailor tsunami education and outreach to local communities. Without this federally funded program and the state allocations, there would be little, if any, tsunami programs in our states.

The National Weather Service's TsunamiReady program is an excellent incentive for communities to reach at least a minimum standard of readiness. Reasons for so few participating communities could be that this is a relatively new program, but more importantly, program certification requires a large investment of time and resources from the local communities. These investments include installing and maintaining emergency notification infrastructure, evacuation planning, and conducting drills and education activities. Many coastal communities have limited resources to carry out these program requirements.

Changing behavior and attitudes is not an overnight process and takes many years -- therefore, TsunamiReady communities will come on line as products are developed and given to the communities and awareness and preparedness to the tsunami hazard increases -- the bottom line, the communities must buy-in to protecting itself from this hazard, even at potential social and economic loss.

Since meeting the program criteria is a local responsibility, TsunamiReady participation could be encouraged by the permanent increased allocation for the annual tsunami budgets for the five states in the National Program as detailed earlier.

3. What roles do NOAA, USGS and FEMA play in your activities? How can these agencies be more useful in your efforts?

NOAA and USGS have been invaluable partners for the states in providing financial, technological, and nationwide networking resources that have resulted in faster and more accurate warning systems for distant tsunami events. NOAA has also been helpful in providing technical assistance for tsunami inundation mapping, as well as offering a centralized repository for computer data developed from mapping of potential tsunami inundation on US coasts. The Advanced National Seismic System (ANSS) of the USGS provides near instant determination of earthquakes. FEMA has offered helpful advice and served in a key coordination role between the states and other federal partners in the National Tsunami Hazard Mitigation Program (NTHMP).

All of these federal agencies could be more helpful to the states by increasing financial & technological support to amplify what the states do best: natural hazards characterization, mapping tsunami evacuation zones in partnership with local cities and counties, emergency response guidance to local government, and earthquake and tsunami education to the local populace.

FEMA could be a more active partner to the states by directly funding state mitigation efforts, including preparedness and response infrastructure (telecommunications, emergency supply caches, state-federal coordination of military and Coast Guard assets, tsunami flood mapping and education). Since 9/11 and the establishment of DHS, FEMA's ability to support tsunami efforts in the states has been considerably reduced and until DHS can fully develop it's programs and funding streams, FEMA who has a very high stake in tsunami response and recovery, will lag behind in its responsibilities to support state efforts.

NOAA would be more effective, if the parts of NOAA that do bathymetric surveys would give the highest priority to surveys of those parts of the US coast that (1) lack detailed bathymetric data, and (2) are most vulnerable to tsunami flooding. Detailed bathymetry, particularly in bays, estuaries, and shallow water at the coast, is one of the major data needs for the state tsunami hazard mapping programs.

USGS would greatly aid state efforts to map tsunami inundation, if they could regularly provide comprehensive digital terrain data through photogrammetry or airborne laser surveys (LIDAR) for the most vulnerable parts of the US coastline lacking such data. This data, when combined with the bathymetry from NOAA, would empower the state tsunami mapping teams with accurate digital elevation data essential to accurate tsunami inundation mapping.

Additionally, there needs be better research on the nature seismic activity between the subduction zone plates. Because of insufficient instrumentation along the coast, the depth and characterization of earthquakes along the edge of the off shore plate boundaries are not well understood.

USGS and NOAA should combine their resources to provide 24-hr/7-day-a-week tsunami warnings from a single location that is relatively invulnerable to the large earthquakes and tsunamis. This location should have a critical mass of geologists, geophysicists, and tsunami experts available to make instant, collaborative decisions 24 hours a day. For example, a collaborative team that included a geologist would have known from the geology of the Indonesian coast that a magnitude 8.5 to 9.0 earthquake at that particular location was most likely a subduction zone event that would almost certainly generate a devastating tsunami. This knowledge base might well have spurred a more robust warning that may well have saved thousands of lives.

4. Please describe inundation maps. How important are they to your ability to plan? Who prepares these maps and who pays for them?

In 1995, Oregon created legislation that called for mapping tsunami inundation zones, that includes limitations on new construction and require tsunami drills in K-12 schools. Inundation maps are prepared in Oregon by the Oregon Department of Geology and Mineral Industries (DOGAMI) in collaboration with NOAA and with local partners in academia, principally the Oregon Graduate Institute of Science and Technology, Oregon Health Sciences University. DOGAMI publishes and widely distributes the maps after review by local government authorities, technical experts, and the publication staff. The inundation maps are indispensable. Without them, evacuation maps for complex areas such as estuaries and bays are mere guesswork.

The first three inundation maps done for Oregon were supported by a combination of USGS National Earthquake Hazard Reduction Program (NEHRP) funds, State funds, and NOAA funding. After about 1997, the inundation maps were supported mainly by NOAA funds through the NTHMP with some support by the State (principally labor in-kind contributions). With State budgets struggling to keep essential public services like the K-12 schools open, there is virtually no likelihood that these specialized mapping projects would have been supported through state or local funds.

NTHMP has also funded the creation & printing of local evacuation maps, produced from inundation maps. These maps are then distributed as free brochures by local government. Depending on the resources available to local communities, some jurisdictions continue printing the brochures, while others, particularly unincorporated rural communities, often need continuing financial aid in order to provide these valuable products to visitors and the local population. Federal funding from NTHMP to the state tsunami mitigation programs has empowered the states to standardize the evacuation map brochures and reprint brochures for these rural communities.

5. What is your opinion of the Administration's new proposal to improve the U.S.'s tsunami detection and warning programs? Are there ways it can be improved, and if so, what are they?

The Administration's proposed detection and warning system is essential for issuance of world wide warnings about large distant (trans-oceanic) tsunami. The Administration's proposal may be more technically robust, and perhaps more cost effective, if the probabilities of various tsunami sources were fully evaluated prior to final buoy siting. This inexpensive initial research would enable NOAA to place the buoy detectors in optimal locations to effectively minimize population exposure to potential tsunami threats. It may result that fewer buoys than are currently being proposed would be required. NOAA or the National Academy of Science could sponsor a panel of experts to review the final buoy site recommendations.

It is critical to note that the current buoy network and Administration's ocean-wide buoy program would do little to nothing to limit loss of life in coastal areas that are right next to tsunami-generating earthquakes faults. Travel time from the Cascadia earthquake source to the US west coast is too short for the proposed system to operate effectively. In fact, the existing buoys are designed and located to only detect and measure outgoing tsunami.

Oregon communities at the coastline have 10 to 30 minutes to react and evacuate following a probable magnitude 9 Cascadia Subduction Zone earthquake. The most cost-effective means of limiting loss of life from locally produced tsunamis is mapping where the dangerous areas are and then implementing a long-term, relentless public education campaign aimed at developing the "culture of awareness" that will cause people to leave these dangerous areas when they feel a large earthquake at the coast. Empowering local government and the coastal states to implement this work is the most effective means of solving the problem.

Financial and scientific support should also be dedicated to develop innovative new warning technologies able to detect and warn of locally produced tsunamis from submarine landslides and from "silent" or "slow" earthquakes that result little or no shaking. Educating people to respond when the earth shakes does not work for these events. Complementary to developing these new warning technologies is the requirement to conduct a geological assessment of the potential for these types of tsunami-generating sources on the US coastline. These assessments could be completed via cooperative applied research projects performed by state geologic surveys and funded by the US Geological Survey.

Conclusion

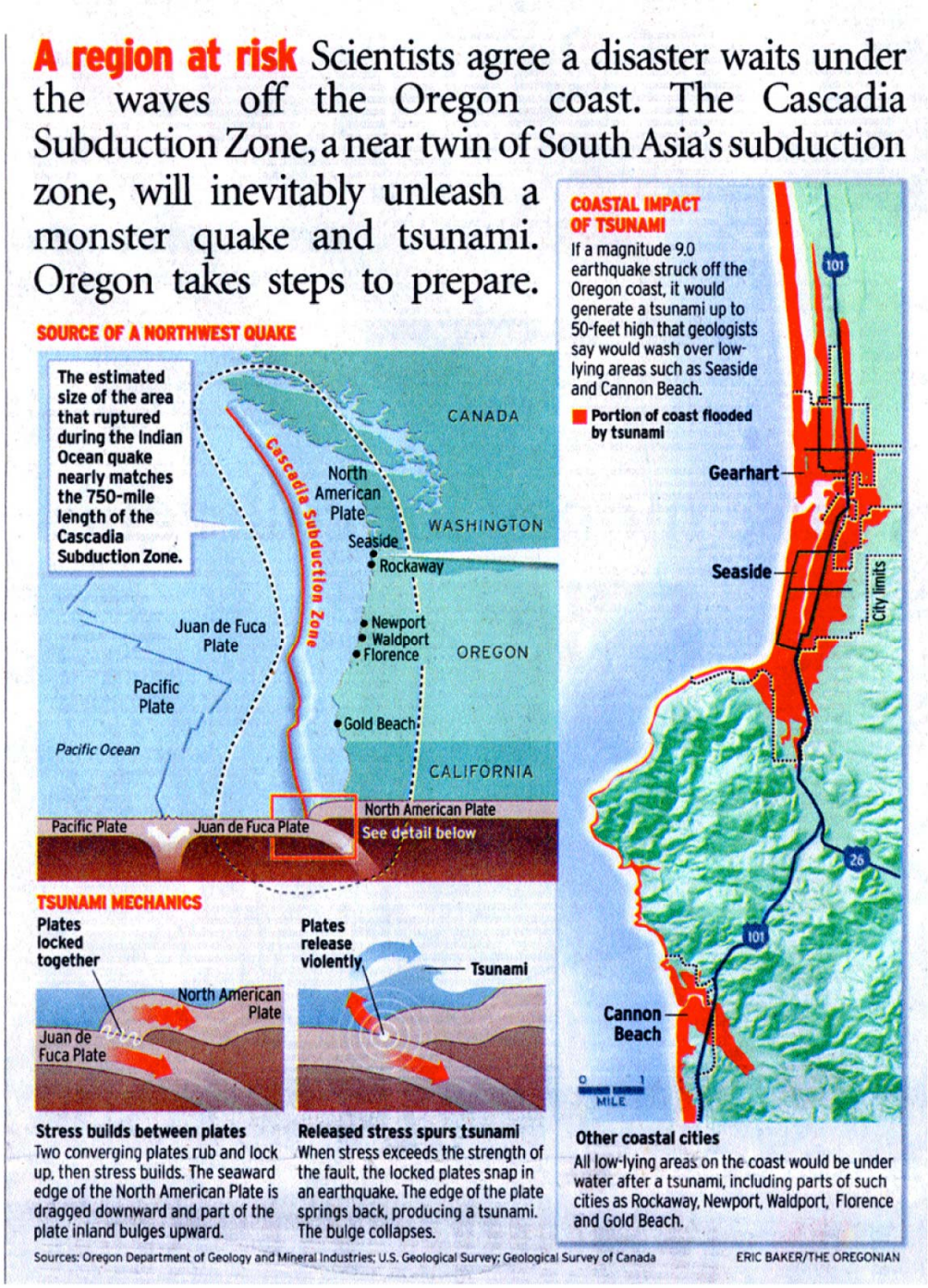
I have just returned from the 1st International Conference on Urban Disaster Reduction in Kobe, Japan and participated in two days of work sessions with my tsunami program counter parts from Japan. Our joint recommendations focused on the need to increase our level of confidence in the technology we rely on, translate more research into direct application, and increase our investment in the "culture of awareness." Considering the history of Japan's tsunami countermeasures, it is validating to see we have universal concerns about our respective societies' needed direction for higher safety.

The proposed increase in tsunami buoys, coupled with an expanded seismic monitoring network will greatly enhance our nations ability to detect and warn of potential distant tsunami strikes. But the NOAA DART buoy network does not provide adequate warning time for near shore tsunami. In fact, it is critical not to rely on their warning in the event of a near shore earthquake, since so little time is available for evacuation.

Please understand that supporting each of the Pacific state's tsunami programs is the most effective way to build the "culture of awareness" necessary for prompt evacuation before local tsunami and for the notification infrastructure necessary to deliver warnings of approaching distant tsunami.

Thank you.

Oregon Girds for Inevitable Disaster



Source: Richard Hill, 1/17/2005
Oregonian, Portland, Oregon

Figure 1.

Tsunami Education Program

Hazard Identification and Evacuation Route Signs: Rockaway Beach, Oregon

Tsunami Evacuation Drill of High School: Seaside, Oregon

Figure 2

Tsunami Inundation Map
Gold Beach, Oregon

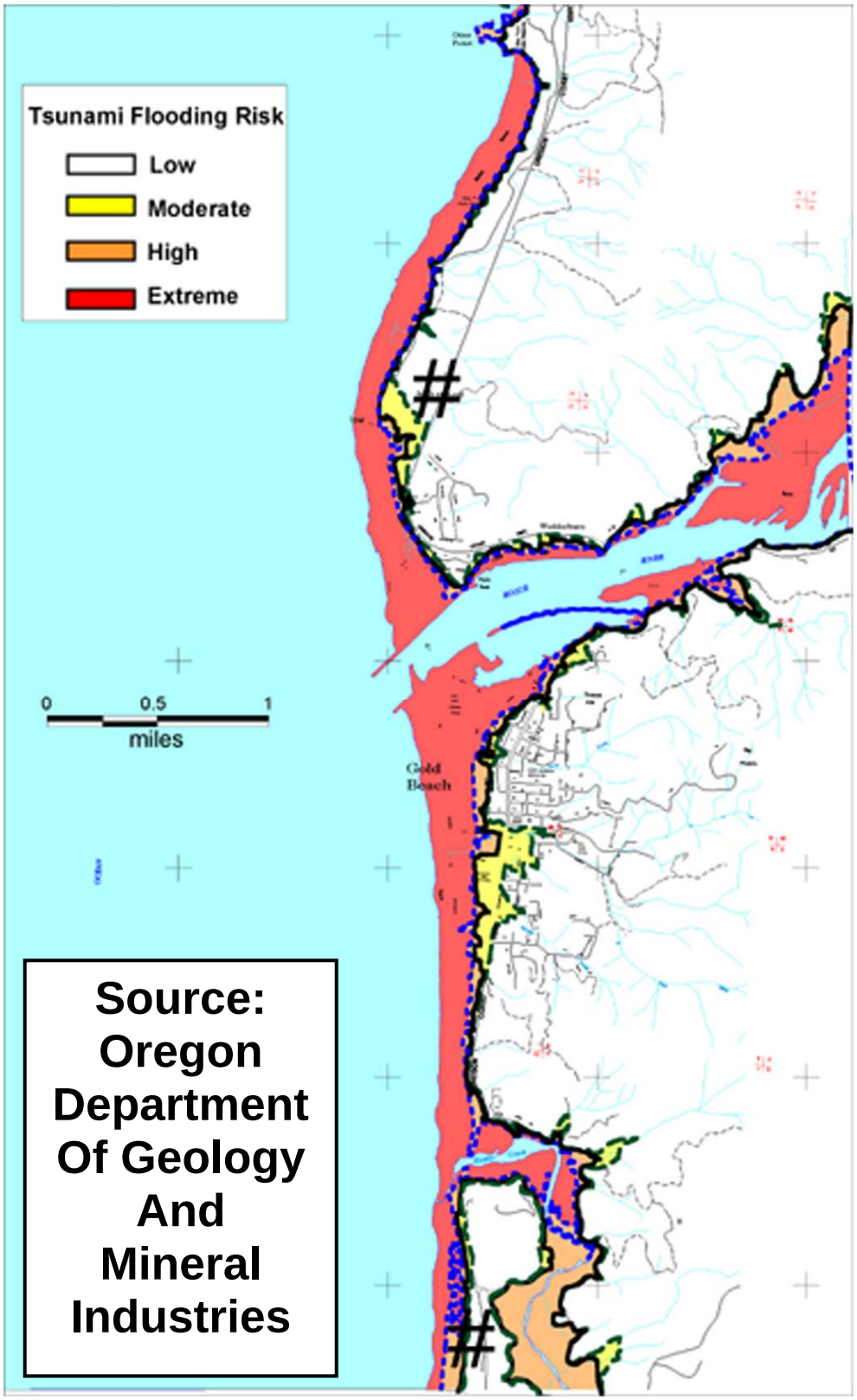


Figure 3


IF YOU FEEL THE GROUND SHAKE, MOVE QUICKLY TO HIGHER GROUND AND SAFETY!
DO NOT WAIT FOR AN OFFICIAL WARNING!
TSUNAMI EVACUATION ROUTE
NOTICE
The evacuation zone on this map was developed by the Oregon Department of Geology and Mineral Industries in consultation with local officials. It is intended to represent a worst-case scenario for a tsunami caused by an undersea earthquake near the Oregon coast. Evacuation routes were developed by local officials and reviewed by the Oregon Department of Emergency Management.
The Oregon Department of Geology and Mineral Industries is publishing this brochure because the information furthers the mission of the Department. The map is intended for emergency response and should not be used for site-specific planning.
Gold Beach Tsunami Evacuation Map
LEGEND
Evacuation Zone
Evacuation Route
Police & Fire
Hospital
School
Oceanside Dr.
GOLD BEACH AIRPORT
Airport Way
Curry County Fairgrounds
Harbor Way
Rogue R.
TOMCAT HILL
Moore
Tom Cat
Coldiron Hill
Grassy Mtn. Rd.
North Fork Riley Creek
Middle Fork Riley Creek
South Fork Riley Creek
101
10th
11th
8th
6th
3rd
1st
0
0.5
1 Miles
North

Figure 4

January 24, 2005

Mr. Sherwood L. Boehlert
Chairman
U.S. House of Representatives
Committee on Science
2320 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Boehlert:

Below is a brief biographical statement for my testimony on Tsunami Preparedness:

Professional Experience

- Earthquake and Tsunami Programs Coordinator with Oregon Emergency Management since July 2004;
- Employed as FEMA Reservist for five years, conducting Community Education and Outreach for Hazard Mitigation Programs;
  - Region X, Bothell, Washington – 1.5 years
  - Region IX, San Francisco, California – 3 years
- Worked as program coordinator and public affairs assistant for earthquake safety
  - City of Oakland, California – 2 years
  - City of Berkeley, California – 1 year

Education

- M.A. in Geography, San Francisco State University
- B.A. in Film, San Francisco State University

Sincerely,

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