TsuInfo Alert
prepared by the Washington State Department of Natural Resources on behalf of the
National Tsunami Hazard Mitigation Program
a state/federal partnership funded through the National Oceanic and Atmospheric Administration (NOAA)

Contents **Volume 13, Number 2** **April 2011**

REPORT FROM CALIFORNIA

Building tsunami-resilient communities in the United States: An example from California

By Lori Dengler, James Goltz, Johanna Fenton, Kevin Miller, and Rick Wilson

Abstract

California is at risk from tsunamis generated locally from regional fault systems, from distant earthquake sources elsewhere in the Pacific, and from submarine and subaerial landslides. Since 1800, over 100 tsunamis have been observed or recorded on the California coast and 16 caused damage to property and/or casualties. The U.S. National Tsunami Hazard Mitigation Program (NTHMP), established in 1996, has provided a framework and funding for States to develop and implement tsunami risk reduction efforts. In the years since the inception of the NTHMP, the California tsunami program has implemented a tsunami mitigation and preparedness strategy that includes: 1) tsunami inundation maps for all populated coastal areas of the state, 2) guidance for coastal emergency managers in response planning and evacuation route mapping, 3) workshops and exercises for coastal counties and communities, 4) video-electronic-print educational materials and an annual Tsunami Awareness Week, 5) tsunami signage, siren installation and siren protocols, 6) assisting communities in becoming recognized as TsunamiReady, 7) supporting regional tsunami work groups, 8) tsunami warning communication tests using the actual "live" codes in the Emergency Alert System (EAS), 9) evacuation drills, and 10) initiated the development of products for the maritime and land-use planning communities in the state. Recent tsunami events including the near- and far-field affects from the 2009 Samoa and the 2010 Chile tsunamis have influenced California tsunami mitigation efforts. Both of these events resulted in Tsunami Advisories being issued along the California coast. The West Coast Alaska Tsunami Warning Center changed the definition of Advisory in 2007 and these were the first times the new definition of advisory had been used. The response of California coastal jurisdictions to the Advisories was inconsistent and highlighted the need for better communication and outreach efforts. The experiences in Samoa and Chile demonstrated the success of education efforts in reducing loss of life. However, these events also illustrated several problems: the vulnerability of transient populations such as tourists and non-resident workers, the exposure of areas with barriers to high ground, and confusion about how and where to evacuate.

1. Introduction

The California coast is at risk from tsunamis generated locally or elsewhere in the Pacific basin. Over 100 likely tsunamis have been observed or recorded in California since 1800. While the majority of these events were small and only detected by tide gauges, 16 were large enough to cause property damage and five events caused deaths (NGDC, 2010). (*continued on page 3*)

TsuInfo Alert

is prepared by the Washington State Department of Natural Resources
on behalf of the National Tsunami Hazard Mitigation Program,
a State/Federal Partnership funded through the National Oceanic and Atmospheric Administration (NOAA).

It is assembled by
Lee Walkling, Librarian,
and is published bi-monthly by the
Washington Department of Natural Resources, Division of Geology and Earth Resources.

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ISSN 1938-5064

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The perception of California's tsunami risk changed in 1992 when a magnitude 7.2 earthquake in Northern California produced a small local tsunami. Although the tsunami did not cause damage, it raised concern in the United States about near-source tsunami hazards and contributed to the formation of the U.S. National Tsunami Hazard Mitigation Program (NTHMP) in 1996. The NTHMP provided funding to strengthen the warning system, provide tsunami hazard assessments, and initiated tsunami mitigation programs in the five Pacific states. The 2004 Indian Ocean tsunami raised tsunami concerns and increased the size of the NTHMP to include all coastal states and territories and provided more funding to both the national program and to the states.

Several recent events have focused additional attention on California's tsunami hazard since the Indian Ocean tsunami. In June 2005 a magnitude 7.2 earthquake located 90 miles off the Northern California coast triggered a tsunami warning for the entire West Coast of the United States and revealed numerous weaknesses in California's tsunami preparedness (California Seismic Safety Commission, 2005). In November 2006, tsunami alert bulletins were issued for the Pacific after a magnitude 8.3 earthquake in the Kuril Islands. The alerts were cancelled before waves were due to arrive in California but two Northern California counties chose to conduct limited evacuations of the beach and harbor areas based on informal dialog with the West Coast Alaska Tsunami Warning Center (Dengler et al., 2009). Strong currents produced by the tsunami caused an estimated $20 million in damage to docks at Crescent City harbor in Del Norte County, but the evacuations prevented injuries.

As a result of the 2006 Kuril tsunami event, the West Coast Alaska Tsunami Warning Center changed the definition of a Tsunami Advisory bulletin from an alert that meant the arrival of significant wave activity was greater than six hours away, to a localized threat of strong currents in harbors like the impacts observed in Crescent City. The first time the new advisory definition was used in California was September 29, 2009 after the magnitude 8 Samoa earthquake (Wilson et al., in press). California was again placed in an Advisory on February 27, 2010 after the magnitude 8.8 Chile earthquake. The Chile tsunami caused an estimated two – three million (US dollars) in damage on the Southern California coast (Wilson et al., 2010a).

Recognition of the local, regional, and distant tsunami hazards on California's coast has led to a number of tsunami planning, outreach and mitigation projects. This paper describes the California state tsunami program, what the program has accomplished since its inception, and lessons for California and the United States from recent tsunamis.

2. California's tsunami risk

The California Seismic Safety Commission summarized the tsunami hazard to California (2005) and described the historic record of tsunamis recorded or observed within the state. It also examined other potential tsunami hazards based on paleoseismology and assessments of the earthquake potential of California fault systems.

2.1 Historic tsunamis

The written record of tsunamis in California is relatively short. Native peoples inhabited the region for thousands of years but passed on their traditions and experiences through oral history and left no written records. The first Spanish missions were established in the late 1700s and Americans of European ancestry began to establish settlements in the early 1800s but widespread settlement didn't begin until the Gold Rush of 1849. The first tide gauges were established at San Diego and San Francisco in the 1870s. In this relatively short time period, the National Geophysical Data Center (NGDC, 2010) reports 102 possible or probable tsunamis (Fig. 1) that were observed or recorded in the state with a validity 2 or higher.

The majority of the events in the NGDC database (72) were caused by large earthquakes elsewhere in the Pacific basin. The most common source regions for these teletsunamis were Alaska and the Aleutian Islands (15), South America (14), the Kuril Islands and Kamchatka (13), and Japan (10). Eleven historic teletsunamis events caused some damage to property and five caused fatalities. The most significant was the March 28, 1964 tsunami caused by the M_w 9.2 Prince William Sound Alaska earthquake, which killed 14 in California, flooded 29 city blocks in Crescent City in Northern California and caused damage to ports and harbors elsewhere in the state.

Thirty likely tsunamis in the database were of local origin, caused by earthquakes along California's coastal margin and near shore faults. While none of these tsunami events caused significant damage, five caused minor damage and two caused deaths. There are numerous active fault systems offshore and close to the coast that haven't produced tsunamigenic earthquakes in the short historic record but have characteristics that have led scientists to consider them potentially hazardous. Ground shaking associated with these local earthquakes is also capable of producing submarine or subaerial landslides. These local sources pose a significant challenge to warning and evacuation, as the travel times to populated areas may be only minutes to tens of minutes.

Complexities of the California coastline and nearshore bathymetry produce characteristic long-duration tsunami events at California coastal locations. Figure 2 shows the marigram recorded at Santa Barbara in the February 27 tsunami generated by the Chilean magnitude 8.8 earthquake. The largest amplitude wave (91 cm)

occurs more than five hours after the initial onset of the tsunami and observable surges lasted more than two days. In 1960, the tsunami signal at Crescent City from the great Chilean earthquake persisted for more than five days (Kendall et al., 2008). The delay of the largest amplitude waves and long duration of hazardous conditions poses challenges for emergency management (Kelley et al., 2007).

2.2 The paleoseismic record of tsunamis

The short written record makes it difficult to accurately assess the potential tsunami hazard posed by California's faults based on historic data alone. There is mounting evidence that the state has been struck repeatedly in the past by tsunami sources not represented in the historic database. The best documented of these prehistoric hazards is the Cascadia subduction zone (CSZ). Paleoseismology studies suggest peak wave heights along California's North Coast in the 8 – 20 meter range from past Cascadia events (PG&E, 2003; Leroy 1999; Patton and Witter, 2006). The last major earthquake and tsunami on the Cascadia subduction zone occurred in 1700 and recent paleoseismic studies suggest that the average recurrence of major Cascadia earthquakes along the Northern California coast may be as low as 250 years (Goldfinger et al., in press). Not only is the CSZ likely to produce very large waves, the expected arrival time of the first water surges is only minutes to tens of minutes.

Other fault systems may also pose a significant tsunami hazard. Less well-studied than the CSZ, the offshore tectonics of Southern California is complex with fault-segment stepovers, restraining and releasing bends, that can cause significant vertical displacement and tsunami-genesis in a predominately strike-slip environment (Legg and Barberopoulou, 2007). California's tsunami hazard is not restricted to the coast. Fault displacement or submarine landslides in lakes can also produce tsunamis and seiches. Deposits in Lake Tahoe on the California – Nevada border have been interpreted as tsunami produced (Moore et al., 2006), and tsunami numerical modeling of Lake Tahoe suggests waves as high as 10 meters (Ichinose et al., 2000).

Figure 3 shows the relative tsunami hazard of local sources based on currently available data.

2.3 Likely frequency of tsunami alert bulletins

Tsunamis are perceived as a rare occurrence in California. Although damaging tsunamis have been infrequent in the state's short history, tsunami alert bulletins are not rare. To illustrate this, we examined all of the earthquakes that have occurred in the Pacific basin since 1900. Figure 4 shows the likely bulletins that would have been issued for the California coast using the current West Coast Alaska Tsunami Warning Center criteria.

Thirty-five alert bulletins would have been issued to California coastal communities over this time period, an average recurrence rate of just over 3 years. From this perspective, tsunami events are a regularly recurring event and not as rare as many might think. It is particularly important to train new dispatchers and coastal emergency managers, as there is a 16% chance that they will need to react to a tsunami alert bulletin in their first six months on the job.

3. The California State Tsunami Program

The history of California's Tsunami Program dates back to the formation of the Southern California Earthquake Preparedness Project (SCEPP) in 1980 and the Bay Area Regional Earthquake Preparedness Project (BAREPP) in 1984. The focus in the first decade of the program was earthquake hazard reduction. The formation of the National Tsunami Hazard Mitigation Program in 1996 provided impetus and some funding for tsunami mitigation efforts. Funding was substantially increased in 2009 and the current leadership of the California Emergency Management Agency (Cal EMA) has promoted a more aggressive effort statewide to develop plans for catastrophic earthquake and tsunami response and recovery, renewed the emphasis on public earthquake and tsunami preparedness and education, provided guidance and leadership in promoting the implementation of new technologies and continues to provide a voice for earthquake and tsunami-informed hazard mitigation and wise land-use planning.

3.1 Tsunami inundation mapping

In December 2009, the state program, comprised of the California Emergency Management Agency (Cal-EMA), the California Geological Survey (CGS), and numerical modelers at the USC-Tsunami Research Center, completed a multi-year project by releasing a set of statewide inundation maps covering low-lying, populated areas within the state (Barberopoulou et al., 2009; Wilson et al., 2008). The inundation mapping project defined likely sources both local and distant and compiled maps representing credible worst-case inundation events to assist emergency managers in defining evacuation zones and routes. Figure 5 is an example of a map from the Crescent City area of Northern California.

In 2011, the output from the state's tsunami inundation mapping project including water heights, expected inundation extent, flow depths, and current velocities, will be collected and managed in a database at CGS. The database will include the results from over 400 tsunami scenarios including local and distant sources. This data will be used to develop additional mitigation products for local jurisdictions. A tsunami source database and tsunami deposit database are being developed to help the state continue to evaluate the effectiveness of the existing maps (Wilson et al, 2009b).

3.2 Guidance for coastal counties

A primary objective of the California tsunami program is to provide coastal jurisdictions (both cities and counties) with the tools to manage their tsunami hazard. The state program provides: 1) guidance and review for earthquake hazards which may inhibit safe evacuation (Wilson and Miller, 2010), 2) scenario specific information that local jurisdictions can use as "playbooks" during real events, 3) assistance in evaluating evacuation times for residents in inundation areas (Wilson and Miller, 2010; Graehl and Dengler, 2008), 4) workshops to understand tsunami risk, warning protocols and state response procedures, and 5) table top and functional exercises.

3.3 Education and outreach

From its inception, the U.S. National Tsunami Hazard Mitigation Program (NTHMP) has considered education as a major part of reducing vulnerability to tsunami hazards in the United States. During the first year of the NTHMP, a Strategic Implementation Plan was developed to assess existing mitigation programs and materials, formulate mitigation strategies and set priorities for projects (Dengler, 1998). The Plan recognized the different tsunami exposure and unique demographic situations of the five Pacific states and the need to incorporate tsunami efforts into existing earthquake and all-hazard mitigation programs. The goal of the plan was to encourage "tsunami resistant" coastal communities. The concept of tsunami-resiliency was adopted by the NTHMP in 2004 as a framework for US tsunami hazard mitigation projects (Bernard, 2005). A tsunami-resilient community "....should (1) understand the nature of the hazard, (2) have the tools they need to mitigate the tsunami risk, (3) disseminate information about the tsunami hazard, (4) exchange information with other at-risk areas, and (5) institutionalize planning for a tsunami disaster (Jonientz-Trisler et al., 2005).

The California program recognizes education and outreach as a central part of all of its activities. This includes print and electronic materials, public service announcements and video materials. Considerable effort has gone into honing and prioritizing the educational message. All state products emphasize the importance of both natural warnings such as long-duration ground shaking and ocean drawdown and official warnings. Figure 6 shows examples of state educational products.

The state has established two websites. The first www.tsunami.ca.gov hosts tsunami inundation maps and educational materials. The second allows individuals to type in an address or location to determine whether they are in a tsunami hazard area and provides actionable information they can use to become safe from a tsunami: (myhazards.calema.ca.gov). In addition to products, the program has also supported events and activities, including the State Tsunami Awareness Week, held annually the third week in March, and exhibits at fairs on the North Coast described in more detail in Dengler et al. 2006.

3.4 Signs

Tsunami hazard and evacuation route signs were developed by the Oregon Department of Transportation and adopted by the National Tsunami Hazard Mitigation Program at their first meeting in 1996 for use in the five Pacific states. A suite of signs for use in California was approved in 2006 (Fig. 7). The state program purchases signs for coastal communities and assists in developing effective sign placement plans (Wilson and Miller, 2010). To date, the state program has purchased approximately 2000 tsunami hazard signs for local jurisdictions.

3.5 TsunamiReady Program

In 2001 the National Weather Service initiated the TsunamiReady program to improve community tsunami resiliency. The TsunamiReady program sets minimum guidelines for jurisdictions to follow for adequate tsunami readiness, encourages consistency in educational materials, response, and planning among coastal communities and recognizes communities that have taken the steps necessary to prepare their emergency response infrastructure and population for a tsunami emergency. California has embraced the TsunamiReady Program and has worked closely with NOAA's National Weather Service to encourage and facilitate community participation in the program. Currently California has the largest number of TsunamiReady Communities in the National Tsunami Hazard Mitigation Program at 18, including the largest city to be designated TsunamiReady (San Francisco) and the only TsunamiReady university (University of California, Santa Barbara).

One TsunamiReady initiative that is unique to California is the effort to make all of California's coastal state parks and beaches TsunamiReady by 2014. The California Emergency Management Agency, which is the lead agency for California's Tsunami Program has developed a template for planning and is working with the Redwood State and National Park which has achieved TsunamiReady status, to promote park participation. The parks initiative will emphasize tsunami warning and evacuation plan development, hazard sign acquisition and placement and visitor/user public information about tsunamis and tsunami safety. There are 122 coastal parks and beach parks in California that attract several million people each year.

3.6 Regional tsunami workshops

In the aftermath of the Great Sumatra Earthquake and Indian Ocean Tsunami of 2004, there was great concern among California's 20 coastal counties that they were ill prepared for a similar event affecting the west coast of the US. These concerns were magnified by two events affecting California, which stimulated action toward greater

tsunami resilience. They included a West Coast/Alaska Tsunami Warning Center issued Warning for California following a M7.2 earthquake that occurred approximately 100 miles west of Trinidad in Humboldt County on June 14, 2005 (just 6 months after the Indian Ocean Tsunami) and a M8.4 Kuril Island earthquake/tsunami that caused approximately $20 million in damage to Crescent City's Boat Harbor on November 16, 2006. The California Tsunami Program launched a series of tsunami planning workshops statewide in 2006-2008 which featured an assessment of the local and regional tsunami hazard, training in use of the tsunami inundation maps for evacuation, principles of planning for the hazard, effective public education and facilitation of drills and exercises. Since 2006, there have been approximately 20 workshops covering nearly all coastal counties.

3.7 Tsunami warning communication tests

There are several types of warning communications tests conducted to assure the timely and effective transmission of information, including a Warning, Advisory or Watch from the West Coast Alaska Tsunami Warning Center to the targeted population. The problem as recognized by California officials is that the final link between the WCATWC and the public, the Emergency Alert System using live tsunami event codes (TSW) is almost never tested. The most common form of testing includes the Routine Weekly Test (RWT) and the Routine Monthly Test (RMT) that are best known to the public as interruptions of radio and television broadcasts using the statement: "This is a test, this is a test of the Emergency Alert System. Had this been an actual emergency you would receive instructions from local authorities." The difference between the RWT and RMT and the use of live tsunami event codes (TSW) is significant. Activation of the live codes causes a message to be broadcast over radio and both a written scroll and verbal notification via television that states: "The National Weather Service has issued a tsunami warning for X, Y and Z counties." Why take the risk of alarming the public with such a test? Systems that are not tested cannot be relied upon to function as intended in an emergency.

In 2008, the California Tsunami Program, in cooperation with the National Weather Service and the Redwood Coast Tsunami Work Group conducted the first Live Code Tsunami Warning Communications Test in a single California Coastal County, Humboldt, on the North Coast. This initial test was a success and there were no indications that the public had misunderstood the test or responded in an inappropriate manner (e.g. evacuated unnecessarily or contacted authorities). In 2009 and 2010, the live code test was expanded to the two adjacent counties and the test was performed in Del Norte, Humboldt and Mendocino. In addition to testing the Emergency Alert System using live tsunami event codes, the test in 2009 and 2010 also included testing of tsunami sirens in the region, selective evacuation drills, reverse 911 calling and a flyover by the Civil Air Patrol testing a new public address system from low flying fixed-wing aircraft. Plans are being made to include additional counties in the 2012 test.

3.8 Evacuation drills

A recent evaluation of the U.S. tsunami program by the National Academy of Sciences (NRC, 2010) underscored drills as an important component of local tsunami planning efforts. Evacuation drills help to develop the "muscle memory" for people to respond appropriately to the natural warning signals of a local tsunami. They also provide an opportunity to test evacuation routes, time how long it takes people to reach high ground, and provide input to evacuation models. In the recent National Academy of Sciences review of the U.S. tsunami program (NRC, 2010), a recommendation was made for "..all communities with close or intermediate proximity … to a potential tsunami source … conduct modeling studies to assess the likelihood of successful horizontal evacuations."

The first full-scale tsunami evacuation drill in California was conducted in the town of Samoa in Humboldt County in 2007. Since then, full-scale drills have been held in other North Coast communities and in Ventura and Orange counties. The largest drill conducted to date was in Del Norte County in 2010 when over 800 residents participated in a simulate Cascadia subduction zone tsunami evacuation. See Figure 8.

3.9 Maritime community planning

The affects of tsunamis, large and small, can be significant for the maritime community CalEMA and CGS are working with the maritime community (port authorities, harbor masters, Coast Guard, Boating/ Waterways, etc.) to develop products that help protect harbor infrastructures and vessels from tsunami hazards. Preliminary map products designating offshore safety zones for harbors that recommend sending appropriate vessels to sea, prior to a teletsunami, will be finalized and incorporated into harbor plans and nautical charts over the next several years.

With planned funding from FEMA in 2011, the state program is also initiating development of hazard maps identifying areas of strong tsunami currents within harbors. Maps like these have already been produced by PMEL (Uslu et al., 2010). The state will work with local entities to provide guidance on planning and evacuation for each specific harbor, based on the harbor hazard map results. A significant outreach and education effort for the maritime community will follow. See Figure 9.

3.10 Land-use planning

Through the Seismic Hazard Mapping Act, CGS is producing a tsunami hazard regulatory zone maps that will require "special studies" be done for tsunami hazards

when construction takes place in areas that could be prone to tsunamis, analogous to the state's requirements for construction in active fault zones. This project will require a probabilistic tsunami hazard analysis (PTHA) for the California coast. To this end, CGS has started development of tsunami deposit and source databases that will help determine recurrence intervals for relevant sources affecting California (Wilson et al., 2010b). CGS is evaluating existing PTHA studies for California. The state program is also in the process of meeting with federal, state, and local land-use planning agencies to develop an implementation plan after Tsunami Hazard Zones are produced. These products will help communities be more resilient in recovering from significant tsunamis by requiring appropriate construction and land use based on the hazard.

4. Lessons from recent tsunamis

In the past two years, two tsunami Advisories have been issued for the California coast. On September 29, 2009, a M8.0 earthquake near the Samoan Islands generated a tsunami that caused one to two foot surges and moderate currents within harbors and bays (Wilson et al, in press 2011). On February 27, 2010, the M8.8 Chilean Earthquake produced a tsunami that created three to four foot surges and strong currents that caused damage within at least ten harbors totaling several million dollars statewide (Wilson et al, 2010a). In both cases, response by coastal jurisdictions was inconsistent because of confusion about the significance of the Advisory-level alert status.

Two significant lessons were learned during these events: 1) the state must improve its education of coastal counties about response to Advisory-level events, and 2) the state must improve its outreach efforts to the state's maritime community about what to do during a tsunami. Implementation of the activities described in section 3.10 should help harbor masters better prepare for future tsunamis. The state plans to develop guidance for Advisory-level response activities, which should improve the consistency of those activities by local jurisdictions. The 2009 Samoa tsunami was the first time a Tsunami "Advisory" had been issued for the California coast since the Advisory definition was changed, so there was considerable confusion as to what this status meant and how counties should respond. The 2010 Chile tsunami also resulted in an Advisory and two to three million (US$) in damage to structures and boats in ports and harbor areas. Confusion about the Advisory definition persists and educating coastal emergency managers and the public as to the appropriate response continues to be a challenge.

In addition to the lessons learned from the Advisories issued in California, the state tsunami program has also applied lessons from the impacts of these tsunamis within Samoa and Chile. Both of these events demonstrated the success of tsunami education programs. This was particularly true in Chile where school programs, tsunami signs, and workshops significantly reduced impacts (EERI, 2010). However, the Chilean tsunami pointed out the particular vulnerability of tourists and other transient populations such as workers from inland areas. The California tsunami program is working with state parks to develop tsunami information for campers and day visitors.

5. Conclusions

California's high coastal population, local and regional fault systems, and exposure to tsunamis generated from throughout the Pacific basin has placed it at the forefront of tsunami mitigation efforts in the United States. It is the mission of the California tsunami program to ensure public safety by protecting lives and property before, during, and after a potentially destructive or damaging tsunami. In order to achieve this goal, the state has sought first to use finite funding resources to identify and quantify the tsunami hazard using the best available scientific expertise, data, modeling, mapping, and other methods at its disposal. Secondly, it has been vital to accurately inform the response community of the real and exact nature of the threat by defining inundation zones prior to a tsunami event and leveraging technical expertise during any ongoing tsunami alert notification (specifically incoming wave heights, arrival times, and the dangers of strong currents). Emergency managers need to understand and plan in advance for specific actions and protocols to undertake for each alert notification level (warning, advisory, watch, and information) provided by the NOAA warning center. Through workshops and outreach the emergency management community has become more versed in the planning needs of distant versus locally generated tsunamis. The former requiring established and practiced procedures, the latter an educated public. Finally the state program has provided education and outreach information via a multitude of delivery methods, activities, and end products while keeping the message simple, consistent, and focused. In this way it has sought to continually remind individuals throughout the state that the threat of tsunamis is real but that anyone can protect oneself by understanding their local evacuation area and knowing what to do when they understand a natural or official tsunami warning.

Acknowledgements

Financial support for California's tsunami program has come from the NOAA/National Tsunami Hazard Mitigation Program. Tsunami modeling has been provided by the University of Southern California's Tsunami Research Center. The projects described in this paper were the result of efforts by many people at the state, county, and local level. We particularly thank the efforts of coastal emergency managers, regional NOAA/National Weather Service Forecast Offices in California, and the Redwood Coast Tsunami Work Group.

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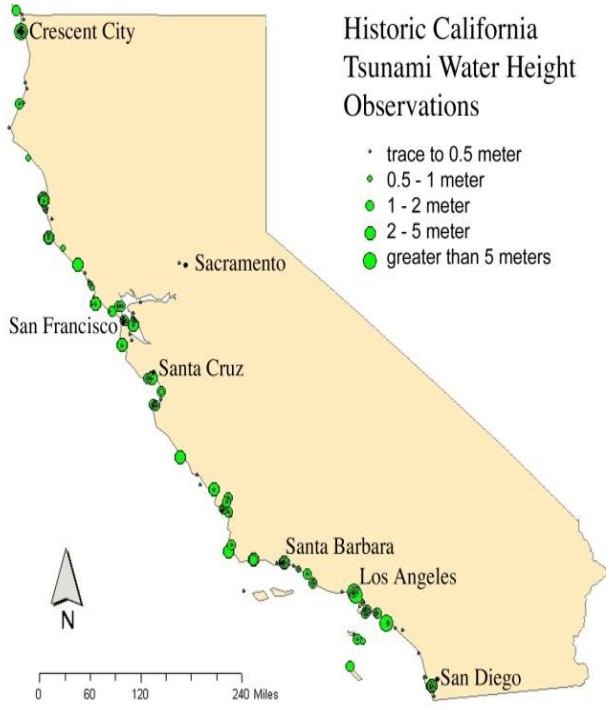
22) Wilson, R., L.A. Dengler, J. D. Goltz, M. R. Legg, K. M. Miller, A. Ritchie, and P. M. Whitmore (in press 2011), Emergency Response and Field Observation Activities of Geoscientists in California (USA) during the September 29, 2009, Samoa Tsunami, Earth Science Reviews.
23) Wilson, R. I., L.A. Dengler, M.R. Legg, K. Long, K. M. Miller (2010a), The 2010 Chilean Tsunami on the California Coastline, Seismological Research Letters Volume 81, No. 2 (abstract).
24) Wilson, R.I., and Miller, K.M., 2010b, Reconnaissance tsunami evacuation hazard analysis for Ventura County, Califorina: Recommendations for tsunami evacuation from local earthquake sources in higher risk areas: California Tsunami Program, Technical Report 2010-01, pp. 29.
25) Wilson, R.I, Barberopoulou, A., Borrero, J.C, Bryant, W. A, Dengler, L.A., Goltz, J.D., Legg, M.R., McGuire, T., Miller, K.M., Real, C.R., and Synolakis, C.E., (2010b): Development of new databases for tsunami hazard analysis in California: in Lee, W.H.K., Kirby, S.H., and Diggles, M.F., compilers, 2010, Program and abstracts of the Second Tsunami Source Workshop; July 19-20, 2010: U.S.Geological Survey Open-File Report 2010-1152, 33 p.

Figure 1. Maximum historic water heights of observed or recorded tsunamis in California since 1800. Data from NGDC (2010).



More figures on page 10

Editor's Rant

The tsunami of the term's misuse

I signed up for Google Alerts, hoping I would get updates on matters relating to TSUNAMIS. The service would save me time and would be more thorough than any Internet searching I could do, even if I had all that extra time. HOWEVER, the Google Alerts are now a quagmire of unrelated items because of the misuse of the term 'tsunami.'

Solar tsunami, glacial tsunami, tsunami of content, a litigation tsunami, data tsunami, consumer-driven tsunami, gray tsunami, tsunami of cuts, tsunami of protest, silver tsunami, crime tsunami, tsunami of cash, political tsunami, fat tsunami, tsunami of need, diabetes tsunami, tsunami of global hunger, tsunami of anger, revenue tsunami, green tsunami, public school finance tsunami, tsunami of cuts, Republican tsunami, ice tsunamis, tsunami of legal action, regulatory tsunami, mini-tsunami of toxic sludge, fraud tsunami, tsunami of change, real estate tsunami, tsunami of fake Twitter messages, tax tsunami, tsunami of instability, tsunami of sentiment, tsunami of applications, Islamic tsunami, hot money tsunami, techno-tsunami, flu tsunami, dementia tsunami, inland tsunami , bunny tsunami, security tsunami...all these terms have been used in online newspapers, press releases and reports.

I've been saving these terms for the past month, thinking I was the only one annoyed at this trendy but ultimately boring overuse of the word 'tsunami.' Today (Jan. 15, 2011) I found an article in the Sydney Morning Herald online (http://www.smh.com.au/national/the-essay-a-common-language-20110114-19r9r.html), The Essay: A common language, by Ruth Wajnryb. Apparently there are annual Word of the Year lists for terms made popular the previous year. *Tsunami* made it in 2010.

"Take tsunami, a loan word from Japanese, originally borrowed in the first decade of the 20th century but catapulted into widespread use following the catastrophic disaster on Boxing Day 2004. This week the term "inland tsunami" was used to describe the deadly wall of water (flood) that swept through Toowoomba. Tsunami's lexical development is telling. A major event launched the word's global arrival and, at first, its use was literal and pinned to a particular event. This then popularised, resulting in a loss of literal specificity as well as the association with the when-and-where of Boxing Day 2004. New meanings, looser and less literal, emerged. Now, it's not uncommon for tsunami to be a near-flippant way of saying "a lot"."

I rest my case.♦

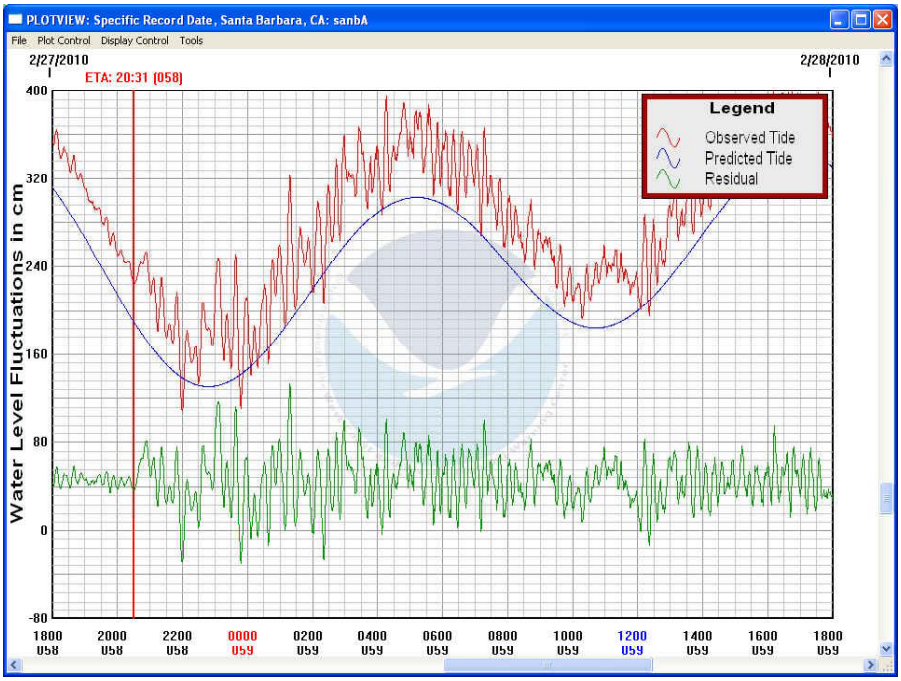


Figure 2. Marigram recorded at Santa Barbara on February 27 and 28, 2010. The red trace is the actual water level recorded, the blue line is the predicted tide and the green trace in the record with the tidal signal removed. The largest amplitude wave (91 cm) is noted by arrow.

Figure 3

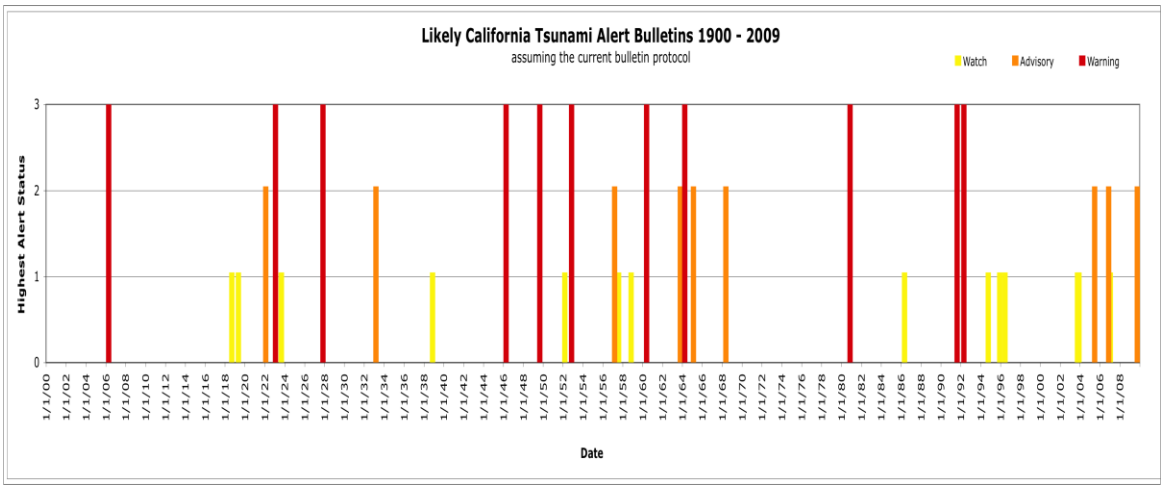


Figure 4. Tsunami alert bulletins that would likely have been issued by the West Coast Alaska Tsunami Warning Center since 1900 if the current criteria for Warnings, Watches and Advisories were being used.

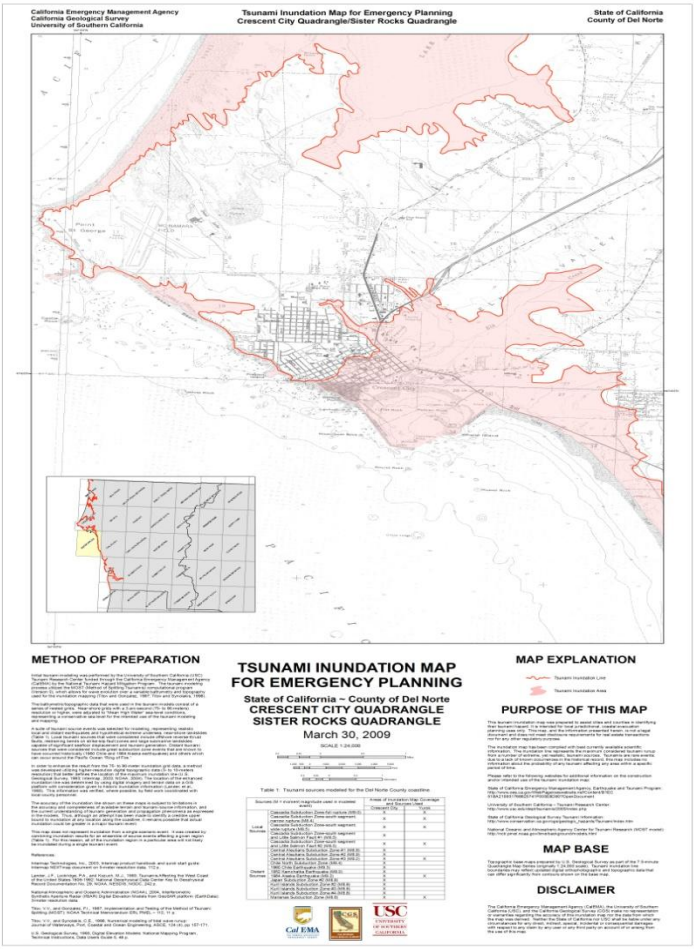


Figure 5. California tsunami inundation map for Crescent City, Del Norte County. Red zone is the expected maximum inundation.

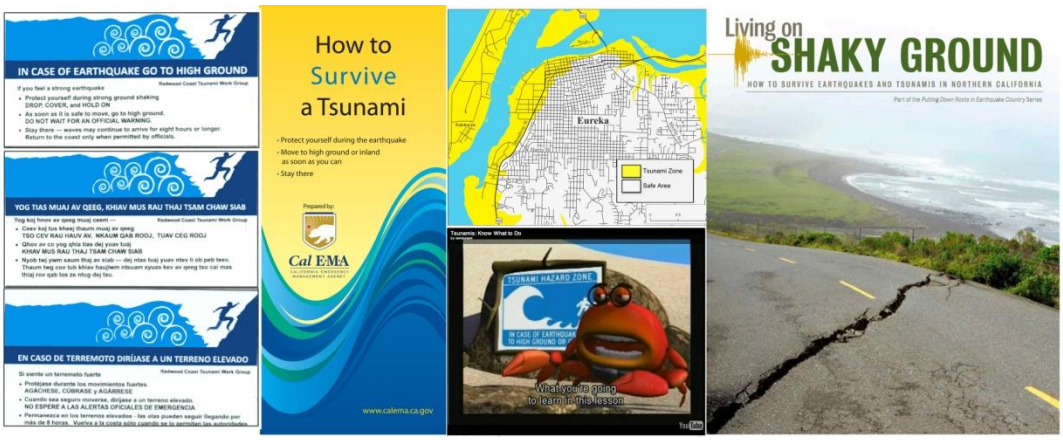


Figure 6. Examples of California tsunami education products A) Refrigerator magnets in English, Hmong, and Spanish; B) State tsunami brochure; C) Tsunami evacuation map for Eureka, California; D) Children's tsunami education video; E) 32-page earthquake-tsunami preparedness magazine.

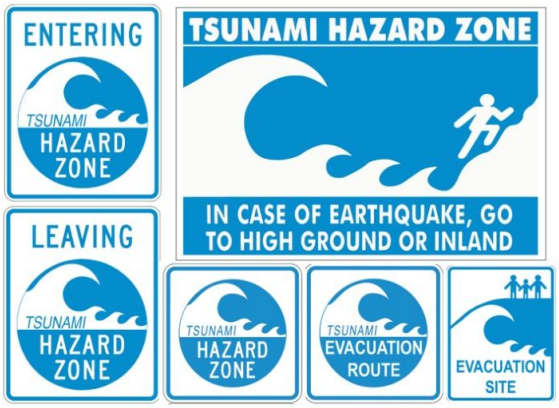


Figure 7. California tsunami signs.

Figure 8. Samoa residents test evacuation routes in California's first tsunami drill in 2007.

Figure 9. Docks were destroyed and boats pulled from moorings at Shelter Island in San Diego Bay during the February 2010 Chilean tsunami. ♦

JAPAN

Japan 's March 11 earthquake/tsunami eyewitness stories, photos and reports
You've seen the videos and many news reports; these links provide a sampling of the data available.

http://www.npr.org/2011/03/22/134755622/Life-Begins-To-Return-To-Normal-in-Sendai-Japan
Sendai begins to recover

http://www.guardian.co.uk/world/2011/mar/20/japan-tsunami-survivors-found

http://online.wsj.com/article/SB10001424052748704608504576208831386615172.html

http://www.ctv.ca/CTVNews/TopStories/20110311/japan-eyewitness-account-110311/

http://www.asiaone.com/News/Latest+News/Asia/Story/A1Story20110312-267687.html

http://www.reuters.com/article/2011/03/22/us-quake-japan-victims-idUSTRE72K7P820110322
Japanese tsunami victims back home, searching for memories

http://www.csmonitor.com/World/Asia-Pacific/2011/0314/Japan-earthquake-and-tsunami-narrow-escapes/A-teenager-runs-up-a-hill-with-her-grandmother-to-safety

http://seattletimes.nwsource.com/html/localnews/2014472656_apwatsunamiwarningwash10thldwritethru.html
Impact on Washington State

http://www.mercurynews.com/breaking-news/ci_17600448?nclick_check=1
Impact on California

http://www.npr.org/templates/story/story.php?storyId=134479357
Impact in Latin America

Photos

http://www.businessweek.com/ap/financialnews/D9M3JTF00.htm
The power of photos...a thoughtful article about Japan's most-documented, photographed tsunami in history

http://www.abc.net.au/news/events/japan-quake-2011/beforeafter.htm
Before and After photos♦

SAMOA

Scientists start year-long tsunami project in Samoa
Feb. 11, 2011
http://www.gns.cri.nz/Home/News-and-Events/Media-Releases/Tsunami-project-in-Samoa
GNS Science media release

Scientists from New Zealand have started a year-long project to develop tsunami evacuation maps for Samoa. The project is funded by the New Zealand Aid Programme, and is being undertaken by tsunami and social science specialists at GNS Science. Four of the team set off for Samoa this week in the first of several visits during the project.

Group leader, Nora Gale, said the project is in partnership with the Samoan Disaster Management Office which has been working with coastal communities to increase tsunami preparedness for several years.

The project team will use 'best practise' methods currently being used in New Zealand to develop tsunami evacuation maps. They plan to consult local communities during the project to ensure the information they produce is appropriately targeted.

One of the first tasks will be to model potential local, regional and distant tsunami sources that pose a risk to Samoa. In addition, scientists at GNS Science will develop inundation models identifying coastal areas most vulnerable to moderate to large tsunamis.

From this they will produce a tsunami evacuation zone map for the whole of Samoa.

In consultation with local authorities, they will select four at-risk villages where they will produce more detailed maps showing safe places and evacuation routes.

New Zealand and Samoan government agencies have been working together to increase the effort spent in tsunami research and preparedness following the devastating tsunami of September 2009.

"The long term intention is to develop a Pacific-wide approach to tsunami inundation mapping and evacuation planning based on the experience gained from this first project in Samoa," Ms Gale said.

By the end of the project, the group will have worked with locals to erect signage and to prepare simulation exercises for communities to practise evacuation drills.

GNS Science is one of the few organisations in the world with the in-house capacity to undertake comprehensive tsunami work. This covers source modelling, wave generation and travel, inundation modelling, evacuation planning and maps, signage, and community education.

The team is maintaining a blog about the project at this link: http://socialsciencematters.blog.com/. ♦

NEW ZEALAND

NIWA: Scientists set to delve into the secrets of the Cook Strait mega-canyon
NIWA Media Release
February 11, 2011
Reprinted with permission

Targeted geological sampling and imaging by NIWA scientists next week will help understand active seabed processes in one of New Zealand's largest seafloor features.

Cook Strait Canyon starts just 10 kilometres off the coast in 50 metre water depths and plunges to 3000 metres south of Cape Palliser. The canyon, one of the largest in the world, is scarred by numerous large submarine landslides and active faults. Despite its size and proximity to the capital very little is known about the events that have shaped this canyon and the hazards they may pose.

This week, scientists led by NIWA Marine Geologist Dr Joshu Mountjoy will use a new dynamic positioning (DP) system onboard NIWA's research vessel *Tangaroa* to collect sediment cores, rock samples and DTIS (deep-towed imaging system) footage of the seafloor. The DP system uses electrically powered thrusters and computerised controls to fix the vessel to a specific area, guided by satellite positioning or transponders on the seabed. It will allow the scientists to take very accurate samples from the canyon floor, landslide scars and fault scarps, in 500-1,000 metre depths.

Data collected will provide information about active sediment transport through the canyon, how often landslides and earthquakes occur, and give scientists a first glimpse of the biology in the canyon.

"This voyage is a step towards understanding one of New Zealand's most remarkable seafloor features. Internationally, mega-scale canyon systems like Cook Strait are regarded as the focus of deep ocean sedimentary activity. We know that dramatic sediment movement occurs through much of Cook Strait in response to tide related currents but we have no information on the canyon system. It is really exciting to be on the verge of collecting the first images and samples from this extraordinary landscape – including the first footage of the biology living in these canyons," says Joshu.

"Data collected will also help us to quantify hazards that could be created by landslides and earthquakes in the canyon system, ensuring New Zealand is better prepared to respond to natural disasters in the future. Landslides in the canyon are huge, up to four times the size of Wellington's Mount Victoria, and have the potential to generate hazardous tsunami.

"We need to know two things - one is to understand how often they occur and the other is to model the tsunami generation potential. This voyage will provide information on how often the landslides happen, while NIWA and GNS Science are working together under the Natural Hazards Research Platform to quantify the tsunami generation potential."

While there are several canyon systems in New Zealand, Cook Strait Canyon is one of the largest and the closest to any major city. NIWA has mapped more than 150 individual landslides throughout the Cook Strait canyon system, ranging in volume from 2.5 million cubic metres to approximately ten cubic kilometres. Understanding the causes and recurrence of these landslides is part of a long-term goal of quantifying the landslide tsunami risk to New Zealand's coastal communities.

The research is funded by the Ministry of Science and Innovation under the "Consequences of Earth Ocean Change and Impacts of Resource Use on Vulnerable Deep Sea Communities" programmes, and through the Natural Hazards Research Platform. ♦

CERT basic training updates announced by FEMA
3/17/2011

What are the changes? The updated course is the same effective training as before, with the units and topics organized in the same way. However, edits were made throughout all of the course materials including the Participant Manual, Instructor Guide, and the PowerPoint files. These changes are intended to assure that protocols are up-to-date and that the content is as clear as possible for those taking the training. Since there are many edits throughout the training, CERT instructors are encouraged to review all of the updated materials.

Who made the changes? To update the Basic Training, FEMA worked with a panel of 12 experienced CERT trainers from across the country, followed by a review by local CERT programs designated by the CERT or CERT/Citizen Corps coordinator in each state. FEMA senior leadership and FEMA's technical review team also reviewed and commented on the updated material. We are grateful for the time and effort from state and local programs that went into this update!

Where can I find the new material? The course files are now available on the national CERT website. Please visit www.citizencorps.gov/cert and click on "Training Materials" to access documents in PDF or Word. On the website you will also find the updated Participant Manual in low vision format. If your local CERT program will need the Participant Manual in Braille, please contact your State Program Manager. State Program Managers can email the CERT National Office with numbers on a state by state basis.

Please note that the updated Instructor Guide references a series of videos that CERT trainers may want to use when they conduct the Basic Training course.

These videos are available on the website by clicking on "Video Material" on the home page.

What comes next? Later this year, the CERT National Office will be posting a new CERT Train-the-Trainer course and the new CERT Program Manager course.

Thank you for your continued interest in and support of CERT, and for all you do in preparing for and responding to disasters in your community!
Sincerely,
The CERT National Program Office
FEMA Individual & Community Preparedness Division

This notice and other Individual & Community Preparedness news can be found on our website at www.citizencorps.gov.

From:
http://www.ready.wv.gov/news/Pages/CERT%20Basic%20Training%20Updates.aspx ♦

The impact of IPAWS—This modernized national alert system is accessible to local emergency managers
By Lorin Bristow
Emergency Management, v. 6, no. 1, p. 52-53.
Reprinted with permission

Few topics in emergency management have received more attention over the past few years than public alerts and warnings. Across the country, emergency managers wrestle with how to effectively and efficiently advise and mobilize the public in an emergency.

But a grand vision for alerting our nation's citizens during times of crisis—the Integrated Public Alert and Warning System (IPAWS)—is beginning to materialize. Federally mandated by presidential executive order, the IPAWS program is progressing rapidly, developing into a promising tool for local emergency managers.

IPAWS background

The IPAWS program launched in 2006 in response to Presidential Executive Order 13407, which required that the U.S. have "an effective, reliable, integrated, flexible and comprehensive system to alert and warn the American people in situations of war, terrorist attack, natural disaster or other hazards to public safety and well-being."

Residing under the U.S. Department of Homeland Security and managed by FEMA, IPAWS' purpose is to create a fully integrated, multi-modal "system of systems" for warning citizens—and to focus on modernizing and enhancing the aging Emergency Alert System (EAS).

The program's primary responsibility is ensuring that the president can speak to the American public during a critical national event, but it also aims to provide the power of a national system to local authorities for use during situations of localized 'imminent threats" and Amber alerts.

In it initial years, the program received negative reviews for its lack of movement and found itself the target of Congress' harsh words. Under new leadership, however, momentum is building and the vision is moving closer to becoming reality. Emergency managers, broadcasters, vendors and other stakeholders nationwide are beginning to seriously engage, wanting to learn more about the program and its local impact.

The program's vision certainly seems worthwhile. But what is it about, what does it mean for emergency managers, and what is the timeline for implementation?

New set of protocols

A major obstacle to creating an integrated alert and warning system has been the lack of standards across various warning devices. Automated calling systems, sirens, Telecommunication Device for the Deaf/Tele Typewriter, electronic billboards, weather radios, facility alarms and the EAS traditionally have operated using separate, proprietary protocols that cannot "speak" with one another. Such an environment has made creating a cohesive alert and warning system impossible.

This situation is beginning to change as the new Common Alerting Protocol ((EDXL-CAP 1.2) has just been approved by the Organization for the Advancement of Structured Information Standards. The clock on an industry implementation timeline started when FEMA formally adopted this protocol last September. With CAP, any user interface capable of creating CAP-compliant messages can activate any warning device capable of *receiving* CAP-compliant messages. This includes EAS hardware designed to interrupt broadcast programming for radio, TV and cable for the purpose of issuing an audio (and now text) emergency message. As vendors begin building these standards into their products, it opens new doors for configuring a wide array of warning systems.

Commercial mobile alert system

Another important technological accomplishment within the IPAWS program is the Commercial Mobile Alert System (CMAS), which allows for sending text-based alerts to mobile devices in targeted geographic areas without requiring opt-in subscriptions from recipients.

Consider, for example, the challenge of warning citizens about a chemical spill from an overturned tanker on a main freeway artery. Local emergency managers would like to issue a warning to drivers entering the affected area and individuals in nearby homes. Today they likely would use land line phones to issue a targeted alert to homes within the area. Drivers on the highway in a defined geographic region, however, wouldn't receive this

needed warning unless they happened to subscribe to an alert program—and neither would the growing number of residents who discarded their land line phones and rely entirely on mobile devices.

CMAS addresses the challenge by sending alerts through the cellular carrier and transmitting only over cell towers within the targeted area to everyone within range. In most cases the message is not a traditional text messaging (a one-to-one method that, with sufficient volume, can cause major bottlenecks within the carrier network). Instead, the messages are cell broadcast messages (a one-to-many approach). Cell broadcasts "ride" along the carrier's administrative channel, which is required for the mobile device to remain connected to the cellular network, and are transmitted to everyone active on a given cell tower at once, which means there is no bottleneck.

CMAS demonstrates how the federal government's involvement can create advances that might otherwise be impossible, because making this technology work requires the cooperation of all major cellular carriers—something not likely to happen if left to occur on its own.

Another concept associated with IPAWS is the Primary Entry Point (PEP) station—a radio station designated to provide public information before, during and after an emergency, whether national or local. PEP stations will also serve as the daisy chain for station-to-station broadcasts of EAS alerts. These stations are equipped with designated circuits and an emergency generator to ensure broadcasts continue even if power is lost. FEMA helps station owners and operators maintain and restore these facilities.

As certain areas in the nation are still not covered by a PEP station, IPAWS is expanding the number of PEP stations from 37 to 74. Once complete, the full system will encompass 90 percent of the U.S. population.

Though emergency managers may not have direct responsibility for these PEP systems, it is helpful for local agencies to be aware of the additional resource that might be available as new sites are deployed.

A final advancement of direct interest to emergency managers is the Geo-Targeted Alerting System (GTAS), a joint development effort between the National Oceanic and Atmospheric Administration and the IPAWS program. The map-based GTAS application taps into the administration's atmospheric condition data to help determine the population impact of a toxic substance release or severe weather event. GTAS can model more than 500 types of hazardous substances and create notification boundaries based on the results. Once an affected area is defined, alerts and warning can be issued using CAP through whatever means are available.

Implementation timelines

Published timelines for these IPAWS initiatives are optimistic but potentially realistic. As of Sept. 30, 2010, a 180-day clock started for broadcasters to transition their old analog EAS systems to digital ones. The time frame was short, which was of concern for some broadcasters. The FCC noted industry apprehensions, and extended the deadline 180 days to Sept. 30, 2011. Also expect the PEP station expansion to roll out over the next year. Full implementation of new stations is targeted for the third or fourth quarter of 2011.

CMAS will take a bit longer to implement. For one thing, most mobile devices in the country today don't have built-in capabilities to receive cellular broadcast messages. New-generation devices do, but it will be at least two years before old devices "turn over" and the majority of devices in the country have this functionality. In the meantime, the IPAWS aggregator and message gateway is being built to receive and disseminate messages properly. This critical middle piece is expected to be released mid- to late 2011, with CMAS being fully functional by the end of 2012.

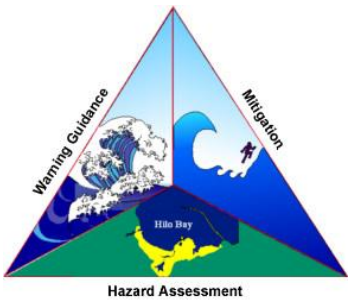
The vision of an integrated national alert system is a grand one. With determination and support from stakeholders, however, the vision appears to be on target to become reality soon.

IPAWS Vision: Timely alert and warning to American citizens in the preservation of life and property.

IPAWS Mission: Provide integrated services and capabilities to federal, state, territorial, tribal and local authorities that enable them to alert and warn their respective communities via multiple communications methods.

IPAWS Goals: 1) Create and maintain an interoperable environment for alert and warning
2) Make alert and warning more effective.
3) Strengthen the resilience of the IPAWS infrastructure.

Lorin Bristow is managing partner with Galain Solutions, Inc. Galain offers independent subject-matter expertise on alert and warning practices and technology for public safety agencies, corporations and educational institutions. Its principals Rick Wimberly and Bristow are frequent authors and speakers, and are featured bloggers for *Emergency Management* magazine (www.emergencymgmt.com/alerts]. ♦



FCC orders first national EAS test

by Deborah D. McAdams, February 3, 2011
http://www.televisionbroadcast.com/article/113264
Reprinted with permission

WASHINGTON: The Federal Communications Commission today approved an order to conduct the first national test of the Emergency Alert System. The commission voted unanimously to adopt a Third Report and Order that sets forth rules for the test, to be initiated by a presidential alert from Washington to TV, radio, cable and satellite systems across the country. No president has ever triggered an emergency alert, and the system has never been tested intentionally.

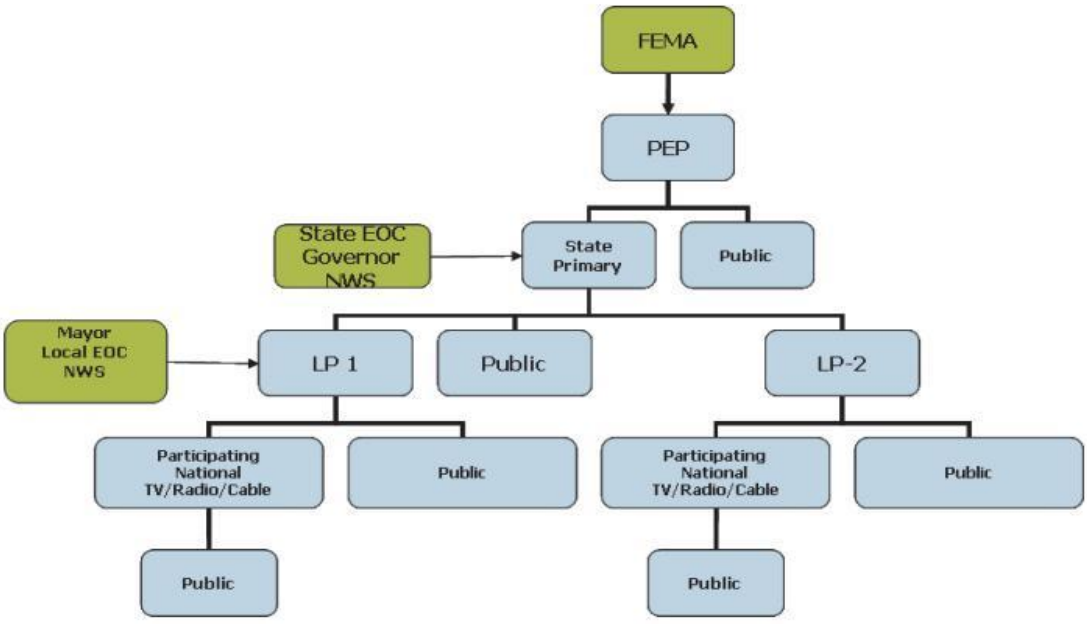
The date and time of the test is yet to be determined, but it will not be delayed until after the compliance deadline for implementation of the Common Alerting Protocol. All EAS participants have until Sept. 30, 2011 to implement CAP, an advanced data format intended to standardize alerts from various federal agencies.

"We do not believe it is necessary to delay testing until the period for CAP compliance ends," the FCC order states. The Federal Emergency Management Agency "anticipates continuing use of legacy EAS into the foreseeable future."

All TV and radio providers in the EAS chain will be required to participate. They must have the equipment necessary to receive and transmit a live Emergency Action Notification code relaying a presidential message to viewers and listeners. They'll also have to submit test-related data to the FCC's Public Safety and Homeland Security Bureau within 45 days of the exercise.

A limited-area test of the EAN was conducted a year ago across Alaska. Several anomalies were revealed, including dead equipment and communications failures. The national alert system relies on a daisy-chain architecture whereby the EAN is transmitted to designated radio stations that are monitored by State Primaries, which in turn retransmit the alert to Local Primaries that notify all other broadcast and cable participants. The United States is divided into 550 local EAS areas, each with at least two Local Primaries monitoring two sources for presidential alerts. A single failure within the system can leave hundreds of participants out of the loop.

The order provides a two-month public notification period before any national EAS test. The FCC, along with the Federal Emergency Management Agency and the National Weather Service will work with TV and radio stations to let the public know what's up. To that end, a nationwide EAS Public Education and Awareness Campaign with workshops, outreach, and television and radio ads will be launched.



Tales of two earthquakes offer lessons for the future
By Eric Holdeman
February 28, 2011
From: http://www.emergencymgmt.com/disaster/Two-Earthquakes-Lessons-Future-022811.html
Emergency Management (online)
Reprinted with permission

Ideally we learn from experiences and build on successes while trying not to repeat our mistakes. Many times in our after-action reviews and by our behavior, we refer to post-disaster analysis as "lessons learned" when we should refer to them as "lessons observed."

We are doomed to repeat the mistakes of others and our own if we don't change our behavior. With that said, it is appropriate to look back at the 10 years since the Nisqually earthquake that hit western Washington and the metro Seattle area on Feb. 28, 2001. Unfortunately we now have another quake on our geological timeline — the recent earthquake in Christchurch, New Zealand. Although it is just days old, there are lessons to be learned or just observed from that event.

The magnitude 6.8 Nisqually earthquake happened about mid-morning. It was approximately 30 miles deep and 40 miles south of Seattle. There was a long period of shaking. These types of earthquakes have had a recurrence interval of around 25 to 30 years. The impact of it might be considered similar to the first magnitude 7.1 quake that hit in the vicinity of Christchurch in September 2010. There were damages, but nothing significant.

While here in Washington state, seismologists and emergency managers alike hoped that the Nisqually earthquake would be a wake-up call — in reality it was a snooze alarm quake. People did "quake-up" for a moment, then turned off the disaster preparedness and mitigation alarm and went back to sleep. People in downtown Seattle self-evacuated, drove to their children's schools, picked up the kids and went home. When the FEMA director did show up, there really wasn't much to show in the way of damages. Another name for the event was the "Chimney Quake" since that seemed to be the primary damage from the shaking.

Some good came out of the aftermath of Nisqually. It was Nisqually that got the King County Council to commit the resources to build a $30 million Regional Communications and Emergency Coordination Center that had been designed, but lacked funding for construction. It was completed and occupied in 2003. Seattle also has a new state-of-the-art Emergency Operations Center that was completed in the last few years.

The only positive action to come out of the Washington state Legislature was passage of the law that authorized the state to join the Emergency Management Assistance Compact. It had been introduced in an earlier session, but was not passed until this event happened during a legislative session. The earthquake provided the emotional impetus to get it passed and signed by the governor.

The quake also shone light on the sorry status of the Alaskan Way Viaduct. Now 10 years later and many votes, arguments and citizen initiatives, it is finally on course to be replaced with a deep bore tunnel.

Starbucks headquarters had a real scare from the Nisqually earthquake. Fortunately the company was in a building that had been seismically retrofitted. It was in an area of soft soils and the outcomes could have been much worse without a wise investment in mitigation.

Similarly the $250,000 that was spent to retrofit an unreinforced masonry building that was then serving as the King County Emergency Operations Center saved the county from trying to relocate to an alternate facility in the middle of the response, or worse, digging its Office of Emergency Management staff out of the rubble.

The day was also memorable for me as the director of King County's Office of Emergency Management. I recall someone coming up to me the same day as the quake and handing me a fax stating that the president had pulled the plug on Project Impact. It was a highly regarded FEMA program that had promoted public-private partnerships in mitigation. In Seattle, the program saved lives the day of the quake at public schools that had water towers removed from their roofs. Even now I shake my head in disbelief that the program was canceled — what an unfortunate coincidence.

There are other lessons not learned from the event. The quake happened during an extremely dry winter for western Washington. Though there was some liquefaction from ground water, it was really minimal when compared to the initial reports of flooding being caused in Christchurch due to liquefaction. While there could have been hundreds if not thousands of landslides during a wet winter, there were only a few slides from Nisqually.

Washington state has still not undertaken the task of identifying all the unreinforced masonry buildings in the state. Conducting such an inventory will provide some risk analysis of how big the issue is in the state. California addressed this issue decades ago and is on a path to corect deficiencies in its building stock. Only Seattle had taken any action to identify the types of buildings most at risk during a quake.

The Washington State Department of Natural Resources has over time decimated its geology department via budget cuts. The position of the geologist who did the liquefaction mapping for the state was eliminated years ago. The newspaper quote I remember him most for is: "This state will not do anything about the earthquake hazard until they are dragging dead bodies out of buildings." Unfortunately it is a blunt and accurate assessment. In these tough budget times, the ground shaking, damages and deaths from a future quake are far from elected officials' minds. As one fire marshal once said, "Every line in the fire code is written in blood." So too it appears that

the seismic code will be written in blood. No lessons learned yet.

The second and most recent Christchurch quake is a strong reminder that the return interval for quakes is not always measured in decades; sometimes it can be months. It is assumed that many of the buildings that collapsed were damaged and weakened in the first quake. As we measure how long we have before the next disaster we must remember Christchurch.

Significant earthquakes have happened in the last 12 months in Haiti, Chile and New Zealand. Before that China and Pakistan were countries that experienced major quakes and terrible death tolls. With major portions of the United States at risk, our turn is coming. California is overdue for a quake, and it may not be the state with the epicenter of the next event. ♦

NEWS

March 20-26, 2011, NTHMP Tsunami Awareness Week

TsuInfo Alert received notice of this event on March 21. Visit the website: http://nthmp.tsunami.gov/taw/tsunami-awareness-week.html for President Obama's letter, tsunami awareness video, public service announcements, a factsheet, and information about PACIFEX11and LANTEX/CARIBEWAVE11 (March 23).

2011 annual NTHMP meeting was held February 1-2, 2011 in Portland, Oregon
Meeting minutes are available at the NTHMP website: http://nthmp.tsunami.gov/2011annualmeeting/index.html

2011 annual warning guidance subcommittee meeting, Feb. 1, 2011
http://nthmp.tsunami.gov/Minutes/wcsmeetings/2011annualmeeting.html

Congratulations to new TsunamiReady communities

Since October 2010, eleven new communities have become TsunamiReady: Big Lagoon Community and Rancheria Indian Tribe, Redwood National and State Park, San Diego, Florence, Aguadaa, Aguadilla, Cabo Rojo, Ilwaco, Raymond, South Bend, and Shoalwater Bay Tribe.

Quileute Tsunami Protection legislation
(Tsunami Protection Legislation H.R. 6527)

The Quileute Tribe [Washington State] is pleased to announce the Tsunami Protection Legislation introduced by Congressman Norm Dicks on December 16th 2010. If passed, this bill will provide solutions to concerns for the safety of members of our tribe, as well as the sustainability of our tribal government, housing and cultural practices.

View the Quileute Tribe's Media Statement: here
View the complete bill online: here
View the Peninsula Daily News article: here
View the Seattle Times article: here
From: http://www.quileutenation.org/

EU tsunami and earthquake exercise planned for Crete

"This year Greece will host a European exercise test that will examine the case of a major earthquake and subsequent tsunami, as announced by Ph.D Kostas Sinolakis in January. Sinolakis is the director of the natural disaster lab at the Technical University of Crete and of the tsunami research center at the University of Southern California.

'It is an exercise for evacuation in case of a major natural disaster, an earthquake and a large tsunami,' said the eminent Greek scholar, noting that this exercise is an EU initiative and will be attended by many countries. Kostas Sinolakis added that a map exercise will be held in the spring of 2011. The actual exercise will take place between November 2011 and February 2012. The region selected is southwest o Crete from Elafonissi to Agie Roumeli in the Hania prefecture. The criterion used is its remoteness in order to test intervention speed of those participating in the drill."

From:
http://greece.greekreporter.com/2011/01/02/eu-tsunami-earthquake-response-exercise-scheduled-on-crete/
Posted by Venetia Aftzigianni, January 2, 2011

Time to update your clocks, smoke detector batteries, and NHC contact info (note from the Natural Hazards Center)

What, you've never heard of the last one? It's a good time of year to make sure you've sent the Natural Hazards Center your most recent contact info and e-mail subscription preferences. In the next few weeks, we'll be sending e-mail invitations to our 36th Annual Natural Hazards

Research and Applications Workshop and updates to our Quick Response Grant Program, as well as the next issues of *DR* and the *Natural Hazards Observer*.

We'd hate to have you miss out, and all it takes is one trip to our handy Web form. And if you think you're already *so* up to date, try getting up to the minute with our Twitter feed. That's where we post the stuff that can't even wait for the next issue of *DR*.

From: Disaster Research 564, March 10, 2011, p. 6

NOAA offers social science tools to aid coastal management

From the Human Dimensions Program Manager, NOAA Coastal Services Center, March 3, 2009

While many coastal programs focus on the natural science side of coastal resources management, we all know the people side of the equation is equally important. Why do people feel and act the way they do? How do we get people more involved in science-based decision making? And how does one properly collect stakeholder information and, in turn, apply it to address coastal management challenges?

Social science provides the tools needed to answer these questions, and the National Oceanic and Atmospheric Administration (NOAA) has many social science resources available to assist in this quest, including publications, technical assistance, and training courses.

Some examples and information sheets for the following topics can be accessed at http://www.csc.noaa.gov/howtoguides.html

- Social science wheel. This outreach product introduces the human dimension of coastal management at the most basic level.
- "Survey guidance" and "Stakeholder engagement." These introductory publications provide the basic concepts and practices associated with these topics.
- CanVis. This easy-to-use visualization tool helps people "see" potential development or landscape change.
- HD.gov. Social science practitioners use this interagency Web portal to get information about the human dimensions of natural resource management.
- Technical services. Staff at the NOAA Coastal Services Center are available to provide assistance with the design and implementation of many social science tools, including needs assessments, surveys, stakeholder engagement processes, facilitation and process design, economic impact analysis, and land use visualization.
- Training. The NOAA Coastal Services Center offers numerous training opportunities, including Coastal Community Planning and Development; Managing Visitor Use in Coastal and Marine Protected Areas; and Planning for Meaningful Evaluation.
- Products and Services catalog. A catalog to use to access all of the products and services provided by the Center. http://www.csc.noaa.gov/publications/Products_and_Services_Catalog.pdf

Traditional knowledge and Red Cross disaster preparedness in the Pacific

Better together—that's the conclusion of this recently released Australian Red Cross report on incorporating local knowledge into disaster preparedness planning. The report touts the benefits of combining traditional and scientific knowledge to reduce disaster impacts—a combination that can lead to increased understanding about risks, empowerment of the local population, and increased community engagement with preparedness. Case studies from the Solomon Islands and Papua New Guinea further illustrate the power of indigenous knowledge in preparing for disasters. Visit: http://www.pacificdisaster.net/pdnadmin/data/original/ARC_2010_traditional_knwldg.pdf

From: Disaster Research 564, March 10, 2011, p. 6

Disaster planning handicap: Los Angeles isn't prepared to protect the disabled

It will soon be safer to live with a disability in Los Angeles, but it took a two-year court battle to do it. Earlier this month, a federal judge ordered the city to address gaps in its emergency preparedness plans that leave approximately 800,000 disabled residents unprotected in emergency situations, according to the *Los Angeles Times*.

"Because of the city's failure to address their unique needs, individuals with disabilities are disproportionately vulnerable to harm in the event of an emergency or disaster," U.S. District Court Judge Consuelo B. Marshall ruled, according to the article.

The plight of the disabled during Hurricanes Katrina and Rita prompted the class-action suit, filed in 2009 by Los Angeles resident Audrey Harthorn and the disability rights group Communities Actively Living Independent and Free, according to the Associated Press.

An examination of Los Angeles' emergency operations plan indicated that city's disabled residents could be equally compromised. Among the issues not addressed by the existing plan are access to emergency shelters, transportation and evacuation assistance, and medication storage and dispensation at shelters, according to a press release.

Although city attorneys argued that gaps in the plan should be filled by the American Red Cross, as well as "personal preparedness," Judge Marshall gave L.A. three weeks from her February 10 ruling to meet with the plaintiffs and craft a plan, according to the *Times.*

Shawna Parks, of the Disability Rights Legal Center, which helped represent the plaintiffs, told the *Times* she expected the case to set a standard for other communities.

"It was the first case that's addressed it," she said. "It sets a precedent that makes a lot of other jurisdictions pay attention."

From: Disaster Research 563, Feb. 24 2011

PUBLICATIONS

Marine Geodesy, volume 34, issue 1, 2011

This is a special tsunami issue. The website allows you to see the table of contents and to order specific articles.http://www.informaworld.com/smpp/title~content=t713657895~db=all

Three publications by NOAA's National Geophysical Data Center, World Data Center and ITIC

NOAA's National Geophysical Data Center (NGDC) and co-located World Data Center (WDC) for Geophysics and Marine Geology and the International Tsunami Information Center (ITIC), A UNESCO/IOCNOAA partnership, have collaborated to produce three educational print and digital maps depicting the following geologic events: 1. Significant volcanic eruptions 4360 B.C. to A.D. 2010; 2. Significant earthquakes 2150 B.C. to A.D. 2010; and 3. Tsunami sources 1650 B.C. to A.D. 2010 from earthquake, volcano, landslide and other causes. These maps identify event location, intensity, and socio-economic effects overlaid onto detailed topography and bathymetry from the ETOPO1 1 arc-minute global relief model. Each map also lists details of the most intense and fatal events, including dates, damage and local/regional effects. The data are mainly compiled from NGDC's global historical volcanic, earthquake and tsunami integrated databases. For reference purposes, the posters also provide non-damaging earthquakes and volcanic eruptions from the Smithsonian Institute's Global Volcanism Program, and the U.S. Geological Survey's Preliminary Determination of Epicenters.

Abstract by Paul Dunbar, Kelly J. Stroker, Heather McCullough, and Laura Kong, 2011, GSA Abstracts with Programs, v. 42, no. 5, p. 275.

Recommendations for an effective national mitigation effort

This white paper was funded through a cooperative agreement between the National Emergency Management Association and the Federal Emergency Management Agency in 2009. It's subtitle is "Building stronger partnerships, increased resilience, and disaster resistance for a safer nation."

It is available online: http://www.nemaweb.org/?3177

Natural Hazards and Earth System Sciences, special issue 117, 2011

Special issue 117 concerns tsunamis and is entitled *New developments in tsunami science: from hazard to risk*, and was edited by I. Didenkulova, S. Monserrat, and S. Tinti.

It's available online: http://www.nat-hazards-earth-syst-sci.net/special_issue117.html.

WEBSITES

HONSHU EARTHQUAKE AND TSUNAMI**: http://itic.ioc-unesco.org/index.php?option=com_content&view=article&id=1713&Itemid=2365&lang=en**

11 March 2011, MW 9.0, near the east coast of Honshu, Japan, tsunami data: alert information, sea level measurements, seismic data, model simulations, data & information sites, media sites, satellite imagery, videos, and post-earthquake tsunami surveys.

HONSHU EARTHQUAKE AND TSUNAMI: **http://www.youtube.com/watch?v=xylDxj6-9dY**

Japan earthquake swarm Google Earth animation. Shows frequency of occurrence and magnitude for each earthquake. Amazing to watch.

HONSHU EARTHQUAKE AND TSUNAMI: **http://itic.ioc-unesco.org/index.php?option= com_content&view=article&id=1713&Itemid=2365&lang=en**

IOC/UNESCO Bulletins No. 1-8 as of 24 March 2011. Statistics and reports from Japanese Fire and Disaster Management Agency (FDMA), National Police agency, and Japan Railways, giving closures, deaths, injuries, fires, number of evacuees, and road conditions.

HONSHU EARTHQUAKE AND TSUNAMI: **http://earthquake.usgs.gov/earthquakes/eqarchives/poster/2011/20110311.php**

U.S. Geological Survey poster and report on the Tokohu (Honshu) earthquake, March 11, 2011.

http://www.firstresponder.gov/Pages/FRArticle.aspx?AID=32

First Responder Communities of Practice

This new site from the U.S. Department of Homeland Security's Science and Technology Directorate seems akin to Facebook with a focus on emergency management and homeland security. Billed as a "vetted, professional networking" site, members need to supply proof of eligibility, including a "sponsor" to vouch for them (those working in response and homeland security fields are welcome to join with a nod from a government official). Once approved, members are invited to use a variety of technologies to collaborate on areas of interest.

From: Disaster Research 561, Jan. 28, 2011

http://www.fema.gov/about/cwg.shtm
FEMA's Children's Working Group

The Federal Emergency Management Agency has devoted a Web page to the progress of its Children's Working Group. Visitors can learn more about the group, which is tasked with insuring that children's interests are integrated into emergency planning, and access resources on children and disasters. A working group newsletter is also available.

From: Disaster Research 561, Jan. 28, 2011

http://www.masscomm.txstate.edu/cslmm/research.html
An Achilles Heel in Emergency Communications

This two-year study, subtitled *The Deplorable Policies and Practices Pertaining to Non-English Speaking Populations*, examines emergency communications to Spanish speakers in West Texas and finds both broadcast media and government agencies severely lacking in their ability to get emergency information to Latinos. An 80-person forum attended by public and private sector representatives did result in a number of recommendations to address the issue.

From: Disaster Research 561, Jan. 28, 2011

http://www.fema.gov/pdf/about/divisions/npd/CPG_101_V2.pdf
Developing and Maintaining Emergency Operations Plans

The Federal Emergency Management Agency has updated its Comprehensive Preparedness Guide to emphasize emergency planning methods that engage the entire community. The guide, which reflects the trend toward more integrated, flexible, risk-based planning, will be useful to a variety of disciplines charged with assessing risk.

From: Disaster Research 561, Jan. 28, 2011

http://www.nap.edu/catalog.php?record_id=13076
Public Response to Warnings on Mobile Devices

This book, in prepublication from National Academies Press, presents ideas from a recent National Research Council workshop on how people respond to emergency warnings, especially those received via mobile devices. The book, available free online, covers the planned Commercial Mobile Alert System, communicating during a crisis, public education and training, and communicating with at-risk populations. Research gaps and opportunities are also explored.

From: Disaster Research 562, Feb. 10, 2011

http://psbroadband.com/
Public Safety Broadband

Having a hard time staying abreast of the complex world of public safety communications? Now you don't need to worry, because the consultants at Corner Alliance have you covered. The company is keeping track of the many-pronged efforts to build an interoperable public safety communication network and has listed news, upcoming meetings, and FCC actions on a no-frills Wordpress blog. It just might be the simplest thing in public safety communications yet.

From: Disaster Research 562, Feb. 10, 2011

http://www.sm4em.org/
Social Media 4 Emergency Management

Social media in emergency management is on the rise and the newly established Social Media 4 Emergency Management Web site is here to help those ready to jump into the fray. The site's been tracking updates, sharing best practices, building wikis, and standardizing Twitter hashtags (check out #SMEM, for example). Blog post topics range from the challenges of social media in government to international Web site reach. With tips on establishing a social media presence and lists of upcoming events, budding socialites will have plenty to guide them.

From: Disaster Research 563, Feb. 24 2011

http://blogs.archives.gov/online-public-access/?p=4400
Photographs Relating to Disasters and Emergency Management, 1998-2008

If a picture is worth a thousand words, then the approximately 8,000 photographs recently released by the Federal Emergency Management Agency is a fortune in disaster documentation. The collection, now available through the National Archives, covers a range of FEMA work, including Hurricane Katrina and Tropical Storm Kay, tornados and flooding, political leaders, damaged landscapes, and survivors. Browse the images individually or search by keyword, but take a moment to peek into this treasure chest of disaster graphics.

From: Disaster Research 563, Feb. 24 2011

http://www.gscnc.org/dhs.html
Girl Scouts Emergency Preparedness Patch Program

It looks like the Boy Scouts just lost their Be Prepared monopoly, thanks to a collaboration between the Girl Scouts and the Federal Emergency Management Agency Citizen Corps. The two groups were able to rendezvous and create the Be Prepared Emergency Preparedness Patch Program, which will allow girl scouts to identify emergency risks, learn about alerts and warning systems, prepare for emergencies, and get trained in community emergency planning.

From: Disaster Research 563, Feb. 24 2011

http://www.sciencenews.org/view/generic/id/61041/title/Mangroves_do_a_coast_good

Mangroves do a coast good, by Sid Perkins, posted July 9, 2010. "Field studies of an Indonesian coastline ravaged by a tsunami in December 2004 suggest that leaving mangrove forests intact along a shoreline could substantially reduce damage from moderate-sized tsunamis." See complete report at website.

EXHIBITS

April 17, 2011
9th Annual Story Festival

The Pacific Tsunami Museum's 9th annual story festival will be held on Sunday, April 17, 2011. The theme this year is "I Grew up on Piopio St." It is that little bit of a street just behind the Chevron Station on the corner of Kamehameha and Pauahi that takes you across the Waiolama Canal and to the Visitor's Center. It is an area rich in Hawaiian history. Piopio St. was once a thriving community of many different businesses interspersed with homes and fruit trees and one that elicits many fond memories of life, before it was wiped out by the 1960 tsunami. Individuals who grew up on Piopio St. will share their childhood memories as well as their tsunami experiences

From:
http://www.tsunami.org/events_to_come_revised6-1-08.html

CONFERENCES/EVENTS

April 20, 9:45 a.m.
Washington 2011 Earthquake Drop, Cover and Hold Drills

April 26-27, 2011
Partners in Emergency Preparedness

Washington State University**,** Tacoma, Washington**.** This conference will discuss earthquake research, contingency planning, school preparedness, public health preparedness, and public information. Session topics include business continuity, pediatric disaster response plans, incident command for community organizations, and the National Commission on Children and Disasters' recommendations.

May 10-11, 2011
International Crisis and Risk Communication Conference

University of Central Florida**,** Orlando, Florida**.** Cost and Registration: $645 before May 9, open until filled. This conference will focus on communicating risk and crisis information in an age of many communication technologies. Session topics will include social media's impact on crisis communication, communications during the Gulf oil spill and H1N1 outbreak, social media's role in disaster scandals, and federal crisis communications.

From: Disaster Research 564, March 10, 2011, p. 7

May 11-13, 2011
Second International Conference on Disaster Management and Human Health

Wessex Institute of Technology**,** Orlando, Florida**,** Cost and Registration: $1450, open until filled. This conference will address global risk, strategies to prepare for disruptive events, and methods of prevention in disaster management and public health. Conference topics include risk mitigation; surveillance and early warning systems; pandemic and biological threats; service sustainability; and public health preparedness.

From: Disaster Research 564, March 10, 2011, p. 7

June 6-9, 2011
14th Annual Emergency Management Higher Education Conference

Federal Emergency Management Agency**,** Emmitsburg, Maryland**.** Cost and Registration: Free for accepted applicants, application period closes May 13.

This conference allows emergency management educators and academic program administrators to meet with practitioners and discuss curricula, creating new programs, accreditation, and other issues involved in emergency management education. Topics will include NIMS training, integrating geospatial technology, and administrating emergency management educational departments.

From: Disaster Research 564, March 10, 2011, p. 7

September 21, 10:15 a.m.
Washington, 2011 Earthquake Drop, Cover and Hold Drills ♦

Material added to the NTHMP Library

March – April 2011

Note: These, and all our tsunami materials, are included in the online (searchable) catalog at http://www.dnr.wa.gov/ResearchScience/Topics/GeologyPublicationsLibrary/Pages/washbib.aspx. Click on SEARCH DATABASE, then type 'tsunamis' in the Subject field to get a full listing of all the tsunami reports and maps in the collection.

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Wegscheider, S.; Post, J.; Zosseder, K.; Muck, M.; Strunz, G.; Riedlinger, T.; Muhari, A.; Anwar, H. Z., 2011, Generating tsunami risk knowledge at community level as a base for planning and implementation of risk reduction strategies: Natural Hazards and Earth System Sciences, v. 11, no. 2, p. 249-258.♦

National Level Exercise 2011

The Federal Emergency Management Agency's National Level Exercise is mere weeks away, and this site is the place to learn all about the faux disaster that will play out May 16-20.

http://www.fema.gov/media/fact_sheets/nle2011_fs.shtm

VIDEO-CD-DVD RESERVATIONS

To reserve tsunami videos, CDs or DVDs, contact *TsuInfo Alert* Video Reservations, Lee Walkling, Division of Geology and Earth Resources Library, 1111 Washington St. SE, MS 47007, Olympia, WA 98504-7007; or e-mail lee.walkling@dnr.wa.gov

Adventures of Disaster Dudes (14 min.). Preparedness for preteens. American Red Cross.

The Alaska Earthquake, 1964 (20 min.) Includes data on the tsunamis generated by that event.

Business Survival Kit for Earthquakes & Other Disasters; What every business should know before disaster strikes (27 min.). Global Net Productions for the Cascadia Regional Earthquake Workgroup, 2003. With CD disaster planning toolkit & other data.

Cannon Beach Fire District Community Warning System (COWS) (21 min.) Explains why Cannon Beach chose their particular warning system.

Cascadia: The Hidden Fire–An Earthquake Survival Guide (10 min.). Global Net Productions, 2001. A promo for a documentary about the Cascadia subduction zone and the preparedness its existence demands of Alaska, Oregon and Washington states. Includes mention of tsunamis.

Disasters are Preventable (22 min.) Ways to reduce losses from various kinds of disasters through preparedness and prevention.

Disaster Mitigation Campaign (15 min.). American Red Cross; 2000 TV spots. Hurricanes, high winds, floods, earthquakes.

Earthquake…Drop, Cover & Hold (5 min.). Washington Emergency Management Division. 1998.

Forum: Earthquakes & Tsunamis (2 hrs.). CVTV-23, Vancouver, WA (January 24, 2000). 2 lectures: Brian Atwater describes the detective work and sources of information about the Jan. 1700 Cascadia earthquake and tsunami; Walter C. Dudley talks about Hawaiian tsunamis and warning systems.

International Tsunami Information Centre, 2004, Tsunami warning evacuation news clips and video footage, UNESCO /IOC International Tsunami Information Centre, 1 **DVD**, 12 min.

Killer Wave: Power of the Tsunami (60 min.).National Geographic video.

Mitigation: Making Families and Communities Safer (13 min.) American Red Cross.

Not Business as Usual: Emergency Planning for Small Businesses, sponsored by CREW (Cascadia Regional Earthquake Workgroup) (10 min.), 2001. Discusses disaster preparedness and business continuity. Although it was made for Utah, the multi-hazard issues remain valid for everyone. Websites are included at the end of the video for further information and for the source of a manual for emergency preparedness for businesses.

Numerical Model Aonae Tsunami–7-12-93 (animation by Dr. Vasily Titov) and Tsunami Early Warning by Glenn Farley, KING 5 News (The Glenn Farley portion cannot be rebroadcast.)

Ocean Fury--Tsunamis in Alaska (25 min.) VHS and **DVD**. Produced by Moving Images for NOAA Sea Grant College Program, 2004.

The Prediction Problem (58 min.) Episode 3 of the PBS series "Fire on the Rim." Explores earthquakes and tsunamis around the Pacific Rim

Protecting Our Kids from Disasters (15 min.) Gives good instructions to help parents and volunteers make effective but low-cost, non-structural changes to child care facilities, in preparation for natural disasters. Accompanying booklet. Does NOT address problems specifically caused by tsunamis.

The Quake Hunters (45 min.) A good mystery story, explaining how a 300-year old Cascadia earthquake was finally dated by finding records in Japan about a rogue tsunami in January 1700

Raging Planet; Tidal Wave (50 min.) Produced for the Discovery Channel in 1997, this video shows a Japanese city that builds walls against tsunamis, talks with scientists about tsunami prediction, and has incredible survival stories.

Raging Sea: KGMB-TV Tsunami Special. (23.5 min.) Aired 4-17-99, tsunami preparedness in Hawaii.

The Restless Planet (60 min.) An episode of "Savage Earth" series. About earthquakes, with examples from Japan, Mexico, and the 1989 Loma Prieta earthquake.

Run to High Ground (14 min.). Produced by Global Net Productions for Washington Emergency Management Division and Provincial Emergency Program of British Columbia, 2004. Features storyteller Viola Riebe, Hoh Tribe. For K-6 grade levels. Have video and **DVD** versions.

Tsunami and Earthquake Video (60 min.). "Tsunami: How Occur, How Protect," "Learning from Earthquakes," "Computer modeling of alternative source scenarios."

Tsunami: Killer Wave, Born of Fire (10 min.). NOAA/ PMEL. Features tsunami destruction and fires on Okushiri Island, Japan; good graphics, explanations, and safety in-formation. Narrated by Dr. Eddie Bernard, (with Japanese subtitles).

Tsunami: Surviving the Killer Waves (13 min.). 2 versions, one with breaks inserted for discussion time.

Tsunami Chasers (52 min.). Costas Synolakis leads a research team to Papua New Guinea to study submarine landslide-induced tsunamis. Beyond Productions for the Discovery Channel.

Tsunami Evacuation PSA (30 sec.). DIS Interactive Technologies for WA Emergency Management Division. 2000.

NEW Tsunami preparedness in Washington; version 1.0. 32-min. DVD.

TsunamiReady Education CD, 2005, American Geological Institute Earth Science Week kit.

Understanding Volcanic Hazards (25 min.). Includes information about volcano-induced tsunamis and landslides.

UNESCO/IOC International Tsunami Information Centre, 2005, U.S. National Tsunami Hazard Mitigation Program public information products—B-roll footage, tsunami science, warnings, and preparedness: UNESCO/IOC International Tsunami Information Centre, 1 **DVD,** 57 min.

The Wave: a Japanese Folktale (9 min.) Animated film to start discussions of tsunami preparedness for children.

Waves of Destruction (60 min.) An episode of the "Savage Earth" series. Tsunamis around the Pacific Rim.

Who Wants to be Disaster Smart? (9 min.). Washington Military Department/Emergency Management Division. 2000. A game show format, along the lines of *Who Wants to be a Millionaire*?, for teens. Questions cover a range of different hazards.

The Wild Sea: Enjoy It...Safely (7 min.) Produced by the Ocean Shores Wash. Interpretive Center, this video deals with beach safety, including tsunamis. ♦

This Citizen Corps Notification is provided by FEMA's Individual and Community Preparedness Division.

We would like to provide an update on the earthquake and tsunami that has impacted Japan and the U.S. Pacific Region. FEMA is closely monitoring the affects of the earthquake and subsequent tsunami that struck Japan early this morning, and as directed by the President, FEMA is in close contact and coordination with state and local officials and stands ready to support them in any way needed, through our regional offices in the West Coast and in the pacific area.

FEMA is working in support of the United States Agency for International Development (USAID) who is the lead federal agency when it comes to responding to international disasters.

If you are looking for ways to help, you can **donate** to support Japan Tsunami Response by going to http://www.interaction.org/.

For additional information and updates on response efforts, you can go to the USAID Disaster Assistance Website.

Our immediate priority is the safety of the people and communities in the affected areas. We remind everyone who lives in the region to monitor their local news for updates and directions provided by their local officials.

If you are concerned about the safety of friends or family and you cannot get in touch with them, you may contact the U.S. State Department.

If you are in Japan and you would like to contact the U.S. State Department, email japanemergencyusc@state.gov.

If you are outside Japan and you would like to contact the U.S. State Department, email pacifictsunamiusc@state.gov.

You can check the below sites for updates related to the earthquake and tsunami:

- US Agency of International Development
- National Oceanic and Atmospheric Association
- National Weather Service

Sincerely,

The National Office of Citizen Corps
FEMA Individual & Community Preparedness Division

FEMA (Federal Emergency Management Agency) [fema@service.govdelivery.com]
E-mail sent Fri 3/11/2011 4:44 PM

CARIBE WAVE/LANTEX 2011: First Caribbean Wide Tsunami Exercise
Submitted by Christa G. von Hillebrandt-Andrade, NOAA NWS Caribbean Tsunami Warning Program
March 21, 2011

On March 23, 2011 the first Caribbean-wide tsunami exercise, CARIBE WAVE/LANTEX 2011 was conducted in the Caribbean and adjacent regions under the framework of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG CARIBE EWS), the NOAA Tsunami Program and the regional emergency management agencies. The Manager of the NOAA NWS Caribbean Tsunami Warning Program (CTWP), Christa von Hillebrandt-Andrade, chaired the Task Team for the exercise that was established at the 5th session of the ICG CARIBE EWS in March, 2010.

The scenario was a repeat of the 1867 Virgin Islands earthquake and tsunami with impacts focused on the Eastern Caribbean. In addition to being the first Caribbean-wide exercise, many other new milestones in terms of tsunami exercises in the Caribbean and Western Atlantic were achieved.

As of Monday, 22 of 29 member states in the Caribbean were expected to join the exercise, representing a participation rate of over 75%. For the first time, the manual was translated and distributed in three languages (English, Spanish and French). Special websites (http://redsismica.uprm.edu and http://www.srh.noaa.gov/srh/ctwp) were created for posting all the materials related for the exercise. Five webinars in English and Spanish were hosted by the Caribbean to present and discuss CARIBE WAVE 2011.

In addition to the travel times provided by the US Tsunami Warning Centers, the CTWP prepared and distributed travel time maps and tables with arrival and travel times for 325 tsunami forecast and sea level stations in the Caribbean. An online evaluation form was established for the participants to submit their comments. To try to assure a successful communication between the tsunami warning centers and the tsunami warning focal points in the region, the list of Tsunami Warning Focal Points and National Contacts were updated. Gaps in forecast points were also identified and resolved. Tens of presentations on the exercise in Puerto Rico, on the US mainland and throughout the region at a wide variety of venues were given to promote the exercise and participated in numerous interviews with the media.

For the first time as part of such an exercise, over 260 participants from Puerto Rico, the Virgin Islands and countries throughout the whole Caribbean were to receive emails from the US TWC during the exercise with the corresponding tsunami bulletins. A delegation from Mexico visited Puerto Rico during the exercise to observe the exercise.

A report will be prepared by the CTWP to be presented at the Sixth session of ICG CARIBE EWS in April. Thanks to the CARIBE WAVE Exercise there is no doubt that the Caribbean will be better prepared for a tsunami when one strikes the region.♦

From: Dr. George Pararas-Carayannis (March 24, 2011)

Re: Tsunami threats to coastal nuclear power plants (letter to Russell Hoffman)
http://www.animatedsoftware.com/environm/onofre/pararas1.htm

I wrote a letter in 2001 about the impact of natural disasters on nuclear power plants - particularly from earthquakes, tsunamis and hurricane surges. My letter is now being circulated by concerned groups and you can read it by clicking on the link below.

There is a profound inability to shut down a nuclear power plant in time to avoid potential failure of its cooling system and the secondary impacts of a nuclear source melt down. A major nuclear disaster occurred in 2004 in India by the tsunami (but never revealed). The same thing is now happening in Japan (and only partially revealed). The problem in Japan is far from over. There is a proliferation of nuclear plants in many countries without proper consideration of potential impacts. There are several more plants in Japan, China, France and many other countries that could face similar problems - particularly those that our over 40 years old.

Date: Tue, 26 Jun 2001 12:45:25 +0800
To: "Russell D. Hoffman" <rhoffman@animatedsoftware.com>
From: itmc@pixi.com
Subject: Re: Tsunami threats to coastal nuclear power plants

Dear Mr. Hoffman,

I apologize for the delay in responding but I get 30-40 email per day and often it is difficult to respond promptly. I realize that you are very concerned about the safety of the San Onofre nuclear plant and, obviously, you have done a lot of research on this subject.

I too share your concerns about nuclear power plant safety. As a member of a special committee and working group of the American Nuclear Society, I co-authored the environmental standards and standards for the siting of nuclear power plants and recommended an extremely conservative approach using worse possible scenarios for their design. I have also attended meetings of the President's Council on Environmental Quality (CEQ) in Washington. (Pararas-Carayannis, George. Offshore Nuclear Power Plants: Major Considerations and Policy Issues. Chap. VIII: Direct Environmental Impacts of Offshore Plants, 8 Nov. 1973, President's Council on Environmental Quality (CEQ), Task Force on Offshore Nuclear Power Plants)(see also listing of additional studies- below.)

I was also consultant to the U.S. Nuclear Regulatory Commission,to the U.S. Corps of Engineers and to different United Nations scientific organizations (on the safety in the siting and design of nuclear power plants on coastal areas and offshore).

As Director of the International Tsunami Information Center, one of my particular concerns was the safety of nuclear power plants and the effects of a tsunami on the possible failure of their cooling systems - even if sited at high enough elevation. I was concerned not only about failure due to flooding, but also for failure due to withdrawal of water which could create a cave-in effect due to the loss of hydrostatic pressure. For distantly generated events, I was concerned on whether a plant could shut down within a reasonable length of time. Of course for locally generated events, this would be impossible.

As consultant to the Nuclear Regulatory Commission on the licencing of units 2 and 3 of the San Onofre Nuclear Plant, the Crystal River (Florida) plant and others I read all the Impact statements that were filed by utilities and commented on their adequacy. For the Crystal River nuclear plant I developed a mathematical model of a mega-hurricane (a hypothetical design hurricane striking the plant at right angle) and verified the model with actual historical hurricanes (Camille Carol, etc.).As a result of my study, the Nuclear Regulatory Commision required the Utilities Company to redesign the cooling system and build the pumps at a much higher elevation than Dames and Moore (Engineering Consultants) were recommending.

I was also at the San Onofre plant when the 1971 San Fernando earthquake occurred and I did did studies of historical tsunamis in the Santa Barbara Channel for the consulting firm "Marine Advisors'. I was particularly concerned about a possible repeat of the 1812 Santa Barbara earthquake and tsunami and the effects which they may have on the safety of the San Onofre plant. (See also my new book on the "BIG ONE - The Next Great California earthquake". Go to http://www.forbesint.com/Book.htm). Chapter 15 of my book is devoted to the assessment of the California Tsunami hazard. In fact I tried to map the faults in the Santa Barbara Channel that could generate a tsunami.

In summary, and as my new book indicates, I am still concerned about the potential hazard of earthquakes and tsunamis in California. I do not believe that all the risks have been adequately assessed. Any efforts - such as yours- to increase public awareness as to the need for preparedness, are commendable. Although I have retired from government service, I am willing to assist, as consultant, in any assessment of the earthquake and tsunami hazard potential at Orange County and elsewhere - particularly now that there is additional new data.

With Best Wishes,
Dr. George Pararas-Carayannis

Partial listing of publications concerning nuclear power plants:

Pararas-Carayannis, George. The Energy Crisis and the Marine Environment. A Presentation Given at the Marine Technology Society Meeting, NY Section, Jan.10, 1974.

Pararas-Carayannis, George. American National Standard:Tsunami Guidelines at Power Reactor Sites, American Nuclear Society, Nuclear Power Engineering Committee, Working Group 2, April 1974.

Pararas-Carayannis, George. Verification Study of a Bathystrophic Storm Surge Model. U.S. Army, Corps of Engineers Coastal Engineering Research Center, Washington, D.C., Technical Memorandum No. 50, May 1975.

Pararas-Carayannis, George. Tsunami Hazard and Design of Coastal Structures. in Proc.15th International Conference on Coastal Engineering, , pp. 2248-53, Am. Soc. Civil Eng. (IOS), 1976.

Pararas-Carayannis, George. Proposed American National Standard - Aquatic Ecological Survey Guidelines For the Siting, Design. Construction, and Operation of Thermal Power Plants. American Nuclear Society, Monogram, September, 1979.

Pararas-Carayannis, George. Tsunami Hazard Analysis, Tsunami Hazard Planning, Protection Measures, Tsunami Exercises, and Public Education. Proceedings of International Tsunami Workshop, Sidney, B.C., Canada, July 29 - August 1, 1985.

See also: Preliminary web page and report on the March 11, 2011 Earthquake and Tsunami. I will expand on the source mechanisms of both the earthquake and the tsunami soon as I get more data to analyze.
Go to http://drgeorgepc.com/Tsunami2011JapanSanriku.html ♦

THE WHITE HOUSE
WASHINGTON

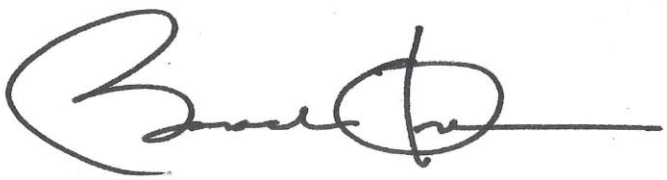
March 16, 2011

I send greetings to all those observing National Tsunami Awareness Week.

Tsunamis are uncommon but deadly natural phenomena that threaten shorelines across America and around the world. The heartbreaking loss of life from the recent earthquake and tsunami in Japan reflects the catastrophic damage these unexpected disasters can cause, and Americans continue to keep all those affected in our thoughts and prayers.

As we offer our assistance to those impacted by this tragedy, we also renew our commitment to ensuring preparedness along our shores. Efficient warning systems and awareness in coastal communities are vital to protecting Americans in at-risk areas of the country. To meet these needs, the National Tsunami Hazard Mitigation Program (NTHMP), a partnership of State and local governments and Federal agencies, is working to reduce the impact of tsunamis through hazard assessment, evacuation planning, and educational outreach. While the danger posed by tsunamis cannot be eliminated, these efforts can help save lives by equipping citizens to effectively respond to emergency situations.

On behalf of all Americans, I thank those involved with the NTHMP for their contributions to the safety of Americans in coastal communities. I wish you all the best.



INFREQUENTLY ASKED QUESTIONS

What percentage of American households have pets?

62 %.
In September 2010, FEMA compiled a website *Preparing your pets for disaster*:
http://www.fema.gov/news/newsrelease.fema?id=52653

How many minutes after the Japan earthquake was a tsunami warning issued?

3 minutes. The earthquake was at 05:46 UTC (local time: 14:46). The first Major Tsunami Warning by the JMA (Japan Meteorological Agency) was made at 05:49.

According to the National Geophysical Data Center, NOAA, what was the Japan tsunami wave height in Saipan (Northern Mariana Islands)? Subic Bay? La Push, Washington? Pago Pago (American Samoa)? Acapulco? and Papeete Tahiti? And what were the distances from the epicenter for each of these places?

Saipan	0.65 m	2,589 km	Northern Mariana Islands
Subic Bay	0.07 m	3,396 km	Philippines
La Push,WA	0.53 m	7,159 km	United States
Pago Pago	0.34 m	7,623 km	American Samoa
Papeete	0.39 m	9,414 km	Tahiti
Acapulco	0.65 m	11,101 km	Mexico

What did Oregon Department of Transportation workers find in 2010?

"State workers have uncovered the remnants of the region's ancient past along an Oregon highway project that could shed light on what the Northwest looked like before the ice age and what disasters may lie ahead.

Oregon Department of Transportation workers discovered trees at least 50,000 years old that were buried 150 feet below ground during an ancient landslide. They found the pieces while digging into hillsides near Eddyville along Highway 20."

"We can put together a record and see how often these big earthquakes occur," he said. "And so if we can get them over the last 50,000 years, then we can say this is what happened in the past and this will be the recurrence interval for the future."

"It gives scientists an idea of when the region can expect a major tsunami like the one that nearly wiped out Sumatra. Coincidentally, the very highway project where the discovery was made will serve as an escape route for tsunami survivors when the Big One hits here."

Full story: http://www.katu.com/news/local/110322434.html

Where can you find information about links between emergency management and tourism?

http://www.eturbonews.com/20358/linking-emergency-management-and-tourism has an article *Linking emergency management with tourist*, by David Beirman, Jan. 4, 2011.

"eTN) - The UN World Tourism Organization (UNWTO) has undertaken to fund a major project for 2011 to develop a program to integrate emergency management and tourism, one of the key missing links in tourism crisis and recovery management."♦

***Tsunami Warning Center—4 Levels of Messaging* brochure**
http://www.stormready.noaa.gov/tsunamiready/resources/Tsmi_Brochure10.pdf

Available for printing, this colorful brochure includes definitions for Tsunami warnings, advisories, watches, and information statements.

Earthquake Safety Checklist

This quick reference guide helps individuals and families prepare for an earthquake and prevent earthquake-related damage to their homes. The easy-to-read booklet features instructions on conducting earthquake drills and "hazard hunts." Also included are a checklist of disaster supplies, tips on what to do during and after an earthquake, and additional resources. [Available in English and Spanish in print; Tagalog, Japanese, Chinese (simplified), Vietnamese, Korean, and Chinese (traditional) versions available online only.]
http://www.fema.gov/library/viewRecord.do?id=1664

MORE ON JAPAN

Natural Hazards Center Japanese Disasters Resource Page

Like everyone else, the Natural Hazards Center has spent the past two weeks saturated with news and research relating to Japan's many earthquake-spawned disasters. But we've also spent the past 35 years collecting and disseminating the very best disaster resources and information. You only need to take a moment to visit our page of news reports, research documents, and bibliographies to find something useful. Check back often, we're adding new resources all the time.

http://www.colorado.edu/hazards/earthquake_japan.html

Japan quake: Aid worker's diary
25 March 2011 Last updated at 11:39 ET
http://www.bbc.co.uk/news/world-asia-pacific-12815474

Kathy Mueller is working for the International Federation of Red Cross (IFRC) in Japan, which was hit by a devastating earthquake and tsunami on 11 March. This is her account.

Japan earthquake: International teams in rescue effort
15 March 2011 Last updated at 11:59 ET
http://www.bbc.co.uk/news/world-asia-pacific-12745746

The British rescue team has been sent to Ofunato along with teams from the US and China. It is made up of 59 fire service search and rescue specialists, two rescue dogs and a medical support team of four. Full report is online, with photos.

Tsunami children hunt for parents (video)
http://www.bbc.co.uk/news/world-asia-pacific-12813630

Japan hails the heroic "Fukushima 50"
http://www.bbc.co.uk/news/world-asia-pacific-12779510

In Japanese disaster films they like heroes who sacrifice everything for the greater good - stoic, determined, refusing to back down in the face of adversity or even certain death. These are the qualities the country admires.

Now the newspapers here have a new band of heroes to lionise - the workers, emergency services personnel and the scientists battling to save the Fukushima nuclear plant, their fellow citizens and themselves.

Full story at http://www.bbc.co.uk/news/world-asia-pacific-12779510

Japan earthquake survivor's grim search for his mother amid devastation
http://www.guardian.co.uk/world/2011/mar/25/japan-earthquake-survivor-search-mother?intcmp=239

Day after day Yuya Kikawada walks through the wreckage, checking shelters and hospitals, refusing to give up hope.

Full story at the webpage.

Japan disaster: an eyewitness view
http://www.telegraph.co.uk/expat/expatlife/8384933/Japan-disaster-an-eyewitness-view.html

A Telegraph Expat reader has sent in this evocative account of the immediate aftermath of the Japan earthquake disaster.

By David Baresch 9:55AM GMT 16 Mar 2011

Eyewitness videos of Japan earthquake/tsunami
http://www.youtube.com/watch?v=otceQ7CRcMs

Japan tsunami footage to help predict future waves

When the powerful earthquake of 11 March triggered a tsunami that struck swathes of Japan's north-east coast, residents, TV crews and fixed cameras captured images of the devastating wave.

Footage of the debris-filled water sweeping across fields and through houses has since been broadcast all over the world.

But as well as providing an idea of how it felt to experience the tragedy first-hand, experts say the images can now be used to better understand the characteristics of tsunamis and help save lives in the future.

"Without exaggeration, it will lead to a quantum leap in the way that we calculate and we estimate how fast the tsunami propagates on land," says Dr Costas Synolakis from the University of Southern California and the Hellenic Centre for Marine Research in Greece.

http://www.bbc.co.uk/news/world-south-asia-12786619