NTHMP Tsunami Education Assessment

Task Statement for Tsunami Education Assessment

TASK 1: Perform assessment of existing tsunami education efforts within 10 tsunami-threatened communities.

Subtask A: Meet with MES members for information on approximately 20 - 30 existing educational programs

Subtask B: Meet with team members of existing federal and state tsunami education programs to review and assess existing educational programs and gather recommendations.

Subtask C: Provide report of the complied results of these assessments to the MEC-EC

EXECUTIVE SUMMARY

This report presents and discusses the results of interviews with 45 professionals in 15 states and territories about the topic of tsunami education and outreach. It covers the topics of the scope of such work, the audiences for it, activities currently engaged to conduct it, natural hazard education activities related to tsunamis, and messaging.

The scope of tsunami education and outreach is large. It varies from simple awareness-raising to very specific training for professionals, as well as the generally accepted understanding of sharing information with the public, from children to adults and from seaside residents to visitors to elected officials.

The challenges presented in doing tsunami education and outreach are consistent with the challenges for other natural hazards that have a potentially high impact, but occur with low frequency.

Tsunami education has been done for many years in Hawaii, Alaska, California, Oregon, and Washington, and a little more recently in Puerto Rico, and is not done very much in other areas of the country. This report explains where and why.

This report was written by a Certified Emergency Manager who specializes in risk communication and is passionate about applying social science research to disaster education. This is the perspective from which this report is written. It is descriptive, but also makes some recommendations for inclusion in the forthcoming NTHMP Tsunami Education Plan.

This report reflects the thoughts and opinions of many bright and passionate people, but does not necessarily include everyone in the field. It is dynamic and will continue to grow and evolve as more information is learned.

I. U.S. Locations for tsunami education and outreach

Tsunami Education: East Coast of the United States

For the most part, the only tsunami education activities that are being done on the East Coast are to meet minimal, mostly passive requirements for the TsunamiReady program for 15 East Coast jurisdictions that have so qualified. (See requirements here)

There is not much evidence of tsunami education and outreach being done anywhere else on the East Coast with the exception of Maine, where a passionate champion is pushing hard for such work beyond minimum requirements.

Tsunami Education -- Gulf Coast States -- Florida, Alabama, Mississippi, Louisiana, Texas

Tsunami education on Gulf Coast areas is pretty much non-existent because the tsunami threat is still being determined through studies and research. The vast majority of hazard education and outreach on the Gulf, as expected, is about hurricanes. There is a strong feeling among Gulf Coast emergency managers that the public has been educated so long about hurricane storm surge that many of them perceive the tsunami threat to be the same.

They have been educated for many years about what to do and where to go when a hurricane threatens that it is a common belief, albeit inaccurate, that they will have long warning times and they should take the same actions – evacuate far inland. It is generally believed that until research can confirm a specific tsunami threat to Gulf Coast states that tsunami education is a very low priority.

Tsunami Education -- West Coast States -- California, Oregon, Washington

The states of California, Oregon, and Washington have had history of tsunami events as well as frequent reminders through earthquakes of the threat. Relatively local earthquakes and landslides off the California, Oregon, and Washington coast pose the greatest threat of tsunamis that can reach California's coastline in less than an hour. An earthquake on the Cascadia subduction zone, off the coast of northern California, could trigger a tsunami that could reach land within minutes. Earthquakes off the rest of the California coast (south of Cape Mendocino) take place mainly on strike-slip faults, and because the movement they generate is mostly lateral, tsunamis from local sources are less likely to occur because the ocean floor and overlying water is not typically thrust upward.

(Reference)

The most devastating tsunami to affect California in recent history was from the magnitude 9.2 Alaskan earthquake of 1964. Areas of northern California experienced a six-meter (20-foot) tsunami wave that flooded low-lying communities, such as Crescent City, and river valleys, killing 11 people.

Tsunami waves struck Northern California, Oregon, and Washington on March 11, 2011, spawned from a 9.0M earthquake near Honshu, Japan. Waves reaching eight (8) feet struck Crescent City, California, and resulted in one death (a videographer was among four swept out to sea and while three were rescued by the Coast Guard, the videographer was not.) The second tsunami-related death from the March 11 tsunamis was to a 25-year-old man who was standing on the north shore of the Klamath River near its mouth and entrance to the Pacific, approximately 20 miles south of Crescent City, CA. He was swept away by the second surge of the tsunami that struck the area.

Tsunami warnings were issued north of Cape Mendocino, California, north through Oregon, Washington, British Columbia, and Alaska (in addition to warnings for Hawaii and other Pacific

interests.) The warnings continued for over 24 hours in some locations. It was reported by NWSFO Eureka that a surge of the tsunami, 19 hours after the initial wave struck in Crescent City, was on top of lunar high tide. Water from that surge overtopped roadways that previously were not inundated.)

Most coastal residents, visitors, and local officials are aware of the threat to life and property borne from frequent earthquake education activities, and in recent years, the tremendous attention and participation from *The Great California ShakeOut*! which has had great success in its three-year history. Oregon has begun its own *Great Oregon Shakeout*! following California's lead, conducting a statewide drill on January 26, 2011.

California is including tsunami preparedness, outreach, and education in the materials, presentations, website, and promotion for the 2011 Great California Shakeout to be held October 20, 2011.

Much work has been done in all three states on tsunami outreach and education for many years. Most of the tsunami education in these states is done in conjunction with earthquake education, which makes sense since tsunamis that have affected these states have been caused by both distant and near-field earthquakes.

Some communities consider themselves to be well educated about the threat, and well-prepared. Crescent City, California, is one such example. Having been hit with a tsunami as a result of the 1964 Alaska earthquake resulting in 11 deaths, there has been long-term, ongoing, tsunami education activities in that area, as well as throughout Northern California. Signs, print materials, inserts in telephone directories, websites, public meetings and presentations, and so forth continue on a regular basis. One can cite this area as a good example of having “a culture of preparedness” embedded.

Another example of a successful grassroots effort is the Redwood Coast Tsunami Work Group, which is an organization of local, state and federal agencies, tribes, relief and service groups, land managers, and businesses from Del Norte, Humboldt and Mendocino Counties in California. It is sponsored by Humboldt State University in Eureka, California. What makes this activity successful is that many local organizations and agencies participate in it, and it is led by a well-respected grass-roots organizing team. It has been in existence since 1996, and its longevity is a testament to both excellent leadership and true community collaboration. This group produces localized tsunami maps and information that is specific to each community. Its information resonates well with residents. Social science affirms that the more “local” information is included in outreach and education efforts, the more likely people will pay attention because they believe it applies to them.

However, attempts to replicate the success of the Redwood Coast Tsunami Working Group in other communities have not been successful. Despite valiant efforts by California EMA leadership, organizing cross-jurisdictional and cross-organizational working groups has not worked. The primary reason for a lack of success in replication efforts, according to California EMA, is the inability to identify a local champion who is willing to invest the time, energy, and resources to organize such a group.

There are many long-term efforts in seaside communities in Oregon, as well. Working in close cooperation with the State of Oregon Department of Geology and Mineral Industries, targeted programs and outreach activities occur with regular frequency. As of late 2010, 35 communities in Oregon have tsunami maps, and 6 more are on the way, composing 41 total target communities for the TsunamiReady Program. However, it was pointed out that some of the communities respond better to outreach efforts than others. Much of that has to do with the involvement of local residents who are recognized leaders in each respective community. Without involvement of such a leader, it is difficult to develop interest and attendance at public events where tsunami preparedness is promoted.

The State of Washington also has long-term, ongoing, tsunami outreach and education activities in place both at the state level and in seaside communities. At the state level, the Washington Military Department Emergency Management Division has dedicated staff to coordinate tsunami preparedness and planning efforts. All four counties with a direct Pacific Ocean coastline have achieved TsunamiReady status, along with an Indian Nation and an Indian Tribe, and six seaside communities. More are planned to be recognized as TsunamiReady in 2011.

Regular meetings of representatives of seaside communities, Indian Tribes, emergency managers, and knowledgeable experts are organized by the state Emergency Management office where information is exchanged and ideas are shared to foster mutual collaboration and understanding of emerging science and technology. This is an excellent example of state leadership without imposition of direction. Each community decides what is best for its residents and applies available resources to conduct outreach.

Tsunami Education -- Alaska

Alaska deserves independent recognition related to tsunami events for obvious reasons, with the largest coastline of any U.S. state and Aleutian islands on the Pacific Rim subject to earthquakes and tsunamis. The Great Alaska Earthquake of 1964, with the resulting the tsunami, is recent-enough in mind and memory to use as a focus for tsunami education and outreach with the local population and visitors alike. There are frequent and recent reminders of Alaska tsunami risk on an ongoing basis.

Much work has been done in Alaska on tsunami education. The work is impressive, thorough, and far-reaching. Much of the tsunami education and outreach is tailored to meet the needs of indigenous populations and the culture. It is carried out by local champions and is led and organized by very committed people at the West Coast and Alaska Tsunami Warning Center and affiliates of the National Weather Service, the University of Alaska at Fairbanks Geophysical Institute's “Alaska Tsunami Education Program” (ATEP), other federal agencies such as FEMA and the USGS, as well as a strong commitment by the State of Alaska Division of Homeland Security and Emergency Management.

Tsunami Education -- Hawaii

As with Alaska, Hawaii also deserves independent recognition for work related to tsunamis. Hawaii has been affected by tsunamis generated by distant earthquakes as well as near-field events. Many tsunamis have struck Hawaiian Islands, and the tsunamis of 1946 and 1960 that resulted in deaths are recent enough in mind and memory to use as a focus for ongoing tsunami education and outreach. As with Alaska, there are frequent and recent reminders of tsunamis – as recently as February, 2010.

Much work has been done in Hawaii, particularly on the Island of Hawaii where the 1946 tsunami struck Hilo and caused a significant number of deaths and destruction. The Pacific Tsunami Museum located in Hilo has created interactive exhibits and serves visitors in person and on-line, providing important, culturally-specific and adapted information about tsunamis and safety actions.

The State of Hawaii Civil Defense Agency as well as county/city governments (e.g., Honolulu City/County, Maui County, Kauai County, Hawaii County, and the City of Hilo) have champions who incorporate tsunami education through various activities, drills, exercises, and school-based events. It should be noted that all four counties in the State of Hawaii have achieved TsunamiReady status.

The International Tsunami Education Centre developed a course on tsunamis (AWR-217) at the University of Hawaii's National Disaster Preparedness Training Center. It has recently received FEMA accreditation and is available for the professional community. It is a one-day awareness-level course that provides a basic understanding of tsunamis, hazard assessment, warning and dissemination, community response strategies to effectively reduce tsunami risk.

The International Tsunami Information Center (ITIC) is located in Honolulu, and while the ITIC's focus is international, its staff have collaborated with many in the United States to share tsunami outreach and education activities, and to collaborate locally on same. The ITIC developed Tsunami Teacher which is described in greater detail elsewhere in this report. (See “public education”).

Much of the ongoing tsunami education work throughout Hawaii is coordinated through and with the Pacific Tsunami Warning Center. The work has been crafted to meet the needs of indigenous populations and the culture unique to Hawaii, as well as Guam, American Samoa, and the CNMI. It is carried out by local champions and is led and organized by very committed people at the Pacific Tsunami Warning Center and affiliate agencies and organizations listed above.

Tsunami Education -- Guam, American Samoa, Commonwealth of the Northern Marianas Islands

Guam and the three principal islands of the CNMI – Saipan, Tinian, and Rota – have achieved TsunamiReady status. As a part of achieving that status, tsunami education and outreach has been delivered to the residents and visitors of these island territories and commonwealths. Because resources are scarce for local officials to conduct ongoing tsunami education activities, such work is done as time permits and as personnel are available to do it.

The general perception of the coastal residents of Guam and the CNMI are that they are aware of their risk, and generally know what to do following the traditions of folklore which carries tsunami risk and safety instructions by word-of-mouth and from family to family. This is a good thing: it demonstrates that there is a fundamental understanding of the risk and that action to avoid danger needs to be taken quickly using nature's warning clues.

American Samoa, a group of seven islands about 2,300 miles southwest of Hawaii, is a U.S. territory that makes up the Samoan group of islands in the center of Polynesia, along with the independent country of Western Samoa. American Samoa has not (yet) achieved TsunamiReady status, but tsunami education and outreach has been done for years on an informal and ongoing basis. A recent tsunami (September 29, 2009) which resulted in 119 deaths and millions in property damage, is high on the minds of local residents. Ongoing tsunami education and outreach efforts, village by village, are conducted. Challenges include recruiting and training a local champion in each village. The work is tough and resources are scarce.

Tsunami Education -- Puerto Rico and the U.S. Virgin Islands

The risk of earthquake and resulting tsunamis for Puerto Rico is high, and there have been some reminders in recent history which cause tsunami education activities to be included among earthquake and other natural hazard education actions undertaken by local emergency managers, the Puerto Rico Department of Education, and others.

The Puerto Rico Seismic Network (PRSN) based at the University of Puerto Rico in Mayaguez has

served as the locus of this work for some time, and serves both Puerto Rico and the U.S. Virgin Islands. This group works collaboratively with the West Coast and Alaska Tsunami Warning Center, the National Weather Service, other federal agencies, and the Puerto Rico State Emergency Management Agency.

Many materials have been developed that have been locally adjusted to meet specific audience information needs, including that most residents of Puerto Rico speak Spanish. Outreach and education materials are initially written in Spanish then translated into English where needed. That is a much better approach (than English to Spanish) because the nuances of the use of the language for the audiences are important and immediately incorporated.

As of October, 2010, 11 communities have achieved TsunamiReady status on Puerto Rico, with ten (10) planned to achieve such status in 2011.

There is history of tsunami events affecting Puerto Rico and the U.S. Virgin Islands, yet the history dates back to two events that occurred in 1867 and 1918, where records are scarce. However, there is enough science and historical information to confirm the threat, and thus, resources have been dedicated to conduct various tsunami education and outreach activities in coastal areas of Puerto Rico. Further, occasional meetings (“summits”) are held to gather responsible people, including local elected officials, to discuss and develop focused tsunami education and outreach activities.

Tsunami sirens have been installed and tested in Mayaguez, Puerto Rico, in 2007 with more sirens being installed in Aguadilla in 2010. Seven sirens in Aguadilla were tested with a live drill on February 23. Drill compliance was successful, based on previous public outreach efforts done by local emergency managers with the support of a representative of the PRSN. However, a significant problem occurred: the siren tone was followed by recorded verbal announcements. The announcements were only in English, and the wrong announcement (about an 'active shooter in the area') was played. It didn't make much of a difference, though, because school children and adults in the area pretty much only understand Spanish. They followed their teachers and evacuated to a designated assembly area as practice anyway.

In 2011, tsunami siren installation will proceed on the U.S. Virgin Islands: four for St. Thomas, four for St. Croix and two for St. John. Those supporting this effort recognize that public outreach and education is required to ensure people know what the sirens mean and what to do when they hear them.

Summary of U.S. Locations for Tsunami Education

It is not surprising, therefore, that intense work on tsunami education and outreach has been conducted for many years in states and locations where tsunamis have happened and are a threat: Alaska, Hawaii, California, Oregon, and Washington, as well as the islands of American Samoa, Guam, the CNMI (Saipan, Tinian, and Rota), and Puerto Rico.

It is equally not as surprising that tsunami education and outreach has not been done very much on the U.S. East Coast and is practically non-existent on the Gulf Coast. People get active in conducting tsunami education and outreach when they have evidence of a threat and can justify expending limited resources on the effort, or when they apply for and work toward achieving TsunamiReady status.

II. Audiences for tsunami education and outreach

Audiences: Coastal Residents

Residents of coastlines at risk for tsunami are a high priority for outreach and education. The good thing is that residents who have lived in the area for some time are generally aware that tsunamis can happen, and that information is available to them to explain how to recognize that a tsunami may come, how they will be warned, where to go and what to do.

Coastal residents at greatest risk are those who have built or occupied structures in identified tsunami inundation zones. Focused outreach specifically for these residents is an ongoing need, and is best done by local champions right there where the threat is greatest (i.e., within or near the threatened town, beach, community, municipio, etc.)

Other coastal residents at great risk are newcomers. Many people retire and move to live near a shoreline to enjoy the views and relaxation of the “beach life.” In most cases, new coastal residents are not informed prior to buying or building a home what the risk is. If information such as inundation maps, explanatory details, or historical diagrams and images are available through telephone directories, signage, and city/county websites, then it helps to build awareness of the tsunami threat. However, the greatest challenge to anyone wishing to educate newcomers about tsunamis is that often it is newcomers who are most complacent. They do not seek information about something they do not know about.

Audiences: visitors

Visitors to coastal areas at risk for tsunami are potentially at greatest risk. Often, they stay in a hotel for a brief period, and are there to enjoy the weather and amenities of the beach. It is human nature not to go look for trouble, so it is doubtful that many visitors will look for a telephone directory or a printed brochure in a rack in the hotel lobby that provides tsunami information. Visitors live in blissful unawareness, and will rely on the leadership of others – usually coastal residents who happen to be sharing the beach or staffing the hotel – to lead the way in finding out about a tsunami threat, a warning, as well as know what actions to take.

It was clearly stated by many coastal county and city emergency managers that the visitor population was a great concern. There are pressures not to “scare away” visitors who pump lots of money into local economies through tourism. In fact, some localities on the East Coast have local ordinances that restrict when and how emergency preparedness information may be shared with visitors.

Further, social science research indicates that most people react to a threat based on what they know from previous experience. If their experience is with tornadoes, they haven't a clue what to do for a tsunami. If their experience is with hurricanes, they may be misled by perceiving that they have more time to act because hurricanes are long-lead events whereas tsunamis are not. If their experience is with earthquakes, they may “drop, cover, and hold on” then when the earth has stopped shaking, dust themselves off and be happy they and their loved-ones were uninjured, without thinking that a subsequent greater danger – a tsunami – could be coming. (Though some will think about aftershocks, but again, that's earthquake response and not tsunami response.)

Audiences: service industry for visitors -- lodging operators and visitors bureaus

Many interviewees described concern about dealing with coastal hotel and motel operators. Most had difficulty, but some had success. The degree of success varied but activities were most successful in providing information to visitors in areas where tsunamis have happened before.

As with most service industries, they want to promote what drives their revenue: tourism. They generally resist, and sometimes actively oppose, having local officials provide information directly to visitors. Some lodging operators will attend meetings that local officials hold, so they can be better educated. But the hope that these lodging operator representatives will share information with their guests is only that – a hope, not a reality.

There have been successes, however. Tsunami awareness signage placed on beaches that shows maps and provides information have helped to educate visitors and local residents alike. Best yet, signs do not have to be staffed and are usable all year long. Many coastal communities in California, Oregon, Washington, Alaska, Hawaii, Puerto Rico, Guam, American Samoa, and the CNMI have such signs in place. The signs, in turn, raise awareness.

There are three problems with beachfront signs, though:

1) sometimes tsunami signs are vandalized or stolen, and they are expensive to replace. It has been reported, for example, that dozens of signs have been stolen on the West Coast of Puerto Rico and in some areas of Hawaii.

2) “sign clutter” is an issue for some local officials. They don't want a large number of signs dotting the coastline about specific hazards ranging from tsunamis to rip currents to “sneaker waves” to strong sun. An innovative approach to dealing with concerns about “sign clutter” has been implemented by the NWSFO Eureka, California, where eight topics of interest with icons have been created, and four of the eight are selected for one sign, posted on certain beaches to tailor the information on the sign for the hazards that exist on a specific beach.

3) signs with pictograms can be potentially misinterpreted. See the page on this wiki on "signs".

Additionally, some communities have posted colorful tsunami maps with instructions on the beach. This helps visitors learn through visual references where to go if they feel an earthquake or hear a tsunami siren or warning.

Social science research has indicated why visitors to seaside communities are at greatest risk: they are unfamiliar with the area and do not know the names of locations referred to in radio and television broadcasts. Signs such as this helps to provide references so visitors can identify where to go if they have to evacuate.

Audiences: Coastal emergency managers, law enforcement, fire departments, EMS, and related first responders

Responsible officials in this category are usually hired for their respective positions based on their knowledge about emergency response and planning, and not necessarily about specific hazards, including tsunamis. While emergency managers on the whole have a good concept of natural hazards, their knowledge about tsunamis is generally less than their knowledge of other more frequent recurrent hazards such as earthquakes, hurricanes, floods, etc. This is not a hard-and-fast statement;

it is an observation derived through discussions with emergency managers during the International Association of Emergency Managers conference held in October, 2010. Certainly, emergency managers in California, Oregon, Washington, Alaska, and Hawaii have more knowledge and understanding of tsunamis, as one would anticipate they would.

Law enforcement personnel look at the tsunami issue through a different lens: safety and security through response to events, not proactive outreach in advance. Law enforcement representatives generally do not participate in tsunami preparedness and planning, but may attend community presentations, especially when new or updated tsunami maps are brought to a community and a meeting is held for local officials. Exceptions apply: for example, the emergency manager in Humboldt County, California, is part of the Humboldt County Sheriff's Office.

Fire and EMS personnel do both pre-event and post-event education activities, but as one can imagine, most of their work is related to fire prevention and safety. However, fire and EMS personnel who are doing public education activities are sometimes willing to include additional information on other hazards (such as tsunami) when time and interest permits.

Audiences: Local and State Elected Officials

Local and state elected officials were specifically mentioned as a target audience for tsunami education and outreach. This was for specific reasons:

1) Elected officials are seen as respected leaders in their jurisdictions, and their constituents pay attention to what they say (whether or not they agree with it, they pay attention.)

2) Elected officials control budgets that affect staffing of agencies involved in tsunami preparedness, planning, education, mitigation, and response.

If local elected leaders do not believe that their constituents are at risk, then they are less likely to support allocations of budget resources for this work. However, if they are convinced that there is a risk and their duty to protect public welfare is at stake, they are more likely to support and direct resources to help.

3) Elected officials are influenced sometimes by political campaign donations from businesses whose interests serve visitors. Sometimes elected officials choose to accept the position of a donor over what the science says about the risk. Enough said… it's a political challenge that vexes emergency management often.

Successful efforts for conducting tsunami education and outreach have been done. For example, when a new tsunami map is created for a seaside community in Oregon, state and local technical professionals reach out to community leaders, including elected officials, and brief them first about the new map and what it means to the community. Following that, presentations for the public are held and often elected officials attend and sometimes emcee or speak at the event. That adds credibility to the purpose and content.

Audiences: Non-profit and NGOs who engage the public through services they provide

Non-profit organizations, such as local chapters of the American Red Cross, frequently engage in providing disaster preparedness information through direct distribution of educational materials, as

well as conducting presentations, staffing exhibits, and door-to-door visits. Most of this work is done by volunteers, who come into this activity in their own right as an experienced professional from past or present work that they do. Many volunteers are knowledgeable and well educated about natural hazards, but like emergency managers, are not as knowledgeable about tsunamis as they are with other events that happen more frequently.

Community Emergency Response Teams (CERT, a part of the national Citizen Corps movement) have been established in almost 4,000 communities nationwide.

Many organizers of CERT programs have had trouble finding activities to keep volunteers engaged during “down time” – i.e., between disaster responses. Proactive and national award-winning CERT leaders have trained their respective CERT volunteers to conduct public education and outreach quite successfully. CERT should be considered a resource to serve as the “arms and legs” of a proactive public education activity for tsunami outreach. A ping to a CERT listserv, however, has not resulted in anyone self-identifying as having their CERT members do tsunami outreach, but 49 responses have indicated that they have CERT members do earthquake education, so tsunami education is not a far stretch. This is an opportunity yet to be developed.

III. Tsunami Education and Outreach Activities

Tsunami Public Outreach: Print

There are a number of print publications related to building awareness of tsunamis, as well as information on the science, warnings, and actions to take when a tsunami may happen. Some of these publications have been around for many years, while most have been developed, printed, and distributed within the last four years.

Most tsunami-specific print publications are locally-produced, using grant funds from NTHMP and other sources. Further, most of these publications are localized to serve the audience(s) for whom the piece was prepared. Doing so is concurrent with social science research, because it is well documented that people will respond to names and images of places that they recognize.

There are two major problems with print materials: cost and usage. High quality four-color materials (brochures, maps, coloring books, posters) cost a lot of money to print and to ship. Thus, quantities are usually limited. As for usage, a lot of research has been done

(reference) that regretfully reinforces the fact that people will be nice and accept a print piece, but seldom will actually read it or follow recommended actions contained therein. Further, in times of stress or emergency, no one will run back to find a printed brochure that tells them what to do. Thus, printed materials that provide emergency public information (EPI Action) are not useful, yet remain plentiful.

The primary purpose of print materials is for awareness-raising, defining the threat, explaining science, and helping to develop a better overall understanding of the problem.

Of the 105 print materials reviewed during this exercise, most seem to be trying to do all things for all audiences – raise awareness, urge preparedness, call to action for response when a tsunami happens, and even to urge further dissemination. This practice of “multi-audience multi-call recommendations” will be considered when the overall Tsunami Outreach and Education Plan is developed.

Tsunami Public Outreach -- Static Websites

There are hundreds of web pages on dozens of websites that provide some form of tsunami-related outreach and education. All of the federal-level NTHMP partners have multiple webpages with this content. Most states and many localities have tsunami-specific or tsunami-related content on one or more of their respective website pages. A catalog of static webpages related to tsunamis is here.

Some websites sponsored by federal agencies and states link to each other and some do not. However, it will not be the subject of this paper to discuss the pros and cons of such activities. Those discussing the content of the “tsunami portal” are addressing this issue. It is only an observation that this practice is occurring.

The difficulty of static websites is two-fold: maintenance and accuracy (or reliability). People put information up on websites regularly, but how often do they go back to read it a month, six months, or a year later to determine if the information on it is timely, accurate, and current?

Throughout the research phase of this task, literally hundreds and hundreds of web pages were reviewed. Many of the pages were two to ten years old.

Some of the pages were “evergreen” while some had dates promoting meetings or workshops that occurred months and years ago.

The problem is that the main driver of people to static web pages is search engines. Recent research by Google pointed out that 95% of web page viewers all got there by doing a search – not by typing in a URL directly into a browser.

Since creators of web pages cannot control how search engines will find them or rank them, we have no control over what anyone may find. Almost every search is different. Further, Google points out that for disaster preparedness, people will select the first three to five pages that come up in rankings, regardless of the provider of the content. While it is the full intent that Government providers of information (federal, state, local) wish to think that their information is “best,” that is not how people judge what to read and what to use.

This report is not suggesting to stop developing static web pages. However, to optimize SEO (search engine optimization), it is important to keep the page fresh, and to encourage others to link to it. Part of the SEO process causes pages to rank higher that are linked by other pages on the net.

The more links, the higher the ranking.

And woe be to users of certain content management systems (CMS). Some CMS systems do not work well with SEO and cause pages not to be found or not ranked high when searches are done. Thus, fewer people actually see the pages, read the content, and view the images.

Public Outreach – Social Media and Dynamic Internet-based Communications

Like it or not, social media such as Facebook is here to stay. While a lot of information on social media is fleeting, there are a lot of people who use social media every day, for hours each day. Dynamic internet-based communication is a fancy way of describing texting, Instant Messaging, Email, and similar systems. People send messages to each other all the time, and more are doing that through dynamic internet processes these days than by older methods such as regular email and telephone.

A well-developed social media plan will have a core of messaging from which to select so when attention is raised (such as a big earthquake), then messages can be distributed in a proactive manner as a reactive response.

The concept of having tools-at-the-ready to harness the strengths of social networking was recommended by many interviewees, but none have, as yet, developed the core of messages and a response plan to do it. This issue must also be addressed in the overall Tsunami Education and Outreach Plan.

Tsunami Public Outreach – "Town Hall" Meetings and Public Presentations

The TsunamiReady Program states in its requirements, “Conduct or sponsor Tsunami awareness programs.” While this requirement is general in nature, it has been carried out in many TsunamiReady communities through “Town Hall” meetings or other public presentations.

When well-promoted and especially when tied to a current event (such as a recent tsunami warning, distant earthquake that could have produced a tsunami, or even something like the release of an updated tsunami map), the event is usually well-attended. What makes these meetings successful is keeping the topic focused on one specific issue, having local representatives lead the presentation and discussion, having local elected officials involved as well, keeping it short, and providing opportunity for discussion and dialogue.

Unfortunately, many public presentations about disaster-related topics tend to be generalized and cover multiple hazards at the same time. They also tend to be perceived sometimes by the public (like it or not) as the “chicken little” syndrome, with officials claiming “much ado about nothing.”

These public perceptions are tied to one of the most vexing issues of disaster preparedness: denial. We must remember that denial is not a river in Egypt; it is a state of mind.

There is evidence of a lack of success in holding public presentations when they are longer than one hour and cover multiple topics. Specifically, the four-hour “Are You Ready?” workshop has not been successful anywhere. When held, it attracts the “disaster junkies” who already know this stuff and are prepared. It does not reach those at greatest risk and in need of information – because those are the people floating on that river of denial.

Through discussions with many interviewees while preparing this report, it was strongly recommended that the NTHMP Education Plan include a “train-the-trainer” component with a specific implementation plan to conduct it so more local “Tsunami Education Champions” can be developed and give them tools to be successful with tsunami education and outreach activities.

Tsunami Public Outreach – commercial and public media (television, radio, newspapers)

Public media coverage for tsunamis usually occurs at two times: 1) when a tsunami warning has been issued (or when a local tsunami happens), and 2) at specific times such as tsunami anniversary recognition (Hilo, Anchorage, etc.)

When a tsunami makes the news, reporters scramble for information and often cite sources that they find on the internet (right or wrong.) That is why it is so important to keep webpages updated (see previous statement on this topic.) You never know when a search engine with land a generalist

reporter assigned-for-the-moment to cover a tsunami. The reporter, who wants to report accurately, will hit her or his computer and do a search and land on who-knows-where and quote who-knows-what.

Reporters, like the public, will “shop around” for information on the internet and will not necessarily accept information as the gospel truth even if it comes from a government source. They like to hear what critics say or those who provide alternative points of view, and sometimes quote them (vexing tsunami professionals once again).

But it is not all bad. When the earthquake off the coast of Chile that happened in February, 2010, occurred and caused a tsunami which resulted in a warning for Hawaii, the news coverage in Hawaii was swift and thorough. For the most part, the coverage was accurate. Tsunami experts and professionals in Hawaii had already developed relationships with the media serving their state and media representatives knew whom to contact and where to look for information.

That cannot be said for reporters from other parts of the United States. A “Google News” search about that event resulted in over 3,000 articles in newspapers across the globe. More than half of 100 on-line articles had some inaccurate information and even a few had woefully awful content, such as references to “the tidal wave that didn't strike Honolulu.”

What has shown to be successful in having accurate news coverage of actual tsunami events is having established relationships with the reporters so they know whom to contact – and also being available immediately when they call as they often are on deadline. If they can't reach you, they will call someone else and keep calling until they reach someone who will speak with them, whether the person is knowledgeable or not.

For pre-event or preparedness tsunami education, there is little media attention with one exception: Malika Dudley, reporter for Hawaii News Now (KGMB, KHNL), who happens to be the daughter of Dr. Walter Dudley, a renowned tsunami expert. Malika Dudley has produced a number of tsunami-related segments for broadcast television as well as public service announcements. These video segments are clear, accurate, precise, to-the-point, and excellently produced. She continues to do great work and has benefited many with her service.

Tsunami Public Outreach – Telephone Directory Inserts

One example of public outreach suggested for meet TsunamiReady requirements is to have tsunami maps and educational information printed as an insert into telephone directories. Some localities have done this, such as Honolulu, Hawaii.

Prior to the widespread use of the internet and cell phones, telephone directories were considered a superb resource in each household for information not only about local offices and people to call, but also to provide disaster preparedness information. Unfortunately, that is not the case today.

According to internal research from Verizon, one of the country's leading telephone service providers, they are considering dropping the production of telephone directories at all. Their research indicates that less than 2% of the households that receive the directories actually use them. If less than 2% of households use a telephone directory, even fewer will refer to it for disaster preparedness information.

In the opinion of many interviewees as well as this author, printing information in telephone directories is a diversion of resources of time and money that can be better used elsewhere. That is

not to say that if a printer of telephone directories is willing to print information on a pro-bono basis that the practice should be stopped. But resources to develop maps and content for inclusion in telephone directories could be better applied to other outlets if a local telephone directory provider is not interested (or hasn't been approached.)

Update: in March, 2011, the Federal Communications Commission issued a ruling that allows states to require telephone companies to ask subscribers to “opt in” to receive a printed telephone directory, instead of the default of everyone receiving one whether they want it or not. FCC data showed that 95% of the public no longer refers to a printed telephone directory, and does not keep one when received (they discard or recycle it). Therefore, this is another indication that spending a lot of time negotiating with phone companies to place tsunami information in telephone directories may not have much return on the investment, because people will not have printed telephone directories to refer to.

Tsunami Public Outreach – Video

Video these days is widely available through internet streaming methods. Right or wrong, short or long, accurate or totally fallacious, there is a lot of video out there about tsunamis.

Most tsunami-related video can be found on YouTube. One of the best examples is an animated video developed by San Diego County, California, titled, "Tsunamis: Know What To Do." This grant-funded 8-minute video was produced and uploaded onto YouTube in 2009. It has been very well received by the tsunami community. Its target is elementary-school aged children. As of February 18, 2011, it had been viewed via YouTube 22,600 times. It has been shown via DVD and other presentation media in schools throughout coastal California and other states, as well.

There are several other high-quality, professionally-produced videos about tsunamis as well. Visit the websites of the State of Washington EMD or Puerto Rico Seismic Network, for example, and you will see streaming videos that provide information about the tsunami threat to the respective states/territories. These videos are very well done. No data is available on how many people have seen them or in what other manner the videos have been disseminated.

It is interesting and not surprising that real-time video taken of various tsunami events when waves are rolling in and which are available on YouTube have had hundreds of thousands of viewers. The large viewership is due to two reasons: 1) people love “reality” TV; and 2) the video has been available on YouTube for a long time, so viewership accumulates over years.

Video-based Public Service Announcements have also been created and some are available for viewing or downloading from various websites (States of Hawaii and Alaska, APTWC, PTWC, and others). Most PSAs are short and to-the-point and are focused on tsunami awareness. Some give information about safety actions. It remains debatable that a video PSA and its specific recommendations for safety will be remembered when someone is faced with imminent danger. PSAs are best used to raise awareness and for public education purposes, such as for science classes in school.

There is a dearth of good-quality, accurate, tsunami-related video. What a few interviewees stated would be helpful is to have “B-roll” and tsunami animation made available to them to support creation of a video that has local content targeted to specific states, counties, or communities.

Tsunami Public Education – School-based Lessons and Curriculum

TsunamiReady Guidelines -- reference

• Encourage the inclusion of Tsunami information in primary and secondary school curriculums. NWS will help identify curriculum support material. • Provide an opportunity biennially for a Tsunami awareness presentation by the local NWS office and/or the local Emergency Manager. • Schools within the defined hazard zone must have Tsunami evacuation drills at least biennially. • Written safety material should be provided to all staff and students. • Have an earthquake plan.

Requirements for the TsunamiReady Program specifically address school-based tsunami education as shown above.

There are numerous challenges to introduce tsunami information into school-based courses of study. The primary barrier is that teachers are required by their respective states and school districts to adhere to a well-established set of standards of education. Teaching anything that is not contained in the standards is considered “adding more to an already overburdened plate” and teachers as well as school administrators will strongly resist it. You will hear them say, “your concern is important, but so are the concerns of a thousand other issues that we're asked to address every day!” Further, states must ensure compliance with the No Child Left Behind Act (P.L. 107-110) which specifically requires that teachers teach only the content found in a state's standards of education – and nothing else.

When, however, lesson plans are designed to help teachers achieve their respective state's standards of education – by helping them to teach science and mathematics, for example – then it will be easier to introduce tsunami education into U.S. classrooms because it overcomes the fundamental barrier to having a teacher use it for reasons described above.

Through this Assessment process, the work of the Alaska Tsunami Education Program (ATEP) at the Geophysical Institute of the University of Alaska came to light. ATEP has developed thorough, K-12, standards-based curriculum materials and lesson plans that have any teaching objectives aligned with Alaska state standards of education. These materials are outstanding. Replication of this process for use in other states is strongly recommended.

One interviewee for this Assessment is developing standards-based lesson plans for the Puerto Rico Seismic Network (PRSN), based at the University of Puerto Rico in Mayaguez. These lesson plans are under development.

Many interviewees for this report requested that standards-based and standards-aligned lesson plans be developed that will help include information about tsunamis into the everyday curriculum in schools. This is easier said than done, but there are two superb models out there to consider: the American Red Cross Masters of Disaster® curriculum and the National Fire Protection Association Risk Watch® set excellent examples to follow. Each have received national awards from respectable educational organizations for the standards-based design and quality of content.

Regarding other TsunamiReady education recommendations, it is fine to have a tsunami awareness presentation made biennially in schools, and that sometimes works and sometimes doesn't, depending on a number of factors that have more to do with administrative scheduling issues and also with perception of risk by gatekeepers (the controllers of the schedule for school assemblies.)

However, it is well recognized that an outside speaker is good for raising initial awareness, but his or her message is quickly forgotten.

Another issue that came up during discussions with interviewees is the perception that giving a printed piece to a child in school results in the child bringing it home and the parents reading it. This is not true, and has not been true for decades. While there are a few exceptions – most notably children who bring home a fire safety practice exercise for the family to complete – seldom do printed materials distributed in school that do not require interaction with them (writing, completing, coloring, cutting apart, building, etc.) result in anything being done other than contributing to more recycling at some point in time.

Tsunami Signage

The description of how signage has worked well for tsunami education and outreach has been described already in this report. Please see "Audiences – Service Industry for Visitors".

To summarize, signs that are in color, are designed for outdoor display, are durable, and that include maps and specific local information, are considered most useful. Signs that simply say, "Tsunami Hazard Zone" are least useful because they provide the least information, other than to introduce that the area has a risk of tsunami strike (sometime, somewhere.)

Tsunami Outreach -- Drills and Exercises

The TsunamiReady Program requirements suggest conducting drills and exercises to test tsunami response plans, including sirens and other warning systems. In order for such drills to be successful, public education and outreach must occur long in advance so that people understand what they will hear and what to do.

California has conducted a three-county "live code" tsunami drill for several years with great success. (This drill was canceled for March 23, 2011, in light of the real warnings and sirens sounding on March 11). Further, tsunami siren drills have also been conducted on the West Coast of Puerto Rico. Well before the drills, local officials and volunteers disseminate information through all forms of media, schools, and public places of assembly to explain what is planned and what to do. Many people participate in the actual exercise by evacuating their home, school, or business and practicing where to go.

The same has been done in limited areas of seaside communities in Oregon, Washington, and Hawaii.

Social science confirms that people will respond appropriately to a warning if they have practiced that response through guided direction at non-stressful, non-emergency times.

Several interviewees recommended further expansion of holding such drills and exercises in the future.

Tsunami Outreach: Training for Professionals (emergency management, law enforcement, fire & EMS, and other first responders)

Training the professional response community on the science of the tsunami hazard, and providing

specific information about how warnings are conveyed and what to do and where to go is helpful and important for this community. Most states that have a history of tsunami events offer workshops or training courses on a regular basis for this community. Further, the Tsunami Awareness Course (AWR-217) developed at the University of Hawaii's National Disaster Preparedness Training Center (reference) was specifically designed for this audience. The difficulty with it is its availability, as it is offered in person and not on-line (yet).

The West Coast/Alaska Tsunami Warning Center has offered week-long courses (primarily for WCMs but others in tsunami-responsible positions have attended) that provide intense and thorough education about tsunami matters from their science and history to causation to warnings, and much more.

These courses are oversubscribed each year. Two of these week-long courses have been offered each year – one of them focused on the East Coast, and one of them focused on the West Coast.

COMET, an independent educational arm of the University Corporation for Atmospheric Research (UCAR), has developed two courses available on-line that benefit the professional community: “Tsunami Science” explains the science behind tsunami generation, propagation, and inundation and “Tsunami Warning System” describes the processes involved in anticipating, detecting, and warning for a tsunami by summarizing data collection, modeling, analysis, and alert procedures used at NOAA's Tsunami Warning Centers.

More tsunami-specific modules are under development by COMET for release in 2011.

Some interviewees stated a need or desire for additional training courses related to tsunami plan preparation and how to incorporate such plans with existing federally- and state-required disaster response plans.

Tsunami Outreach: Support of Voluntary Organizations and Interested Groups

One of the most difficult challenges with public education and outreach is having enough time and people to do it. When the task is held close, then not as much can be done simply for lack of time to do it by any one person. By entrusting public education and outreach to be done collaboratively by supporting organizations, then it reaches far more people more quickly.

Voluntary organizations that have been involved in tsunami education include local chapters of the American Red Cross. In some areas, Community Emergency Response Teams (CERT) may also be involved – but descriptions of involvement for this report only stated that CERT members handed out printed literature at events and county fairs.

These groups – voluntary (not “volunteer”) organizations can be very helpful in conducting tsunami outreach and education if asked and if given support and training to do so.

For more information, see the section on ”Audiences—Non-Profit and NGOs“.

Tsunami Outreach: Advocacy and Education for Elected Officials

Elected officials are both a target to receive tsunami education and outreach, as well as a desired participant in sharing it with their respective constituents.

The matter of reaching and involving elected officials was discussed in the section titled "Audiences – State and Local Elected Officials."

IV. Related Tsunami Education and Outreach Activities

Topics Related to Tsunamis: Earthquakes

Tsunamis are not isolated events. In the U.S., most tsunamis that have caused deaths have occurred as a result of subduction zone earthquakes. (A few have occurred from a local undersea landslide, which resulted in few deaths. Earthquakes remain the highest concern.)

Earthquake education activities have been ongoing in the United States for many years, particularly in states where earthquakes happen with frequency.

When tsunamis – or the possibility of tsunamis – are included in earthquake education activities, it helps for these reasons:

1) It provides context to the threat, so that people understand that tsunamis are not isolated events, but are caused by an external force – most often an earthquake. 2) It carries the message at a time when otherwise it may not be carried, so some audiences benefit because they haven't heard about it before. 3) It helps to address confusion between safety messaging. For an earthquake, one is supposed to "drop, cover, and hold on" while for a tsunami, one is supposed to move in the general direction of "up and away." It is not possible to do both safety actions simultaneously, so having someone explain when to do each action – in sequence – is important.

It is strongly recommended by many interviewees for this report to integrate tsunami education into earthquake education activities where it is not already being conducted. Further, development of a simple (but not pedantic) explanation of the differences between a potential tsunami-causing subduction zone fault vis-à-vis a strike/slip fault that does not produce tsunamis would be helpful.

Topics Related (by the public) to Tsunamis: Hurricane (surge)

On the East Coast, one of the most frequent destructive threat from a natural hazard is a tropical storm or hurricane. For many years, residents and visitors of seaside communities and beaches have been educated about storm surge evacuation zones. Many telephone directories in Gulf Coast and some states in the Southeast have maps of evacuation zones printed in them.

East Coast interviewees for this report indicated that their concern is that the public has been so frequently reminded about surge zones that they believe that a hurricane surge zone is the same thing as a tsunami inundation zone, and therefore they react or respond in the same way. There is little (if any) understanding that a tsunami is a series of waves where the entire ocean is moving – rather than a wall of water pushed ahead of a storm by winds.

For tsunami education and outreach to work on the East Coast, it must be uncoupled from the hurricane threat. While that is possible, it will only be successful by being able to explain specific information that describes where and how a tsunami may strike East coast states.

For purposes of the National Tsunami Education Plan of the NTHMP, efforts to decouple hurricane surge from tsunami education is important, but not of great urgency considering that much more

research is required to fully understand the threat.

Other hazards that the public relates to tsunamis

Through all of the interviews that composed information for this report, there were no other related activities identified, such as for threats of undersea landslide. Some professionals question how large a tsunami could be generated from a nearby undersea landslide, though there is evidence of that occurring in Alaska and Puerto Rico. No other natural hazards were mentioned, though the literature and research suggests that a meteor of sufficient size could generate a tsunami – though discussion of same is best left for dramatic movies.

V. Messaging

Information about tsunamis varies by locality, but is fairly consistent within each state. Tsunami preparedness advocates in states that have had tsunami events on their respective coastlines (HI, AK, CA, OR, WA – the five original members of the NTHMP) provide local history with descriptive information.

The science of tsunamigenesis is evolving, and as such, it is hard to explain the exact circumstances that will cause a tsunami to happen. Not all earthquakes that occur undersea or near a coastline produce tsunamis. Sometimes tsunamis are generated, but are smaller than the public expected (e.g., tsunami striking Hawaii after the February, 2010, 8.8Mw earthquake in Chile).

There is ongoing conflict of the degree of safety actions (e.g. evacuation) with its related messaging when a tsunami Information Statement, Advisory, Watch, or Warning is issued based only on the magnitude of the earthquake that triggers it.

“Survivor Stories” is an interesting method of sharing folklore and blending it with safety messaging. This has been done particularly well on the island of Hawaii and in Hilo, in particular, at the Pacific Tsunami Museum. It has also been done successfully in American Samoa after the 2009 tsunami. Native American storytelling is both an art and a method of ongoing communication, and survivor stories have also been done to some extend in tribal areas in Alaska, Washington, and Oregon.

Safety messaging is less consistent from locality to locality and from state to state.

Safety messaging breaks down into these categories:

1) Recognition of a life threatening situation

People will not respond until they feel that they or their loved-ones are threatened. Safety messaging explains what those threats look (and feel) like.

Terms such as “nature's warning” help, but there is not uniform consensus on what “nature's warnings” are. It is also difficult to explain that some tsunamis wrap around islands and therefore do not cause recession of seawater prior to the first wave striking.

2) Counterintuitivism

People will do what they feel they need to do, even if it is not the correct thing to do when faced with an urgent life-threatening situation. For example, there are many instances where people run out of a

building during the shaking of an earthquake because it is innate human nature to flee when in fear for one's life.

The same applies to tsunamis. It is counterintuitive to run up hill or to high floors of tall buildings when the seawater is flowing away from you, because you do not realize that in very little time, water will be rushing toward you faster than you can run away from it. (This applies in the case of a tsunami that is preceded by seawater recession – see point #1 above.

What Mileti and many others involved in social science have taught us for many years is that the best way to teach someone to do something that is counterintuitive is to conduct drills, exercises, and practice sessions. Repeatedly. Over and over again. In different situations and contexts.

With loved-ones. At the office. At home. At school. All-of-the-above.

3) Protective Behaviors

Research clearly shows that people first react to protect the lives of those they love, even if it puts them in greater danger. People will run back into a burning building to save a family member or a pet; people will run barefooted across broken glass to get to a child's bedroom when the earth shakes.

For tsunami, people will run toward a beach if they think they can save the life of a loved-one. You can preach until you are blue in the face not to do that, but your advice will fall on deaf ears.

The best way to deal with this is to educate the entire family unit, not just one member thinking that all will benefit from it.

4) Curiosity

Tsunamis are an interesting phenomenon due to their rarity and how they make the sea behave. For tsunamis that involve seawater recession before the waves reach shore, people who have no experience or knowledge about the hazard will be attracted to the sea floor that they otherwise have not seen before.

For purposes of tsunami safety messaging, the phenomenon of curiosity must be addressed. Fortunately, in most existing tsunami education materials, it already is.

5) Warning

The process of warning the public is complex and is deserving of a treatise of its own. In fact, many such treatae have been written by people much smarter than the author of this paper.

The point is that people not only have to receive a warning, they have to understand what it means. Simply hearing a siren on a beach does not necessarily cause an immediate evacuation of a beach – especially by visitors who are unfamiliar with the area and who have not been involved in tsunami siren drills. If verbal announcements are made between the sound of a siren, the announcements must be: a) in the local language (for example, announcements in English on a siren in Western Puerto Rico are not useful, since most residents of the area do not understand English.) b) directive and specific, rather than using a term that must be interpreted. For example, “clear the beach immediately. Follow tsunami evacuation routes to safety” is much better than “a tsunami advisory has been issued by the National Weather Service.”

6) Verification

The problem with tsunami warnings is that they are issued long before anyone can observe physical changes to the sea or their environment. Most people hesitate, or wait to confirm, a warning that they receive.

The process of verification (or sometimes called “confirmation”) is at a minimum, annoying to local officials, and at worst, the cause of people choosing to delay getting away from the path of danger.

We must recognize that people will verify their danger before taking action. They may call a friend on the phone, ask a neighbor, or even call 9-1-1.

Public education and outreach must address the verification process and explain that if people really must verify, how they can do that without overwhelming local resources and delaying evacuation unnecessarily.

7) Action

Okay, so one recognizes that something bad is going to happen – a tsunami is on its way. Your warning may be feeling an earthquake, or by hearing a siren, getting a text message, an announcement on radio or TV, etc.

Now what to do?

During interviews for this paper, we discovered some differences in recommendations about safety actions to take. Generally, “go up and away” was recommended, but it gets dicey when trying to define where “up” is (tall building/what floor? Hill? Inland/how far? On and on….)

There are many other safety actions that are included in tsunami education materials. Some of them are redundant, some are unspecific or imprecise, and some are easily confused by non-scientists.

Much more work needs to be done to review the various safety action messages and achieve concurrence on what they should say, including whether the messages should be adjusted based on several factors: 1) near-field or distant earthquake; 2) location of the person relative to the sea; 3) differences in culture and methods of receiving information; 4) physical location of the threatened area; and more.

It is recommended that the National Tsunami Education Plan more fully develop the entire process related to tsunami messaging described in this section of this report, and that we consider offering workshops and/or training courses on how to best craft messages that range from awareness-raising to action-taking that will encourage the best response from all persons at risk and in all areas of the United States.

VI. Tsunami Assessment: Summary of Observations

Good work on tsunami education and outreach is being done in many parts of the United States. The most successful efforts involve local champions who tailor their messages to reach their audience's information needs based on level of understanding of the threat as well as culture.

There are a number of variances in what is considered “tsunami education and outreach.” There are variances in tsunami safety messaging. There are variances in understanding the tsunami threat based on experiences with other natural hazards that people have learned about.

There are a number of recommendations for consideration of items and actions to include in the

National Tsunami Education Plan for the NTHMP. Some of these have been listed in this report and others are yet to be developed.

Standards of practice for disaster education as recommended by the Social Science Community have been followed, mostly intuitively, by many communities and states that engage in educating audiences about tsunamis. The localization and adaptation of outreach activities and content is commendable and encouraged to continue. There need not be a “top down” approach to impose standardized tsunami education and outreach, but instead, a demonstration of leadership in sharing what is known – the science of the hazard, the social science of approaches to public outreach and education, successful practices that can be adopted and adapted, and methods of evaluating the impact of such efforts.

The National Tsunami Education Plan will flow from this report. It will include recommendations for approaches to refine and develop effective methods, procedures, and practices for tsunami outreach and education. There is a demand, sometimes strongly requested, for training and instruction on how to apply social science research to improve tsunami outreach and education. There are needs to learn how to engage targeted, high-risk audiences as well as how to involve elected officials, business owners and operators, and others.

Tsunami education and outreach has yet to achieve broader inclusion among education activities for other natural hazards … but it doesn't have to be that way. Teamwork with passionate professionals can make this happen through a collaborative, engaged process.

Tsunami Assessment Interviewee List

Interviewees (P – In Person, T – Telephone, E – Email)

Atwater, Brian: Geologist, University of Washington, Seattle, WA (P)
Barton, Elizabeth: Natural Hazards Planner, Augusta, ME (P)
Benthian, Mark: Director of Communication, Education, and Outreach, Southern California Earthquake Center, University of Southern California, Los Angeles, CA (T)
Buehner, Ted: Warning Coordination Meteorologist, NWS, Seattle, WA (P)
Burtness, Larry: Historian and Planner, Quileute Nation, LaPush, WA (P)
Champlin, Gregg: Natural Hazards Program Specialist, Concord, NH (T)
Charvat, Steve: Secretary, International Association of Emergency Managers and Emergency Manager, University of Washington, Seattle, WA (P) (P)
Crawford, George: (retired) Earthquake Program Manager, WA (P)
Diaz, Walter: Professor, University of Puerto Rico, Mayaguez, PR (P)
Dombrowsky, Rainer: Emergency Management Planner, Maryland Emergency Management Agency, Reisterstown, MD (P)
Dreher, Tammy: Earthquake Program Manager, West Columbia, SC (T)
Dudley, Walt: Professor, University of Hawaii at Hilo, Hilo, HI (T)
Fryer, Gerald: Geophysicist and Outreach Coordinator, Pacific Tsunami Warning Center, Ewa Beach, HI (T)
Goltz, Jim: Earthquake and Tsunami Program Manager, California Emergency Management Agency, Sacramento, CA (T, P)
González, Wildaomaris: Puerto Rico Seismic Network, Mayaguez, PR (P)
Gross, Lyn: Director, Emergency Services Coordinating Agency, Lynnwood, WA (P)
Hoskin, Kristin: International Association of Emergency Managers International Representative and Emergency Manager, Christchurch, New Zealand (E)

Johnston, Jeanne: Tsunami Survivor Story collector extraordinaire (P, E)
Jones, Lucy: Chief Scientist, CalTech, Pasadena, CA (P)
Jones, Ana-Marie: Director, Collaborating Agencies Responding to Disaster, Oakland, CA (T)
Kong, Laura: Director, International Tsunami Information Center, Honolulu, HI (P)
Linterman, Penny: Hazards Planner, Clallam County, Port Angeles, WA (P)
Long, Kate: Earthquake and Tsunami Program Specialist, California Emergency Management Agency, Sacramento, CA (T)
Mileti, Dennis: (retired) (former) Director Natural Hazards Center and Professor Emeritus of Sociology, University of Colorado, Boulder, CO (T, E)
Miller, Kevin: Earthquake and Tsunami Program, California Geological Survey, Oakland, CA (T)
Mojica, Rafael: Warning Coordination Meteorologist, San Juan, Puerto Rico (T)
Peach, Bill: Emergency Preparedness Coordinator, Quileute Nation, LaPush, WA (P)
Petty, Erv: Tsunami Program Manager, Alaska Emergency Management Agency, Anchorage, AK (P)
Preller, Cindi: Tsunami Outreach Coordinator, West Coast and Alaska Tsunami Warning Center, Palmer, AK (T, E)
Pridmore, Cindy: Earthquake and Tsunami Program, California Geological Survey, Sacramento, CA (T)
Richards, Kevin: Earthquake and Tsunami Program Manager, Hawaii Civil Defense Agency, Honolulu, HI (P, T)
Rizzo, Althea: Earthquake and Tsunami Program Manager, Oregon Emergency Management Agency, Portland, OR (P, T)
Schelling, John: State of Washington Emergency Management, Camp Murray, WA (P)
Shepherd, Keri: Planner, Quileute Nation, LaPush, WA (P)
Summers, Dan: Director, Collier County Emergency Services, Naples, FL (P)
Theobald, Joe: Director Emergency Services, Ocean City, MD (T)
von Hillebrandt-Andrade, Christa: Director, Puerto Rico Seismic Network, Mayaguez, PR (P, T)
Walker, Hui-Shan: First Vice President, International Association of Emergency Managers, Norfolk, VA (P)
Walsh, Chris: Hurricane Planner, Georgia Emergency Management Agency, Atlanta, GA (P)
Walsh, Tim: State Geologist, Department of Natural Resources, Olympia, WA (P, T)
Wilde, Tyree: Warning Coordination Meteorologist, NWS, Portland, OR (P)
Williams, Charles: Preparedness Division Chief, Alabama Emergency Management Agency, Clanton, AL (P, T)
Wilson, Rick: Engineering Geologist, California Geological Survey, Sacramento, CA (P, T)
Witter, Rob: Regional Coastal Geologist, Oregon Department of Geology and Mineral Industries, Newport, OR (P)

States (15):

AK, AL, CA, FL, GA, HI, MD, ME, NH, OR, PR, SC, VA, WA

Plus Tribal, Territorial, and International locations

Disclaimer

Disclaimer: this report represents the opinions of the interviewees and professional recommendations of the author, and does not necessarily reflect official positions of the National Weather Service, Integrated Systems Solutions, Inc., or any other agency, organization, or company.

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