MITIGATION DIRECTORATE

National Tsunami Hazard Mitigation Program

PREPARING FOR TSUNAMI HAZARDS

The National Tsunami Hazard Mitigation Program (NTHMP) is a Federal and State program designed to protect people and reduce property losses in the event of a tsunami. Led by the National Oceanic and Atmospheric Administration (NOAA), the NTHMP consists of other primary participants, including the Federal Emergency Management Agency (FEMA), the U.S. Geological Survey (USGS), the National Science Foundation (NSF), and State emergency management and geoscience agencies from Alaska, California, Hawaii, Oregon, and Washington. This program is currently expanding to include 17 new coastal U.S. States, Territories, and Commonwealths at some level of risk to tsunamis along the Atlantic and the Gulf of Mexico, and elsewhere in the Pacific Ocean.

FEMA SUPPORT FOR STATE AND LOCAL AGENCIES

Every coastal community in the United States is potentially at risk of a tsunami, although they most frequently occur in the West Coast States, Alaska, Hawaii, and the Caribbean territories. The most likely severe and extensive tsunami impacts are along the Cascadia, Aleutian, and Caribbean Subduction Zones. Hawaii is in the unique and historic position of being directly in line with several Pacific Ocean Subduction Zones, as well as being at risk from its own seismic sources. FEMA's role in the NTHMP is to assist State and local agencies in developing tsunami preparedness, mitigation, and response capabilities. FEMA's activities include the following:

- **Mitigation Subcommittee Chair** – Members of the Subcommittee include State emergency management and geoscience agencies and the warning coordinating meteorologists. FEMA coordinates the mitigation and outreach activities of the subcommittee by overseeing and tracking the goals and objectives of the Strategic Implementation Plan for Tsunami Mitigation Projects and updating the Mitigation Activities Matrix. This is necessary to maintain focus on mitigation priorities, avoid duplication, and assess effectiveness of products through time. FEMA also advocates and assists with multi-state projects and activities where appropriate in scope. The products and activities include assisting at-risk communities to become "Tsunami Resilient Communities."
- **Training** – FEMA's training programs for emergency managers address issues such as planning, community warning, evacuation, and public awareness. These are important elements in addressing tsunami risk.

THE TSUNAMI HAZARD

A tsunami is a series of pressure waves caused by a sudden shift in the ocean floor. Such shifts are usually caused by earthquakes, but they can also be caused by undersea landslides or slumps, volcanoes, or even meteor impacts.

In deep ocean waters, the waves can travel hundreds of miles an hour with little surface indication. However, as the waves approach land, shallow waters cause them to build up, sometimes to significant heights.

The massive Indian Ocean tsunami caused by an earthquake in Sumatra in December 2004 had reports of tsunami wave heights as high as 60 feet. More than 300,000 people were killed across Sri Lanka, India, Indonesia, Thailand, Burma, and Malaysia.

- **Technical assistance** – FEMA works with other Federal agencies and the States to provide technical assistance to local jurisdictions. Depending on the needs and resources of each community, this assistance ranges from guidance on evacuation planning to information on how to assess and mitigate the risk from tsunamis and other hazards.
- **Design and construction guidance** – FEMA's technical manuals provide design and construction guidance for reducing damage to coastal structures caused by flooding, much of which is applicable to tsunamis.
- **Risk assessment** – FEMA is responsible for mapping flood hazards in communities across the country. To help link flood mapping to the tsunami hazard, FEMA's National Flood Insurance Program (NFIP), NOAA, and USGS funded a pilot project in Seaside, Oregon, to develop a method for determining the probability and magnitude of tsunamis in ways compatible with FEMA's existing Flood Insurance Rate Maps (FIRMs).
- **Public education** – FEMA produces public education materials on tsunami preparedness, mitigation, and response.
- **Community Rating System (CRS) incentives** –The CRS rewards communities that do more than meet the minimum requirements of the NFIP to prevent or reduce flood losses by initiating new flood protection activities for "special" flood hazards like tsunamis. The CRS offers eight categories of tsunami credits (totaling 200 points) that can help lower insurance premiums in a community at risk to tsunamis. The categories range in topic from direct acquisition and relocation projects to zoning that may prohibit future development.

A locally generated tsunami can develop so rapidly that sometimes evacuation to high ground is not possible, especially if the triggering earthquake severely damages potential escape routes. FEMA, with funding from NOAA, is developing guidance on the design of structures that could be used for vertical evacuation, information that is especially critical for low-lying communities that lack sufficient access to high ground and may have to rely on vertical evacuation in existing buildings. The project also includes guidance on designing tsunami shelters that would be capable of withstanding both the ground shaking expected in a severe earthquake and water impact from a tsunami. This is a significant challenge since current design practice takes into account earthquake or coastal storm surge, but does not address stronger forces that a tsunami would generate.

NOAA'S MISSION: DETECTION, WARNING, AND AWARENESS

As part of NOAA's responsibility as head of the NTHMP, NOAA's National Weather Service (NWS) manages a 24-hour tsunami detection and warning system that issues tsunami warnings to government authorities and the public. The agency operates two tsunami detection and warning centers that continuously monitor data from seismological and tidal stations for the Pacific Rim:

- The West Coast and Alaska Tsunami Warning Center (WCATWC) in Palmer, Alaska, with Areas-of-Responsibility (AORs) including Alaska and the West Coast of the U.S. and Canada, the Atlantic Coast of the U.S. and Canada, and the Gulf of Mexico.
- The Richard H. Hagemeyer International Pacific Tsunami Warning Center (PTWC) in Ewa Beach, Hawaii with AORs including Hawai and countries around the Pacific Rim and Indian Ocean.

NOAA also develops monitoring technologies, uses modeling to predict tsunami inundation, and produces tsunami -inundation maps for community leaders and emergency managers. Tsunami modeling is a critical part of the Nation's tsunami warning system.

THE U.S. TSUNAMI RISK

An earthquake occurring off the coast of Washington, Oregon, or northern California poses a significant tsunami risk. An earthquake in this area – known as the Cascadia Subduction Zone – would result in a tsunami, with only few minutes of warning time being provided to the residents along the Pacific Northwest coastline.

In addition, NWS's TsunamiReady Program helps local jurisdictions develop the warning component of their tsunami preparedness programs by providing technical assistance in meeting qualifying criteria for emergency operating centers, warning systems, evacuation routes, safe areas, and drills targeting school-aged children. NWS, originally concerned primarily with Pacific coastal States, now works with State and Federal program partners in all areas of the Atlantic, Gulf, and Caribbean with some level of tsunami risk to educate the public about tsunami hazards.

THE ROLE OF OTHER FEDERAL AGENCIES IN NTHMP

In addition to the work done by FEMA and NOAA, other Federal agencies have responsibilities under the NTHMP. These program activities include:

- Monitoring of earthquakes by the USGS through a network of seismic detectors to identify tsunami wave generation.
- Funding under the NSF's Network for Earthquake Engineering Simulation (NEES) Program for basic research to learn how tsunamis impact the built environment, including funding for a tsunami wave tank at Oregon State University.

TSUNAMI RESILIENT COMMUNITIES

The NTHMP Mitigation Subcommittee developed the *Strategic Implementation Plan for Tsunami Mitigation Projects* (http://www.pmel.noaa.gov/pubs/PDF/deng2030/deng2030.pdf), which provides a framework for the development of specific tools and policies for States and local communities to become "tsunami resilient," thus reducing the impact of future tsunamis. As defined by the NTHMP Mitigation Subcommittee, a tsunami resilient community understands the nature of the tsunami hazard, has the tools it needs to mitigate the tsunami risk, disseminates information about the tsunami hazard, exchanges information with other at-risk areas, and institutionalizes planning for a tsunami disaster. Activities led and supported by the Mitigation Subcommittee to foster tsunami resilient communities are in the following areas of emphasis:

- Improving tsunami education
- Providing tools to supply guidance and support local planners and emergency managers
- Creating and strengthening links within and among States to support long-term tsunami mitigation
- Improving the mitigation science and infrastructure

FOR MORE INFORMATION

To obtain more information on the NTHMP, visit: http://nthmp.tsunami.gov.