POST-DISASTER TECHNICAL CLEARINGHOUSES: AN OPERATIONAL MODEL FOR TSUNAMIS IN HAWAII

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ABSTRACT

The Hawaii Post-Disaster Technical Clearinghouse is an initiative of the Hawaii State Civil Defense-sponsored Tsunami Technical Review Committee (TTRC) and Hawaii State Earthquake Advisory Committee (HSEAC). The technical clearinghouse is envisioned as a multi-hazard system to collect, report and store information collected immediately following a disaster such as an earthquake or a tsunami. The scientific data and damage assessment surveys are to be made electronically available to emergency officials and to field investigators. The HSEAC and TTRC will partner with the Pacific Disaster Center (PDC) to implement methods for hosting the electronic technical clearinghouse, displaying the information archived into a Geographical Information System (GIS) database, and automating the creation of reports and summaries as data are accumulated.

BACKGROUND

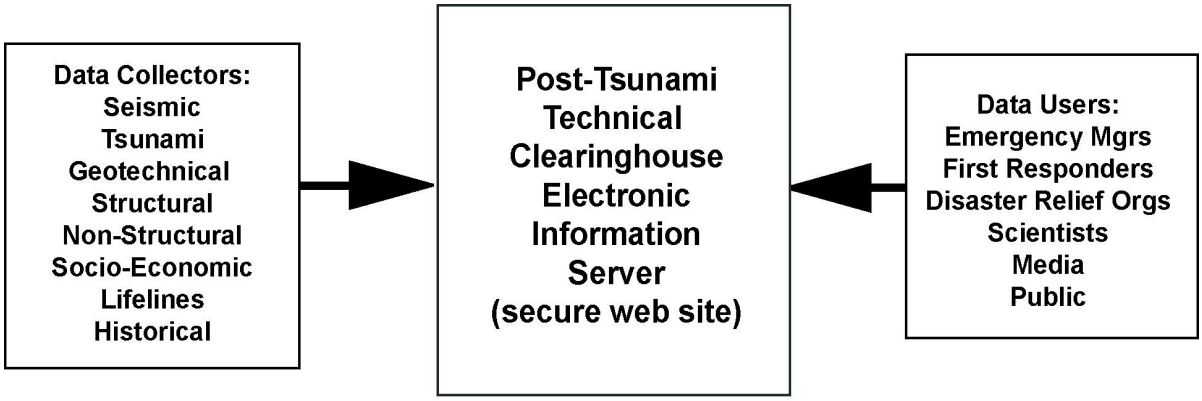
A destructive tsunami can attract a large number of local, national, and international tsunami professionals interested in investigating and documenting its scientific, economic, and social impact on affected communities. At the same tsunami scientists are wanting to collect tsunami runup and inundation data, and geologists, structural engineers, and social scientists are wanting to document the seismic effects, deformation, and structural damage, and obtain eyewitness observations from people and businesses directly affected, emergency responders and government officials must focus their highest priorities on public safety, field damage reconnaissance, and integrity evaluation of critical support lifelines and infrastructure. Without a coordination plan that is integrated into government emergency operations, perishable data collection may prove to be logistically difficult before erosion or bulldozers eliminate the evidence, and in all likelihood, could interfere and conflict with emergency responder activities.

The establishment of a Post-Disaster Tsunami Technical Clearinghouse (TTC) after a major tsunami will provide the framework for the coordination of activities, and integration of scientific and engineering investigations with the Federal Emergency Management Agency (FEMA) Disaster Field Office (DFO) and other emergency management operations. In addition, the TTC will serve as a forum for daily information sharing, and a single point-of-contact for interactions with the media and the public. The goals of the TTC, which include

both a physical site and an electronic information server, will be to assist in the response, damage assessment, and early recovery from the natural disaster without increasing the burden on emergency officials, facilitate researcher access to the affected areas, and to contribute to the capture of valuable and perishable data.

This model is based on efforts currently taking place in the United States to develop post-earthquake technical clearinghouses to integrate scientific investigations into emergency response and recovery plans (*U. S. National Earthquake Hazards Reduction Program Strategic Plan, 2001-2005; Western States Seismic Policy Council 2001 Policy Recommendation*). The efforts include Project QUAKE (http://www.wdc.ndin.net/quake.htm), being developed in parallel with the FEMA Bay Area HAZUS User Group and the California Office of Emergency Services Post Earthquake Information Clearinghouse, and a Western States Seismic Policy Council (WSSPC) Basin & Range Province Committee workshop (*http://www.wsspc.org/publicpolicy/committees/clearhouse2001.htm*) to develop an easily-adaptable clearinghouse plan based on the California Clearinghouse Plan. The University of Washington implemented one of the first online technical clearinghouses (*http://maximus.ce.washington.edu/~nisqually/*) to facilitate the collection, dissemination, and archiving of data from the February 28, 2001, Nisqually Earthquake.

HAWAII POST-DISASTER TECHNICAL CLEARINGHOUSE – TSUNAMI AND EARTHQUAKE EVENT



OPERATIONAL PLAN AND INTELLIGENCE GATHERING

The clearinghouse is intended to facilitate exchange of critical information from field investigations, and to promote its use by technical specialists and emergency managers during response and recovery from major earthquakes and tsunamis. The clearinghouse will provide a single point of contact for easy exchange of information among researchers, emergency managers, and practitioners. It will work in cooperation with the Hawaii State Civil Defense State Emergency Operations Center (EOC). It will accommodate investigators from other states and countries, and provide a contact for media to use in gathering more in-depth information on damages and their implications.

The clearinghouse will allow for a more coherent and methodical investigation of all earthquake and associated tsunami impacts, the gathering of perishable data, and the tracking of all field investigations. It will make possible the documentation of findings and

observations, and provide for a Geographic Information System capability for widespread, standardized information dissemination through the electronic clearinghouse.

The collection of perishable tsunami data (runup and inundation) should begin immediately following the event, and even before the formal Presidential Declaration of the disaster or emergency. Rapid mobilization of pre-cleared, trained teams of volunteers, as described by Hawaii State Civil Defense Tsunami Observation Plan and Field Guide for Measuring Tsunami Runups and Inundations (*Tsunami Technical Review Committee, 2002*), will increase the likelihood that perishable tsunami data can be collected before it is naturally destroyed or disrupted by emergency response activities.

MANAGEMENT

In Hawaii, the technical clearinghouse coordinators will be the State and County Tsunami Advisors. The International Tsunami Information Center (UNESCO/IOC, currently hosted by NOAA/National Weather Service/Pacific Region) can provide coordination and logistical assistance, and can act as a liaison to interface with national and international tsunami scientists seeking participation and/or information. A Steering Group composed of the technical clearinghouse coordinators, the Hawaii SCD Tsunami Program Manager, and the Pacific Disaster Center Senior Scientist, will initially guide the development and implementation of the technical clearinghouse, and conduct periodic reviews to identify improvements. The group will seek input from other members of the Hawaii earthquake and tsunami community, including the Tsunami Technical Review Committee, the Hawaii State Earthquake Advisory Committee, the Richard H. Hagemeyer Pacific Tsunami Warning Center (PTWC), the U.S. Geological Survey Hawaiian Volcano Observatory, as well as other Federal, State and County agencies with emergency response and recovery responsibilities. The electronic clearinghouse will reside and be hosted at the Pacific Disaster Center, who will be responsible for developing and maintaining its framework under the guidance of the TTC Steering Group.

Initially, the following Hawaii-based organizations that will be active in, and support the work of, the clearinghouse are:

- Hawaii State and County Civil Defense Agencies
- Hawaii State Tsunami Technical Review Committee
- Hawaii State Earthquake Advisory Committee
- State Hazard Mitigation Forum and State Multi-hazard Science Advisory Committee
- Pacific Disaster Center
- Federal Emergency Management Agency, Region IX (FEMA IX)
- International Tsunami Information Center
- University of Hawaii
- Structural Engineers Association of Hawaii (SEAOH)
- U.S. Geological Survey (USGS)
- U.S. Army Corps of Engineers, Honolulu District (USACE)
- U.S. National Weather Service, Pacific Region (NWS)

Other research institutions, professional organizations, and out-of-state agencies may take part in the clearinghouse activities; their participation will be determined by the location and the impacts of the earthquake and/or tsunami in question.

OPERATIONS

The primary tasks of the clearinghouse will be to 1) collect and verify perishable reconnaissance information; 2) convey that information to the EOC; 3) serve as the "check-in" and "check-out" point for all researchers who arrive at the scene; 4) provide updated damage information to all investigators, through daily briefings and reports; 5) track where investigators are in the damaged area; and 6) introduce method into what is frequently haphazard by arranging for investigators to cover areas not yet sufficiently reported on. The clearinghouse will channel researchers and observers toward the specific damaged areas where their expertise will be most valuable. Arrangements for access into secured areas will be facilitated by the clearinghouse through provision of letters of passage, badges, and contacts with local governments. All researchers requesting letters of passage will sign in with the clearinghouse staff coordinator, and be asked to observe certain protocols with respect to local emergency managers and residents.

The Technical Clearinghouse functions include the following:

- Managing & Coordinating
- Public Affairs and Media
- EOC Liaison
- Communications
- GIS product development
- Tsunami and Geologic Effects Mapping
- Overflights
- Acitivities Tracking
- Risk Evaluation
- Hazard Evaluation
- Site Inspections and Damage Assessment

A. Thresholds for Activation

The State Tsunami Advisors will also work with State Civil Defense (Tsunami Program Manager), the Pacific Disaster Center, and FEMA in activating the TTC to coordinate activities, and facilitate information sharing among the many potential users of the tsunami inundation and runup data, and damage assessments

The TTC will be put into operation at the discretion of the Technical Clearinghouse Steering Committee. In the case of an earthquake, the clearinghouse may be activated when it is damaging and/or has a magnitude of 5.5 or above and/or generates a damaging tsunami. A federal disaster declaration is not necessary to activate the clearinghouse, but the clearinghouse will always be activated when there is a federal disaster declaration.

B. Timing and Duration

Since the clearinghouse should be operating by the time the first reconnaissance organization or agency arrives on the scene, it is critical to get it operational within 24 hours of the event. Ideally, the clearinghouse infrastructure will already be in place at the PDC, and can be activated immediately upon notification of an event. The duration of clearinghouse operation is dependent on the magnitude of the damage and extent of the response and early recovery periods. Clearinghouse operations can be reduced when the need for reconnaissance decreases. Termination will occur after most perishable damage information has been gathered and detailed studies begin.

C. Relationship to Local Agencies to Federal Agencies

In the United States, the combined emergency management responsibilities of local, State, and Federal governments, as well as voluntary disaster relief organizations, the private sector, and international sources constitute the U.S. disaster response framework for providing assistance after a major disaster. Within this framework, the Federal Government can provide personnel, equipment, supplies, facilities, and managerial, technical, and advisory services in support of State and Local disaster assistance efforts. FEMA has been delegated primary responsibility for coordinating Federal emergency preparedness, planning, management, and disaster assistance functions under the Federal Response Plan (FRP, *1999*). FEMA uses Mission Assignments to task other Federal Agencies for emergency work that is beyond the capabilities of the affected state. In the past, for the collection of scientific data associated with tsunami and earthquakes, this has generally involved the U.S. Army Corps of Engineers (USACE) and the U.S. Geological Survey (USGS), but other agencies with expertise and resources can be tasked.

The Disaster Field Office, FEMA's primary locus of activity, has a different role from the immediate information-gathering of the EOC and the technical clearinghouse. The TTC will be in operation before the DFO, which is more concerned with disaster-recovery activities and is typically not activated immediately.

D. Federal Agencies Providing Data

Federal Support Agencies to FEMA which may be involved in scientific tsunami data collection by providing technical expertise, data, and staff support for disaster operations and situation assessment activities primarily include:

- Department of Commerce (NOAA/National Weather Service and National Ocean Service for nautical and aeronautical charting, surveys, tidal and geodetic services, geo-referenced coastal imagery, meteorology, hydrology, stream flows; and National Institute of Standards and Technology for structural engineering of buildings and lifelines);
- Department of Defense (U.S. Army Corps of Engineers for engineering, hydrology, water level data);
- Department of the Interior (U.S. Geological Survey for seismology, volcanology, hydrology, remote sensing)
- Department of Transportation (U.S. Coast Guard for waterways, Federal Highway Administration for roadways);
- National Aeronautics and Space Administration (remote sensing technology).
- Additionally, the Civil Air Patrol may be involved in conducting aerial reconnaissance

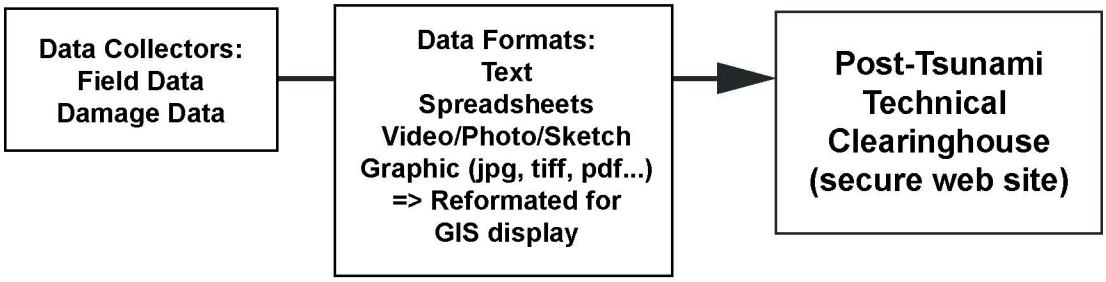
WEB SITE ELECTRONIC INFORMATION SERVER

An important component of the TTC is the development of a reliable and robust telecommunications and electronic information sharing network with sufficient bandwidth that is accessible to the different users. To implement this concept, the TTC will partner with the PDC, whose advanced information and communication technology and systems currently provide information support to disaster managers in Hawaii and the Pacific. The PDC will provide a central repository for storage of all collected information. GIS-based information and web-based tools will be used to create user-friendly applications that will permit electronic sharing of multi-disciplinary data among geographically-scattered users. A web site hosted by the PDC will be established immediately for each event to provide users with a central data repository for accessing, managing, and viewing all information, data, surveys,

and reports collected. Federal, State, and County emergency management, health, and resource agencies, non-profit disaster relief organizations, and engineering and survey scientists would be allowed access to the password-protected, secure site for reviewing and posting information. In addition, an ultra high-volume, web portal accessible by the general public for disaster-related information will be established.

A clearinghouse website will be established by the PDC for each event to make clearinghouse reports, databases, and maps generally available. The clearinghouse will facilitate uniform data collection and management by providing paper and electronic-format data sheets for tsunami, geoscience, and engineering data collection. The PDC will implement web-based GIS tools, which will allow users to display graphical reports and summaries of existing data. Daily briefings and reports will be posted on the clearinghouse web page and distributed to the EOC, DFO, media, and other interested parties.

DATA COLLECTION AND MANAGEMENT



In order to provide for efficient archiving and posting of field data, standard report formats will be used. These data will be available as PDF files of textual data reports, graphical files of sketches and digital photos, and as data input into database spreadsheets. Although the use of hardcopy forms may be necessary, data collectors will use electronic media (such as Personal Desktop Assistant, notebooks, etc.) for data collection when possible, and will submit their reports via electronic means whenever possible. Agencies or groups will be responsible for compiling databases, maps, and reports with the TTC facilitating as needed; all databases should be compiled in Microsoft Access or Microsoft Excel for easy cross-platform accessibility. The data repository will be populated through the online submission of reports via the Internet for posting on the secure web site. Manual submission of reports by facsimile transmission will also be possible. Pre-cleared users will be given online access to all data via the Internet.

In Hawaii, tsunami scientists on the Tsunami Technical Review Committee have developed the Hawaii Post-Tsunami Scientific Survey Plan (*Tsunami Technical Review Committee, 2002*), whose goal is to record tsunami arrivals and their impacts on all significant coastlines. These field data would be posted on the TTC within a few days after the event. The Field Guide identifies and trains island-based volunteers to collect runup and inundation data immediately and within a few days after a destructive local or distant tsunami impacts the coastlines of the state. The guide uses the UNESCO/Intergovernmental Oceanographic Commission (IOC) Post-Tsunami Survey Field Guide (*1998*), and adapts it to local Hawaii conditions; historical data are included in the field notebooks each team is equipped with. The Plan, to be incorporated into Hawaii State Civil Defense standard operating procedures, pre-clears participants for access into restricted, but safe areas, and will include coordinated, pre-established Federal Agency mission agreements for the perishable data collection.

SAMPLE DATA COLLECTED AND ARCHIVED AT CLEARINGHOUSE:

Seismological Information

- Earthquake Seismograms
- Earthquake Source Information (Harvard CMT, USGS Rapid Moment Tensor)
- Shaking Intensity Maps
- Instrumental Intensity: ShakeMap (Peak Ground Acceleration and/or Ground Velocity)
- Felt Intensity as reported by observers
- Aftershocks
- Strong Motion Seismological Records
- Earthquake Hazards
- Historical Seismicity
- Current Seismicity

Tsunami Information

- Tsunami Arrival Eyewitness Observations
- Tsunami Maregrams
- Tsunami Travel Times
- Tsunami Runup
- Inundation
- Tsunami Damage, including aerial surveys
- Tsunami Hazards
- Historical Tsunami Activity

Geotechnical Information

- Ground Deformation - Tilt/Uplift/Subsidence, Surface Fault Rupture
- Ground failure (landslide, liquefaction, lateral spreading, ground cracking,
- hydrologic effects)
- Effects on structures

Structural and Non-Structural Impacts

- Buildings
- Bridges
- Architectural and Nonstructural Elements - architectural, mechanical, electrical elements that are hazardous, disruptive, or costly, including nonstructural elements such as ceilings, light fixtures, sprinklers, windows, partitions, cabinets, shelving, piping,

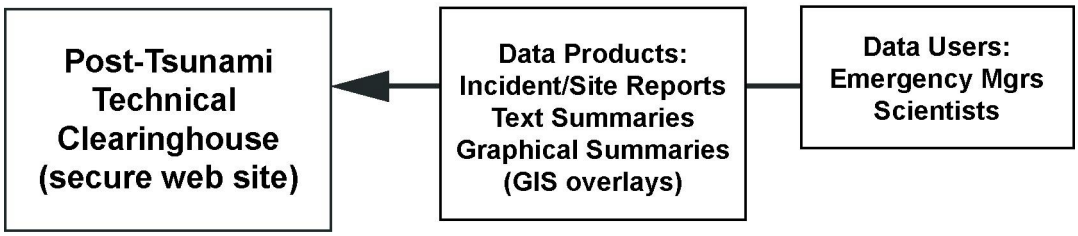
Social and Economic Impacts

- Emergency Management and Response Effectiveness
- Evacuation and Shelter use
- Search and Rescue operations
- Communications (hardware, social interaction)
- Emergency plans in place and temporary measures exercised
- Injuries, Deaths
- Social and Economic impacts on segments of population. e.g., language barriers, business types, specific locations, etc)
- Business disruption (loss of facility and/or operations shutdown), including government business

Lifelines - Estimated losses to facility, operational losses, casualties

- Ground Transportation Structures (Roadways, Bridges)
- Airports and Harbors
- Electrical Facilities

DATA DISSEMINATION



The TTC web site will enable efficient and widespread information sharing. Trusted users may access any data posted to the TTC, daily briefings and summaries, and pre-defined formatted reports, or users may utilize the web-based GIS tools to select information layers to plot and print for use in emergency response and recovery operations, or distribution to the EOC, DFO, media, and other interested parties.

FINANCING

During a clearinghouse activation, the accounting of costs for operations will be the responsibility of each participating organization. Because the clearinghouse is a response function, it may be possible to cover some of its costs in a presidentially-declared disaster. Funds for the initial development of the electronic clearinghouse framework and GIS tools are being sought so that the capability can be established prior to the disaster. In disasters with no federal declaration, costs will be smaller; arrangements will be based on the understanding that the organizations would have undertaken many of the clearinghouse tasks, and funded them, irrespective of clearinghouse activation. Since the electronic clearinghouse framework will already have been established, it can be activated for the posting of data and investigations by any participating organization for any event without cost.

REFERENCES

Ad Hoc ICG/ITSU Post-Tsunami Survey Working Group, Post-Tsunami Survey Field Guide (First Edition), IOC Manuals and Guides 37, UNESCO/IOC, 61 pp., 1998.

Federal Emergency Management Agency Bay Area HAZUS User Group and California Office of Emergency Services, Project QUAKE, California Post Earthquake Information Clearinghouse, Web Site **http://www.wdc.ndin.net/quake.htm),** 2000.

Federal Emergency Management Agency, Federal Response Plan, 9230.1-PL, **http://www.fema.gov/rrr/frp/,** 1999.

Tsunami Technical Review Committee, Field Guide for Measuring Tsunami Runups and Inundations, State of Hawaii, Dept. of Defense, Civil Defense Division, 84 pp., 2002.

University of Washington, The Nisqually Earthquake Information Clearinghouse, Web Site **http://maximus.ce.washington.edu/~nisqually/**, 2002.

Western States Seismic Policy Council Basin & Range Province Committee, Model Post-Earthquake Technical Clearinghouse Plan, Web Site **http://www.wsspc.org/publicpolicy/committees/clearhouse2001.htm,** 2001.