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**INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)**

EXERCISE PACIFIC WAVE '08

SUMMARY REPORT

ABSTRACT

Most of the world's earthquakes and tsunamis occur in the Pacific Ocean and its marginal seas. On average, the Pacific is struck by a locally damaging tsunami every year or two, and by a major Pacific-wide tsunami a few times each century. In 1960 a magnitude 9.5 earthquake occurred off the coast of Chile. It generated a mostly un-warned tsunami that caused damage and casualties across the entire Pacific basin – even as far away as Japan. Following that event, UNESCO's Intergovernmental Oceanographic Commission (IOC) formed the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) to promote the exchange seismic and sea level data for rapid tsunami detection and analysis, to provide warnings for such events and to coordinate mitigation efforts among its Member States. At its Twenty-Second Session held during September 2007 in Guayaquil, Ecuador, the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS, the former ICG/ITSU) recommended that a Pacific-wide tsunami exercise, Exercise Pacific Wave 08 (PacWave08) be carried out in 2008 with results compiled and written before the next meeting of the ICG in February 2009.

The terrible impact of the 26 December 2004 Indonesia earthquake and Indian Ocean tsunami tragically demonstrated what can happen without an effective tsunami warning system. Tsunamis may not occur often, but when they do they can impact coasts, sometimes across an entire ocean, within minutes and extending for many hours. An efficient and effective warning system is needed that is ready to react 24 hours a day to any potential tsunami threat, and that can then act quickly from end-to-end to alert those at risk along coasts and motivate them take immediate and appropriate steps to save their lives. A Pacific-wide tsunami exercise is an effective tool for evaluating the readiness of the PTWS and to identify changes that can improve its effectiveness. There has not been a major Pacific tsunami in more than 40 years, but another will occur and the PTWS must be prepared.

The first Pacific-wide exercise, "Exercise Pacific Wave 06" (EPW06), was carried out in May of 2006. A summary of EPW06 can be accessed at:

http://www.ioc-tsunami.org/index.php?option=com_content&task=view&id=270&Itemid=972

This second exercise followed up on the first and helped establish such exercises as part of the routine work of maintaining the PTWS. Information documents for PacWave08 were posted to:

http://www.ioc-tsunami.org/index.php?option=com_content&task=view&id=271&Itemid=973

and

http://ioc3.unesco.org/itic/categories.php?category_no=395

A total of 40 countries and subnational entities independently participated in PacWave08, including 28 of 33 countries with official ICG/PTWS Tsunami Warning Focal Points and/or National Contacts. This Summary Report is based on 32 Post-Exercise Evaluation Forms received from 27 countries.

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1. Introduction

Exercise Pacific Wave '08 (PacWav08) was proposed and agreed to at the Twenty-Second Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS, formerly ICG/ITSU) held in Ecuador in September 2007. Recommendation ICG/PTWS-XXII.4 called for a Pacific-wide, tsunami exercise that would simulate each country being put into a tsunami warning situation and require decision-making taken to the step just prior to public notification.

All countries of the Pacific were encouraged to participate in the PacWave08. Exercise Pacific Wave '08 is the second Pacific-wide drill of what should be a regular schedule of Pacific exercises in the future.

PacWave08 was organized and coordinated by a Task Team chaired by PTWC and comprised of the Pacific Tsunami Warning Center (PTWC, international operational headquarters in Hawaii), the West Coast and Alaska Tsunami Warning Center (WC/ATWC), Northwest Pacific Tsunami Advisory Center (NWPTAC), ITIC, Australia, Chile, China, Ecuador, New Zealand, Nicaragua, Republic of Korea, New Zealand, Peru, and Russian Federation. PacWav08 Terms of Reference are provided in Recommendation ICG/PTWS-XXII.4 in Annex I.

Dr. Patricio Bernal, IOC Executive Secretary and UNESCO Assistant Director General, formally announced the planning of PacWave08 through IOC Circular Letter No. 2272 dated 25 September 2008 (Annex II), and requested ICG/PTWS Member States to nominate national contacts for the Exercise.

A total of 40 countries and subnational entities independently participated in PacWave08, which included 28 of 33 countries with official ICG/PTWS Tsunami Warning Focal Points and/or National Contacts. Altogether, the Pacific countries participating were:

- | | |
|---|----------------------|
| • Australia | • Marshall Islands |
| • Canada (British Columbia) | • New Caledonia |
| • Chile | • New Zealand |
| • China (Hong Kong, State Oceanic Administration) | • Nicaragua |
| • Colombia | • Niue |
| • Commonwealth of the Northern Marianas Islands | • Palau |
| • Cook Islands | • Papua New Guinea |
| • Costa Rica | • Peru |
| • Ecuador | • Philippines |
| • El Salvador | • Republic of Korea |
| • Federated States of Micronesia (Chuuk, Kosrae State, Pohnpei, Yap States) | • Russian Federation |
| • Fiji | • Samoa |
| • France (French Polynesia, New Caledonia) | • Singapore |
| • Indonesia | • Solomon Islands |
| | • Thailand |
| | • Tonga |
| | • USA |
| | • Vanuatu |
| | • Vietnam |

- Japan
- Malaysia

The Exercise Pacific Wave '08 Summary Report is based on the Post-Exercise Evaluation Forms developed by an inter-sessional Task Team. A total of 33 evaluation forms were received from 27 countries.

2. Concept of the Exercise

2.1 Purpose

The purpose of the exercise was to evaluate and improve the effectiveness of the PTWS, its operational Tsunami Warning Centers, and its Member States in responding to a destructive tsunami. The exercise provided an opportunity for Pacific countries to exercise their operational lines of communications, review their tsunami warning and emergency response procedures, and to promote emergency preparedness. Regular Exercises are important for maintaining staff readiness for the real event. This is especially true for tsunamis, which are infrequent but when they occur, require rapid response. The pre-exercise planning and post-exercise evaluation process is as helpful as the actual exercise, because it brings together all stakeholders to closely cooperate and coordinate their actions. Every Pacific country was encouraged to participate.

2.2 Objectives

From the scenario (Annex III), each country should have developed their own specific objectives for the exercise. The following were the overarching objectives of the exercise:

1. Validate the international Tsunami Warning [or Advisory] Centers' dissemination process of issuing Tsunami Watch and Warning Bulletins to Pacific countries.
2. Validate the process of countries receiving and confirming Tsunami Bulletins through their designated focal points.
3. Validate dissemination of warning messages to relevant agencies within a country.
4. Validate the organizational decision making process about public warnings and evacuations.
5. Identify the methods that would be used to notify and instruct the public.
6. Assess the elapsed time until the public would be notified and instructed.

2.3 Type of Exercise

The exercise should have been carried out in a readiness style that aimed to involve communication and decision making at Government levels, without disrupting or alarming the general public. Individual countries, however, might at their discretion elect to extend the exercise down to the level of actually notifying the public.

Exercises stimulate the development, training, testing, and evaluation of Disaster Plans and Standard Operating Procedures. Exercise participants may have used their own past multi-hazard drills (e.g. flood, typhoon, earthquake, etc.) as a framework to conduct Exercise Pacific Wave 08.

Exercises can be conducted at various scales of magnitude and sophistication. The following are types of exercises that can be conducted:

1. **Orientation Exercise (Seminar):** An Orientation Exercise lays the groundwork for a comprehensive exercise program. It is a planned event, developed to bring together individuals and officials with a role or interest in multi-hazard response planning, problem solving, development of standard operational procedures (SOPs), and resource integration and coordination. An Orientation Exercise will have a specific goal and written objectives and result in an agreed upon Plan of Action.
2. **Drill:** The Drill is a planned activity that tests, develops, and/or maintains skills in a single or limited emergency response procedure. Drills generally involve operational response of single departments or agencies, organizations, or facilities, but may be a subset of full-scale exercises. Drills can involve internal notifications and/or filed activities. Limited evacuation may or may not be conducted, such as within a school, pilot hotel, or village.
3. **Tabletop Exercise:** The Tabletop Exercise is a planned activity in which local officials, key staff, and organizations with disaster management responsibilities are presented with simulated emergency situations. It is usually informal, in a conference room environment, and is designed to elicit constructive discussion from the participants to assess plans, policies, and procedures. Participants will examine and attempt to resolve problems, based on plans and procedures, if they exist. Individuals are encouraged to discuss decisions in depth based on their organization's Standard Operating Procedures (SOPs) with emphasis on slow-paced problem solving, rather than rapid, real time decision-making. An Exercise Controller (moderator) introduces a simulated tsunami scenario to participants via written message, simulated telephone or radio call, or by other means. Exercise problems and activities (injects) are further introduced. Participants conduct group discussions, and resolution is generally agreed upon, and then summarized by a group leader. A Tabletop Exercise should have specific goals, objectives, and a scenario narrative.
4. **Functional Exercise:** A Functional Exercise is a planned activity designed to test and evaluate individual capacities, multiple activities within a function, or interdependent groups of functions among various agencies. It is based on a simulation of a realistic emergency situation that includes a description of the situation (narrative) with communications between players and simulators. The Functional Exercise gives the players (decision-makers) a fully simulated experience of being in a major disaster event. It should take place at the appropriate coordination location (i.e. warning and emergency operations centers, command center or post, master control center, etc.) and activate all the appropriate members designated by the plan. For a tsunami exercise, organizations should test their SOPs using real time simulation tsunami bulletins. Both internal and external agencies (government, private sector, and volunteer agencies) should be involved. It requires players, controllers, simulators, and evaluators. Message traffic will be simulated and inserted by the control team for player response/actions, under real time constraints. It may or may not include public evacuations. A Functional Exercise should have specific goals, objectives, and a scenario narrative.

5. **Full-scale Exercise:** A Full-scale Exercise is the culmination of a progressive exercise program that has grown with the capacity of the community to conduct exercises. A Full-Scale exercise is a planned activity in a “challenging” environment that encompasses a majority of the tsunami warning and emergency management functions, and involves multiple layers of government (national, provincial, local). This type of exercise involves the actual mobilization and deployment of the appropriate personnel and resources needed to demonstrate operational capabilities. EOCs and other local command centers are required to be activated. It tests all aspects of emergency response, and should demonstrate interagency cooperation. A Full-scale exercise is the largest, costliest and most complex exercise type. It may or may not include public evacuations.

Example Time Frames for Different Exercise Types

Style	Planning Period	Duration	Comments
Orientation Exercise	2 wks	1 day	Individual or mixed groups
Drill	2 days	1 day	Individual technical groups generally
Tabletop Exercise	2 weeks	1-3 days	Single or multiple agency
Functional Exercise	1-2 months	1-5 days	Multiple Agency participation
Full-scale Exercise	2-6 months	1 day/ week	Multiple Agency (National and International)

2.4 Exercise Description

The Exercise placed all Pacific countries into a Tsunami Warning situation that would require countries to practice their emergency response decision-making for the arrival of a destructive Pacific-wide tsunami upon their shores, and depending on the country, to take actions and test standard operating procedures to the step just prior to public notification.

2.5 Post-Exercise Evaluation

PTWS participants were requested to submit responses to a detailed questionnaire survey focusing on the adequacy of plans, policies, procedures, assessment capabilities, communication, resources and inter-agency/inter-jurisdictional relationships to support effective tsunami warning and decision-making at all levels of government. The findings are presented in Annex V based on responses from 27 countries. Member States requested that the Final Report be available for presentation to the IOC General Assembly in June 2007.

2.6 Exercise Pacific Wave 08 Scenario

The simulated tsunami was generated by a magnitude 9.2 earthquake off the northeast coast of Japan at 40°N, 143°E that occurred on October 29, 2008 at 0000UTC. An earthquake of this size would be likely to generate a tsunami with widespread destructive effects. Bulletins were issued for approximately 24 hours until the tsunami was simulated

to have crossed the entire Pacific. Complete detail on the simulation and messaging can be found in Annex III.

3. POST-EXERCISE EVALUATION FINDINGS

A total of 27 countries representing 33 agencies submitted detailed evaluation forms. Responses from the following countries and agencies are compiled and discussed below.

- Australia (Australian Tsunami Warning System)
- Canada (British Columbia Provincial Emergency Program)
- Chile (SHOA)
- China (China National Marine Environmental Forecasting Centre)
- China (Hong Kong Observatory)
- Colombia (OSSO – SNDAT)
- Cook Islands (CI Meteorological Services, CI Police, CI Airport Authority)
- Costa Rica (CNEUN)
- Ecuador (Instituto Oceanografico de la Armada)
- Federated States of Micronesia (FSM), Chuuk State (CDCO)
- FSM Government (OEEM)
- FSM (Weather Service Office, EMO & Response Action Team, Kosrae)
- FSM (Weather Service Office, Pohnpei)
- FSM (Department of Public Safety)
- FSM, Yap State (Disaster Coordinating Office)
- Fiji (Ministry of Lands and Mineral Resources)
- Japan (Japan Meteorological Agency)
- Malaysia (Malaysian Meteorological Department)
- France (CEA/DASE/Laboratoire de Geophysique, New Caledonia High Commissionner Sécurité Civile)
- New Zealand (Ministry of Civil Defence and Emergency Management)
- Nicaragua (INETER)
- Papua New Guinea (Port Moresby Geophysical Observatory)
- Peru (HYDRONAV)
- Philippines (Institute of Volcanology and Seismology)
- Republic of Korea (Korea Meteor. Adm., Nation. Emer. Mgmt. Agency)
- Russia (Sakhalin & Kamchatka TWCs)
- Samoa (Ministry of Natural Resources, Environment & Meteorology)
- Singapore (Meteorological Services Division, National Environment Agency)
- Thailand (Thailand National Disaster Warning Centre)
- Tonga (National Emergency Management Office)
- USA (Guam, American Samoa Weather Service Office)
- Vanuatu (Vanuatu Meteorological Services – Seismology)
- Vietnam (Institute of Oceanography)

A summary of the detailed Evaluation Forms findings is provided in Annex V. The Exercise Pacific Wave 089 Summary Report and Annex V was compiled by Mr. Lev Ryzhkov of the Russian Federation, with the assistance of Charles McCreery, Pacific Tsunami Warning Center, and Laura Kong, International Tsunami Information Center.

3.1 Overall assessment

The majority of responding countries and agencies that completed the evaluation forms expressed the positive view that Exercise Pacific Wave 08 successfully met the exercise objectives. The following observations are provided in summary:

- The most common opinion of the participating countries was that the Exercise planning, conduct, format, and style were satisfactory. Each country had specific goals and conducted their exercise accordingly.
- Agencies in countries educated their population and trained their tsunami warning service personnel over the last year. Responsible agencies learned from Exercise Pacific Wave 06, and then took measures to ensure smoother functioning of their TWSs. However, further training is still necessary so that TWS personnel know their tsunami event roles very well.
- Conducting the Exercise in real time allowed for better visualization of the tsunami's propagation and as a result, the actions taken by the TWSs could be taken in a more convincing and realistic way.
- The Exercise was considered important and contributed to the improvement and development of tsunami plans for public warnings and response activities.
- Most TWCs disseminate the warning messages to their Emergency Services – so that the evacuation plans should be timely activated – and to the local governments - in order to provide notification as quickly as possible to the population when there is imminent danger. Local governments are recommended to develop their local disaster management plans in order to enable a fast and orderly response.
- Communications problems arose in reaching the farthest islands in island countries. It was noted that a high quality communication system is needed to be able to disseminate warnings without failure. Communications aspects should be thoroughly addressed and improvements identified. Funding will be needed to implement the recommendations.
- As a result of the Exercise, the awareness of the population on tsunami hazards was increased.

Core Objective Review: Outcomes arising from the evaluation about the effectiveness of the six core objectives for Exercise Pacific Wave 08 were:

1. That tsunami information dissemination was timely and methods used were effective - the majority of participating countries and agencies expressed that this objective was successfully met.
2. Although response was limited, it appears that Objective 2 was met. Tsunami warning bulletins usually arrived by fax, email, or GTS. Confirmations were usually made immediately or within ten minutes using the same communication systems.
3. Most of the lead agencies were successful in disseminating the tsunami warnings in-country to their emergency services agencies, national government agencies and local, provincial and regional government agencies. A wide variety of communication methods were used including fax, telephone, email, SMS, dedicated landlines, satellite links, and radio communications. There was a positive response by participating countries and agencies stating that the communication methods used and the timeliness of information issued was sufficient to support national information requirements.
4. The majority of evaluations for Objective 4 were positive stating that this objective was met (particularly in regards to the proven ability to assemble country

- management groups in a timely manner). The only comment made was that further attention is required when considering the quality of in-country information feedback and confirmation from response agencies and local level governments.
5. The majority of responding countries and agencies stated that they intend to use public radio broadcasts, TV announcements, SMS cell phone systems, and a national website during a real tsunami event. In most of the participating countries, these media infrastructures already exist.
 6. The average elapsed time achieved from time of receipt of warning to activating the public notification systems was 57 minutes.

3.2 Communication Findings

With respect to the dissemination of messages, the following outcomes were compiled:

- In general, the exercise was a good test of the lines of communication and that the exercise was beneficial. PacWave08 confirmed the dissemination and receipt process of warning messages from the PTWC, WC/ATWC, and NWPTAC to the involved countries and highlighted some opportunities for improvement. Most tsunami bulletins were sent in a timely manner.
- Countries generally received tsunami bulletins via fax, email, SMS, and/or GTS. A number of fax and email addresses of PTWC were not successful, and need to be checked and followed up with each country. Confirmations were acknowledged using same systems within 10 minutes of receipt.
- A wide range of methods (fax, email, telephone, SMS, and other telecommunication systems) were used within countries and largely worked, despite some difficulties with telecommunication systems in some developing countries.
- The average elapsed time achieved from time of receipt of warning to activating the public notification systems was 57 minutes.
- Many countries reported that the method of notification embracing wider masses of population – public radio broadcasts, TV announcements/teletext and public announcement systems – are preferable and will be used for future exercises and in real life events. Currently, many of the public communication warning arrangements exist in participating countries.
- New Caledonia High Commissioner Securite Civile Noumea reported that at all Bulletins sent via fax and email were received quasi instantaneously (within a minute). The telex messages sent by GTS were received 3-8 minutes after the others. Thus, New Caledonia remarked that the SMS was considered as non operational/robust communication system in case of a disaster.
- Singapore reported that they received the bulletins from either GTS, fax and e-mail to the focal point. The messages received through GTS were most timely. There was a delay of about 5 minutes via fax and e-mail.

3.3 Recommendations

It is relevant to review the recommendations from Exercise Pacific Wave 06 in order to evaluate the success of Exercise Pacific Wave 08 and to formulate recommendations that will assist in the decision-making and the planning of future exercises or drills. Briefly, from Exercise Pacific Wave 06, the following recommendations were made:

- It is suggested the Exercise Pacific Wave (EPW) be conducted regularly once per year to assist with a country's vigilance and operational preparedness testing in the event of a tsunami. It was expressed that tsunami warning exercises conducted annually would assist countries and agencies by encouraging planning, facilitating operational testing and increasing preparedness for tsunamigenic events. Countries should consider to develop and conduct regular national tsunami exercises prior to a EPW for maximum benefit;
- To increase the realism of the exercise, it is suggested that Exercise Pacific Wave be conducted in real time instead of at an accelerated, compressed time schedule.
- Countries should regularly review and confirm their 7 x 24 Tsunami Warning Focal Point contact data.
- Future Exercise Pacific Wave exercises should have the lead national agencies continue to engage and coordinate the flow, content, and understanding of tsunami warning information with other national agencies and/or stakeholders. They should also engage local, provincial, and regional agencies to ensure vigilance and regular preparedness testing.
- Future Exercise Pacific Wave exercises should focus also on developing methods and mechanisms for improving the timeliness of tsunami warnings to the general public;
- With respect to the message contents, it was recommended to consider the inclusion of additional information in Tsunami Warning Centre messages, such as a simple English word-picture of tsunami threatened areas;
- With respect to improving public information dissemination, it was recommended as high priority to increase networking and public awareness activities between agencies and the media.
- Future exercises should provide opportunities for regional cross-learning as exercise observers, or by conducting adjacent-country cooperative exercises so that countries may learn and benefit from each other's experiences.

Based on EPW06 and a review of the responses to PacWave08, the following recommendations are made:

- Regular Pacific-wide exercises, conducted in real time, should be carried out to continually encourage operational preparedness for a tsunami. This will assist countries and agencies by in developing and testing warning and response plans. It is recommended by FSM to conduct a PacWave-type exercise every six months, at least for the short term, in order to assist countries to be ready before an actual tsunami event. Nationally, countries are encouraged to develop and conduct individual tsunami exercises to regularly exercise their national arrangements.
- In order for countries to properly prepare, it is recommended that IOC officially announce future PacWave activities at least three months prior to the event, and distribute documents at least two months prior.

- It is generally not known how successful local communities will be in being alerted in a timely manner and then in effectively enacting an actual public evacuation on a 24x7 basis. No coastal communities enacted a public evacuation during PacWave08. It is recommended that an increased emphasis be placed on local community-based preparedness, training, and exercises that extend “to the last kilometer on the beach.”
- It is recommended that the PTWS Working Group on Pacific Emergency Communications serve as a focal point providing information on methods of robust public alerting, especially down to the local levels within countries and the role of media in information dissemination.
- A key to enabling fast tsunami response is have plans pre-discussed and decided, e.g., standard operating procedures for end-to-end tsunami warning and emergency response. The IOC has a project, “Strengthening Tsunami Warning and Emergency Response: Training Workshop on the Development of Standard Operating Procedures (SOPs) for Indian Ocean and Southeast Asian Countries,” and it is recommended that the PTWS request similar workshops.
- The FSM recommended that a feasibility study be conducted in all PTWS MS to identify and evaluate relevant warning systems that can be utilized in those places lacking the financial resources and assets to improve their own warning coordination.
- Peru recommended that for future exercises, the bulletins be in the national language of each country in order to improve comprehension and facilitate faster action. Nicaragua also misinterpreted the English in the 1st message. A longer Exercise preparation time would allow countries to translate the international English messages into their language(s) for use nationally.

4. SUMMARY

The Indian Ocean Tsunami of 24 December 2004 graphically demonstrated the potential threat posed by a major tsunami. Exercises Pacific Wave 2006 and Pacific Wave 2008 provided the opportunity for participating countries to exercise procedures and communication arrangements for such situations in the Pacific. The second Pacific-wide Exercise also tested the progress of Pacific Region countries in making necessary improvements to guarantee the smooth and effective functioning of their tsunami warning procedures and communications.

To measure the success of Exercise Pacific Wave 2008, the Post-Exercise Evaluation Forms were disseminated to all countries of the Pacific Region, and reminders were sent to prompt their sending the completed Evaluation Forms to the Task Team for compiling the results. The Task Team received 32 completed Evaluation Forms and a number of these were incomplete. However, the important information obtained made it possible for the Task Team to assess each country’s ability to receive the tsunami warning message, and to prepare and disseminate a public notification.

The overwhelming majority of responding countries/agencies (27 out of 28) expressed a positive view on Exercise Pacific Wave 2008 planning and conduct. They also approved of the exercise being conducted in real time. However, at least four countries (China, FSM, New Zealand, Tonga) felt that PacWave08 planning did not give sufficient advance notice for their agency's internal preparation.

Most Tsunami Bulletins were disseminated from their country's national focal points to:

- Emergency services agencies;
- Other national government agencies;
- Local city and district agencies.

Most participants rated the quality of information issued nationally met the objective of supporting national and local level decision-making. Some countries however, did not test this objective due to insufficient time for planning and requested a longer timeline for future exercise planning.

The majority of participants assembled a disaster management group in a timely manner in order to achieve good decision-making. Several countries (particularly developed countries) advised that management group assembly procedures are already pre-determined and made it possible to assemble the decision-making management group within 5 minutes after the first warning.

There were no reported public evacuations conducted in PacWave08, compared to EPW06 in which five countries conducted public evacuations. It is generally unknown how fast alerts can be disseminated to local communities, and then how successful these communities will be in effectively enacting an actual public evacuation on a 24x7 basis.

The majority of respondents reported that Exercise Pacific Wave 2008 contributed to the improvement and development of planning relating to public warnings and response activities.

As in EPW06, the evaluation questionnaire responses showed that the PacWave08 objectives were successfully met. The key outcomes include the following:

- The PacWave08 objectives were exercised, evaluated and reported, thus enabling Pacific recommendations and lessons learned to be formulated.
- The intercommunication and dynamics between the various Tsunami Warning Centres, the national Tsunami Warning Focal Points, and the information dissemination points within countries and agencies continues to be a learning process but this is in itself, strengthening country preparedness.
- Tsunami warning centres and/or emergency agencies can still improve their processes of how warnings are communicated, especially 'downstream' to communities.
- Stakeholder coordination and other mechanisms for improving planning and continuous review and improvement of tsunami response standard operating procedures at all levels (national, regional and local) continue to be needed.

Future tsunami exercises should emphasize both actual exercise activities (warning receipt, notification, and response) and the post-exercise evaluation components. Because exercises are testing the feasibility and applicability of established standard operating procedures, it is essential that post-exercise assessments be carried out to identify problems and where possible, to establish immediate corrective actions.

As a result of PacWave08, certain shortcomings have been identified and some are being addressed. Hopefully, countries will take this opportunity to take action and continue to work together, and to network and share information to improve the Pacific's capacity as a region to deal with tsunamis.

ANNEX I. RECOMMENDATION ICG/PTWS-XXII.4

PACIFIC-WIDE TSUNAMI EXERCISE

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System,

Noting that the Indian Ocean tsunami of 26 December 2004 brought to the attention of the world the urgent need to be more prepared for such events,

Understanding that simulating scenarios and learning lessons from such exercises is an effective way to improve preparedness,

Recognizing that the PTWS requires regular testing and review,

Recommends that the second end-to-end tsunami exercise be carried out for the Pacific Ocean during the third quarter of 2008, with a final report of results written before the next ICG Session;

Decides that a Task Team be formed to design and carry out the exercise and bearing in mind the following elements:

- (i) Membership of the Task Team for organizing the exercise should include representatives from PTWC, WC/ATWC, NWPTAC, Australia, New Zealand, Peru, Republic of Korea, the Russian Federation, and ITIC
- (ii) The exercise should simulate each country being put into a warning situation requiring decision-making and be taken to the step just prior to public-notification
- (iii) The scenario to be exercised will be a destructive tsunami generated off the northeast coast of Japan and crossing the Pacific. It will be simulated with notification by PTWC and other warning centres such as WC/ATWC and the NWPTAC to the designated contact points and national emergency authorities of the Member States responsible for tsunamis
- (iv) The scenario will be conducted in real time
- (v) Member States be strongly encouraged to participate
- (vi) Due care be taken so as not to inadvertently alarm the public; a most conservative approach may be best, considering this will only be the second such Pacific-wide exercise
- (vii) Member States share information about the Pacific Wave 06 exercise as well as past National or Sub-National tsunami exercises prior to this exercise
- (viii) Participating Member States be required to share information regarding the procedures applied and lessons learned during the exercise
- (ix) The details of the exercise, as well as its set of outcomes and performance measures be defined in advance, taking into consideration when possible, the results of the Member State assessments; outcomes and performance measures should be collected using a standard instrument and at a minimum include:
 - a. How each Member State received the warning (e.g., GTS, fax, e-mail)?

- b. Elapsed time between when the bulletin is issued and when it is received and recognized
 - c. What assessment tools are applied for decision-making about evacuations?
 - d. How the public would be notified and instructed?
 - e. Elapsed time until the public would be notified and instructed
 - f. Summary of each Member State's National Emergency Plan for tsunamis, including any chapters on exercises
 - g. Feedback from stakeholders regarding their performance and the performance of the information providers
 - h. Media response;
- (x) ICG/PTWS National Contacts will be responsible for collecting results of their Member State and providing them to the Task Team by 1st December 2008
- (xi) A formal letter announcing the exercise and providing its details should be composed by the Task Team and sent by the IOC as a Circular Letter to TNC and TWFP no later than 1st January 2008

This exercise is the second exercise in a pattern of recurring exercises to be conducted by the ICG/PTWS;

Requests that resources be made available from the IOC and Member States to facilitate organizational and follow-up meetings, and a contractor to help facilitate the debriefing process and quickly assemble the report.

Financial implications: US\$ 5,000 in 2008

ANNEX II. EXERCISE PACIFIC WAVE 08 ANNOUNCEMENT



INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
COMMISSION OCÉANOGRAPHIQUE INTERGOUVERNEMENTALE
COMISIÓN OCEANOGRÁFICA INTERGUBERNAMENTAL
МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ
اللجنة الدولية الحكومية لعلوم المحيطات
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IOC Circular Letter No. 2272
(English only)

25 September 2008

To : ICG/PTWS Tsunami Warning Focal Points (TWFP) and Tsunami National Contacts (TNC)
ICG/PTWS Chair and Vice-Chairs

cc. : Official National Coordinating Body for liaison with the IOC Member States
Permanent Delegates/Observer Missions to UNESCO of IOC Member States
Directors of UNESCO and IOC Regional Officers in the Asia/Pacific Region
Regional Organizations cooperating with UNESCO/IOC: SOPAC, CPPS

Subject: PTWS Pacific-wide Tsunami Exercise "Pacific Wave 08"

At the XXIInd Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System PTWS XXII held in Guayaquil, Ecuador, October 2007, Member States recognized that the PTWS requires regular testing and review and noted that simulating scenarios and learning lessons from such exercises is an effective way to improve preparedness. They consequently recommended that a second Pacific wide tsunami exercise be carried out in 2008. This letter seeks to advise you of the planned exercise.

The name of the exercise will be "Pacific Wave 08." The exercise will take place from 28-30 October 2008. The exercise will simulate Pacific countries being placed into a Tsunami Warning situation, and require Member State decision-making, and steps taken to just prior to public notification. These steps may be played during the exercise dates or the following days. The exercise scenario will use a single earthquake source located off of the northeast coast of Japan, and the simulated tsunami will propagate in real time across the entire Pacific taking approximately 24 hours to travel from Japan to the coast of South America. Exercise bulletins will be issued by the Pacific Tsunami Warning Center (PTWC), the West Coast/Alaska Tsunami Warning Center (WC/ATWC) and the Northwest Pacific Tsunami Advisory Center (NWPTAC). A Pacific Wave 08 Exercise Manual will be distributed shortly with further details on the scenario as well as the text of simulated warning bulletins for the exercise from PTWC, WC/ATWC and NWPTAC.

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-

Guiding principles for the planning and conduct of Exercise Pacific Wave 08 are listed in Attachment 1 for your information. The key point to take from these principles is that the exercise is not required to be conducted through to community level. Rather, the aim is to exercise the operational lines of communication within the PTWS without disrupting or alarming individual citizens. Member countries will, however, be encouraged to exercise, evaluate and report back on communication and decision making within a warning situation down to the level just prior to public notification.

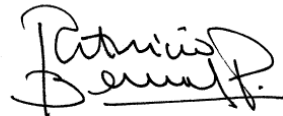
Despite this, you will note that there remains an option to exercise further levels of communication, such as public broadcasts and sirens, and provide relevant feedback during exercise evaluation. This activity will be regarded as optional. Each country will decide and design its own national exercise that commences after receiving the first message from the warning centers.

In order to ensure the commitment of participating countries is fully coordinated, we seek your nomination of National Contact for the Pacific Wave 08 exercise with whom we will communicate to about planning for the conduct of the exercise. The designated National Contact will be expected to confirm the accuracy of existing tsunami warning arrangements within your country, including the identification of operational points of contact for the receipt and dissemination of tsunami warnings downstream from the national tsunami operational centre. The designated National Contact for the Pacific Wave 08 will also be responsible for coordinating input to the exercise evaluation instrument, which will be circulated as part of the Pacific Wave 08 Exercise Manual.

The 26 December 2004 Indian Ocean tsunami disaster continues to remind us of the need to be prepared for this infrequent but potentially devastating hazard and to practice and improve our preparedness. This is especially true in the Pacific where destructive tsunamis occur most frequently. The Pacific Wave 08 exercise is an important activity in this regard. We trust that you and your country Authorities will support this initiative.

I would be grateful if you could provide the details of your National Contact for the Pacific Wave 08 by 30 September 2008 to the ICG/PTWS Secretariat through email (p.koltermann@unesco.org, cc to l.kong@unesco.org), facsimile, or post at the address above. You are also encouraged to further disseminate copies of this letter to appropriate organizations and authorities within your country.

Yours sincerely,



Patricio Bernal
Assistant Director-General, UNESCO
Executive Secretary, IOC

ANNEX III. EXERCISE PACIFIC WAVE 08 SCENARIO

1. General Idea

For this exercise, following ICG/PTWS-XXII.4, there will be a single exercise scenario played out in real time. The scenario will be a major earthquake off the northeast coast of Japan that generates a destructive teletsunami affecting countries from Japan to Chile over the course of about 24 hours. Centers that will issue bulletins for this exercise will be the Pacific Tsunami Warning Center (PTWC) in Hawaii, the West Coast and Alaska Tsunami Warning Center (WC/ATWC) in Alaska, and the Northwest Pacific Tsunami Advisory Center (NWPTAC) in Japan. The timeline for issuance of bulletins is given in Table 1. WMO product identifiers for the bulletins are given in Table 2.

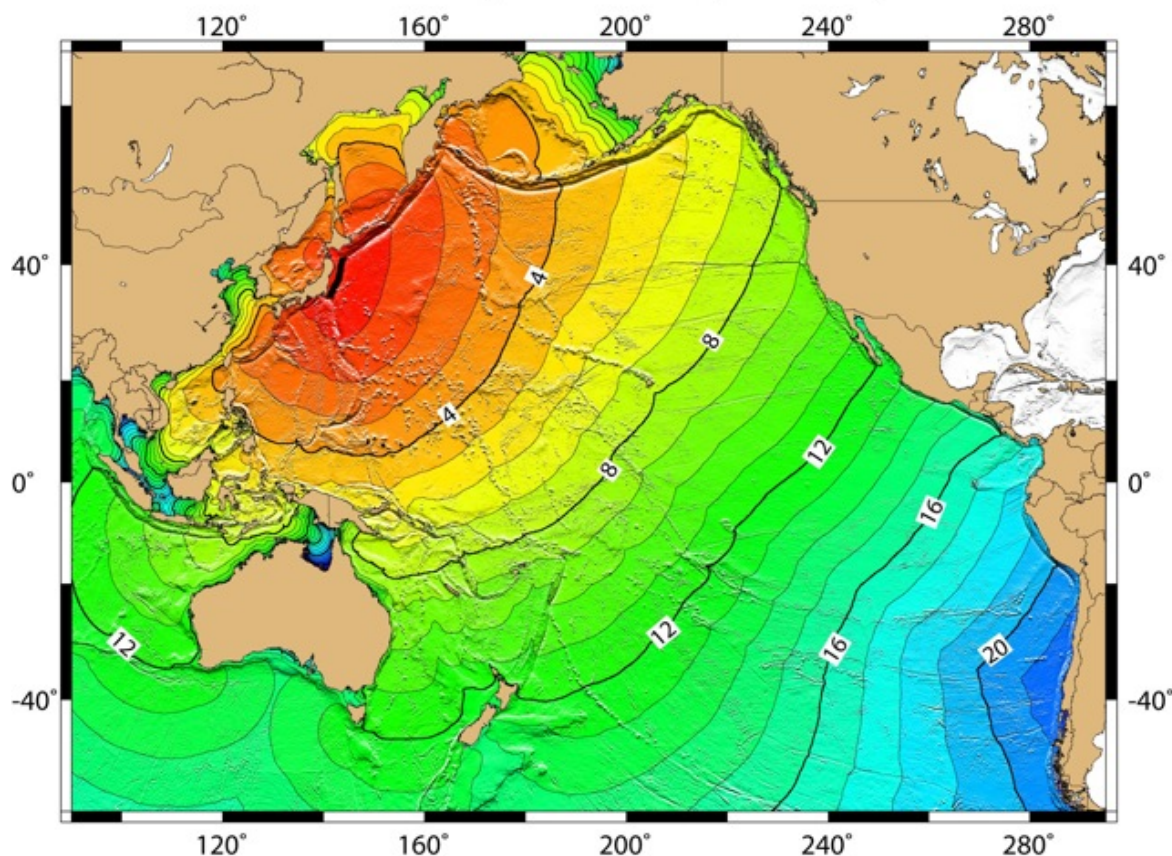
Participant countries may elect to exercise in their own timelines in order to achieve their particular objectives. For example, a particular country's exercise control may choose to feed the PTWC bulletins into the exercise at times of their own choosing, or alternatively put them in envelopes with the time they must be opened written on each, with each key participant agency having their own set of envelopes. All bulletins, provided in advance in Appendices I-V, will facilitate this approach.

Coverage. While an actual major tsunami generated off the northeast coast of Japan would likely only affect a subset of PTWS countries, all Member States are encouraged to participate and estimated tsunami arrival times to all PTWS countries are included in PTWC bulletins. In addition, countries are welcome to modify estimated arrival times or estimated wave amplitudes to suit their preference – for example, to have the tsunami arrive sooner and with a larger amplitude. Countries in the Pacific that are not Member States of the ICG/PTWS are also encouraged to participate and are covered by the scenario.

Messages. The initial bulletin will be issued by the NWPTAC because the earthquake is located in the immediate vicinity of Japan. Initial bulletins from PTWC and WC/ATWC will follow, initially using the earthquake parameters from the NWPTAC. To avoid any possible misinterpretation, bulletins issued by the warning centers will be in a “dummy” exercise message format (Appendix I) that will refer participants to a specific scenario bulletin number in this exercise manual (in Appendices II – IV). Dummy messages will be issued for each simulated real message at the beginning of the exercise, but later PTWC and WC/ATWC dummy messages will be issued only once every four hours until the simulated tsunami has crossed the entire Pacific and the exercise concludes. The schedule of bulletins is given in Table 1.

Exercise Pacific Wave 08

Tsunami Travel Times (1-hr contours)
M9.2 Earthquake source (black line)



2. Special Ideas

The Scenario. The simulated tsunami will be generated by a magnitude 9.2 earthquake off the northeast coast of Japan at 40°N, 143°E that occurs on October 29, 2008 at 0000UTC. An earthquake of this size would be likely to generate a tsunami with widespread destructive effects. Bulletins will be issued for approximately 24 hours until the tsunami is simulated to have crossed the entire Pacific.

3. Master Schedule and Timings (Exercise Script)

Table 1: Scenario Timeline

Tsunami from magnitude 9.2 earthquake with epicenter at 40°N, 143°E occurring on October 29, 2008 at 0000UTC.

Date (UTC)	Time (UTC)	NWPTAC Message			PTWC Message			WC/ATWC Message		
		#	Type	Dummy	#	Type	Dummy	#	Type	Dummy
10/29	0005	01	TAB	Yes						
10/29	0010				01	RWW	Yes	01	WWA	Yes
10/29	0040				02	RWW	Yes	02	WWA	Yes
10/29	0050	02	TAB	Yes						

10/29	0110							03	WWA	Yes
10/29	0140				03	PWW	Yes	04	WWA	Yes
10/29	0145	03	TAB	Yes						
10/29	0210							05	WWA	No
10/29	0240				04	PWW	Yes	06	WWA	Yes
10/29	0245	04	TAB	Yes						
10/29	0310							07	WWA	No
10/29	0340				05	PWW	Yes	08	WWA	Yes
10/29	0345	05	TAB	Yes						
10/29	0410							09	WWA	No
10/29	0440				06	PWW	No	10	WWA	No
10/29	0445	06	TAB	Yes						
10/29	0510							11	WWA	No
10/29	0540				07	PWW	No	12	WWA	No
10/29	0610							13	WWA	No
10/29	0640				08	PWW	No	14	WWA	No
10/29	0710							15	WWA	No
10/29	0740				09	PWW	Yes	16	WWA	Yes
10/29	0745	07	TAB	Yes						
10/29	0810							17	WWA	No
10/29	0840				10	PWW	No	18	WWA	No
10/29	0910							19	WWA	No
10/29	0940				11	PWW	No	20	WWA	No
10/29	0945	08	TAB	Yes						
10/29	1010							21	WWA	No
10/29	1040				12	PWW	No	22	WWA	No
10/29	1110							23	WWA	No
10/29	1140				13	PWW	Yes	24	WWA	Yes
10/29	1145	09	TAB	Yes						
10/29	1210							25	WWA	No
10/29	1240				14	PWW	No	26	WWA	No
10/29	1310							27	WWA	No
10/29	1340				15	PWW	No	28	WWA	No
10/29	1410							29	WWA	No
10/29	1440				16	PWW	No	30	WWA	No
10/29	1510							31	WWA	No
10/29	1540				17	PWW	Yes	32	WWA	Yes
10/29	1610							33	WWA	No
10/29	1640				18	PWW	No	34	WWA	No
10/29	1710							35	WWA	No
10/29	1740				19	PWW	No	36	WWA	No
10/29	1810							37	WWA	No
10/29	1840				20	PWW	No	38	WWA	No
10/29	1910							39	WWA	No
10/29	1940				21	PWW	Yes	40	WWA	Yes
10/29	2010							41	WWA	No
10/29	2040				22	PWW	No	42	WWA	No
10/29	2110							43	WWA	No
10/29	2140				23	PWW	No	44	WWA	No

10/29	2210							45	WWA	No
10/29	2240				24	PWW	No	46	WWA	No
10/29	2310							47	WWA	No
10/29	2340				25	FPW	Yes	48	Can	Yes

NWPTAC Bulletin Type:

TAB NWPTAC Advisory

PTWC Bulletin Types:

RWW Regional Warning Watch

PWW Pacific-Wide Warning

FPW Final Pacific-Wide Warning

WC/ATWC Bulletin Types:

WWA Warning Watch Advisory

Can WWA Cancellation

Dummy:

Yes Dummy Issued

No Dummy Not Issued

Table 2: Product Types

Product Types Issued for Dummy Exercise Bulletins

Center	WMO Product ID	AFTN	EMWIN	Fax	Email
NWPTAC	WEPA40 RJTD	No	No	Yes	Yes
PTWC	WEPA40 PHEB	Yes	Yes	Yes	Yes
WC/ATWC	WEPA41 PAAQ	Yes	Yes	Yes	Yes
	WEAK51 PAAQ	Yes	Yes	Yes	Yes

4. Actions in Case of a Real Event

All documentation and correspondence relating to this exercise is to be clearly identified as **Exercise Pacific Wave 08** and **For Exercise Purposes Only**. In the case of a real event occurring during the exercise, PTWC, NWPTAC, and/or WC/ATWC will issue their normal message products for the event. Such messages will be given full priority and a decision will be made by each Center whether to continue or cease their participation in the exercise. Smaller earthquakes that only trigger a Tsunami Information Bulletin will not disrupt the exercise.

ANNEX IV. MEDIA PRESS RELEASES

TEMPLATE FOR NEWS RELEASE

USE AGENCY MASTHEAD

Contact: (insert name)
(insert phone number)
(insert email address)

FOR IMMEDIATE RELEASE
(insert date)

PACIFIC-WIDE TSUNAMI DRILL SET FOR OCTOBER

(insert country name) will join over (insert number) other countries around the Pacific Rim as a participant in a mock tsunami scenario during 28 – 30 October 2008. The purpose of this Pacific-wide exercise is to increase preparedness, evaluate response capabilities in each country and improve coordination throughout the region.

“The 2004 Indian Ocean tsunami brought to the attention of the world the urgent need to be more prepared for such events,” said (insert name of appropriate official). “This important exercise will test the current procedures of the Pacific Tsunami Warning System and help identify operational strengths and weaknesses in each country.”

The exercise, titled Exercise Pacific Wave 08 (PACWAVE08), will simulate Pacific countries being put into a Tsunami Warning situation requiring government decision-making. It is the second such exercise with the first having been carried out in May 2006. The role-playing of the exercise will be taken to the step just prior to public notification.

The exercise can be divided into two stages. In the first stage, a destructive tsunami crossing the Pacific from an earthquake near Japan will be simulated by international notifications from Japan’s Northwest Pacific Tsunami Advisory Center (NWPTAC), the U.S. Pacific Tsunami Warning Center (PTWC) and the U.S. West Coast and Alaska Tsunami Warning Center (WC/ATWC). Bulletins will be transmitted from these tsunami warning centers to focal points designated by each country that are responsible for that country’s tsunami response.

In the second stage, conducted simultaneously in response to receipt of the international messages and any national tsunami detection, analysis, and forecasting capabilities, government officials will simulate decision-making and alerting procedures down to the last step before public notification. Notification of emergency management and response authorities for a single coastal community will be used as a measure of the end-to-end process of the entire country for purposes of this exercise. Due care will be taken to ensure the public is not inadvertently alarmed.

Insert paragraph tailored for specific country. Could identify participating agencies and specific plans. Could describe current early warning program, past

evacuation drills (if any), ongoing mitigation and public education programs, etc. Could describe tsunami threat, history of tsunami hazards, if any.

Should any actual tsunami threat occur during the time period of the exercise, 28-30 October 2008, the drill will be terminated.

Following the exercise, a review and evaluation will be conducted by all participants. “We see this exercise as an essential element in the routine maintenance of the Pacific Tsunami Warning and Mitigation System,” said (insert name of appropriate official). “Our goal is to ensure a timely and effective early warning of tsunamis, educate communities at risk about safety preparedness, and improve our overall coordination. We will evaluate what works well, where improvements are needed, make necessary changes, and continue to practice.”

The exercise is in the Work Plan of the Intergovernmental Coordination Group of the Pacific Tsunami Warning and Mitigation System (ICG/PTWS). ICG/PTWS is a body of the UNESCO’s Intergovernmental Oceanographic Commission.

###

On the Web:

PACWAVE08 Information: [http://www.ioc-](http://www.ioc-tsunami.org/index.php?option=com_content&task=view&id=271&Itemid=973)

[tsunami.org/index.php?option=com_content&task=view&id=271&Itemid=973](http://www.ioc-tsunami.org/index.php?option=com_content&task=view&id=271&Itemid=973)

Media Resources: http://ioc3.unesco.org/itic/categories.php?category_no=150

Pacific Tsunami Warning System: <http://ioc3.unesco.org/ptws/>

Pacific Tsunami Warning Center: <http://www.prh.noaa.gov/ptwc/>

Insert country URLs

**UNESCO PRESS RELEASE
22 OCTOBER 2008**



**United Nations Educational, Scientific and Cultural
Organization**

UNESCO Member States in the Pacific will stage tsunami drill

More than 20 countries* around the Pacific Rim will participate in a pre-arranged tsunami scenario from 28 to 30 October. Testing the UNESCO-initiated Pacific Tsunami Warning and Mitigation System (PTWS), the drill aims to evaluate the system, increase preparedness and improve coordination throughout the region.

“Exercise Pacific Wave 08” will simulate a Tsunami Warning situation, requiring countries to make decisions and take all preliminary steps short of alerting the public.

According to the scenario, a powerful earthquake located off Japan’s northeast coast will generate the simulated major tsunami. It will spread in real time across the entire Pacific, taking approximately 24 hours to travel from Japan to the coast of South America. Bulletins will be issued by the Northwest Pacific Tsunami Advisory Center (NWPTAC) in Tokyo, Japan, the Pacific Tsunami Warning Center (PTWC) in Hawaii, USA, and the West Coast and Alaska Tsunami Warning Center (WCATWC) in Alaska, USA, and sent to focal points responsible for tsunami response in the countries concerned. Although a real-life tsunami would likely affect only a subset of countries in the region, all have been encouraged to take part.

The test will not involve populations but will review current warning system procedures and help identify operational strengths and weaknesses in each country. The Indian Ocean tsunami disaster in December 2004 provided a cruel reminder of the need to be prepared for these infrequent but potentially devastating hazards, particularly in the Pacific where destructive tsunamis occur most frequently. This month’s test will be the second such exercise; the first was conducted in May 2006.

The drill was recommended by Member States attending the 22nd session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) held in Guayaquil, Ecuador, in October 2007. The ICG/PTWS was established by UNESCO’s Intergovernmental Oceanographic Commission (IOC) in 1965, to promote exchange of seismic and sea level data for rapid tsunami detection, to provide warnings and to coordinate mitigation efforts among Member States.

After the 2004 tsunami, the IOC received the mandate to help UNESCO Member States of the Indian Ocean rim set up their own Tsunami Early Warning System (IOTWS). At the same time IOC began coordinating the creation of similar systems in the Caribbean (CARIBE-EWS) and the Mediterranean and Northeast Atlantic Ocean and connected Seas (NEAMTWS).

** Countries include Canada, Chile, China, Colombia, Cook Islands, Costa Rica, Ecuador, El Salvador, France, (French Polynesia and New Caledonia), Nicaragua, Japan, Malaysia, New Zealand, Niue, Peru, Russian Federation, Samoa, Singapore, Republic of Korea, Thailand and the United States. The island of Yap, Federated States of Micronesia, will also participate.*

Related link

More information

Author(s): Press Release N°2008-107 - Source: UNESCOPRESS - Publication
Date: 22-10-2008

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ANNEX V. POST-EXERCISE EVALUATION COMPILATION

POST-EXERCISE EVALUATION OF EXERCISE PACIFIC WAVE 08: DETAILED EVALUATION FORMS FINDINGS

The following information is taken and compiled from the evaluation reports of participants who responded and considered the information against the objectives (including the six core objectives) put in place to measure the effectiveness of Exercise Pacific Wave 2008, using a four (4) point evaluation scale. This rating scale is outlined below.

RATING SCALE DEFINITION	
Rating	Definition
1	Did not meet the objective
2	Met some of the objective
3	Met the objective
4	Exceeded the objective

Assessment of Planning and Conduct

Participants made the following assessments about the overall planning and conduct of Exercise Pacific Wave 2008:

Topic: The planning, conduct, format and style of the exercise.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	1	-	24	3	-	28
EPW06	-	4	11	-	3	18

Overview:

The overwhelming majority of responding countries/agencies (27 out of 28) presented scores or expressed a positive view that Exercise Pacific Wave 2008 planning and conduct successfully met this objective. They also approved of the Exercise being held in real time.

Notes:

Australia participated in the Exercise Pacific Wave 08. Australia declared that they have an independent and uniquely structured tsunami warning system and that several aspects of the international PW08 format were not relevant to the Australian TWS. Instead of Post-Exercise Evaluation Forms Australia presented a Report informing that in order to emulate PW08 as closely as possible, the exercise in Australia was run using the same initiating earthquake details, and also utilized many of the pseudo observational details contained in PTWC and NWPTAC bulletins. A consensus decision between the Australian Government agencies (the Bureau of Meteorology, Geoscience Australia and Emergency Management Australia) and state and territory emergency management authorities, was to use the exercise to test the generation of tsunami bulletins and transmission of these bulletins through to the state and territory disaster coordination centers, but not to the

media or the general public, and stopping short of any simulated community evacuations. It was determined that the required objectives could be achieved in 10 hours in Australia. Exercise PW08 was assessed as successful and beneficial in Australia. The most significant benefit related to the innovation of running sheets. Prior to the exercise a running sheet of all expected activities throughout the 10 hours of the exercise was prepared to guide participants through the exercise (Attachment A in their report). The running sheet included guidance notes for all participants, status notes for deep ocean sensor stations, scheduled times of issue of watches, warnings, national summaries and cancellation bulletins, and expected times of tsunami arrival at monitoring sites (both tide gauges and deep ocean sensors). The running sheet concept was considered so valuable to operational staff that it was decided to facilitate the preparation of running sheets for real tsunami events. A continuously open conference telephone link between the central warning office and all of the state based liaison points throughout the exercise ensured consistent advice and guidance was provided to the response agencies. This facility was deemed to be an essential component of the operational arrangements.

Canada, British Columbia, Provincial Emergency Program, remarked that there were many positive components to the Pacific Wave 08 Exercise. The format of Pacific Wave 08 made it easy for PEP to participate at their own level, which was greatly appreciated. The incoming messages were received in a timely and organized fashion and the structure of the messages was conducive to players not in the exercise, limiting confusion.

In an additional Annex to the Post-Exercise Evaluation Forms, Chile included its specific objectives of the Chilean National TWS (SNAM) for the Exercise Pacific Wave 08:

- Alert and alarm bulletins emission and dissemination protocol testing for the information received from PTWC ;
- Reception and evaluation protocols testing for the PTWC Tsunami bulletins received at SNAM in Chile;
- Elapsed time evaluation from the PTWC Tsunami bulletin reception to information relay towards National Emergency Office for the Ministry of the Interior (ONEMI), which is the national emergency and civil protection organization in charge of the local Tsunami alerts and/or alarms dissemination.

Cook Islands, having MeteoServices, Police and Airport Authorities as the only organizations with complete response procedures for a tsunami, reported that they carried out a table top exercise for key stakeholders so as to fulfill the objectives identified by the exercise. The table top exercise raised awareness levels in organizations. In reality their communities are not prepared for tsunami threat because the majority of the population have never experienced a tsunami. It was recommended that when all organizational and community response procedures are in place, an operational exercise be implemented to evaluate response.

China, Hong Kong, expressed a wish that the exercise should preferably be announced officially at least 3 months ahead and the planning document distributed 2 months ahead to allow more time for planning and preparation.

Colombia reported in Spanish. The essential data were taken into account for compiling the Summary Report.

Ecuador made a remark that planning, conduct, form and style of the Exercise were correct. It let them coordinate the activities with naval agencies in the Ecuadorian ports and the Risk Management Secretary.

The FSM, Chuuk State did not present completed Post-Exercise Evaluation Forms. In a short Report the Chuuk Disaster Coordinating Office stated that a week prior to the exercise, the State Task Force was organized and prepared for the upcoming Exercise Pacific Wave 08. Respective departments, agencies and entities were briefed ahead of time for the implementation of the Exercise. On 29 October 2008 at 0026 UTC a Tsunami Warning Bulletin No. 1 was relayed from the Chuuk Weather Service to the Disaster Coordinating Office and was immediately forwarded to the Governor's Office. Simultaneously, Command Post was established and the Task Force started to disseminate the Tsunami alert to the residents and general public through the Radio Station, SSB radio, CB radio, telephones, mobile phones. The FSM, Chuuk State reported that the Task Force ran its full operation procedures with very limited and meager resources: one laptop computer, one old HP printer, one vehicle for the Disaster Coordinating Office (DCO), no budget for POL, only one SSB Radio Station, unable to reach the farthest island in the State, only one land-line telephone, six hand-held radios, need repairs, no cell-phone for the Task Force, only two DCO personnel. They noted that their public awareness program was inadequate, and that their Disaster Emergency Plan needs to be updated.

The FSM Office of Environment and Emergency Management (OEEM) and the FSM Weather Service Office (WSO) recommended that an exercise of this type be carried out every six months to enable the participants to be ready before an actual tsunami event.

Only one participant, the FSM Pohnpei Department of Public Safety (DPS) declared that the Exercise was not planned out well: they received the exercise packet two days before the exercise began and had no time to meet with the State and Municipal focal point for better coordination. They pleaded to note that their jurisdiction extended to Kapingamarangi that is located 450 miles south-west of Pohnpei and Pingelap Atoll which is extended to 160 miles east of Pohnpei.

The FSM Yap State Disaster Coordinating Office emphasized that there is a need to improve the level of planning within the country and also that a feasibility study should be conducted in all the IOC member states to evaluate and identify relevant warning systems that can be utilized in those places lacking the financial resources and assets to improve their warning coordination.

France, New Caledonia did not present Evaluation forms. In a short report from High Commissioner Securite Civile Noumea a Table was presented which showed that all Bulletins sent via fax and email were received quasi instantaneously (within a minute). The telex messages sent by GTS were received 3-8 minutes after the others. Thus, New Caledonia remarked that the SMS was considered as non operational/robust communication system in case of a disaster. The alert communication system currently in phase of implementation will be based on a network of around 60 sirens implemented in the 4 islands (Nouvelle Calédonie, Lifou, Marae and Ouvéa) triggered by Inmarsat from the Noumea Civil Defence center. On October 29, the High Commissioner informed the population with a Press Communicate. The awareness of all population on tsunami hazard was increased. No evacuation drill was organized during this exercise.

New Zealand informed that the hard copy booklets did not arrive by courier until two days after the exercise. However, it was helpful to receive emails and have the instructing information coming from PTWC.

Nicaragua reported in English. Nicaragua misunderstood the time of issue of the first bulletin. Peru suggested that in future exercises the bulletins be in the state language of each country, in their case in Spanish.

USA American Samoa Government did not present Post Exercise Evaluation Forms, but their Territorial Emergency Management Coordinating Office (TEMCO) reported that prior to the exercise, preliminary meetings were held and it was determined that the exercise would test and validate the lines of communication from the NOAA station down to the village mayor level. According to the emergency operations plan for Earthquake/Tsunami and within 60 min, TEMCO had 27 departments and agencies on site at the EOC. The Office of Samoan Affairs was also alerted by TEMCO and they made the calls to 67 village mayors. The response from the parties involved was very positive. Several issues were raised, not the least of which was the fact that the EOC itself is in the Tsunami zone and that an alternate site or mobile center needs to be identified. Also, transportation of the EOC might be an issue as the main road is in major sections, right on the coast and therefore subject to severe damage. It was also found that weather radios had some reception problems and many individuals (mayors) and agencies who should have had a radio, did not. All in all though, it was agreed that the exercise was a good test of the lines of communication and that the exercise was beneficial to the territory particularly as they were entering the tropical storm season.

USA, Guam stated that tsunami run-up heights were unrealistic in some cases. They agreed internally to use a 2 meters run-up.

Singapore exercised only sub-objectives 1 (a) and 1 (b). They remarked that they received the bulletins from either GTS, fax and e-mail to the focal point. The messages received through GTS were most timely. There was a delay of about 5 minutes via fax and e-mail.

Tonga commented that the planning and conduct of the Exercise Pacific Wave 08 would have been much better if they had enough time. Unfortunately they were admitted late to participating countries due to some communication breakdown on their part. However, preparation and planning of the Exercise from the PTWC side was very good.

Objective 1: Validate the tsunami warning centers' dissemination process of issuing tsunami watch and warning bulletins to Pacific basin countries.

The participating countries and agencies provided the following assessment on a range of sub-objectives relating to Objective 1;

Validation of Tsunami Warning Centre's Dissemination Process;

Topic 1a: Tsunami Warning Timeliness

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	-	3	14	5	6	28
EPW06	-	4	11	1	2	18

Overview:

In respect to tsunami warning “timeliness”, a majority of responders (19) felt that this sub-objective was met or exceeded.

For some less developed countries, telecommunications systems suffered from delays (some up to 1-2 hours) for warnings delivered by email, fax, and telephone. It was noted by these countries that having a high priority emergency line would be useful in ensuring the timeliness of warning messages.

For some countries, warnings emailed from the PTWC were significantly delayed (1-2 hours) and it was suggested that follow up telephone calls confirming that messages were received and understood would be useful. It was also suggested that faxes supporting information sent by email or delivered by phone would be a further advantage.

Notes:

Chile noted that the tsunami arrival times to the Chilean coast estimated by the Chilean Hydrographic and Oceanographic Service of the Chilean Navy (SHOA) was not the same with the times sent on the Tsunami bulletins (will be revised).

Colombia receives PTWC bulletins via email, not by fax.

Ecuador commented that information emission was so timely and accurate, it let them an excellent dissemination with the Naval agencies and the Risk Secretary. People reacted correctly and observed the messages reception with attention, at the same time estimating them. That information received via GTS was timely, but faxed information was too slow. On the other hand, while warnings delivered by telephone were timely it did not allow for vital detailed and specific information to be passed on.

USA; The Weather Forecasting Office Guam noted that they received bulletins via AWIPS and fax. AWIPS sets off an alarm. WFO Guam then notifies: Guam Office of Civil Defence, CNMI (Saipan) Emergency Management Office, WSO Palau, WSO Yap, WSO Chuuk, WSO Pohnpey, WSO Majuro. If they cannot reach WSO, they call the Disaster Coordination Office directly.

The FSM OEEM recommended that the Tsunami Bulletins from PTWC should be disseminated directly to the Emergency Management Office instead of the WSO.

The FSM Pohnpei WSO expressed the same recommendation.

The FSM DPS stated that the reception and validation of the Tsunami Bulletins from the TWC in the Pohnpey State was timely. However from the State Coordination Center to the last mile it was inefficient because of lack of communications equipment. They also faced difficulties in interpreting the terminology used in the warnings and in Zulu Time conversion.

The FSM Yap State DCO noted that the validation of Bulletins was conducted through the focal point, Yap State WSO: timely dissemination of bulletins was more than adequate and kept them working "non-stop". They made a remark that there's a need for a training for all Emergency Operation Center (EOC) personnel to understand the basics and dynamics of the process. The State is currently reviewing these shortfalls; there's the hope that soon improvements will be made, once the leadership approved, to increase the

number of staff, and will be dedicated only to all-hazards functions with additional funding, hopefully.

Japan: As the scenario for the Exercise was an earthquake close to Japan, the Japan Meteorological Agency, the national tsunami warning authority in Japan, quickly detected the earthquake and disseminated a tsunami warning in Japan before it received bulletins from the PTWC. The bulletins of the PTWC were useful to validate the JMA's analysis.

In Malaysia all messages issued by TWCs were received via GTS within 1 minute and via fax within 5 minutes.

The New Zealand Ministry of Civil Defence & Emergency Management (MCDEM) showed that Tsunami Bulletins arrived by email to MCDEM the same minute as issued by PTWC. Faxes arrived a few minutes after the emails – all arrived OK.

Topic 1b: Methods used for disseminating tsunami warning bulletins.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	-	4	13	3	8	28
EPW06	1	1	13	-	3	18

Overview:

The majority of responding countries/agencies expressed satisfaction in the methods used to send tsunami bulletins. They made comment that the PTWC method of using GTS, email and fax worked satisfactorily.

Notes:

Cook Islands noted in their Report that one of the more efficient ways of receiving the warnings from PTWC was via SMS. Two of the allocated mobile numbers received the warnings within a minute of being sent by PTWC. They were the mobile numbers of the Cook Islands Meteorological Services and that of the Cook Islands Airport Authority. One of them acts as an alternate receiving station for the other in case the original receiver fails to respond or acknowledge the warnings. On the other hand, New Caledonia pointed out that the SMS was considered as non operational/robust communication system in case of a disaster.

The FSM OEEM recommended that they receive the Tsunami Bulletins directly either by fax or email.

The FSM Pohnpei WSO recommended the same method.

The FSM Yap State DCO noted that they also received the Bulletins from PTWC through emails – it was considered as part of SOP. They made a remark that due to the limited means of communications it is difficult to coordinate actions and exchange information between the WSO and DCO and other off-island institutions. Communications lines are overloaded, they should be more developed and improved.

Malaysia reported that messages were received via GTS, fax and emails. The GTS method was the best: it would trigger an alarm on arrival.

The New Zealand MCDEM made a remark that Emails and faxes were appropriate methods for receiving the bulletins. They did not receive any SMS messages – they believe that this is not possible. (?) If SMS messaging could be utilized, they would certainly use this as another method of redundancy to enhance reliability.

The Tsunami Warning Center of Peru, HYDRONAV, suggested the warning messages issued by PTWC to be received via cell phone as SMS by focal point(s):

HIDRONAV	Technical Head	Captain Rodolfo Sablich
	Cell phone	511 8881 26142
	Email	rsablich@dhn.mil.pe

HIDRONAV	Head of Oceanography	Commander José Tejada
	Department	
	Cell phone	511 9996 37492
		511 9981 25972
	Email	jtejeda@dhn.mil.pe

The Philippines participating agency, Philippine Institute of Volcanology and Seismology – Department of Science and Technology (PHIVOLCS), reported that Tsunami Bulletins were received from the TWCs via fax and email and that RANET SMS Notification messages were also received by selected PHIVOLCS personnel.

Objective 2: Validate the process for countries to receive and confirm tsunami bulletins.

Participants made the following comments relating to the receipt and confirmation of tsunami warning bulletins during Exercise Pacific Wave 2008.

Overview: It is difficult to judge the success of Objective 2 for Exercise Pacific Wave 2008 because not all countries/agencies responded to this section of the evaluation questionnaire. However, based on the limited responses received, it appears that the warning bulletins usually arrived by fax, email or GTS. Confirmations were generally made using the same systems, and usually occurred immediately or within 10 minutes of receipt.

Notes:

National Tsunami Warning Focal Point

1. Time of receipt (hh:mm) of warnings by the national focal point from (UTC):

PTWC: Chile 00:16 (fax, SMS, email); China-Hong Kong Observatory 00:10 (GTS), 00:11 (email), 00:12 (fax); China-NMEFC 00:18 (fax); Colombia 00:18 (email); Costa Rica 00:10 (email); WFO Guam 00:11; Japan 00:10 (GTS, email, fax); Malaysia 00:10 (GTS), 00:10 (fax), 00:15 (email); FSM Yap State WSO 00:35 (email); New Caledonia 00:10 (email), 00:10 (fax), 00:15 (GTS); New Zealand 00:10 (email, faxes arrived a few minutes later); Nicaragua 00:07 (email, fax); Peru 00:11 (AFTN); Philippines 00:10 (fax), 00:10 (email); Republic of Korea 00:10 (email); Russian Federation 00:10 (GTS, fax, email); Papua New Guinea 00:13 (fax, email), Tonga 00:10 (fax, email)

Note: Eight countries did not advise the timing of receipt of bulletin 1. Most of the participating countries did not advise of bulletins 2 to 12 receipt.

WC/ATWC:

China-NMEFC 00:10 (GTS); Japan 00:11 (GTS, email, fax); Russian Federation 00:06 (GTS, fax, email); Papua New Guinea 00:06 (fax, email).

Note: No other countries advised receipt of any WC/ATWC bulletin.

NWPTAC: China-Hong Kong 00:06 (GTS), 00:06 (email), 00:07 (fax); China-NMEFC 00:08 (fax); Malaysia 00:05 (GTS), 00:05 (fax), 00:05 (email); Philippines 00:05 (fax), 00:05 (email); Republic of Korea 00:06 (email); Russian Federation (GTS, fax, email).

Japan Meteorological Agency is the NWPTAC itself.

Note: 21 countries did not advise timing of bulletin 1 receipt from NWPTAC.

2. Method of receipt by national focal point:

Fax – received by 10 (11) respondents

Email – received by 13 (9) respondents

SMS – received by 3 respondents

GTS – received by 6 respondents

Telephone – received by 1 respondent

The above information indicates that Bulletins from the PTWC were the most widely received with fax, email or GTS methods being mostly used.

Confirmation

1 & 2. Time & Method of confirmation of receipt of warning back to Tsunami Warning Center(s) (UTC):

China-Hong Kong 00:14 (PTWC), 00:10 (NWPTAC) (GTS); Costa Rica 00:55 (PTWC); Japan – automatically (PTWC, WC/ATWC) (GTS); Malaysia – within 1 minute (PTWC, NWPTAC) (GTS); Peru 00:12 (PTWC) (AFTN); Philippines 00:18 (PTWC, NWPTAC) (email); Russian Federation 02:31 (NWPTAC), (GTS).

The JMA's system automatically sends confirmations through the GTS as soon as it receives bulletins. Therefore, the confirmation messages should have been sent on the same time which JMA received the bulletins.

Papua New Guinea – Port Moresby Geophysical Observatory stated that they should have sent confirmation of the Bulletins receipt but unfortunately hadn't.

National Decision-making & Dissemination Points (if different to the National Tsunami Warning Focal Point)

1. Time of passing the information to the national decision-making & dissemination point:

Chile (SNAM-to-ONEMI) – 00:26 (delay 10 minutes); Colombia 00:28 (10 minutes delay); WFO Guam – from CNMI EMO 00:13 – to – Majuro WFO 00:21; Malaysia 00:15 (10 minutes delay); FSM Yap State WSO 00:40 (5 minutes delay); Philippines –to-Office of Civil Defence 00:31 (fax), 00:35 (email) (26-30 minutes delay); Republic of Korea 00:10 (4 minutes delay).

2. Method of passing the information to national decision-making & dissemination point:

Chile – internet, fax and email; Malaysia – SMS, Telephone, fax; France, New Caledonia – fax, email, SMS, Radio, TELEPHONE; Philippines –fax, email.

Chile: The Hydrographic and Oceanographic Service of the Chilean Navy (SHOA), permanent and official organization for the State in charge of operating the National Tsunami Warning System (SNAM), informed that their Mail Server was offline at the beginning of the Exercise Pacific Wave 08, so Bulletins 1 and 2 were not received on time via email. the situation was corrected at 01:09. Confirmation of receipt is not considered in their internal procedures.

Chile SHOA and SNAM relay information to ONEMI, National Emergency Office for the Ministry of the Interior, the national emergency and civil protection organization in charge of the local Tsunami alerts.

Objective 3: Validate dissemination of the warning message to relevant agencies within a country, province and local jurisdiction.

Participants made the following assessments about the internal dissemination of the tsunami warning within their country.

Overview:

The information suggests that most Tsunami messages disseminated within countries were to:

- Emergency services agencies;
- Other national government agencies;
- Local city and district agencies.

This information indicates (despite most participants not providing a response) that once the tsunami warning was received by the country, the national focal points distributed the warning to agencies within countries either immediately or within 10 minutes. The dissemination of in-country warnings were dispersed through a wide variety of methods including fax, telephone, email, and SMS – as well as dedicated landlines, satellite links, and radio communications. Although some in-country warnings failed it did not emerge as a significant issue because often alternative methods of disseminating warnings were available.

Method(s) of confirming receipt of messages by agencies/provinces/local jurisdictions;

- fax – 9 responders
- radio – 2 response

- telephone – 10 (3) responders
- email – 4 (2) responders
- SMS – 2 response

Note: 11 participants did not provide this information.

National Reports: Dissemination of Warning

Dissemination Points

1. The warning was disseminated to:

Agency Warning Was Disseminated To	For EPW08	For EPW06
Emergency Services	12	14
Other national government agencies	15	12
Science agencies/universities for assessment	6	3
Local government: provincial/regional level	8	11
Local government: city/district level	10	6

Note: Seven countries/agencies did not supply answers

Delivery

1. Time of sending of warning to the above (UTC):
Chile 00:57 (11 minutes delay after Bulletin N°2 arrival), SHOA sent Tsunami Warning to the national government agencies; China – Hong Kong– not applicable, as a local timeline was adopted for the Exercise in Hong Kong; PR China 00:13; Colombia – with 5 to 10 minutes delay; Costa Rica 00:55; WFO Guam– from CNMI EMO 00:13 – to – Majuro WFO 00:21 (phone calls); Malaysia 00:15; FSM Yap State DCO 00:45; New Zealand - the PTWC bulletins were used to suit the training needs for staff involved in the test rather than keeping to the PTWC timing of bulletins; Nicaragua 14:05; Peru 00:15; Philippines 00:31 fax – 00:35 email; Republic of Korea 00:10; Russian Federation 00:08; Papua New Guinea – immediately on receipt; Tonga 01:14 – to various agencies – 02:38
2. Methods of delivery to agencies/provinces/local jurisdictions:
Chile, SHOA to ONEMI by fax and email, SHOA to Naval communication Network by email and Naval messaging system; China – Hong Kong-fax, email, telephone; PR China - fax; Colombia - email, fax, SMS; Costa Rica – beeper; WFO Guam – individual phone calls and fax (from 00:28 till 00:47); Malaysia – SMS, fax; FSM Chuuk State – SSB radio, CB radio, telephones, mobile phone; FSM Yap State DCO – phone calls, vhf radio, SSB radio; New Zealand – fax, email, SMS; Nicaragua – radio, email, mobile phone, fax; Peru – individual phone calls, fax; Philippines – fax, email, SMS; Republic of Korea – fax; Russian Federation – telegraph, TV, radio, group voice message, individual phone calls, fax; Papua New Guinea – fax, email; Tonga – fax, phone.
3. Number of failed deliveries (as shown by delivery systems):
China – Hong Kong – Nil; PR China – None; Colombia – via email – None, Costa Rica – 5; WFO Guam – None by phone, some via fax; Malaysia – None; FSM Yap State DCO – 8 out of 15; New Zealand – quite many because of a high proportion of recipients; Nicaragua – some via fax; Peru – Nil; Philippines – None; Republic

of Korea – None; Russian Federation – None; Papua New Guinea – None; Tonga – many.

4. Reasons for failed deliveries:
Costa Rica - beeper failure; WFO Guam – overworked fax machine; FSM Yap State DCO – overloaded communications means; New Zealand – technical configuration error – this is being resolved; Nicaragua- no dial tone (fax); Tonga – Many offices were out of operation after office hours.
5. Alternate action taken to reach recipients where failures occurred:
Costa Rica – cell phone; WFO Guam – via internet; FSM Yap State DCO – through Public Safety patrol units and ensured radio broadcasting, also faxes near government offices; New Zealand - they have a procedure where non-responders are followed up by MCDEM staff or local Civil Defence Emergency Management Group representatives; Nicaragua – radio, mobile phone.

Note: 13 participants did not give dissemination times or followed their own SOPs.

Confirmations

1. Methods of confirming receipt of message by agencies/provinces/local jurisdictions:
Chile - automatically by email; China-Hong Kong – phone calls; PR China – fax; Colombia – email, telephone, fax; Costa Rica – email; WFO Guam – phone or fax; Malaysia – phone, fax; New Zealand – email, SMS, phone; Nicaragua –radio, phone, email; Peru – phone, fax; Philippines – fax, SMS; Republic of Korea – fax; Russian Federation – telegraph, radio, phone, fax; Papua New Guinea – telephone, fax; Tonga – fax, phone.
2. Time that the process of confirmations of receipt of message was completed:
Chile - was not measured; China –Hong Kong –immediately; PR China 01:09; Costa Rica – 01:05; Malaysia – 5 to 10 minutes; New Zealand – due to technical reasons there are no accurate data; Nicaragua – 14:35; Peru – 00:16; Philippines – 1 to 19 minutes; Republic of Korea 00:40; Russian Federation – 00:30; Papua New Guinea – 00:30.
3. Number of non-confirmations:
Chile -was not measured; China – Hong Kong – Nil; PR China – None; Costa Rica – 2; Malaysia – Nil; Peru – Nil; Philippines – tsunami cancellation message was not confirmed; Republic Korea – None; Russian Federation – None; Papua New Guinea – None; Tonga – many.
4. Reasons for non-confirmation:
Chile - not applicable; Costa Rica – email failure; WFO Guam – did not want to interrupt PTWC; Philippines – Office of Civil Defence staff thought it was unnecessary; Tonga – due to closed offices.
Japan commented that several dummy messages were delivered to the relevant organizations through the dedicated telephone line and satellite communication link, same as actual events. They do not take actions for confirmation of the receipt of messages, because in an emergency situation the operator should not be swamped with confirmation and the confirmation work, which may produce an unnecessary congestion in communication traffic. If there have been failures in

receiving messages, the recipients check their receivers and if necessary, ask it to JMA during / after the exercise.

The delivery of messages to local/provinces/regional government agencies were through the following methods:

- telephone – 8 responders
- fax – 13 (6) responders
- radio – 4 (2) responders
- SMS – 5 (2) responders
- email – 7 (4) responders

Note: 13 participants did not advise of method.

Participants advised of the following number of failed deliveries (as shown by delivery systems);

- nil failures – 10
- failure due to technical/communications problems – 6

Note: Nine participants did not advise of the failures.

Participants advised of various alternative delivery methods in the face of failed deliveries: cell phone, internet, radio.

A range of sub-objectives for Objective 3 were also assessed. The following information emerged:

Topic 3a: The information issued by national decision-makers and dissemination of warnings was timely.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	-	4	12	3	9	28
EPW06	1	-	12	1	4	18

Overview:

Conclusions drawn from this information suggest that the majority of participants expressed that tsunami warning timeliness within countries met or exceeded expectations. The country giving a low rating advised that timeliness of information to local areas was affected by poor quality of telecommunications within their country.

Topic 3b: The methods of communication from national decision-makers to dissemination points were sufficient to support local decision-making;

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	-	2	13	2	11	28
EPW06	1	-	14	-	3	18

Overview:

The outcomes show that the majority of responding participants (15) believed that the in-country warning received met the objective of supporting local decision makers. The country giving a low rating advised that it was due to poor telecommunication systems within their country.

Objective 4: Validate the organisational decision making process about public warnings and evacuations.

Overall Objective 4 Overview: Objective 4 had a range of elements. The range of issues explored through this core objective identified that all of the sub objectives were believed to have been met, except for the quality of feedback from local provincial agencies to the national lead agencies.

Topic 4a: The method of communication between national decision-makers and dissemination points and individual response agencies and provinces/local jurisdictions was sufficient to support national information requirements.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	1	4	11	-	12	28
EPW06	2	1	12	-	3	18

Overview:

Although a majority of participants (11) gave feedback that the methods of communication met objectives, comments were made that in less developed regions it was common to find poor telecommunication services to provincial and regional areas. There was also comment made that aid assistance strengthening communication infrastructure would be useful.

Most of the participating countries/agencies sent warning messages from their national focal point to emergency agencies, other national government agencies and regional and provincial government agencies. Through these processes it was stated that the timeliness of warning messages to these stakeholders met the objectives in this part of the exercise. The methods used were also rated as successful in meeting local and national information requirements.

A wide range of methods (fax, email, telephone, and other telecommunication systems) were used within countries and largely worked, despite some difficulties with telecommunication systems in some developing countries.

Notes:

Malaysia commented that the methods used were successful in meeting local and national information requirements. Recipients/officers concerned understood messages received and acted accordingly.

This was not an objective of the New Zealand exercise. However, the collation of responses was faulty and is now being resolved.

While the methods utilized by the national Philippines agencies PHIVOLCS & OCD in the exchange of information were sufficient, communication of warning down to local jurisdictions remain insufficient for immediate response of coastal communities.

Tonga remarked that some District Emergency Committees do not have adequate/appropriate communication equipment.

Topic 4b: Arrangements to assemble a management group relevant to decision-making on tsunami warnings and response were in place before the exercise.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	-	2	15	-	11	28
EPW06	2	2	10	2	2	18

Overview:

The majority of participants (15) rated the objective of arrangements to assemble their management group as being met.

Several countries remarked that management processes for decision making are already planned and pre-determined.

Notes:

Canada, British Columbia noted that A Tsunami Notification Test was conducted on October 28, 2008 at 2330 UTC. This message was intentionally sent out just prior to the first message in the Pacific Wave 08 exercise. As part of their series of regularly scheduled tests, the notification was sent to all provincial stakeholders and at-risk communities in tsunami hazard zones via the Provincial emergency Notification System. Approximately 1000 phone calls, 300 emails, and 300 faxes were made in 30 minutes. In conjunction with the PENS test, Environment Canada also launched a test message on the Weather radio system. The notification message indicated this test was part of a Pacific-wide tsunami exercise.

Chile SHOA informed the Navy and Government Agencies about the Exercise Pacific Wave 08, however they did not participate in the exercise.

The FSM OEEM and FSM WSO, Pohnpei commented that four (4) States in the FSM did their own arrangements within their jurisdictions.

Topic 4c: The management group relevant to decision-making on tsunami warning and response was assembled within minutes after receiving the first warning. Timely in this instance was to facilitate good decision-making.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	1	1	9	4	13	28
EPW06	2	2	10	2	2	18

Overview:

The majority of participants (13) also rated this element met or exceeded the ability to achieve management group assembly in a timely manner in order to achieve good decision-making. Several countries (particularly developed countries) advised that management group assembly procedures are already pre-determined and made it possible to assemble the decision-making management group within 5 minutes after the first warning. Again, one country (developing country) felt it was difficult to achieve timeliness due to poor telecommunications infrastructure in their country, and there were instances of internal confusion.

Notes:

In China, Hong Kong Observatory, the management group assembled within 5 minutes after the PTWC warning receipt, right after the HKO issued its first tsunami warning.

The FSM OEEM and FSM WSO remarked to this objective: “coordination was excellent” and “excellent – we are ready for tsunami”, but more work to improve their response plan is still needed.

Japan did not form a management group during the Exercise. However in a real event they would have done so: it is pre-determined in the national disaster management plan of Japan.

In Malaysia the Management group assembled in a timely manner in order to achieve good decision-making.

In Philippines, since the occurrence of this event was set at normal office hours, the management group (Director, Officer-in-Charge & Senior Staff of the earthquake monitoring division) was able to informally convene immediately to provide decisions in the issuance of bulletins with appropriate alert levels. If the exercise had commenced in the evening, the group may not have been assembled convened completely after receiving the first warning and decisions may have been issued by only a fewer people or by phone, as per SOP.

Tonga remarked: we did not go as far as assembling the decision makers when warning were received.

Topic 4d: The quality of the information issued by our national decision-making and dissemination point was sufficient to support local level decision-making.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	1	3	10	1	13	28
EPW06	1	2	9	1	5	18

Overview:

Most participants (11) rated the quality of information issued nationally met the objective of supporting local level decision making. Some countries however, did not test this objective due to insufficient time for planning and requested a longer timeline for future exercise planning.

Notes:

In China, Hong Kong, in addition to tsunami warnings disseminated to relevant agencies and mass media, a press conference was simulated.

Costa Rica stated: We, as a country, do not have tsunami risk maps, therefore, we do not know which specific areas would be at risk if a tsunami were coming. We have not defined evacuation routes either. Therefore, we can only give general recommendations, such as, get away of the beach for example.

In USA, Guam Office of Civil Defence provided comprehensive information; mayors conducted some evacuations.

In Japan, contents of warning messages are pre-determined in order to meet the needs of recipients such as disaster management organizations and local governments.

In Malaysia the information issued to the Disaster Response Agencies was clear and concise in two languages, English and Malay. They were able to act based on the SOP.

Based on arrival times at forecast points in the issued bulletins by PTWC and NWPTAC, tsunami bulletins issued by Philippines PHIVOLCS list provinces that may be impacted by destructive waves. Owing to uncertainty in arrival times at the forecast points, the bulletins only provide a time range when these waves would arrive for all areas.

Tonga noted that the information provided was relevant for decision-making process/purposes.

Topic 4e: The quality of the information received back from response agencies and local level government were sufficient to support national level decision-making.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	1	5	7	-	15	28
EPW06	2	4	8	-	4	18

Overview:

With this sub-objective, many responding participants (six) felt that the quality of information feedback received from other national agencies and local government levels did not fully meet objectives. However, most of the participants also advised that such feedback was not actively sought nor encouraged during the exercise.

Notes:

In China, Hong Kong, tsunami monitoring and warning including advice on precautionary measures to the public was made by the Hong Kong Observatory alone, without the need for feedback from response agencies.

In Japan no information was sent back from other agencies during the Exercise.

In Philippines some of the regional offices furnished the institute with their “dummy incident reports” for this exercise, detailing number of households that evacuated and response activities that supported areas that will be impacted by the approaching tsunami. The cancellation of the tsunami warning by PHIVOLCS did not rely on these reports since it lacked description on ongoing wave activity at the local coastline and there are no sufficient watch points that would allow sea-level monitoring. However, response activities may have been coordinated by the Office of Civil Defence based on these reports.

Tonga informed that response agencies did not refer back to them but proceeded with disseminating the information as far as possible.

Topic 4f: Sufficient national information was available to support national level decision-making (PTWC, WC/ATWC, NWPTAC information, country-generated scientific assessments, national considerations etc).

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	1	2	10	3	12	28
EPW06	-	2	10	2	3	18

Overview:

From this information it can be seen that most responding participants (thirteen) believed the objective was met in relation to sufficient national information being available.

Notes:

In Philippines the estimated time of arrival and wave heights from the international warning agencies became the basis for determining the appropriate warning level in the national tsunami bulletins issued by PHIVOLCS.

However, the list of possible affected areas was decided among the provinces that had coastlines fronting the Pacific Ocean. PHIVOLCS bulletins did not include some forecast points in the warning bulletins from NWPTAC and PTWC that are located in the western side or within the interior of the country.

Tonga's remark was that decision-making will be based on information issued from warning centers. National information is still sketchy at this point.

Topic 4g: Sufficient local information was available to support assessment and decision-making (local hazard assessments, inundation areas identified, evacuation plans etc).

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	2	3	6	1	16	28
EPW06	2	1	5	1	9	18

Overview:

This question was not answered by most of the participants. It was noted after the Exercise Pacific Wave 06 that more risk modelling, inundation modelling, and bathymetric studies were needed in high-risk areas. This was considered that decision making could be more effective in creating community awareness to design large scale evacuation plans and for allocation of post tsunami management resources.

Notes

Philippines PHIVOLCS has sufficient information on which areas will be impacted by the scenario event. However, at the local level, a list of towns and cities that may be inundated by the tsunami waves is not immediately available but could easily be generated from existing databases. While some local evacuation plans have been developed and tsunami drills have been conducted, these activities do not cover all areas that may be impacted by this scenario event. PHIVOLCS plans to provide provinces and municipalities with its inundation maps and urgently requests them to develop tsunami evacuation plans.

Tonga remarked that they did not go as far as having to assemble people for decision-making purposes. Their operation was limited to receiving and disseminating the warning

bulletins through appropriate channel of communication as indicated in their National Management Plan without alerting the public

Topic 4h: We were able to make decisions about appropriate warnings and response.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	1	1	14	1	11	28
EPW06	-	3	13	-	2	18

Overview:

The majority of participants expressed the view that the objective was met in being able to make decisions about the appropriate warnings and response.

Notes:

For Malaysia it was proven that only a high standard of communication system is needed in order to disseminate the warning.

Topic 4i: Decision-making was based on pre-existing plans for an event of this nature.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	2	3	14	-	9	28
EPW06	1	2	13	-	2	18

Overview:

Again, a majority of participants (14) gave endorsement to the objective because decision-making was based on pre-existing plans in a similar event. It was expressed that warning messages were disseminated in a timely manner to other agencies because of existing standard operating procedures. Again, the countries that gave lower ratings did so because of the difficulties caused by poor telecommunication systems within their country and/or because of poor knowledge and planning at local provincial levels.

Notes:

The FSM OEEM and FSM WSO remarked: “We have no plan for event like tsunami yet.

In Malaysia warning messages were disseminated in a timely manner to other agencies because of existing standard operating procedures.

The Ministry of Civil Defence & Emergency Management of New Zealand has standard operating procedures that outline the decision-making process for sending national warning, advisory and cancellation messages, along with a process to record the acknowledgements of such messages.

In Philippines the communication set-up for a trans-Pacific destructive tsunami had been formulated and adopted by the two national agencies, PHIVOLCS and OCD. However, at the local level, plans may not yet be fully outlined and tested.

Topic 4j: The exercise contributed to the improvement or the development of planning related to public warnings and other response activities required for an event of this nature.

Objectives	Not Met	Some Met	Met	Exceeded	No Resp	Total
EPW08	1	1	9	3	14	28
EPW06	1	1	12	2	2	18

Overview:

The majority of respondents (12) reported that this sub objective met or exceeded expectations and that Exercise Pacific Wave 2008 contributed to the improvement and development of planning relating to public warnings and response activities.

Notes:

Canada, British Colombia stated that many lessons were learned through their internal training exercise, but the one point that stands out the most is the importance of the interaction between their Canadian partners with the Canadian Hydrographical Service (CHS). These colleagues are the technical experts that British Colombia relies on for technical information specific to British Columbia.

New Zealand commented that the exercise contributed to discovering some technical and training issues with their national warning system. These are now being rectified.

Philippines remarked that the exercise identified gaps in sending the tsunami information warning downstream based on the timeline and feedback from the regional offices and some local agencies.

Objective 5: Identify the modes that would be employed to notify and instruct the public.

Participants made the following assessments regarding tsunami warning methods and the means of translating these messages to the public.

Overview: It was shown by the responses that means of notification embracing wider masses of population – public radio broadcasts, TV announcements/teletext and public announcement systems – are preferable and will be used for future exercises and in real life events. Currently, many of the public communication warning arrangements exist in participating countries.

Alerting Methods. As part of the decision-making processes during this exercise, it has been determined that the following means of public notification and instruction will be used in a real event of this kind;

Method	Countries Intending to Use	Countries with Existing Arrangements
Public radio broadcasts	21 countries	18 countries
TV announcements/teletext	15 countries	14 countries
Public announcement systems	14 (5) countries	12 (3) countries
Cell broadcast	8 (4) countries	7 (2) countries
SMS (cell)	8 (10) countries	6 (6) countries
Public call centre	3 countries	1 countries
Website	13 countries	10 countries
Telephone	13 countries	13 countries
Sirens	11 (8) countries	12 (5) countries
Door to door announcements	8 countries	7 countries
Other - email		
- Ranet (radio internet)		
- VHF radio		
- UHF manned radio		
- Fax	1 country	2 country
- Loudspeakers	1 country	
- SEWS		
- Bells and horns	1 country	2 countries
- NWR	1 country	1 country
- vigilant & watchman cars	1 country	1 country
- drums	1 country	1 country

Objective 6: Assess the elapsed time until the public would be notified and instructed.

Overview: Of 28 agencies/countries that presented Reports on the Exercise Pacific Wave 08, 14 gave no data on time of public notification. The average elapsed time achieved from time of receipt of warning to activating the public notification systems was 57 minutes.

Notes:

Participants made the following assessments about the timings of public warnings during Exercise Pacific Wave 2008:

Activity	Elapsed Time
Making a decision on public warning (From time of receipt of warning)	Fourteen (14) participants advised elapsed times ranging from 2 minutes to 60 minutes, achieving 20 minutes elapsed time on average
Formulation/compilation of public notification (From time of decision)	Fourteen (14) participants advised elapsed times ranging from 1 minutes to 60

	minutes, achieving 13 minutes elapsed time on average
Activation of public notification systems (From time of notification formulated)	Fourteen (12) participants advised elapsed times ranging from 1 minute to 2 hours, achieving 24 minutes elapsed time on average
Total Time	Total average elapsed time achieved was 57 minutes

ANNEX VI. PTWC MESSAGE DISSEMINATION SUMMARY

The following tables summarize the email, facsimile, and RANET dissemination of bulletins issued by the Pacific Tsunami Warning Center (PTWC) as part of Exercise Pacific Wave '08. Actual email addresses have been obscured in this report to protect their potential sensitivity.

Table 1. PTWC PacWave08 Email Address Problems

Country or Subnational Entity	Email Address	PACWAVE08 Problem
American Samoa	None	
Argentina	xxxxxxxx@xxxxx.xxx.xx	X
Australia	xxxx@xxx.xxxxxxxxx.xxx.xx	
Australia	xxxx@xxxxxx.xxxxxxxxxxxxxx.xxx.xx	
Australia	xxxx@xxx.xxx.xx	
Australia	xxxxxx_xxx@xxxxxx.xxx.xx	X
Australia	xxxxxx@xxxxxxxxx.xxx.xxx.xx	
Australia	xxxxxx@xxx.xxx.xx	
Australia	x.xxx@xxx.xxx.xx	
Australia	x.xxxxx@xxx.xxx.xx	
Australia	xxx@xxx.xxx.xx	
Australia	xxxxx.xxxxxxx@xx.xxx.xx	
Australia	xxx.xxx@xxx.xxx.xx	
Australia	xxx.xxxxx@xxx.xxx.xx	
Australia	xxxxxxxx.xxxx@xxx.xxx.xx	
Australia	xxx@xxxxxxxx.xxx.xx	
Australia	xxxxx@xx.xxx.xx	
Australia	xxxxxxxx.xxxx@xx.xxx.xx	
Australia	xxxxxx@xxx.xxx.xx	
Brunei	xxxxxxxx@xxxxxx.xx	
Brunei	xxx@xxxxxx.xx	
Cambodia	None	
Canada	xxxxx.xxxx@xxxxx.xxx.xx.xx	
Canada	xxxxxxxxxxxx@xxx.xxx-xxx.xx.xx	
Canada	xxxxxxxx@xxx-xxx.xx.xx	
Chile	xxxxxxxx@xxxx.xx	
Chile	xxxx@xxxx.xx	
Chile	xxxxxxxx@xxxx.xx	
Chile	xxxxxxxx@xxxx.xx	
Chile	xxxxxxxx@xxxx.xx	X
Chile	xxxx@xxxx.xx	
China	xxx@xxxxx.xxx.xx	
China	xxxx@xxxxx.xxx.xx	
China	xx@xxx.xxx.xx	
China	xxxx@xxxxx.xxx.xx	
Chuuk - Micronesia	xxxxxxxx.xxxxx@xxxx.xxx	
Colombia	xxxx@xxxxxxxx.xxx.xx	
Colombia	xxxxxx@xxx.xxx.xx	X
Colombia	xxxxxx@xxx.xxx.xx	
Colombia	xxx@xxxxxxxx.xxxxxxx.xxx.xx	X
Colombia	xxxxxx@xxx.xxx.xx	
Colombia	xxx_xxx@xxxxx.xxx	
Colombia	xxxx@xxxxx.xxx.xx	
Colombia	xxxxxx@xxxx.xxxxxxx.xx	X

Colombia	xxx @ xxxx.xxxxxxxx.xxx.xx	X
Colombia	xxxxxxx @ xxxxx.xxx.xx	X
Cook Islands	xxxx @ xxxxxx.xxx.xx	
Cook Islands	xxxxxx @ xxxxxx.xxx.xx	
Cook Islands	xxxxxxx @ xxxxxxxx.xxx.xx	
Costa Rica	xxxxxxx @ xxx.xx.xx	
Costa Rica	xxxxxxx @ xxx.xx.xx	
Costa Rica	xxxxxxxxxxxxxx @ xxxxx.xxx	
Costa Rica	xxxxx.xxxx @ xxxxx.xxx.xx	
Costa Rica	xxxxxxxxxxx @ xxx.xx.xx	X
Costa Rica	xxxxxxxxxxx @ xxx.xx.xx	
Costa Rica	xxxxxxxxxxxxxxx @ xxx.xx.xx	
Costa Rica	xxxxxxxxxxx @ xxx.xx.xx	
Costa Rica	xxxxxx @ xxx.xx.xx	
Costa Rica	xxxxxxxxxxxxxx @ xxxxx.xxx	
Ecuador	xxxxxx @ xxxxxx.xxx.xx	
Ecuador	xxxxxx-xxx @ xxxxxx.xxx.xx	
Ecuador	xxxxxxx @ xxxxxx.xxx.xx	
Ecuador	xxxxxxxx @ xxxxxx.xxx.xx	
Ecuador	xxxxx @ xxxxxx.xxx.xx	
Ecuador	xxxxxxxxxxx @ xxxxxx.xxx.xx	
Ecuador	xxxxxxx @ xxxxxx.xxx.xx	
El Salvador	xxxxxxxx @ xxxx.xxx.xx	X
El Salvador	xxxxxxxx @ xxxx.xxx.xx	X
El Salvador	xxxxxxxx.xxxxxx @ xxxxxxxxxx.xxx.xx	X
El Salvador	xxxxxxxxxxx @ xxxx.xxx.xx	
El Salvador	xxxxxxx @ xxxx.xxx.xx	
Fiji	xxxxxxx @ xxx.xxx.xx	
Fiji	xxx @ xxx.xxx.xx	
France	xxxxxxxxxxx @ xxxxx.xx	
France	xxxxxxx @ xxxxx.xx	
France	xxxxxxxxxxxxxx _xxxxxx @ xxxxx.xx	
France	xxxxx _xxxxxxxxxxxx @ xxxxx.xx	X
French Polynesia	xxxx @ xxxxxx.xx	
French Polynesia	xxxxxxx.x @ xxxxxx.xx	
Guam – U.S.	xxxx @ xxxxxx.xxx.xxx	
Guatemala	xxxxxxxxxxx @ xxxxxxxxx.xxx.xx	
Guatemala	xxxxxxxx @ xxxxxxxxx.xxx.xx	X
Honduras	xxxxxxxxxxxxxxxxxxxxxx _xxxxxx @ xxxxx.xxx	
Honduras	xxxxxxxx @ xxxxx.xxx	
Honduras	xxxxxx @ xxxxx.xxx	X
Hong Kong - China	xxxxxx @ xxx.xxx.xx	
Hong Kong - China	xxxxxx @ xxx.xxx.xx	
Hong Kong - China	xxxxxxxx @ xxx.xxx.xx	
Hong Kong - China	xxxxxx @ xxx.xxx.xx	
Indonesia	xxxxxx @ xxx.xx.xx	
Indonesia	xxxx @ xxx.xx.xx	
Indonesia	xxxxxx @ xxx.xx.xx	X
Indonesia	xxxxxx @ xxx.xx.xx	
Indonesia	xxx @ xxx.xx.xx	
Indonesia	xxxxxx @ xxxxx.xxx	X
Intl Tsunami Info Center	xxxx.xxxxxxx @ xxxxx.xxx	
Intl Tsunami Info Center	xxxx.xxxxxxx @ xxxxx.xxx	
Japan	xxxxxxx @ xxxxx-xx.xxxxx.xxxxxx.xx.xx	
Japan	xxxxxxxx @ xxx.xxxxxx.xx.xx	
Kiribati	xxxxxxx @ xxxxx.xxx	
Korea - North	None	
Korea - South	xxxxxxx @ xxx.xx.xx	

Korea - South	xxxxxx@xxx.xx.xx	
Korea - South	xxxxxxxxxx@xxxx.xxxx.xxx	
Kosrae - Micronesia	xxxxxxxxxx@xxxx.xxx	X
Macao - China	None	
Malaysia	xxx@xxx.xxx.xx	X
Malaysia	xxxxxx@xxx.xxx.xx	X
Malaysia	xxxxxx@xxx.xxx.xx	X
Malaysia	xxxxx@xxx.xxx.xx	X
Malaysia	xxx@xxx.xxx.xx	X
Malaysia	xxxxxx@xxx.xxx.xx	X
Malaysia	xxx@xxx.xxx.xx	
Malaysia	xxxxxx@xxx.xxx.xx	
Malaysia	xxxxxx@xxx.xxx.xx	
Marshall Islands	xxx_xx@xxxxxx.xxx	
Marshall Islands	xxxxxx@xxxxxx.xxx	
Marshall Islands	xxxxxx.xxxxx@xxxx.xxx	
Mexico	xxxxxx@xxxx.xxx.xx	
Mexico	xxxxxxxx@xxxxxxxx.xxx.xx	
Mexico	xxx@xxxxxxxx.xxx.xx	
Mexico	xxxxxxxx@xxxxxx.xx	
Mexico	xxx@xxxxxx.xx	
Micronesia	xxxxxxxx@xxxx.xxx	
Misc EU Contacts	xxxx.xxxxx@xx.xxxxxx.xx	
Misc EU Contacts	xxxxxxxxxx-xxxx@xx.xxxxxx.xx	
Nauru	xxxxxxxx@xxxxxx.xxx.xx	
Nauru	xxxxxx.xxxxxxx@xxx.xxx.xx	
New Caledonia	xxxx.xx@xxxxxx.xx	
New Caledonia	xxxxxxxx.xxxxxxxxxxx@xxxxxx.xx	
New Caledonia	xxx-xxxxxxxx@xxxxxxxx-xxxxxxxxxxx.xxx.xx	X
New Caledonia	xxxxxxxx.xxxxx@xxxxxxxx-xxxxxxxxxxx.xxx.xx	
New Caledonia	xxx-xxxxxxxxxxx.xxxxx@xxxxxxxx-xxxxxxxxxxx.xxx.xx	
New Zealand	xxxxx.xxxxx@xxxx.xxx.xx	
New Zealand	xxxxxxxxxxxx@xxx.xxx.xx	
New Zealand	xxxxxxxxxx_xxxx_xxxxxxx@xxx.xxx.xx	
New Zealand	xxxx@xxx.xxxx.xx	
New Zealand	xx.xxxxx@xxx.xxxx.xx	
Nicaragua	xxxxxx@xxxxxx.xx	X
Nicaragua	xxxxxx@xxx.xxx.xx	
Nicaragua	xxxxxxxx.xxxxx@xx.xxxxxx.xxx.xx	X
Nicaragua	xxxxxx@xx.xxxxxx.xxx.xx	X
Nicaragua	xxx@xx.xxxxxx.xxx.xx	X
Nicaragua	xxxxxxxx.xxxxx@xx.xxxxxx.xxx.xx	X
Niue	xxxx.xxxxx@xxxx.xxx.xx	
Niue	xxxxxx@xxxx.xxx.xx	X
Niue	xxxxxxxxxx.xxxxxxx@xxxx.xxx.xx	
Norfolk Island	None	
Northern Mariana Islands	xxxxxxxxxx@xxxxxx.xxx.xx	X
Northern Mariana Islands	xxxxxxxx@xxxxxx.xxx.xx	
Pacific Disaster Center	xxxx@xxxxxx.xxx.xxx	
Palau - Micronesia	xxxx@xxxxxxxx.xxx	X
Palau - Micronesia	xxxx.xxxxx@xxxx.xxx	
Panama	xxxxxxxxxxxxxx@xxxxxxxx.xxx.xx	
Papua New Guinea	xxxx@xxxxxxxx.xxx.xx	
Papua New Guinea	xxxxxx@xxxxxx.xxx.xx	X
Peru	xxxxxx@xxx.xxx.xx	
Peru	xxxx@xxxxxx.xxx.xx	
Peru	xxxxxxxx@xxx.xxx.xx	X
Peru	xxxxxxxx@xxx.xxx.xx	

Peru	xxxxxxx@xxx.xxx.xx	
Philippines	xxxxxx@xxxxxxxxx.xxx.xxx.xx	X
Philippines	xxxxxx@xxxxxxxxx.xxx.xxx.xx	
Philippines	xxxxxxx@xxxxxxxxx.xxx.xxx.xx	
Philippines	xxxx@xxxxxxxxx.xxx.xxx.xx	
Philippines	xxxxxx@xxxxxxxxx.xxx.xxx.xx	
Philippines	xxxx_xxxxxxxxx@xxxxx.xxx	
Philippines	xxxxxxx@xxxxx.xxx	
Philippines	xxxxxx_xxxxxxxxx@xxxxx.xxx	
Pitcairn Islands – U.K.	xxxxx@xxxxxxxxx.xxx.xx	X
Pitcairn Islands – U.K.	xx@xxxxxxxxx.xxx.xx	X
Pitcairn Islands – U.K.	xxxxx@xxxxxxxxx.xxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xxx	
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxxxxxx@xxxxxxxxx.xx	X
Pitcairn Islands – U.K.	xxxx@xxxxxxxxxxxxxxx.xxx	
Pohnpei - Micronesia	None	
Russia	x_xxxxxxxxx@xxxxxxxxx.xx	X
Russia	xxxxxx@xxxx.xx	
Russia	xxx@xxxxxxxxx.xx	X
Russia	xxx@xxxxxxxxx.xx	
Russia	xxxxxxx.xxxxxxxxxxxx@xxxxxxxxxxx.xx	X
Russia	xxxxxxxx@xxxxxxxxxxx.xx	
Russia	xxxxx.xxxxxxxxx@xxxxx.xxx	
Russia	xxxxxxx_xxxxxxxxx@xxxxxxxxx.xx	X
Samoa	xxxxxxxxxxx@xxxxxxxxxxx.xxx.xx	X
Samoa	xxxxxxxxxx.xxxxxxxxx@xxxx.xxx.xx	
Samoa	xxxxxx.xxxx@xxxx.xxx.xx	
Samoa	xxxxxxxxxx.xxxxxx@xxxx.xxx.xx	
Samoa	xxxxxxxxxx.xxxx@xxxx.xxx.xx	
Samoa	xxxxxxxx.xxxx@xxxx.xxx.xx	
Singapore	xxx_xxxxxxxxx@xxx.xxx.xx	X
Singapore	xxxx@xxxxxxxxx.xxx.xx	
Singapore	xxxxx_xxxx_xxxx@xxx.xxx.xx	X
Singapore	xxx_xxx_xxx@xxx.xxx.xx	X
Singapore	xxx_xxxx_xxx@xxx.xxx.xx	X
Solomon Islands	xxx@xxxxxxxxx.xxx.xx	
Solomon Islands	xxxxxxxxxx@xxxxx.xxx.xx	
Solomon Islands	xxxxxxxxxxx@xxxxxxxxx.xxx.xx	
Solomon Islands	xxxxxxxx@xxx.xxx.xx	
Taiwan	xxxx@xxxxx.xxx.xxx.xx	
Taiwan	xxx@xxx.xxx.xxx.xx	
Taiwan	xxxxx@xxxxx.xxx.xxx.xx	
Taiwan	xxxxxxxxxxx@xxxxx.xxx	
Thailand	xxxxxxxxxx@xxxxxx.xxx.xx.xx	
Thailand	xxxxxxxxxxx.x@xxxxxx.xxx.xx	X
Thailand	xxxx_xx@xxxxx.xxx	
Thailand	xxxxxxxx_xxx@xxxxx.xxx	

Thailand	xxxxxxx@xxxxxx.xxx	
Thailand	xxxxx_xxx@xxxxx.xxx	
Thailand	xxxx@xxxxxxx.xxx	
Thailand	xxxxxxx@xxxxx.xxx	
Thailand	xxxxxxx@xxxxx.xxx	X
Thailand	xxxxxxx_xxx@xxxxxxx.xxx	
Thailand	xxxxxxx@xxx.xx.xx	
Tokelau - New Zealand	xxxx@xxxxxxx.xxx	
Tonga	xxxxxxxxxxx@xxx.xxx.xx	X
Tonga	xxxxxxxx@xxx.xxx.xx	X
Tonga	xxx.xxxxxxxx@xxx.xx	
Tonga	xxxxx@xxxxxxxxx.xx	
Tonga	xxxxxxxx@xxx.xxx.xx	X
Tonga	xxx_xxx@xxx.xxx.xx	
Tuvalu	xxxxxxx@xxxxx.xxx	
U.N. Org Contacts	xxxxxxx.xxx@xxxxxx.xxx	
U.N. Org Contacts	x.xxxxxxxxxx@xxxxxx.xxx	
U.N. Org Contacts	xxxxxxx_xxxx@xxxx.xxx	X
United Kingdom	xxx@x.xxx.xxx.xx	
United Kingdom	xxx@x.xxx.xxx.xx	
United Kingdom	xxxxxxxxxxx@x.xxx.xxx.xx	
United Kingdom	xxx-xxxx@x.xxx.xxx.xx	
United Kingdom	xxx-xxxxx@x.xxx.xxx.xx	
United Kingdom	xxx-xxx@x.xxx.xxx.xx	
United States	xxxx@xxxx.xxxx.xxx	
United States	xxxxxx@xxxx.xxx	
United States	xxxxxxxx.xxxxxxxxx@xxxx.xxx	
Vanuatu	xxxxxx@xxxxx.xxx.xx	
Vanuatu	xxxxxx@xxxxxxx.xxx.xx	
Vanuatu	xxxxxx@xxxxxxx.xxx.xx	
Vanuatu	xxxxx@xxxxxxx.xxx.xx	
Vanuatu	xx_xxxxxx@xxxxxxx.xxx.xx	X
Vietnam	xxxxxxxx@xxx.xxx.xx	
Vietnam	xxxxxx@xxx.xxx.xx	
Vietnam	xxxxxx@xxx.xxxx.xx.xx	X
Vietnam	xxx-xxxxx@xxxxx.xxx.xx	
Vietnam	xxxxxxxx@xxxx.xxx.xx	
Wake Island – U.S.	None	
Wallace and Futuna	None	
Yap - Micronesia	xxxxx_x@xxxxx.xxx	
Yap - Micronesia	xxxxx.xxxxxx@xxxx.xxx	

Table 2. PTWC PacWave08 Fax Results and Problems
(Actual fax numbers have been obscured in this report to protect their potential sensitivity.)

OFFICE	FAX NUMBER	#1 DLV R/CNCL	#1 ELAPSED	#1 ATTEMPTS	#2 DLV R/CNCL	#2 ELAPSED	#2 ATTEMPTS	#3 DLV R/CNCL	#3 ELAPSED	#3 ATTEMPTS	#4 DLV R/CNCL	#4 ELAPSED	#4 ATTEMPTS	#5 DLV R/CNCL	#5 ELAPSED	#5 ATTEMPTS	#6 DLV R/CNCL	#6 ELAPSED	#6 ATTEMPTS	#7 DLV R/CNCL	#7 ELAPSED	#7 ATTEMPTS	#8 DLV R/CNCL	#8 ELAPSED	#8 ATTEMPTS	#9 DLV R/CNCL	#9 ELAPSED	#9 ATTEMPTS	#10 DLV R/CNCL	#10 ELAPSED	#10 ATTEMPTS
AMERICAN SAMOA MET OPS	1684XXXXXXX	D	0:13	4	D	0:02	1	D	0:03	1	D	0:07	3	D	0:03	1	D	0:05	2	D	0:04	2	D	0:24	1	D	0:11	4	D	0:03	1
AUSTRALIA BOM	011613XXXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:03	1	D	0:03	1	D	0:02	1	D	0:02	1	D	0:23	1	D	0:02	1	D	0:03	1
CANADA PROVINCIAL EMER PROG	1250XXXXXXXX	D	0:02	1	D	0:02	1	D	0:01	1	D	0:01	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:22	1	D	0:02	1	D	0:02	1
CHILE SHOA VALPARAISO	011563XXXXXXXX	C	2:05		C	2:38		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
CHILE SHOA VALPARAISO	011563XXXXXXXX	D	0:03	1	D	1:03	9	D	0:04	1	D	0:03	1	D	0:25	6	D	0:19	5	D	0:08	3	D	0:31	3	D	0:03	1	D	0:37	7
CHINA NMEFC	011861XXXXXXXX	D	0:08	1	D	0:06	1	D	0:06	1	D	0:15	1	D	0:06	1	D	0:22	1	D	0:09	1	D	0:36	1	C	2:05		C	2:05	
CHUUK DMO	011691XXXXXXXX	C	2:05		C	2:05		C	2:06		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
CHUUK WSO 1	011691XXXXXXXX	C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
CHUUK WSO 2	011691XXXXXXXX	C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
COLOMBIA OSSO CALI	011572XXXXXXXX	C	2:05		C	2:09		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	1:11		C	2:05		C	2:05	
COOK IS MET SVC	011682XXXXX	D	0:15	4	D	0:09	3	D	0:02	1	D	0:03	1	D	0:03	1	D	0:03	1	D	0:09	3	C	2:05		C	2:05		D	0:14	4
COSTA RICA CNE	011506XXXXXXXX	D	0:02	1	D	0:04	2	D	0:02	1	D	0:03	1	D	0:03	1	D	0:02	1	D	0:02	1	D	0:23	1	D	0:02	1	D	0:02	1
COSTA RICA 911	011506XXXXXXXX	D	0:02	1	D	0:01	1	D	0:02	1	C	2:06		C	2:05		C	2:05		D	0:58	8	D	0:24	1	D	0:03	1	D	0:02	1
ECUADOR INOCAR 1	011593XXXXXXXX	D	0:04	1	D	0:04	1	D	0:04	1	D	0:03	1	D	0:04	1	D	0:06	2	D	0:03	1	D	0:24	1	D	0:04	1	D	0:04	1
ECUADOR INOCAR 2	011593XXXXXXXX	D	0:02	1	D	0:03	1	D	0:02	1	D	0:09	2	D	0:02	1	D	0:02	1	D	0:03	1	D	0:26	2	D	0:03	1	D	0:03	1
EL SALVADOR SNET 1	011503XXXXXXXX	D	0:07	2	D	0:03	1	D	0:10	3	D	0:04	1	D	0:07	2	D	0:10	3	D	0:11	3	D	0:32	3	D	0:07	2	D	0:14	4
EL SALVADOR SNET 2	011503XXXXXXXX	D	0:08	3	D	0:10	3	D	0:09	3	D	0:03	1	D	0:38	7	D	0:06	2	D	0:13	4	D	1:41	9	D	0:05	2	D	0:04	1
FIJI MINERAL RESOURCES DIV	011679XXXXXXXX	D	0:06	1	D	0:05	2	D	0:02	1	D	0:13	1	D	0:01	1	D	0:13	1	D	0:06	1	D	0:30	1	D	0:07	1	D	0:03	2
FRENCH POLYNESIA LDG 1	011689XXXXXX	D	1:32	5	D	1:03	1	D	0:04	1	D	0:03	1	D	0:03	1	D	0:05	2	D	0:05	2	D	0:24	1	D	0:03	1	D	0:06	2
FRENCH POLYNESIA LDG 2	011689XXXXXX	C	0:10		C	2:14		C	1:23		D	0:31	2	D	0:01	1	D	0:14	1	D	0:02	1	D	0:36	2	C	0:08		D	0:04	1
GUAM WFO	1671XXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:01	1	D	0:02	1	D	0:02	1	D	0:29	3	D	0:02	1	C	2:05	
GUATEMALA INSIVUMEH 1	011502XXXXXXXX	D	0:18	5	C	0:24		D	0:24	6	D	0:19	5	D	0:10	3	D	0:03	1	D	0:03	1	D	0:26	2	D	0:03	1	D	0:03	1
GUATEMALA INSIVUMEH 2	011502XXXXXXXX	C	2:05		C	2:37		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
HONG KONG OBSERVATORY 1	011852XXXXXXXX	C	2:05		C	2:15		C	2:07		C	2:05		C	2:05		C	2:07		C	2:05		C	2:05		C	2:05		C	2:05	
HONG KONG OBSERVATORY 2	011852XXXXXXXX	D	0:02	1	D	0:02	1	D	0:03	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:22	1	D	0:03	1	D	0:02	1
INDONESIA AMG JAKARTA	011622XXXXXXXX	C	2:05		C	2:40		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
JAPAN MET AGENCY 1	011813XXXXXXXX	D	0:07	1	D	0:05	1	D	0:05	1	D	0:14	1	D	0:05	1	D	0:18	1	D	0:07	1	D	0:32	1	D	0:07	1	D	0:02	1
JAPAN MET AGENCY 2	011813XXXXXXXX	D	0:07	1	D	0:02	1	D	0:05	1	D	0:14	1	D	0:05	1	D	0:18	1	D	0:07	1	D	0:32	1	D	0:02	1	D	0:04	1
KOREA DPR CENTRAL MET	011850XXXXXXXX	D	0:07	1	D	0:06	1	D	0:02	1	D	0:15	1	D	0:06	2	D	0:18	1	D	0:09	1	D	0:35	1	D	0:07	1	D	0:02	1

OFFICE	FAX NUMBER	#1 DLV R/CNCL	#1 ELAPSED	#1 ATTEMPTS	#2 DLV R/CNCL	#2 ELAPSED	#2 ATTEMPTS	#3 DLV R/CNCL	#3 ELAPSED	#3 ATTEMPTS	#4 DLV R/CNCL	#4 ELAPSED	#4 ATTEMPTS	#5 DLV R/CNCL	#5 ELAPSED	#5 ATTEMPTS	#6 DLV R/CNCL	#6 ELAPSED	#6 ATTEMPTS	#7 DLV R/CNCL	#7 ELAPSED	#7 ATTEMPTS	#8 DLV R/CNCL	#8 ELAPSED	#8 ATTEMPTS	#9 DLV R/CNCL	#9 ELAPSED	#9 ATTEMPTS	#10 DLV R/CNCL	#10 ELAPSED	#10 ATTEMPTS
KOREA REP MET ADMIN	011822XXXXXXX	D	0:14	4	D	0:10	3	D	0:05	1	D	0:15	1	D	0:06	1	D	0:18	1	D	0:07	1	D	0:32	1	D	0:02	1	D	0:02	1
KOSRAE DMO	011691XXXXXXX	D	0:04	1	D	1:36	10	D	0:45	2	D	0:06	2	D	0:04	1	D	0:09	2	D	0:38	7	D	0:29	3	D	1:02	8	D	0:10	3
KWAJALEIN WEATHER STATION	1805XXXXXXX	D	0:02	1	D	0:03	2	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:03	1	D	0:22	1	D	0:02	1	D	0:02	1
MAJURO WSO	011692XXXXXXX	D	0:03	1	D	0:05	1	D	0:03	1	D	0:04	1	D	0:04	1	D	0:04	1	D	0:06	2	D	0:24	1	D	0:04	1	D	0:05	2
MALAYSIA MET 1	011603XXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:03	1	D	0:02	1	D	0:03	1	D	0:02	1	D	0:23	1	D	0:02	1	D	0:02	1
MALAYSIA MET 2	011603XXXXXXX	D	0:03	1	D	0:02	1	D	0:02	1	D	0:14	5	D	0:01	1	D	0:03	1	D	0:03	1	D	0:23	1	D	0:02	1	D	0:03	1
MARIANAS EMO 1	1670XXXXXXX	C	0:04		C	0:04		D	0:10	4	D	0:02	1	D	0:04	2	D	0:02	1	D	0:04	2	D	0:21	1	D	0:02	1	D	0:04	2
MARIANAS EMO 2	1670XXXXXXX	D	0:48	9	D	0:19	1	C	0:03		D	0:04	2	D	0:01	1	D	0:02	1	D	0:04	2	D	0:24	2	D	0:02	1	D	0:02	1
MARSHALL IS NDMO	011692XXXXXXX	D	0:04	1	D	0:03	1	D	0:04	1	D	0:03	1	D	0:03	1	D	0:03	1	D	0:03	1	D	0:23	1	D	0:03	1	D	0:03	1
MEXICO NAVY 1	011525XXXXXXXXX	C	2:05		C	2:05		C	2:05		C	2:05		C	2:06		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
MEXICO NAVY 2	011525XXXXXXXXX	D	0:03	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:23	1	D	0:04	2	D	0:02	1
MEXICO NAVY 3	011525XXXXXXXXX	D	0:02	1	D	0:03	1	D	0:02	1	D	0:03	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:22	1	D	0:02	1	D	0:02	1
MEXICO MET SERVICE	011525XXXXXXXXX	C	2:05		C	2:07		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
NEW CALEDONIA PACWAVE08A	011687XXXXXX	D	0:07	3	D	1:33	10	D	0:34	1	D	0:13	4	D	0:02	1	D	0:02	1	D	0:07	3	D	0:24	1	D	0:05	2	D	0:02	1
NEW CALEDONIA PACWAVE08B	011687XXXXXX	D	0:12	4	D	0:02	1	D	0:02	1	D	0:24	6	D	0:01	1	D	0:02	1	D	0:04	2	D	0:26	3	D	0:09	3	D	0:05	2
NEW CALEDONIA MRCC	011689XXXXXX	C	2:05		C	2:35		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
NEW ZEALAND MCDEM 1	011644XXXXXXX	D	0:06	3	D	0:02	1	D	0:09	4	D	0:03	1	D	0:02	1	D	0:07	3	D	0:03	1	D	0:24	1	D	0:03	1	D	0:04	2
NEW ZEALAND MCDEM 2	011649XXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:03	1	D	0:03	1	D	0:02	1	D	0:19	1	D	0:03	1	D	0:02	1
NEW ZEALAND MCDEM 3	011644XXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:06	3	D	0:02	1	D	0:03	1	D	0:02	1	D	0:18	1	D	0:03	1	D	0:02	1
NEW ZEALAND GNS 1	011644XXXXXXX	D	0:03	1	D	0:02	1	D	0:03	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:22	1	D	0:04	1	D	0:02	1
NEW ZEALAND GNS 2	011647XXXXXXX	D	0:02	1	D	0:02	1	D	0:03	1	D	0:02	1	D	0:03	1	D	0:09	3	D	0:02	1	D	0:25	2	D	0:02	1	D	0:03	1
NEW ZEALAND AID	011644XXXXXXX	D	0:04	1	D	0:04	1	D	0:04	1	D	0:09	1	D	0:04	1	D	0:08	1	D	0:02	1	D	0:24	1	D	0:02	1	D	0:02	1
NICARAGUA INETER 1	011505XXXXXXX	C	2:07		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:06	
NICARAGUA INETER 2	011505XXXXXXX	D	0:03	1	D	0:03	1	D	0:04	2	D	0:03	1	D	0:05	2	D	0:22	6	D	0:08	3	D	1:31	9	D	1:12	9	D	0:03	1
NICARAGUA INETER 3	011505XXXXXXX	C	0:03		C	0:07		C	0:03		C	0:06		C	0:06		C	0:03		C	1:42		C	1:02		C	0:11		C	0:03	
PALAU NEMO	011680XXXXXXX	D	0:03	1	D	0:05	2	D	0:03	1	D	0:03	1	D	0:03	1	D	0:06	2	D	0:03	1	D	0:31	3	D	0:15	4	D	0:03	1
PALAU WSO	011680XXXXXXX	D	0:06	2	D	0:12	4	D	0:08	3	D	0:10	3	D	0:03	1	D	0:03	1	D	0:03	1	D	0:20	1	D	0:03	1	D	0:03	1
PAPUA NEW GUINEA PMO	011675XXXXXXX	D	0:04	1	D	0:04	1	D	0:04	1	D	0:02	1	D	0:04	1	D	0:10	1	D	0:02	1	D	0:26	1	D	0:07	1	D	0:02	1
PAPUA NEW GUINEA NDES	011675XXXXXXX	D	0:04	1	D	0:04	1	D	0:11	4	D	0:11	1	D	0:04	1	D	0:11	1	D	0:04	1	D	0:26	1	D	0:02	1	D	0:03	1
PERU CORPAC 1	011511XXXXXXX	D	0:03	1	D	0:08	3	C	0:16		D	0:05	2	D	0:03	1	D	0:03	1	D	0:03	1	D	0:23	1	D	0:03	1	C	0:11	
PERU CORPAC 2	011511XXXXXXX	D	0:04	1	D	0:04	2	D	0:03	1	D	0:03	1	D	0:03	1	D	0:03	1	D	0:05	2	D	0:20	1	D	0:03	1	D	0:03	1
PHILIPPINES PHIVOLCS1	011632XXXXXXX	D	0:03	1	D	1:03	9	D	0:04	1	D	0:02	1	D	0:02	1	D	1:07	9	D	0:07	3	D	0:22	1	D	0:02	1	D	0:04	2
PHILIPPINES PHIVOLCS2	011632XXXXXXX	C	2:05		C	2:05		C	2:05		C	2:34		C	2:05		D	0:10	2	D	0:04	1	D	0:29	2	C	0:28		D	0:05	2

OFFICE	FAX NUMBER	#1 DLV R/CNCL	#1 ELAPSED	#1 ATTEMPTS	#2 DLV R/CNCL	#2 ELAPSED	#2 ATTEMPTS	#3 DLV R/CNCL	#3 ELAPSED	#3 ATTEMPTS	#4 DLV R/CNCL	#4 ELAPSED	#4 ATTEMPTS	#5 DLV R/CNCL	#5 ELAPSED	#5 ATTEMPTS	#6 DLV R/CNCL	#6 ELAPSED	#6 ATTEMPTS	#7 DLV R/CNCL	#7 ELAPSED	#7 ATTEMPTS	#8 DLV R/CNCL	#8 ELAPSED	#8 ATTEMPTS	#9 DLV R/CNCL	#9 ELAPSED	#9 ATTEMPTS	#10 DLV R/CNCL	#10 ELAPSED	#10 ATTEMPTS
PHILIPPINES PHIVOLCS3	011632XXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:23	1	D	0:03	1	D	0:02	1
PITCAIRN ISLAND	011872XXXXXXXXXX	C	2:05		C	2:45		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
PITCAIRN IS GOV	011649XXXXXXXXXX	D	0:03	1	D	0:02	1	D	0:03	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:03	1	D	0:24	1	D	0:03	1	D	0:02	1
POHNPEI DMO	011691XXXXXXXXXX	C	2:06		C	2:05		C	2:06		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
POHNPEI WSO	011691XXXXXXXXXX	D	0:06	2	D	0:06	2	D	0:04	1	D	0:04	1	D	0:04	1	D	0:06	1	D	0:04	1	D	0:22	1	D	0:04	1	D	0:15	4
RUSSIA SAKHALIN TWC 1	011742XXXXXXXXXX	D	0:02	1	D	0:06	1	D	0:02	1	D	0:14	1	D	0:38	7	D	0:19	1	D	0:10	2	D	0:33	1	D	0:03	1	D	0:02	1
RUSSIA SAKHALIN TWC 2	011742XXXXXXXXXX	D	0:03	1	D	0:08	3	D	0:03	1	D	0:04	2	D	0:06	2	D	0:03	1	D	0:03	1	D	0:34	4	D	0:03	1	D	0:03	1
RUSSIA KAMCHATKA TWC	011741XXXXXXXXXX	D	0:08	1	D	0:06	1	C	0:05		D	0:20	3	C	0:09		C	0:22		C	0:11		D	0:33	1	D	0:13	3	D	0:10	3
RUSSIA VLADIVOSTOK TWC	011742XXXXXXXXXX	D	0:08	3	D	0:06	3	C	2:05		D	1:44	4	D	0:45	1	C	2:05		C	2:05		D	0:38	6	D	0:08	3	D	0:31	7
SAMOA MET OPS 1	011685XXXXXX	C	2:08		C	2:13		C	2:05		C	2:05		C	2:06		C	2:05		C	2:05		C	2:05		C	0:14		D	0:04	1
SAMOA MET OPS 2	011685XXXXXX	D	0:06	1	D	0:04	1	C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		D	1:11	4	C	0:07		D	1:17	9
SINGAPORE MET SERVICE	011656XXXXXXXXXX	D	0:03	1	D	0:03	1	D	0:02	1	D	0:07	3	D	0:02	1	D	0:02	1	D	0:02	1	D	0:22	1	D	0:02	1	D	0:02	1
SOLOMON ISLANDS NEOC	011677XXXXXX	D	0:03	1	D	0:11	4	D	0:13	4	D	0:06	2	D	0:02	1	D	0:11	3	D	0:09	3	D	0:24	1	D	0:09	3	D	0:05	2
SOLOMON IS MET SVC 1	011677XXXXXX	D	0:03	1	D	0:02	1	D	0:02	1	D	0:19	5																		
SOLOMON IS MET SVC 1	011677XXXXXX													D	0:02	1	D	0:05	2	D	0:05	2	D	0:27	2	D	0:03	1	D	0:04	2
SOLOMON IS MET SVC 2	011677XXXXXX	C	2:05		C	2:34		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
THAILAND NDWC 1	011662XXXXXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:05	2	D	0:05	2	D	0:02	1	D	0:02	1	D	0:22	1	D	0:02	1	D	0:03	1
THAILAND NDWC 2	011662XXXXXXXXXX	D	0:05	1	D	0:05	1	D	0:07	2	D	0:03	1	D	0:05	1	D	0:16	3	C	2:05		D	0:40	4	D	0:03	1	D	0:06	2
THAILAND NDWC 3	011662XXXXXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:23	1	D	0:02	1	D	0:02	1
THAILAND NDWC 4	011662XXXXXXXXXX	D	0:36	1	D	0:08	1	C	2:07		C	2:05		C	2:05		C	2:05		C	2:05		D	1:31	7	D	0:08	2	D	0:11	3
TONGA MET SERVICE	011676XXXXXX	D	0:05	1	D	0:04	1	D	0:04	1	D	0:11	1	D	0:02	1	D	0:12	1	D	0:05	1	D	0:30	1	D	0:02	1	D	0:10	4
TONGA COMMS CORP	011676XXXXXX	D	0:05	1	D	0:05	1	D	0:05	1	D	0:12	1	D	0:04	1	D	0:14	2	D	0:06	1	D	0:27	1	D	0:03	1	D	0:03	1
UNITED STATES PTWC	1808XXXXXXXXXX	D	0:13	1	D	0:06	1	D	0:06	1	D	0:15	1	D	0:06	1	D	0:23	1	D	0:11	2	D	0:37	1	D	0:01	1	D	0:03	1
UNITED STATES FEMA	1808XXXXXXXXXX	D	0:03	2	D	0:02	1	D	0:02	1	D	0:02	1	D	0:04	2	D	0:02	1	D	0:02	1	D	0:22	1	D	0:03	2	D	0:02	1
UNITED STATES PEACESAT	1808XXXXXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:01	1	D	0:02	1	D	0:03	1	D	0:19	1	D	0:03	1	D	0:02	1
UNITED STATES HVO	1808XXXXXXXXXX	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:03	2	D	0:19	1	D	0:02	1	D	0:02	1
VANUATU DEPT OF MET 1	011678XXXXXX	D	0:13	4	D	0:04	2	D	0:05	2	D	0:17	5	D	0:03	1	D	0:05	2	D	0:02	1	D	0:26	2	D	0:03	1	D	0:03	1
VANUATU DEPT OF MET 2	011678XXXXXX	C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05		C	2:05	
VIETNAM INST OF GEOPHYSICS 1	011844XXXXXXXXXX	C	2:09		C	2:05		C	2:05		C	2:05		C	2:07		D	0:10	3	D	0:12	4	D	0:25	2	D	0:03	1	C	2:05	
VIETNAM INST OF GEOPHYSICS 2	011844XXXXXXXXXX	D	0:02	1	D	0:02	1	D	0:04	2	D	0:03	1	D	0:02	1	D	0:02	1	D	0:02	1	D	0:19	1	D	0:05	2	D	0:02	1
YAP WSO	011691XXXXXXXXXX	D	0:46	1	D	0:18	1	D	0:03	1	D	0:06	2	D	0:03	1	D	0:09	2	D	0:03	1	D	0:29	3	D	0:07	2	D	0:03	1

Table 3. PTWC PACWAVE08 RANET Distribution – PTWS Recipients
(Email addresses and phone numbers have been obscured in this report to protect their potential sensitivity.)

Country	PTWS	IOTWS	CARIBE -EWS	Last	First	E-Mail	Mobile	Alt / Land Line
Australia	x	x		Crane	Geoff	x.xxxxx@xxx.xxx.xx	*****	*****
Australia	x	x		Bailey	Rick	x.xxxxxx@xxx.xxx.xx	*****	*****
Chile	x			SHOA	Director	xxxxxxxxx@xxx.xx	*****	*****
Chile	x			Officer	Service Duty	xxxxxxxx@xxx.xx	*****	*****
Chile	x			Carrasco	Patricio	xxxxxxxxx@xxx.xx	*****	*****
Chile	x			Enriquez	Lt. Adres	xxxxxxxxx@xxx.xx	*****	*****
Chile	x			Oceanographer	Duty	xxxxxxxx@xxx.xx	*****	*****
Cook Islands	x			Ngamata	Joseph	xxxxxxxx@xxxxxxxx.xxx.xx	*****	*****
Cook Islands	x			Ngari	Arona	xxxxxx@xxx.xxx.xx	*****	*****
Cook Islands	x			Mokoroa	Mac	xxx@xxxxxxxxxxx.xxx.xx	*****	*****
Cook Islands	x			Carlson	Charles	xxxxxxxxx@xxx.xxx.xx	*****	*****
East Timor	x	x		Mocellin	Jane	xxxxx.xxxxxxxxx@xxx.xxx	*****	*****
East Timor	x	x		Mocellin	Jane S.P.	xxxxx.xxxxxxxxx@xxx.xxx	*****	*****
El Salvador	x			Marroquin	Griselda	xxxxxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Larreynaga	Jeniffer	xxxxxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Garcia	Luis	xxxxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Carranza	Sandra	xxxxxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Lopez	Deysi	xxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Gavidia	Francisco	xxxxxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Hernandez	Douglas	xxxxxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Gonzalez	Claudia	xxxxxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			de Godoy	Elda	xxxxxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Duran	Ernesto	xxxxxx@xxx.xxx.xx	*****	*****
El Salvador	x			Diaz	Manuel	xxxxx@xxx.xxx.xx	*****	*****
Fiji	x			Waqicelua	Alipate	xxxxxxx.xxxxxxxxxx@xxx.xxx.xx	*****	*****
Fiji	x			Chand	Savita	xxxxxxxxx@xxxxxx.xxx.xx	*****	*****
Fiji	x			Prasad	Rajendra	xxxxxxxxx.xxxxxx@xxx.xxx.xx	*****	*****
Fiji	x			Chandra	Mukesh	xxxxxx.xxxxxx@xxxxxx.xxx.xx	*****	*****
Fiji	x			Rokovada	Joeli	xxxxxxxxx@xxxxxx.xxx.xx	*****	*****
French Polynesia	x			Reymond	Dominque	xxxxxxxx.x@xxxxxxxx.xx	*****	*****
Hong Kong	x			Wong	W	xxxxxx@xxx.xxx.xx	*****	*****
Hong Kong	x			Woo	W.C.	xxxxx@xxx.xxx.xx	*****	*****
Indonesia	x	x		Harjadi	Prih	xxxx@xxx.xx.xx	*****	*****
Indonesia	x	x		Andi	Hanif	xxxxxxxxx@xxx.xx.xx	*****	*****
New Zealand	x			Garry	Clarke	xxxxx.xxxxxx@xxxxxxxxxxx.xxx	*****	*****
Philippines	x			Narag	Ishmael		*****	*****

Country	PTWS	IOTWS	CARIBE -EWS	Last	First	E-Mail	Mobile	Alt / Land Line
Philippines	x			Office	Director	xxxxxx_xxxxxxx@xxxxx.xxx	*****	*****
Philippines	x			SMS	PHIVOLCS		*****	*****
Philippines	x			Bautista	Bartolome		*****	*****
Philippines	x			Bautista	Bart	xxxx@xxxxxxxx.xxx.xxx	*****	*****
Philippines	x			Solidum	Renato	xxxxxx_xxxxxxx@xxxxx.xxx	*****	*****
Philippines	x			Solidum	Renato	xxxxxx@xxxxxxxx.xxx.xxx	*****	*****
PNG	x			Mose	Martin		*****	
Thailand	x	x		Jegillos	Sanny	xxxxx.xxxxxxxxx@xxxx.xxx	*****	*****
Thailand	x	x		Whelden	Richard	xxxxxxxx@xxxxx.xxx	*****	*****
Thailand	x	x		Subbhiah	A R	x.xxxxxx@xxx.xxx.xx	*****	*****
Thailand	x	x		Whelden	Richard	xxxxxxxx@xxxxx.xxx	*****	*****
Tokelau	x			Patelesio	Zak		*****	*****
Tonga	x			Finaulahi	Seluvaia	xxxxxxxxxx@xxx.xxx.xx	*****	*****
Tonga	x			Met. Service	Tonga		*****	*****
Tonga	x			Taumoefolau	Ofa	xxxxxxxxxxxx@xxx.xxx.xx	*****	*****
Tonga	x			Vite	Selusalema	xxxxx@xxx.xxx.xx	*****	*****
Tonga	x			Fa anunu	Ofa	xxxxxxxx@xxx.xx.xx	*****	*****
Tonga	x			Havea	Neniasi	xxxxxx@xxx.xx.xx	*****	

Table 4. Exercise Pacific Wave 08 - Evaluation Forms Summary

Country	Agency	P/C	1a	1b	TR	Sent To	TD	3a	3b	4a	4b	4c	4d	4e	4f	4g	4h	4i	4j	5 Notification	6 Elapsed
1 Chile	SHOA	3	3	3	00:16	O	00:57	-	-	-	3	-	-	-	3	n/a	3	3	n/a	R,S,D	n/r
2 China	Hong K	3	-	-	00:06	E,L	-	(4)	-	-	(3)	5m	prc	n/a	-	-	-	(3)	-	R,TV,PC,w	d2f3a2
3 China	SOA +	3	3	3	00:08	L	00:13	3x6	3x6	3	3	3	3	-	3	-	3	3	-		
4 Colombia	OSSO	3	3	3	00:18	E,O,S	00:28	3	2	2	3	3	2	2	2	1	2	1	?		15,20,15
5 Cook Is.																					
6 Costa Rica	CNdeEUN	3	3	3	00:10	O,S	00:55	3	3	3	3	3	2	3	2	2	3	2	-		
7 USA, Guam	NWSFO	4	4	4	00:11	E,O	00:13	4	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	4	Almost All	15,20,15
8 Japan	JMA	3	3	3	00:05	E,L		3	3	3	3	-	3	-	3	3	3	3	3	Almost All	3-5,2,2
9 Malaysia	MMD	3	4	4	00:05	E,O,L	00:15	4	3	3	3	4	4	3	3	3	4	3	4	R,TV,PA,SMS,W,F	?
10 FSM, Chuuk	DCO						00:26													R, SSB, T,C	
11 FSM, Govt	OEEM	3	3	2	-	All	-	3	3	3	2	4	3	2	4	3	3	3	3	R,PA,T	10,5,n/a
12 FSM, Pohnpei	WSO	3	2	2		All		3	3	3	3	4	3	2	4	4	3	3	3	R, PA,T	10,10,20
13 FSM, Pohnpei	Public Safety	1	2					2	2	2	-	1	1	1	1	1	1	1	1	Almost All	1h,1h,2h
14 FSM, Yap	DCO	3	2	2		L		2	4	-	2	2	-	2	4	-	3	2	4	R,T,D,SSB	45,1,70
15 New Caledonia	NCCivDef				00:10																
16 New Zealand	MCDEM	3	4	3	00:10	E,O,S,L		-	-	2	-	-	-	-	-	-	3	3	3	All	-
17 Nicaragua	INETER	3	3	2		O,L,P,C		2	3	3	3	3	3	3	3	3	3	3	3	Almost All	10,8,5
18 Peru	HIDRONAV	3	3	3	00:11	E,O	00:15	3	3	3	3	3	3	3	3	3	3	3	3	All	35,3,1
19 Philippines	PIVS	3	3	3	00:05	O	00:31	3	3	2	3	4	3	3	3	2	3	3	3	All	10,10,5
20 Rep.of Korea	KMA	3	3	3	00:10	O,S	00:10	3	3	3	3	3	3	3	3	-	3	3	3	Almost All	5,5,20
21 Russia	Sakh TWC	3	3	3	00:06	E,O,L	00:08	3	3	3	3	3	3	3	3	3	3	3	3	R,TV,PA,W,D	2,3,5
22 Samoa	TEMCO																				
23 Singapore	MSD	3	3																		
24 PNG	PortMorGO	3	3	3	00:06	E,O		2	3	3	3	3	2	2	3	2	3	2	2		60,30,30
25 Australia	ATWS	3																			
26 Ecuador	InsOceArm	4	4	3	00:09	O		3	3	-	-	-	-	-	-	-	-	-	-	C,W,R,T	n/a
27 Tonga	NaEmManOf	4	4	4				3	-	1	-	-	4	-	-	-	-	3	3		n/a
28 Canada-BC	PEP	3	3	3																	n/a

Abbreviations: P/C-Planning/Conduct of Exercise; **1a,1b**-Exercise Objectives; **TR**-Time of Receipt of Initial Bulletin from International TWC; **Sent To**-Sent from the National Focal Point to which of the following: E-Emergency Services, O-Other National Government Agencies, S-Science Agencies, L-Local Government, P-provincial Government, C-City Government; **TD**-Time of Initial Dissemination; **3a,3b,4a,4b,4c,4d,4e,4f,4g,4h,4i**-Exercise Objectives; **5 Notification**-How the Public would be Notified: R-radio, TV-television, S-sirens, D-door-to-door, PC-public call centre, PA-public announcement system, W-website, SSB-SSB radio, SMS-SMS, F-Fax, T-telephone, C-cellular telephone; **6 Elapsed**-Elapsed Time(s) to Public Notification (minutes)

ANNEX VII. NWPTAC MESSAGE DISSEMINATION SUMMARY

The following table summarizes the email and facsimile dissemination of bulletins issued by the Northwest Pacific Tsunami Advisory Center (NWPTAC) as part of Exercise Pacific Wave '08. Red (x) indicates transmission was not successful. Telephone numbers and email addresses have been obscured in this report to protect their potential sensitivity.

[illegible]

[illegible]

ANNEX VIII. WC/ATWC MESSAGE DISSEMINATION SUMMARY

The following table summarizes the message dissemination of bulletins issued by the West Coast / Alaska Tsunami Warning Center (WC/ATWC) as part of Exercise Pacific Wave '08. All transmissions were successful.

#	Type	Dummy	Time Sent	Comments
1	WWA	Yes	10	Sent ok NWWS, NADIN2, NWSTG, Email
2	WWA	Yes	40	Sent ok NWWS, NADIN2, NWSTG, Email
3	WWA	Yes	110	Sent ok NWWS, NADIN2, NWSTG, Email
4	WWA	Yes	140	Sent ok NWWS, NWSTG, Email - Resent NADIN2
5	WWA	No		
6	WWA	Yes	240	Sent ok NWWS, NADIN2, NWSTG, Email
7	WWA	No		
8	WWA	Yes	340	Sent ok NWWS, NADIN2, NWSTG, Email
9-15	WWA	No		
16	WWA	Yes	740	Sent ok NWWS, NADIN2, NWSTG, Email
17-23	WWA	No		
24	WWA	Yes	1140	Sent ok NWWS, NADIN2, NWSTG, Email
25-31	WWA	No		
32	WWA	Yes	1540	Sent ok NWWS, NADIN2, NWSTG, Email
33-39	WWA	No		
40	WWA	Yes	1940	Sent ok NWWS, NADIN2, NWSTG, Email
41-47	WWA	No		
48	Can	Yes	2340	Sent ok NWWS, NADIN2, NWSTG, Email

ANNEX IX. REPORT PREPARATION

The Final Report was prepared by the PTWS Exercise Pacific Wave 08 Task Team. A special appreciation is given to Mr. Lev Ryzhkov of ROSHYDROMET, Russian Federation for compiling and analysing the findings from the post-exercise evaluation questionnaires completed by countries participating in Exercise Pacific Wave 2008.

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