U.S. INDIAN OCEAN TSUNAMI WARNING SYSTEM (IOTWS) PROGRAM

PROCEEDING OF TSUNAMI ALERT RAPID NOTIFICATION SYSTEM (TARNS)

"FIRST WORKSHOP: SYSTEM DESIGN & PLAN" (MAY 2006)

May 2006 Version 1.0

Prepared for the United States Agency for International Development
by the IRG-Tetra Tech Joint Venture

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Tsunami Alert Rapid Notification System (TARNS)
(Interagency Coordination in Response to Emergency Warning)

First Workshop: System Design and Plan

Proceedings

24-26 May 2006
Sailom Hotel in Hua Hin, Thailand

Implementing Agency:
National Disaster Warning Center, Thailand (NDWC)

Facilitating Institution:
United States Department of Agriculture, Forest Service (USFS)
National Oceanic and Atmospheric Administration (NOAA)
through theU.S. Indian Ocean Tsunami Warning System (IOTWS) Program

Supported by:
The United States Agency for International Development (USAID)

USAID | ASIA
FROM THE AMERICAN PEOPLE

U.S. Contribution to the Indian Ocean Tsunami Warning System

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Background

On March 24, 2006, The National Disaster Warning Center (NDWC) of Thailand signed a Memorandum of Agreement with USAID's Regional Development Mission for Asia (RDM/A) to enhance the Tsunami Alert Rapid Notification System (TARNS) for interagency coordination in Response to emergency warning in Thailand . The TARNS initiative is a step towards helping NDWC to enhance and implement a robust conceptual plan for adopting the right technologies and procedures to deliver both disaster warnings and "all clear" alerts quickly and efficiently, and it involves nation-wide simulation exercises.

On May 24-26, 2006, the National Disaster Warning Center (NDWC) of Thailand in collaboration with the U.S. Agency for International Development (USAID), U.S. Forest Service (USFS) and the National Oceanic and Atmospheric Administration (NOAA) conducted a three-day workshop to enhance the Tsunami Alert Rapid Notification System (TARNS) in Thailand. The workshop was designed to facilitate development of an interagency communications plan that will improve the delivery of early warnings to people in danger from tsunamis and other hazards. The workshop was the first step in Thailand to develop a comprehensive end-to-end model extending to the local level for rapid warning communications during emergency situations. Following the U.S. model, the approach calls for increased coordination at each level of the warning system- national, provincial, and local to assure warnings are received and processed quickly, and emergency managers can prepare for evacuations in times of danger.

Workshop Objective

The specific objectives of the workshop were to:

- Enhance TARNS in Thailand to showcase as a regional model in the Indian Ocean
- Formalize the establishment of a Thai TARNS Interagency Workgroup and TARNS Core Workgroup with respective roles and functions
- Increase understanding of Tsunami Alert Rapid Notification System (TARNS) requirements
- Share experiences and lessons learned on tsunami warning systems in both the countries Thailand and U.S.
- Examine existing Thai TARNS and design more robust system based on shared principles and lessons learned. U.S. has provided TARNS templates, principles, communications mapping, and sample SOPs and checklists.
- Develop a draft of conceptual framework of TARNS plan for Thailand and identify key elements (to be further developed and refined by the TARNS Core Workgroup for presentation at the Second TARNS Workshop)
- Strategize follow-up steps leading to the Second TARNS Workshop; set dates and key agenda topics

Inaugural Session

Introduction

H.E. Dr. Smith Dharmasaroja, Vice Minister to the Office of the Prime Minister, opened the meeting with Mr. Richard Whelden, Deputy Director, USAID Regional Development Mission/Asia (RDM/A) giving welcome remarks on behalf of the U.S. government. U.S. Ambassador Ralph Boyce provided a statement encouraging cooperation between the agencies to increase the speed of warning delivery.

Summary of the Speeches

Summary of the speech by H.E. Dr. Smith Dharmasaroja, Vice Minister to the Office of the Prime Minister

Dr. Smith welcomed the participants and the resource persons for attending the first TARNS workshop and mentioned that he was assigned by the Minister to preside over this important workshop. He informed audience that after the last tsunami, Thai government has provided support and established a Tsunami Warning Center on May 30, 2005. The Government aims to enhance NDWC to be capable of giving out tsunami and earthquake warning efficiently as well as warning for other natural hazards. The Prime Minister has assigned Dr. Smith to work as the Chairman of the Early Warning Committee which has been set up to study all kinds of natural hazards that will affect livelihood and property of people and government security. Later, on September 6, 2005, the Cabinet approved the draft protocol on Disaster Warning System Management 2005 and approved the organization structure and staffing of NDWC. It is an office headed by Executive Director under the Secretariat Office of Prime Minister. Its mission is to receive, analyze and disseminate warning; educate public and related government officials to mitigate impact of disaster and facilitate the relief and rehabilitation. NDWC has already received credit from international community as a leader in warning system development, especially when it signed an agreement with USAID to develop efficient warning system under US IOTWS program that allowed interaction and knowledge exchange between U.S. and Thai experts. Dr. Smith invited all stakeholders to contribute their knowledge and experience to the TARNS workshop as part of the plan to develop Thailand national warning system, which will be used as a model for other countries.

Summary of the taped statement by H.E. Ambassador Ralph L. Boyce, U.S. Embassy-Bangkok

Ambassador Ralph L. Boyce thanked Thai Government for the its great achievements made in past 17 months since the tsunami disaster to rebuild homes, communities, and livelihoods and to establish Thailand's early warning system. He mentioned that the National Disaster Warning Center, established just over a year ago, is now well equipped to receive alerts from international warning centers in the Asia-Pacific region, and to transmit warning messages across Thailand in a variety of languages. He said that getting these technologies and systems into place is an impressive achievement. He informed that the newly made US-Thai joint effort to

establish the Tsunami Alert Rapid Notification System will provide a comprehensive national system for officials to issue tsunami alerts quickly down to the community level. In fact, the TARNS effort in Thailand will serve as an important model for other countries to follow in the region. The joint program will provide an opportunity for US experts to share hard-earned lessons from America that can be adapted to Thailand's own requirements. Mr. Boyce also pointed out that a number of challenges still remain for implementing TARNS in Thailand. He said that setting up the system will require a high state of operational readiness and extensive inter-agency coordination. The government agencies, response personnel, and humanitarian organizations will need to know the roles they will play during an actual emergency. He stated that this will be particularly challenging for infrequent but high-risk disasters like tsunamis. He invited participants to meet all of these challenges and make success of the workshop.

Summary of the speech by Mr. Richard Whelden, Deputy Mission Director, Regional Development Mission/Asia, USAID

Mr. Richard welcomed participants for taking the first important step to implement the Tsunami Alert Rapid Notification System in Thailand, which will contribute to the international effort to develop the IOTWS. This is a particularly important part of the U.S. contribution to the Indian Ocean under the US IOTWS Program. He informed that two months ago, the NDWC and USAID signed a Memorandum of Agreement to strengthen U.S commitment to support Thailand in the development of effective early warning system. He mentioned that last week Thailand was one of the 28 countries participating in the first-ever exercise of Pacific Wave. Early on, NDWC reported a telecommunications problem during the drill. That problem could be seen as a sign of trouble with Thailand's systems, but one could also say Thai Government learned a lot more about improving redundancies in the warning system than if nothing had gone wrong at all. He informed that it is a great opportunity for USAID, the USFS, NOAA, and other partners in the TARNS workshop to share U.S. experiences and technical expertise with the NDWC to establish Thailand's all-hazards warning system. He said that this work is extremely important for Thailand, and for the region as a whole. TARNS System in Thailand will serve as a model that will contribute to the development of other national systems that are a part of the Indian Ocean Tsunami Warning System. Finally he informed that USAID and the U.S. Government as a whole are very pleased to be able to continue the long-standing cooperation between these two countries.

Summary of the Workshop Presentations

H.E. Dr. Smith Dharmasaroja, Vice Minister to the Office of the Prime Minister made the keynote presentation on the overview of tsunami early warning system of Thailand and informed about the future planned activities for establishment of early warning system with multi hazard framework in the country. Mr. Orestes Anastasia, Program Manager, US IOTWS Program, USAID presented the overview of the U.S. IOTWS Program in the region and other activities under US IOTWS program. Ms. Deanne Shulman, Senior Emergency Management Specialist, US Forest Service presented the background of TARNS and partnership program in Thailand and talked

about the activities planned under this program. Mr. Waiyapot Worakanok, Disaster Management Expert, NDWC made a presentation of the existing capacity of TARNS System in Thailand and related initiatives in NDWC. Other presenters includes Dr. Charles McCreery, the Director of the Pacific Tsunami Warning Center (PTWC) in Hawaii, Mayor Harry Kim of Hawaii Island, who has overseen evacuations and response to several tsunami warnings in Hawaii in his thirty years of work for the state, Ted Buehner, the Warning Coordination Meteorologist from NOAA working with coastal communities and media to assist in evacuation and future mitigation strategies, and Brian Yanagi, a representative from the UNESCO Intergovernmental Oceanographic Commission specializing in tsunami warning delivery.

Workshop participants were asked to participate in small group discussions and engage in animated discussions about how to improve the current system. Participants included a wide array of Thai officials from all levels of government extending to the community level, along with representatives from the private sector, international agencies, school teachers, and university faculties. Participants worked to identify opportunities for enhancing interagency coordination for early warning dissemination system. The group discussed existing communication technologies in Thailand and explored ways of using available technology to improve the efficiency and accuracy of warning delivery that reaches the people in danger in coastal areas. There were total three small group discussion sessions in the workshop. Each small group contained 6 sub-groups with designated chairperson, note-taker, and facilitator.

The first small group discussed on enhancement of existing TARNS- how to improve the current system. Participants discussed TARNS lessons learned in Thailand and identified challenges/ constrain for intergovernmental coordination in response to early warning information dissemination (EWID). Constrains and recommendations for enhancing EWID are summarized in Annex-1.

The second discussion topic was on organizational mandate and the processes to perform the task, staffing and equipment to complete the tasks, linkage with other levels of government activities to enhance TARNS. The third discussion topic was to identify issues and recommendations in context of Thai TARNS development. Six groups discussed with specific topic areas. Those were:

- TARNS legal authority and regulatory framework, TARNS decision authorities – issuing the alert, decision to issue evacuation order, interagency MOU requirements for TARNS
- Designing multiple & redundant communication pathways
- TARNS testing, evaluation, and training protocols, TARNS SOPS and checklists from national to village levels.
- Tailoring the message for notification of differing audiences; consistency of message and terminology for emergency managers, politicians, local populations, media, and challenges and solutions for disseminating alert to all populations
- Sustainability of TARNS and maintenance requirements with adaptation to all-hazard warning system
- Siren protocols and standardized alert system training procedures for coastal populations

Agencies involved in information dissemination and their roles and responsibilities are described in Annex-2. For effective coordination for disaster warning dissemination some recommendations for legal authority/ rule and regulation were suggested by the group discussions. Summaries of these are provided in Annex-3. Recommendations on siren and standardized alert system training procedures for coastal population are summarized in Annex-4.

A panel discussion with U.S. experts on TARNS synthesis of principles and lessons learned in the U. S. was held on day three of the workshop. The U.S. experts described the fifteen principles of the US TARNS and discussed them with the participants. The summary of the discussions are mentioned in Annex-5

Representatives of the Thai Government agreed to form an interim Interagency Workgroup, chaired by the Vice Minister to the Office of the Prime Minister. The Interagency Workgroup aims to enhance the interagency coordination for early warning and work to develop a comprehensive integrated plan for effective disaster warning dissemination system. Members took initial steps to establish an action plan and strategy for developing the conceptual framework model for TARNS in Thailand. The NDWC will serve as the lead coordinating agency for the Thai Government, and work in partnership with the U.S. Government team to help replicate the TARNS approach in other countries across the Indian Ocean Region.

Future workshops are planned to help further develop interagency coordination for tsunami warnings. All participants expressed commitment to meet as a group for an additional two sessions scheduled during the next sixteen months to continue interagency engagement for development of the comprehensive TARNS plan.

Workshop Evaluation

An evaluation question was provided to the participants getting feedback of the workshop and future program. A total of 28 responses came from the participants. Based on their response it was found that the overall performance of the workshop was very successful. 93% of the participants agreed that the workshop met its objectives very successfully. 100% agreed on the usefulness of the resource persons and facilitators and their great efforts. 86% agreed the content of the course was very useful. Summary of the comments are highlighted in the Box.

The participants identified the most important items/issues

Concept of TARNS can be applied in all 6 Red Cross Units in the affected Area. TARNS will help to improve communication system of Red Cross communication center and warning plan. It will also help to bring appropriate technology to Red Cross- *Red Cross*, Thailand

I will disseminate TARNS knowledge in parent-teacher meeting and talk about it in the class so that the people are confident about the system- *School Teacher*

TARNS workshop will help DoPA for more preparedness to support disaster management at local level. This knowledge is very helpful for the organization- *DoPA*

TARNS will improve the notification and warning system of the organization. We will contact U.S. experts for advice, suggestions for enhancing operation procedures- *TMD*

Speakers provided excellent information about the emergency warning system- *Tourism Authority*

that they have learned in the workshop for enhancing TARNS in Thailand, which includes:

- Difficulties in community and coordination
- Constrains in communication problem and equipment upgrade
- Training procedure for warning personnel
- Capacity building for local people
- Development guideline and improvement of warning system
- Decision making process based on U.S. experience
- Coordination with others, learning their scope of work in disaster warning
- Knowledge of end to end warning system in U.S. and TARNS
- Roles and responsibilities of NDWC
- Planning for TARNS development
- Approaches to reach people quickly
- Technical knowledge (e.g. sensing, communication, relief, etc)
- The policy of the core agencies
- Guideline for warning management
- Application of knowledge into school and transferring knowledge to villages

The workshop came out as a big success in the sense that the knowledge shared by the U.S experts and Thai experts were very useful for the interagency group to know each other's activities and build further cooperation and coordination between them. Participants identified the use of the knowledge in their own field, which are as follows:

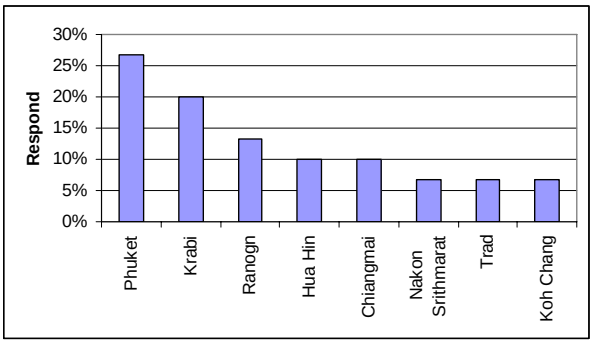
- To develop strong coordination among agencies and public. It will help in collective action for emergency situation together
- To establish communication system and network with the help of TARNS based on the information from others agencies
- To enhance the use of GIS and RS in communication system
- To develop the warning system to reach public at risk prone area
- To facilitate better coordination with media for all type of disasters
- To practice real drill and exercises
- To train decision makers
- To be better prepared to support disaster management
- To use the format of the workshop at the local level The format of the workshop can be used at local level

Listed below are some suggestions given by participants in order to increase the efficiency of the future workshops, which include a need to:

- Identify local problem deeply and solve those in the workshop during discussion sessions
- Establish working group consisting of members at decision making level
- List out small group discussion topics/ issues more precisely and clearly
- Invite other agencies such as Ministry of Public Health, Social Development Agencies, Army and other agencies in the risk areas that have complete equipment and can work as the first responder
- Conduct workshops in the risk areas involving more local agencies

- Allowing the presentation of individual organization about the current plan of the future warning system and also about the lessons learned
- Increase the number of case studies in the workshop by the U.S. experts
- Implement more plans for national and local media
- Allot more time for group discussions
- Send objectives and topics of discussion to the participants in advance for preparation
- Ensure that the host organization should be the one who has expertise in this area
- Encourage more contribution from participants on technical report and concept
- Include site visit to a place with good communication and technology system

The second TARNS workshop plans to discuss about communication technology and media. 60% of the participants put their opinion for the second TARNS workshop in the south. The bar chart shows the percentage of the response for the next workshop venue.



Closing Session

The workshop was closed by the remark from H.E. Dr. Smith Dharmasaroja, Vice Minister to the Office of the Prime Minister and Ms. Deanne Shulman, Senior Emergency Management Specialist, US Forest Service. Dr. Smith mentioned that it was a great pleasure for him to participate in the TARNS workshop and learn a lot from U.S. experts. He said that the workshop has successfully achieved its objectives of sharing US-Thailand experience in tsunami warning and this knowledge will be used to develop a concept of operation framework and simulation exercise for Thailand in the near future. Dr. Smith informed the participants that TARNS is a very important aspect in emergency situation. In several situations, if the warning had been disseminated to population at risk in time, there would not have been so many lives lost or property damaged. He said that this warning system can be applied to not only tsunami but other hazards such as floods and land slides. He mentioned that the result of the meeting as well as the discussions during the workshop was a good start in developing warning system which involves collaboration and coordination from government and international agencies. He hoped that next meeting will be more collaborative than this. He concluded by thanking USAID for its generous contribution, providing supports for implementing the TARNS program in Thailand. Certificates of Attendance were given to all participants.

Annex-1: Challenges/Constrains and recommendations for EWID

- ***Siren Towers:*** The buffer zone of the siren towers doesn't cover all the risk prone areas, as the people who live outside of the buffer zone have no other means to receive the warning quickly. Thus alternative media's for information dissemination is necessary. In such a case speakerphone/loud speaker same used as in car or motorbike need to be used at the local level. Civil defense volunteer can also play a significant role in disseminating information at the community level using these technologies.

- ***Warning System of NDWC:*** People don't understand the warning system of NDWC and the types of messages they provides. How the warning operates and what does it mean in term of wording/language, makes people confusing sometimes. This issue regarding the right interpretation of warnings needs to be addressed at.

- ***One Way Communication:*** NDWC doesn't have any capacity/ technology to follow up and get feed back from the receiver on information disseminations. NDWC cannot confirm whether the information has reached the correct agencies or people or not. Multiple information dissemination like trunked radio, VH and Citizen Band (CB) radio need to be adopted to use alternatively and make the system more effective Contact information (e.g. fax, tel. number, email, contact person name, etc) of related agencies/organizations (national, Provincial and local level) involved in information disseminations also needs to be updated after a periodic time interval by all responsible agencies.

- ***Fax System:*** Communication through fax is not reliable because the fax machine is not on automatic mode all the time.

- ***Fishing Boat Communication:*** The information communication with all kind of fishermen boats need to be improved. Some boat (big ones) has radio while some small boats don't have a radio because of financial problem. All fishermen need to be informed about the weather information and others through fishermen radio. Thus it needs to make fishing boat communication mandatory for them.

- ***SMS Message:*** SMS warning message are not received in appropriate time and also not understandable in some cases. The message needs to be short (one single message), easy to understand and clear for the local people. NDWC should have contact numbers (mobile phone number) of all leaders from national level and local level to immediately send warning message (SMS) right after any disaster events.

- ***Standard System:*** The warning systems for disasters are not standardized in this country at all. Different organizations have different

operation procedures that cause delay of making order and operation as well as confusing the staff/organizations on roles and responsibilities. Early warning for disasters need to be standardized based on specific areas. The nature and type of disasters are different on each geographic location and causes different effects on life and property, thus the warning system should be based on the nature of each disaster as well as its geographical coverage. Preparedness and response should be set up based on the effect of each disaster. Moreover, different strategies for the backup plan need to be formed in case of unexpected situations.

- ***Drill:*** Some of the risk areas are not able to take part in regular drill exercise due to budget constrains. Traffic jam during evacuation drill causes sometimes unusual accidents. Evacuation drills in the local level still need to be improved and community people need to know more about it. The evacuation route and location of safe places need to be clarified. The exercise needs to be conducted as often as possible to raise awareness to people in the community and prepare them for the future events. Practice of evacuation drills at least twice a year must be made mandatory and it should cover all the risk areas with support from Thai Government. The evacuation drill also needs to be improved based on the type of disaster and geographic coverage. Evacuation drill requires a standardized plan in national, provincial and local level in cooperation with all agencies, organizations such as TAO, PAO, school, hotel, etc.

- ***Capacity Building:*** People at the community level lack the knowledge on disaster preparedness and response mechanism. When disaster happens, people try to solve only the problem faced at that moment, they do not have a plan to respond to the situation. People living in the risk areas (especially student) need to be trained for disaster warning system. This knowledge will help people to understand and trust the operation system of Thai Government. Discussions at all levels (national, local, school, hotel, tourist industry, vendors and mass) about warning system and how to operate on response mechanism after disaster event should be taken up. Awareness and training on disaster management for hotel and tourist industry are also required. Hotels need to develop brochures about tsunami and put them in every guest room. Training on disaster warning system on the mass media is also necessary to understand the system and distribute information correctly as well as the training on the Standard Operation Procedures (SOP) of the government should be disseminated over the mass media.

- ***Operation Center:*** At least one operation relief and information center at the provincial and local level needs to be established to take quick action when the disaster occurs. People in town/ municipality can seek help form local foundations such as rescue foundations (e.g. Por-Tek-Tung) and civil defense volunteer unit, while in the mean time, community level people can help themselves and ask help from other organizations.

- ***Community Networking:*** People in the community should learn how to respond when disaster happens and try to set up the plan to help each other in the community because disaster can happen at any time. We can't rely on only one system like SMS, satellite phone, TV/Radio because these systems might collapse or jam anytime. Thus there should be an establishment of community network using the leaders of the community and religion, civil defense volunteer unit, police, local foundations etc to support in pre disaster and post disaster situations. At least one radio channel for community broadcasting is also necessary.

- ***Unskilled professional:*** People involved in the warning system disseminations sometimes fail to understand the operating system and meaning of the warning. As a result they may send unclear message to other people which cause confusion sometimes.

- ***Lack of Staffs:*** There is lack of staffs in the emergency operation center of NDWC; the center should increase the number of staff who 24/7 because such events can occur at any time including night time.

- ***Community Guide Book:*** Guide book for all disasters including nature of disaster, effects, preparedness, response and evacuation plan must be provided. Manual/guide book on disaster for people and mass media also needs to be developed for specific disasters.

- ***Decision Making:*** Taking decision/order quickly is still in the bureaucratic process which causes delay in dissemination of information and action. The buildings and concrete structures need resistant capacity against earthquake, flood and tsunamis. The role of NDWC should be made clear at all levels (staff, agencies, mass media, people, etc.). CPX meetings should necessarily be scheduled to be held at least twice a year at the national level.

- ***Strengthening Local Government:*** Local government needs strengthening. TAO can be the center point of giving out warning to the people at the community level. Leadership at the provincial level and community level also needs to establish.

Annex-2: Interagency Coordination for warning dissemination

For enhancement of TARNS process, existing interagency coordination system and gaps need to be identified from the very beginning. It was also found that if disaster happened in the middle of the night, it will cause a great deal of problem on communication system between NDWC, DDPM and TAO who doesn't have staff working at night in some areas. The agencies involved in information dissemination and their roles and responsibilities are described below:

National Disaster Warning Center (NDWC)

NDWC receives data regarding seismic and tidal from the Hydro-Met Department. The operation center works 24/7 and there are15 staffs who are always on duty. The warning message mainly disseminates to Prime Ministers Office, Governor, Department of Disaster Preparedness and Mitigation (DDPM), Districts, TAO's, etc. There are four levels of information disseminations of early warning from NDWC. Those are level 1: Advisory, level 2: Watching, level 3: Warning, level 4: Termination. The information disseminations system is shown in the figure-1.

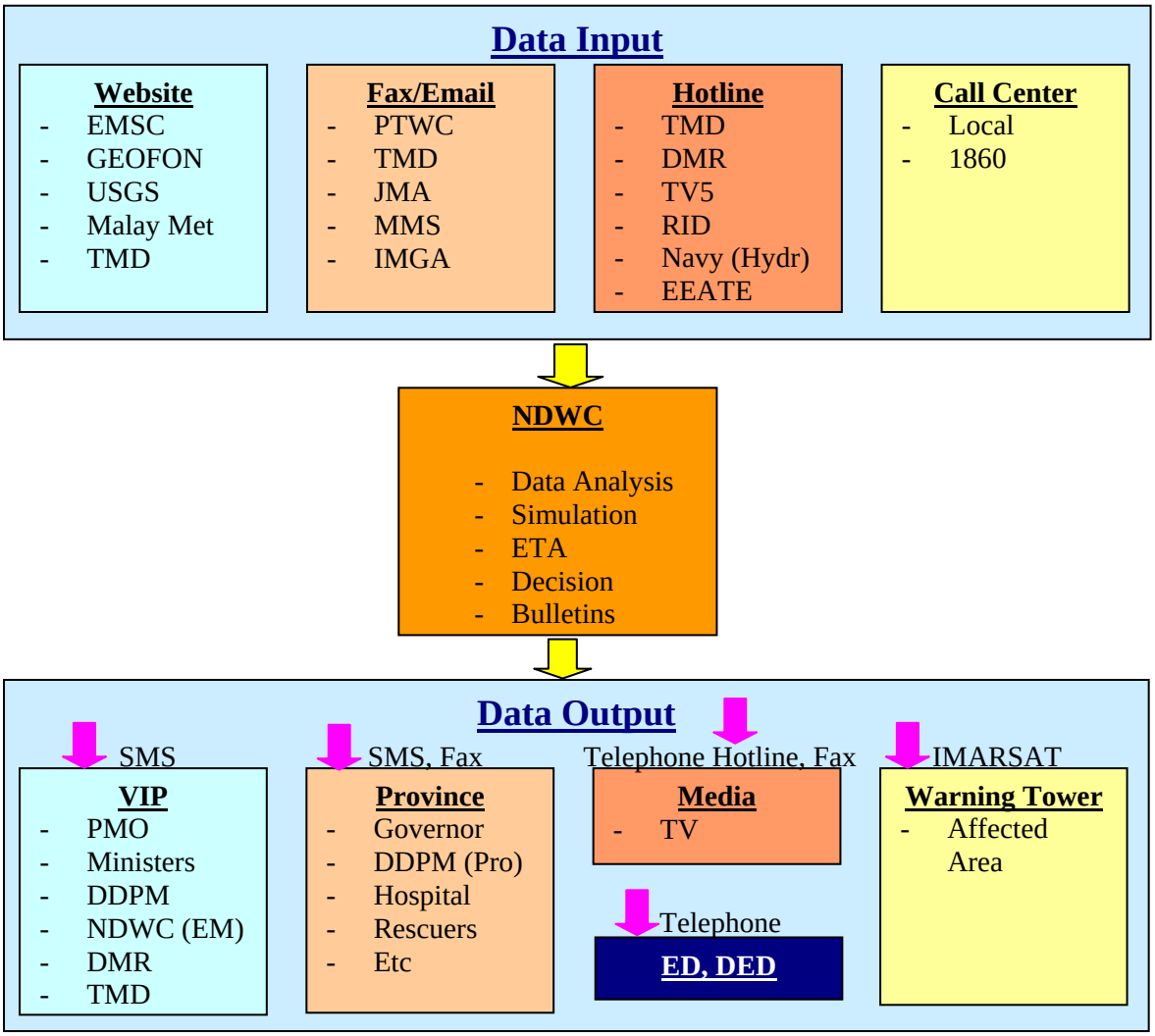


Figure 1:Data Input-Output for Early Warning System for NDWC

Thai Meteorological Department (TMD)

Thai Met Department operates 24/7 and receives information from various agencies. TMD receives real time data from national data networks and international data networks as well. It takes about 14-40 minutes for collect, analyze and send information to relevant organizations. TMD has expertise and equipments (tide gauge, buoy, data network, etc) but resources are not enough to activate and generate warning quickly. They are trying to improve organizational capacity by extending network and data storage system. The communication networking system of TMD is shown in the figure 2.

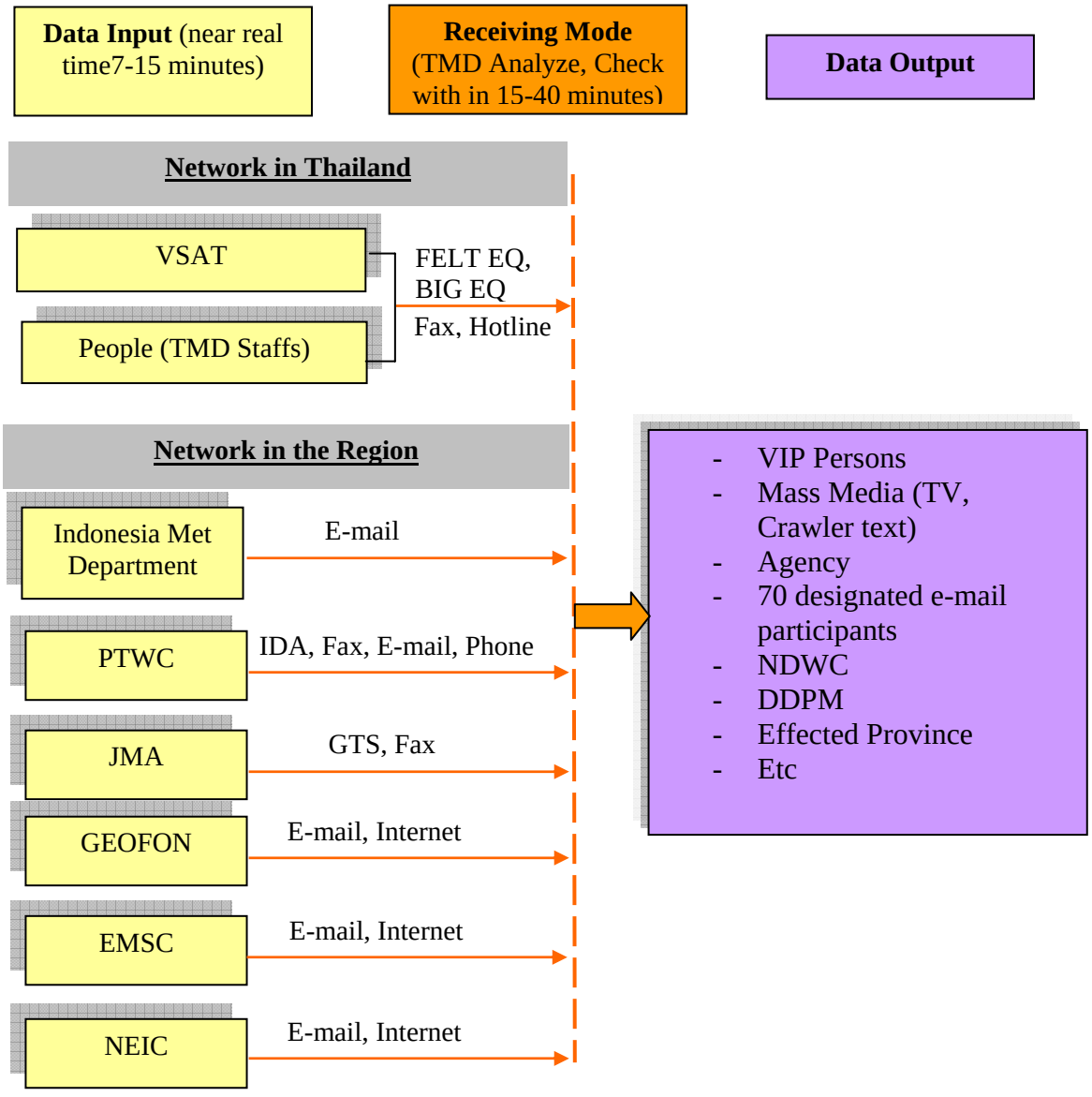


Figure 2:The Communication Network System of TMD

TMD, NDWC, DDPM informs Governors, Vice Governor, district office, TAO by phone including head of other government agencies in the areas, including private sectors, foundations and media's. The inter agencies coordination system for NDWC, DDPM, TMD is shown in figure 3.

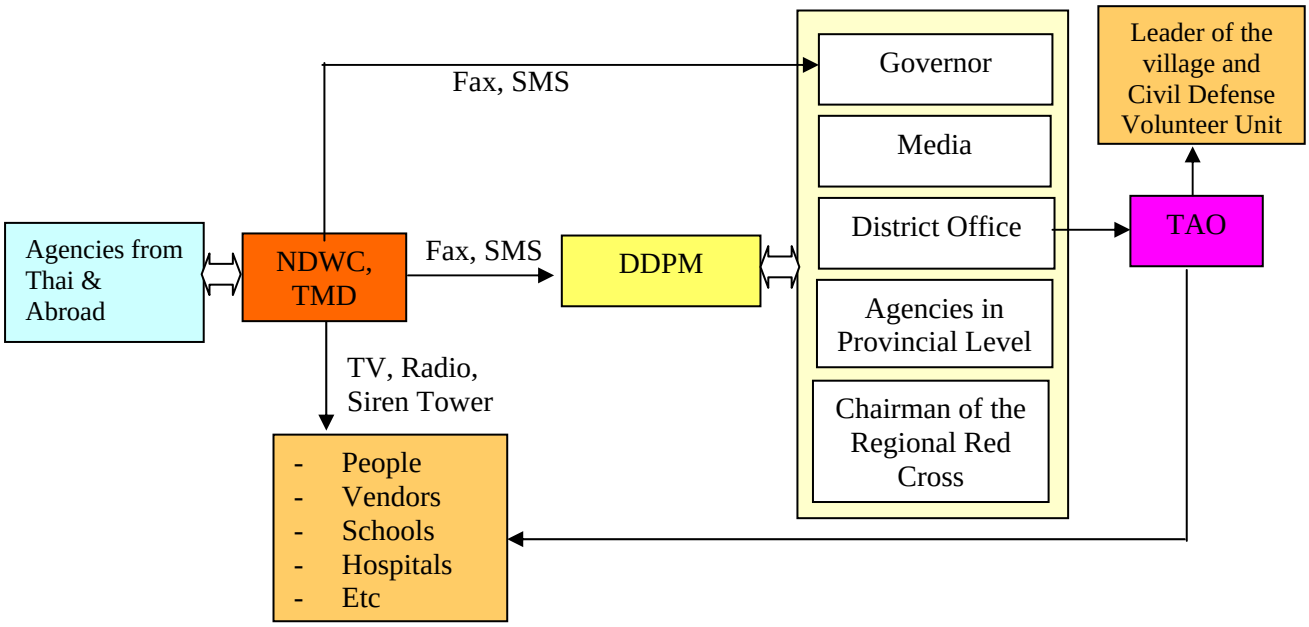


Figure 3: Interagency Coordination Flow Chart on Emergency Situation

Department of Disaster Prevention and Mitigation (DDPM)

Department of Disaster Prevention and Mitigation (DDPM) is the principal government agency designated to shoulder the task and responsibility on disaster management so as to remain Thailand as the inhabitable and secure country. DDPM coordinates with related agencies according to their policy in emergency situation. The major communication system is telephone. They have 3 land phone lines in each province. DDPM also provides vehicles to help people. (In Pang-Nga province DDPM has only 1 car with 5 seats, which is available for emergency situation). DDPM closely work with districts and TAO for food and temporary shelters and sets up service center for victims. TAO informs village leaders. Village leaders inform villagers and coordinate with DDPM and other agencies.

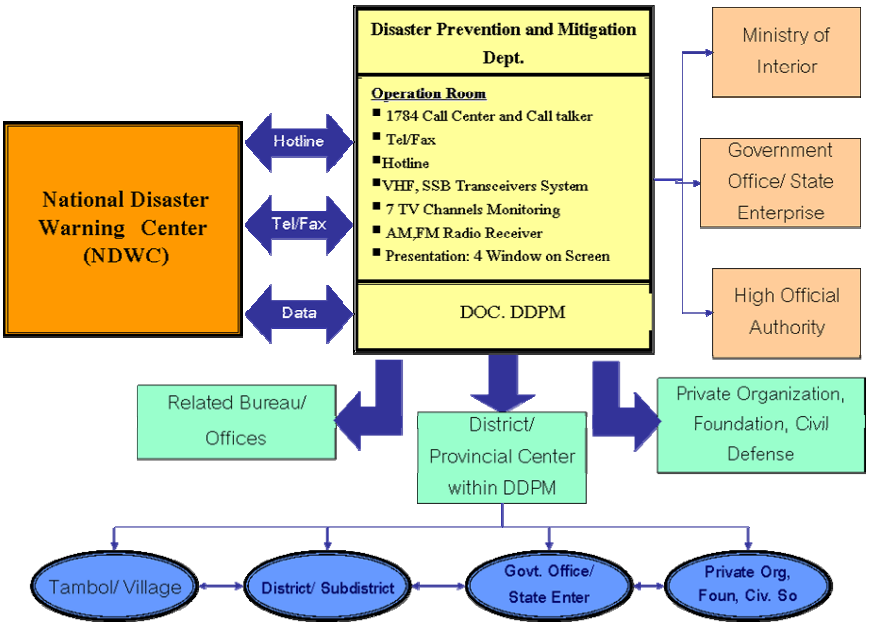


Figure 4:Information flow from DDPM to Other agencies

DDPM follows the following steps for operation procedures in information disseminations.

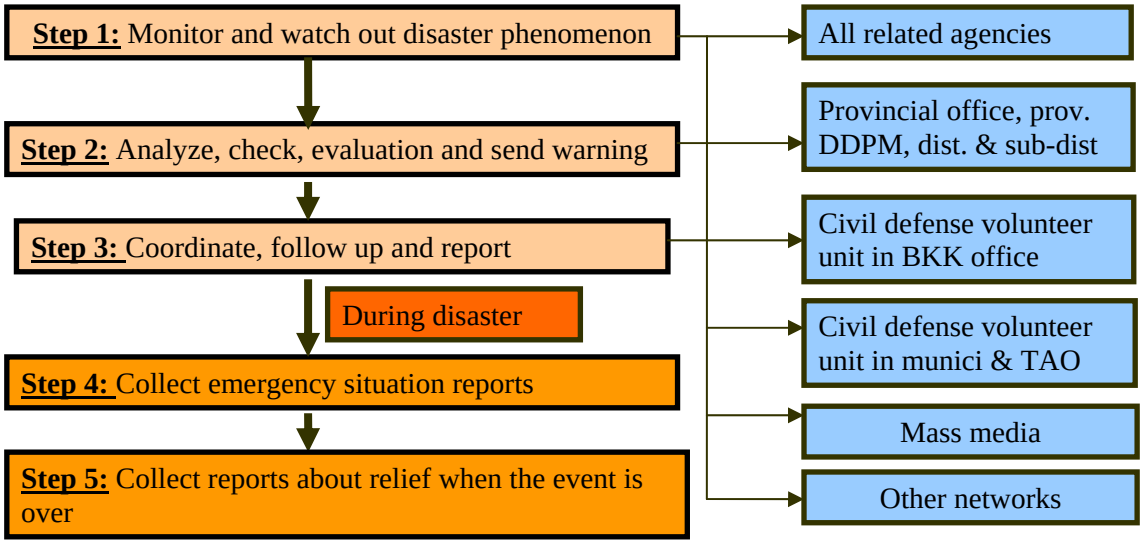


Figure 5: DDPM Operation Procedures for information dissemination

The commutation system for operation room of DDPM mainly involves 1784 use in call center, VHF for coordination network, Telephone, Fax, CB (245 MHz). The linkages of communication system of DDPM Communication center at regional level are shown in figure 6.

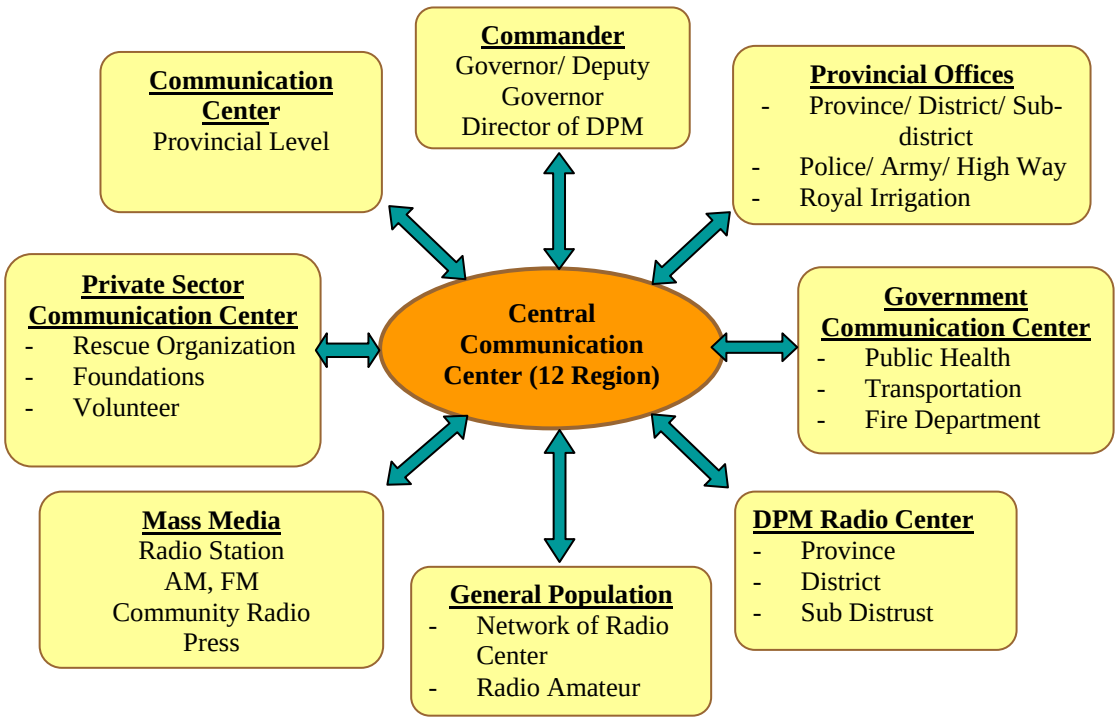


Figure 6: Linkage of Communication System of DDPM Communication Center

Ministry of Interior also involved in disaster preparedness from national level to local level. When NDWC sends warning messages to DOPA via all electronic devices, DOPA sends information to DOLA, provinces, provincial DPM's, districts, sub-districts (TAO), and communities respectively. The communication system on top level can use all electronic devices (telephone /fax, email, SMS, satellite, etc.) but at the community level it needs more support on equipments and other devices to disseminate information. Mobile unit (e.g. loudspeakers, car/motorbike and persons) are required for this kind of activities including walkie-talkie, community radio broadcasting, etc. Moreover, there are also some information gaps at the local level. The disaster management procedures in each govt. agencies are not clear and organized and some agencies do not have enough staff to serve and inform effected people quickly. Communication network is required to fill this gap among govt. agencies as well as those at the community level.

Provincial DDPM Office

Provincial DDPM works from the secretariat of the Governor at the provincial level. They receive information from DDPM headquarters in Bangkok and also from the Governor,s office. They don't have any feedback mechanism for information. Information dissemination of the provincial level is shown in figure 7.

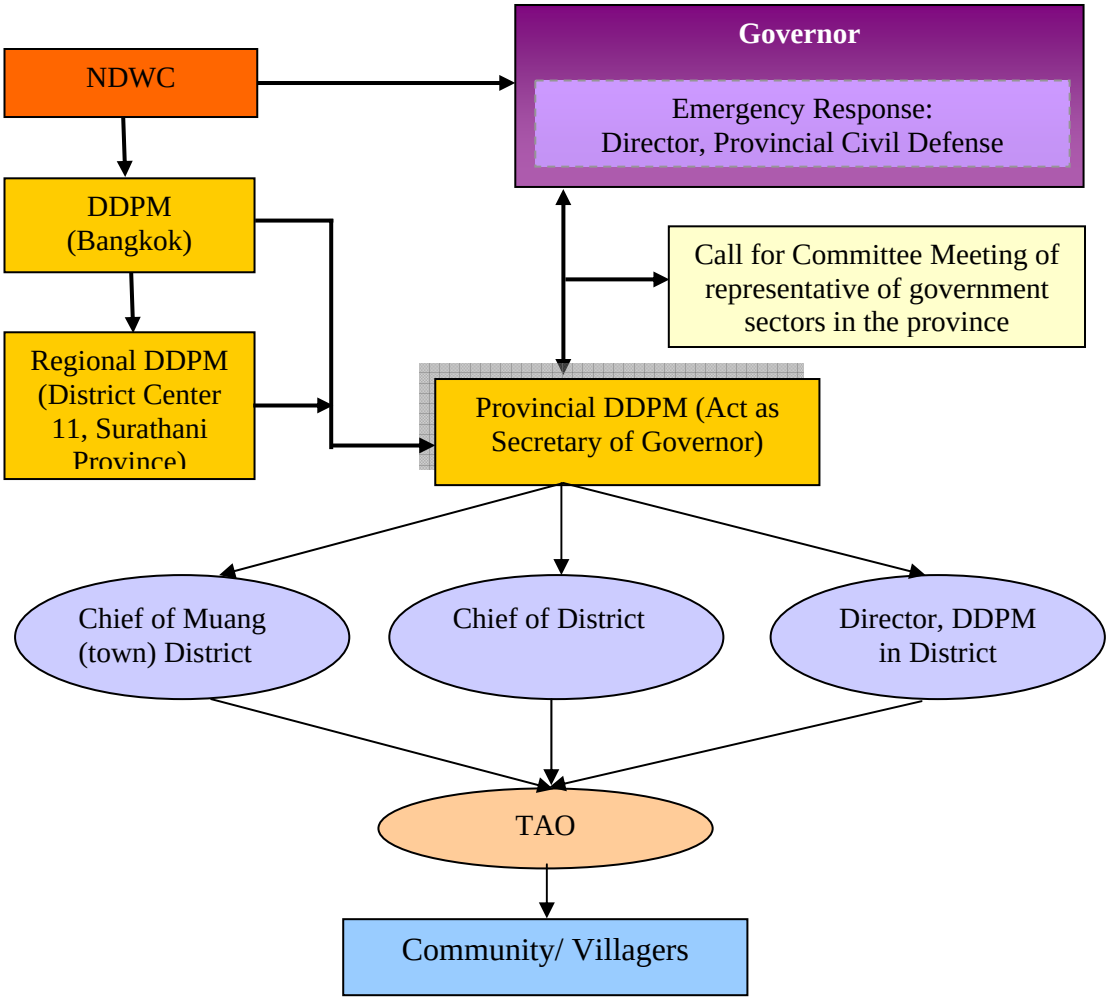


Figure 7: Information dissemination of provincial level

Department of Provincial Administration (DoPA)

DoPA's communication division mainly deals with safety and security issues and maintains the regional communication system. There are 12 television broadcasting stations, including office of the Governor and District office. DoPA have trunk Radio (800 MHz), VHF, Satellite VSAT, SSB, SMS and also inform Deputy Governor, Chief of District about the information with feedback from Advance Info Service (AIS). The communication linkage with DoPA is shown in figure 8.

Department of Fisheries (DoF)

DoF has hotline with the Coastal Fisheries Department in Phuket. They send warning to all fishing boats using HF/VHF communication. The Citizen Band (CB-245) warns the marine boats. They have 5 channels in CB. Normally every day they send weather information to the fishing boats and other marine boats. Coastal fisheries radio has 3 stations in the south (Trang, Phuket and Ranong). Radio stations get news from TMD through fax/phone and broadcast the received news to the ships/ marine boats in the sea. This radio stations have 500 registered members in Thailand, India and Indonesia. The coastal fisheries radio is very important for fishermen, commercial boats and tourist boats but each station has only 2 staff on duty who work for 7-8 hrs/day which sometime cause delay of information flow at night. The communication networks of DoF and DoPA are shown in figure 8.

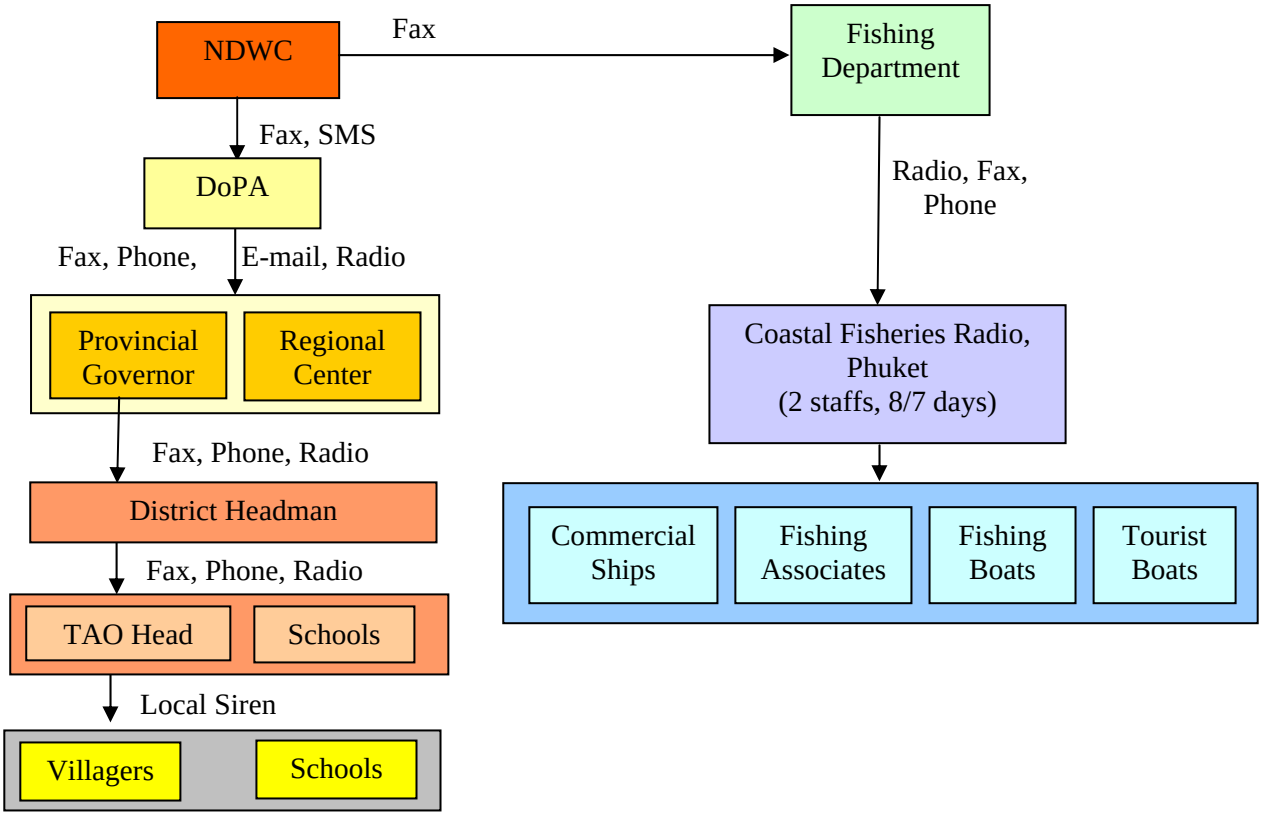


Figure 8: Communication network from national level to local level

Department of Public Relation

Department of Public Relation broadcast information through TV/Radio. There are 8 major television channels and 64 radio stations covered by the department. 12 staffs for the radio stations and 30 staffs for the television channel are working 19 hrs/7 days. In case of emergency the Department of Public Relation receives information via fax from NDWC and phone call from other agencies and broadcast that information through TV and Radio.

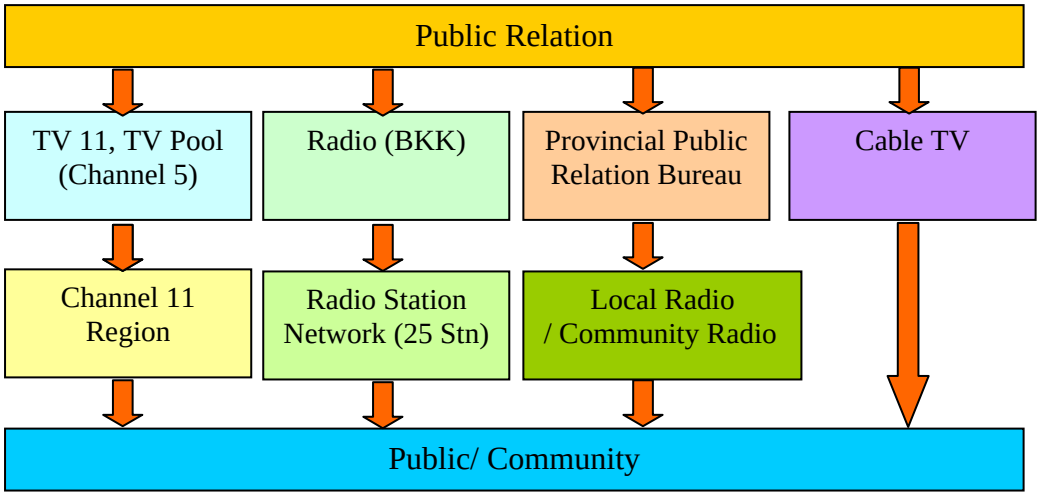


Figure 9: Information Dissemination through Department of Public Relation

TV Pool/Channel Five

TV pool acts as the center to coordinate with media from other channels like radio and television. When NDWC sends signal to announce warning messages to TV pool, TV pool sends the signal to other television channels (3, 7, 9, 11, ITV, global TV) immediately to broadcast news from NDWC. At the same time, TV pool sends information through the army radio in the country (126 stations), MCOT radio and other public relation radio stations. TV pool tries to get connection with other television channels or radio stations in the community so that people miss do not out on any information. TV pool now-a-days do not get good cooperation from other TV channels which can enable it to take immediate action. Ideally once the TV channels get signal from TV pool they should be able to link signal and broadcast news from NDWC. TV pool has mutual agreement with other channels about this protocol but it is not clear enough at the operational level. The warning notification system of the TV Pool is shown in the figure 10.

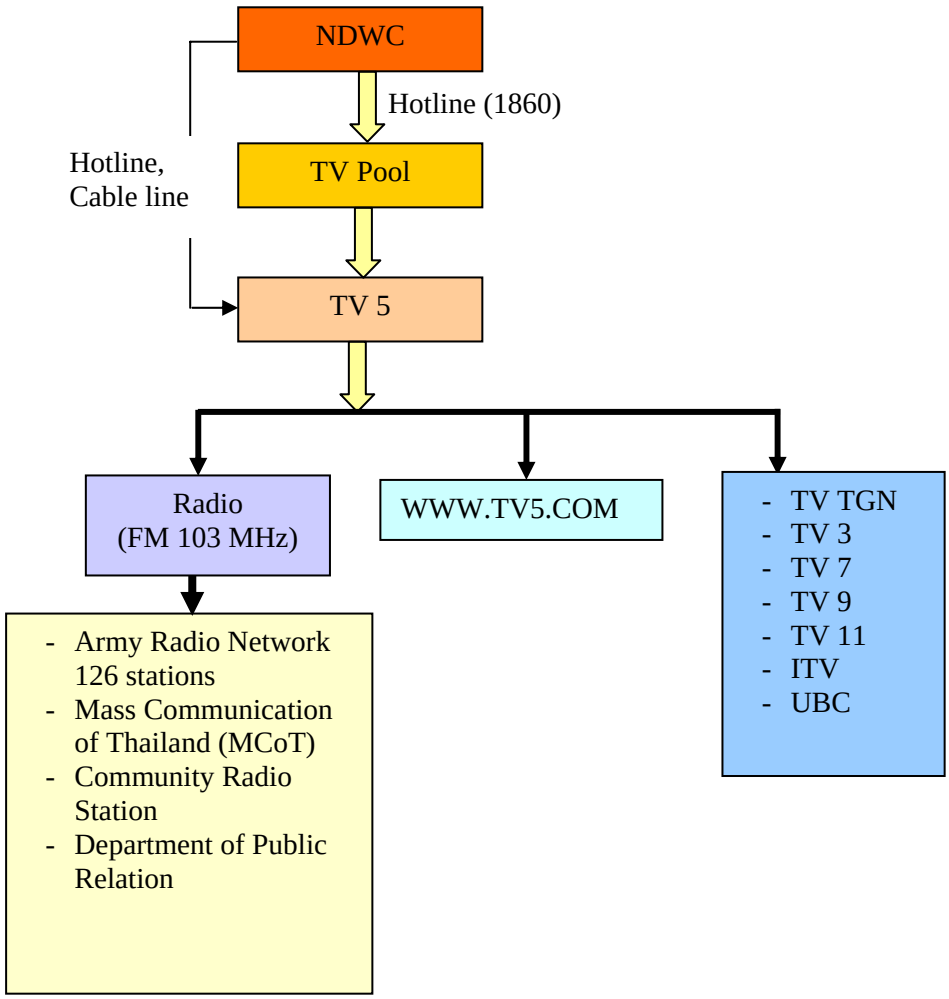


Figure 10: Warning Notification System of TV Pool

Patong Municipality

Patong Municipality provides service on preparedness before, during and after any disaster events. Municipality disseminates warning and provides support in relief operations too. There are 26 staffs' who serve 24/7. They also have rescue vehicles and first aid kits. The activities of the Municipality are shown is figure 11.

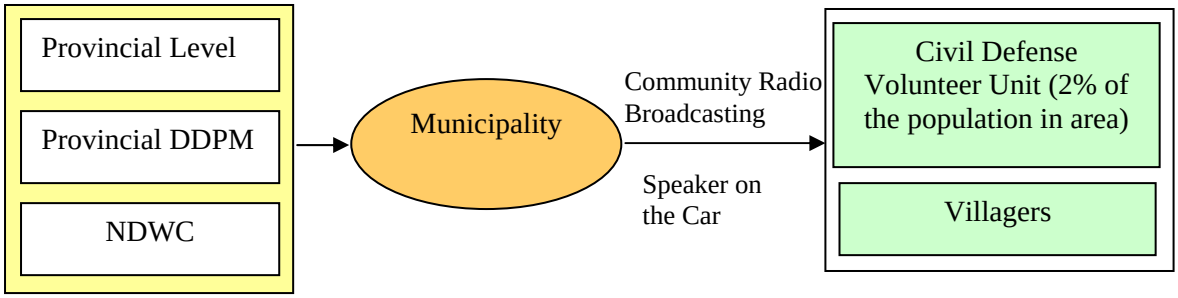


Figure 11: Information dissemination of the Municipality

National Telecommunication Commission (NTC)

The National Telecommunication Commission controls, monitors and provides all communication channels. The overall mandate of the NTC is to support communication system and check the capacity/ functionality of the communication system in disaster prone areas. NTC has the equipments to check the system as well. There are 13 stations in the country which operates 24/7. The information flows are as follows:

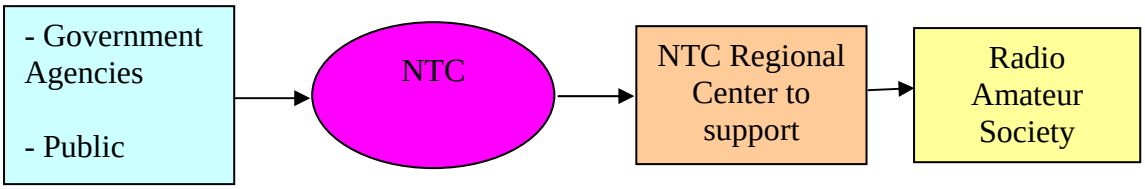


Figure 12: Information Flows of NTC

Radio Amateur Society/ CB Radio (Citizen Band)

Volunteer radio and Radio Amateur Society has the capacity of exchanging information. They have equipment and good network system in Thailand and also in neighboring countries of Thailand. During last tsunami, Radio Amateur Society acted as interagency coordinator for disseminating information. There are many types of radio system available (e.g. short wave, citizen bands) which can be used to the make system more effective and used if other systems fail. People in the community can use short wave radio or radio amateur to contact each other for their general purpose. These types of communication system still have some limitations because of expensive registration formalities.

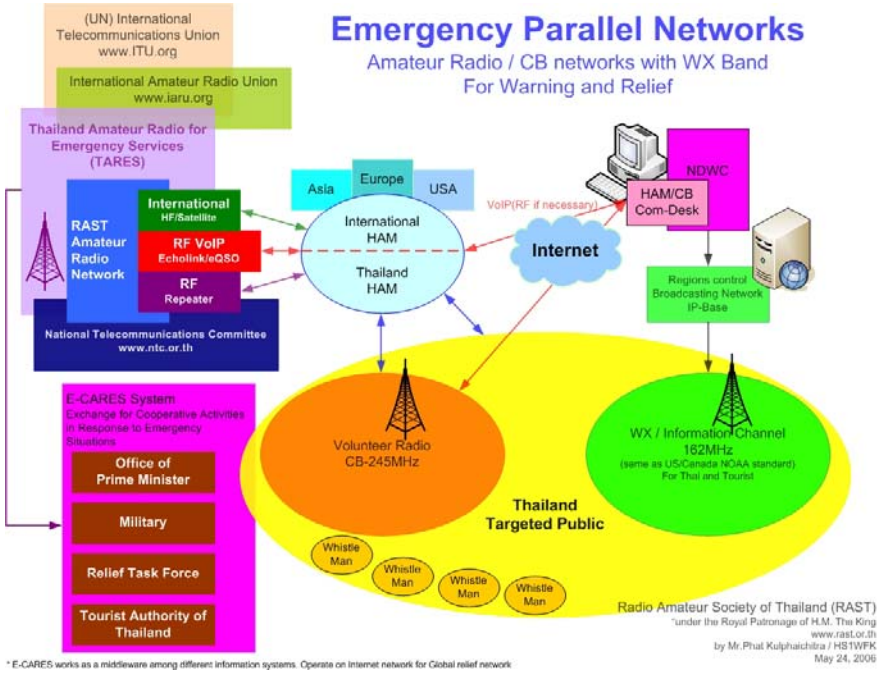


Figure 13: Emergency Parallel Network for Radio Amateur Society

Radio Amateur Society operates as a back up or parallel communication system for emergency network under NTC law dealing with controlling and monitoring. It acts as a supporting system in case of requested from other agencies. They can not directly contact with other communication agencies in the network. It is bound by law/rule to not to make contact with a third party which can create conflict in the time of disaster in coordinating with other agencies. Radio Amateur Society needs to work closely with CB Radio because CB radio is also registered/ contracted by NTC. CB radio has the capacity to disseminate information to all organization and even direct to people in the community but not set up all areas. The proposed emergency parallel network for Radio Amateur Society is shown in the figure 13.

International Telecommunication Union (ITU)

ITU focuses on telecommunication before/during/after emergency situation. Learning from experiences ITU has found that most of the countries have equipments and capacity but lack of effective use of it. Some recommendations for the effective use of the system were:

- To identify network infrastructure in the country and see that it supports their needs. For example, policemen have trunked radio, army has army radio network and both organizations have good network and equipment, which can be used during disaster events.
- To get coordination/connection from other agencies by signing MOU
- To participate in international agreement especially on the issue of importing telecommunication equipment to be used during emergency situation. This kind of agreement has already been made in Finland but Thailand hasn't joined in this agreement yet, so it causes delay of clearing equipments from customs office.

Tourism Authority of Thailand (TAT)

The Tourism Authority of Thailand disseminates information to public especially to the tourists. The organization doesn't have legal authority to command other agencies. It is working as a coordinator in its responsible areas. Tourism Authority receives information from governor or ministries in case of emergency. The main communication systems are fax and land telephone only.

TAT acts as a public relation unit and coordinator during disaster events. TAT has 22 centers around the country and 15 centers abroad. TAT can widely disseminate information to the tourists and investigate tourists during disaster events by gathering tourist information from immigration office and hotels.

Red Cross

Red Cross main office is located in Bangkok and has 13 centers in the whole country. Red Cross center in the Pang-Nga province is in Tong-Song district and responsible for 14 province in the south area. Two staffs work in the center 24/7 and get warning from DDPM by trunked radio. Red Cross has facilities and equipment (i.e. car, truck, boat) which can, immediately be used in disaster prone areas within short interval. Red Cross also provides health services, livelihood training, shelters, foods and first aid kits to the community people.

Policemen

Police provide help/ support in the case of an emergency with the help of police law/policy. Police radio networking lies under the Ministry of Interior. But the information sometimes gets delayed in flowing from top to the end users because of the coordination problems.

Communication Problem - Highlights

Agencies	Problems in Communication
Hydro-Met	No direct communication line for sending and receiving data from NDWC
NDWC	One way communication which are not able to follow up the status of the disaster situation in the effected areas
DDPM	Coordinating with district level with district office, Chairman of the Provincial Red Cross and TAO doesn't function well because of lack of well trained human resources on protocol and responsibilities
Red Cross	DDPM doesn't contact or ask for help from Red Cross because DDPM doesn't know that there are representative of Red Cross in the Provincial level
Overall	The Civil Defense Plan is available in the national level, provincial level, district level but is not used efficiently because of the lack of understanding at each level. In most cases the people at each level are not aware of their mandates and operation procedures to support the major plan. Some of the line agencies don't have enough budgets to operate and also lack staff.

Annex-3: Recommendations for Legal Authority/ Rules and Regulations

A small group discussion on legal authority and regulation framework for TARNS recommended some issues for effective interagency communication for emergency responses. Those are as follows:

- There should be good coordination with the mass media. For example, all TV channel should broadcast news immediately after getting signal from TV pool or responsible agencies
- To protect persons who issues warning, sometimes it requires time to analyze data to issue a warning and give proper information. Thus it causes false alarm in some cases when an authorized person gives an order in short period of time
- There should be proper rules and regulations for handling hazards and early warning
- There should be a well equipped communication network for better coordination among agencies for information dissemination and emergency early warning
- There should be a set of rules and regulation for protecting warning system and equipments (i.e. warning tower, tide gauge, etc)
- The SOPs on disaster prevention and mitigation including early warning system for every organization should be formulated SOPs should be clear and every organization should have the same understanding on its procedures for better consistency
- There should be a holistic network system created from top-down and from bottom-up (national to local). SOPs should exercise as much as possible with a regular time frame
- There should be more signing of MoU's or LoA's between interagency collaboration on early warning.

Annex-4: Siren protocols and standardized alert system

A small group discussion on siren protocols and standardization of alert system for training procedures of the coastal population to make communities resilience was done during the workshop. The summary of the discussion are as follows:

Components of Emergency warning procedures

For alert rapid notification system of early warning, the group suggested that the following components should be standardized.

- Use of standard data collection, data analyzing and decision making process for early warning
- Use of standard warning words or sentences in an easy to understand format
- Use of reliable warning information from related network organizations at both national level and community level
- To disseminate warning information through multiple pathways
- Use of standard system for dissemination of information to end users
- Use of standard configuration of communication equipment from NDWC for public need
- Use of proper system of warning to the public
- To clear the doubts in the minds of the public about the warning system
- Use of standard capacity building, training and knowledge development materials
- To evaluate and improve the warning system
- Use of standard emergency action plan.

Technical Regulations for Siren Towers

Some specific standard rules and regulations are also required for the siren towers. There is some information available for the siren towers but at the same time there is a need to develop standard rules and regulations for the siren tower.

- ***General information:*** A general information circular in an easy to understand language is needed to be circulated by the responsible agencies (e.g. location, lat-lon, coverage, etc).

- ***Structural condition***: The structural conditions of the tower need to be observed on a regular basic. Normally siren towers were designed as a stand alone self sustaining concrete structure or steal platform. The height is about 20-25 meters from the ground, the radius of the concrete/steel cylinder is at least 1 meter and the foundation is more than 2.5 x 2.5 square meters.

- ***Sound system:*** Sound system consists of loud speaker, siren and controller. Loud speaker, siren are controlled from the control room at NDWC, Nonthaburi, Bangkok for giving warning to public. It consists of sound and can give out messages in five (5) different languages (Thai, English, German,

Mandarin and Japanese), also sounds of the siren are different for each disaster. All are pre-recorded voice messages.

- ***Quality of Loud speaker/siren:*** Normally the speakers are designed as modular. Speakers' configurations are of two types; omni-directional speaker and directional array type speaker. Anti-rusting and weather-resistant material are used for the speakers which has all directions sound system, decibel output ≤ 120 dB and cover 30 meters. It provides clear warning message ≤ 1.5 km. away from the tower.

- ***Controlling system:*** The tower consists of Main Controller (MC) located at NDWC and Remote Unit (RU) which is located at the towers. The MC has been established to receive information from other organizations about the disaster event and disseminates the information to the towers. The MC needs some specific capacity to control RU's characteristics. The RU is the machine linked with loud speaker/siren to receive warning signals from MC and also receive-send information within the province through radio wave and satellite. It needs to work in any weather condition. Power source comes from power supply directly or Solar cell panel. Each RU needs to have backup battery for 2 hours at least. The RU is also able to pre-record multiple voice messages or warning sound. Provincial Monitoring Center (PMC) needs to monitor and collects data from siren towers in the province through sound system and send information to NDWC via leased line system.

- ***Communication system from national to local level:*** There is a need for a robust communication system form top-down to bottom-up level for the warning system. A strong linkage between tower and PMC by radio wave system and linkage between PMC and NDWC through leased line system are necessary. Linkage between tower and NDWC via satellite (Inmarsat Satellite) communication operational system is one of the redundant systems which can support each other. Communication system must be able to operate in every weather condition. Surge Protection should be installed with all equipments.

- ***Power supply system:*** Siren tower must have power supply system for both AV and DC at 220V as well as Solar Cell. Controller must have power supply system for both AV and DC at 220V as well as battery backup system. Communication system must have power supply system for both AV and DC at 220V as well as battery backup system as well.

- ***Training and manual for siren tower:*** There is a need to set up training on operations and controlling system of for warning towers at national level and training on operation and maintenance at the province level. There is a need to involve other r agencies also in understanding of the system. There is also a need to develop public manual and exercise about warning towers for the people in risk areas.

Factors for Decision Making Authority of Warning

The people who will be involved in decision making process need to have certain qualifications to hold the post. Some factors identified are as follows:

- To decide who is to be given the power of decision making at each level
- To ascertain the level of education required for the decision maker
- To ascertain the level of social status of the decision maker including the influence groups
- To maintain the career profiles of and religions followed by the decision makers
- To have information about the nationality and languages of the decision makers
- To ensure that they are trained in disaster response mechanism.

Linkage system of warning process

The existing tsunami warning system for Thailand is shown in figure 14.

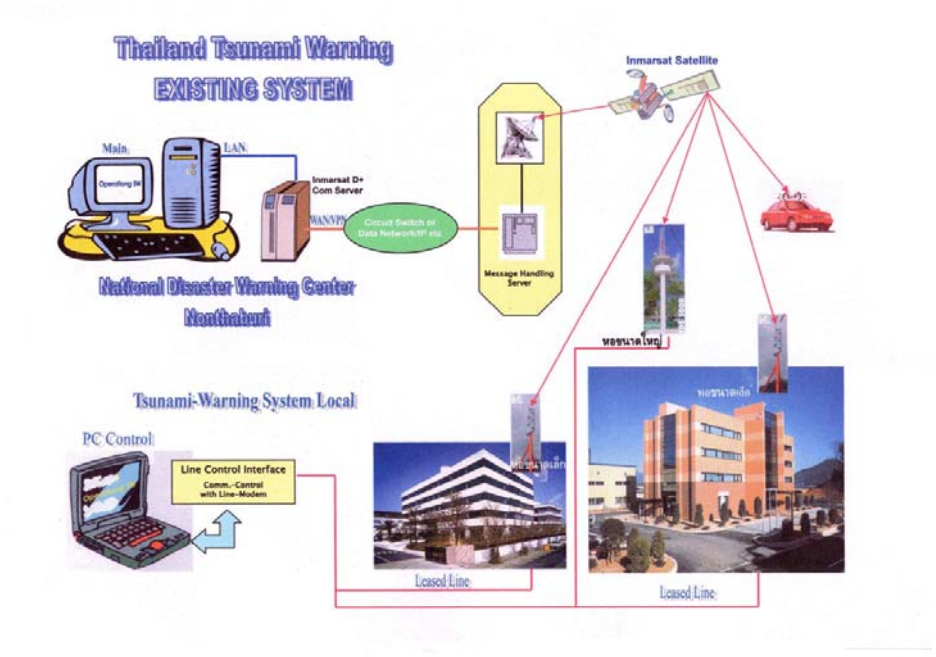


Figure 14: Tsunami Warning System in Thailand

Annex-5: Panel Discussions on TARNS Principles

A panel discussion with U.S. Experts on TARNS Synthesis of Principles and Lessons Learned in the United States was held during the workshop. An interactive discussion on TARNS principles was made by the participants with keeping in view the Thai context. Some of the principles discussed were as follows:

1) Redundant communication pathways, some of which includes verification of receipt of information are very essential for effective early warning dissemination.
2) Media plays an important role and it is a necessary redundant communication pathway (psychology of warning validation)
3) Media will be involved, either as a formal partner of the system or not but it needs to be trained to serve a useful role.
4) System must be flexible to allow space for additional content beyond basic warning/watch/etc. (local content and other site specific information). The System must collect feedback from people. Otherwise there is a scope of confusions which will force people to make phone calls for additional information. When such incident happen much more confusions arise (comical spills, explosion, fires, etc) which need to be dealt with very strategically. Thus all these various type of things need to be considered when such a system is being designed.
5) There is a need to ensure that the last mile communication is adapted to local conditions. Especially keeping in perspective the roles of media which is the most important supplement for disseminating the information quickly. There is a need to establish a good relationship with them at the same time. For example, in Hawaii there are isolated islands and thus there is a need to establish a good relationship with media for information dissemination because it becomes difficult to identify the kind of media which have access in the community and also, to find out alternatives if there is no electricity in the community. In case the noise of drums or others interrupts the siren then it has to be seen what course of action can be taken to facilitate the communication. The community needs to interpret the meaning of different signals and understand the evacuation routes. There is a need to identify the local community media for information dissemination. For example, in Chaingmai radio Thailand has the broadcast system which uses the tribal language and they do not understand the Thai language.
6) There should be a plan to provide for special needs of diverse populations (elderly, infirm, foreigners, ethnic groups, etc.) for both warning and evacuation. Every group has it own specific needs. There is a need to identify there location and understand their needs and develop strategies as per their requirements. There is a need to consider the requirements of the ethnic group too. This is not an easy task and it needs a lot of time. Help can be taken from the local organization that deals with social works and involves in such activities.
7) There is a need to avoid multiple, conflicting and confusing warning messages.
8) There is a need to make the message content regarding the nature of the threat and the life saving action as clear as possible. Timely and accurate flow

of information for media is also necessary. Every one needs to realize their responsibility and also be clear about his role and about who is responsible to send the information.

9) Decisions regarding the authorities issuing warnings, ordering evacuations, etc. should be clearly identified and adhered to in the event of a disaster.
10) Warning timeframes should aim for maximum lead time before expected arrival of the tsunami, with consideration for challenges of "last mile" communication and time required for evacuation. Once a year there is a need to perform table top exercise and practice.
11) Legacy conditions will impact future upgrade/effectiveness of the system (and therefore must be considered when establishing the system). Everyone needs to understand the complete flow of information to the last mile and if there is any legacy component it needs to be understood carefully and maintained The siren system is totally new in Thailand and there is a need to build the confidence of the people in this new technology. There should be a clear distribution of responsibilities among the staff for the maintenance of the tower.
12) There should be a plan for the long-term sustainability of all-hazard framework and for its maintenance, training, and operations
13) There should be a plan to conduct routine testing on a scheduled basis (daily, weekly, monthly). It will also build confidence in local people and scientist as well.
14) All stakeholders must be included in the system design (potentially impacted populations, infrastructure engineers, telecom officials, etc.).
15) The regulatory framework in the nation will impact all aspects of the warning system.

Annex-6: Participant List

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Annex-7: Agenda

TRAVEL DAY: TUESDAY, 23 MAY

13.00 – 14.00	Brief on NDWC, Thailand and its operation
14.00 – 14.15	Coffee Break
14.30 – 17:30	Travel to Hua Hin by Mini-vans
17:30 – 18:00	Check in Sailom Hotel
18:30 – 20:00	Welcome Reception Dinner

DAY 1 PROGRAM: WEDNESDAY, 24 MAY

Expected Outcome for Day 1:
Thai and U.S. participants gain knowledge on tsunami warning systems through sharing of experiences and lessons learned.

08:30 – 09:00 Registration

09:00 – 10:30 Opening Session

- Opening Addresses
  - ❖ Government of Thailand- Minister to the Office of the Prime Minister or Vice Minister Dr. Smith Dharmasaroja
  - ❖ Government of the United States – Ambassador Ralph L. Boyce, U.S. Embassy (Taped Speech)
  - ❖ Government of the United States – Mr. Richard Whelden, Deputy Director, USAID Regional Development Mission/ Asia
- Keynote Presentation: Tsunami Early Warning System of Thailand –Dr. Smith Dharmasaroja, Vice Minister to the Office of the Prime Minister
- Presentation: Overview of the U.S. Indian Ocean Tsunami Warning System (IOTWS) Program – Mr. Orestes Anastasia, Program Manager, US IOTWS Program, USAID
- Group Picture

10.30 – 10.45 Coffee Break

10:45 – 11:15 Presentation: What is TARNS and Description of TARNS Partnership Program in Thailand – Ms. Deanne Shulman, Senior Emergency Management Specialist, US Forest Service

11:15 – 12:00 Workshop Introduction and Overview

- Introductions of workshop participants and agency role in TARNS – Dr. Tavida Kamolvej, Workshop Facilitator and Disaster Management Communications Expert
- Meetings and business arrangements, ground roles – Facilitator
- Respective expectations, function and roles of NDWC, TARNS Interagency Workgroup Group and TARNS Core Workgroup for development of the TARNS - Dr. Cherdsak Virapat, NDWC
- Overview of workshop process and outcomes – Facilitator

- Review of workshop agenda - Facilitator

12:00 - 13:00	Lunch
13:00 – 13:30	Presentation: Existing Capacity of TARNS System in Thailand and Related Initiatives in Thailand – Mr. Waiyapot Worakanok, Disaster Management Expert, NDWC
13:30 – 14:15	U.S. Case Study: June 14, 2005 and Role of the Media – Mr. Ted Buehner, Warning Coordination Meteorologist, Seattle Weather Forecast Service, National Weather Service, NOAA
14:15 -15:45	Small Group Discussions with Report-Out: TARNS Lessons Learned in Thailand – Facilitator Output will be identification of primary challenges facing Thailand for Intergovernmental Coordination in Response to Emergency Warning
15.45 – 16:00	Coffee Break
16:00 – 16:45	Presentation followed by Q&A: Regional and National Level of TARNS System; CONOPS in the United States – Dr. Charles McCreery, Director, Pacific Tsunami Warning Center, NOAA
16:45 - 17:00	Wrap-up session for Day 1 – Facilitator
18:30 – 20:00	Dinner

DAY 2 PROGRAM: THURSDAY, 25 MAY

Expected Outcome for Day 2:
Based on presentation materials and discussions, identify key issues for enhancement of a Tsunami Alert Rapid Notification System (TARNS) process for Thailand

08:30 - 08:45	Review of Day 2 Process and Expected Outcomes – Facilitator
08:45 – 09:30	Presentation Followed by Q&A: U.S. State Role in TARNS System; Plans, Checklists, Standard Operating Procedures – Mr. Brian Yanagi, UNESCO/IOC International Tsunami Information Centre
09:30- 10:15	Presentation followed by Q&A: U.S. Local Government Role in TARNS System: Plans, Checklists, Standard Operating Procedures, Outreach to Communities – Mr. Harry Kim, Mayor, County of Hawaii
10:15 – 10:30	Coffee Break
10:30 – 12:00	Small Group Discussions (groupings will be pre-determined): - Facilitator Questions to Answer 1. What is your mandate and the processes to perform? (Legal Authority, SOPs, Checklists, etc.) 2. What staffing and equipment do you have to complete the tasks?

3. How do your tasks connect to other levels of government function in communicating the warnings to other agencies or levels of government?
4. What are the differences between the current written procedures and the reality and what can be done to make better procedures?
5. What if the event happens in the middle of the night, would it change your plans and processes of response?

12:00 - 13:00 Lunch

13:00 – 14:00 Small Group Report-out - Facilitator

14:00 – 15:00 Panel Discussion with U.S. Experts ---TARNS Synthesis of Principles and Lessons Learned in the United States

15:00 – 15:30 Coffee Break

15:30 – 16:45 Small Group Topical Discussions - issues identification and recommendations in context of Thai TARNS development (6 groups each with designated chairperson, note-taker, and facilitator)

- 1) TARNS Legal Authority and Regulatory Framework, 2) TARNS Decision Authorities – Issuing the Alert, Decision to Issue Evacuation Order, 3) Interagency MOU Requirements for TARNS
- Designing multiple & redundant communication pathways
- 1) TARNS testing, evaluation, and training protocols, 2) TARNS SOPS and Checklists
  - National Level - NDWC and other agencies
  - Provincial Level
  - District/Tambon/Village levels
- 1) Tailoring the message for notification of differing audiences; consistency of message and terminology for emergency managers, politicians, local populations, media, and 2) Challenges and solutions to disseminating alert to all populations (languages, special needs groups, indoor/outdoor devices, cultural sensitivities, etc.)
- Sustainability of TARNS and maintenance requirements with adaptation to all-hazard warning system
- Siren protocols and standardized alert system training procedures for coastal populations (sirens, loudspeakers, etc)

16:45 – 17:00 Wrap-up Day 2 - Facilitator

18:30 – 20:00 Dinner

DAY 3 PROGRAM: FRIDAY, 26 MAY

Expected Outcome for Day 3:
Identify key elements for a Thai TARNS System Plan and develop a work-plan with time schedule for development. Strategize for the Second TARNS Workshop; select dates and identify key topics including presentation of the draft Thai TARNS Plan.

08:30 - 08:45	Review of Day 3 Process and Expected Outcomes – Facilitator
08:45 –09:45	Small Group Report Out to Plenary (from Day 2) with outputs including recommendations on each topical area issue - Facilitator
09:45-10:00	Coffee Break
10:00 – 11:00	Small Group Discussion: Identify key elements of a conceptual draft framework Thai TARNS Plan in an Outline Format
11:00 – 12:00	Small Group Report Out to Plenary: Facilitator
12:00-13:00	Lunch
13:00 – 14:00	Synthesis of key elements for a Thai TARNS Plan: Facilitator
14:00 -14:30	Plenary Discussion: 1) Deliberations and Prioritization of tasks to develop TARNS Plan for Thailand (tasks and deadlines), and 2) Planning for the Second TARNS Workshop (dates, topics) - Facilitator
14:30 – 14:45	Coffee Break
14:45 – 15:00	Wrap-up and workshop feedback: Facilitator
15:00 – 15:15	Closing Remarks: USAID
15:15 – 15:30	Formal Workshop Close: NDWC

Annex-8: Planed ICS Collaborative Activity Plan

An interim Interagency Workgroup has formed chaired by His Excellency Dr. Smith Dharmasaroja, Vice Minister to the Office of the Prime Minister. The Interagency Workgroup will aim to enhance the interagency coordination for early warning and work to develop a comprehensive integrated plan for effective disaster warning dissemination. The NDWC will serve as the lead coordinating agency for the Thai government, and work in partnership with the U.S. Government team to help replicate the TARNS approach in other countries across the Indian Ocean Region.

The TARNS program will be implemented in 4 workshops and two simulation exercises:

- Workshop 1: TARNS System Design and Plan *(First workshop completed, 24-26 May 2006)*
- Workshop 2: Enhance Communication, Technology and Relationship with Media
- Workshop 3: Development of Framework Plan for TARNS
- Workshop 4: Regional Model of Tsunami Alert Rapid Notification System
- Simulation Exercise 1: Field visit at provincial, district and TAO level to enhance TARNS
- Simulation Exercise 2: Full scale exercise on alert rapid notification system

A planned program of specific future collaborative activities with a timeline is shown in the table below. It is important to note that due to funding parameters of the U.S. government, all activities under the US IOTWS Program must be completed by September 30, 2007.

Timeframe	Activity
May 24-26, 2006 (Completed)	First TARNS workshop to develop system design and plan for interagency coordination to delivery the early warnings to people
July 25-27, 2006	Second TARNS workshop to develop communication system, technology and media training
August-January, 06-07	Field visit at the provincial, district, TAO and community level to develop robust TARNS
January, 2007	Third TARNS workshop to develop plan for the TARNS
Feb-March, 2007	Full scale table top exercise
April, 2007	Regional Model showcase of TARNS