Draft Summary Report on Three Pilot Workshops for Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System

Philippines

Bangladesh

Pakistan

Highly successful two-day pilot workshops were conducted in Philippines, Bangladesh, and Pakistan 3 – 11 October 2013 by an international, multi-agency team. The purpose of the workshop was to identify Standard Operating Procedures (SOP) best practices, gaps and needs, and recommendations, and an action plan to meet the needs of the three countries and of the project for the other 10 beneficiary countries involved. NOTE: This is a summary report. Detailed reports on each pilot country visit were completed and will be available.

James C. Weyman, Project Manager, Technical Advisor
18 November 2013

SUMMARY REPORT ON THREE PILOT WORKSHOPS ON SYNERGIZED STANDARD OPERATING PROCEDURES (SSOP) FOR COASTAL MULTI-HAZARDS EARLY WARNING SYSTEM

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1. **Introduction**

The Economic and Social Commission of Asia and Pacific (ESCAP) approved a submitted project *Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System* and funded it through the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and South East Asia. ESCAP/World Meteorological Organization (WMO) Typhoon Committee (TC) and the WMO/ESCAP Panel on Tropical Cyclones (PTC) in cooperation with other agencies had recognized a strong need to create synergies in early warning systems among different types of coastal hazards by reviewing existing Standard Operating Procedures (SOPs).

2. **Project Overview**

The goal of the project is to promote community resilience to coastal multi-hazards through effective SOPs for multi-hazards EWSs. The project is a collaboration with
➢ Economic and Social Commission of Asia and Pacific (ESCAP),
➢ Asia Disaster Preparedness Center (ADPC),
➢ Asia-Pacific Broadcasting Union (ABU),
➢ Global Alliance on Accessible Technologies and Environments (GAATES),
➢ Intergovernmental Oceanographic Commission (IOC) of UNESCO,
➢ Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES),
➢ United Nations Development Programme (UNDP) Asia-Pacific Regional Centre.
It involves thirteen beneficiary countries in TC and PTC regions. The designated target groups include National Meteorological and Hydrological Services, National Tsunami Warning Centres, and National Disaster Management Offices in TC and PTC Members' countries.

Activity 1 is to collect, review, analyze, and synergize existing SOPs in TC and PTC Members' countries and develop a Manual/Handbook of SSOP Procedures. The second item in Activity 1 was to pilot the SSOP project in 3 selected countries. The three selected pilot countries selected were the Philippines, Bangladesh, and Pakistan. The Pilot Workshop held 3 – 11 2013.

3. **Purposes of the Workshops**

➢ Review existing coastal multi-hazards EWS SOPs of hydro-meteorological service, disaster management, media, elected official, and others from national to local levels,
➢ Identified best practices, gaps and needs, and recommendations for internal and cross-cutting SOPs, and
➢ Develop action plan to highlight best practices, fill gaps and needs, and review capacity.

4. **Three In-Country Pilot Workshops and Team Members**

➢ October 3-4, 2013 Manila, Philippines
➢ October 6-7, 2013 Dhaka, Bangladesh
➢ October 10-11, 2013 Islamabad, Pakistan

Team members for the Philippines and Bangladesh Pilot in-country visits were:
▶ Jim Weyman, Project Manager/Technical Advisor
▶ Olavo Rasquinho, Meteorological Expert, TCS

- ▶ Atiq Kainan Ahmed, Disaster Response Expert, ADPC
- ▶ Mr. Walter Welz, Media Expert, ABU
- ▶ Ahmed Said Al Barwani, Hydrology Expert, PTC

Since Mr. Weyman was unable to obtain a visa to Pakistan in time for the visit and Mr. Welz had a previously scheduled meeting, the team members for the Pakistan in-country visit were:
- ▶ Olavo Rasquinho, Meteorological Expert, TCS
- ▶ Atiq Kainan Ahmed, Disaster Response Expert, ADPC
- ▶ Mr. Nadeem Ahmed, Media Expert, ABU
- ▶ Ahmed Said Al Barwani, Hydrology Expert, PTC

Mr. Weyman did participate on several different occasions, especially during the groups' presentations following the breakout sessions, via Skype form his home.

5. Workshop Programme Overview

The programme for the two-day workshops were jointly developed by members of pilot countries and the Project Manager. Approximately 25 people attended each workshop.

Day 1

Session 1: Roles and Responsibilities in Coastal Multi-hazards Early Warning System at national, district, and local levels.

Session 2: Identification of Issues, Gaps, and Challenges in Early Warning System.

Session 3: Roles of Standard Operating Procedures (internal, external, and integrated) for Early Warning System including Development Procedure and Annual Review

Session 4: Identification of Issues, Gaps, and Challenges in Early Warning System Standard Operating Procedures.

Session 5: Plans and Thoughts for the Future.

Day 2

Session 1: Mapping and Modeling the Storm Surge Hazard

Session 2: Bridging the Gaps in the SOPs for Early Warning System – The Road Ahead

Session 3. Challenge to Issue Effective, Understandable Forecasts, Advisories, and Tropical Cyclone Bulletins

Session 4: Building Relationships

Session 5: Goals and Completion Dates

Summary of Strengths, Gaps, Needs, and Recommendations

NOTE: The Typhoon Committee Secretariat has establish a web page at the Typhoon Committee web site (http://www.typhooncommittee.org/SSOP/indexSSOP.html) which will include the presentations given at the pilot workshops, the project documents and reports, other related documents and a possible blog for comments and discussions.

6. Workshops Summary

Detailed reports of each pilot visit were prepared. The following was compiled and summarized from these detailed reports. For additional details on these three items, please see the detailed reports.

6.1. Early Warning System

The recurring themes in the workshops for an effective early warning system are listed below with a short description. Although not specifically SOP related, they have been included as part of an overall needs assessment in this area.

6.1.1   High level government commitment and support – most important

It was believed that an effective EWS begins with elected leaders and high government officials understanding their vital roles and knowing the current capabilities of their country's system. This takes political commitment, effective governance and institutional arrangements to ensure EWS is an integral part at all levels of the government. To support this, there needs to be a commitment of budgeted resources and dedicated investments. The workshop participants discussed how this was achieved in their countries and that continued emphasis was needed.

6.1.2   Legal and legislature framework

In this context, the legal framework of the Philippine Disaster Risk Reduction and Management program as contained Republic Act (RA) No. 10121 of 2010 and the associated National Disaster Risk Reduction and Management (NDRRM) system and NDRRM Plan 2011 – 2028 was discussed. Bangladesh has a national Standing Orders on Disasters for relevant ministries and organizations which provided policy and guidance. Pakistan had formulated a Disaster Risk Management Needs Report and then formulated a National Disaster Risk Reduction Policy 2012, and National Disaster Management Plan (NDMP) 2012 – 2022 which set the policy framework for national to province to district level. Volume II of the NDMP focuses on Establish Multi-hazard Early Warning and Evacuation Systems. With these as foundations, it was believed additional work was needed.

6.1.3   Collaboration and coordination at all levels – national, regional, and local

Policies and guidance should be in place to enable effective coordination among all agencies at national, regional, and local levels, both horizontally and vertically. Then to have established mechanisms to systematically collect feedback and evaluation at all levels and then translate the information gathered into corrective actions for system improvement. The active participation at all levels should include national, regional, local governments and agencies, but also private, professional and civil society organizations, communities, families, individuals, and regional and international organizations. It was noted that a shared vision can help to see beyond individual goals, affiliations, and interests.

6.1.4   Media involvement as a partner

Research findings show media is among the most important sources of information during and after natural disasters. The media needs quick, accurate information in simple language to broadcast so people can understand and take action. In this way media can influence public belief and behavior about risk. Therefore an effective partnership among warning, disaster management, and government agencies with the media can support an effective EWS.   It was also noted a single, official source of information with regular press conferences and release of data is essential.

6.1.5   A multi-hazard approach

Hazards occur at different frequency. A hazard such as a tsunami occurs infrequently at most locations and a single hazard EWS can become less effective over time. But a multi-hazard EWS which includes cyclones, coastal flooding, flash flooding, high waves, high winds, and heavy rains would be used and tested more frequently thus maintaining currency and also improving effectiveness.

6.1.6 Fully implemented elements of a people centered early warning system:

a. Analysis of risks/risk knowledge;
b. Detection, monitoring, and forecasting/warning services;
c. Dissemination and communication capability; and
d. Prepare/response capacity.

This would include: 1) availability of accurate hazard and evacuation maps indicating inundation areas, shortest escape routes and safe evacuation sites; 2) a dense, real time network of maintained observing sites for accurate detection, location and evaluation; 3) appropriate systems and highly trained staff to accurately analyze and forecast the hazard threat; 4) rapid, redundant, effective communications system for transmitting the information to authorities and the public at all levels and locations which are continually maintained and tested; and 6) a well-informed and prepared citizenry to take proper actions and responses as needed.

6.2 Standard Operating Procedures

The strengths, gaps, and needs varied among the three pilot countries visited, varied within and between agencies within countries, and varied at different levels of government. Below is a summary of the findings related to SOPs divided into strengths and then needs and gaps. During a two day workshop with about 25 participants, not all of the strengths, gaps, and needs could be identified and documented. Therefore there may be others that are not listed.

6.2.1 Strengths

a. Favorable Framework for Creation/Maintaining SOPs.
In the Philippines, there is a good regulatory framework created by Philippine Disaster Risk Reduction and Management program and the National Disaster Risk Reduction and Management system to create and maintain linkages among various agencies and levels of government. A good example of this is the Department of Interior and Local Government's strong relationship with Local Government Units. In Bangladesh, a national Standing Order on Disaster for 39 relevant ministries and organizations provides excellent policy and guidance documentation and the foundation to build internal and integrated SOPs.

b. Excellent Examples of Existing SOPs.

The Philippine Institute of Volcanology and Seismology has excellent SOPs for earthquake, tsunami, and volcano monitoring and warning which have been tested and validated through drills and actual events. In addition, PAGASA has a good existing SOP for tropical cyclones. In Pakistan, the PMD Flood Forecasting Division has developed detailed, comprehensive interagency SOPs on Hydro-Meteorological Forecasting which includes causes of floods, EWS and flood forecasting system, responsibilities of stakeholders, and dissemination system. Also the division has developed internal PMD Flood Forecasting

Division SOPs to implement the interagency SOP. The Pakistan Dam Safety Council, Federal Flood Commission have developed comprehensive Mangla Dam operations SOPs and PMD has good examples of tsunami and PMD's Tropical Cyclone Warning Center SOPs.

c.   Systems to assist in detection, monitoring, forecasting, and warning services

Bangladesh Meteorological Department has jointly developed a flood forecasting system with Flood Forecast and Warning Center and Bangladesh Water Development Board. In Pakistan, the Lai Nullah Flood Forecasting and Warning System with automated real time data monitoring and coded alert stages has become a model for urban flood forecasting and warning in Pakistan.

d.   Systems/Situations to assist in dissemination and communications

In the Philippines, the media gives high priority to early warning information and attempts to disseminate it quickly. Also twenty-four hours before landfall, PAGASA begins conducting press conferences and creates a special holding area for media. In Bangladesh, the Cyclone Preparedness Programme is an outstanding example of an effective volunteer organization and is a model programme in disaster management. With nearly 50,000 volunteers the programme minimizes the loss of life and damage of properties through participating in EWS, search and rescue, evaluation, first aid, relief distribution and rehabilitation activities.

e.   Systems to assist in response/preparedness capacity

In the Philippines there is a Strong Community Based Disaster Risk Reduction Management (CBDRRM) program in place. Pakistan has developed a detailed Monsoon Contingency Plan for Balochistan Province which covers scenarios, coordination arrangements, and preparedness and response planning.

f.   Supporting MOUs in place

BMD has developed several MOUs to define roles and responsibilities. There are MOUs among BMD, Department of Disaster Management (DDM) and government broadcast media; among BMD, DDM, and Cyclone Preparedness Programme; and a projected MOU between BMD and Coastal Inundation Forecasting Demonstration.

6.2.2 Needs and Gaps

The needs and gaps identified in the three workshops varied extensively. Below is summary of some of the commonly identified needs and gaps broken into categories. A complete list of all of the SOP related needs and gaps are located in Appendix II.

One overall recommendation was that SOP direction and guidance should come from the highest levels of government to mandate the need to disseminate, consult, and collaborate at all levels of government and mandate participation. One item to mandate is the testing for coastal hazards like tsunami and storm surge.

a.   SOPs for Specific Areas Needs
- Each agency SOPs for the implementation of their roles and responsibilities defined in EWS national policies and orders for disasters
- SOPs for both technical and non-technical activities
- Hydro-meteorological service SOPs on all aspects of forecast and warning process to provide timely, accurate information to meet users' requirements

- Hydro-meteorological SOP for development, use, and dissemination of storm surge information
- Hydro-meteorological SOP to cover back-up plans for catastrophic events such as power failure, fire, facility damaged, etc.
- Hydro-meteorological SOP for cyclone forecasting and warning process in consultation with all stakeholders
- Hydro-meteorological service SOP concerning preparing after action reports for warning situations which can be released to media and public
- National DRR/management operations center SOP on response procedures during a disaster
- DRR/management agencies below national level of government SOPs on heavy rain situations
- Local government SOPs on evacuation, sheltering, and resettlement

b. Integrated, cross-cutting SOPs Needs
- SOP standards to enable better sharing of procedures, especially for local governments to use higher level government SOPs for guidance
- SOP on entire spectrum of disaster management
- Multiagency, detailed SOP on dissemination/communication process of alerts and warnings, including backup systems to meet the requirements of the users
- Multiagency SOP on the process and mechanism for sharing data and data analysis
- Local communities SOPs for EWS related activities to prevent conflicting activities and to ensure rapid dissemination/communication of information
- Provision of SOPs to other agencies and consultations from the national down to local officials
- Coordination procedures on dissemination of warnings and information by national, district and local governmental agencies to the media to prevent issuance of conflicting information
- Coordinated procedures on release of warning/alert information and DRR information
- Coordinated procedures on the process of implementation of new or updated SOPs involving all relevant agencies
- Coordinated process and procedures with all agencies involved for simplification of alert and warning information to include in SOPs, including use of technical terms, number of warning levels, emphasis on hazards not technical terms, specific non-generic warnings, simplified warnings and bulletins that media can "rip and read", and consideration of color coded warnings associated with certain actions (i.e., prepare, most vulnerable evacuation, general evacuation).
- Involvement of non-government private, professional, civil society, community organizations and families in the development of SOPs
- Guide book or reference manual for media to understand and communicate warning information

c. Testing and maintaining needs
- Annual or scheduled reviews of all SOPs
- Updated DRR/management offices SOPs based on past experience
- Conduct post disaster assessment between DRR/management and media
- Review of SOPs after changes in equipment, procedures, etc.
- Prioritized review and updating of SOPs after new National Disaster Management Plan
- Validate SOPs in all coastal areas

d. Awareness of SOPs Needs
- Government and public awareness of the importance of SOPs

e. MOU related needs

- National plan or MOU clearly defining all roles and responsibilities in EWS
- MOU between DRR/management and media to define methods of communicating
- MOU between hydro-meteorological service and media on methods and procedures of dissemination of data (e.g., timing of updates, content, source, press conferences, etc.)
- MOU between hydro-meteorological service and DRR/management agency
- MOU for agreement on the single, official source of information for government
- MOU on data formats, warnings, and monitoring systems which would include a standardized color alerting code and format
- MOU on coordination process, both top-down and bottom-up, for implementation of SOPs

6.3   Recommendations for the SSOP Manual/Handbook.

General

Three major themes were emphasized:

➢ There is a wide variety of cultures, governments, past experiences, relationships, risks, and people among countries and even within many countries. Therefore, the SSOPs must be flexible best practices, operational guidelines and recommendations that can be applied in a variety of situations.

➢ For SOPs to be useful and effective, direction and guidance should come from the highest levels of government to mandate the need to disseminate, consult, and collaborate at all levels of government and mandate participation. In addition, a national or regional coordinated policy document is needed to define roles and responsibilities

➢ Although the process and project is focused on the National Meteorological and Hydrological Services, the National Disaster Management Offices, and the National Tsunami Warning Centers, other relevant government, business, and community agencies must be involved in detailed, integrated ways to make the end to end, cross-cutting early warning system work.

Specifics

Suggested considerations when developing SOPs:

a. The requirement for government coordination and cooperation within and among national, regional, and local levels.
b. Technical and financial assistance may be required to prepare these SOPs efficiently and funds should be identified/requested.
c. Different countries have different disasters levels owing to the fault lines, weather patterns and other factors that need to be considered;

Manual/Handbook should contain:

a. Minimum baseline standard requirements
b. Ideas/guidelines on format and content
c. Ideas and checklist for SOPs for different types of events and different levels of threat
d. Ideas and guidelines for multi-hazards SOPs with different parts for different hazards i.e., tropical cyclone, tsunami, storm surge, earthquake, land slide, etc.
e. Need for regular updating as and when required and after a disaster;
f. Need to test and conduct regular exercises/drills to validate SOPs
g. Protocols to use with different levels of government
h. Examples from other countries of SOPs and other related actions and procedures
i. List of relevant available websites, case studies, documents, and videos for reference information

j. Ideas and examples of usage of social media and its application for information dissemination and 24/7/365 weather, hazard, and early warning updates;

k. The need to incorporate designation of spokesperson for event

l. Usefulness of an electronic database on different types of disasters categorized by meteorological, hydrological, tsunami, etc. in EWS

m. Ideas on advance communication techniques (net radio, cell phone applications) for first responders

Section on education and awareness

a. Ideas and guidelines on education/public awareness programs including video on disaster preparedness, prevention, mitigation, response in national as well as in local languages (material about disaster management for school, college curriculum, refresher courses, brief script and color coding);

b. Concept that seminars/workshops can be provided for the media to provide basic orientation, training, and story ideas and request each media outlet to place high priority on attending these seminars/workshops. Some type of government seal of approval or certificate could be given to those who attend regularly and updated yearly.

c. Conduct awareness campaigns for politicians, policy makers, communities, and the people at large about the possible threats posed to communities by the natural hazards.

Include suggestion on process for national development and coordination:

a. Need for regulatory framework, by-laws, guidelines, etc.;

b. Clearly defined roles and responsibilities of various concerned organizations for different hazard type;

c. Guide-line to prepare SOP should be provided from National level

d. Responsible ministry or department should request SOPs from all agencies which must comply with national policy or orders and describe specific actions to meet their assigned roles and responsibilities

e. After development of the draft SOPs from different agencies, the responsible ministry or department should have all relevant agencies meet, discuss, identify short comings, and make recommendations/suggestions to ensure effective coordination and actions.

f. When finalized, all SOPs should be available to all concerned agencies, possibly through an electronic data base, so that everybody understands what each other are doing and also so the SOPs can be updated as required.

g. Regular exercise among stakeholders based on the handbook guidelines.

7.   Conclusions

The purposes of the workshop was to review existing coastal multi-hazards EWS SOPs of hydro-meteorological service, disaster management, media, elected official, and others from national to local levels; to identified best practices, gaps and needs, and recommendations for internal and cross-cutting SOPs; and to develop action plan to highlight best practices, fill gaps and needs, and review capacity. The first two purposes have been met and were described above.

The action plan based upon the project proposal is now to take the information from these three pilot workshops and other sources of relevant, available information and to develop a Manual/Handbook of Synergized Standard Operating Procedures for Coastal Multi-hazards Early Warning Systems focusing on the hydro-meteorological aspects to meet the needs of diverse users. This development will be done in collaboration and coordination with the three pilot countries, the other 10 beneficiary countries, and the 7

partner organizations listed in Section 2 above. This Manual/Handbook will then form the foundation for the training and working meeting scheduled under Activity 2 of the project.

8.   Appendixes

Appendixes I, II, III, IV, and V were compiled for discussion and reference purposes for the Pilot Workshops by Jim Weyman, Project Manager/Technical Advisor, Project on Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System. These are included as Appendixes to demonstrate some of the information available and necessary for the Manual/Handbook required for developing and reviewing SOPs.   These were compiled based extensively upon the information and wording in the following documents:

For Appendixes I and II:

1. Developing Effective Standard Operating Procedures, David Grusenmeyer, Sr. Extension Associate, PRO-DAIRY, Cornell University.
2. Guide to Writing Standard Operating Procedures (SOPs), Department of Environment and Conservation, Government of Australia, 10 December 2009.
3. Guide to Writing Standard Operating Procedures, Office of Engineering Safety, Texas A&M University
4. Guidance for Preparing Standard Operating Procedures, (SOPs), United States Environmental Protection Agency, Office of Environmental Information, Washington, DC, EPA QA/G-6, April 2007
5. Guidance for Preparing a Standard Operating Procedure, Montana Department of Environmental Quality,
6. Water Quality Planning Bureau, WQPBDMS-001, March 22, 2004.
7. Guidance for the Preparation of Standard Operating Procedures For Quality-Related Document, Illinois Environmental Protection Agency, Bureau of Water, Document Control No. 065, September 2008
8. Guidelines for Creating a Memorandum of Understanding and a Standard Operating Procedure between a National Meteorological or Hydro-meteorological Service and a Partner Agency WMO-No. 1099 PWS-26
9. Report of Multi-Hazard Early Warning and Decision Support Systems Workshop, Shanghai Meteorological Service, Shanghai, China, March 21 -23, 2012
10. Standard Operating Procedures (SOPs) – A Quick Guide, Kelly Gleason, Research, Clinfield Limited, Cambridge, Great Britain, March 10, 2013.
11. Standard Operating Procedures: A Writing Guide,Richard Stup, senior extension associate, Human Resources, Penn State Dairy Alliance, Penn State College of Agricultural Research and Cooperative Extension

For Appendixes III, IV and V:

1. Asian Disaster Preparedness Center (ADPC): Two types of Checklists and Questionnaires developed for the Early Warning Gaps Assessment (National and Community) and Household Survey (household level for Pilot Sites) under the UNESCAP project. A document prepared under the project name: Technical assistance for *Enhancing the Capacity of End-to-end Multi-hazard Early Warning Systems (EWS)* for Coastal hazards in Myanmar, Sri Lanka & Philippines.
2. Global Facility for Disaster Reduction and recovery (GFDRR), 2011: Implementing Hazard Early Warning Systems, David Rogers and Vladimir Tsirkunov.
3. International Federation of Red Cross and Red Crescent Societies (IFRC), 2012: Community Early

    Warning Systems: Guiding Principles

4. International Strategy for Disaster Reduction, 2006: Developing Early Warning Systems: A Check-List. The Third International Conference on Early Warning (EWC-III) from Concept to Action, 27-29 March 2006, Bonn, Germany, ISDR, 13pp.

5. World Meteorological Organization (WMO), 2010: Guidelines on Early Warning Systems and Application of Nowcasting and Warning Operations, Lead Authors: Elliot Jacks, Jim Davidson, H.G. Wai with Contributions by: Charles Dupuy, Vlasta Tutis and Kevin Scharfenberg.

6. World Meteorological Organization. Disaster Risk Reduction Programme, Multi-Hazard Early Warning Systems, www.wmo.int/pages/prog/drr/projects/Thematic/MHEWS/MHEWS_en.html

Appendix I – Compilation – A Guide to Writing Effective SOPs for EWS
(See Note above in Section 8)

Guide to Writing Effective Standard Operating Procedures for Early Warning System

Why Write Standard Operating Procedures

Most people naturally want to do a good job. Well-written standard operating procedures (SOPs) provide direction, improve communication, reduce training time, and improve work consistency. The SOP development process is an excellent way for managers, workers, and technical advisers to cooperate for everyone's benefit. A very positive sense of teamwork arises when these parties work together toward common goals. Standard operating procedures used in combination with planned training and regular performance feedback lead to an effective and motivated workforce.

An SOP is a prescribed set of steps to be followed when certain defined conditions arise, such as severe weather. It contains written procedures of individual, often sequential, tasks that need to be completed. This helps to ensure the procedure is completed in the same way and to the same standard each time. SOPs are important because they are developed before an emergency, indicate the most efficient and effective ways to perform an operation, and help produce predictable, reproducible results while maintaining the quality and consistency of its service. NMHS can use SOPs to ensure consistent delivery of services and products to partner agencies and to the public.

Overview

- What ways do you intend to use the SOP after it is developed: employee orientation and training, refresher training, advanced training, work site reminders, cross training, performance appraisal, employee safety and accident prevention, process improvement, quality control, or job description development?
- Who will be using the SOP?
- What ways will the SOP be used?
- Who should be involved in its development?
- How can you best accomplish the development?

Developing useful and effective SOPs requires time and commitment from all management and employee levels. Once the development task is complete three important steps still remain.
- Educate employees about the new SOP.
- Control "procedural drift" by ensuring that the SOP is followed consistently over time.
- Establish an evaluation and review system to be certain that over time all the steps of an SOP are still correct and appropriate for the production system.

Reasons for writing SOPs:

1. To protect the health and safety of employees.
2. To ensure that operations are done consistently to maintain quality control of processes and products.

3. To provide personnel with numbered step by step instructions on a specific procedure with minimum variability to increase efficiency

4. To ensure that all operations continue and are completed on a prescribed schedule with minimal impact.

5. To provide people consistency to achieve top performance and improves productivity.

6. To ensure that approved procedures are followed in compliance with company and government regulations.

7. To serve as a training document to facilitate training in procedures, for both new personnel, those that need re-training (i.e., after extended absence from a position), or for cross training through step by step instructions to ensure that nothing is missed.

8. To serve as an historical record of the how, why and when of steps in a process for use when modifications are made to that process and when a SOP must be revised.

9. To encourage improvements and work evaluation by ensuring that the procedures are completed, and can be used in incident investigations to improve operations and safety practices.

10. To promote quality though consistent collection of the data, even if there are changes in the people, or unfamiliar people are required to do task.

11. To assist in conducting performance evaluations. They provide a common understanding for what needs to be done and shared expectations for how tasks are completed.

12. To enable employees to coach and support each other if there is documentation available on exactly how various tasks must be done and everyone knows what their co-workers are supposed to be doing. This can also help generate a more cooperative team approach to getting all the daily tasks done correctly every day.

13. To encourage regular evaluation of work activity and continuous improvement in how things are done.

When should you write an SOP?

Write SOPs when new equipment or processes create new work situations. Write or rewrite SOPs when new information suggests benefits from modifying work behaviors to improve performance. For new or revised SOPs, identify all the processes, functions or operations that occur within each of the areas and then group, combine or subdivide those which require it. Write SOPs for all jobs before a job is begun and test them before putting them into final application.

Systematically update all SOPs by asking workers to evaluate existing SOPs, work practice guidelines, and other documents. Procedures could be revised, perhaps by the group(s) who prepared them and reviewed.

For whom should you write an SOP?

Write the SOP for the person or persons who will perform a particular job. Consider such factors as the age, education, knowledge, skills, experience and training of the person(s), and the "social culture" or work history within which the individuals work. SOPs are needed at different levels. These would include high level SOPs agreed to by different agencies, and then individual SOPs for each agency to complete the task defined in the high level SOP.

Who should write SOPs?

Get everyone on board. Successful SOP development and implementation typically requires that all people who are affected by a SOP be involved in a team-based SOP development and problem solving process. Identify the best individual to lead the development effort for each SOP and assign a development team of experienced employees, managers, representatives, consultants and anyone else who

can bring relevant expertise to the effort. Where possible, SOPs should be developed and reviewed by several people qualified to determine its completeness and clarity of safety, environmental and operational components. Ideally, teams may include some or all of the following should write SOPs: 1) people who will perform the job; 2) people who will perform maintenance on equipment involved in an SOP; 3) engineers or others who design equipment and processes; 4) technical writers; 5) safety personnel; 6) environmental personnel; and others as required.

Team SOP writing: 1) Ensures that comprehensive knowledge acquired from different perspectives is applied; 2) Creates "buy-in," which increases the likelihood that the SOPs will be implemented; 3) Trains people who can train others, because writers know it intimately and are more likely to be effective trainers (coaches); 4) Involves people from diverse parts of the operations, which helps when new and modified processes are implemented and SOPs must be updated; and 5) Encourages employees to follow the SOP and listen to supervisors because they know writers invested time and effort on behalf of employees.

Tips to Keep in Mind When Writing Standard Operating Procedures
1. Incorporate safety, health and environment into the traditional how-to-operate or how-to-do steps. How much someone knows about an entire process or job affects the way he or she does that job. This teaches the person comprehensively so he or she has a complete picture of the responsibilities for doing a job properly. This simplifies follow-up training.
2. Write an SOP as long as necessary for a specific job or a specific use. A good SOP isn't difficult to read and it allows anyone to get on with the task at hand with confidence. Highly detailed procedures cannot take the place of training. Recognizing this, procedure writers should not attempt to answer all possible questions that a worker might have. SOPs should complement and serve as a basis for introductory training. For long or complex tasks or for jobs performed infrequently, it is beneficial to have longer SOPs. If employees are familiar with a process or it is a simpler process, then a shorter SOP is appropriate. Keep in mind that the average person is uncomfortable following a long list of steps because they: 1) look formidable, which makes the task daunting and tedious; 2) are difficult for your eyes to follow and you may forget where you are which can lead to mistakes; 3) may cause people to become nervous and anxious to "get it over with; 4) hide important steps that should be performed with caution; and 5) are difficult for writers to write while ensuring that the sequence is clear. The solution to SOPs that involve a long list of steps is to break up the steps into logical sections of about 10 steps per section, such as "Getting ready for the process," "Initial steps," "Final steps."
3. Standard Operating Procedures should be understandable to everyone who uses them. Writers should always try to write procedures as simply as possible while communicating well. SOPs are most effective when they are written in short and imperative sentences (usually begin with an action verb in the form of a command); are not too wordy or vague (vagueness often increases the likelihood of errors or inconsistency); and use acronyms and abbreviations sparingly.   A good SOP is clear and brief, making it easy to follow. It emphasizes the critical steps and warns about safety issues.
4. Write SOPs for people who perform under different work and interpersonal circumstances.
   Write SOPs for: people who work alone; two or more people who will work together as a team; people who will supervise other people doing a job.
   On occasion, two or more people must use a single SOP at the same time. This kind of SOP must explain the conditions or timing under which each person is to perform a specific step. This allows each participant to understand the sequence of steps that everyone is participating in and to know when it is his or her turn to perform a step.

5. Consider the work culture within which people work. If you write for people in a culture in which shortcuts are accepted practice, explain the reasons behind certain steps so that SOP users will understand the importance of following all the steps in the proper order.

6. Consider the age, education, knowledge, skill, experience and training, and work culture of the individuals who will be performing the SOP steps.

7. Consider how people learn and accomplish tasks. For visual learners, a series of pictures or a flow chart will work best. For auditory learners, recorded instructions may be more useful. Physical limitations, such as poor eyesight, may necessitate large clear print or big bright pictures and plenty of light. If an employee's hearing is poor, the person may not be able to hear instructions, especially if there is competing background noise. Does an employee have a learning disability that interferes with his or her ability to comprehend and process information and instructions? Does the person have difficulty remembering instructions or details from one time to the next? Converting SOPs to brief reminder cards or pictures may be helpful. What are employee levels of language proficiency? Can they read and understand it? Can they read and understand another language?

8. Many people do not read all the steps before starting on step one. Many people read a step, perform it, read the next step, perform it, and so on. To solve this, forecast future effects and steps at certain points in the SOP to tell reader things they should know in advance, such as upcoming steps that require caution, precision, timing, assistance, and personal protective equipment.

9. Once you have completed writing an SOP, have several trained workers test it against actual practices and give you feedback and have it evaluated for safety, health and environmental aspects.

10. Inform every one of the completed written SOP. Train them on the SOPs' contents and tell them where they can find it for future reference. Talk with all employees to gain agreement that procedures and expectations are appropriate and achievable.

11. Review the effectiveness of SOPs after a few weeks and make necessary changes if in-the-field practice suggests that descriptions should be improved. Review SOPs when processes and equipment are changed.

12. Keep a computer accessible file and at least one notebook as backup of all approved SOPs

Different Styles of SOPs
1. **Simple steps or a checklist.** These are easy to write and follow and work well for short, simple, straightforward tasks.

2. **Hierarchical steps.** An extension of the simple steps format, this format works better for tasks that require additional detail or sub-steps within each primary step.

3. **Linear Graphic flow chart.** Think of this as a graphic version of the two previous formats. It works well for tasks where activities must be done in a specific order and where an easy-to-follow reminder at the job site is useful.

4. **Annotated Pictures.** This format works well for people who cannot read or where a language barrier exists. Since pictures can dramatically reduce the need for written explanations, this format helps to shorten complex and detailed SOPs. For some employees, SOP pictures can make excellent work site reminders. For example a photo illustrating how a work site should be set up or arranged, or the proper locations of shields, levers, switches and handles on a piece of equipment.

5. **Branching flowchart.** This format makes complex SOPs, especially those with a number of decisions that affect subsequent steps, easier to follow. Boxes within the flow chart can also be expanded to include checklists or sub steps.

General SOP Format and Development of SOP

A SOP for the same task will differ from area to area and SOPs will differ for different task. An SOP should be organized and follow a general format to ensure ease and efficiency in use. The following is a general format and the steps needed to develop the SOPs.

Title Page

The first page of each SOP should be a title page having the following information:

1. A title that clearly identifies the activity or procedure and uses descriptive action words and
2. A SOP identification number, date of issue and/or revision, the name of the applicable agency, division, and/or bureau to which the SOP applies. If you are developing SOPs for several different areas of your operation, give each area an identifying code then number the SOPs within it, for example, for tropical cyclones, SOPs TC-1, TC-2, TC-3 and for marine area M-1, M-2, M-3. This will make it easier to file the SOPs, refer to them in related SOPs, and for an employee to find a specific SOP for reference later. It may be very helpful for each page of the SOP to have a "header" in document control format. A short title can identify the activity covered by the SOP and serve as a reference designation. The revision number and date are useful in identifying the SOP in use when reviewing historical data. The user can also quickly check if the SOP is complete when the number of pages is indicated.

Approval/Revision Page

1. Name of Organization or project for which the SOP was prepared
2. Names of people who prepared the SOP
3. Signatures and dates of the individuals who approved the SOP.
4. Implementation Date
5. Acknowledgements
6. Revision history log

Table of Contents

A Table of Contents is needed for quick reference for locating, and to denote, changes or revisions made only to certain sections of an SOP.

Procedural Text

The text of an SOP should be clearly worded so as to be readily understandable by a person knowledgeable with the general concept of the procedure. Procedural items to consider and include:

1. Purpose, Scope and Applicability. Describe the purpose and any regulatory requirements. The scope should answer the following questions: Which specific operations or tasks within an operation will be covered? Which are not covered? Who is the SOP written for?
2. Task. Develop an overall task description. Include the number of people required for the task, their skill levels, the equipment and supplies required, any personal protective or safety equipment required, and a description of how the finished product or result should look.
3. Summary of Method. Briefly summarize the procedure.
4. Definitions. Identify any acronyms, abbreviations or specialized terms used.
5. Health and Safety Warnings. Indicate operations that could be dangerous or risk injury.
6. Cautions. Activities that could result in equipment damage, possible invalidation of results, etc. are listed here and also at critical steps in the procedure.
7. Interferences. Describe any component of the process that may interfere with the final results.
8. If applicable, personnel qualifications (the minimal experience that the SOP follower should have to complete the task satisfactorily and citing any applicable requirements, like certification or training)

9. Equipment and Supplies. A listing and specifying, where necessary, equipment and materials.
10. Procedures.
    a. Identifying all pertinent steps, specific order, timing sequence and times allowed, and materials needed to accomplish the procedure and how they are to be used if appropriate. The procedures should be written in a step-by-step (cookbook) format that clearly describes the steps in chronological order. Use the active voice and present verb tense. The term "you" should not be used, but implied. Describe each task in detail.
    b. An SOP may reference other SOPs. In such a case, cite the other SOP or attach a copy.
    c. Define terms and concepts when needed.
    d. Place health and safety warnings prominently in the SOP.
    e. As mentioned before people can't remember more than 10 or 12 steps, so they tend to have difficulty with long SOPs. If your SOP goes beyond 10 steps, break it into logical sub-task SOPs.
    f. Checklists/Forms. Many activities use checklists or forms to ensure that steps are followed in order. Checklists also document completed actions. Any checklists or forms that are included as part of an activity should be referenced at the points in the procedure where they are used; blank and completed copies of the checklists should be attached to the SOP. In some cases, detailed checklists are prepared specifically for a given activity, as for an inspection. In those cases, the SOP should describe, at least generally, how the checklist is to be prepared, or on what it is to be based. Copies of specific checklists are then maintained in the file with the activity results and/or with the SOP. Remember that the checklist is not an SOP, but a part of one.

Quality Control and Quality Assurance Section
QC activities are designed to allow self-verification of the quality and consistency of the work. Describe the preparation of appropriate QC procedures and QC material that are required to successfully demonstrate performance of the method. Specific criteria for each should be included. Describe the frequency of required calibration and QC checks and discuss the rationale for decisions. Specify who or what organization is responsible for each QA activity, where or how QA materials are to be procured and/or verified. Assign responsibility for taking corrective   action, based on the results of the QA activities.

Reference Section
Documents or procedures that interface with the SOP should be fully referenced (including version), such as related SOPs and published literature or methods manuals. Citations cannot substitute for the description of the method being followed in the organization. Fully cite all references noted in the body of the SOP and attach any that are not readily available.

Appendix II – Compilation – Checklist for Effective SOPs for EWS (See Note above in Section 8)

Checklist for Effective SOPs for EWS

SOP Development

- ☐ Are new SOPs written when new equipment or processes create new work situations?
- ☐ Are such factors as the age, education, knowledge, skills, experience and training of the person(s), and the "social culture" or work history within which the individuals work considered in the SOPs?
- ☐ Did the development process consider how people learn and accomplish tasks (visual, hearing, physical limitations, memory problems, language proficiency)?
- ☐ Were new SOPs reviewed and tested before implementation?
- ☐ Were appropriate different styles of SOPs (simple step, hierarchical step, linear graphic flow chart, annotated pictures, and/or branching flowchart) used?
- ☐ Were appropriate QC procedures and QC material prepared to successfully demonstrate performance of the method?

SOP Content and Use

- ☐ Are SOPs in compliance with agency and government regulations?
- ☐ Are safety, health and environment concerns incorporated into the traditional how-to-operate or how-to-do steps?
- ☐ Are there SOPs for different levels of activities?
- ☐ Are SOPs that involve a long list of steps broken into separate logical sections of about 10 steps per section?
- ☐ Are SOPs written in short and imperative sentences (usually begin with an action verb in the form of a command); are not too wordy or vague (vagueness often increases the likelihood of errors or inconsistency); and use acronyms and abbreviations sparingly?
- ☐ Are SOPs clear and brief and emphasize critical steps and warns about safety issues.
- ☐ Are all personnel knowledgeable on SOPs for their area of work?
- ☐ Do the SOPs include in advance things to know about upcoming steps that require caution, precision, timing, assistance, and personal protective equipment?
- ☐ Does each SOP have:
  - A title that clearly identifies the activity or procedure and uses descriptive action words
  - A SOP identification number, date of issue and/or revision, the name of the applicable agency, division, and/or bureau to which the SOP applies.
  - Name of Organization or project for which the SOP was prepared
  - Names of people who prepared the SOP
  - Signatures and dates of the individuals who approved the SOP.
  - Implementation Date
  - Acknowledgements
  - Revision history log
- ☐ Is the SOP Table of Contents a quick reference guide?

- ☐ Is the Purpose, Scope and Applicability identified?
- ☐ Is an overall task described which includes the number of people required for the task, their skill levels, the equipment and supplies required, any personal protective or safety equipment required, and a description of how the finished product or result should look?
- ☐ Are there:
  - A Summary of Method?
  - A summary of the procedure?
  - Acronyms, abbreviations and specialized terms defined?
  - Health and Safety Warnings included?
- ☐ Cautions listed for possible equipment damage, possible invalidation of results, etc. in beginning and at critical steps in the procedure.
- ☐ Interferences listed which may interfere with the final results.
- ☐ Personnel qualifications, if applicable, (the minimal experience that the SOP follower should have to complete the task satisfactorily and citing any applicable requirements, like certification or training) provided?
- ☐ A list Equipment and Supplies included?

- ☐ For the Procedures:
  - Are all pertinent steps identified in sufficient detail?
  - Is the specific order, timing sequence and times allowed, and materials needed to accomplish the procedure and how they are to be used if appropriate included?
  - Is active voice and present verb tense used?
  - Is the "you" avoided?
  - If another SOP is referenced, is it identified and where it can be found?
  - Are terms and concepts defined when needed?
  - Place health and safety warnings prominently in the SOP.
  - Are procedures with more than 10 steps broken into logical sub-tasks?
  - Are checklists used? Are they appropriately referenced and/or attached?
- ☐ Are QC activities designed to allow self-verification of the quality and consistency of the work?
- ☐ Are documents or procedures that interface with the SOP fully referenced (including version), such as related SOPs and published literature or methods manuals?

SOP Documentation

- ☐ Is an historical record kept of all SOPs when modifications are made to that process and when a SOP must be revised?
- ☐ Are computer accessible files and at least one notebook as backup of all approved SOPs available?

SOP Monitoring, Review and Training

- ☐ Are employees trained on new SOPs?
- ☐ Are SOPs used to facilitate training in procedures, for both new personnel, those that need re-training (i.e., after extended absence from a position), or for cross training through step by step instructions to ensure that nothing is missed?

☐   Is an annual evaluation and review system established to be certain that over time all the steps of SOP are still correct and appropriate for the production system?

☐   Do workers routinely evaluate existing SOPs, work practice guidelines, and other documents for possible revisions to SOPs?

☐   Are procedures in place to ensure that SOPs are followed consistently over time?

☐   Are references to performing SOP tasks included in conducting performance evaluations?

☐   Are SOPs use to regularly evaluate work activity and possible improvements?

Appendix III – Compilation – Information on Early Warning System Overview
(See Note above in Section 8)

Information on Early Warning System Overview

Elements of a people centered early warning system based upon the International Strategy for Disaster Reduction Third International Conference on Early Warning (EWC-III) from Concept to Action, 27-29 March 2006, Bonn, Germany are:

1. Analyses of risks/risk knowledge
2. Detection, monitoring, and forecasting/warning services;
3. Dissemination and communication; and
4. Prepare/response capacity.

These four components need to be coordinated across many agencies at national to local levels for the system to work.   The roles and responsibilities of various public and private sector stakeholders for implementation of EWS should be clarified and reflected in the national to local regulatory frameworks, planning, budgetary, coordination, and operational mechanisms.

Cross-cutting Issues. There are a range of overarching issues that should be taken into account when designing and maintaining effective early warning systems.

1.   Effective Governance and Institutional Arrangements.   Well-developed governance and institutional arrangements support the successful development and sustainability of sound early warning systems. *Vertical and horizontal communication and coordination between early warning stakeholders should also be established.*

2. A Multi-Hazard Approach
Where possible, early warning systems should link all hazard-based systems. Economies of scale, sustainability and efficiency can be enhanced if systems and operational activities are established and maintained within a multipurpose framework that considers all hazards and end user needs. Multi-hazard early warning systems will also be activated more often than a single-hazard warning system, and therefore should provide better functionality and reliability for dangerous high intensity events, such as tsunamis, that occur infrequently. Multi-hazard systems also help the public better understand the range of risks they face and reinforce desired preparedness actions and warning response behaviors.

3. Involvement of Local Communities
People-centered early warning systems rely on the direct participation of those most likely to be exposed to hazards. Without the involvement of local authorities and communities at risk, government and institutional interventions and responses to hazard events are likely to be inadequate. A local, 'bottom-up' approach to early warning, with the active participation of local communities, civic groups and traditional structures can contribute to the reduction of vulnerability and to the strengthening of local capacities.

4. Consideration of Gender Perspectives and Cultural Diversity

It inessential to recognize that different groups have different vulnerabilities according to culture, gender, disabilities, age, or other characteristics that influence their capacity to effectively prepare for, prevent and respond to disasters. Women and men often play different roles in society and have different access to information in disaster situations. The elderly, disabled and socio-economically disadvantaged are often more vulnerable.

Information, institutional arrangements and warning communication systems should be tailored to meet the needs of every group in every vulnerable community.

Although often referred to as the "last mile" in an end-to-end EWS, the community is better imagined as the "first mile," where warning information must reach and be acted upon. Well-informed communities are familiar with priority risks. Communities are the first responders in protecting their households and disadvantaged individuals. Many communities are motivated and able independently to drive EWS from the local level without waiting for information or warning from the outside. Other communities are prepared to receive monitoring or warning information and subsequently organize and implement a set of appropriate responses.

5. End-to-end Roles for EWS Participants

Local Community Level
• Strengthen capacity of at-risk communities and volunteers to receive, analyze and act on warnings.
• Reinforce the capacity of local authorities to protect communities (auxiliary role of national societies).
• Guide communities to develop and drive EWS, providing local monitoring of conditions and messages originating at the 'first mile.'
• Link communities to 'external' early warning knowledge.
• Provide a reality-check for global, regional and national EWS efforts

National Level
• Integrate early warning into ongoing strategic and operational DRR programs.
• Support national governments to develop people centered EWS, tailored and closely linked to at-risk communities.
• Advocate for partnerships with other EWS, including regional and global actors that provide technical assistance and useful monitoring and warning products.
• Serve as a link between technical information/monitoring and national decision-makers.

Regional and Global level
• Bridge gap as liaison between knowledge centers or regional for a and national and local early warning efforts.
• Advocate for the provision of user-friendly, top-down, early warning messages across multiple time scales.
• Require and support routine reality-checks from the field and feedback on EWS products and messages.
• Organize exchanges between agencies to share good practice and lessons learned in EWS.

Guiding principle 1: Integrate within DRR—EWS is not a stand-alone

Setting up a EWS at any level without clear links to other disaster risk reduction/management efforts and entities will inevitably result in inefficient or unsustainable products and less effective impact(loss of life and livelihoods).The goal, then, is to create a DRR package that responds to needs identified by governments and/or communities that can be sustained by engaging relevant actors throughout a nationwide system.

Guiding principle 2: Aim for synergy across levels: community, national and regional/global

Just as EWS should not be extracted and isolated from a more integrated DRR program, EWS at any level will thrive when other levels are also active and functioning. It is the synergy between these levels that will provide the greatest protection for lives and livelihoods.

Guiding principle 3: Insist on multi-hazard EWS

Multi-hazard EWSs:

1. Are developed on the basis of a systematic analysis and prioritization of a set of threats and hazards to which a country or community is exposed. This means time has been taken to systematically consider many and identify those that are most damaging and most manageable by a EWS effort. This integrated and holistic analysis puts the EWS on a more sturdy foundation.

2. Produce more stable levels of EWS activity throughout the year. During the off-season when one hazard is dormant another hazard may require monitoring. When two hazards are off-season (e.g., flood in the dry season), vulnerability (or resilience) may still be monitored.

3. Result in greater efficiency of limited human and financial resources. Centralizing EWS at any level minimizes system maintenance and number of required staff/volunteers.

4. Increase clarity. A one-stop-shop that has been given authority will result in less confusion for users on where to seek early warning information.

5. Emphasize similarities. Hazards behave differently and may affect very different time scales and geographical areas, but other elements of most EWS are, in fact, very similar: need for and process (not instruments) of monitoring, need for staged warning (e.g., green, yellow, red levels) and process of warnings.

Guiding principle 4: Systematically include vulnerability

Risk is a function of two elements: hazards and vulnerability. If the aim is to reduce risk, preparation of EWS for hazards can't be done in isolation of EWS for vulnerability. Both hazards and vulnerability must be given importance in EWS. Hazards and vulnerability should be assessed together to track risk.

Guiding principle 5: Design EWS components with multiple functions

EWS sustainability depends on proposing system components that serve multiple purposes within a community. Disaster risk reduction/management agents are often surprised with the priorities highlighted by the at-risk communities they support. Rather than a recent deadly tsunami or periodical floods that take five or so lives each year, poor communities in developing countries give greater importance to daily survival, food security and meeting primary and socio-cultural needs (such as school costs, medical costs, water, baptisms or funerals) each month. It is therefore important for EWS efforts to understand and address local communities' priorities and needs. There are two main techniques that can be used to address EWS concerns and daily needs simultaneously: income generating activities and multipurpose equipment;

Guiding principle 6: Accommodate multiple timescales
In order to take advantage of longer-lead times to prepare and to manage changing risks, it can be useful to incorporate multiple-timescales of early warning information into EWS. To be relevant, when using multiple timescales of forecast information, it is important to understand that the set of actions that make sense locally hours before an extreme event begins may be very different from the set of actions that make sense long before when a seasonal forecast indicates enhanced flood risk for a coming rainy season. The further in advance a forecast is made, the less certainty and detail it provides. Therefore, different types of actions will be appropriate for different timescales of forecast information.

Guiding principle 7: Embrace multiple knowledge systems
Generally speaking, there are three knowledge systems: transmitted, experiential and empirical. While individuals, households and communities 'own' the first two (often called indigenous, local, or folk knowledge), empirical knowledge is generally reserved for the institution of science.

Guiding principle 8: Account for evolving risk and rising uncertainty
All types of knowledge previously discussed have started to fail under multiple global pressures. First of all, globalization and modern development have resulted in changed livelihoods and less communication between and across generations. Messages/information from the past are no longer considered relevant or a priority. Technology and telecommunications with endless information sources may accentuate the rift and push knowledge of the past further out of sight. The interplay of many different processes (i.e., population growth, unsustainable development, rapid unplanned urbanization, climate change, upstream environmental degradation, local changes in markets and governance, etc.)Contribute considerably to increase people's vulnerability and to reduce their capacity to cope or recover from hazards and threats. Hand-in-hand with evolving risk patterns comes heightened uncertainty.

Guiding principle 9: EWS without borders: target the full vulnerability and hazard landscape
Hazards know no borders. They do not respect administrative, cultural or linguistic boundaries nor distinguish between a rebel zone and an IDP camp. In disaster risk reduction/management activities, one must think like a hazard, and target the full hazard landscape, regardless of pre-conceived and socially constructed boundaries. It can be useful to explore cross-border and cross-regional EWS through bilateral and regional agreements between states, including coordination mechanisms for cross-border hazards. These and other mechanisms can also include information exchange and capacity building.

Guiding principle 10: Demand appropriate technology
There is a place for high technology in EWS; however it must be harnessed effectively. A sophisticated warning remains useless if not linked to effective action. Many times EWS originates from the heavy investment in global and regional monitoring of hazards and telecommunications and the internet to communicate. However all technology requires training for technical knowledge/skills, installation and maintenance costs, and human resources for system sustainability and proper use. The more sophisticated the technology, the greater the cost for each of these elements. An effective EWS incorporates technology that is appropriate (high cost-efficiency, robust, resilient, easily used, easily replaced parts and maintenance, etc.) at every level. All new technology, appropriate or otherwise, needs to be introduced with a strong layer of awareness raising and community sensitization.

Guiding principle 11: Require redundancy in indicators and communication channels
Redundancy is an important concept for disaster risk reduction/management and for an effective EWS. Redundancy is the provision of additional or duplicate systems or equipment that function in case an

operating component or a full system fails. In general, redundancy is about being thorough and careful and recognizing that systems can and will fail at many points for many different reasons. Research shows that belief increases only after the same warning has been heard multiple times which redundancy can help. At least two elements need to have redundancy: indicators that are monitored and communication channels used to send warning messages.

Guiding principle 12: Target and reach disadvantaged and vulnerable groups

EWS must always include disadvantaged groups as a key focus, during every component and at every level. The term disadvantaged is chosen instead of vulnerability to include a wider group at-risk (exposed and/or vulnerable). It is not useful in disaster risk reduction/management to isolate gender because those disadvantaged or marginalized are not strictly women, children, older persons and persons with disabilities. Depending on the hazard, they also may include the homeless, semi-illiterate, those working at night on a river, youth playing near the river, single-headed households (whatever their gender), or very simply the least economically secure.

Nearly every community has a group of people that are, for whatever intentional or unintentional reason, marginalized. It may be visitors—tourists, or seasonal and permanent immigrants to a community. Since they are unable to understand the local language and pick up cultural clues from their neighbors, they become marginalized during an imminent hazard. They must all be accounted for in early warning: identified, included, engaged or at the very least, warned. Providing redundancy in the modes of early warnings will ensure that people who may not be able to hear an early warning or those not able to see or read a text warning are included in the communication strategy. A multi-media approach is an effective way to reach disadvantaged groups.

Guiding principle 13: Build partnership and individual engagement

The mainstay of sustainable EWS at is closely tied to partnership and engagement of specific individuals. A full-fledged multi-hazard and multi-level system can only thrive when partnerships are crystallized and committed individuals are visibly attached to the efforts. Their inclusion brings active participation and ownership of EWS products to the forefront. A main argument in support of partnership is that partners bring greater resources, financial or otherwise. The list of potential partners is long, and will vary with each level, hazard and context. First explore EWS partnerships at the first mile, at the local or community level. In at-risk communities, it identify committed volunteers and credible champions.   Many other examples of partnership are detailed below: schools and youth, private sector, government, military, civil society, NGOs, and media.

Community-level practice: guiding principles per EWS component

Analyses of Risk/Risk Knowledge

Guiding principle K-1 although risk knowledge exercises may not lead to early warning, all early warning must be founded on risk knowledge. Results of the risk knowledge efforts should link to some type of action. The community have already voiced the need or strong desire for an intervention of some sort. Although learning about risk is a valuable action in itself, it most certainly provides opportunity for follow-on action to reduce risk in a community. That action may include simple measures of hazard mitigation, such as creating volunteer teams to regularly drain channels in which debris causes localized floods. The action may involve more specific training or even the assisted movement of an entire village from a chronic flood zone to a hazard-free area.

Guiding principleK-2 Accept that a community's priorities may not be your own

Understanding risk at a community level is an opportunity to look into local perceptions. These perceptions may often appear unfounded or at odds with your reality. For example, you may learn that although hundreds lost their lives two years ago in a major disaster, that same disaster takes a back seat today to the daily challenge of survival, feeding one's children today. If, despite this difference in perception, we proceed to set up a EWS for that same disaster, it may not be a meaningful or sustainable exercise. The only way to marry the two perceptions—one prioritizing disaster and another daily survival—may be to identify and develop an incoming generating activity that meets the community's prioritized needs while also contributing equipment or other elements required for an eventual EWS.

Detecting, Monitoring, Warning/Forecasting Services

Guiding principle M-1 Passive receivers of information do not save lives

In most countries, monitoring is conducted by technicians or scientists at a central (global, regional or national) level. The most common agency for environmental hazards is the National Meteorological Service/Department. They combine high technology (such as satellite imagery) with measurements set up to be compiled from many localities (such as automated weather stations).The resulting information is then analyzed, packaged and communicated to those who are at-risk of a given hazard or disaster. This is a classic top-down EWS where communities are more or less passive receivers of monitoring products. To be considered a community-based EWS at least one of the four EWS components must be 'active' inside the community. If a community does not observe and record information, it needs to be able, at the very least, to analyze the information received from the outside. If community is entirely dependent on monitoring information coming to them from the outside, it is critical that those who receive it also own that information. Analysis leads to ownership.

Guiding principle M-2 Some communities will need to DRIVE their EWS

Communities should be empowered not only to receive and act on messages, but also to drive, or at least actively participate, in monitoring the conditions closest to them. Only in this case do we have a true bottom-up "community-driven EWS."

Guiding principle M-3 Public displays of monitoring data can motivate communities

Tracking monitoring information is vital to detect trends. A regular analysis of trends leads to forecasts and eventually warnings. Onaway to publicize detected by the EWS is to put them on public display. The display is reminder that information can promote powerful change. Billboards or posters in public places with EWS information changing everyday can spark a growing interesting those changes and can get skeptical community members to develop an appetite for information in general. Such billboards can be as simple as a handwritten series of numbers on a poster outside a town hall. With more resources, blackboards near the market or sophisticated score signs in town have also been used to display monitoring information.

Guiding principle M-4 when hazards evolve, so must their monitoring

Just as hazards evolve, so must monitoring information. After every season or hazard event, it is crucial for the EWS committee/team to return to the information collected, and critically analyze the experience. The information gathered during monitoring feeds directly into warning communication by providing the material used to prepare a clear message and a full communication strategy. An actionable early warning provides a timely message that reaches, is understood and is acted upon by the population at-risk.

Communication is the central theme of this component; there are many experts in communication whose skills should be put to good use when preparing messages and launching a communication campaign to deliver the message. (See document on General Information for NHMS, Warnings, communications, and relationships.)

Dissemination and Communication

Guiding principle C-1 clearly delegate responsibility to author/alert or aid in the dissemination/ understanding

Clearly identifying the role of author/provider and the person who will aid in the dissemination/understanding. The author may be outside community (wherever monitoring is conducted), but the person aiding in dissemination/understanding should be from inside or closely related to the community who may be the first to receive the message. First receivers benefit from specific training in forecast interpretation, communication and mediation—to repackage and transmit messages in a timely manner. The goal is to carefully consider the audience and to promote an on-going two-way dialogue between the author/provider—disseminator/communicator—recipient. An efficient community EWS communication component should identify more than one disseminator/communicator. This process will increase certainty that those most at-risk and are more likely to be understand and acted upon the information

Guiding principle C-2 do not fall into the sophistication trap for warning devices

Contemporary thinking often believes everything modern and technocratic is more reliable or more likely to work. This fallacy is dangerous because it leads to the use of inappropriate technology. In community and national EWS, no-to-low technology has provided excellent results in transmitting messages. The definitions of technology are:

1. No-technology: In some communities, to deal with illiteracy, warning messages take the shape of drawings (pre-determined or not) that promote very swift understanding. Runners rapidly transporting messages from one place to another and town criers use no technology beyond their voices to mediate. Posters and anything recorded on paper is considered no-tech.
2. Low technology: Flags, boards, whistles and megaphones. Traditional sounds and instruments have long been the mediators/conveyors of warning messages.
3. Mid Technology: SMS (UMS for earthquake), telephone, radios, high frequency radios, secure radio transmission
4. High technology: automatic SMS (subscriptions to automatic alerts), TV, Internet, and satellite-driven instruments.

Redundancy: Singular dependence on one communication device or channel can also be problematic.

Guiding principle C-3 Use staged warnings (levels and colors) in dissemination

Warnings are issued in stages of increasing urgency; therefore the communication/dissemination strategy must include a staged flow of information. There are many equivalents of staged warnings. Traffic lights are typically in threes: green to go, yellow to beware and red to stop; a childhood game "Ready, Steady, Go" (or the equivalent "On your mark, Get Set, Go") stages warnings for runners; and there are others. Very commonly, early warnings draw on three stages progressively increasing in importance such as: watch, warning and alert. They also often color code warning communication devices to align with the three stages: green, yellow and red where red is the most important stage. Beware of cultural differences in the meanings and interpretations of color by those affected with color blindness (typically four to eight per cent of the population).

Guiding principle C-4 Use an effective communication strategy

The warning/information has been prepared and packaged taking into full account the profile and perceptions of the at-risk recipients, the challenge is literally to speed it on its way. To get that message launched, a communication strategy is needed. The communication strategy maps out all possible local options to be able to identify the most efficient:

1. Devices: the technology used to convey messages. Below we will explore low, medium and high technology options used in warning communication.
2. Dissemination or channels: the flow, frequency and redundancy of message transmission.
3. An effective communication strategy includes a multi-media approach: audible, visual, electronic and personal communications.

(See *Guiding principle C-2 Do not fall into the sophistication trap for warning devices* above concerning technology.)

Preparedness and Response Capacity

Guiding principle R-1 In EWS, we respond to warnings, not to disasters

The response here is to a warning, not to a disaster. Remember that disasters are preventable, and EWS is one tool that helps prevent them. Response capability typically involves actions that prepare for, or reduce the impact of, a hazard or disaster. A community is deemed "response capable" when they know, have practiced and have the means to engage in appropriate response actions. This approach focuses on the goal of preventing disasters through early warning, making disaster response less and less necessary. In early warning, we respond to warnings to prevent disasters. An EWS should include a means to receive feedback from community members; depending on the cultural context, it can be a suggestion-box, a contact form ina website or gathering information as part of school programs (example: volunteers can organize an activity with students in which they gather information at their homes, as homework, regarding feasible response options).

Guiding principle R-2 Strive to organize robust no-regrets response actions

Robust response actions in early warning are those that are useful, not wasteful, even if the disaster does not come as planned (as in a false alarm). Robust could also mean actions that are common to (will be useful during)more than one hazard. Efforts to develop response actions that satisfy hazards as well as other, perhaps daily, needs will also make them more meaningful, robust and sustainable. Priority should be given to response actions that have multiple utilities. For a response action to be robust through time, it should rely on community knowledge and locally available resources. External funding may be present at a moment, but communities should not depend on it as it may not be always available, different locally generated funding options should be considered.

Guiding principle R-3 Embed response options in annually updating contingency plans with links to funding

An important tool for disaster risk managers is contingency plans. These are regularly updated plans that are negotiated at the community level. The contingency plan's Standard Operating Procedures should be a clear inventory who does what when and how in an emergency. Whole community contingency or response plans are good ideas, but so are response plans at the household level. Getting people involved in an exploration of responses that they can do with their children in their homes makes the experience very personal.

Guiding principle R-4 Practice makes perfect: test-drive your response actions

Drills and simulations must be conducted to test if the response options and contingency plans are adequate and if the community as a whole is prepared to use it effectively. The results of these simulation activities or those of the actual response actions when an event strikes should be analyzed regularly to improve this component and the EWS as a whole. It is important to remember that although fear may be present during a real event (particularly during hazards with short lead-times), practice makes people face their fears and installs reflexes and life-saving routines.

Appendix IV – Compilation – Early Warning System Checklist Items
(See Note above in Section 8)

Early Warning System Checklist Items

I.   Analyses of Risk/Risk Knowledge

1. Organizational Arrangements Established
- ☐ Were key national government agencies involved in hazard and vulnerability assessments identified and roles clarified (e.g., agencies responsible for economic data, demographic data, land-use planning, and social data)?
- ☐ Was the responsibility for coordinating hazard identification, vulnerability and risk assessment assigned to one national organization?
- ☐ Did legislation or government policy mandate the preparation of hazard and vulnerability maps for all communities in place?
- ☐ Were national standards for the systematic collection, sharing and assessment of hazard and vulnerability data developed and standardized with neighboring or regional countries?
- ☐ Didthe process include an assessment and review ofthe accuracy of these risk data and information and a determination of impacts of the risks by scientific and technical experts?
- ☐ Was a strategy to actively engage communities in local hazard and vulnerability analyses developed?

2. Natural Hazards Identified
- ☐ Were characteristics of key natural hazards (e.g., intensity, frequency and probability) analyzed and historical data evaluated?
- ☐ Were hazard maps developed to identify the geographical areas and communities that could be affected by natural hazards?
- ☐ Was an integrated hazard map developed to assess the interaction of multiple natural hazards?

3. Community Vulnerability Analyzed
- ☐ Were community vulnerability assessments conducted for all relevant natural hazards?
- ☐ Were historical data sources and potential future hazard events considered in vulnerability assessments?
- ☐ Were factors such as gender, disability, elderly, access to infrastructure, economic diversity and environmental sensitivities considered in vulnerability?
- ☐ Were local knowledge, community "memory", and relevant experience during past events included in the assessment of vulnerability of the community to the hazards identified.
- ☐ Was geographical distribution of hazards used to identify vulnerable communities and regions.
- ☐ Were vulnerabilities documented and mapped (e.g., people/communities along coastlines)?
- ☐ Was an assessment undertaken on the accessibility of early warning and broadcasting strategies?

4. Risks Assessed
- ☐ Were interaction of hazards and vulnerabilities assessed to determine the risks faced by each region or community?
- ☐ Was community and industry consultation conducted to ensure risk information is comprehensive and includes historical and indigenous knowledge, and local information and national level data?
- ☐ Were activities that increase risks identified and evaluated?
- ☐ Were the results of risks assessment integrated into local risk management plans and warning messages?

5. Information Stored and Accessible
- ☐ Was a central 'library' or GIS database established to store all disaster and natural hazard risk information?
- ☐ Were hazard and vulnerability data available to government, the public and the international community?
- ☐ Was a maintenance plan developed to keep data current and updated?
- ☐ Is there a process to review and update risk data each year, and include information on any new or emerging vulnerabilities and hazards established?

II.   Detecting, Monitoring and Warning/Forecasting Service

1. Institutional Mechanisms Established
- ☐ Were standardized process, and roles and responsibilities of all organizations generating and issuing warnings established and mandated by law?
- ☐ Were agreements and interagency protocols established to ensure consistency of warning language and communication channels where different hazards are handled by different agencies?
- ☐ Was an all-hazard plan established to obtain mutual efficiencies/effectiveness among warning systems?
- ☐ DoEWS partners, including local authorities, know which organizations are responsible for warnings?
- ☐ Were protocols in place for communication responsibilities and channels for technical warning services?
- ☐ Were communication arrangements with international and regional organizations established and used?
- ☐ Were regional agreements, coordination mechanisms and specialized centers in place for regional concerns such as tropical cyclones, floods in shared basins, data exchange, and technical capacity building?
- ☐ Is the warning system subjected to system-wide tests and exercises at least once each year?
- ☐ Was a national all-hazards committee on technical warning systems in place and linked to national disaster management and reduction authorities, including the national platform for disaster risk reduction?
- ☐ Was a system established to verify that warnings reached the intended recipients?
- ☐ Are warning centers staffed at all times (24 hours per day, seven days per week)?

2. Monitoring Systems Developed
- ☐ Are measurement parameters and specifications documented for each relevant hazard?
- ☐ Are plans and documents for monitoring networks available and agreed with experts and relevant authorities?

- ☐ Is the technical equipment suited to local conditions and circumstances?
- ☐ Are personnel trained in the maintenance and use of the monitoring equipment?
- ☐ Are the observational networks and frequency of data availability sufficient to determine threat and danger in time to provide effective warnings (e.g., high frequency rainfall rates/data for flash floods)
- ☐ Are applicable data/analyses from regional networks, adjacent territories and international entities available?
- ☐ Are data received, processed and available in meaningful formats in real time, or near-real time?
- ☐ Is a plan in place to quickly obtain, review and disseminate data on vulnerabilities associated with hazards?
- ☐ Are data routinely archived and accessible for verification and research purposes?
- ☐ Are plans in place to identify and document gaps/needs in monitoring systems and ways to improve capacity?
- ☐ Were organizations of persons with disabilities consulted?

3. Forecasting and Warning Systems Established

- ☐ Are data analyses, prediction and warning generation based on latest scientific and technical methodologies?
- ☐ Are data and warning products issued in accordance with international standards and protocols?
- ☐ Are warning analysts sufficiently trained to analyze, identify, forecast, and issue warnings for risks?
- ☐ Are capacity building plans and programs in place for warning analysts and decision makers?
- ☐ Are warning centers equipped with appropriate equipment (especially computing infrastructure) and software needed to handle data and run prediction models?
- ☐ Are fail-safe systems in place, such as power back-up, equipment redundancy, office evaluations, and on-call personnel systems?
- ☐ Are warnings generated and disseminated in an efficient/timely manner
- ☐ Are warnings generated and disseminated in a variety of formats suited to users' needs?
- ☐ Do the warning and response agencies maintain a situational awareness and act decisively when needed to make changes?
- ☐ Is there a plan implemented to routinely monitor and evaluate operational processes, including data quality and warning performance and seek ways to improve?
- ☐ Is research activities undertaken in fields of meteorology, hydrology, climatology, oceanography, social science to enhance understanding and improve forecast/warning services?
- ☐ Are verifications and assessments of warning services conducted after events to measure performance, identify and correct deficiencies, and capture best practices?
- ☐ Are inter-agency "after action" meetings held to improve early warning system?

III. Dissemination and Communication

1. Organizational and Decision-making Processes Institutionalized

- ☐ Is the warning dissemination chain enforced through government policy or legislation (e.g., message passed from government to emergency managers and communities, etc.)?
- ☐ Are recognized authorities empowered to disseminate warning messages (e.g., meteorological authorities to provide weather messages, health authorities to provide health warnings)?

☐ Are functions, roles and responsibilities of each agency/person in warning dissemination process specified in legislation or government policy (e.g., national meteorological and hydrological services, media, NGOs)?

☐ Are roles and responsibilities of regional or cross border early warning centers defined, including the dissemination of warnings to neighboring countries?

☐ Is there a volunteer network trained and empowered to receive and widely disseminate hazard warnings to remote households and communities?

☐ Is there a communication strategy to ensure that people with disabilities, including people who are deaf or have a hearing disabilities receive broadcasts?

2. Effective Communication Systems and Equipment Installed

☐ Are communication and dissemination systems tailored to needs of individual communities (e.g., radio or television for those with access; and sirens, warning flags or messenger runners for remote communities)?

☐ Do the communication/dissemination systems work 24 hours/day, 7 days/week, regardless of time of year?

☐ Do the disaster risk management bodies, the warning agencies, and media maintain active communications during a hazardous event?

☐ Does the alarming communication technology reach the entire population, including seasonal populations, people with disabilities, fishermen, and remote locations?

☐ Are multiple communication mediums used for dissemination (e.g., mass media, informal communication)?

☐ Are local communications methods and people effectively used to communicate warnings or information?

☐ Were agreements developed to use private sector resources (e.g, amateur radios, safety shelters)?

☐ Are consistent warning dissemination and communication systems used for all hazards?

☐ Are communication systems two-way and interactive for confirmation that warnings have been received?

☐ Are equipment maintenance and upgrade program implemented and redundancies enforced so back-up systems are in place in the event of a failure?

☐ Are international organizations or experts consulted to assist with identification and procurement of appropriate equipment?

☐ Are warning and disaster risk management agencies trained in effective human communications and interview techniques?

3. Warning Messages Recognized and Understood

☐ Have agreed upon warning and message wording been jointly developed and coordinated?

☐ Are warning alerts and messages tailored to the specific needs of those at risk (e.g., for diverse cultural, social, gender, linguistic and educational backgrounds)?

☐ Are warning alerts/messages geographically-specific to ensure warnings are targeted to those at risk only?

☐ Is there a warning validation process?

☐ Is there a warning confirmation process?

☐ Do messages incorporate the understanding of the values, concerns and interests of those who will need to take action (e.g., instructions for safeguarding livestock and pets)?

☐ Are warning alerts clearly recognizable, consistent over time and include follow-up actions when required?

☐ Can warnings and information be conveyed in different formats – texts, graphics, color-coded, audio, etc.?

☐ Are warnings specific about the nature of the threat and its impacts?

☐ Are mechanisms in place to inform the community when the threat has ended?

☐ Have studies into how people access and interpret early warning messages been undertaken and lessons learnt incorporated into message formats and dissemination processes.

☐ Do warnings communicate targeted risk information to help guide/motivate user response?

☐ Can people with disabilities receive and understand warnings (sign language, text and audio formats)?

IV. Preparedness and Response Capacity

1. Warnings Respected

☐ Are warnings generated and distributed to those at risk by credible sources (e.g., government, spiritual leaders, respected community organizations)?

☐ Has the public perception of natural hazard risks and the warning service been analyzed to predict community responses?

☐ Have strategies been developed to build credibility and trust in warnings (e.g., understanding difference between forecasts and warnings)?

☐ Are there methods for warnings to be delivered by multiple credible sources (people often seek secondary source of confirmation)?

☐ Have steps been taken to minimize false alarms and to improve communications to maintain trust in the warning system?

2. Disaster Preparedness and Response Plans Established

☐ Are disaster preparedness and response plans empowered by law?

☐ Do disaster preparedness and response plans target individual needs of vulnerable communities?

☐ Were hazard and vulnerability maps utilized to develop emergency preparedness and response plans?

☐ Is there a plan methodology to analyze previous disaster events and responses and to review lessons learnt and then incorporated them into disaster management plans?

☐ Are strategies implemented to maintain preparedness for recurrent hazard events?

☐ Are emergency preparedness and response plans reviewed yearly and changed when needed and then disseminated to the community and practiced?

3. Community Response Capacity Assessed and Strengthened

☐ Was there an assessment of the community ability to respond effectively to early warnings done?

☐ Are responses to previous disasters analyzed and lessons learnt incorporated into future capacity building strategies?

☐ Are community-focused organizations engaged to assist with capacity building?

☐ Are community and volunteer education and training programs developed and implemented?

☐ Is preparedness maintained for recurrent hazard events?

☐ Are previous disaster events and responses analyzed and lessons learnt incorporated into disaster management plans?

☐ Are there regular tests and drills undertaken to test the effectiveness of the early warning dissemination processes and responses?

4. Public Awareness and Education Enhanced

- ☐ Is simple information on hazards, vulnerabilities, risks, and how to reduce disaster impacts disseminated to vulnerable people, communities and decision-makers?
- ☐ Is community educated conducted on how warnings will be disseminated and which sources are reliable and how to respond to different types of hazards after an early warning message is received?
- ☐ Is the community trained to recognize simple hydro-meteorological and geophysical hazard signals to allow immediate response?
- ☐ Is on-going public awareness and education built in to school curricula from primary schools to university?
- ☐ Is mass media, internet, and folk/alternative media utilized to improve public awareness?
- ☐ Are public awareness and education campaigns tailored to the specific need of each audience (e.g., children, vulnerable people, emergency managers, and media)?
- ☐ Do educational and awareness activities emphasize personal risks and possible life- or property-saving actions to take?
- ☐ Are public awareness strategies and programs evaluated at least once per year and updated where required?

Appendix V – Compilation – General Basic Information on Early Warning System for NHMS, Warnings, Communications, and Relationships
(See Note above in Section 8)

General Basic Information on Early Warning System for NHMS, Warnings, Communications, and Relationships

1.   Framework of Risk Management

NMHSs play a role in:

a. In risk identification element: Systematic observation and monitoring of hydro-meteorological parameters; provision of quality-assured archived and real-time data; hazard analysis and mapping; as well as forecasts of hazards, their changing patterns and impacts;

b. In risk reduction element: Provision of hazard forecasts and early warnings related to specific impacts (e.g., a flood or heat-health) to support emergency preparedness and response; climate data and forecasts (probabilistic information on hazards and their changing patterns) to support medium and long-term sectoral planning; and,

c. In risk transfer element: Provision of historical and real-time hazard data and analysis to support catastrophe insurance, bonds and weather-indexed risk transfer mechanisms.

2.   Effective Early Warning Systems

A warning system must empower individuals, communities and businesses to respond timely and appropriately to hazards in order to reduce the risk of death, injury, property loss and damage. Warnings must get the message across and stimulate those at risk to take action. Increasingly precise warnings are required by disaster mitigation decision-makers. These require improvements in weather warnings (Gunasekera 2004):

- extending the lead time of warnings;
- improving the accuracy of warnings;
- greater demand for probabilistic forecasts;
- better communication and dissemination of warnings;
- using new techniques to alert the public;
- targeting of the warning services to relevant and specific users (right information to right people at right time and right place); and
- warning messages are understood and the appropriate action taken in response.
- warnings in a variety of formats (audio, text, electronic) to ensure that people with disabilities receive the warnings.

Longer lead times should be considered together with the need to reduce false alarm rates and a balance should be struck between the two whereby decisions can be based on optimum lead times for warnings (Rogers and Tsirkunov 2010).

3.   Partnerships

The design and operation of severe weather warning systems must be based on a commitment to cooperation and information exchange and the concept of partnership in the overall public interest (WMO 2010). The benefits of such partnerships include:

a. drawing expertise from a wide range of disciplines, such as social science, community planning, engineering, etc.;

b. accomplishing tasks that cannot be managed by a single agency or organization;

c. demonstrating to government budget planners a commitment to work together towards a common goal and making better use of scarce financial resources;

d. leveraging resources for research, awareness, preparedness, etc.;

e. sharing costs, knowledge, and lessons learned;

f. ensuring a consistent message (the warning bulletins and other outreach material) from multiple credible sources; and

g. yielding wider distribution of the message through multiple outlets and receiving feedbacks from a whole range of users.

4.   Relationships and Needs of Users

To identify and evaluate the weather information needs of the users, there is a need for NMHSs to build relationships and work in partnership with users in both the public and private sectors. NMHSs partners include:

a. other government agencies with missions involving the protection of life and property, such as the National Hydrological Services (NHSs) where they are separate agencies from National Meteorological Services (NMSs), national, regional or local emergency management agencies, first responders, and infrastructure managers (dams, transportation departments, bridges);

b. the media;

c. Non-Government Organizations (NGOs);

d. emergency relief and humanitarian organizations, such as the International Red Cross and Red Crescent Society (IFRC);

e. academic institutions and schools;

f. trained volunteers associated with NMHSs, such as cooperative observers, storm spotters, and amateur radio operators;

g. meteorological societies and other professional associations in risk management disciplines;

h. private sector weather companies;

i. utility services, telecommunication operators and other operation-critical or weather-sensitive businesses; and

j. the public who will be the recipients of the information.

An understanding by the NMHSs of the decision-making processes being made by all of the sectors impacted by the hazard is a vital part of the EWS to ensure that information is tailored to the specific needs of the user. This involves efficient and timely synthesis and a valuable description of weather-related data and information and its effect on the users' operations and objectives. These will vary widely for each stakeholder for the same weather event. It also includes a quantitative understanding of the social and economic cost and benefit of warnings (Rogers and Tsirkunov 2010). Maximizing the benefit depends on understanding the uncertainty in the warning, the decisions that depend on the warning, and the level of acceptance of false alarms. Good communication is essential to develop an effective high value warning system.

A typical partnership would involve disaster, warning, and risk management experts from government, business, academia, non-government relief organizations such as the Red Cross and Red Crescent Society, and emergency management officials, to agree on warning standards, procedures, and systems. Sustained partnerships must also be formed with the social science community. An interdisciplinary group of practitioners, researchers, and stakeholders is best suited to address challenges in reaching out to vulnerable populations and turning warnings into effective action. In addition to stakeholders and partners, a range of experts in various fields such as economics, sociology, and human factors should be consulted throughout the planning and implementation of any new severe weather services.

An understanding by the NHMS of the weather impact on tactical decision making process being made by emergency managers will allow development of decision support services tailored to these stakeholders. These processes and the associated NMHSs services should be identified and trained on in advance. These needs may vary widely from stakeholder to stakeholder for the same weather event. An excellent way for NMHSs to prepare and refine their decision support service is to be an active participant in tabletop, functional and full-scale exercises by local emergency managers.

5.   Stakeholder Involvement

An effective severe weather warning system in a risk management plan understands the needs of a multi-cultural, economically stratified and often mobile community, and the understanding by the community of the hazard, its vulnerability and the most suited protective action to take. Stakeholders need to be consulted as partner's in the design and refinement of severe weather warning systems. Stakeholders include the public, other national government agencies, emergency management agencies, local authorities, NGOs, the media, social scientists, national and regional infrastructure authorities, academia, etc. Involving stakeholders in developing and enhancing the end-to-end-to-end severe weather warning system has many benefits, such as:

a.   improved presentation, structure, and wording of the warnings themselves;
b.   more effective communication of the risks and actions to take in response to severe weather;
c.   better understanding of how, and how often, stakeholders want to receive warnings; and,
d.   increased sense of ownership, and therefore, credibility in the warning system.

6.   Communications.

Vertical and horizontal communication and coordination between early warning stakeholders is also essential. For successful communication to take place, there are at least three actors.

They are as follows:

a.   **Author:** Responsible for creating or assembling the contents of the alert message (typically a technical service such as meteorology, hydrology or health; but sometimes a community).
b.   **Interpreter/Communicator:**Receives, aggregates, reformulates and redistributes alert messages among at-risk recipients; also known as transmitters or 'first receivers.' S/he should attempt to preserve the original information but may make meaningful changes to the message content or envelope. It is rare that a message goes directly from the author to a recipient with no interpreter/communicator.

c. **Recipient:** A 'consumer, also known as the audience. Often, the authors do not know their audience well, the recipients. They are often the same people who are responsible for monitoring, scientific and technical experts and are not necessarily skilled in communicating data in ordinary language. Recipients when they receive the message do not understand the full meaning. The real meaning may be lost in technical language and a tone that does not hold attention; the language itself may not be in the locally understood dialect. This makes the role of interpreter/communicator extremely important. The disaster risk reduction/ management, media, government, spiritual, or other leaders/persons who act as interpreter/communicator, then must polish their skill as interpreter/communicator of early warning messages. When developing official EWS, planners must account for the recipient's perceptions, their past experience of reacting to warnings, and general public beliefs and attitudes regarding disasters.

Message content

A worthy early warning message must contain the six following elements:
  1. Timing: When is the hazard due to strike?
  2. Location: Which areas are going to be affected?
  3. Scale: What is the magnitude of the hazard? (e.g., level of water, wind speed, etc.)
  4. Impact: What will be the effect of the hazard on the communities and environment?
  5. Probability: What are the chances of this happening?
  6. Response: What should at-risk populations do to protect themselves?

Message tone

Recent research is mixed on the importance of emotion in a warning message. Messages with strong emotional appeal may in some contexts be more successful in both reaching and convincing the recipient. In addition, messages need to use a "vocabulary" that resembles that of the recipient community: language, tone, choice of meaningful words.

Message standardization

It is vital to seek a balance between consistency and contextualization to have messages that are not contradictory or confusing. Consider language, vocabulary and culture as strong influences to guide the phrasing and tone of the messages. Warning messages, however, are not subject to the 30-second rule for commercial publicity. It is better to provide the full story and to let it evolve. It is also advised to prepare messages long before the hazards strike; they can and should always be adapted to each context. They could even be in an annex of the contingency plan.

Messages in plain language are more likely to be understood by older people and people with little education. Plan language messages are also appreciated by many persons with disabilities, particularly those with developmental disabilities and learning disabilities. Message should be accompanied by closed captioning and sign language interpretation to ensure that people who are deaf are included in the recipient population.