MANUAL ON SYNERGIZED STANDARD OPERATING PROCEDURES (SSOP) FOR COASTAL MULTI-HAZARDS EARLY WARNING SYSTEM

The purpose of this Manual on Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System (EWS) is to promote community resilience to coastal multi-hazards and to improve the policy and institutional arrangements at national, district, and community levels through integrated, effective standard operating procedures for multi-hazards EWS.

EXECUTIVE SUMMARY

SOPs are vitally important in an EWS. However to be effective, SOPs must:
   a. Fit into the framework of country's EWS;
   b. Accurately describe and document the roles and responsibilities of the agency, especially the NMHS;
   c. Incorporate concepts of multi-hazards;
   d. Ensure tasks are integrated with other agencies and with all levels of government, especially local communities;
   e. Be written in a simple, easily understood format;
   f. Be synergized both from a multi-hazard and a multi-agency perspective;
   g. Follow an identified process for reviewing, testing, and approving before implementation;
   h. Include a sustainable process for reviewing and updating; and
   i. Be incorporated into training and education programs for maximum effectiveness.

This Manual provides information, examples, and references for these nine items to help countries and agencies within the country, especially the NMHS, to prepare and implement effective SOPs to ensure the various aspects of the EWS provide timely, required information to save lives and protect property.

The Manual consists of 14 Modules divided into five Parts to highlight the linkage between ongoing efforts with existing SOPs and the need to improve them into an SSOP for a multi-hazard early warning system of coastal areas.The five parts are: Technical Background; Strategic Framework of SOPs; Formalization of SOPs; Towards an Effective and Sustainable Process of Improvement; and Operationalizing SSOPs. Each Module within these 5 parts provides detailed information for the subject listed. In addition, the first three Appendixes are very important and special emphasis should be placed on their review. The first Appendix is a Quick Reference Guide which contains high-level information, similar to an executive summary, for each module in a condensed form. The second Appendix is a template for a very basic SOP. The third Appendix is an excellent SOP Checklist, which can be used to evaluate current SOPs and the development of new ones.

In an EWS, several levels of documentation exist and should be strongly considered for incorporation.
1. National, high-level policy document(s), which provides a comprehensive and integrated management, approach which encompasses all stages of disaster management. These documents clearly define the roles and responsibilities of citizens, public representatives, ministries, agencies, and non-government organizations and often specify "who" (responsible agency) and "what" (roles and responsibilities) of an EWS.
2. Memorandums of Understanding (MOUs). MOUs helps to ensure different agencies and organizations understand each other's roles and responsibilities and how they can perform in an integrated manner as partners. MOUs can either be bilateral (between two agencies) or multilateral (among multiple agencies). An MOU identifies the parties involved; defines the subject matter and objectives; and establishes agreed upon roles and responsibilities.
3. SOPs. There are effectively two levels of SOPs. The higher level SOPs are the ones that specify the "who", "what", "when", "where", and "why" associated with natural disasters and are the main focus of this Manual.The lower level SOPs, sometimes referred to as operational directives or checklists, specify the detailed "how to" and are specific to a particular workplace. These are not shared or synergized because of their specific nature.Module 12 is partly focused on these lower level SOPs and provides some ideas of what may be needed.

ESCAP approved and funded a project entitled *Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System.* The goal of the project is to promote community resilience to coastal multi-hazards through effective, synergized SOPs for multi-hazards EWS. One of the activities to meet this goal was the preparation of this manual. The manual was designed to provide flexible approaches, operational guidelines, and recommendations based upon best practices and available resources for SSOPs to be used in a variety of situations. It includes key concepts, basic principles, and basic standards for SSOPs.

TABLE OF CONTENTS

INTRODUCTION

Background and Approaches to Improve Existing SOPs

The Economic and Social Commission of Asia and Pacific (ESCAP) approved a project *Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System* submitted by the ESCAP/World Meteorological Organization (WMO) Typhoon Committee and the WMO/ESCAP Panel on Tropical Cyclones (PTC). The TC and 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) and making recommendations regarding these.

The goal of the project is to promote community resilience to coastal multi-hazards through effective, synergized SOPs for multi-hazards EWSs. One of the activities to meet this goal was the preparation of this manual. The manual was designed to provide flexible approaches, operational guidelines, and recommendations based upon best practices and available resources for SSOPs to be used in a variety of situations. It includes key concepts, basic principles, and basic standards for SSOPs.

It was envisioned that future SSOPs could:

a. Build upon the past achievements in SOPs by TC and PTC Members on early warnings of typhoon-related disasters, especially those relevant to end-to-end early warning systems and community-based disaster risk management and

b. Further enhance ongoing processes of the TC and PTC Members for better sustainable socio-economic development of the high economic growth areas of coastal zones. With the key focuses of the project on coastal areas, multi-hazards, integrated systems, and synergies, SSOPs will further improve TC's and PTC's early warning system operations.

Intended Target Readers or Users of the Manual

The intended target users of this manual are the national meteorological and hydrological services for use in developing SSOPs for their technical roles and responsibilities within the early warning system but also SSOPs related to other warning providers, disaster managers, media, and fishermen. However, since SSOP development builds upon existing and sectoral SOPs which better serve the high economic potentials of coastal areas, the manual will include key areas related to economic policies and decision making and along with technical areas. Linkages between technical aspects of SSOPs and socio-economic implications are important to provide policy guidance to practitioners in various aspects related to multi-hazard early warning systems. Thus, the manual is also intended to provide guidance to support policy and decision-makers on DRR and EWS.

Key strategic areas linking existing SOPs to SSOP

The three major strategic areas linking existing SOPs to SSOP are *multi-hazards*, *integrated systems for early warning*, and *synergies*. It may be noted that these areas are referred to in various sections of the manual. It is important to highlight at the beginning of the manual key policy aspects of these areas so as to help guide subsequent efforts in improving existing SOPs and EWS operations to produce a sustainable and effective process.

(a) Multi-hazards early warning systems

For the TC and PTC regions, it is expected that the multi-hazard EWS would cover the following hazards: cyclones, floods, storm surge, tsunami, landslides, strong winds, high waves, etc.

(b) Integrated EWS

An integrated EWS is expected to provide an integrated framework for all hazards for an end-to-end operation towards an effective EWS.

(c) Synergies

SSOP is expected to identify and operationalize strategic areas of synergies on the basis of multi-hazards EWS, integrated EWS, stakeholders and socio-economic sectors and to formalize these strategic areas into an effective and operational framework.

Organization of the SSOP Manual

The Manual consists of 14 Modules divided into five Parts to highlight the linkage between ongoing efforts with existing SOPs and the need to improve them into an SSOP for a multi-hazard early warning system of coastal areasand appropriate Appendixes. Each Module provides detailed information for the subject listed.

The first three Appendixes are very important and special emphasis should be placed on their review. The first Appendix is a Quick Reference Guide which contains high-level information, similar to an executive summary, for each module in a condensed form. The Quick Reference Guide can be used to get a quick overview of what each module contains for higher level policy makers who do not need all of the details and also for others to evaluate if this module is important to their situations. The second Appendix is a template for a very basic SOP. Modules seven, twelve and thirteen provide much more detail and additional considerations in developing SOPs. The third Appendix is an excellent SOP Checklist which can be used to evaluate current SOPs and the development of new ones.

Acknowledgements

missions to the 6 countries of Cambodia, Malaysia, Maldives, Myanmar, Sri Lanka, and Viet Nam and provided valuable insights; and the 6 expert consultants who conducted specific hands-on training session on SOP implementation and review both for immediate application and for future reference and use.

Also very kind appreciation is expressed to the organizations and individuals who have previously done extensive research and work in the fields of early warning systems and SOPs without which this manual would not have been possible. Appendix IV contains a partial list of these resources which were used in the creation of this manual and also serve as an excellent reference list for others.

Most importantly, this project and the SSOP manual would not have been possible without the professional, dedicated, and knowledgeable work by the staff of the Typhoon Committee Secretariat under the excellent leadership of Mr. Olavo Rasquinho and with the outstanding logistical support of Ms. Lisa Kou and the help of other staff members of the TCS with special emphasis to Dr. Jinping Liu who drafted the initial versions of the terms of reference of the project.

PART I: TECHNICAL BACKGROUND

MODULE ONE: EARLY WARNING SYSTEM OVERVIEW

Four Elements of People-Centered Early Warning Systems

As the foundation for a short overview of an early warning system, the four elements of people- centered early warning systemswas defined in the International Strategy for Disaster Reduction Third International Conference on Early Warning (EWC-III) from Concept to Action, 27-29 March 2006, Bonn, Germany report. Since then, these four elements have been reviewed and the wording slightly modified by many different agencies, including WMO, based upon their different experiences and focus areas. Although slightly different wording may be used by some, the basic concepts of the four elements have remained:

1. Analyses of risk/risk knowledge
2. Monitoring and warning service;
3. Dissemination and communication; and
4. Response capability.

Within these four elements, based upon discussions, training sessions, and missions to a number of targeted countries for this project, the following items were identified for this project as required for an effective EWS:

➢ Involvement and commitment of high-level government policy makers;
➢ Legal and legislative framework;
➢ National plan or policy identifying roles and responsibilities;
➢ EWS as an integral part of all levels of government
➢ Coordination across many agencies at national to local levels;
➢ Operational mechanism defined;
➢ Budgetary and technical support; and
➢ Designation of an agency for coordination activities.

Comprehensive and Integrated Approach for Development of EWS - Four Approaches

Australia has adopted a comprehensive and integrated approach to the development of its EWS based upon four broad approaches. These are:
    a. All hazards approach;
    b. Comprehensive approach;
    c. All agencies approach; and
    d. A prepared community.

*All Hazard Approach:*The all hazards approach refers to the development of arrangements for managingthe large range of possible effects of risksand disasters. This concept is useful to the extent that a large range of risks can cause similar consequences, and suchmeasures as warning, evacuation, medical services and community recovery will be required during and followingemergencies. However, many risks willrequire specific response and recovery measures and will almost certainly requirespecific prevention and mitigation measures. Also see Module 4.

*The Comprehensive Approach. P*lanning for an effective EWS must adopt the comprehensive approach to ensure a balance between the reduction of riskand the enhancement of community resilience while ensuring effective response and recovery capabilities. The fourcomponents of the comprehensive approachare:

    a. Prevention;
    b. Preparedness;
    c. Response; and
    d. Recovery.

*All Agencies Approach.*The all agencies approachrecognizes that no single agency can prepare for, and deal with the disruption to community lifeand infrastructure that can result from a disaster event. The all agencies approach involves effectively coordinating theactivities of the large number of organizations and agencies that are required to contribute to the comprehensive approach spectrum within andacross all levels of Government.The all agencies approach recognizes the need for coordination arrangements, containing input of the national government,State and Local governments, to be articulated and set within a legislative and public policy framework. The arrangementsmust reflect the role of all agencies in the EWS within the context of community safety andsustainability. Also see Module 6.

*A prepared community.*In a disaster situation, individual and community "self-help" can often provide the most readily available and effective relief,as assistance from external sources may be limited or delayed by other demands on resources. Local government and community organizations provide the basis for organizing effective and immediately available community resources.Local volunteer organizations, when effectively integrated into EWS arrangements, can be of vitalassistance in giving access to community resources and expertise, and also act as a link in the essential information chainbetween Local government, disaster management agencies and the community. Individuals can assist by being aware oflocal hazards and recommended precautions against risks. Individuals and families that heed advice on appropriateprecautions can also reduce the demands on emergency management agencies, thus helping to ensure that their Localgovernment arrangements remain effective. Additionally, individuals can assist by actively participating in volunteer organizations.

The basic requirements for a prepared community are:

    a. Alert, informed and active community members;
    b. Effective community organizations with identified and constructive roles in local emergency management arrangements;
    c. Local governments which acknowledge their roles in community safety issues and which have well established, widelyunderstoodand practiced arrangements for discharging their community safety responsibilities; and
    d. Organizations and communities being able to work together to respond to the emergency, save lives and property, andassist the community to recover.

Also see Module 8, Local Communities.

Community Early Warning Systems: Guiding Principles

The International Federation of Red Cross and Red Crescent Societies (IFRC) in Geneva published an important document entitled "Community Early Warning Systems: Guiding Principles" in 2012. In this paper, the IFRC identified 13 "Cross-Cutting" Guiding Principles and 13 "Community Level" Guiding Principles. These 26 principles provide excellent guidance within the framework of this project, especially in the areas of synergism and multi-hazard approaches and things to emphasize in EWS SOPs. Listed below is the title and area

of emphasis for these guiding principles. Appendix VI contains a more complete description and additional information on these guiding principles taken from the IFRCdocument which can be a valuable resource for EWSs and supporting SOPs.

The 13 "Cross-Cutting" Principles include:

Guiding principle 1: Integrate within DRR—EWS is not a stand-alone;
Guiding principle 2: Aim for synergy across levels: community, national and regional/global
Guiding principle 3: Insist on multi-hazard EWS
Guiding principle 4: Systematically include vulnerability
Guiding principle 5: Design EWS components with multiple functions
Guiding principle 6: Accommodate multiple timescales
Guiding principle 7: Embrace multiple knowledge systems
Guiding principle 8: Account for evolving risk and rising uncertainty
Guiding principle 9: EWS without borders: target the full vulnerability and hazard-scape
Guiding principle 10: Demand appropriate technology
Guiding principle 11: Require redundancy in indicators and communication channels
Guiding principle 12: Target and reach disadvantaged and vulnerable groups
Guiding principle 13: Build partnership and individual engagement

The 13 "Community Level" Guiding Principles include:

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
Guiding principle K-2: Accept that a community's priorities may not be your own

Monitoring
Guiding principle M-1: Passive receivers of information do not save lives
Guiding principle M-2: Some communities will need to drive their EWS
Guiding principle M-3: Public displays of monitoring can motivate communities
Guiding principle M-4: When hazards evolve, so must their monitoring

Response capability
Guiding principle R-1: In EWS, people respond to warnings, not to disasters
Guiding principle R-2: Strive to organize robust no-regrets response actions
Guiding principle R-3: Embed response options in annually updating contingency plans with links to funding
Guiding principle R-4: Practice makes perfect: test-drive your response actions

Warning Communication
Guiding principle C-1: Clearly delegate responsibility to alert or mediate
Guiding principle C-2: Do not fall into the sophistication trap for warning devices
Guiding principle C-3: Use staged warnings (levels and colors) in dissemination

MODULE TWO: ROLE OF NATIONAL METEOROLOGICAL AND HYDROLOGICALSERVICES IN EWS

Much of the following is a summary of information from a Global Facility for Disaster Reduction and Recovery (GFDRR) Weather and Climate Information and Decision Support Systems (WCIDS) report entitled Implementing Hazard Early Warning Systems, GFDRR WCIDS Report 11-03, David Rogers and Vladimir Tsirkunov. Appendix VII contains additional data and information from this document which can be a useful resource for NMHSs.

Some parts of this module are redundant with other modules, but they are included here to provide a concise summarization of various items in one place.

As we know, the role of NMHSs in early warning and disaster risk management is critical since so many naturalhazards, which cause floods, wind storms, storm surges, wildfires, droughts, landslides, and others and the resulting social and economic losses are weather-related. These hazardous events are likely to become more common due to climate change.

Four Areas in Which NMHSs Play a Critical Role

1. *Risk Identification and Reduction*

   a. Risk identification: 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 along with impacts;

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

2. *Effective Early Warning Systems*

A warning system must ensure individuals, communities and businesses respond timely and appropriately to hazards in order to reduce the risk of death, injury, property loss and damage. People must understand the warning messages and the warnings must stimulate those at risk to take action. To do this, increasingly effective, usefulwarnings are required through:

   a. Extended lead time with reduced false alarm rate;
   b. Improved accuracy;
   c. Probabilistic forecasts;
   d. Better communication and dissemination;
   e. New techniques to alert the public;
   f. Targeted warning services to relevant, specific users (right information to right people at right time and right place);
   g. Understandablewarnings specifying appropriate actions to be taken; and
   h. Variety of warning formats (audio, text, electronic) for disabled/vulnerable people.

It should be noted NMHSs-operated observing systems such as basic surface observations, upper air observations, rain gauges (manual and automatic) observations, automated weather observing systems, river gauges, satellite images, and weather radars along with numerical

model data and an efficient communications system form the backbone of NMHSs warning service and play a crucial role in the early warning system.

3. Partnerships

A commitment to partnership cooperation and information exchange is required for effective severe weather warning systems. The benefits of such partnerships include:

a. Expertise from many disciplines, such as social science, community planning, engineering, etc.;
b. Accomplishment of tasks that cannot be managed by a single agency or organization;
c. Demonstration to government budget planners of a cooperative commitment to 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 consistent warning and education messages from multiple credible sources; and
g. Wider distribution of messages through multiple outlets and receiving multiple feedbacks.

4. Identifying StakeholdersInvolvement in Needs and Decision-Making Assessments

NMHSs need to build partnerships and relationships with stakeholders in both the public and private sectors.Partnerships can be used to agree on warning standards, procedures, and systems, and interdisciplinary partnerships can address the challenges in engaging vulnerable populations and turning warnings into effective action.

NMHSs stakeholderscan include:

a. Other government agencies involved in the protection of life and property, such as other warning agencies; national, regional or local emergency management/DRR agencies; first responders; and infrastructure (bridges, dams, and transportation departments) managers;
b. Media;
c. Non-Governmental Organizations (NGOs);
d. Emergency relief and humanitarian organizations, such as the International Red Cross and Red Crescent Society (IFRC);
e. Academic institutions and schools in technical areas, but also in the fields of sociology, economics, human interactions, etc.;
f. Trained volunteers (cooperative observers, storm spotters, amateur radio operators, etc.);
g. Meteorological and hydrological societies and other professional associations in risk management disciplines;
h. Private sector weather companies if available;
i. Utility services, telecommunication operators and other operation-critical or weather-sensitive businesses; and
j. Public who will be the recipients of the information..

Involvement of Stakeholders

The needs and decision-making processes will vary widely for each stakeholder for the same weather event because of different sectorial aspects, cultures, vulnerabilities, economic statuses, and community capabilities. However if the NMHS understands these different

needs, decision-making processes and impact on stakeholders' operations, the warning/alert information and decision support services they provide can be tailored to the specific needs of the stakeholders.

Involving stakeholders in developing and enhancing the end-to-end-to-end severe weather warning system can provide excellent benefits, such as:

a. Improved presentation, structure, and wording of the warnings themselves;
b. Increased effectivenessof communicating risks and actions to take;
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.

PART II: STRATEGIC FRAMEWORK OF SSOP

MODULE THREE: ROLE OF SOPS IN AN EARLY WARNING SYSTEM

When an early warning system for a natural hazard is activated, it must work immediately in an effective, efficient, integrated manner to protect the lives and property of the country's citizens. If an effective early warning system has not been established then incorrect actions or no actions may lead to devastating impacts on the country's people, economy, and infrastructure. When a hazard is imminent or occurring, personnel involved in the EWS must know what to do and how to do it to provide advanced warning of the hazard to the impact area.

Vital Role of SOPs in EWS

SOPs are vital to an effective EWS 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 service.

High-Level Policy Documents

Many countries have high-level documents such as Bangladesh's "*Standard Orders on Disasters*", Myanmar's "*Standing Orders on Natural Disaster Management in Myanmar (Restricted)",* or Malaysia's "*National Security Council Directive No. 20: The Policy and Mechanism on National Disaster Management and Relief*" which provides a comprehensive and integrated management approach which encompasses all stages of disaster management. These documents clearly define the roles and responsibilities of citizens, public representatives, ministries, agencies, and non-government organizations and often specify "who" (responsible agency)and "what" (roles and responsibilities)of an EWS.

Levels of SOPs and Related Information

In most countries, there are effectively two levels of SOPs. The higher level SOPs are the ones that specify the "who", "what", "when", "where", and "why" associated with natural disasters. These are the ones that are the main focus of this Manual.The lower level SOPs specify the detailed "how to do it", are specific to a particular workplace, and include reference to internal procedures, internal websites and staff telephone numbers. These are sometimes referred to as operational directives or checklists and would not normally be shared with other agencies or synergized because of the specific needs and ideas of each country. Module 12 is focused on these lower level SOPs and provide some ideas of what may be needed.

Development of SOPs

Developing SOPs for different hazards and for different phases is often time consuming and difficult. Within each agency, people must understand their roles and responsibilities in an EWS and develop internal, technical SOPs to perform their missions. However, while some activities are entirely within one agency, many activities interaction with other agencies at their own level of government and with agencies and people at all levels of government. Therefore each agency or organization must collaborate with other agencies to ensure the required information gets to the people at risk so they can perform the correct actions to save their lives and property regardless of whether they are in a large city or a rural, coastal

location. SOPs can help to ensure that people involved in the EWS take the most effective and efficientsteps during a natural disaster emergency to provide life-saving information and direction when needed.

MODULE FOUR: COASTAL MULTI-HAZARD SOPS

Due to few, infrequent tsunami and some other coastal events, operational, communications, and coordination problems may develop in some country's stand-alone, single hazard early warning system. Because there are many significant and varied demands on national, district, and local governments, these other demands may prevent them from maintaining an effective early warning system for all hazards. Therefore, the concept was developed that an operational coastal multi-hazard early warning system could be more sustainable for a longer time.

Coastal Hazards

Although all countries don't experience all of them, the following is a list of possible coastal hazards:

a. Tsunami (both locally and distant generated);
b. Tropical Cyclones (heavy rain, strong winds, and storm surge all of which vary based upon the distance and intensity of the system);
c. Thunderstorms (varying levels and occurrences of heavy rain, strong winds, hail, waterspout, and tornado);
d. Very Heavy Rain (associated with monsoons and other phenomena); and
e. Strong Winds and Associated High Waves (produced by near and distant low pressure systems).

Multi-Hazard Aspects of SOPs

In the development of multi-hazard EWSs, a country can conduct a systematic analysis of similarities and differences of their coastal threats and hazards. Although hazards behave differently and may occur on very different time scales and effect different geographical areas, elements of most EWS for these hazards are similar: e.g., need for and processes involved in monitoring; need for staged warning (e.g., green, blue, yellow, red levels);coordination among agencies;and processes of issuing and disseminating warnings.

- Although tropical cyclones and tsunamis are very different in time scales and sometimes in magnitude of inundation, some similarities can be included into each hazard's SOPs. Expected inundation areas, planning inundation charts, inundation measurements, and graphically depicted warnings, although not perfectly aligned, can be used to communicate information to decision makers and the public.
- Coordination processes among agencies and organizations at the same levels of government and also vertically from national to local communities can be made similar so they are executed on a more frequent basis rather than different processes for each that are exercised rarely.
- Similar color coding to indicate potential risk/impact for different stages or phases of hazards can be beneficial. It is easier to train and to communicate the threat to the public, media, and others using a standard set of colors: for example green, orange, yellow, red, and black, than to use different colors or different symbols for different hazards. Agencies and people can be confused on the meaning and actions to be taken if different colors/symbols are used.

- Also, although the hazards may be significantly different, similarities can be identified in the processing of issuing and disseminating warnings and incorporated into the SOPs for different hazards. For example, similar formats and wording of warnings or alerts can assist those using these products in identifying the most important information and the actions to be taken. If similar dissemination systems and processes are used for all hazard warnings, then the systems and processes are tested on a more frequent basis; people and agencies become knowledgeable and experienced on the dissemination with less chances of miscommunications or misunderstandings; and the people at the end of the process who require the information in a timely manner to save their lives will be aware and trained on how they receive information.

If these similarities can be identified and incorporated into the EWS, a multi-hazard approach can produce more stable levels of EWS activity throughout the year. For example, during a period when one hazard is dormant another hazard may require the activation of the EWS. Even in periods where all hazards are dormant, vulnerability or resilience may still be monitored. In addition a multi-hazard EWS can result in greater efficiency of limited human and financial resources because centralizing EWS minimizes system maintenance and number of required staff/volunteers. Also a centralized approach can assist in training and users may experience less confusion on where to seek early warning information.

Acknowledgement of Hazards Differences

However great care must be taken in developing a coastal multi-hazards EWS. For example, tsunami and storm surges have similarities and differences. Storm surges caused by tropical cyclones usually have a longer lead time than tsunamis and the duration of the inundation can be longer, especially for slow moving tropical cyclones. Because there is not an earthquake early warning, inundation by tsunami can be more difficult and less dependable to forecast than storm surges. Differences in the warnings providers need to be clearly understood at the operational level and good communications need to be maintained between different warning providers. SOPs need to be well developed for the warning providers as well as media and disaster managers to ensure that the correct actions are taken for different hazard types and that the general public can take appropriate actions during the warning.

MODULE FIVE: MEMORANDUMS OF UNDERSTANDING (MOUS)

Most countries have broad, policy documents which describe roles, responsibilities, tasks, and functions of different agencies or organizations within a country during a disaster. For example, Bangladesh has a "Standing Orders on Disaster", Myanmar has a "Standing Order on Natural Disaster Management in Myanmar" on a restricted basis, and others have similar documents. These documents usually provide broad direction and responsibilities but not the details or the exact manner on how the different agencies and organizations will work together to integrate their activities to achieve maximum efficiency and effectiveness.

Role of MOUs for NMHS

One method to ensure these different agencies and organizations understand each other's roles and responsibilities and how they can perform in an integrated manner as partners, is for them to create a bilateral or multilateral Memorandum of Understanding (MOU). An MOU identifies the parties involved; formalizes a relationship; defines the subject matter of the agreement and its objectives; the benefits for the agencies involved; agreed upon roles and responsibilities; summarizes the essential terms of the agreement; and must be signed by the participating parties. For multilateral MOUs, the benefits of a large number of agencies included in a single MOU must be balanced by possible constraints in drafting, training, implementation, revising, and updating.

For NMHSs, it is important and recommended that they have an MOU between themselves and the DRR/disaster management agencies and between themselves and the important media outlets because of the importance that each plays in the EWS. It is a method to ensure that each agency understands what the other one will do in certain situations before a disaster occurs or is imminent. It also can be advantageous to have MOUs between different levels of government to ensure a smooth transition of the required information and warnings occur from the national to local levels.

Guidelines for Creating a Memorandum of Understanding and a Standard Operating Procedure between a National Meteorological or Hydro-meteorological Service and a Partner Agency

WMOGuidelines for Creatinga Memorandum ofUnderstanding and aStandard OperatingProcedure between aNational Meteorologicalor Hydro-meteorologicalService and aPartner Agency, WMO-No. 1099, PWS-26, 2012 is an excellent MOU reference. In that document it states several overarching principles which should be considered. They include: a mutual desire by both parties for an MOU, with ashared and equal commitment to working together;provisions in the MOU should not conflict with any existing arrangements or policies defined elsewhere; structure and content of the MOU should be clear, simple, and unambiguous to avoid misunderstandings; the MOU is a 'living' document and should include provisions for reviewing, updating, or canceling; and should be developed with relevant legal, financial, and other experts to avoid unintendedimplications.

WMO-No. 1099, PWS-26 also contains a template and several examples of MOUs, which can be found at http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm.

In addition to the references in the WMO manual, Appendix VIII contains an MOU-type document, "*Standard Emergency Warning Signal (SEWS) and Its Use in Queensland*".

Although not specifically named an MOU, it has all of the hallmarks of a good MOU. It contains a multi-hazard approach and also multi-partner aspects and provides an excellent example of some ideas on format and content to include.

MODULE SIX: AGENCY, MULTI-LEVEL INTEGRATED SOPS

Need for Integrated SOPs

As stated above, one agency or organization cannot develop all of the needed SOPs in isolation without involving other agencies. Coordination, collaboration, support, and assistance are needed not only horizontally with other agencies at the same level of government, but also vertically to involve all levels of government and citizens. An effective EWS must provide the required information to the people at risk so they can perform the correct actions to save their lives and property regardless of whether they are in a large city or a rural, coastal location. SOPs can help to ensure the most effective and efficient steps are taken during a natural disaster emergency to provide the highest level of quality service.

Fostering Partnerships and Good Relationship

Good partnerships and relationships are very important in the preparation, coordination, and implementation of useful agency, multi-level integrated SOPs. If good relationships exist, then this process will proceed smoothly and timely. Without good, trusting relationships, the SOP process could be contentious and take a very long time to complete. Therefore it is recommended, as much as possible within the country and the country's culture for the NMHS to do the following items to help create partnerships and relationships:

a. Visit each other's workplaces to gain familiarity with operations;

b. Provide training to DRRs/media where appropriate;

c. Secure hotline between the NMHS and DRR operational centers;

d. Joint pre-season public awareness campaigns with DRRs;

e. Give a "heads up" to DRR prior to public warning;

f. Include suitable Response Statements in warnings which havebeen provided by the DMA;

g. Provide probability estimates of severe weather threats to DRRs

h. Place an NMHS officer in the DRR operational center duringmajor events

i. Joint media conferences with DRRs during major events;

j. NMHS and DRRs on the same consultative committees anddisaster management groups;

k. Involve DRRs/media in improving the warning system

l. Develop MOUs/SOPs with DRRs and the media; and

m. Note that mutual respect, trust and confidence has to be builtand earned over time – but it should always be a realistic goal.

Development Process on Integrated SOPs

There are several ways to develop agency, multi-level integrated SOPs, but a step-by-step, thorough review of the hazards, vulnerabilities, exposure, all agencies and organizations involved in the early warning system, and the needs of the users of the EWS is a logically one.

Most likely, a high-level policy document specifies the roles and responsibilities for various hazards, agencies and levels of government involved, the different stakeholders and their

needs for different hazards, media involvement and interactions, and private sector actions. If any of these are not identified in a high-level policy document, then the roles, responsibilities, and needs of those not identified must be determined before all SOPs can be finalized. Required information or coordination must be known first, so that SOPs can be developed to deliver the needed information or coordination.

Once the roles and responsibilities are understood for each hazard and for each level of the hazards, SOPs can be developed to specify the "how to do it" for each task and responsibilities to meet the requirements identified.

Items for Coordination and Integration

Some of the items that are recommended to be coordinated and integrated among agencies and different levels of government are:

- *Transmission and reception of required information at all levels and all agencies.* This includes information being passed "down" and throughout the system. But it also includes methods to receive data and information "up" from using agencies, people on the ground where the hazard is occurring, questions on status of situation, and clarification/confirmation of rumors concerning the hazard or its impacts.
- *Sharing of information among agencies and people who require this information.* MOUs and then the implementing SOPs should clearly state what information or data is required by whom and how that information will be shared. Ensuring all agencies are working from the same set of data and assumptions can ensure integrated actions, prevent actions that may cause additional problems from the hazard, prevent conflicting actions, and convey to the public a sense of confidence from unified action.
- *Release of warnings.* Different countries have different ways to prepare, review and release warnings. These different methods are developed to meet the needs of each country. However once identified, all agencies need to know and understand the process of preparing, reviewing, and releasing warnings to prevent misunderstanding and the dissemination of incorrect information. Coordinated, integrated SOPs can define a set of steps to be followed when warnings are required and then identify sequential tasks that need to be completed to prepare, review and release warnings. These SOPs, developed before an emergency occurs, ensure the process is performed in the same way and to the same standard each time in the most efficient and effective method.
- *Release of official information.* It has been found in many different situations, that it is best to have a single person/position or a small team of designated spokespersons to release official information. This designation should be identified in MOUs and implemented in SOPs. This helps to ensure only official, accurate information is disseminated. It also assists the media and others to know who to go for comments or information. One method to ensure timely release of official information is for the designated person(s) to schedule and hold regularly scheduled press conferences. If press conferences cannot be held, than regular scheduled times should be identified when updated, additional official information will be provided through official channels. The schedule for press conferences and/or scheduled release of updated information, once set, should be followed to ensure the media and others know when they can receive accurate, dependable information.

  Many times the media will come directly to the NMHSs for observational and forecasted information on the hazard. During the planning stages before an actual occurrence of a hazard, the NMHSs should coordinate with the other agencies involved in the EWS and

identify the information they are authorized to release. For example during a tropical cyclone event, the NMHSs usually release the intensity, forecast track, and expected impacts of the tropical cyclone along with basic precautions/actions to be taken. Other information such as evacuation orders and areas, available shelters, and actions other government agencies are taking should be released by the authorized person(s). Once again, this should be coordinated in the planning stages, so conflicting information is not released and no one in the EWS process is surprised by the release of any information.

- *Preventing conflicting information from being disseminated.* All SOPs for all agencies and personnel involved in the EWS process, should address what information can be released and by whom. This recommendation is not to reduce or prevent the flow of vital, accurate data during an emergency to the agencies and people who require it. But often in emergencies/ disasters rumors, conflicting information, and unsubstantiated reports rapidly spread through the population and cause panic or unsafe actions. The people involved in the EWS can help to prevent most of this by following their agencies' SOPs on validating, confirming, reviewing, and releasing information on the emergency.

- *Dealing with the Media.* It is recommended that SOPs be developed internally and also in coordination with the media on the media's access to people, locations and offices. The media often want immediate information from the experts and may disrupt operations unless clear guidance is provided in advance. When Typhoon Haiyan impacted the Philippines, "some TV crews disrupted PAGASA's operations at the headquarters and theTacloban station due to the lack of its internal non–access policy." (WMO, UN ESCAP, and ESCAP/WMO Typhoon Committee Post-Typhoon Haiyan (Yolanda) Expert Mission to the Philippines, Manila and Tacloban, 7 – 12 April 2014 Mission Report). SOPs and MOUs prepared in advance can help to prevent these types of interference by the media.

PART III: FORMALIZATION OF SSOP

MODULE SEVEN: WRITING EFFECTIVE STANDARD OPERATING PROCEDURES (SOPs)

The following is a compilation of information on effective SOPs found in References 2, 4, 5, 6, 7, 8, 9, 13, and 17 in Appendix IV.

Purpose of SOPs

Well-written 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 and develop a positive sense of teamwork.

Definition of SOPs

An SOP is a set of steps to be followed when certain conditions arise, such as different levels of severe weather. It contains written procedures of individual, 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;they indicate the most efficient and effective ways to perform an operation; and they help produce predictable, reproducible results while maintaining the quality and consistency of service. NMHSs can use SOPs to ensure consistent delivery of services and products to partner agencies and to the public. However, developing useful and effective SOPs requires time and commitment from all management and employee levels.

Questions to Ask Before Writing an SOP

Before preparing an SOP, it is recommended that you consider:

- What is the specific task to be accomplished and what is the expected outcome?
- Will vulnerable and special needs persons be affected and does the SOP address these impacts?
- Who will be using the SOP?
- What ways will the SOP be used?
- Who should be involved in its development of the SOP?
- How can the development of the SOP be best accomplished?

Reasons for Writing SOPs

There are many reasons to write SOPs, some of which include to:

1. Ensure operations are done consistently;
2. Maintain quality control of processes and products through consistent doing of the tasks;
3. Provide personnel with a specific procedure with minimum variability to increase efficiency;
4. Ensure all operations are completed on a prescribed schedule with minimal impact;
5. Ensure approved procedures are followed in compliance with government regulations;
6. Facilitate training in procedures for new personnel, those that need re-training, and for

cross training to ensure that nothing is missed;

7. Serve as an historical record of the how, why and when things were accomplished for investigations and other reasons;
8. Ensure other staff members know what their co-workers are doing; and
9. Encourage regular evaluation of work activity and continuous improvement in how things are done.

When Should You Write or Rewrite an SOP

Write or rewrite SOPs when:

- New equipment or processes create new work situations;
- None are currently available for specified procedures;
- New information suggests there is a better way to improve performance; and
- Workers' evaluation of existing SOPs identify required changes or ways to improve the process.

New SOPs should be written for all tasks or jobs before they begin and then tested before putting them into final form.

For whom should you write an SOP

- Write the SOP for the person(s) 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 all levels involved in the early warning process. These would include high- level SOPs agreed to by different agencies, and then individual, detailed SOPs for each agency to complete the tasks defined in the high level SOP.

Who should write SOPs

- Successful SOP development and implementation requires that all people who are affected by an 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 or anyone else who can bring relevant expertise to the effort.
- SOPs should be developed and reviewed by several people qualified to determine their completeness and clarity of safety, environmental and operational components.
- In forming teams to write SOPs, consideration should be given to some or all of the following: (a) people who will perform the job; (b) people who will perform maintenance on equipment involved in an SOP; (c) engineers or others who design equipment and processes; (d) technical writers; (f) safety personnel; (g) environmental personnel; and (h) others as required.

Using a team to write an SOP helps to:

1. Ensure that comprehensive knowledge acquired from different perspectives is applied;
2. Create "buy-in," which increases the likelihood that the SOPs will be implemented;

3. Train people who can train others, because writers know it intimately and are more likely to be effective trainers (coaches);
4. Involve people from diverse parts of the operations, which helps when new and modified processes are implemented and SOPs must be updated; and
5. Encourage employees to follow the SOP and listen to supervisors because they know writers invested time and effort on behalf of employees.

When SOPs need to be revised, it is suggested that the group(s) or individual(s) who originally prepared and reviewed them be requested to revise them.

Consolidated List of Tips to Consider When Writing SOPs

Note: The user should review the list and then decide to use those that are necessary for his application.

1. Include an overall view of the situation and responsibilities and how this SOP fits into this overall process. How much someone knows about an entire process or job affects the way he or she does their part.
2. SOPsshould only be as long as necessary for a specific job or a specific use. A good SOP should not be difficult to read or to understand and should not attempt to answer all possible questions.
3. 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.
4. If an SOP involves a long list of steps, then it becomes difficult to understand and to perform in a timely manner. One solution might be to break up steps into logical sections of about 10 steps per section, such as "Getting ready for the process," "Initial steps," "Final steps."
5. SOP should be written as simply as possible so everyone can understand them.
6. SOPs are most effective when they are written in short sentences beginning with an action verb in the form of a command. A good SOP is clear and brief which makes it easy to follow while emphasizing critical steps.
7. Do not make SOPs too wordy or vague (people can interpret differently) or do not usetoo many acronyms and abbreviations.
8. Write SOPs for people who will work alone, work as a team of two or more people, or supervise other people doing a job.When two or more people must use a single SOP at the same time, the SOP must explain when and how each person is to perform a specific step. This allows each participant to understand the sequence of steps and to know when it is his or her turn to perform a step.
9. To avoid people taking shortcuts, explain the reasons behind certain steps so that SOP users will understand the importance of following all the steps in the proper order.
10. Consider the age, education, knowledge, skill, experience and training, and work culture of the individuals who will be performing the SOP steps.
11. 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.
12. Consider any physical limitations people using the SOP may have. If people have poor eyesight, then large clear print or big bright pictures and plenty of light might be required. If an employee's hearing is poor, the person may not be able to hear instructions, especially if there is competing background noise.
13. Consider employees levels of language proficiency. Can they read and understand the SOP?

14. 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. If there is information in upcoming steps that require caution, precision, timing, assistance, or personal protective equipment, alert the person performing the task before coming to these steps.
15. Once you have completed writing an SOP, have several trained workers test it against actual practices and give you feedback. Have it evaluated for safety, health, and environmental aspects.
16. 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 ensure procedures and expectations are appropriate and achievable.
17. 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.
18. Keep a computer accessible file and at least one notebook as backup of all approved SOPs.

19. Integrated SOPs involving multiple agencies will require more time and coordination to prepare than SOPs for a single agency. Therefore begin preparation of integrated SOPs far in advance of when they might be needed to allow sufficient time to prepare, coordination, and approve.

Different Styles of SOPs

There are many different styles of SOPs depending upon: the task to be completed, the complexity of the task, the length of the task, and the level of the SOP. In the following paragraphs, 5 different formats are provided and suggestions on when these might be used. An SOP can follow one of these formats, a combination of two or more formats, or a format developed by the country involved. Whatever format that most effectively and efficiently permits personnel to perform the task in the correct way should be used.

Figure 7.1. Standard Operating Procedure Format Choices And Criteria		
Many Decisions?	**More Than 10 Steps?**	**Best SOP Format**
No	No	Simple Steps
No	Yes	Ranked Order Steps or Graphic
Yes	No	Flow Chart
Yes	Yes	Graphic or Branching Flow Chart

1. **Simple steps or a checklist.** These are easy to write and follow and work well for short,

> **Example from Malaysia's Guidelines for Media Management Center (MMC) on Disaster/Crisis Section, Section 6, Early Response of MMC**
>
> Duties of the MMC Officer immediately after reporting to Disaster Operations Commander (DOC) are to:
> 1. Set up and operate MMC;
> 2. Place directional signs and sign post of MMC at a strategic location at the disaster site for the local and international mass media;
> 3. Request all the local and international media to register and provide them with the pass for access to MMC;
> 4. Obtain the necessary information on the disaster from DOC for dissemination to the media. DOC must sign the information document before disseminating it;
> 5. Arrange the interview briefing or visit of the relevant government officials/leaders and media in a well-planned and scheduled manner; and
> 6. Arrange the necessary equipment for the media.

simple, straightforward tasks.

2. **Ranked ordered steps.** This is an extension of the simple steps format. It works better for tasks that require additional detail or sub-steps within each primary step.

Expanded Example with Sub-Steps from Malaysia's Guidelines for Media Management Center (MMC) on Disaster/Crisis Section 6. Early Response of MMC (Expanded sub-sections not part of Malaysia's SOP, added for example)

Duties of the MMC Officer immediately after reporting to Diaster Operations Commander (DOC) are to:

1. Set up and operate MMC:
   a. Locate building where the MMC will be located;
   b. Locate and place 3 tables, 1 podium, 15 chairs, 2 desks in the MMC;
   c. Position MMC computer on one desk and ensure there is internet capability;
   d. Set up projector to display graphics for media presentation;
   e. Locate sound system and ensure microphones are on and operational; and
   f. Prepare blank media pass before opening the MMC so they can be rapidly completed as the press arrives.
2. Place directional signs and sign post of MMC at a strategic location at the disaster site for the local and international mass media:
   a. There are 5 directional signs. Place these at different locations within the disaster site;
   b. Place the large MMC sign at the entrance to the MMC; and
   c. Inform various officials and emergency personnel of the location of the MMC in case they are asked for comments or location of MMC.
3. Request all the local and international media to register and provide them with the pass for access to MMC:
   a. Place a table by the entrance of the MMC and ensure it is staffed at all time;
   b. Prepare a register sheet with entries for name, news affiliation, local address, cell phone number, and email address and ensure every media representative completes all sections; and
   c. After registering, provide each media representative a pass with their names, news affiliation, and picture (if possible) on it.

4. Obtain the necessary information on the disaster from DOC for dissemination to the media. DOC must sign the information document before disseminating it;
   a. Coordinate with DOC in person if possible or via cell phone if cannot coordinate in person;
   b. After reaching agreement on the information to disseminate, type the information to be release, print a copy, and have DOC review and sign it; and
   c. Once the signed information document is completed, make copies and distribute it to the media.
5. Arrange the interview briefing or visit of the relevant government officials/leaders and media in a well-planned and scheduled manner:
   a. Coordinate with the DOC and obtain approval for the list of government officials/leaders who will provide interviews;
   b. Coordinat schedule of approved speakers with the individual speakers to ensure their availability; Provide schedule to the media;
   c. Attempt to schedule at least on interview every hour to maintain a constant flow of information to the media; and
   d. Ten minutes before each interview, remind speakers of time and place, and remind media representatives of the upcoming interviews.
6. Arrange the necessary equipment for the media:
   a. Print media will usually need a place to prepare their reports and then a method to send them and
   b. Video media will need a place to conduct interviewss or to film their segments. Ensure the appearance of this is good and well-lit.

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3. **Graphic flow chart.** This is a graphical 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 reminderat the job site is useful.

Example: Malaysia's Flowchart for Issuance and Dissemination of Tropical Cyclone Advisory/Warning
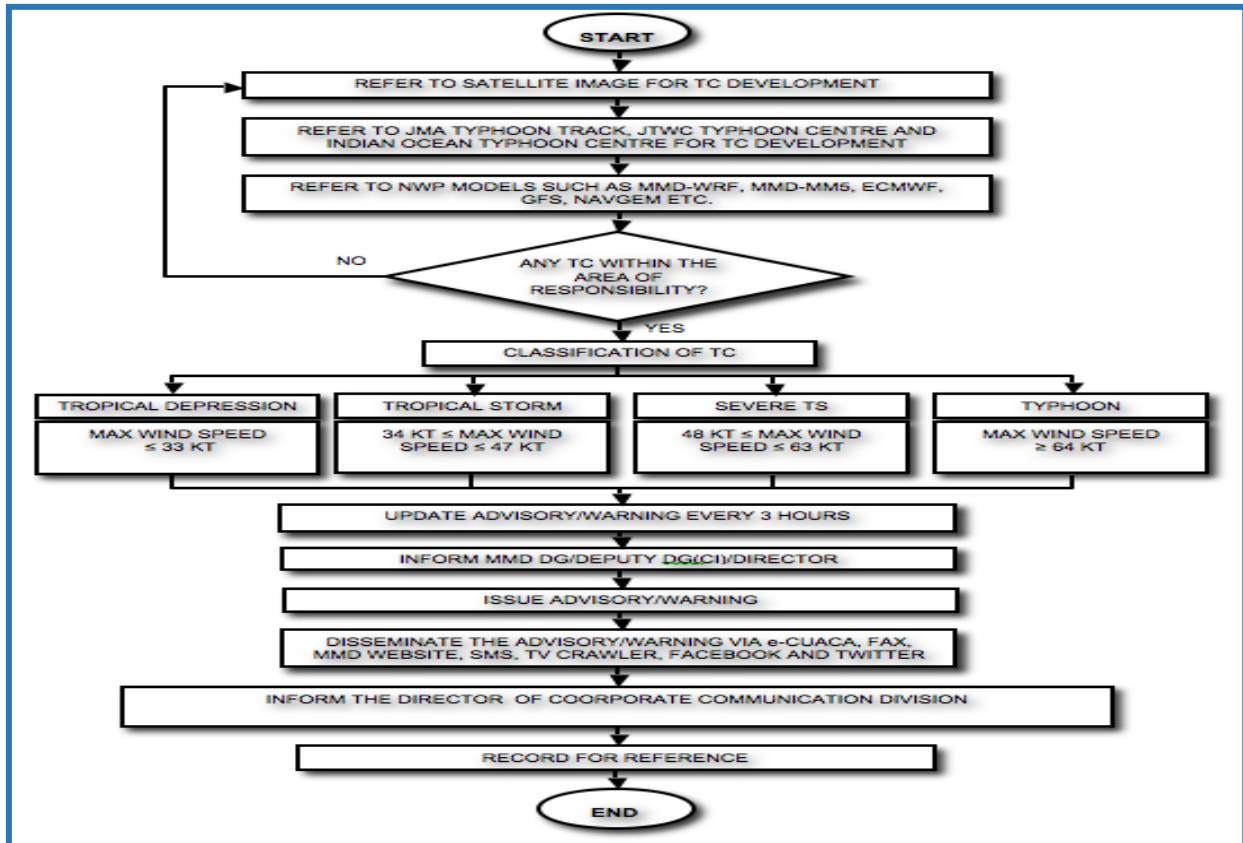
Example: Shanghai Meteorological Service Flowchart for Fast Track Mechanism Used During Emergencies.
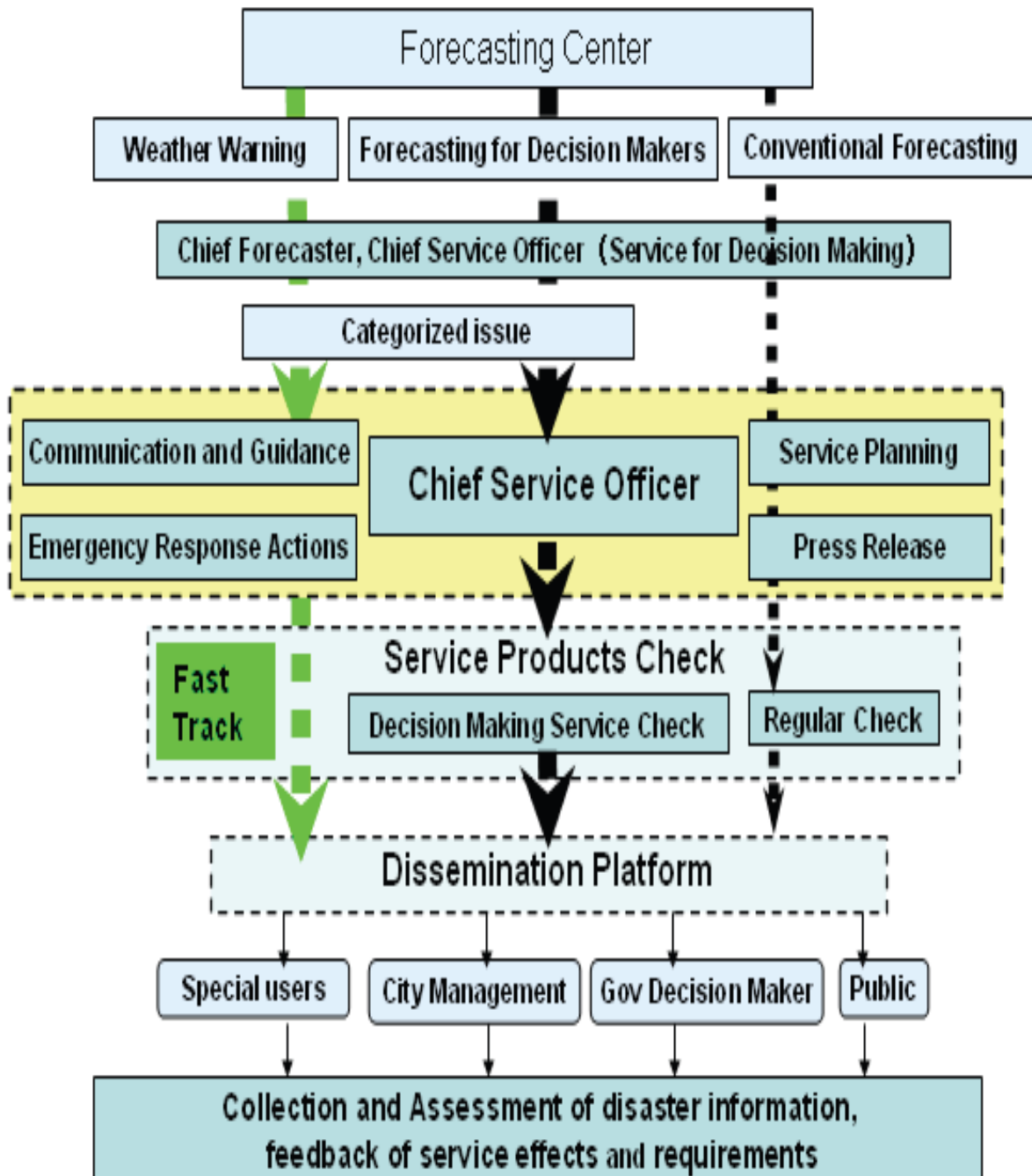
4. **Annotated Pictures.** This format works well in complex processes or where a language barrier may exist. Because, pictures can dramatically reduce the need for written explanations, this format helps to shorten complex and detailed SOPs. SOP pictures can make excellent work site reminders. For example, 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 can be very useful.

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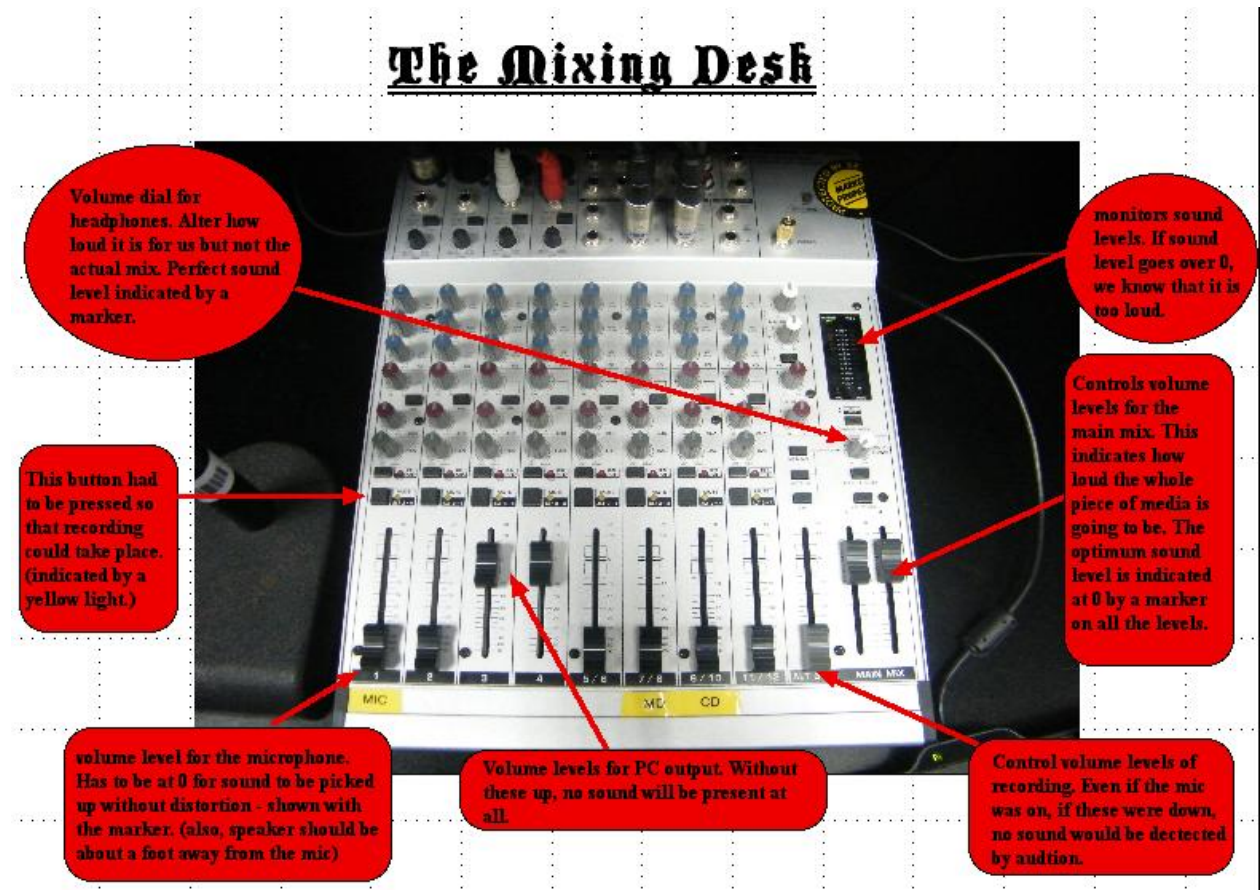
4. **Branching flowchart.** This format makes complex SOPs, especially those with a number of decisions that affect subsequent steps, easier to follow. Boxes within the flow chart can also be expanded to include checklists or sub steps.

Example: Consultation on Proposed Building Impacts on Species/Critical Habitat
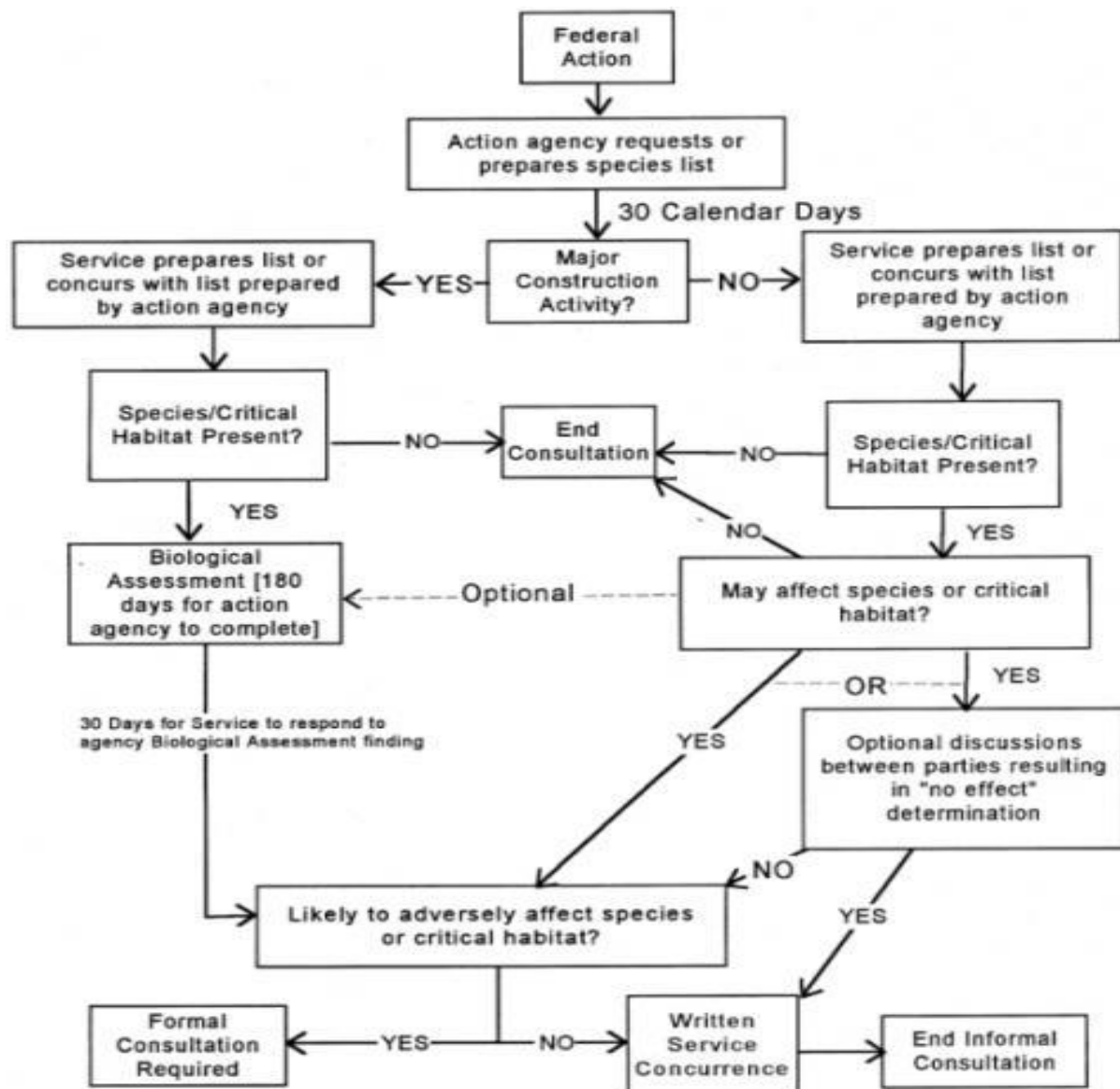
SOP Development and General SOP Format

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.

Time-line Concept: Most SOPs should follow a time-line concept, so tasks are in chronological order of how they are to be performed. If multiple tasks must be performed at the same time, a multi-column ranked order step SOP can be used with the parallel columns describing the different steps which need to be taken in conjunction with each other. Another useful approach is to use a flow chart with a varying time at the top and different flow chart lines to depict the various task to be completed at the same or different times.

NOTE: Not every item listed below needs to be included in every SOP. Each should be considered, but only include those that are needed to avoid making the SOP too long and cumbersome.

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;
2. An 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; and
3. 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; and
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 cannot 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; and
    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 (QC) and Quality Assurance (QA) 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.

MODULE EIGHT: REVIEW, TESTING, APPROVAL AND IMPLEMENTATION OF NEW SOPS

Review and Testing

SOPs should be reviewed by someonewho has the appropriate training and experience with the process. The reviewer submits their comments to the author of the SOP, who is responsible for incorporating comments into a revised version.Then as part of thevalidation process, the draft SOP should be tested by a person other than the original writer to ensure it performs as expected. It may be useful to have a person not familiar with the work to follow the steps of the SOP. The person should test the SOP by performing each step exactly as it is described. Any steps that cause confusion or hesitation for the test worker should be revised.

Approval

The reviewed and revised SOP should be approved as described in the agency'sprocedures or in its own SOP for preparation of SOPs. Generally the immediate supervisor, section or branch chief, and a person who knows the agency's SOP process review and approve each SOP. Signature approval indicates that an SOP has been both reviewed and approved by management.

Distribution and Implementation

Each agency should have an established process of how this is done. Often there is an SOP explaining the process. It is important to consider how the people who will use the SOP are made aware of it, that they understand it, and are capable of carrying out the SOP. Thus whether an SOP or some other document is used to distribute and implement a developed SOP, it should include the specific process to be used and documentation needed for the process. The distribution and implementation documentation should include the implementation date, a statement that says that after the implementation date these procedures are mandatory, instructions that these procedures must be followed with little interpretation to maintain the same high quality of service regardless of who is performing the task, and any training needed/required.

Implementation may involve training or retraining everyone to follow the procedure exactly. If training is not provided, individuals will interpret the meaning of procedures in different ways, leading to inconsistency in work routines and performance.The trainer can explain and demonstrate both why and how each step in the SOP is performed and then give the learner a chance to practice. The trainer can also share the reasons why procedures must be performed correctly, not just what to do or how to do it. People are much more likely to follow procedures exactly when they understand why they are important. In addition, sharing "why" demonstrates that you care about the worker and helps develop the worker's job knowledge.

Documenting Reviews or Training

AnSOP signature log for the people who will be using the SOP can be created which is kept either as a hard copy or on an electronic database. Some agencies have an online system which lists and logs SOPs, SOP users and alerts when SOPs are due to be reviewed, etc.

Follow-up

A process should be in place on how individuals can communicate back on how well the SOPs are functioning and when changes may need to be made to update the SOPs as requirements change. In addition, several months following the SOP implementation, a review should be conducted to ensure people understand the SOP and are following it. If discrepancies are found, the SOP may need to be revised.

PART IV: TOWARDS AN EFFECTIVE AND SUSTAINABLE PROCESS OF IMPROVEMENT

MODULE NINE: FRAMEWORK FOR SUSTAINING AN IMPROVEMENT PROCESS OF SOPS, INCLUDING SUBSEQUENT REVIEW AND UPDATING

Once an SOP is developed, reviewed, and implemented, the process is still not complete. The SOPs must be reviewed and updated because conditions change, new equipment is acquired, new research shows better ways to prepare and transmit warnings, and many other things. Therefore the SOP process should be a continuous one with the goal to improve the service to the early warning system. Such a process is preferably conducted within the context of strategic planning and management of EWS with brief information about such a framework and technical guidance as presented in the following sections.

Key Factors for an Effective and Sustainable Process of Improvement

In order to ensure effectiveness and sustainability of the process of improvement, it is necessary to ensure commitment of top leadership and participation of all key stakeholders in accordance with the usual practice of strategic planning and management. For such a process, key factors of a strategic planning and management of the process are expected to include the following:

- Commitment of top leadership to integrating EWS into the socio-economic development;
- Translation of the commitment into a shared vision for all key stakeholders;
- Establishment of performance indicators to ensure effective implementation and an appropriate system of accountability; and
- Development of an effective program of support for the implementation.

Scheduled Regular Review

SOPs should be systematically reviewed on a periodic basis, e.g., every 1-2 years, to ensure that the policies and procedures remain current and appropriate, or to determine whether the SOPs are even needed. The review date should be added to each SOP that has been reviewed. If an SOP describes a process that is no longer followed, it should be withdrawn from the current file and archived. The review process should not be overly cumbersome to encourage timely review. The frequency of review and the individual(s) responsible for the review should be indicated by management in the organization's SOP Plan. In addition, whenever procedures are changed, SOPs should be updated and re-approved.

Evaluation of Service

Each country's National Meteorological and Hydrological Service (NMHS) can use a variety of methods to assess its service after hazardous weather events.

1. One of these can be a formal national service assessment, which is an evaluation of the NMHS performance, in the form of a report, generated by a service assessment team. A national service assessment follows a significant hydro-meteorological, oceanographic, or geological event that results in warning(s) and/or other operational activities by the

NMHS. The report serves as an evaluative tool to: (a) identify and share best practices in operations and procedures; (b) identify and recommend service enhancements; (c) identify and address service deficiencies; and (d) identify SOPs which need to be modified, added, or coordinated. Regional service assessments are similar to national service assessments, but are conducted for hazardous events at a lower threshold and are intended to be completed in a shorter period of time.

2. After-Action Reviews (AAR) are less formal and canbe performed to determine what happened, what went well, and what can be improved. Information collected during AARs may be used by decision makers to determine:

   - What happened? Consider the entire event from the initial outlook through support to recovery efforts;
   - Significant events and decision points in timeline;
   - What went well? Start with the positives. Pick several things that you thought went well;
   - What can we improve?Identify those things that you thought could be improved; and
   - Address key areas such as communications, resource management, equipment, meteorological knowledge, and operations of the equipment.

3. When possible the warning offices should hold after actions meeting with disaster management, media, government officials, and general public to determine the effectiveness of their services and any recommendations they have to improve operation.

4. It is suggested that the warning offices also hold internal meetings of their own personnel to get their insights and ideas on how they performed, what went well, what should be improved, and suggested methods for improvement.

Use of Service Assessments, After-Action Reports, and After-Action Meetings for Significant Events

The information learned during these assessments, after-action reports and meetings, and internal meetings should be used to evaluate the SOPs. Identified SOPs and needs should be discussed and the SOPs should be updated as needed.

Summary of Changes / Revision History

The revision number and date of the change should be inserted after each modification. If desired, modify only the pertinent section of an SOP and indicate the change date/revision number for that section in the Table of Contents and the document control notation.

Include a table that lists the version number of the SOP, the approval date, a description of the changes, and the author of each set of changes. An effective date for the changes should be included somewhere in the document.The Revision History table needs to be updated each time the procedure is updated and approved. Each approved revision should be a major version revision, taking the document from version 1.0 to 2.0.

MODULE TEN: EDUCATION AND TRAINING

WMO's Disaster Risk Reduction Program in collaboration with others identified 10 common principles for successful early warning systems. The ninth item identified in these common principles was "Regular training and education programs in risk awareness and emergency response actions." This reflects the importance of regular training, education, and exercises in ensuring an early warning system works effectively and efficiently when needed. SOPs can play a very important role in this area. An SOP can contain the process, timeline, and methods to ensure these aspects are completed and can describe how to develop and execute an exercise or drill. In addition, through exercises and public education and training deficiencies in the current SOPs may be identified and improvements made.

Two types of training, education, and exercisesare discussed here. These include training for:

1. Personnel directly involved in the early warning system and
2. Personnel who receive the EWS information and must take actions (such as the public, farmers, fishermen, shipping companies, etc.).

Education, Training, and Exercises for EWS Personnel

If warning and related SOPs are only used during emergencies, there is a high probability that they will fail when needed. Continually educating, training, and exercising is the key to ensure when the procedures are needed, the tasks will be completed correctly and efficiently.

New People to the Organization

New people to the unit or organization or returning people who have not been there for a long time should receive extensive education on the agency's mission and how it fits into the overall EWS. Then they will understand their roles and responsibilities better and how critical their role is to the entire EWS. Then their education and training should be focused on their operational duties and a thorough review of the SOPs they are expected to use. Part of this training should be testing and exercising them in different simulated situations to ensure they understand what to do and how they can do it. This initial training is very critical to the success of the unit's mission, because at some point these new people are going to be responsible for issuing warnings and providing important services, and the agency will demand that be done correctly.

Recurring Training Prior to Start of a Specific Season

People who have been in the agency for a while, will also need training and exercises to maintain their proficiency. If there are distinct tropical cyclone, monsoon, and/or heavy rain seasons, then prior to these seasons, training or an exercise or both should be conducted to review the procedures and to ensure the SOPs are current and accurate. This improves effectiveness and efficiency before an emergency or severe weather occurs. Appendix VIII, Example 1, contains an example of an SOP which addresses this training and preparation.

Recurring Training on Seldom Used SOPs

Some SOPs, for example a fire in a facility or similar type SOPs, are seldom used in real operations. Therefore, an unannounced test or exercise should be conducted yearly on these SOPs to ensure they are accurate and that the people know how to perform the assigned tasks.

Education, Training, and Exercises for Public

The documented public safety benefit of an early warning system is response readiness. With appropriate training and preparedness, the public will learn to take various protective measures to reduce the risk of injury and minimize damage. Thus it is very important to provide training and educationto and conduct exercises with the public so they will interpret the EWS information correctly and take the appropriate actions to save their lives or property.

MODULE ELEVEN: LOCAL COMMUNITIES

Involvement of Local Communities in EWS and SOP Development

WMO's Disaster Risk Reduction Program in collaboration with others identified 10 commonprinciples for successful early warning systems. The second item identified in those common principles was "Effective EWSs are built upon four components: (i) hazard detection, monitoring and forecasting; (ii) analyzing risks and incorporation of risk information in emergency planning and warnings; (iii) disseminating timely and "authoritative" warnings; and (iv) community planning and preparedness." Thus an effective EWS must involve the local community in the planning aspects and also in ensuring the local community is adequately prepared for natural hazards.   Again, SOPs can play a very important role in this area. Before applicable SOPs are developed and implemented, there should be coordination and an understanding of the local community needs, so when they receive EWS information they will act upon it. This greatly increases the effectiveness of the EWS and leads to saving of lives at the local level.   However this is not an easy and quick task. It takes a lot of effort to work with the many various local communities and different communities require different things. But it is necessary to do so in order to have an effective EWS which reaches down to the local communities and "last mile."

There are many good references related to local communities, early warning system, and community-based early warning systems. A few of these are listed at the end of this Module. The following is a brief compilation of some general ideas involving local communities.

Early warning systems are absolutely necessary and recognized as such by every country. However in many cases, these early warning systems do notexist, are ineffective, or do not adequate serve thelocal community levels. People-centered, community-based early warning systems helpcommunities to prepare for and survive destructive natural hazards.   By involving the local communities in all phases of planning for SOPs, weaknesses in dissemination, warning content and wording, vulnerable populations, and knowledge of appropriate actions to take can be addressed in advance and not as the emergency evolves (which is often too late).   Therefore, public awareness, education, and involvement are critical.

Four Areas/Processes of People-Centered Early Warning Systems

At the "People-Centered Early Warning Systems" Session held at the World Conference on Disaster Reduction, in January 2005, in Kobe Japan,the following four core areas/processes of people-centered early warning systems were defined.   As you can see, the local communities must play a major role in each of these areas/processes.

Incorporation of a Combination of 'Bottom-up' and 'Top-down' Elements.

Associated with the "bottom-up" approach, it is essential to identify needs, patterns of vulnerability and to develop the legitimacy required to ensure that warnings are acted upon.

Involvement of Local Communities in the Early Warning Process.

Data collection by local people using readily available technologies can provide information which is of critical use for the early warning system. Simple technologies, such as rainfall and river gauges combined with equally simple rules of thumb can often enable communities

to monitor threats and provide effective warnings. However, a certain amount of caution and discretion should be exercised when using these data based upon a knowledge of the training of the persons taking the observation, the calibration of the instrument used, and the appropriate positioning of the instrument.

Multi-hazard Approach.

In the Pacific and other places, low power FM radio systems were initially developed to provide warnings, especially related to tropical cyclones. However, they soon evolved to serve basic communication functions. Thus the radios are used daily and have become important to the local communities. As a result, they are well maintained and available when warnings are needed. Low power FM radios used to receive warnings are cheap, highly reliable, and excellent at ensuring the "last mile" connectivity required. During a severe weather event when televisions, mobile phones, landline phones, Internet and other communications systems fail, battery powdered radios can continue to function.

Building Awareness into the Structure of Communities.

Without awareness people will not respond and risk cannot be reduced. Education – particularly if it can be promoted as a core part of the curriculum in schools – training, and a wide variety of outreach activities can serve this purpose.

Reasons for Taking Actions

Hazard awareness and education ofthe public do not lead directly to people doing the appropriate actions at the appropriate times. Researchers have found that people take action only when they:

- Know what specific actions can be taken to reduce their risks;
- Are convinced that these actions will be effective;
- Believe in their own ability to carry out the tasks;
- Want validation from many sources (for example,friends, experts, public authorities, respected community leaders, radio, television and web sites) before they act; and
- Think others are doing it.

Findings of Post-Typhoon Haiyan (Yolanda) Expert Mission to the Philippines

WMO, UN ESCAP, and the ESCAP/WMO Typhoon Committee Post-Typhoon Haiyan (Yolanda) Expert Mission to the Philippines (Manila and Tacloban) was carried out from 7 to 12 April 2014. The Mission Report identified, in terms of local communities, the following:

- A combination of possible lack of appreciation and utilization of available hazardmaps at the local level for exceptionally severe storm surge resulted in evacuation to unsafe shelters that were destroyed;
- Unfamiliarity of the term "storm surge", lack of short knowledge of past storm surge events, and past experiences in which TC warnings were issued but nothing occurred, led to people being unaware or underestimating the large risk and severity of the typhoon and the resulting storm surge event;
- Inconsistency in effective leadership and coordination at the local level may have led to inadequate response;
- The non-existence of an organized body of community-based volunteers to establish he link between the local government units and fishermen and other communities, in the last milewarning dissemination, prevented the warnings from reaching the addressees insome areas affected by Haiyan;

- The heavy emphasis on using electronic means to disseminate emergency warnings left out large number of people who do not have access to the Internet or mobilephones. There is an overwhelming need to look at low-tech solutions to reach these people;
- There is no evidence of any stakeholder in the chain of communications makingspecial effort to reach the most vulnerable groups – women, children, people with disabilities and elderly. These groups need to be targeted through different channelsof communications then radio and TV and with specialized TV messages; and
- There is no concentrated effort on behalf of the agencies issuing the signal toeducate the end-users of what the warnings mean and how to react if the warning isissued.

Special attention should be paid to the item on community-based volunteers. In the pilot

Community-based Volunteers

Despite the good performance of the dissemination of the warnings, it seems that it failed between the Local Government Units and some communities, including fishermen and rural communities. According to explanations given by PAGASA, the mode of dissemination is done using telephone/fax/SMS; media (radio, TV and newspapers); website/e-mail alerts; social media (Facebook, Twitter); mobile Apps; signs; billboards; bells and drums (in indigenous communities). Nevertheless it seems that these means are not fully efficient at the last-mile of the process.

One way of trying to solve this gap could be to continue, intensify and expand to all over the country the actions already taken in the province of Cebu, Philippines, which consisted of training 940 community-based volunteers from the municipalities of Borbon, Sogod, Carmen, Catmon and Moalboa, in the aftermath of Washi/Sendong and the 6.9 magnitude earthquake in Negros.

mission to Bangladesh, they proudly emphasized their large community-based volunteer system. The following taken from the Post-Typhoon Haiyan Report describes this system.

Other things to be considered for adding to this section:

- Explanation of Why Actions are Necessary for Different Hazards
- Identify and Document Procedures for Communities
- Dissemination Down to Last Kilometer/Mile

References

1. Guidelines on Early Warning Systems and Application of Nowcasting and Warning Operations PWS-21 WMO/TD No. 1559. Lead Authors: Elliot

Jacks, Jim Davidson, H.G. Wai (Contributions by: Charles Dupuy, Vlasta Tutis and Kevin Scharfenberg) World Meteorological Organization, 2010.

2. Symposium on Multi-Hazard Early Warning Systems for Integrated Disaster Risk Management, Session V: Integration of Risk Information and Early Warnings in Emergency, Preparedness, Planning and Response, Horst Letz. Geneva, 23-24 May 2006, World Meteorological Organisation and International Federation of the Red Cross and Red Crescent Societies.

3. WMO, Disaster Risk Reduction Programme Multi-Hazard Early Warning Systems (MHEWS) website: http://www.wmo.int/pages/prog/drr/projects/Thematic/MHEWS/MHEWS_en.html

4. "Institutional Partnerships in Multi-Hazard Early Warning Systems: A compilation of Seven National Good Practices and Guiding Principles," Springer Verlag, Golnaraghi, M. (Ed.) (2012)

5. Public Awareness and Public Education for Disaster Risk Reduction: A Guide International Federation of Red Cross and Red Crescent Societies, Geneva, 2011.

6. Four Elements of People-Centered Early Warning Systems, UN-ISDR/Platform for the Promotion of Early Warning Systems – A Public Entity Risk Institute Symposium, Public Entity Risk Institute (PERI), April 2005.

PART V: OPERATIONALIZING SSOPS

MODULE TWELVE: OPERATIONAL DUTY SOPS

Operationally, these are likely the most important SOPs for NMHSs because they are the detailed ones which contain the "how to do tasks" whichensure the NMHS provides a high level of service to accomplish its assigned mission. They are detailed procedures which lists the detailed steps on the best method to analyze situation; determine if a warning is needed; prepare and format warnings; issue warnings; communicate and disseminate warnings; and dictate follow-up actions. Some countries use common/similar definitions and thresholds for such things as tropical cyclone classification and open sea wind speed warnings, etc.These identified similarities can be used to create synergized SOPs. Also there are common tasks associated with different hazards which can be used to create a multi-hazard EWS.

General Common Areas for Possible Synergizing with Others

Defined Criteria

Different Stages and Levels

Frequency of Warnings/Updates

Warnings/Alerts Numbered and Time Issued

Information or Decisions on Sources of Reliable Information

Dissemination and Backup Methods

Updating Information

Social Media

Common Areas for Possible Coastal Multi-Hazard Synergizing

Coastal Hazards

Heavy Rain

High Winds

High Waves

River/Stream Flooding near coastal area

Swells

Thunderstorms (Wind, Hail, Rain)

Tropical Cyclones

Tsunami

Special Examples for selected Hazards

Tropical Cyclones – Synergized Possibilities

All of the various items listed below are not always clearly in the synergized or not synergized category. Some of these could be in both categories, but they have been grouped

where they may mostly be included. Thus parts of some may be synergized, but other parts may be very specific to the country.

Parts that could be synergized:

Preparation
1. Pre-cyclone Exercise ideas
2. Telecommunications tests
3. Publicity and Broadcast of Warnings
4. Observational Data and Organization check
5. Reference Publications and Forms review

Tropical Cyclone
1. Terminology used in the region
2. Classification of cyclonic disturbances and tropical cyclones
3. Tropical cyclone characteristics
4. Terms related to the warning and warning system
5. Meaning of terms used for international exchanges
6. Units used
7. Units used in international exchanges
8. Units used in national bulletins
9. Classification of cyclonic disturbances
10. Identification of tropical cyclones
11. Structure of the tropical cyclone (Eye, eye wall, rain/spiral bands, outer storm area, and vertical structure
12. Life cycle of a tropical cyclone (Formation, developing, maximum stage, decaying)
13. Hazards due to tropical cyclones (Winds, storm surge, high waves, heavy rain)
14. Historical Cyclones and their Impact
15. Climatology of Tropical Cyclones
16. Frequency of Disturbances
17. Location of Genesis
18. Intensification

Regional Specialized Meteorological Centers – Tropical Cyclones Products and Services
1. Bulletins issued by RSMC
2. Tropical weather outlook
3. Special Tropical weather outlook
4. Tropical cyclone advisories
5. Tropical cyclone warnings for the high seas
6. Warnings and advisories for aviation
7. Tropical cyclone warnings for national purposes
8.   Storm surge guidance
9. Graphical presentation of track and intensity

Monitoring
1. Satellite analysis
2. Synoptic analysis
3. Dvorak Fix
4. Telecommunication headings for the exchange of radar observations
5. Telecommunication headings for the exchange of other messages
6. Telecommunication headings for the exchange of tropical cyclone advisories and warnings for aviation

7. Existing GTS circuits

Prediction
1. Forecast development and movement
2. Intensity Forecasting
3. Use of Model Data
4. Cone of uncertainty
5. Rainfall Prediction
6. Storm Surge Prediction
7. Coastal inundation

Post Cyclone Action
1. Preliminary and Final Reports
2. Press Bulletin
3. Final Report Scrutiny of Action Taken
4. Visit of Officer to Cyclone Affected Areas
5. Assessment of Damage
6. Purpose of Survey
7. Annual Cyclone Review Meeting
8. Back-plotting and Re-analysis

Limited but some synergize possibilities

Early Warning System
1. Tropical Warning system
2. Staffing
3. Data and Products
4. Decision making
5. Communication and dissemination
   Procedures to be followed
   Tropical cyclone warning headings
   List of important telephone numbers and addresses connected with tropical cyclone
6. Coordination

Monitoring and Prediction
1. Surface (Land, Ocean) Based Observations
   Land (conventional, cooperative network, upper air, radar)
   Ocean (ship, buoys)
   Air (Aircraft)
   Satellite (Geostationary, polar orbiter, different wave lengths)
   Request for specials or extra
2. Observations from outside region
3. Port and Sea warnings
   Forecasts for coastal areas, fisherman, navy,
4. Content and Wording of warning
5. Tropical cyclone warnings for national purposes
6. Aviation warnings and alerts
7. Data monitoring and quality control
8. Archive of data for event

MODULE THIRTEEN: NON-OPERATIONAL, SUPPORTING SOPS

Supporting SOPs for non-operational events can be as important as those for operational warning SOPs. If there is a fire in the facility, there is a loss of power, and/or communications are lost, the personnel responsible for preparing and issuing the warnings cannot do their job properly and thus the warning process and early warning system will fail. Thus to prepare for these unusual events, SOPs should be prepared in advance so that the personnel know exactly what to do, operations can be continued (although they may be somewhat degraded), and warnings will be issued and disseminated.

Fire in the Facility – Some Possible Things to Consider

1. A fire evacuation map should be developed for each facility and then posted by the entry doors and by all fire extinguishers within the facility. The map should be a floor plan of the facility with the location of exit doors and fire extinguishers identified. Arrows should be drawn on the map through the corridors indicating the quickest exit route.
2. The staff should be trained as to the quickest exit from the building based on their room assignments.
3. The SOP in the event of a fire should cover such things as:
   a. The first to detect a fire should activate the fire alarms or if fire alarms are not available start to notify everyone;
   b. Ensure the facility manager is notified;
   c. It is the facility manager's responsibility to ensure that all personnel in the area have evacuated the building by either personally or assigning people to search all safe possible parts of the building;
   d. The facility manager should be aware of any specific needs of the people within the building to ensure they receive proper assistance to exit the building;
   e. If someone has been trained on the use of a fire extinguisher and the fire is small, the facility manager can decide to have one or two people stay to help suppress the fire while all others are evacuated;
   f. A rally point should be designated outside the building where the staff will meet. This area should be at least 100 feet from the building;
   g. A person(s) should be designated to wait for the firemen in an appropriate position outside the building to direct them to the fire; and
   h. No one should re-enter the building until an official of the fire department has granted permission. People should be positioned near entrances to ensure someone who is not aware of the fire doesn't inadvertently enter the building.

Loss of Power Considerations

A step-by-step SOP should be developed for personnel to follow in the event of loss of power. Each country and each office has different power sources and different backup systems, so the SOPs will vary. But some general considerations can be included in the SOP.

SOP Considerations:

1. The backup power source should be clearly identified. The SOP should specify whether the backup power will automatically start or must office personnel take specific actions to start the backup power.

2. If certain equipment may be affected by power surges when the backup power begins or when commercial power is restored, these should be identified and procedures should be developed to either power down this equipment or actions to take to minimize possible damage.
3. The SOP should address the situation when the backup power fails. This is often unlikely, but it does occur. If backup power fails during an emergency and procedures have not been developed before the event, the impact could be devastating.
4. If commercial power fails or backup power fails, procedures should be identified to call the appropriate technicians (along with the correct phone numbers) to repair it. Only it is absolutely safe and the personnel have been trained should the operational person attempt to investigate or repair the power failure.
5. Any other impacts from a power failure should be considered in advance, and proper procedures developed to resolve or limit these impacts.

Loss of Communications Considerations

Most countries and offices have multiple, redundant communications systems to disseminate warning information. However some communications systems only serve specific users while others serve different users. It is recommended that each communication system be evaluated to determine any impacts of outages on each specific user and then SOPs developed to provide instructions and procedures to disseminate the information in different ways.

This is extremely important because all agencies or personnel may not have access to the redundant systems and may not receive the correct information. This is especially true for people at the "last mile" in rural, remote locations and to vulnerable, dis-advantaged, disabled populations who depend on specific methods to receive warning information.

During tests and exercises, some communications systems should be disabled and the SOPs used to test their effectiveness. As it has been said many times, a perfect warning is no good if the right people do not receive it at the right time.

Backup Roles and Responsibilities Considerations

There are two types of backup roles and responsibilities. The first is if one office or location is impaired and cannot perform their mission, then another office must be prepared to assume their mission responsibilities. SOPs would be needed for the first office to know who and how to contact their backup office and separate SOPs for the backup office to know what to do to perform all necessary tasks in a backup situations. The second situation is if another office is impaired and cannot perform their mission, and the second office must perform all of the necessary tasks for the first office. Again, both offices would need SOPs - one to request the need for backup and the other to know what to do.

This can be a very complex process to develop these SOPs, but are necessary because if an office cannot perform their mission in a critical situation, a disaster of enormous magnitude is likely to result.

Office Requesting Backup.

One of the most important items for the office requesting backup is to ensure the office has multiple ways to request the backup. Because this will be an unusual situation and

circumstances, normal communications methods may not work and alternates may be needed. These should be researched and tested before any emergency and then documented in SOPs. Also the office requesting backup should have a way to keep the backup office informed of their situation, how long the outage may last, and possible arrangement for people to go to the backup office to assist during long backup periods.

Office Assuming Backup Role.

Performing a backup role takes a lot of additional work and places additional stress on the office performing the backup. To ensure this backup role can be performed, the office should develop specific SOPs and test these to evaluate whether they can perform the backup mission. There are many things to consider in backing up another office and to incorporate into the necessary SOPs. Some of the most important ones are:

1. Ensure access to the data and information required to perform the backup role. Since the backup area will be different from your normal area of coverage, some of the observations, satellite data, radar data, etc. may not normally be available to the backup office. Thus, special planning and actions will be needed to ensure these data are available when needed;
2. Ensure access to the communications and dissemination systems required to perform the backup role. Again in normal operations, the backup office may not normally have access to the communications and dissemination systems that the other office uses to perform their mission. If a perfect warning cannot be communicated or disseminated then it is useless; and
3. Ensure access to the phone numbers or contact systems for those people in the early warning system that the backup office will need to coordinate with. In any warning situations, the warning issuers, disaster management agencies, media, government officials, and decision makers will need to coordinate. Since the backup office will be performing the primary mission, they must have a way and the means to coordinate with these people.

MODULE FOURTEEN: PREPARATION OF EFFECTIVE WARNINGS/ALERTS

Module Two, Role of National Meteorological and Hydrological Services (NMHSs) in EWS, provides background material for this module in regards to effective early warning systems, partnerships, and identifying stakeholders' involvement in needs and decision-making assessments.

Manystudies and much research have been done on how the public receives, interprets, and reacts to early warning messages. These studies, research, and Post-Typhoon Haiyan Report have documented ways to avoid confusion, panic, and inappropriate actions during a potential disaster situation. Some of these are discussed below. However, each of these need to be adapted to each country's particular needs, situations, risks, and cultures to be effective.

Findings of Post-Typhoon Haiyan Expert Mission to the Philippines

The importance of preparing effective warnings which can be understood and actions taken was highly evident when Typhoon Haiyan struck the Philippines. The following are from the WMO, UN ESCAP,and the ESCAP/WMO Typhoon Committee Post-Typhoon Haiyan (Yolanda) Expert Mission to the Philippines (Manila and Tacloban), 7 - 12 April 2014 Mission Report.*Each of these need to be considered when preparing SOPs on warning preparation and wording.*

- Lack of scientific and technological capacity to translate hazard information intoimpacts meant that the impacts were underestimated.
- Warnings were not communicated in layman's language and in such a way as totrigger life-saving actions, for example quantifying the height of the storm surge withtangible reference points such as the height of known landmarks or buildings, thespeed of the surge and the extent of the inundation.
- The information on the storm surge is vital for the safety of the people in the coastalarea. It should be more easily understandable information specifying potentialaffected areas, expected inundation heights or storm tides, and the occurrence time.The graphical information is preferable for people to understand disaster crisis bystorm surges clearly.
- Unfamiliarity of the term "storm surge", lack of memory/knowledge of past stormsurge events, the past experiences of not having been affected by TCs in spite of TCwarnings, led to people being caught unawares of or underestimated the extent of therisk and severity of the impact of the typhoon and the resulting storm surge event.
- The non-existence of an organized body of community-based volunteers to establishthe link between the Local Government Units (LGUs) and fishermen and other communities, in the last milewarning dissemination, prevented the warnings from reaching the addressees insome areas affected by Haiyan.
- Lack of understanding the warnings by the public due to the use of scientific jargon,vague language failing to communicate the severity and urgency in the warnings mayhave led to inadequate response by the public. In addition, cultural habits and beliefsmay have contributed to non-action on the part of the recipients.
- The warnings should be stated in a manner that for whom the warnings are intendedto urge the people at risk, to take necessary actions effectively. The nationwideinformation may be used to raise the attention of the entire nation but might be shortof this objective.
- Lack of engagement of social sciences to understand behaviors and decision makingprocesses of the population has a role in lack of proper response.

To ensure a continuous improvement process, the warning content and format and dissemination processes should be reviewed following each event and corrective actions taken as necessary to improve the process. As discussed in Modules 9 and 10, the warning procedures and dissemination process should reviewed often through regular exercises to ensure the EWS process is working and the people understand and take the appropriate actions. In addition, training should be conducted to instruct the people about the various hazards, risks, and threats; that they understand the seriousness of these threats; and that they understand the importance of understanding warning messages.

Effective Communications

For the preparation of effective warnings/alerts, vertical and horizontal communication and coordination between those involved in the early warning process is 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.' She/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:*

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 good early warning message must contain the following six 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.

Color Coded Warnings and Alerts

Many countries use color codes for different warning levels and response actions levels.

1. The Shanghai Meteorological Bureau (SMB) of the China Meteorological Administration (CMA) uses the following system.

<table>
<tr><td colspan="2" align="center">Warning Leveland corresponding Response ActionsLevel</td></tr>
<tr><td>Warning level</td><td align="center">Response Action Levels</td></tr>
<tr><td>Blue</td><td>Municipal emergency headquarters arranges the whole resources for emergency to deal with the event under the lead and command of municipal government, and takes charge of information reporting.</td></tr>
<tr><td>Yellow</td><td>Municipal emergency headquarters takes responsibility to manage the emergency response, and asks for support of the municipal government if it necessary.</td></tr>
<tr><td>Orange</td><td>The related agencies take charge of disposal for hazard event. They need to take action to prevent and control the extension and ask for supports from municipal emergency headquarters if needed.</td></tr>
<tr><td>Red</td><td>The Basic Grid Units (BGU) takes charge of the emergency disposal of light hazard; the public takes suitable defensive action based on the actual need, and ask for help from related agencies according to the BGU mechanism.</td></tr>
</table>

Taking blue warning signal of typhoon as an example, when the meteorological conditions reach the specific standards, the blue warning signal of typhoon will be issued by the Meteorological Service. The standards are as follows: If the tropical cyclone may affect within 24 hours or has already affected, the coastal or land surface wind speed is between 10.8m/s and 13.8m/s or gust speed between 17.2m/s and 20.7m/s, and it is likely to last for some time. As soon as the Shanghai Water Affairs Office receives the blue warning signal of typhoon provided by SMB, the blue warning signal of flood and typhoon prevention will be issued by Shanghai Water Affairs Office immediately.

2. The United States National Hurricane Center (RSMC Miami) has introduced an experimental color coded graphical product, Potential Storm Surge Flooding Map, that will clearly and concisely depict the risk associated with the storm surge hazard from a tropical cyclone. It was developed over the course of several years in consultation with social scientists, emergency managers, broadcast meteorologists, and others, this map shows:
- Geographical areas where inundation from storm surge could occur and
- How high above ground the water could reach in those areas.

Specifically, areas of possible storm surge flooding for a given storm are represented in different colors on the map based on water level:
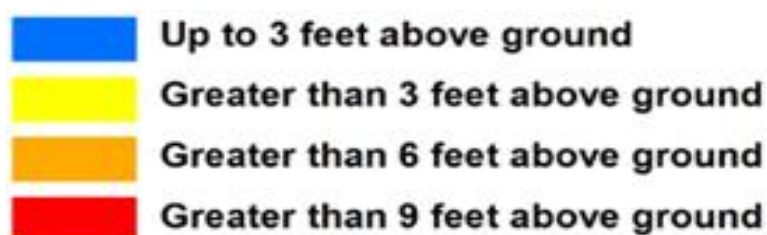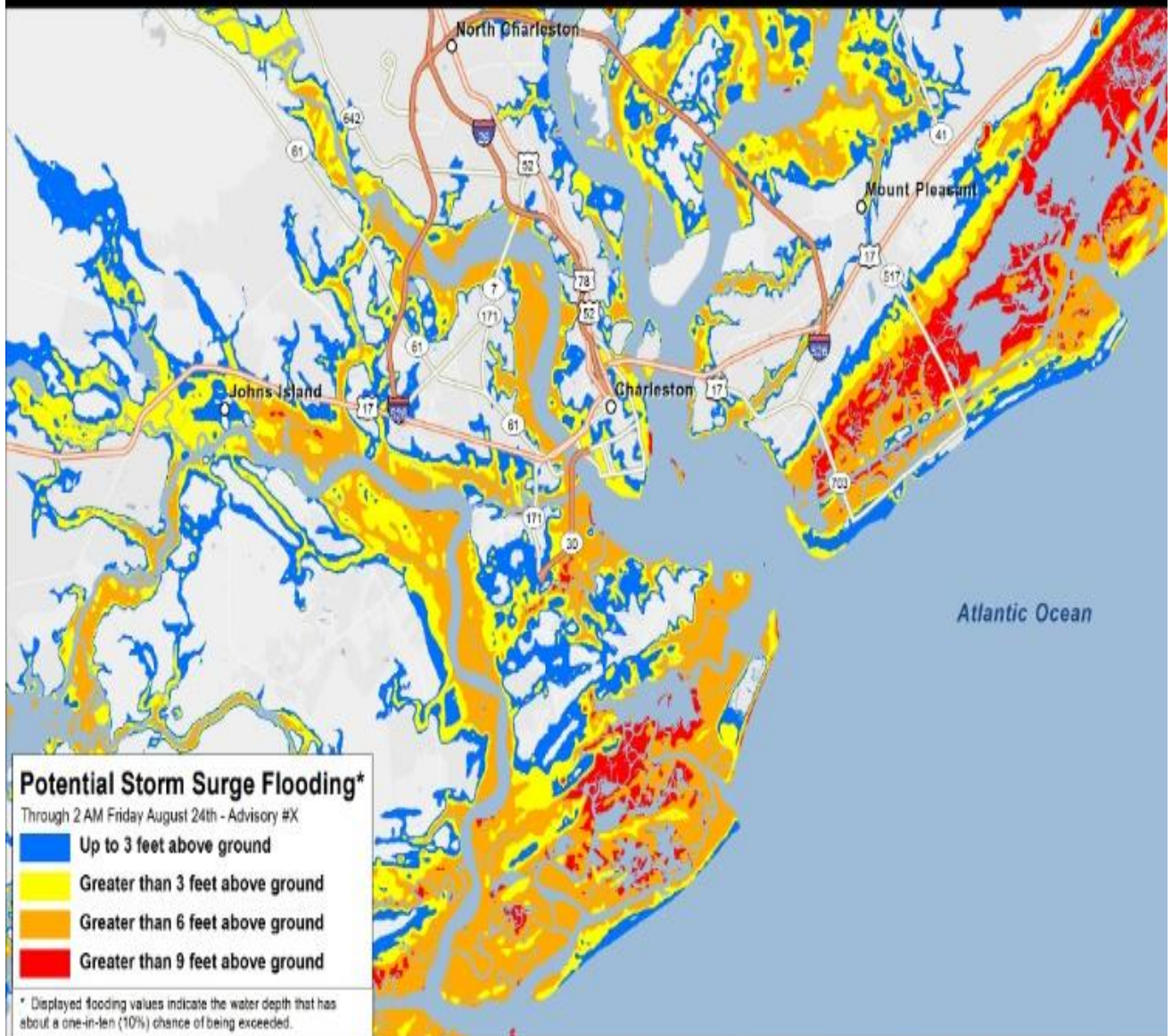
Up to 3 feet above ground
Greater than 3 feet above ground
Greater than 6 feet above ground
Greater than 9 feet above ground

Graphical Warnings

(to be added)

APPENDIX I: QUICK REFERENCE GUIDE

Part 1: Technical Background

1. Module One - Early Warning System Overview

Four Elements of a People-Centered Early Warning System

The four elements of a people-centered early warning systems are:

1. Analyses of risks/risk knowledge;
2. Monitoring and warning service;
3. Dissemination and communication; and
4. Response capability.

The minimum requirements for an effective early warning system are:

- Commitment of high-level government policy makers;
- Legal and legislative framework identifying roles and responsibilities; and
- Made an integral part at all levels of government: national, state, district and community.

Community Early Warning Systems: Guiding Principles

The International Federation of Red Cross and Red Crescent Societies (IFRC) in Geneva published an important document entitled "Community Early Warning Systems: Guiding Principles" in 2012. In this paper, the IFRC identified 13 "Cross-Cutting" Guiding Principles and 13 "Community Level" Guiding Principles. These 26 principles provide excellent guidance within the framework of this project, especially in the areas of synergism and multi-hazard approaches and things to emphasize in EWS SOPs.

2. Module Two –Role of National Meteorological and Hydrological Services (NMHSs) inEWS

Four Areas in which NMHSs Play a Critical Role

NMHSs play a critical role in early warning system because of the extensive social and economic impacts from weather-related naturalhazards. Most of this critical role can be summarized into four categories:

- Play an active role in risk identification and reduction;
- Stimulate those at risk to take action to avoid loss of life or property through warnings;
- Commit to integrated partnership cooperation and information exchange from national to local levels; and
- Identify the needs of a wide variety of stakeholders for decision-making information and tailor services to meet these needs.

Involvement of Stakeholders

Involving stakeholders in developing and enhancing the end-to-end-to-end severe weather warning system can provide excellent benefits, such as:

a. Improved presentation, structure, and wording of the warnings themselves;
b. Increased effectivenessof communicating risks and actions to take;
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.

Part II: Strategic Framework of SSOP

3. Module Three - Role of SOPs in an Early Warning System

Vital Role of SOPs in EWS

SOPs are important because they are developed before an emergency;they indicate the most efficient and effective ways to perform an operation; and they help produce predictable, reproducible results while maintaining the quality and consistency of service. All agencies can use SOPs to ensure consistent delivery of services and products to partner agencies and to the public.

High-Level Policy Documents

Many countries have high-level policy documents. These documents clearly define the roles and responsibilities of citizens, public representatives, ministries, agencies, and non-governmental organizations. They often specify who, when, where, and why. But sometimes the agencies assigned a responsibility has not developed the "how to do it" for each hazard and each step within the components of a people-centered EWS.

Development of SOPs

Coordination, collaboration, support, and assistance are needed both horizontally with other agencies at the same level of government, but also vertically to involve all levels of government and citizens. SOPs can help to ensure the most effective, efficiency steps are taken during a natural disaster emergency to provide the highest level of quality service.

4. Module Four - Coastal Multi-Hazard SOPs

Due to few, infrequent tsunami events, operational, communications, and coordination problems may develop in a country's stand-alone tsunami early warning system. Therefore, the concept was developed that an operational coastal multi-hazard early warning system could be more sustainable for a longer time.

Multi-Hazard Aspects of SOPs

Although hazards behave differently and may occur on very different time scales and effect different geographical areas, elements of most EWS for these hazards have similar requirements: processes involved in monitoring; staged warning (e.g., green, blue, yellow, red levels); coordination among agencies; and processes of issuing and disseminating warnings. If these similarities can be incorporated into the EWS, a multi-hazard approach can produce more stable levels of EWS activity throughout the year; greater efficiency of limited human and financial resources (maintenance and personnel); assist in training; and clarify sources of early warning information.

Acknowledgement of Hazards Differences

Differences in the warnings providers need to be clearly understood at the operational level and good communications need to be maintained between different warning providers. SOPs need to be well developed for the warning providers, media, and disaster managers to ensure that correct actions are taken for different hazard types and that the general public know the differences and can take appropriate actions for each.

5. Module Five - Memorandums of Understanding (MOUs)

Role of MOUs for NMHSs

MOUs can be used to ensure different agencies/organizations understand and support each other's roles and responsibilities and to know how these will be performed when needed in an integrated manner as partners.The structure and content of the MOU should be clear, simple, and unambiguous to avoid misunderstandings and should include provisions for reviewing, updating, or canceling.

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 Guidelines for Creatinga Memorandum of Understanding and aStandard OperatingProcedure between aNational Meteorologicalor Hydro-meteorologicalService and aPartner Agency, WMO-No. 1099, PWS-26, 2012 is an excellent MOU reference. It contains a template and several examples of MOUs which can be found at http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm

6. *Module Six - Agency, Multi-level Integrated SOP*

Need for Integrated SOPs

As stated above, one agency or organization cannot develop all of the needed SOPs in isolation without involving other agencies. Coordination, collaboration, support, and assistance are needed both horizontally with other agencies at the same level of government, but also vertically to involve all levels of government and citizens.

Development Process on Integrated SOPs

Most likely, a high-level policy document specifies the roles and responsibilities for various hazards, agencies and levels of government involved, the different stakeholders and their needs for different hazards, media involvement and interactions, and private sector actions. Required information must be identified first, so SOPdeveloped can deliver the needed information.

Items for Coordination and Integration

- Transmission and reception of required information at all levels and all agencies;
- Sharing of information among agencies and people who require this information;
- Release of warnings;
- Release of official information;
- Preventing conflicting information from being disseminated; and
- Dealing with the Media

Part III: Formalization of SSOP

7. *Module Seven - Writing Effective SOPs*

Purpose and Reasons to Prepare SOPs

Well-written SOPs provide direction, improve communication, reduce training time, and improve work consistency. They are developed before an emergency and indicate the most efficient and effective ways to perform an operation. NMHSs can use SOPs to ensure consistent delivery of services and products to partner agencies and to the public. They can provide a historical record of actions taken.

Definition of SOPs

An SOP is a set of steps which contains written procedures of individual, sequential tasks that need to be completed which ensures consistency and quality.

Questions to Ask Before Writing an SOP

Before preparing a SOP, it is recommended that you consider:

- What is the specific task to be accomplished and what is the expected outcome?
- Will vulnerable and special needs persons be affected and does the SOP address these impacts?
- Who will be using the SOP?
- What ways will the SOP be used?
- Who should be involved in its development of the SOP?
- How can the development of the SOP be best accomplished?

When Should You Write or Rewrite an SOP

Write or rewrite SOPs when new equipment or procedures are introduced, none currently exist, and when reviews show there are ways to improve the process. New SOPs should be written for all tasks or jobs before they begin and then tested before putting them into final form.

For Whom Should You Write an SOP

- Write the SOP for the persons who will perform the task.
- Consider such factors as the age, education, knowledge, skills, and experience of people.
- SOPs are needed at all levels,high-level SOPs agreed to by different agencies and individual, detailed SOPs for each agency.

Who should write SOPs

- SOPs should be developed and reviewed by several people qualified to determine their completeness and clarity of safety, environmental and operational components.
- Team-development helps ensure different perspectives, likelihood of acceptance, more people to provide training, and provides a group to revise as necessary.
- When SOPs need to be revise, the group(s) or individual(s) who originally prepared and reviewed them should then be requested to revise them.

Consolidated List of Tips to Consider When Writing SOPs

1. A good SOP should be easy to read and understand, use short sentences, and doesn't use many acronyms or abbreviations.

2. If an SOP involves a long list of steps, then it becomes difficult to understand and to perform in a timely manner. One solution is to break up the process into logical sections of about 10 steps per section, such as "Getting ready for the process," "Initial steps," "Final steps."

3. When two or more people must use a single SOP at the same time, the SOP must explain when and how each person is to perform a specific step.

4. Explain the reasons behind certain steps so that SOP users will understand and follow them.

5. Consider age, education, knowledge, skill, experience, and any physical limitations.

6. Once you have completed writing an SOP, have several trained workers test it against actual practices and give you feedback.

7. 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.

8. Review the effectiveness of SOPs after a few weeks and make necessary changes.

9. Time-line Concept.   Most SOPs should follow a time-line concept, so tasks are in chronological order. If multiple tasks must be performed at the same time, a multi-column ranked order step SOP can be used with the parallel columns describing the different steps. Another useful approach is to use a flow chart with a varying time at the top and different flow chart lines to depict the various task to be completed at the same or different times.

Different Styles of SOPs

There are many different styles or combination of styles that can be used to prepare SOPs. Five of them are listed below. Examples of each of these are in Module 7.

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

2. **Ranked ordered steps.** This is an extension of the simple steps format. It works better for tasks that require additional detail or sub-steps within each primary step.

3. **Graphic flow chart.** This is a graphical 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 in complex processes or where a language barrier may exist.   Because, pictures can dramatically reduce the need for written explanations, this format helps to shorten complex and detailed SOPs. 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 can be very useful.

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.

Figure 7.1. Standard Operating Procedure Format Choices and Criteria

Many Decisions?	More Than 10 Steps?	Best SOP Format
No	No	Simple Steps
No	Yes	Ranked Order Steps or Graphic
Yes	No	Flow Chart
Yes	Yes	Graphic or Branching Flow Chart

Development and General SOP Format

An SOP should be organized and follow a general format to ensure ease and efficiency in use. The following is a general format. Note, not every item listed below needs to be included in every SOP. Each should be considered, but only include those that are needed.

Overall.   Recommend each page each page have a "header" containing a short title, the reference number, revision number and date. A "footer" can be used for page numbering and date.

*Title Page. C*an contain a title, a reference number, date issued, and applicable agency.

*Approval/Revision Page. N*ame of organization, person(s) names who prepared it, date and approval person, implementation date, and revision history.

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

Procedural Text. The text should be clearly worded and understandable. Procedural items to consider and include:

1. Purpose, scope and applicability.

2. Task.

3. Summary of method.

4. Definitions.

5. Health and safety warnings and equipment cautions.

6. If applicable, personnel qualifications to complete the task satisfactorily

7. Equipment and supplies needed.

8. Procedures.

    a. Identifying all pertinent steps, specific order, timing sequence and times allowed, and materials needed to accomplish the procedure.

    b. Include any references to other SOPs as needed.

    c. Define terms and concepts when needed.

    d. Place health and safety warnings in prominent position.

    e. Break into logical sub-task SOPs if the procedure is too long or very complicated.

    f. Include needed checklists/forms. Can use checklists to ensure that steps are followed in order and documents completed actions.

Quality Control and Quality Assurance Section. Describe or list QC procedures and QC material that are required to successfully demonstrate performance of the method. Specific criteria should be included.

Reference Section. Related SOPs, published literature, or methods manuals should be listed and fully cited.

8. Module Eight - Review, Approval, and Implementation of New SOPs

Review, Testing, Approval, and Implementation

SOPs should be reviewed/validated by someonewho has the appropriate training and experience with the process. As part of the review, the draft SOP should be tested by a person other than the original writer to ensure it performs as expected. The reviewed and revised SOP should be approved as described in the agency'sprocedures or in its own SOP for preparation of SOPs. Each agency should have an established process of how this is done. Often there is an SOP explaining the process. Training or retraining may be needed, but will depend on the complexity of the SOP and the people who will use it.

Documenting Reviews or Training and Follow-up
AnSOP signature log for the people who will be using the SOP can be created which is kept either as a hard copy or on an electronic database. Some agencies have an online system which lists and logs SOPs. A process should be in place for individuals to comment on the

SOP as it is being used. Several months following the SOP implementation, a review can be conducted to ensure the effectiveness of the SOP.

Part IV: Towards an Effective and Sustainable Process of Improvement

9. Module Nine–Framework for Sustaining an Approval Process of SOPs, Including Subsequent Review and Updating

Once an SOP is developed, reviewed, and implemented, the process is still not complete. The SOPs must be reviewed and updated because conditions change or improved methods to prepare and transmit warnings are found.

Scheduled Regular Review

SOPs should be systematically reviewed on a periodic basis, e.g., every 1-2 years. The review date should be added to each SOP that has been reviewed.

Evaluation of Services

Each country's National Meteorological/Hydrological Service (NMHS) can use a variety of methods to assess its service after hazardous weather events.

1. A formal national service assessment can be conducted by a service assessment team to review NMHS's performance following significant hydro-meteorological, oceanographic, or geological event. This assessment can: (a) identify and share best practices in operations and procedures; (b) identify and recommend service enhancements; (c) identify and address service deficiencies; and (d) identify SOPs which need to be modified, added, or coordinated.
2. After-Action Reviews which are less formal can be performed to determine what happened, what went well, and what can be improved.
3. After-action meeting with disaster management, media, government officials, and general public can be conducted to determine the effectiveness of their services and any recommendations they have to improve operation.

4. Internal meetings of their own personnel can be held to get their insights and ideas on how they performed, what went well, what should be improved, and suggested methods for improvement.

Summary of Changes / Revision History

The revision number and date of the change should be inserted after each modification along with the approval date, a description of the changes, and the author of each set of changes

10. Module Ten - Education and Training

WMO's Disaster Risk Reduction Programme identified "Regular training and education programs in risk awareness and emergency response actions" for successful early warning systems. An SOP can contain the process, timeline, and methods to ensure these aspects are completed and can describe how to develop and execute an exercise or drill. If warning and related SOPs are only used during emergencies, there is a high probability that they will fail when needed. Continually educating, training, and exercising is the key to ensure when the procedures are needed, the tasks will be completed correctly and efficiency.

Education, Training, and Exercises for EWS Personnel

New People to the Organization. This initial training is very critical to the success of the unit's mission, because at some point these new people are going to be responsible for

issuing warnings and providing important services, and the agency will demand that be done correctly.

Recurring Training Prior to Start of a Specific Season. If there are distinct tropical cyclone, monsoon, and/or heavy rain seasons, then prior to these seasons, training or an exercise or both should be conducted to review the procedures and to ensure the SOPs are current and accurate.

Recurring Training on Seldom Used SOPs. Some SOPs (e.g., fire in a facility) are seldom used in real operations. Therefore, an unannounced test or exercise should be conducted yearly on these SOPs.

Education, Training, and Exercises for Public

With appropriate training and preparedness, the public will learn to take various protective measures to reduce the risk of injury and minimize damage.

11. Module Eleven - Local Communities

Involvement of Local Communities in EWS and SOP Development

WMO's Disaster Risk Reduction Programme in collaboration with others identified community planning and preparednessas one of the key features of an effective EWS. An effective EWS must involve the local community in the planning aspects.There is a need to coordinate and understand local community needs, so they will act upon warnings. By involving local communities, weaknesses in dissemination, warning content and wording, vulnerable populations, appropriate actions to take can be addressed in advance and not as the emergency evolves (which is often too late).

Four Areas/Processes of People-Centered Early Warning Systems

At the "People-Centered Early Warning Systems" Session held at the World Conference on Disaster Reduction, in January 2005, in Kobe Japan,the following four core areas/processes of people-centered early warning systems were defined.

- Incorporation of a Combination of 'Bottom-up' and 'Top-down' Elements.
- Involvement of Local Communities in the Early Warning Process.
- Multi-hazard Approach
- Building Awareness into the Structure of Communities.

Reasons for Taking Actions

People take actions when they:

- Know what specific actions can be taken to reduce their risks;
- Are convinced that these actions will be effective;
- Believe in their own ability to carry out the tasks;
- Want validation from many sources (for example,friends, experts, public authorities, respected community leaders, radio, television and web sites) before they act; and
- Think others are doing it.

Findings of Post-Typhoon Haiyan (Yolanda) Expert Mission to the Philippines

The WMO, UN ESCAP, and the ESCAP/WMO Typhoon Committee's Post-Typhoon Haiyan (Yolanda) Expert Mission Report identified several issues related to local communities:

- Unfamiliarity of the term "storm surge", little knowledge of past storm surge events, and past false alarms, led people to underestimating the severity of the typhoon and storm surge.

- There were no organized community-based volunteers to link the local government units and fishermen and other communitieswhich prevented warnings from reaching those affected.
- Heavy emphasis on electronic means to disseminate emergency warnings left out large number of people who do not have access to Internet or mobilephones.
- There was no evidence of any special effort to reach the most vulnerable groups – women, children, people with disabilities and elderly.
- Much more effort was needed to educate the end-users of what the warnings mean and how to react.

References Related to Community-Based EWSs

There are many good references related to local communities, early warning system, and community-based early warning systems. A few of these are listed at the end of the Module.

Part V: Operationalizing SSOPs

12. Module Twelve - Operational Duty SOPs

Items identified as needed:

Common Areas to Integrate

      Define Criteria

      Different Stages and Levels

      Frequency of Warnings/Updates

      Warnings/Alerts Numbered and Time Issued

      When Next Update Will be

Tsunami

Tropical Cyclones

Heavy Rain

High Winds

High Waves

Others

Information or Decisions on Sources of Reliable Information

Dissemination and Backup Methods

Updating Information

Social Media

13. Module Thirteen - Non-Operational, Supporting SOPs

Supporting SOPs for non-operational events, such as a fire, loss of power, and loss of communications can be as important as those for operational warning SOPs because the warning process cannot be completed.

Fire in the Facility – Some Possible Things to Consider

1. A fire evacuation map should be developed for each facility and posted, so staff can locate quickest exit.
2. The SOP in the event of a fire should cover such things as:
   a. Activation of fire alarms and notification of manager and personnel
   b. Verification that all people have been evacuated and are at a pre-determined assembly point.
   c. Consideration of any specific needs people within the building.
   d. Prevention measures to ensure no one reentries the building.

Loss of Power Considerations

A step-by-step SOP should be developed for personnel to follow in the event of loss of power. Some general SOP considerations include:

1. Identification of backup power and actions required to start it.
2. Power surges when backup power begins or commercial power is restored.
3. Actions needed if backup power fails.
4. Technicians to call to repair power outage.

Loss of Communications Considerations

Each communication system should be evaluated to determine any impacts of outages on each specific user and SOPs developed to provide procedures to disseminate the information in different ways, especially to last mile. During exercise some communications systems should be disabled to test effectiveness of SOPs.

Backup Roles and Responsibilities Considerations

There are two types of backup roles and responsibilities. The first is one office is impaired and cannot perform their mission. SOPs should specify who to contact and how. The second is the office must assume backup for another office who cannot perform their mission. SOPs are needed to specify all tasks that must be performed.

14. Module Fourteen - Preparation of Effective Warnings/Alerts

Studies and reports have documented ways to avoid confusion, panic, and inappropriate actions in warnings and alerts.

Post-Typhoon Haiyan Expert Mission to the Philippines

The importance of preparing effective warnings which can be understood and actions taken was highly evident when Typhoon Haiyan struck the Philippines. Some of the findings of an expert team are:

- Inability to translate hazard information into impacts leading to underestimated impacts.
- Warnings not in layman's language and no quantifying of storm surge height (with reference to known objects), speed of the surge, the extent of the inundation, and occurrence time.
- Use of scientific jargon, vague language of severity, and non-urgency in the warnings.
- Inadequate use of social sciences to understand behaviors and decision making processes.
- See Module 10 for additional items.

Effective Communications

For the preparation of effective warnings/alerts, vertical and horizontal communication and coordination between those involved in the early warning process is essential. Also, messages need to use a "vocabulary" that resembles that of the recipient community: language, tone, choice of meaningful words.

Message content

An effective early warning message must be in understandable language and contain the six following six 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 standardization

A balance between message standardization and the different situations for a specific warning should be achieved. However use of similar terms and location of important information within a warning need to be considered. Messages in plain language are more likely to be understood by older people, people with little education, and people with certain disabilities. Messages should be accompanied by closed captioning and sign language interpretation.

Color Coded Warnings and Alerts

Many countries use color codes for different warning levels and response actions levels. Examples of those used by the Shanghai Meteorological Bureau (SMB) of the China Meteorological Administration (blue, yellow, orange, and red) and RSMC Miami's experimental color coded graphical product, Potential Storm Surge Flooding Map (also uses blue, yellow, orange, and red) are given in Module 14.

APPENDIX II: BASIC SOP TEMPLATE

(Header - SOP Number, Brief Title, and Implementation Date)

(Name of the Agency or Organization)

Standard Operating Procedure

1. **Title:**

2. **SOP Number:**

3. **Prepared by:**   _____

4. **Approved by:**   _____   **Date:** _____

    Implementation Date: _____

5. **Revisions:1. Approved by:** _____   **Date:** _____

    2. Approved by: _____   **Date:** _____

    3.Approved by: _____   **Date:** _____

6. **Purpose, Scope and Applicability:**

7. **Task: (Overall Description)**

8. **Summary of Method: (Only needed if task is long and/or complex)**

9. **Definitions (Includes Acronyms, abbreviations, or specialized terms):**

10. **Acronyms:**

11. **Procedures:**

Thefollowingactions will beaccomplished**(when or under what circumstance):**
(The actions listed should be specific with little interpretation needed so that regardless of the person(s) doing the actions, they will be completed the same way each time.)
   1. Action 1
   2. Action 2
   3. Action 3
        a. Sub Action 3a
        b. Sub Action 3b
   4. Action 4
   5. Action 6
   6. Action 6

12. **References**
    a. Reference 1

b. Reference 2
c. Reference 3

APPENDIX III: SOP CHECKLIST

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?

- An 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?

- Are health and safety warnings placed 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 an 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 used to regularly evaluate work activity and possible improvements?

APPENDIX IV: LIST OF REFERENCES USED TO PREPARE THE SSOP MANUAL

The manual is based extensively upon the information and wording compiled from the following documents:

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. Developing Effective Standard Operating Procedures, David Grusenmeyer, Sr. Extension Associate, PRO-DAIRY, Cornell University.

3. Global Facility for Disaster Reduction and Recovery (GFDRR), 2011: Implementing Hazard Early Warning Systems, David Rogers and Vladimir Tsirkunov.

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,Water Quality Planning Bureau, WQPBDMS-001, March 22, 2004.

6. 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

7. Guide to Writing Standard Operating Procedures (SOPs), Department of Environment and Conservation, Government of Australia, 10 December 2009.

8. Guide to Writing Standard Operating Procedures, Office of Engineering Safety, Texas A&M University

9. 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, 2012

10. International Federation of Red Cross and Red Crescent Societies (IFRC), 2012: Community Early Warning Systems: Guiding Principles

11. 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.

12. Report of Multi-Hazard Early Warning and Decision Support Systems Workshop, Shanghai Meteorological Service, Shanghai, China, March 21 -23, 2012

13. Standard Operating Procedures (SOPs) – A Quick Guide, Kelly Gleason, Research, Clinfield Limited, Cambridge, Great Britain, March 10, 2013.

14. 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

15. 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.

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

17. WMO, UN ESCAP, and ESCAP/WMO Typhoon Committee Post-Typhoon Haiyan (Yolanda) Expert Missions Report to the Philippines (Manila and Tacloban), 7 – 12 April 2014

APPENDIX V: EARLY WARNING SYSTEM CHECKLIST

Checklist for Effective Early Warning System

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?

☐ Did the process include an assessment and review of the 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. Detection, 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?

☐ Do EWS 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, and 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 education 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 VI: COMMUNITY EARLY WARNING SYSTEMS:
GUIDING PRINCIPLES

The following information is based upon the International Federation of Red Cross and Red Crescent Societies (IFRC) published document entitled "Community Early Warning Systems: Guiding Principles" in 2012.

Cross-Cutting Themes: Guiding Principles

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

Setting up an 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 EWS efforts. 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 cannot 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.)

contributes considerably to the increase of people's vulnerability and to reduction of their capacity to cope with 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 International Displaced Person 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 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 crystalized 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 Risks/Risk Knowledge

Guiding principle K-1: 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 communities 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 principle K-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 an 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.

Detection, Monitoring, and 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 a 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. One way 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 interest in 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 NMHS, 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 is essential. The author may be outside a 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 understood 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 in a 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 VII: ROLE OF NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES (NMHSS) IN EWS

Much of the following information is from a Global Facility for Disaster Reduction and Recovery (GFDRR) Weather and Climate Information and Decision Support Systems (WCIDS) report entitled Implementing Hazard Early Warning Systems, GFDRR WCIDS Report 11-03, David Rogers and Vladimir Tsirkunov published in 2011.

The role of NMHSs in early warning and disaster risk management is critical since so many naturalhazards, which cause floods, heat waves, cold waves, wind storms, wildfires, droughts landslides, epidemics and the resulting social and economic losses are weather-related(ISDR 2006a) and likely to become more common due to climate change (IPCC 2007).

A systematic approach to managing the "risks" associated with disasters can prevent or mitigate their impact. The process must consider the likely effects of natural hazards and the measures by which they can be minimized.

The concept of disaster risk is used to describe the likelihood of harmful consequences arising from the interaction of natural hazards and the community. Two elements are essential in the formulation ofdisaster risk: the probability of occurrence of a hazard, and the vulnerability of the community to thathazard.

Risk = Hazard Probability x Vulnerability

A closer look at the nature of hazards and the notions of vulnerability allows for a better and morecomprehensive understanding of the challenges posed by disaster mitigation:

1. Nature of hazard - By seeking to understand hazards of the past, monitoring of the present, and prediction of the future, a community or public authority is poised tominimize the risk of a disaster. The NMHSs play a key role in this aspect of risk management of weather-related natural disasters; and,
2. Notions of Vulnerability – The community vulnerability is the susceptibility andresilience of the community and environment to natural hazards. Different population segments can be exposed to greater relative risks because of their social and economic conditions[2]. Reducing disaster vulnerability requires increasingknowledge about the likelihood, consequences, imminence and presence of natural hazards, and empowering individuals, communities and public authorities with that knowledge to lower the risk before severe weather events occur, and to respond effectively immediately afterwards.

The importance given to social and economic vulnerability as a rapidly increasing factor of risk in most of today's societies underlines the need to encourage the participation of a wide spectrum of stakeholders in hazard and risk reduction and response activities.

Stakeholders are those people or organizations who may affect, be affected by, or perceive themselves to be affected by, a decision or activity. In developing a disaster risk management system, no single agency can provide a fully comprehensive solution. It is essential that agencies work together and with stakeholders to narrow knowledge gaps and to develop disaster risk management plans using a coordinated approach (WMO 2010). Well-developed governance and institutional arrangements support the successful development and sustainability of sound early warning systems. They are the foundations upon which early warning systems are built, strengthened and maintained.

Good governance is encouraged by robust legal and regulatory frameworks and supported by long-term political commitment and effective institutional arrangements. Effective governance arrangements should encourage local decision-making and participation which are supported by broader administrative and resource capabilities at the national or regional level.

Vertical and horizontal communication and coordination between early warning stakeholders is also essential.

1. Framework of Risk Management

NMHSs play a role in:

a. 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. 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. 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 through:

a. extending the lead time of warnings;
b. improving the accuracy of warnings;
c. greater demand for probabilistic forecasts;
d. better communication and dissemination of warnings;

e. using new techniques to alert the public;

f. targeting of the warning services to relevant and specific users (right information to right people at right time and right place);

g. warning messages which are understandable and the appropriate action taken in response; and

h. 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.

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-Governmental 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. 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 NMHS 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 partners 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 EWSs, 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 good 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.

Appendix VIII

Standard Emergency Warning Signal and Its Use in Queensland

Appendix IX
SOP Examples

1. Action to be taken before the Start of Hurricane Season

_____

Central Pacific Hurricane Center, Pacific Region, USA National Weather Service Standard Operating Procedure

13. Title: Actionstobetakenbefore theHurricaneSeason

14. SOP Number: Tropical Cyclone (TC) – 1

15. Prepared by: _____

16. Approved by: _____   **Date:** _____

Implementation Date: _____

17. Revisions: 1. Approved by: _____   **Date:** _____
2. Approved by: _____   **Date:** _____
3. Approved by: _____   **Date:** _____

18. Purpose, Scope and Applicability. In accordance with NWS Directive 10-601 and to ensure effective, timely products and services during a hurricane situation, the office must prepare for these situations before the hurricane season begins. These activities must include training, testing of communications, coordination with other agencies, and exercising procedures in a test mode. This preparation is critical to ensure the office takes the correct actions to protect lives and property. This SOP applies to all forecasters and management staff in the Central Pacific Hurricane Center.

19. Acronyms:

AM/MIC	Area Manager/Meteorologist in Charge
ATCF	Automated Tropical Cyclone Forecast system
DCO	Data Collection Office
DO	Director of Operations
ESA	Electronic Systems Analyst
LMS	Learning ManagementSystem
NHOP	NationalHurricaneOperationsPlan
NWS	National Weather Service
OIC	Officialsin Charge
PL	Program Leader
SOO	Scientific and Operations Officer
WCM	Warning Coordination Officer

20. Procedures:

Thefollowingactions will beaccomplishednolaterthanMay31 eachyear:

1. Review andcritiquelatest issuancesanddraftsofNWS Directive10-60.(AM/MIC,DO,WCM,SOO,Hurricane PL).
2. Contactcriticalweatherobservers andreview instructions(WCM).
3. Check tropical cyclone related supplies(ESA).
4. Prepare,revise,and/or updateformsforforecast/advisories,publicadvisories,andlocalstatements.Establishsufficien tsuppliesofnecessaryformsin districtdeskandoverflow file(DO,WCM,and/or HurricanePL).
5. ContactEmergency Managementofficialsandreview andcoordinatewarningprocedures (AM/MICorWCM).
6. Conduct statewidehurricanedrillasapplicableincooperationwithfederal, state, county, and local agencies(WCMandHurricanePL).
7. Review NWS Directive10-601,the NHOP,andthehurricanestationdutymanual (all forecasters)
8. Review and Update ATCF and provide written notification to all forecasters of any changes (SOO).
9. Conductatleastonetrainingworkshopprovidingthelatestinformation,includingopera tionaltechniques/methods,available fortropical cyclone forecasting. Thetrainingwill emphasizetropical cyclonesimpactingthe HawaiianIslandsdirectlyorindirectly (SOO, WCM, Hurricane PL)
10. CompletetheLMSmodule "IntroductiontoTropicalMeteorology,Chapter10:TropicalCyclones". (Mandatory for new forecasters who have not previously participated in the office's hurricane program and highly suggested for all forecasters.
11. Testcommunications procedures toensureadequatecapabilities(WCMandHurricanePL).
12. Providewrittenstatementofoperationalcapabilitiesofequipment statewide per NWS Directive 10-601(ESA).
13. Issueamemorandumtothe OICsat DCOs HiloandLihuewithwrittenexercises (SOO, WCM)
14. Conduct a written drill inwhichtheyprepareadvisories,localstatements, aviationproducts,andmarineproducts forasimulatedtropicalcyclone(WCM,SOO,HurricanePL, all forecasters)
    a. Leadforecasters willproducethefollowing products in a test mode:
       WTPA2x   Forecast Advisor
       WTPA3x   PublicAdvisory
       WTPA4x   TropicalCycloneDiscussion
       WTHW80   Hurricane LocalStatement
    b. Lead forecasters and all remaining forecasters willproducethefollowing products in a test mode:
       WTHW80   LocalStatement
       FAHW31   AviationAreaForecast
       WAHW31   AIRMETsforHawaii
       WCPA3x   SIGMETforatropicalcyclone
       FTPA31   TerminalAerodromeForecast(TAF)

FZHW50/FZHW51   Coastalmarinebulletins(MarineZones/HI1)
FZHW60   Offshoremarinebulletin

c. Drillmessagesmusthavethephrase
"…THISISADRILLANDNOTFORREBROADCAST...THISISADRILL..."atthebe
ginning,middle,andendofeachmessage.
d. Alogwill be kept by the forecasters ofanyproblemsencountered or any procedures/SOPs
that need revised, created, or deleted and provided to the AM/MIC, DO, SOO, and
WCM when all forecasters have completed their review and training
e. Areport on the results of the drill will
besubmittedtotheAM/MICthroughtheDOassoonafterthedrillaspossible.
f. Acritiqueofallwrittenexercisesanddrillmaterial will
becompletedandreturnedtotheparticipants.
g. A memorandum will besent tothe Regional Director, Pacific RegionHeadquarters that the
annual drill has been completedinaccordancewith NWS Directive 10-601.

21. References
a. NWS Directive 10-601
b. Appropriate Learning Management System modules
c. SOPs for ATCF operations and hurricane products preparation

2.   SOP Example - Staffing during Different Levels during a Tropical Cyclone

_____

**Central Pacific Hurricane Center, Pacific Region, USA National Weather Service
Standard Operating Procedure**

**22. Title: CentralPacificHurricaneCenter/WFOHonoluluStaffingand Non-Product
Duties**

23. SOP Number: Tropical Cyclone (TC) – 2

24. Prepared by: _____

25. Approved by: _____   **Date:** _____

Implementation Date: _____

26. Revisions: 1. Approved by: _____   **Date:** _____
2. Approved by: _____   **Date:** _____
3. Approved by: _____   **Date:** _____

27. Purpose, Scope and Applicability. Tropicalcyclonespose asignificant threat

tolifeandpropertyinHawaiiandtothemarineandmilitarycommunityacrosstheCentralPacific and also generateintensemediainterest. Thereforetheforecastsforsuchsystemsneedto begivenutmostimportancetoensurethehighestaccuracypossible.Thereforededicated, sufficient staffingisrequiredwheneveratropicalcycloneisinCPHC'sAOR. This SOP applies to all personnel in CPHC/WFO Honolulu.

28. Acronyms:

AM/MIC	Area Manager/Meteorologist in Charge
ARES	*Amateur Radio Emergency Service*
AOR	Area of Responsibility
ATCF	Automated Tropical Cyclone Forecast system
CARCAH	Chief, Aerial Reconnaissance Coordination, All Hurricanes
CPHC	Central Pacific Hurricane Center
DCO	Data Collection Office
DO	Director of Operations
ESA	Electronic Systems Analyst
ET	Electronic Technician
HMT	Hydro-meteorological Technician
HST	Hawaii Standard Time
IT	Information Technology
JTWC	Joint Typhoon Warning Center
LMS	Learning ManagementSystem
NESDIS	*National Environmental Satellite, Data, and Information Service*
NHC	National Hurricane Center
NHOP	NationalHurricaneOperationsPlan

NWS	National Weather Service
OIC	Officialsin Charge
OPL	Observing Program Leader
PL	Program Leader
PRH	Pacific Region Headquarters
SOO	Scientific and Operations Officer
SSH	Senior Service Hydrologist
TWO	Tropical Weather Outlook
WCM	Warning Coordination Officer
WFO	Weather Forecast Office

29. Procedures.
Staffing for six situations are listed below. These 6 situations are:
Pre-Storm Staffing
CPHC Start Up
ConditionIII-Tropical CycloneNot a ThreattoHawaii within96 Hours
ConditionII- Tropical cyclonemay affecttheStateofHawaii within96 Hours
ConditionI- Tropical Cycloneto AffecttheStateofHawaii within48 To 72 Hours
CPHC Spin Down

Pre-StormStaffing

1. TheShift
   SupervisorwillnotifytheAM/MICandDOanytimethereisareasonablepossibilityofatropicalcyclon emovinginto ordevelopinginCPHCs AOR.Thispossibilityshouldalso beindicatedintheTWO.
2. TheDOandShift Supervisorwillcontactthehurricanespecialists/forecastersanddevelop

acontingency staffing scheduletoensure properstaffingofCPHC.

3. The shift supervisor will coordinatewiththe NHCforecastertheforecasttrackandintensityoftropicalcycloneseastof140Wifthetropica lcyclonemaybeathreatto Hawaiiwithinthe120hourperiod.Thismayoccuron aregularbasis,duetoextended forecastsgoingoutto120hours.

CPHCStartUp

1. AfterreceivingaDvorakclassificationof1.5 byWFOHonoluluora2.0 byanyfixagency(JTWC, NHC, NESDIS)ofadevelopingtropicalsystem withinthe CPHCAOR, the Shift Supervisorwillactivate CPHCandnotifyappropriatestafftoensureall WFOHonoluluandCPHC positions are staffed as required.

2. CPHCwillhavededicatedstaffingbyhurricanespecialistsanytimeatropicalcyclone(tropicaldepr ession, tropicalstorm, orhurricane)islocatedwithintheCPHCs AOR.

3. The designated CPHC hurricane specialistwill perform only tropicalcyclonedutiesandwillnotassist in workat anotherpositionsuchasWFOandCenter positions,Storm Coordinator, orShift Supervisor.

4. IntheeventonlyGeneralForecasters areworkingWFOandCenter positionsand aleadforecaster isworkingCPHC, theShift Supervisorwillbe designatedasthepersonworkingtheWFO-1position.

5. TheShift SupervisorwillhaveoversightofCPHCproducts andensure propercoordinationtakesplacebetweenCPHCandtheWFO/Centerpositionsasappropriate.

SOP TC-2 (Staffing Non-Product Duties)   26 September 2014

6. CPHCshiftschedulesarenot restrictedtothetwelvehourshifts workedatthe WFOandCenter positions.Dependingonthesystem andCPHCstaff flexibility,different dutyhoursshould beconsidered.

7. IntheeventofmorethanonetropicalcyclonewithintheCPHCAOR,additionalstaff will beneededforCPHCtomonitorandproducetheforecastsfor thosesystems.Thegoalis tohavenoforecaster workingmorethanonestorm.

ConditionIII-Tropical CycloneNot a ThreattoHawaii within96 Hours but in AOR

Products Issued:
WTPA2x(TCMCPx)	Forecast/Advisory
WTPA3x(TCPCPx)	PublicAdvisory
WTPA4x(TCDCPx)	TropicalCycloneDiscussion
FKPA2x(TCACPx)	ICAOAviationBulletins
WTPA6x(TCUCPx)	Narrativestatingchangingconditionsasrequired
FOPA1x(PWSCPx)	Probabilistic WindSpeed

Staffing:
1. ThreeoutofthefollowingfourAM/MIC,DO,WCM,andSOO,and SSHandalsotheHurricaneProgramLeadershallbewithintelephonecontacttoassist oranswerquestions.
2. Not a threat to Hawaii beyond 96 hours:
   a. CPHCstaffed24/7 byHurricaneSpecialist.
   b. NormalstaffingatWFO,Center andHMT/PublicServicepositions
3. System a possible threat to Hawaii after 96 hours:
   a. CPHCstaffed24/7 byHurricaneSpecialist.

b. NormalstaffingatWFO,Center andHMT/PublicServicepositions
c. ShiftSupervisorshouldconsiderextrastaffingtohandleincreasedphonecalls, media interest,andforecast demands,suchascoordinatinggriddedforecastswithNHC orCPHCforecast.

Documentation:
Shiftsupervisorwillbeginalogofallmediaandcivildefensecontactsandensureallpersonnellogtheirrespectivecontacts.

ConditionII- Tropical cyclonemay affecttheStateofHawaii within96 Hours

Products Issued:

WTPA2x(TCMCPx)	Forecast/Advisory
WTPA3x(TCPCPx)	PublicAdvisory
WTPA4x(TCDCPx)	TropicalCycloneDiscussion
FKPA2x(TCACPx)	ICAOAviationBulletins
WTPA6x(TCUCPx)	Narrativestatingchangingconditionsasrequired
FOPA1x(PWSCPx)	ExperimentalProbabilisticWindSpeed
WTHW80(HLSHFO)	LocalStatement(issued byWFOpositions, orasdesignated

byshiftsupervisor)onlyifawatchisineffect foranypartofHawaii

Staffing
1. AM/MIC orDO,WCM orSOO,and SSH orHurricane PL shall be recalled and on shift.
2. CPHCstaffed24/7 byHurricaneSpecialist.
3. NormalstaffingatWFO,Center andHMT/PublicServicepositions

SOP TC-2 (Staffing Non-Product Duties)   26 September 2014

4. ShiftSupervisorshouldconsiderextrastaffingtohandleincreasedphonecalls, media interest,andforecast demands,suchascoordinatinggriddedforecastswithNHC orCPHCforecast.
5. Telephoneassistancefrom0500- 2100HSTshallbeprovided by recalled personnel,management teammembers, or PRHstaffmembers.

Duties
1 . Shift Supervisorwillensurethetropicalcyclonecoordinationsheet(see SOP TC-5)iscompletedevery6 hoursandallstaffmembershaveacopy.
2. The AM/MIC or DOwillcoordinatereconnaissancerequirementswithTPCandCARCAH. A72-hour
leadtimeisrequiredbeforethefirstfixcanbeprovidedunlessareconnaissancecrewisalreadyavailableinHawaii.
3. AM/MICordesignatedpersonshallhandlepress,radio,andTVassignments.
4. AM/MICshallconsiderrecallingselectedpersonnelonleave.
5. WCM shall alert ARESpersonnelofpendingactivationof volunteer SKYWARN amateur radio network.
6. ESA shallbealerted ofthepossibilityof24 hourETcoverage.
7. AM/MIC or DO will hold a daily coordinationmeetingtodeterminestaffingrequirements.
8. DOshallalert the OPL,HMTs,andSatellite/ITsupportcontractorsofthepossibilityof24 hour coverage.
9. DOshallalert theDCOsofthepossibilityof24 hour coverage.
10. ESAordesignateshallcheckallemergencysuppliesandequipment,suchasflashlights,water containers,etc.,toensurethat theyareavailableinproperworking order.

Documentation

Shiftsupervisorwillcontinuealogofallmediaand   emergency managementcontactsandensureallpersonnellogtheirrespectivecontacts.

ConditionI- Tropical Cycloneto AffecttheStateofHawaii within48 To 72 Hours

Products Issued:

WTPA2x(TCMCPx)   Forecast/Advisory
WTPA3x(TCPCPx)   PublicAdvisory
WTPA4x(TCDCPx)   TropicalCycloneDiscussion
FKPA2x(TCACPx)   ICAOAviationBulletins
WTPA6x(TCUCPx)   Narrativestatingchangingconditionsasrequired
FOPA1x(PWSCPx)   ProbabilisticWindSpeed
WTHW80(HLSHFO)LocalStatement(issued byWFOpositions, orasdesignated byshiftsupervisor)

Staffing:

1. CPHCstaffed24/7 byHurricaneSpecialist/Forecaster. TheshiftsupervisorwillcoordinatewiththeDOtodeterminestaffingrequirementsandcontactstaff to be recalled asnecessary.
2. Stafftwopeopletohandlepress,radio,television, public, and other agencies calls between0500-2230 HST. Staff one person for these duties between 2230 – 0500 HST.
3. AM/MICandDOwillalternate12 hour coverage.
4. Staffat least oneperson to:
   a. Operate theradar

   b. Issueshort-fusewarnings(flashflood andtornado) andshort-termforecastsandstatements
   c. Assist CPHCinprovidingradarfixes.
5. OnepersonwillbeassignedasaTropicalCycloneCoordinator.See listofduties under separate SOP.
6. DCOsshallgoto 24 hourcoverage48 hoursbeforethetropicalcycloneaffectstheirislands.
7. HMTcoverageincreasedto 24 hours
8. Electronicstechniciancoverageincreasedto 24 hours
9. Satellite/ITcontractorscoverageincreasedto 24 hours

Duties:

1. AM/MICand/or DOwillcoordinatereconnaissancerequirementswiththeTPCandCARCAH. A72-hour leadtimeisrequiredbeforethefirstfixcanbeprovided,unlessareconnaissancecrewisalreadyavailable inHawaii.
2. Shift Supervisorwillensurethetropicalcyclonecoordinationsheet(see separate SOP)iscompletedevery6 hoursandallstaffmembershaveacopy.
3. 24 hourtelephonecoverageshallbeprovided byrecalled,managementteampersonnel.
4. AM/MICordesigneemayrequestsother assistance fromPRHstaffmembersand/or recallselectedpersonnelfromleave.
5. Activatethe volunteer SKYWARN amateur radio network.

Documentation

Shiftsupervisorwillcontinuealogofallmediaand   emergency managementcontactsandensureallpersonnellogtheirrespectivecontacts.

CPHCSpinDown: Tropical Cyclone has left AOR or dissipated

Staffing
TheAM/MICmayrequest extrastafffora dayor two after the tropical cyclone has left the AOR or has dissipated,especiallyiftherehasbeenasignificantimpactinHawaiithat resultsinunusualmediaattention and/or requirementsforreports beingfiledtoPRHandNWS Headquarters.
In addition, therequirement forextra operational staffingmaybeextendedas determined by the shift supervisor.

Duties
1.   IntheeventofahandoffofastormtoJTWCorTPC,thehandofftimewillbecoordinated   bythe   CPHCforecaster   andanticipatedahead   oftime.TheCPHCforecaster willnotifytheshiftsupervisorofthisexpectedhandofftime,whowillthenworkwiththeDOtocontactaff ectedstaffandreturntothe regularfixedschedule.
2.   Intheeventofadecayingsystemwithinthe CPHCAOR,the CPHCforecaster willmakethedecisionwhentostopforecastadvisories.The CPHC forecaster willcoordinatewiththeshiftsupervisorandDOasearlyaspossibleontheendingtime.Theshiftsupervis orandDOwillcontactaffectedstaff andreturntotheregularfixedscheduleiftherearenoactivewatchesandwarningsrequiringextrastaffing (e.g.,flashfloodwatchesand/or warningsmay berequirediftheremnantsofaformer tropicalcyclonemovesintotheislands).

Documentation
Shiftsupervisorwillcontinuealogofallmediaand   emergency managementcontactsandensureallpersonnellogtheirrespectivecontacts.

9. **References**

3. **SOP Example – Issuance Products**

_____

Central Pacific Hurricane Center, Pacific Region, USA National Weather Service Standard Operating Procedure

1. **Title: CentralPacificHurricaneCenter/WFOHonoluluProduct Issuance**

2. **SOP Number: Tropical Cyclone (TC) – 3**

3. **Prepared by:** _____

4. **Approved by:** _____ **Date:** _____

          Implementation Date: _____

5. Revisions: 1. Approved by: _____ **Date:** _____
             2. Approved by: _____ **Date:** _____
             3. Approved by: _____ **Date:** _____

6. Table of Contents

7. Purpose, Scope and Applicability. Tropicalcyclonespose asignificant threat tolifeandpropertyinHawaiiandtothemarineandmilitarycommunityacrosstheCentralPacific and also generateintensemediainterest. Thereforetheforecastsforsuchsystemsneedto begivenutmostimportancetoensurethehighestaccuracypossible.Thereforeaccurate, timely, and effective services and forecasts are requiredwheneveratropicalcycloneisinCPHC'sAOR. This SOP applies to all personnel in CPHC/WFO Honolulu.

8. Acronyms:

AM/MIC	Area Manager/Meteorologist in Charge
ARES	*Amateur Radio Emergency Service*
AOR	Area of Responsibility
ATCF	Automated Tropical Cyclone Forecast system

SOP TC – 3 (Product Issuance)   26 September 2014

CARCAH	Chief, Aerial Reconnaissance Coordination, All Hurricanes
CPHC	Central Pacific Hurricane Center
DCO	Data Collection Office
DO	Director of Operations
ESA	Electronic Systems Analyst
ET	Electronic Technician
HMT	Hydro-meteorological Technician
HST	Hawaii Standard Time
IT	Information Technology
JTWC	Joint Typhoon Warning Center
LMS	Learning ManagementSystem
NESDIS	*National Environmental Satellite, Data, and Information Service*
NHC	National Hurricane Center
NHOP	NationalHurricaneOperationsPlan
NWS	National Weather Service
OIC	Officialsin Charge

OPL	Observing Program Leader
PL	Program Leader
PRH	Pacific Region Headquarters
SOO	Scientific and Operations Officer
SSH	Senior Service Hydrologist
TWO	Tropical Weather Outlook
WCM	Warning Coordination Officer
WFO	Weather Forecast Office

9. Information and Guidance Policy

a. AOR: CPHC's AOR lies between 140 degrees west longitude and the International Dateline, north of the Equator. CPHC is responsible for preparing all tropical cyclone products in its AOR.

b. Issuance Times: Scheduled tropical cyclone products are issued at 0300, 0900, 1500, and 2100 UTC.

c. Position Times: Position times will be the same as issuance times. The synoptic position for 0000, 0600, 1200, and 1800 UTC will also be included.

d. Product Numbers:

- A number system is used in the WMO header located on the first line of all tropical cyclone products: i.e., WTPA21, WTPA31, WTPA41 and FKPA21 are all used for the same storm, WTPA22, WTPA32, WTPA42 and FKPA22 for another storm, etc.

- The single digit in the AWIPS ID located on the second line of all tropical cyclone products shall correspond with the second digit in the WMO header. For example, TCMCP2 corresponds with WTPA22 PHFO.

- WMO Headers and AWIPS ID will be incremented by one as the storm is handled by CPHC, independent of the number it had in TPC's or JTWC's AOR.

e. Issuance Numbers: Issuance numbers located on the third line of all tropical cyclone products will be consistent. For example, TROPICAL STORM TOM FORECAST/ADVISORY NUMBER 15, TROPICAL STORM TOM PUBLIC ADVISORY NUMBER 15, TROPICAL STORM TOM DISCUSSION NUMBER 15, etc.

SOP TC – 3 (Product Issuance)   26 September 2014

f. Both product numbers and issuance numbers are incorporated into the Automatic Tropical Cyclone Forecast (ATCF) system. Detailed instructions on use of ATCF are in SOP TC-7 ATCF Guide.

g. Tropical Depression Numbers: Tropical depressions that form in the CPHC AOR will be assigned a number with the suffix C. The first depression of the season to form in the Central North Pacific shall be named ONE-C.

h. Tropical Cyclone Names: If a tropical depression reaches tropical storm intensity in the CPHC AOR, it will be given a name from the CPHC list of Hawaiian names. If a tropical cyclone crosses 140W from the east, or the dateline from the west, the ATCF ID number and the name assigned to the system by the NHC and JMA/JTWC respectively, will be retained.

i. The Hurricane Forecaster in the preparation of the tropical cyclone products should:

- Rely heavily on the previous forecast when making his or her forecast to avoid

thewindshieldwiperor   yo-yoforecasteffect.Theforecaster   should
becautiousandnotautomaticallygowithbigchangesinmodelguidance,especiallyifthechanges
areintheextendedforecastperiods.

- Preparepreliminarypositions.DisplayobjectiveaidesonATCFassoonasreceived.Theobjectiv
eaidsareusuallyavailablefordownloadingafewminutesaftersubmission.
- Check current plotsagainstpreliminarypositionsandmovement.Adjust asnecessary.
- Theforecast/advisory(WTPA21-25),publicadvisory(WTPA31-
35),tropicalcyclonediscussion(WTPA41-45),windspeedprobabilitytext(FOPA11-
15),andtheICAOadvisory(FKPA21-25)should betransmittednolaterthan the issuance time.

j. NHC   Coordination: The   shift   supervisor   will   coordinatewiththe
NHCforecastertheforecasttrackandintensityoftropicalcycloneseastof140Wifthetropica
lcyclonemaybeathreatto Hawaiiwithinthe120hourperiod.

k. Tropicalcycloneforecastsandadvisoriesshould   bediscontinuedwhenthesubject
systemhashadnodeepconvectionfora24   hour   period,   orby   forecaster
discretion,thesystemistropical depressionintensity,isweakeningandisnotexpectedtostrengthen.

l. Thelast   advisoryissued   bythe
CPHCforasystemmovingintotheWesternNorthPacificshallcontainastatementsimilartothefollowi
ng:

THISISTHELASTBULLETINISSUEDBYTHECENTRALPACIFICHURRICANECENTE
R.THENEXTBULLETINWILLBEISSUEDBYTHERSMCTOKYO.FORU.S.INTERESTS,
SEEDODWARNINGSISSUEDBYTHEJOINTTYPHOONWARNINGCENTER.

10. Procedures.

A. For All Tropical Cyclones within CPHC's AOR:

The Hurricane Forecaster will:

1. CompletetheForecast/Advisories,PublicAdvisories,Discussions,ICAOAdvisories,an
d TCSurface WindSpeedProbabilitiesTextProduct to betransmitted nolaterthan
15minutesbefore   issuance.Thisallows   otherteammembersto   quality
checktheproductsbeforetransmission.   (Note:
HurricaneLocalStatements,ifrequired,willbeissuedbyWFO
HonolulustaffaftertheCPHCforecastadvisoriesareissued).

SOP TC – 3 (Product Issuance)   **26 September 2014**

2. Notify
theAM/MICand/orDOofpotentialthreats.TheywillthennotifytheRegionalDirectorofth
ePacificRegion.
3. EnsurethattheaviationforecasterissuesaviationtropicalcycloneSIGMETsto   match
theadvisories.
4. Arrangeforspecialupperairsoundings fromPHLIandPHTO.
5. EnsurethattheHighSeasMarineForecasterincludesrequestsfor3hourlyshipreportsinthe
HighSeasForecast.
6. ProvideacopyofthelatesttropicalcycloneadvisoriestothePacificRegionHurricaneWatch
OfficefordisseminationtoNationalWeatherServiceHeadquarterswhenawarning
and/orwatch isineffect.
7. CoordinatethetransferofwarningresponsibilitywithNHCwhen

atropicalcycloneisabouttoentertheCPHCAORfromtheeast.Thebesttimetocoordinatewiththe NHCforecasterisoneandahalfhourspastthesynoptichour.IftheNHCisworking an Atlanticcyclone,theforecasterwillbebusywithconferencecallsto WFOsbytwo hourspastthesynoptichour.

8. CoordinatewiththeTropicalDutyOfficer(TDO)attheNAVPACMETOCCENfortransfertoJTWCwhenasystemisforecasttocrosstheInternationalDatelinefromeastto west.ToobtainthepreviousfixesandforecastsfromJTWC,useATCF(followproceduresintheATCFmanual).

B. ForTropicalCyclonesthatThreatenHawaii

The Hurricane Forecaster will:

1. Not suggest or forecast atrackmorethan48 hoursaftersynoptictime in the public advisory.Themediamayeliminateanyqualifiersyouprovide,such as"ifitmaintainsitspresenttrack,itwillbe...",etc.

2. For tropical cyclones not yet in CPHC's AOR, useonlytheinformationgivenintheadvisoriesfromTPC orJTWC bulletins when a mediarequest is received.

3. IftheHawaiianIslandsarebeingthreatened,contactState Emergency Management wellinadvanceofthe issuanceoftheadvisoryproducts totherestofthe world.

4. Ahurricanewatchand atropicalstormwarningcanbeineffectatthesametimeforthesameisland(s).

5. TropicalStormWatches will beissuedfor tropicalstormsnotexpectedtoreachhurricaneintensity orfor tropicaldepressionsexpectedtoreachonly tropicalstormintensity.

6. TropicalStormWarningswill beissuedwhentropicalstormconditionsareexpected.Accordingly,theymaybeissued oneithersideofahurricane warningarea.

7. Issuetornadowatches, ormentionthethreat oftornadoes forthoseareasthat areexpectedto beimpacted byrain bandsinthenortheast through southeast semi-circleofthestormcirculation.CoordinateeachtornadowatchissuancewithWFO-1andWFO-2 positions,sincetheywillneedtoissuea WatchCountyNotification(WCN).

8. Whendowngradingwarnings,theordershould befrom(1)HurricaneWarningto(2)TropicalStormWarningand(3)WarningCancellation.

9. TropicalWeather Outlooks (TWOs),prepared bythesatellitemeteorologistattheWFO-2desk,should becoordinatedwiththe CPHCforecaster,ifapplicable,andcheckedforconsistencybeforetransmission

10. Do notcompareasystemwithapast storm,except possiblyinthetropicalcyclonediscussionproduct.

11. Providingpositions toCivilDefenseandother agencies:

a. Youmayprovidereconnaissancefixes.

b. When giving outsatellitefixes(dependingonquality),includereliabilityterms(i.e.,infraredvs.visual),time,whetherornot theyarerepresentativeofpresent andpastmovement,etc.

12. ConversationsonHAWASarerecorded.Therefore, becarefulwhatyousayover thesystem.

13. Donotwaituntilroutinetimes tomakechanges.TheTropicalCycloneUpdate(WTPA60)productisaquickandconvenientwaytoupdateifsignificant

changesareoccurring.ItisstronglyrecommendedthataTCUbeissuedintheeventofanunexpected,butsignificantcourseorintensitychangeas soon aspossibletoacknowledgetousersthatweareawareofthecourseorintensitychange,andanupdatedforecastwillbesent shortly.

14. TheWFO-11positionforecaster shouldnottrytoduplicatediscussions betweentheFXHW60andWTPA41‑45.IntheFXHW60product,justaddthe statement"SEEWTPA41-45FORSPECIFICDETAILS."
15. CoordinatewithWFO-1and WDFO-2 positionforecastersonanythreatsofheavyrainfall.Ifthethreat exists,includethepotentialforfloodingintheTCPandTCDproducts.

C. Tropical Cyclone Products and Issuance Times

WMOHeading	AWIPSID	ProductDescription
WTPA21‑25PHFO	TCMCP1-5	Forecast/Advisory
WTPA31‑35PHFO	TCPCP1-5	PublicTropicalCycloneAdvisory
WTPA41‑45PHFO	TCDCP1-5	TropicalCycloneDiscussion
WTPA60PHFO	TCUCP	TropicalCycloneUpdate
FKPA21-25 PHFO	TCAPA1-5	ICAOAdvisory
ACPN50 PHFO	TWOCP	TropicalWeather Outlook
ACPN60 PHFO	TWSCP	TropicalWeather Summary
FOPA21-25 PHFO	PWSCP1-5	WindSpeed Probabilities

Prepare				Issue By
WTPA2x	WTPA3x	WTPA4x	WindSpeedProb.	
(UTC)	(HST)	(HST)	(HST)	(HST)
1500	0200-0430			0430
1500	0200-0430			0430
1500		0200-0430		0430
1500	0200-0430			0430
2100	0800-1030			1030
2100		0800-1030		1030
2100			0800-1030	1030
2100			0800-1030	1030
0300	1400-1630			1630
0300	1400-1630			1630
0300	1400-1630			1630
0300	1400-1630			1630
0900	2000-2230			2230
0900	2000-2230			2230
0900	2000-2230			2230
0900	2000-2230			2230

SOP TC – 3 (Product Issuance) 26 September 2014

D. WTPA2xPHFO-Forecast/Advisory(TCM)

ATCMisissuedanytimearoutineor specialTCPproductisissued.Theseproducts areroutinelyissuedat0300, 0900, 1500 and 2100 UTCusingthe0000,0600, 1200, 1800 UTCsynoptichourdata, respectively.TCMs

arealsoissuedanytimeaSpecialAdvisorypackageisrequired.Includeanywatchesand/or warningsthat areineffect. Preparation of the TCM will be done using ATCF (See SOP TC-5)

TCMs consistofthreesectionsasfollows:

Initialconditionsattimeofissuance.Theinitialconditionssectioncontains:
Center positiontoonetenthofadegreelatitudeandlongitude.
Positionaccuracyinnauticalmiles.
Directionand speed ofmovement.t
Estimatedminimumcentralpressureinmilliards.
Maximumsustainedwind speed (intensity)withgustsinknots.
34-,50-,64-,100-knot(fourquadrant)wind speed radii.
12 footseasradii(fourquadrant).
Astatementexplainingradii.
Center positiontoonetenthofadegreelatitudeandlongitude attheprevioussynoptichour.

Forecastconditionsat12-,24-,36-, 48-and72-hours.TheForecast sectionconsistsof:
Center positiontoonetenthofadegreelatitudeandlongitude.
Maximumwind speed andgustinknots.
34-,   50-and64-knot(fourquadrant)wind   speed   radii,exceptONLYthe34-and50-
knotwindradiiareincludedforthe48 and 72 hour forecasts.

ExtendedOutlookconditionsat96-and120-hours.TheExtendedOutlooksectioncontains:
Astatementexplainingtrackandintensityerrors.
Center positions toonetenthofadegreelatitudeandlongitude.
Maximumwind speed andgustinknots.

WhenindicatingthestatusofacycloneintheTCM,thetermsremnantlowandextra-
tropicalshouldnotappearalone,butonlyincombinationwiththeterm   post-
tropical.HurricaneForecasters   willhavetheabilityinATCFtoselect   the
propercombinationsoftheterms.Post-tropicalmayoccur alonetodenote systemsthat areneitherextra-
tropicalnor   aremnantlow.Sincethesecombinationsresultinlongtext   that
willnotremainonasinglelineintheTCM(or   tropical
cyclonediscussion),thetermswillbeabbreviatedasfollows:

POST-TROPICAL
POST-TROP/EXTRATROPPOST-TROP/REMNTLOW
HurricaneforecasterscandenoteintheTCMwhenthecenter   ofacycloneisforecastto
beoverland,althoughindicatingthat   along-rangeforecastisover   asmallland
areaprobablyimpliesmoreprecisionthaniswarranted.Forecasters   canalsodenotewhenthecenter
ofatropicalcyclonemovesbackover   water   aftercrossingland.   Inthesecases,
thespecialistaddstheword"inland","over   water"or   other
appropriatewordingattheconclusionofthelinethat   providesthevalidforecasttimeandlocation.
Ifthelinecontainsinformationonthestormstatus(i.e.,post-trop/extratrop)itmay

becometoo   longtoalsodenotetheinland   or   overwater   status.   Inthiscase,
thestormstatushaspriorityandshould beshown.

TCMs shallnotcontain:
Headlines.However,watchesandwarningsmustbeincluded.

ForecastorExtendedOutlookconditionsifthecyclone dropsbelowdepressionstageor becomesextra-tropical.

AlthoughATCFautomaticallyformatstheproduct,thehurricaneforecaster shouldensurethat:
The proper Forecast/Advisorynumberisinplaceonthethirdline.
The properstormidentifierisinplaceonthefourthline,suchasCP042003.
Theradiiof12 footseasareincludedinthetext,sincetheseareeasyvalues toleaveout.

ThefollowingareitemspeculiartoATCFthat thehurricaneforecaster should beawareof:
Iftherearenocurrenttropicalcyclonewatchesand/or
warningsissuedforanycoastalareasinthisadvisory,thefollowingheadlineshould beplacedafterthe timeand dateline:

THEREARENOCOASTALWATCHESORWARNINGSINEFFECT.

When tropicalcyclonewatchesand/or warningsarerequired include changes which have occurred and a summary of watches and warnings. Anexampleoftheformat forthewatch/warninginformation,whichwillalso beusedintheTCP, is:

CHANGESINWATCHESANDWARNINGSWITHTHISADVISORY...
ATROPICALSTORM WARNINGISINEFFECTFORHAWAIICOUNTY.

SUMMARYOFWATCHESANDWARNINGSINEFFECT...
ATROPICALSTORM WARNINGISINEFFECTFOR...HAWAIICOUNTY

ATROPICALSTORM WARNINGMEANSTHATTROPICALSTORM CONDITIONSAREEXPECTEDSOMEWHEREWITHINTHEWARNINGAREAWITHIN36 HOURS.

Indescribingpresentmovement,ensurethat itisallononelineandthat thedirectionofstormmotionisanumberdivisibleby5 degrees.TheproductissometimesalteredwhenthefileistransferredfromATCFtoTheWorldifthemessag ecompositionaccepts66 orlesscharactersperline.

Thehurricaneforecaster
shallcoordinategale,storm,andhurricanewindradiiwiththeHFOmarineforecaster beforeissuanceoftheforecast/advisory.Thisensuresthat theradiiarethesameinallproducts.

ASpecialTCMshallbeissuedat anytimebetweenscheduledissuancetimes toadviseusersofanyabruptorsignificantchangeswhichmayhaveoccurred.SpecialTCMs should beissuedinconjunctionwithaSpecialPublicAdvisory(TCP).

Corrected forecasts/advisoriesshallretainthedate/timegroupandnumberofthescheduledadvisorythat isbeingcorrected.PerformallcorrectionsinATCF, andnotinAWIPS.

(Examples of different types of TCM bulletins would be included here)

E. WTPA3xPHFO- PUBLICADVISORY(TCP)

(All required procedures similar to paragraph D. WTPA2xPHFO-Forecast/Advisory(TCM) above would be included here)

F. WTPA4xPHFO-TROPICALCYCLONEDISCUSSION(TCD)

(All required procedures similar to paragraph D. WTPA2xPHFO-Forecast/Advisory(TCM) above would be included here)

G. WTPA60PHFO-TROPICALCYCLONEUPDATES

(All required procedures similar to paragraph D. WTPA2xPHFO-Forecast/Advisory(TCM) above would be included here)

H. WTPA3xPHFOSpecialAdvisoriesandIntermediateAdvisories
AlsoseeSectionE above on WTPA3xPHFO- PUBLICADVISORY(TCP)

(All required procedures similar to paragraph D. WTPA2xPHFO-Forecast/Advisory(TCM) above would be included here)

I. WTHW80PHFOHURRICANELOCALSTATEMENTS (HLS)

(All required procedures similar to paragraph D. WTPA2xPHFO-Forecast/Advisory(TCM) above would be included here)

J. . ICAO ADVISORY

(All required procedures similar to paragraph D. WTPA2xPHFO-Forecast/Advisory(TCM) above would be included here)

11. References

Appendix X: Applicable Websites

Appendix XI: Additional References

Appendix XII: Acronyms

Appendix XIII: Definitions