ANNEX IV

"LOCAL-SOURCE TSUNAMI RESPONSE BEST PRACTICE"

Release Version 1 – 06/04/19, ICG/PTWS XXVIII, Nicaragua

INTRODUCTION

The purpose of this document is to outline the guiding principles that should be used by Member States of the Pacific Tsunami Warning and Mitigation System to manage local-source tsunami events. This is not intended to be a detailed, prescriptive procedure, but an outline of agreed best practice to assist Member States in developing their own response and readiness procedures and plans. Currently this document is largely designed for local tsunami generated by large earthquakes, but in future could be extended to be include tsunamis from volcanic, landslide, and non-typical sources.

It provides guidance on:

1.0 Local-Source Tsunami Priorities
2.0 Warning Types
3.0 Public Awareness and Education
4.0 Detection and Characterisation
5.0 Items for Subsequent Consideration

1.0 LOCAL-SOURCE TSUNAMI PRIORITIES

1.1 Self-evacuation is the key to surviving local tsunamis, particularly those with very short lead times. People must know and immediately recognise the natural warning signs and be able to self-evacuate successfully. Clear planning and instructions are required on when to evacuate, where to evacuate to, safe areas and when it is safe to return. Evacuation maps showing safe and effective routes and clear signage are essential. Effective public education and exercises will reinforce understanding of the risk and the actions required in an event. Past events provide powerful lessons that can be used to educate communities.

1.2 Official warnings are supplementary to natural warnings. The primary role of official warnings is to reinforce self-evacuation and assist all-clear decisions. People must know not to wait for official warning before evacuating.

1.3 Official warning systems must have fast and simple warning chains. The first official warning must be fast and conservative. It may be the only official warning to be received because of communications and power outages. Pre-calculated products may be the best way to produce impact estimates quickly to inform these warnings. Additional modelling and information can subsequently be used to enhance impact estimates, but they should not delay the issuance of the initial warning.

2.0 WARNING TYPES

There are fundamentally three types or categories of warnings – natural, official and unofficial. All three need to be a part of the warning process. The response plans for Member States must take all three into account. For example, official warnings must reinforce natural warning and self-evacuation.

2.1 *Natural warning*. Natural warnings such as strong or long shaking, unusual sea observations (receding sea level like a fast tides) or sounds (loud aircraft-like roaring) indicate

immediate self-evacuation is required. These can also include animal behaviour, such as animals running away from the ocean.

2.2 ***Official warnings*****.** These are the warnings issued by the National Authority of Member States. Tsunami Service Providers (TSPs such as the Pacific Tsunami Warning Centre, PTWC) issue advisory messages to assist the NTWC to respond to events, but it is the designated NTWC which is responsible for issuing official warnings.

2.21 Official warnings should be designed to reinforce natural warnings and strengthen self-evacuation. It is very important that official warnings do not slow down natural self-evacuation.

2.22 Target releasing warning quickly (target within 10 minutes). Best practice is to issue warnings within 5 to 10 minutes for a local-source tsunami, based on the best information available at the time. However, it is always worthwhile issuing warnings as soon as possible because of the reinforcement of self-evacuation indicated above, and because a local source for nearby people is a regional source for others, allowing more time to evacuate for people further up or down the coast.

2.23 Error on the side of caution. . The first released warning message should be conservative for local-source tsunami. The warning status can be revised once more information becomes available.

Noting that official magnitude estimates often change considerably in the first 30 minutes, it is important to use conservative initial estimates of magnitude until a stable magnitude is reached. For example, in New Zealand 0.3 magnitude units are added to the official magnitude estimates when first assessing the tsunami threat. Another example is Japan (JMA), which uses a worst case scenario of magnitude if the network is suspected to be saturated.

It is often easier and safer to scale down following an over-estimation of impacts than to scale up after an underestimation.

2.24 Target regular warning updates. Use updates both to convey new information but also to reinforce the urgency of the situation and the need to evacuate. Consider developing (and educating the public about) a set schedule of warning updates (even if no change) to allow updated assessment information and build confidence of the communities in a response.

2.25 All clear. It is very important to have mechanisms and procedures for declaring all clear, particularly so for local-source tsunami. Because warnings need to be early and conservative in these events, the chance of false positives are high. Having procedures to quickly step back from the warning state are important but doing so too early has caused issues in the past.

2.26 Issue warnings over multiple channels if possible. Research shows that people are more likely to act upon information if it comes from multiple sources. Possible channels include radio, television, cell phone messages, social media and audible alerts (e.g. sirens). Supplementary information can be made available on slower or static media such as websites.

2.27 Be consistent. Where possible, use the same alert and warning mechanisms throughout the country or area. Many people may not be in their home area when an event occurs. If mechanisms are geographically consistent it is far more likely that they

will recognise a warning and know how to respond. Fast, effective community response is essential in time-critical events such as local tsunamis.

2.3 ***Unofficial warnings*****:** Unofficial warnings come from the community, friends and family. They may be relaying official warning or natural warning sign observations. Social media is now a strong source of unofficial warnings.

3.0 PUBLIC AWARENESS AND EDUCATION

3.1 Have effective, comprehensive and continuing public education programmes. These programmes should be based on natural warnings. It is suggested that the New Zealand "Long or Strong, Get Gone" programme is a good model for an education programme. Education should include that 'long' shaking can be made up of what may feel like separate events – which are in fact the different energy phases of a single earthquake.

Any education programme should include what citizens can expect from official warnings (mechanism and timing) and how to recognise and respond to the natural warnings described in 2.1.

Education programmes need to include what tsunamis are and what to do when tsunamis strike, drawing on historical examples, preferably locally, but international examples are also useful. The action advice should include evacuation routes, maps and safe areas in the local area. It is important to target schools and Emergency Management Centres as mechanisms to educate communities. Planning should also make use of local knowledge and contacts (eg to devise evacuation routes, develop and use appropriate language and signage, and to design effective vertical evacuation – buildings, trees, etc.).

Exercises. Use regular public exercises to reinforce the desirable actions following a strong or long earthquake and official tsunami warnings. Reinforce desired actions with exercises through schools and Emergency Management agencies. Exercises can be at the local, regional or national level. Reinforce the importance of natural warning during exercises and stress that local-sources tsunami official warning are additional information to reinforce natural warning signs and self-evacuation. Allow local communities to practise the likely order of developing events for local-source tsunami to reinforce the "Long or Strong, Get Gone" message.

3.2 Undertake debriefings and post-event public response analysis. Events and exercises should be debriefed in detail. Much can be learned and improved both locally and internationally by understanding the responses to significant tsunami events. As a result, documents and Member State planning and procedures, including detailed SOPs, should also be reviewed after significant events and exercises to reflect any lessons.

4.0 DETECTION AND CHARACTERISATION

4.1 Use shaking. The strength and duration of shaking can be used to help estimate likely impacts, or to corroborate/challenge the earthquake solution. The SOPs of NTWS should consider shaking intensity when assessing the likely tsunami generated by a local earthquake. Shaking strength and extent can also be used as proxy for rupture size (and hence event size in the earthquake case).

4.2 Use magnitude threshold tables. The first estimates of magnitude, location and depth should be used to estimate likely threat and impacts from tsunami with pre-agreed threshold tables for specified locations. As described in 2.23, a conservative approach should be taken to early magnitude estimates if using such tables.

4.3 Refine with more information. Have concise SOPs to ensure warnings are updated quickly as more information becomes available. SOPs should cover how these updates are managed and distributed – e.g. a threshold of change, or what is done when there is no change.

4.4 Regular SOP training and exercising. Conduct regular training and testing of NTWC procedures, particularly for local-source tsunami warnings where time to act is very limited. These exercises should also include testing of communication methods, and debriefing to identify areas needing improvement.

5.0 ITEMS FOR SUBSEQUENT CONSIDERATION

1. The inclusion of false alarms in 3.0 - Public Awareness and Education to maintain confidence and proactive action
2. A separate piece of work to identify the minimum viable capability required of a NTWC and develop guideline procedures and techniques to deliver it.
3. Add references to support research findings mentioned
4. Expand scope or perform a separate piece of work to cover non-typical or non-earthquake-generated tsunamis (2018 Indonesian Palu and volcanic tsunamis, Nicaragua 1992 slow earthquakes)
5. Further refinement of the definition of natural warnings
6. The inclusion of recommendations on communication channels