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US NOAA Pacific Tsunami Warning Center

September 2014

National TWC SOPs – Using PTWC New Products for Threat Assessment: Criteria Tables, Message Templates

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Overview

- **Oct 1, 2014 PTWC to discontinue issuing Warning, Watch, Information Bulletins to PTWC countries.**
- **Instead, PTWC will issue Messages with Tsunami Forecasts (est wave heights or amplitudes)**
- **Sent by email only to Country TWFPs**
- **TWFP/NTWC will be responsible for issuing Warning, Watch, Information Alert for its own country emergency**

Country NTWC tsunami event SOPs:

- **Alert Criteria Table (PTWC Enhanced Products User's Guide) Appendices VI, VIII) gives alert thresholds and Emergency Response actions**
- **Message templates (Appendix VII) facilitates quick std responses. Checklists remind Duty Staff during event**
- **High-level Communication Flow Chart shows primary agencies / stakeholders of warning chain**
  intl Tsunami Service Providers => Natl / Local Warning and Emergency Authorities => Public
- **Planning efforts develop Timeline-driven SOPs describing Time, Who, What, How, and To whom.**
- **Exercises practice and improve TWC / TER SOPs**

Alert Criteria Table

- Thresholds are used to assign Alert Levels (Warning, Advisory, Watch, Information)
- Alert Levels correspond to country's Forecast Maximum Coastal Wave Amplitude and/or earthquake magnitude
- Emergency Response Actions correspond to Alert Level

Simple Criteria Table

Countries may wish to further customize by assigning different thresholds for different source regions.
Two situations:

- **NO QUANTITATIVE PTWC FORECAST.**
  PTWC Information Statement or Threat Message within 10 min after M6.5+ earthquake.

- **QUANTITATIVE PTWC FORECAST PRODUCT**
  PTWC Threat Message, ~30 min after large earthquake with tsunamigenic potential.
  - **Warning / Watch Alerts (1.0 m threshold)**
  - **Warning / Advisory / Watch Alerts (0.3 / 1.0 m thresholds)**

Alert Criteria Table
OT + 10 min: No PTWC Forecast

1. CRITERIA TABLE - NO QUANTITATIVE PTWC FORECAST PRODUCT

Criteria Table for NTWC tsunami alerts and emergency response actions based upon the initial PTWC product, typically issued within 10 minutes of any large Pacific earthquake, prior to the computation of a quantitative tsunami forecast. Key criteria for each situation are indicated in bold red letters.

PTWC Product Type	Earthquake Parameters	Potential Tsunami Type	Are Possible Hazardous Tsunami Waves Indicated for Your Country or Area	Threatened Coast	Time left to Initial Wave Arrival (ETA)	NTWC Alert Level for Threatened Coast	Emergency Response Action
Tsunami Information Statement	Magnitude of 6.5-7.0, or on land, or ≥ 100 km depth	None or Very Minor	**No**	None	Not applicable	INFORMATION	No action required
Tsunami Threat Message	**Magnitude of 7.1-7.5**, undersea or very near the sea, and < 100 km depth	Local Tsunami	**Yes**	< 300 km from earthquake	< 1 hr typical	WARNING	Evacuate threatened coast
			No	≥ 300 km from earthquake	Not given	INFORMATION	Monitor subsequent messages
	Magnitude of 7.6-7.8, undersea or very near the sea, and < 100 km depth	Regional Tsunami	**Yes**	< 1000 km from earthquake	< 3 hrs typical	WARNING	Evacuate threatened coast
			No	≥ 1000 km from earthquake	Not given	INFORMATION	Monitor subsequent messages
	Magnitude of 7.9 and greater, undersea or very near the sea, and < 100 km depth	Basin-wide Tsunami	**Yes**	Potential for a basin-wide tsunami	**< 3 hours**	WARNING	Evacuate coast within 3 hours of ETA
			No		**3 to 6 hours**	WATCH	Prepare to evacuate
			No		**> 6 hours**	INFORMATION	Monitor subsequent messages

NOTES:

- In a local tsunami situation, in order to provide the fastest alert, earthquake magnitude criteria should be used. Issuance of a Warning, Watch, or Information is dependent on the magnitude of the earthquake and its closeness to coastlines. Smaller magnitude earthquakes that are closer to the coast may warrant issuance of a Warning.
- Local tsunami warning threshold criteria based solely on magnitude should be determined after examining a country's historical earthquake tsunami hazard. In some places, the local tsunami magnitude threshold may need to be lower than M7.1. The M7.1 threshold is used by PTWC for its Caribbean Tsunami Watch Service and was used by the PTWC for its Indian Ocean Tsunami Watch Service.
- The 3-hour time criteria is based on the amount of time required for a country to safely complete a coastal evacuation. The 3-hr threshold used by PTWC is considered a conservative, but reasonable time criteria. Historically, the value is from a requirement from Hawaii State Emergency Management Agency as the time required to safely evacuate all coasts of the State of Hawaii. Each country should consider their situation.

Alert Criteria Table
OT + 30 min: Quantitative PTWC Forecast – 1 m

PTWC Product Type	Earthquake Parameters	Maximum Tsunami Wave Amplitude Indicated for Your Country or Area	Threatened Coast	Time left to Initial Wave Arrival	NTWC Alert Level for Threatened Coast	Emergency Response Action
Tsunami Threat Message	Magnitude of 7.1 or greater, undersea or very near the sea, and < 100 km depth	**≥ 1 m**	Sections of coast with forecast amplitudes ≥ 1 m	**< 3 hrs**	WARNING	Evacuate threatened coast
				3 to 6 hrs	WATCH	Prepare to evacuate
				> 6 hrs	INFORMATION	Monitor for subsequent forecasts
		< 1 m	None		INFORMATION	Monitor for subsequent forecasts

NOTES:

- Threatened coast information can be gotten from the public text message, coastal forecast amplitude maps or the KMZ file. If only the Public Text message is used, then the entire country should be placed in a Warning.
- The 3-hour time criteria is based on the amount of time required for a country to safely complete a coastal evacuation. The 3-hr threshold used by PTWC is considered a conservative, but reasonable time criteria. Historically, the value is from a requirement from Hawaii State Emergency Management Agency as the time required to safely evacuate all coasts of the State of Hawaii. Each country should consider their situation.

Alert Criteria Table

OT + 30 min: Quantitative PTWC Forecast – 0.3 / 1 m

PTWC Product Type	Earthquake Parameters	Maximum Tsunami Wave Amplitude Indicated for Your Country or Area	Threatened Coast	Time left to Initial Wave Arrival	NTWC Alert Level for Threatened Coast	Emergency Response Action
Tsunami Threat Message	Magnitude 7.1 or greater, undersea or very near the sea, and < 100 km depth	**≥ 1 m**	Sections of coast with forecast amplitudes ≥ 1 m	**< 3 hrs**	WARNING	Evacuate threatened coast
				3 to 6 hrs	WATCH	Prepare to evacuate
				> 6 hrs	INFORMATION	Monitor for subsequent forecasts
		0.3 to 1 m	Sections of coast with forecast amplitudes 0.3 to 1 m	**< 3 hrs**	ADVISORY	Evacuate beaches and harbors
				3-6 hrs	WATCH	Prepare to evacuate
				> 6 hrs	INFORMATION	Monitor for subsequent forecasts
		< 0.3 m	None		INFORMATION	Monitor for subsequent forecasts

NOTES:

- Threatened coast information from public text message, coastal forecast amplitude maps or the KMZ file. If only the Public Text message is used, then the entire country should be placed in a Warning.
- The 3-hour time criteria is based on the amount of time required for a country to safely complete a coastal evacuation. The 3-hr threshold used by PTWC is considered a conservative, but reasonable time criteria. Historically, the value is from a requirement from Hawaii State Emergency Management Agency as the time required to safely evacuate all coasts of the State of Hawaii. Each country should consider their situation.

Message Products for Alert Levels

- **User's Guide – Appendix VII**
- **Emphasize NTWC and NDMO/DMO are authorities,** not PTWC or other international
- **Create Templates for easy fill-in**
  (or automatically fill-in with incoming PTWC message). Basic text does not change.
  Duty Staff only need to fill in event information.
- **Include Review option:** If automated process or GUI used, need to make sure there are 'REVIEW BEFORE SEND' and 'MANUAL ENTRY' options

Message Products for Alert Levels

- **Mimic EXISTING PTWC Text Bulletin (Warning, Watch, Information)**
- **Structure**: Header, EQ Info, Evaluation, Forecast (if applicable), Recommended Actions (depending on Threat Level), ETA, Potential Impacts, Tsunami Observations, Next Update and Additional Info
- **Customize for country**
  - Use Local Time
  - Replace PTWC with Country's NTWC
  - Retain only country locs (for threat, ETA). Delete other
  - Specify Local Authority for Public Safety Action (Evacuation), Contact info / how to obtain evac status
  - Specify update schedule

New Products – Sharing of TWFP products

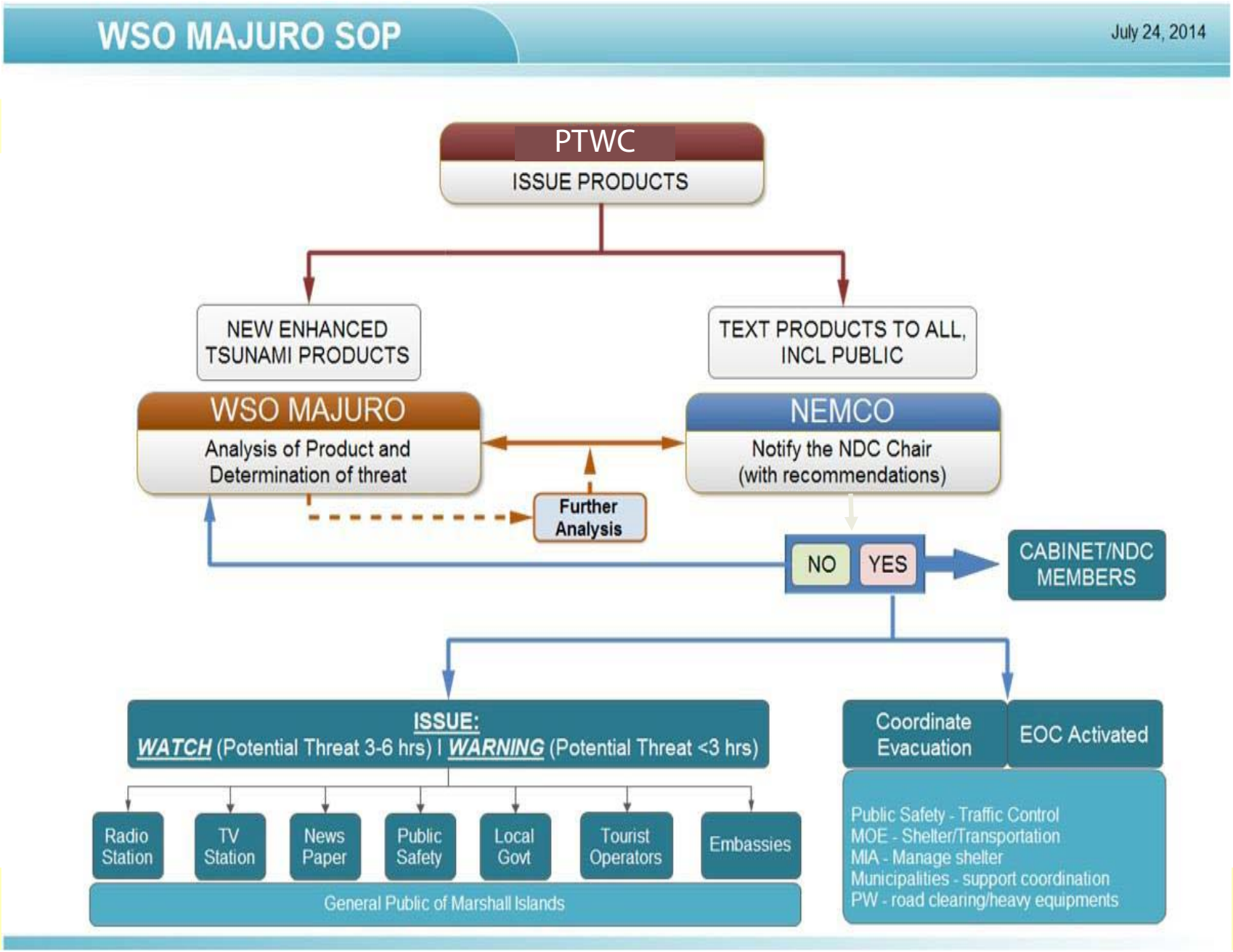
Decide whether to share Graphical Products (currently only to TWFP by email)

- Which Products to share
- To Whom
- Should products be adjusted / customized before sharing?
- Need to socialize/train for shared products

NTWC – TER SOPS

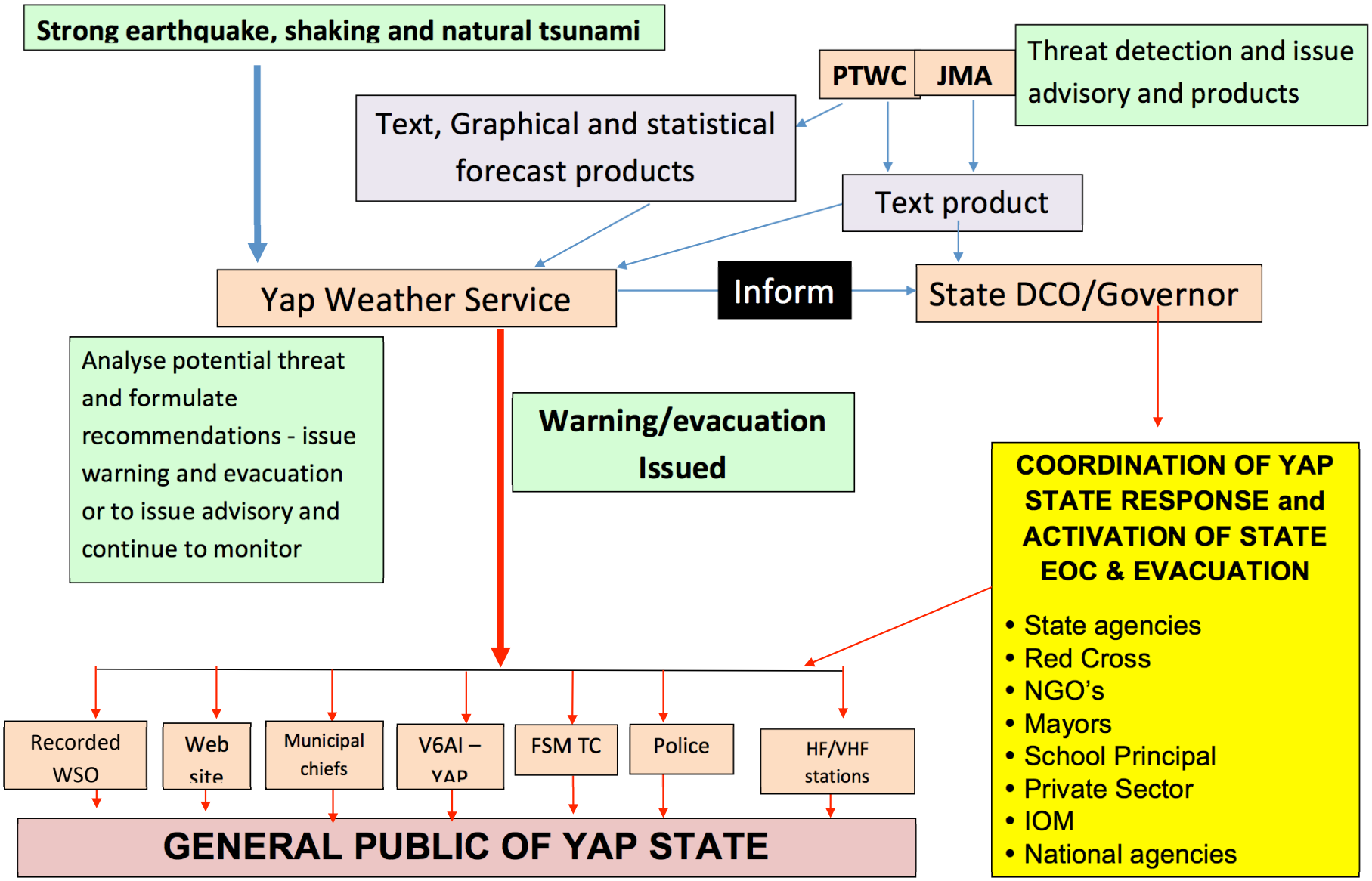
- **Identify Stakeholders. Specify roles.**
- **Describe end-to-end (detection to evacuation)**
- **Warning Communication Flow Chart**
  - Who does What
  - Distant / Regional – Local
  - Warning, Watch, Information Alerts
- **Timeline-driven SOPs**
  - Who does What and When
  - Time, Products, Actions

Example – Tsunami Warning Communication Flow



Example – Tsunami Warning Communication Flow

YAP STATE, FSM - LOCAL TSUNAMI OR < 2 HRS



Timeline-driven SOPs

- Planning for seamless, effective response. Manage expectations.
- Specify critical actions / decision points. What decision, and when it must occur
- Add TIME to Communication Flow Chart
- When, What, Who, How, To whom

EVENT	TIME (When)	ACTIVITY (What actions)	AUTHORITY (Who)	MEDIUM (How)	TO (Target audience)
EQ Occurs					
Assess Threat - Tsunami might come					
Evacuate					
Tsunami comes					
Safe to return / Declare “All Clear”					

EXAMPLE: TIMELINE-DRIVEN SOP

TSUNAMI SCENARIO: Distant Tsunami (8 hrs to arrive)
TIMELINE-DRIVEN INFORMATION FLOW AND SOP for REPUBLIC OF MARSHALL ISLANDS
Draft 0.2, April 2014, ITIC

Notes:

- PTWC will issue 1st Message in 5-15 min, 2nd Message in 30-60 min, and as new information received and/or regularly (nominally hourly). PTWC Text,, Graphical, Statistical Forecast Products only to PTWS TWFP (WSO Majuro) by email; PTWC Text Product is public and goes to many and posted on PTWC web site.
- WSO will issue TIS, Watch, Warning based on PTWC Messages and monitoring of earthquake and tsunami as it propagates across the Pacific. Updates as new information received and/or regularly

TIME (HRS AFTER EQ)	TIME (HRS BEFORE WAVE ARRIVAL)	TIME (WHEN)	EVENT	ACTIVITY - ACTION (WHAT IS DONE AND BY WHOM / INFO AVAILABLE)	AUTHORITY (WHO FROM)	MEDIUM (HOW)	TO (TARGET)	IMPACT
0	8	0000	EQ Occurs	WSS on Duty				
0.08	7.8	0005	PTWC EQ Observatory Message	WSS on Duty responds to Alarm / Email	PTWC	CISN (internet) Alarm / PTWC Email	All with CISN, or WSO	Unknown
0.12	7.75	0007	PTWC Message 1	PTWC Message – earthquake info WSO read and interpret message	PTWC	Email, Fax, Phone from WFO Guam, EMWIN?	WSO	
0.5	7.5	0030	PTWC Message 2	PTWC Message – W-phase Forecast. WSO read and interpret message.	PTWC	Email, Fax, Phone from WFO Guam, EMWIN?	WSO	3ft forecast in RMI
0.75	7.25	0045	TIS	WSO recommends to NDMO/NDC to issue TIS to inform that earthquake has occurred, and is monitoring	WSO issues?	Fax, Phone, ?	NDMO	
0-2	8-6	0000-0200	Large earthquake occurred	Read & Interpret PTWC Bulletins. WSO assess hazard (check for historical impact (online NGDC, offline TsuDig), monitor Tide Tool, contact WFO Guam/PTWC as needed). Inform & coordinate with NDMO.	WSO	Fax, Phone, ?	Natl Govt	Possible Tsunami at source. Waiting for confirmation

1-1.5	7-6.5	0100-0130	PTWC Message 3	PTWC Message - Forecast after DART readings, near-source tsunami observations WSO read and interpret message.	PTWC	Email, Fax, Phone from WFO Guam, EMWIN?	WSO	4ft updated forecast in RMI
2	6	0200	Watch	WSO recommends to NDMO/NDC to issue Watch. Get Ready / Prepare, Do NOT Evacuate at this time. Inform Public	WSO issues?	Fax, Phone, ?	NDMO	
2.25	5.75	0215	Activate EOC	NDMO Watch Staff notify Cabinet / NDC / Stakeholder Agencies, etc to report to EOC	NDMO	Phone, ?	Cabinet, NDC, Stakeholders Agencies,	
2-5	6-3	0200-0500	Tsunami confirmed near source	Read & Interpret PTWC Messages. Monitor tsunami progress across Pacific. Consult with WFO Guam, PTWC or ITIC if needed. Update expected RMI threat. Inform & coordinate with EOC	WSO	TideTool, Pre-computed scenarios, Phone, Radio, etc		May be dangerous to RMI
2.5	5.5	0230	PTWC Message 4	PTWC Message – observations WSO read and interpret message.	PTWC	Email, Fax, Phone from WFO Guam, EMWIN?	WSO	
3	5	0300	Watch	WSO recommends to NDMO/NDC to issue Watch, hourly update. Report obs as tsunami propagates across Pacific	WSO issues?	Fax, Phone, ?	NDMO	
3.5	4.5	0330	PTWC Message 5	PTWC Message – observations WSO read and interpret message.	PTWC	Email, Fax, Phone from WFO Guam, EMWIN?	WSO	
4	4	0400	Watch	WSO recommends to NDMO/NDC to issue Watch, hourly update. Report obs as tsunami propagates across Pacific	WSO issues/	Fax, Phone, ?	NDMO	
4.5	5.5	0430	PTWC Message 5	PTWC Message – observations WSO read and interpret message.	PTWC	Email, Fax, Phone from WFO Guam, EMWIN?	WSO	
5	3	0500	Warning	WSO recommends to NDMO/NDC to issue Warning	WSO issues?	Fax, Phone, ?	NDMO	4ft flooding expected

5.25	2.75	0515	Evacuate	NDMO issues Evacuation	Natl EOC	Radio, TV, etc	Public	
				Various EM activities, such as Roadblocks, Vulnerable Communities (Outer Islands)/ Special Needs Population / Schools evacuation notification and evacuation, Critical Infrastructure notification and response, Ports and Harbors, Airport, etc				
6, 7	2, 1	0600, 0700	Warning	WSO recommends to NDMO/NDC to continue Warning, provide observations	WSO issues	Fax, Phone, ?	NDMO, State/Local EMO	
5-8	3-0	0500-0800	Tsunami propagating across Pacific	Read and Interpret PTWC Messages. Monitor tsunami progress across Pacific. Update expected RMI threat. Inform and coordinate with EOC	WSO		Natl Govt	Dangerous tsunami expected
8	0	0800	Warning, Tsunami arrives	WSO reports tsunami observations in RMI				First wave 6ft high
8-13?	0 to -5?	0800 and later	Dangerous tsunami waves continue to arrive	WSO monitors local sea level gauges to determine when dangerous tsunami waves have stopped arriving. Inform and coordinate with EOC. Make and receive calls giving observations/impact/damage	WSO			Later arriving waves may be > 6ft
?	?	?	Warning Cancellation	Consult with WFO Guam, PTWC or ITIC if needed. WSO recommends to NDMO/NDC to issue Warning Cancellation, or downgrade to Advisory. Waves no longer dangerous. Determine if people should stay out of the water for an additional period (Advisory)	WSO		State / Local / Natl Gove	Waves small (<1 ft)
?	?	?	Search and Rescue	First Responders begin Search and Rescue, if necessary.	State DCO			
?	-12 ?	2000	Safe to return	NDMO / State / Local Authorities issue All-Clear for populations to return to evacuated zones				

Final Guidance

- **Remember Goal: Early warning to save lives**
- **Successful warning must be in time, understood, and actionable (e.g., Warning => Evacuate)**
- **If you have a local threat (< 30-45 min), Education is priority. People must 1. Act on Natural Warnings, 2. Self-Evacuate - do not wait for NTWC warning**
- **NTWC to issue Alert using pre-determined criteria. Duty Staff know what to look for in PTWC products**
- **NTWC can decide Alert Level using only Public Text product (e.g., map forecast height to Warning). NTWC does NOT need to use all products (these add value, further detail).**

Thank You

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