RCPGP Warning System Integration Research Project

Los Angeles / National Capitol Region / New York
Final Report, November 2010

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START ►► National Consortium for the
Study of Terrorism and Responses to Terrorism

A CENTER OF EXCELLENCE OF THE U.S. DEPARTMENT OF HOMELAND SECURITY BASED AT THE UNIVERSITY OF MARYLAND

Executive Summary

Seventy telephone interviews were conducted between April and November 2010 with police, fire, and emergency management officials in cities and counties within in three Regional Catastrophic Preparedness Grants Program (RCPGP) sites: Los Angeles, National Capitol Region, and New York. These interviews provided information about the large-scale disaster plans, communication practices, and perceptions of public warning officials within these sites. This report presents the major themes and findings as they compare to scientifically grounded best practice described in the Public Warning Metric in Appendix B. Key findings include:

Are warning providers prepared to issue messages effectively?
➢ Many interviewed officials still do not adequately prepare for issuing public warnings; inputs and processes vary widely because of organizational history and individual personalities.

Are warning systems structured effectively?
➢ Nearly half of the participants noted technological challenges that could influence the effectiveness of their systems.

Do warning providers alert the public before messaging?
➢ Most warning providers do not explicitly distinguish between an alert and a message when communicating with the public and do not generally issue an "obtrusive" alert.

Are warning messages written effectively?
➢ Despite the demonstrated benefits of working from pre-scripted messages, almost half of the participants write (or would write) the message during the emergency event. Most who write warning messages are unaware of what a message should say to maximize the probability of timely and appropriate public action-taking.

Are warning messages delivered effectively?
➢ Some communities still do not comprehensively identify how to reach special or hard-to-reach populations with their messages. Typically, messages are only repeated if circumstances change.

Are adjustments made in response to public reaction?
➢ Warning providers generally monitor and adjust to public reaction to messages issued.

How do warning providers evaluate their efforts?
➢ Few warning providers solicit public feedback or use that feedback to develop standard operating procedures. Instead, officials rely on interested members of the media or public to contact them with complaints or suggestions.

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Project Overview

The National Consortium for the Study of Terrorism and Responses to Terrorism (START)—a U.S. Department of Homeland Security-funded Center of Excellence based at the University of Maryland—has been awarded a contract in support of FEMA's Regional Catastrophic Preparedness Grants Program (RCPGP). The purpose of the Warning System Integration Research Project is to help ensure that scientifically-grounded, public-warning principles are incorporated within future RCPGP frameworks and initiatives. This project engages the interrelationships among communities and warning messages to help achieve high levels of preparedness in order to minimize the impacts of future disasters.

START researchers contacted public warning officials in emergency management, fire, and law enforcement organizations in the New York City, Washington, DC, and Los Angeles RCPGP sites. These officials were asked to participate in interviews that focused on their current public warning practices, resources, and initiatives. FEMA officials may eventually use this information to help identify, refine, enhance, and/or develop standards and guidelines for public warnings within future RCPGP initiatives.

This project builds on related research and FEMA guidance including: 1) *Personal Preparedness in America*: Findings from the 2009 Citizen Corps Survey: Los Angeles/Long Beach Urban Area, April 2010; 2) *Public Response to Terrorism*: Findings from the National Survey of Disaster Experiences and Preparedness (REV 5), October 30, 2008; 3) Executive Order 13407, 2006; and 4) FEMA's *Comprehensive Preparedness Guide 101* (March 2009). This guide states that an effective emergency plan will include an annex that describes the system that provides reliable, timely, and effective warnings to the public at the onset and throughout a disaster.

START researchers were interested in public warning practices for the pending impact of community-wide disasters that pose a serious threat to life and public health and safety. Such events might include, for example, a flash flood, a toxic cloud from a chemical train derailment, a tornado, hurricane, a terrorist attack, or other severe emergency. START researchers were especially interested in large-scale events requiring rapid protective actions (e.g., shelter in-place or evacuation) to save lives and reduce injuries.

Research Participants and Methodology

This report presents findings drawn from 70 interviews conducted with public information officials across police, fire, and city/county emergency services agencies within the three RCPGP sites below:

Los Angeles/ Long Beach RCPGP Site

Counties Included	Principal Cities Included		
California			
• Los Angeles County	• Anaheim	• Glendale	• Pomona
• Orange County	• Arcadia	• Hemet	• Redlands
• Riverside County	• Burbank	• Irvine	• Riverside
• San Bernardino County	• Camarillo	• Los Angeles	• San Bernardino
• Ventura County	• Carson	• Long Beach	• San Buenaventura
	• Cerritos	• Montebello	(Ventura)
	• Chino	• Monterey Park	• Santa Ana
	• Colton	• Newport Beach	• Santa Monica
	• Compton	• Ontario	• Victorville
	• Costa Mesa	• Orange	• Temecula
	• Fountain Valley	• Oxnard	• Thousand Oaks
	• Fullerton	• Paramount	• Torrance
	• Gardena	• Pasadena	• Tustin

National Capital Region RCPGP Site

Counties Included	Principal Cities Included		
Delaware			
District of Columbia			
		• Washington, DC	
Maryland			
• Anne Arundel County	• Harford County	• Baltimore	
• Baltimore County	• Howard County	• Bethesda	
• Calvert County	• Montgomery County	• Frederick	
• Carroll County	• Prince George's County	• Gaithersburg	
• Charles County	• Queen Anne's County	• Lexington Park	
• Frederick County	• St. Mary's County	• Rockville	
		• Towson	
Pennsylvania			
Virginia			
• Arlington County	• Fredericksburg City	• Arlington	
• Clarke County	• Loudoun County	• Alexandria	
• Culpepper County	• Prince William County	• Culpepper	
• Fairfax County	• Spotsylvania County	• Fairfax	
• Fauquier County	• Stafford County	• Falls Church	
• Frederick County	• Warren County	• Manassas	
		• Manassas Park	
		• Reston	
		• Winchester	
West Virginia			
• Hampshire County	• Jefferson County		

New York/ Northern New Jersey RCPGP Site

Counties Included	Principal Cities Included		
Connecticut			
• Fairfield County		• Bridgeport	• Stamford
• Litchfield County		• Danbury	• Stratford
• New Haven County		• Milford City	• Torrington
		• New Haven	• White Plains
		• Norwalk	
New Jersey			
• Bergen County	• Monmouth County	• Edison	• Trenton
• Essex County	• Morris County	• Ewing	• Union
• Hudson County	• Ocean County	• Newark	• Wayne
• Hunterdon County	• Passaic County		
• Mercer County	• Somerset County		
• Middlesex County	• Sussex County		
	• Union County		
New York			
• Bronx County	• Queens County	• Arlington	• New York
• Dutchess County	• Richmond County	• Kingston	• Newburgh
• Kings County	• Rockland County	• Middletown	• Poughkeepsie
• Nassau County	• Suffolk County		
• New York County	• Ulster County		
• Orange County	• Westchester County		
• Putnam County			
Pennsylvania			
• Pike County			

30 interviews were conducted within the Los Angeles / Long Beach site, 26 within the National Capitol Region site, and 14 within the New York / Northern New Jersey site. Interviews were halted when additional interviews added no new insights to the findings. The fewer number of interviews conducted in the New York / Northern New Jersey site was due to the bulk of New York counties and cities referring the Lead Investigator to the New York City Office of Emergency Management (OEM); many New York officials apparently rely on this office for operational instruction. Interviews yielded sufficient theoretical variation across each site (city and county; urban, suburban, and rural) and type of personnel (city and county officials; police, fire, and emergency management officials).

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The START Lead Investigator for this project contacted officials in the following manner. First, a telephone call was placed to a principal city's City Manager office or principal county's Emergency Management office. The City Manager (or his/her assistant) or county official was asked to identify who writes and issues public warnings for the city or county. The agency of origin of a public warning (city, county, fire, or police) is generally determined by the nature of the incident and the Incident Commander. In some cases, the Lead Investigator was referred to the city or county Public Information Officer (PIO). In other cases, the Lead Investigator was referred to the city's Fire Department or Police Department. Following FEMA guidelines, most large-scale emergencies require the establishment of an Emergency Operations Center (EOC)—and in some cases, a Joint Information Center (JIC)—to ensure coordination among relevant agencies.

Second, once identified, public warning officials were asked to participate in a 20-30 minute, semi-structured, telephone interview. The Lead Investigator recorded participants' responses by hand on the interview protocol developed for this project. The key questions and follow up questions that guided the interviews are included in Appendix A. These questions are based on the Public Warning Metric included in Appendix B. This metric is, in turn, based on a synthesis of more that 350 social scientific research studies concerning effective public warning principles and practices. Finally, participants' responses were grouped and analyzed by the Lead Investigator to identify themes and patterns in the responses. Those themes and patterns are reported in the pages that follow. Percentages are reported for answers across all three RCPGP sites under investigation. Findings among the sites were consistent; however, one significant variation among the sites due to a changed interview question is discussed under Q_4.

Q$_1$: Are warning providers prepared to issue messages effectively?

<u>Scientific Standard</u>: Best practice indicates that an effective warning system should eliminate the system actor's personality; standard operating procedures (SOP), not individuals, should determine actions. Without effective SOPs, persistent "myths" may negatively influence warning efforts (i.e., warnings cause "panic," so they must be withheld until absolutely necessary). Refer to Public Warning Metric section 2.0.

Key Finding: *Even though America invented the profession of emergency management, and even though FEMA and its predecessors have done much in the last 45 years to bring formal planning and preparedness to the fore, many Los Angeles / Long Beach area officials still do not adequately prepare for issuing public warnings to save Americans' lives. Inputs and processes vary widely because of organizational history and individual personalities.*

This section presents interview findings regarding how officials prepare themselves to issue public warnings before and during a large-scale emergency. The majority of officials follow a patchwork of internally generated guidelines and standard operating procedures (SOPs) for issuing public warnings, while others follow no formal guidelines at all. Written procedures may simply constitute one page within a community's larger emergency management plan, or procedures may constitute an entire binder that includes more than a dozen pre-scripted messages. Formalized planning for public warning across the RCPGP region is thus highly uneven. For example, few officials have public warning "thresholds" in place, i.e., specific "rules" that describe when and how to communicate with the public. Instead, messages are issued at the discretion of the incident commander, as "circumstances dictate," or via a PIO's "judgment call." There is currently no single, authoritative source of guidance for preparing officials to issue public warnings. Training is also variable, with some officials participating in internal and external public information training courses, while others simply rely on their experience and informal meetings with PIO peers within their jurisdiction. Local or regional exercises and scenarios are conducted as part of broader emergency planning; however, few organizations participate in exercises that coordinate public warning efforts across multi-jurisdictional levels. Succession planning is generally formalized, with shifts in responsibility (mobilization) also established.

Table 1: Warning Provider Preparedness

	Yes	No	Don't Know
Standard operating procedures are written down.	66%	31%	3%
Warning thresholds are in place.	28%	63%	9%
SOP training is conducted.	76%	23%	1%
Exercises and/or scenarios are conducted.	76%	24%	0%
Succession planning is detailed within SOPs.	89%	10%	1%
Shifts in responsibility are identified.	80%	17%	3%

Q$_2$: Are warning systems structured effectively?

Scientific Standard: A complete warning system includes subsystems that are specified and integrated, including all organizations involved. Systems must account for compatibility, overload, electrical supply, fail-safe, redundancy, and ability to reach special populations. Refer to Public Warning Metric section 2.0.

Key Finding: *Most officials believe that their community's warning systems are structured effectively, i.e., able to withstand and/or adapt to the impact of a major disaster. However, nearly half of the participants noted technological challenges that could hamper the effectiveness of their systems. Additionally, most officials did not have much or any interaction with federal-level organizations that issue warning messages (e.g., the Weather Service or U.S. Geological Survey) and were unsure whether communication from those agencies followed a set of rules and procedures.*

This section presents interview findings regarding how warning systems are structured in order to effectively respond to large-scale emergencies. The majority of warning providers interviewed for this study have seldom or never been contacted by a federal agency (e.g., Weather Service, U.S. Geological Survey, or the FBI) regarding information about a potential disaster. As a result, many officials were unaware of any rules or procedures governing that communication. Furthermore, whether there would be two-way communication between providers and agencies was unclear. Yet, officials generally believed that two-way communication would be possible if circumstances warranted. Roughly an even number of warning providers identified technological challenges in gathering and communicating information as those who identified no such challenges. Noted technological challenges included saturation of dispatch centers during emergencies, system interoperability, Internet and telephone service interruptions, and/or power outages.

Nearly every warning provider identified failsafe mechanisms for their systems; most often, the community's EOC. However, some providers noted that in a severe emergency that disabled the media's ability to broadcast messages, officials would have to resort to door-to-door canvassing and megaphone broadcasts from emergency vehicles. Generally, backup power supplies and redundant communication channels were indentified.

Table 2: Warning System Structure

	Yes	No	Don't Know
Interagency communication follows rules and procedures.	55%	10%	35%
There is two-way communication among agencies.	62%	10%	28%
There are technological challenges in communicating.	49%	45%	6%
Failsafe mechanisms are in place.	99%	0	1%
Redundancies are in place.	94%	0	6%

Q₃: Do warning providers alert the public before messaging?

Scientific Standard: Alerting the public precedes giving them a warning message. An alert should get people's attention before a warning is provided. The warning system should be capable of "obtrusive alerts," including "lights on" in theaters, piercing sounds with TV crawlers, waking sleeping children and adults, and gaining the attention of those with hearing loss or those who are under the influence of alcohol. Refer to Public Warning Metric section 2.0.

Key Finding: *Most warning providers do not explicitly alert the public before issuing warning messages. Even those warning providers who do issue alerts insufficiently account for certain sub-populations such as the elderly, disabled, visitors, and non-English speakers.*

This section presents interview findings regarding whether and how warning providers alert the public in advance of issuing messages. Although some warning providers claim to issue alerts in order to gain the public's attention, seldom do communities issue "obtrusive" alerts (i.e., "lights on" in theaters, use of piercing sounds with TV crawlers, waking people up such as sleeping children, older adults, people with hearing loss, or those who are under the influence). Generally, warning providers rely on media relations, local government television, and various emergency information systems (such as "opt-in" phone/email/text systems) to issue messages without a preceding alert. There is also confusion among some warning providers regarding what constitutes an "alert." For example, some believe that the use of the Emergency Alert System (EAS) is sufficient to alert the public. One participant asked, "What's the difference between a press release and an alert?" While another participant stated, "By the time I'm issuing a message (in response to a fire or earthquake) the public already knows (what is happening)."

Additionally, some warning providers indicated that for a slow onset emergency (i.e., severe weather), media outreach and messaging constituted sufficient alerting. Others, however, acknowledged the insufficiency of that method of altering in the context of a rapid onset emergency (i.e., fire or flood). The majority of participants acknowledged that they do not alert hard to reach and/or special populations, or that their extant altering efforts may not adequately reach these groups.

Table 3: Altering

	Yes	No	Don't Know
Warning provider secures the public's attention before issuing a message.	29%	69%	2%
Obtrusive alerts are issued.	20%	79%	1%
Hard to reach and/or special populations are alerted.	16%	80%	4%

Q₄: Are warning messages written effectively?

<u>Scientific Standard</u>: An effective warning message identifies the "what, when, where, why, and who" concerning an emergency situation. The message is issued from multiple sources. It is written in a style that is clear, specific, accurate, certain, and consistent. Working from pre-scripted messages helps to ensure message completeness, quality, and timeliness during an emergency. Refer to Public Warning Metric section 1.0.

> **Key Finding:** *Few participants in this study had experience in writing public warnings for large-scale disasters requiring evacuation or sheltering-in-place. Few are familiar with what should be in a warning message to facilitate timely and appropriate public action-taking. Slightly more than half of the participants claimed that they do (or would) work from pre-scripted and pre-vetted message, rather than write the message during the emergency event.*

Most of the participants in this study claimed to have never written and/or issued a warning message for a large-scale emergency requiring an evacuation or sheltering-in-place. As a result, an overall assessment of the effectiveness of prior warning messages could not be conducted. Nevertheless, because many communities are increasingly relying on various types of "opt-in" phone/email/text emergency information systems with limited text lengths, it is questionable whether associated messages will consistently align with scientifically grounded best practice (see Public Warning Metric in Appendix B). There is wide variability in the number and format of pre-scripted messages that are available to warning providers. While some providers claim to have pre-scripted messages for "all known hazards," others work mostly (but not completely) from scratch during an emergency event. A handful of participants provided examples of warning messages that had been issued by their community. Most of these messages, however, did not effectively explain "what to do," "when to do it," who should do it (and who should not do it)," "why" (i.e., the hazard and its consequences), and "who" is giving the message, as best practice would indicate that they should. Additionally, few warning providers have ever issued an "all clear" for a protective action, explained the reasons for false alarms, or ever considered doing so (see explanation of table below). Finally, most warning providers offer some form of public education (those who do not explained that another agency provides that service). This education varies in its scope and scale. For example, public education efforts may be limited to a single website, or encompass informational packets, videos, public presentations, utility bill inserts, Public Service Announcements, preparedness kits, or other initiatives.

Table 4: Message Effectiveness

	Yes	**No**	**Don't Know**
Pre-scripted and pre-vetted messages are used.	53%	44%	3%
An "all clear" is/would be issued.**	44%	11%	37%
False alarms are/would be explained.**	51%	10%	39%
Pre-event public warning education is provided.	71%	23%	6%

** Findings for these questions differed across the RCPGP sites. This is because for the National Capitol Region and New York sites, associated interview questions contained the follow up question, "*Would* you issue an 'all clear' or explain false alarms?" This question was added because few officials had ever done either. Thus, readers should assume that most warning providers would issue an "all clear" and explain false alarms if needed.

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Q$_5$: Are warning messages delivered effectively?

Scientific Standard: The warning system should be integrated, planned, exercised and trained for across organizations that play a role in the system. Additionally, it should reach remote, disadvantaged, and impaired publics, including: hospitals in communities, hearing impaired in buildings, visitors and "out-of-towners," and different language speakers. Refer to Public Warning Metric section 2.0.

Key Finding: *Participants report wide variability in the number and type of delivery channels used to communicate warning messages to the public. Additionally, some communities still do not comprehensively identify how to reach special or hard-to-reach populations with their messages. Typically, messages are only repeated if circumstances change. Multiple channels and stakeholders complicate efforts to integrate organizations across the system.*

This section presents interview findings regarding whether warning messages are delivered effectively, i.e., repeatedly, over multiple channels, and to diverse populations. Although frequently repeated messages are heard better because repetition fosters confirmation, confirmation fosters belief, and belief fosters taking an action, most warning providers only issue messages in response to changing circumstances.

Participants also reported variability in the number and type of channels used to deliver warning messages. Some officials have access to only a handful of channels, such as media advisories (television, radio, and print) and websites. Others, however, have access to EAS, notification systems such as Reverse 911®, "opt-in" phone/email/text systems, public access television, cable television, newsletters, Facebook, Twitter, Nixle, and first-responder door-to-door canvassing.

Consideration of special populations ranged from distributing messages in multiple languages (some of those mentioned included Spanish, Mandarin Chinese, Korean, Cambodian, and Tagalog). Disabled, hearing impaired, and elderly populations are generally reached via specific agencies in charge of those groups during an emergency (senior services and disability coordinators, for example). Officials indicated wide variability in the number of special populations considered, with some groups not explicitly identified at all.

Table 5: Message Delivery

	Yes	No	Don't Know
Efforts are made to reach special populations.	72%	23%	5%

Q$_6$: Are adjustments made in response to public reaction?

Scientific Standard: Warnings should not be "static" but an "adapted" conversation based on monitoring public response. Refer to Public Warning Metric section 2.0.

Key Finding: *While most officials claim to make adjustments to their messages in response to public reaction, there is wide variability among warning providers regarding how public response is/should be monitored.*

This section presents interview findings regarding whether warning messages are adjusted based on monitoring public reaction to the messages already delivered. Communities generally require the activation of the EOC (and in some cases a JIC – Joint Information Center) during a large-scale emergency. Within this context, monitoring typically becomes a formalized process, and staff members are instructed to monitor first-responder reports, television, radio, and the Internet to assess how the public is reacting or not reacting to messages, determine what other warning providers are saying, and whether any rumors are arising.

In absence of EOC activation, however, monitoring typically encompasses some form of "media clipping" and/or is dependent on inbound calls and emails from journalists and citizens.

Generally, "adjustment" messages are issued in exactly the same manner as other messages.

Rumor control varies: In some cases, monitoring for rumors relies on word-of-mouth from field-level personnel. In other cases, formal monitoring of media and Internet occurs.

Table 6: Monitoring and Adjusting to Public Response

	Yes	No	Don't Know
Formal monitoring of public reaction is conducted.	84%	9%	7%
Other warning providers' messages are monitored.	86%	11%	3%
Rumor control is performed.	70%	23%	7%

Q₇: How do warning providers evaluate their efforts?

Scientific Standard: No state, city, or county public warning plan should exist in a vacuum or in isolation. The public can best be protected when warning and response planning and evaluation are integrated. All relevant organizations, roles, and responsibilities should be identified, and provisions for continuous communication between these organizations and their stakeholders should be made. Refer to Public Warning Metric section 3.0.

Key Finding: *Even though an after-action report that includes discussion of public warning efforts may be produced in the aftermath of an EOC activation, few warning providers solicit public feedback or use that feedback to develop standard operating procedures. Instead, officials rely on interested members of the media or public to contact them with complaints or suggestions. This "unsolicited" public feedback may nevertheless influence operations and planning as indicate in the table below.*

This section presents interview findings regarding whether warning providers evaluate their efforts via the collection of public feedback. Most warning providers do not systematically collect public feedback regarding their efforts. However, after-action reports are required in the aftermath of some EOC activations. Yet, these after-action reports generally include minimal description of public warning activities.

Most feedback is gathered via inbound communication from citizens and the media. Yet, very few organizations actively seek feedback.

Table 7: Evaluation

	Yes	**No**	**Don't Know**
An after action report is (or would be) produced.	81%	12%	7%
Public feedback is formally sought and collected.	23%	74%	3%
Public feedback influences subsequent operations.	42%	49%	9%

Conclusions

Interview responses suggest that many public warning officials within the three RCPGP sites under investigation are well prepared in some areas, but not in others. The majority of participants cited FEMA requirements and guidelines that ensure failsafe mechanisms, redundancies, monitoring capabilities, special populations protocols, routine exercises, succession planning, and shifts in responsibility are in place. Nevertheless, responses also revealed several areas of potential concern as FEMA works to improve public warning plans, policies, and practices.

Variability among municipalities' and counties' warning protocols and capabilities was anticipated; however, this variability may complicate RCPGP-wide coordination during large-scale events. For example, one county's PIO may issue a warning in response to a rapid onset emergency; an adjacent county's PIO, however, may not warn residents at the same time or in the same way due to differing practices and assumptions about communication and citizen response. Additionally, one PIO may use pre-scripted and pre-vetted warning messages; the other PIO may have to write warnings under intense pressure and have them vetted by officials. Finally, one PIO may be able to use Facebook and Twitter to monitor response and usefully adjust subsequent warning messages; the other PIO may not. This variability creates added possibilities for loss of life and property. The recommendations below are intended to reduce this variability under acknowledged economic and technological constraints.

The proliferation of commercially available, web-based, "opt-in" alert and messing systems creates both opportunities and problems for warning providers. On one hand, these systems allow officials to quickly reach those who register their communication devices (cell phones and email addresses). These systems can be configured to fit the needs of counties and municipalities. On the other hand, these systems typically limit the number of characters a warning message can contain. This limitation constrains officials' abilities to write and issue warning messages that cover the action(s) to take, why to take them, when to take them, who should and who should not take them, and the source of the message. Scientific best practice indicates that "complete" warning messages improve public response. The recommendations below are intended to lessen the negative impacts of the technological constraints surrounding opt-in alert and messaging systems.

Recommendations

GAO Report (September 2009) "Improved Planning and Coordination Necessary for Modernization and Integration of Public Alert and Warning System" underscored the challenges involved in implementing an integrated alert and warning system. In 2009, FEMA released its "Comprehensive Preparedness Guide 101," which instructed officials to create an annex within their Emergency Operations Plans (EOPs) that described their agency's public warning policies and procedures. However, findings from this research project suggest that few organizations within the LA, NYC, or National Capitol Region have yet created this comprehensive annex. Additionally, FEMA's existing guidance is insufficient in that it does not outline the policies or procedure that need to be consistent *across* municipalities and counties within a particular RCPGP site. As a result, this section provides recommendations for ensuring that public information officers use scientifically grounded best practice for warning to help save Americans' lives. These recommendations do not target specific technological systems such as EAS or IPAWS, but instead focused on the general practice of public warning.

These recommendations rely on the concept of a **complete warning message (CMW)**. A CMW is designed to and overcome the obstacles of character-limited text messaging systems or other communication channels that impede the full and complete dissemination of a detailed public warning. FEMA considers a short warning message for EAS a warning and lumps more extensive information into other less pressing information categories.

1. **Include pre-scripted and pre-vetted EAS messages for identified hazards.**
    <u>Research Finding and Justification</u>: Only 53% of participants reported using pre-scripted EAS or other warning system messages, and it is likely that even more officials would need to have those messages vetted by senior officials before they could be issued to the public. Some officials reported having upwards of a dozen templates, while others only used a few templates for weather-related incidents. Drafting and vetting warning messages under rapid-onset emergency conditions creates additional possibilities for error and delay.

2. **Include information in EAS messages about where the public can access pre-scripted CWMs for identified hazards.** <u>Research Finding and Justification</u>: Because only 53% of participants reported using pre-scripted EAS or other warning system messages, it is necessary to develop CWMs so that essential information is not omitted or overlooked when EAS and other warning systems are used to communicate with the public. EAS and other warning systems potentially constrain possibilities for issuing complete information. A CWM can be posted/listed/recorded on numerous communication channels (such as web and telephone recordings for special needs populations).

3. **Include pre-scripted and pre-vetted CWMs for identified hazards that cover the action(s) to take, why to take them, when to take them, who should and who shouldn't take them, and the source of the message.** <u>Research Finding and Justification</u>: Because only 53% of participants reported using pre-scripted EAS or other warning system messages, it is likely that rapidly drafted and issued messages will be incomplete. CWMs would help ensure that messages correspond to scientifically grounded best practice.

4. **Describe the source of the CWM as a mix of people, e.g., officials, local newscasters, NGOs, scientists and others as may be appropriate.** <u>Research Finding and Justification</u>: Few participants reported having issued a warning that required sheltering-in-place or evacuation. Most messages for low-impact emergencies reviewed during this study did not identify the sources of information beyond the agency issuing the message. Scientifically grounded best practice indicates that effective warning messages are attributed to multiple, authoritative sources.

5. **Word CWMs so that they are clear, specific, accurate, certain and consistent.** <u>Research Finding and Justification</u>: Most messages for low-impact emergencies reviewed during this study were brief. These messages did generally appear clear, specific, accurate, certain and consistent. Scientifically grounded best practice indicates that effective warning messages for large-scale emergencies must share these same qualities.

6. **Include pre-scripted and pre-vetted CWMs for ending the event, e.g., issuing an all-clear and providing an explanation for events that did not occur.** <u>Research Finding and Justification</u>: Many participants reported having never formally ended a protective action or explained a false alarm (having never experienced one). Although many participants reported that they would do so if circumstances dictated, this is more likely if associated CWMs are in place and incorporated within SOPs.

7. **Describe/identify the plans, procedures and agencies used to provide CWMs.** <u>Research Finding and Justification</u>: Only 66% of participants report having SOPs in place for public warning functions. Scientifically grounded best practice indicates that SOPs reduce errors and improve the effectiveness of warning systems.

8. **Describe/identify the plans, procedures and agencies used to provide CWMs to warning partners both inside and outside the area at risk for all events that might attract national attention and media coverage.** <u>Research Finding and Justification</u>: Only 66% of participants report having SOPs in place for public warning functions. Most of those SOPs were developed in-house. As a result, there may be significant variability among agencies within an RCPGP site. This recommendation reduces that variability by aligning plans and procedures.

9. **Describe/identify the plans, procedures and agencies used to repeatedly disseminate CWMs to the at-risk public through multiple, numerous and diverse channels of communication including social media.** <u>Research Finding and Justification</u>: Most participants reported that they would only resend a warning message if circumstances changed or evidence suggested that the public was not responding. Scientifically grounded best practice indicates that the same message should be repeatedly disseminated in order to spur action. Additionally, less than half of the participants reported using social media, an emerging and important channel.

10. **Describe/identify the procedures and agencies used to monitor actual public response to warnings so that adjustments in subsequent public CWMs can address non-compliance and positively and quickly impact it.** <u>Research Finding and Justification</u>: Although most participants indicated that EOC activation required formal monitoring of public response to warning messages, few participants indicated that procedures were in place to respond to non-compliance.

11. **Describe/identify plans, procedures, and approaches, to actively collect information to evaluate alert, notification and warning event shortcomings and other lessons learned and use these to make needed refinements in local warning plans and procedures.** <u>Research Finding and Justification</u>: Although EOC activation requires an After Action report, most participants acknowledged that public feedback is rarely formally sought and collected. Ideally, public feedback positively influences subsequent operations.

Proposed Guidance for Enhanced Warning Systems

The PI and Project Consultant, Dr. Dennis Mileti, reviewed the Communications, Warning, and Emergency Public Information sections on, respectively, pages C-15 to C-17 of FEMA's 2009 Comprehensive Preparedness Guide 101 (CPG 101), titled "Developing and Maintaining State, Territorial, Tribal, and Local Government Emergency Plans." The PI and Project Consultant compared the communications, warning, and emergency public information guidance therein to: 1) the repetitive warning research findings in the social and behavioral sciences over the last half-century; 2) the warning metric based on them developed for this study and included in Appendix B; and 3) the original empirical findings discerned in this study in order to recommend empirically based and "highly reliable" communication, warning, and emergency public information guidance updates. These follow in the bolded text below. They are included along with the guidance currently provided in non-bolded text on pages C-15 through C-16 of CPG 101. No existing guidance statements have been deleted. It is recommended that this expanded set of guidance recommendations be adopted by FEMA. It is also recommended that all communications, warning and emergency public information guidance recommendations be required for at least major terrorist events of national significance.

COMMUNICATIONS (see page C-15)
This section describes the process for providing reliable and effective communication among organization participating in an emergency operation.
- Describe/identify the procedures and personnel used to manage communications between the on-scene personnel/agencies (e.g., radio frequencies/tactical channels, cell phone, data links. Command Post (CP) Liaisons, communication vehicle/van) in order to establish and maintain a common operating picture of the event.
- Describe/identify the procedures and agencies used to identify and overcome communication shortfalls (e.g., personnel with incompatible equipment, use of ARES/RACES at the CP/off-site locations, CB radios).
- Describe/identify the procedures and personnel used to manage communications between the on-scene and off-site personnel/agencies (e.g. shelters, hospitals, EMA).
- Describe the procedures used by 911/Dispatch Centers to support/coordinate communications for the on-scene personnel/agencies, including alternative methods of service if 911/Dispatch is out of operations (e.g., resource mobilization, documentation, backup).
- Describe the arrangements that exist to protect emergency circuits with telecommunications service priority for prompt restoration/provisioning.
- Describe/identify the procedures used by an EOC to support and coordinate communications between the on- and off-scene personnel and agencies.
- Describe/identify the interoperable communications plan and compatible frequencies used by agencies during a response (e.g., who can talk to whom, including contiguous Local, State, and private agencies).
- Describe how 24-hour communications are provided and maintained.

<u>**WARNING (see page C-16)**</u>
This annex describes the system that provides reliable, timely, and effective warnings to the public at the onset and throughout a disaster.

- Describe/identify the procedures and agencies used to initiate/disseminate the initial notification that a disaster or threat is imminent or has occurred (e.g., EAS activation, door-to-door, sirens, cable/TV messages).
- Describe the use of Emergency Conditions Levels (ECLs) in the public notification process (e.g., snow emergencies, HAZMAT incidents, nuclear power plant events).
- Describe the procedures and agencies used to alert special-needs populations in the workplace, public venues, and in their homes.
➢ Include pre-scripted **and pre-vetted** EAS messages for identified hazards.
➢ **Include information in EAS messages about where the public can access pre-scripted complete warning message (CWMs) for identified hazards.**
➢ **Include pre-scripted and pre-vetted CWMs for identified hazards that cover the action(s) to take, why to take them, when to take them, who should and who shouldn't take them, and the source of the message.**
➢ **Describe the source of the CWM as a mix of people, e.g., officials, local newscasters, NGOs, scientists and others as may be appropriate.**
➢ **Word CWMs so that they are clear, specific, accurate, certain and consistent.**
➢ **Include pre-scripted and pre-vetted CWMs for ending the event, e.g., issuing an all-clear and providing an explanation for events that did not occur.**

<u>**EMERGENCY PUBLIC INFORMATION (see page C-16)**</u>
This annex describes the systems to provide reliable, timely, and effective information to the public at the onset and throughout a disaster.

➢ **Describe/identify the plans, procedures and agencies used to provide CWMs.**
➢ **Describe/identify the plans, procedures and agencies used to provide CWMs to warning partners both inside and outside the area at risk for all events that might attract national attention and media coverage.**
➢ **Describe/identify the plans, procedures and agencies used to repeatedly disseminate CWMs to the at risk public through multiple, numerous and diverse channels of communication including social media.**
- Describe/identify the procedures and agencies used to provide continuous and accessible public information about the disaster (e.g., media briefings, press releases, cable interruptions, EAS), secondary effects, and recovery activities.
➢ **Describe/identify the procedures and agencies used to monitor actual public response to warnings so that adjustments in subsequent public CWMs can address non-compliance and positively and quickly impact it.**
- Describe/identify the procedures and agencies used to ensure that information provided by all sources includes the content necessary to enable reviewers to determine its authenticity and potential validity.
- Describe/identify plans, procedures, programs, and systems to control rumors by correcting misinformation rapidly.
- Describe the procedures and agencies used to inform special-needs populations in the workplace, public venues, and in their homes.

- Describe the role of a public information officer (PIO) and describe the procedures this person will use to coordinate public information releases (e.g., working with media at the scene, using a JIC, coordinating information among agencies/elected officials.
- Describe how responders/local officials will use and work with the media during an emergency (e.g., schedule press briefings; establish media centers on-scene; control access to the scene, responders, and victims).
- Include prepared public instructions for identified hazards, including materials for managers of congregate care facilities, such as childcare centers, group homes, assisted living facilities, and nursing homes.
- Describe the procedures and agencies used to manage rumor control on- and off-scene (e.g. monitoring AM/FM radio and television broadcasts).
- List the local media contacts and describe their abilities to provide warnings.
- **Describe/identify plans, procedures, and approaches, to actively collect information to evaluate alert, notification and warning event shortcomings and other lessons learned and use these to make needed refinements in local warning plans and procedures.**

Contact Information

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Warning System Integration Research Project
Interview Guide

The National Consortium for the Study of Terrorism and Responses to Terrorism (START)—a U.S. Department of Homeland Security-funded Center of Excellence based at the University of Maryland—has been awarded a contract in support of FEMA's Regional Catastrophic Preparedness Grants Program (RCPGP). The purpose of the Warning System Integration Research Project is to help ensure that scientifically-grounded, public-warning principles are incorporated within future RCPGP frameworks and initiatives. This project engages the interrelationships among communities and warning messages to help achieve high levels of preparedness in order to minimize the impacts of future disasters.

START researchers are currently contacting public warning officials in emergency management, fire, and law enforcement organizations in the greater New York City, Washington, DC, and Los Angeles metropolitan areas. These officials are asked to participate in interviews that focus on their current public-warning practices, resources, and initiatives. FEMA officials may eventually use this information to help them identify, refine, enhance, and/or develop standards and guidelines for public warnings within RCPGP initiatives.

If you agree to participate in this study, your name, specific organization, and specific community will <u>not</u> be identified in the grouped data that is reported to FEMA. As a result, a signed informed consent statement is not required to participate. Your participation is confidential, voluntary, and can be ended at any time and for any reason.

Focus of the Interview Questions

FEMA's Comprehensive Preparedness Guide 101 (March 2009) states that an effective emergency plan will include an "annex that describes the system that provides reliable, timely, and effective warnings to the public at the onset and throughout a disaster." START researchers are interested in public warning practices for the pending impact of community-wide disasters that pose a serious threat to life and public health and safety. Such events might include, for example, a flash flood, a toxic cloud from a chemical train derailment, a tornado, hurricane, a terrorist attack, or other severe emergency. START researchers are especially interested in large-scale events requiring rapid protective actions (shelter in-place or evacuation) by the public to save life and reduce injuries.

Interview Questions

Tell me a bit about what you do and the organization that you work for.

When agencies responsible for gathering information about disasters communicate with you, does that communication follow a set of rules and procedures?

Probing questions:
a. Is there two-way communication? For example, can you call back an agency and ask: "Can I get more information?"

b. Are there any technological challenges in getting the information and communicating it to right people?

c. What failsafe mechanisms are in place?

d. What are the redundancies in the system?

Are there standard operating procedures—written down—that tell you how to do your job when issuing a public warning?

Probing questions:
a. Do the agencies that communicate with you have SOPs in place?

b. What thresholds are in place? i.e., "Emergency Condition Levels" that need to be reached? In other words, are there rules about when you communicate with the public?

c. How do you train employees on SOPs? (Yours and others)

d. What kinds of exercises of those SOPs do you conduct? (Yours and others)

e. What kinds of scenarios of those SOPs do you conduct? (Yours and others)

f. Is there succession planning with those SOPs? (Yours and others)

g. Are shifts in responsibility (mobilization) within those SOPs identified? (Yours and others)

Do you do anything to get the public's attention before you issue a message? For example, the Weather Service issues an ear-piercing alert on TV to grab the public's attention.

Probing questions:
a. Do you issue obtrusive alerts?

b. How do you alert hard to reach populations (hospitals, nursing homes, visitors, deaf, cell phone users, etc.)

c. Which special populations do you reach out to?

d. Which special populations might you be missing?

When you issue a warning message to the public, do you work from a pre-scripted and pre-vetted message, or do you write it during the event and then have it vetted by officials? (Can we see some examples of messages for large-scale events?)

Probing questions
a. Do messages explain what to do; when to do it; who should do it and who should not do it; why (i.e., the hazard and its consequences) and who is giving the message? (Assess whether each of these five content elements is clear, specific, accurate, certain, and consistent – code messages along these dimensions).

b. Who is the message from?

c. Is the message issued by multiple sources?

d. What are the lengths of the messages (beyond EAS)?

e. Do you issue an "all clear" at the end of a protective action?

f. Do you explain the reasons for false alarms?

g. What kinds of pre-event public warning education (websites, fliers, etc.) do you provide? (Does anybody provide them?)

When you have your message, how do you get it to the public?

Probing questions
a. Tell me about every single way that you get your message to the public (Web 2.0)

b. How often over each channel do you issue a message?

c. Similar to alerting, what kinds of efforts do you make to reach special populations?

Do you adjust what you're saying based on the public's reaction to the messages that you've already sent? If yes, please give me an example. Note: If the example is about a "rapid onset" emergency (mud flows, fire, or flood) ask a follow up question about a "slow onset" emergency (swine flu, drought, or severe weather).

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Probing questions:
a. How do you actually monitor what the public is <u>doing</u> or <u>not doing</u> in response to the warnings that you issue?

b. How do you monitor what other warning providers are saying?

c. How do you go about issuing correct or updated information in response to changing circumstances?

d. How do you monitor for rumors so that you can dispel them (Web 2.0)?

Do you write an after action report for a major public warning effort?

Probing questions:

a. How do you collect feedback about your public warning efforts?

b. If you collect feedback, how does it influence subsequent operations and/or planning?

Public Warning Metric

Prepared for DHS/FEMA by:

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Introduction & Rationale

Those who write warning messages that are actually issued to the public rarely, if ever, have a working knowledge of the science-based research findings in the social sciences about public warning response and the way that warning message and other related factors direct it. This results in less effective warning messages being issued to the public than is possible, and includes warnings from government detection agencies, local government authorities, and others. Local government officials have the prime responsibility in our society to issue warnings to people in their jurisdictions. Even if national or international warning centers "detect" danger, local officials typically word most of the actual warning messages that reach the people in harm's way. However, there are so many local officials—and turnover among them is too high—that is difficult to imagine ever being able to train them all about how to word early warnings based on social science research findings. Scientific research into public warning response spans the last half-century. There are now some 350 publications that report findings from events studied around the world. All of these publications have been read and summarized in a 350 page long annotated bibliography that describes each piece of research and reports on some key findings. It is available at:

www.colorado.edu/hazards/publications/informer/infrmr2/pubhazbibann.pdf

This Public Warning Metric serves as a partial, preliminary guide for creating public warning systems and messages based on the accumulated research evidence. It is designed to assist officials analyze their community's public warning systems and protocols. The metric contains three critical areas of warning communication best practice: message; dissemination; and planning. A research summary and links to exemplary studies are provided in Appendix A. Examples of effective warning messages that take knowledge from accumulated social science research on public response to warnings are included in Appendix B.

Contents

1.0 Warning Message

1.1. Message Content. Each message sent through the warning communication system should include the following information:

WHAT: Tell audience what to do
WHEN: Tell audience when (time) to do it
WHERE: Say who should and shouldn't do it
WHY: Tell about the hazard's consequences so they now why they are being advised to do what you recommend
WHO: Say who's giving the warning (source)

Note: There is NO single credible source, so use multiple sources for the same message.

1.2. Message Style. Each message sent should be in a style that conforms to the following characteristics:

CLEAR: Simply worded is best
SPECIFIC: Precise and non-ambiguous
ACCURATE: Errors cause problems
CERTAIN: Authoritative and confident
CONSISTENT: <u>Externally</u>: Explain changes from past messages and differences from what others are saying. <u>Internally</u>: Never say, e.g.: "Attack will occur soon, don't worry."

1.3. Message Source. To achieve belief and action, the warning system should send one message over diverse channels, and generally from a "panel" of spokesperson, e.g., officials, Red Cross, scientists, familiar newscaster, and others. Note: firefighters are the most credible source in the United States (for 35%).

1.4. Sample Warning Message. Below is the form and format for a social scientifically grounded warning message designed to maximize belief and action (examples included in Appendix B):

- ➢ **Message label**
- ➢ **Who's speaking**
- ➢ **Who message is for (location)**
- ➢ **What they should do by when (who shouldn't)**
- ➢ **Why they should do it (risk/consequences)**

Repeat:

- ➢ **Who message is for**
- ➢ **What they should do by when**
- ➢ **End: message label and pending information**

1.5. "Canned' Warning Messages. Because it is not possible to train every warning provider in the nation in the social science aspects of warning messaging, pre-written draft messages that can be adapted when an event occurs should be available for use.

2.0 Warning Dissemination

2.1. Reach. The warning system should reach (which could require the use of special delivery systems and devices) remote, disadvantaged, and impaired publics, including: hospitals in communities, hearing impaired in buildings, visitors and "out-of-towners," and different language speakers.

2.2. Obtrusiveness. Alerting the public precedes giving them a warning. An alert should get people's attention before a warning is provided. The warning system should be capable of "obtrusive alerts," including "lights on" in theaters, piercing sounds with TV crawlers, waking sleeping children and adults, and gaining the attention of those with hearing loss or those who are under the influence. *

> *Outside devices loose effectiveness if windows shut and air/heat is on; a 3-minute sounding 10 decibels over ambient outdoor siren has a 62% chance of waking someone up.*

2.3. Informal Warning. The warning system should account for warning diffusion "among those warned." As a rule of thumb, there is 1 informal first warning for every 2 formal first warnings.

2.4. Channels. The warning system should include a high number of communication channels through which the warning is delivered, including personal channels such as route notification when possible and reverse 911. The best communication channels to use are all the ones that are used and available to public being warned.

2.5. Communication Frequency. The warning system ensures message repetition frequency. The "more" it is repeated and heard the better as repetition fosters confirmation, confirmation fosters belief, and belief fosters taking action.

2.6. Warning System Design. A complete warning system includes:
  ➢ Subsystems specified, including all organizations involved
  ➢ Linkages operational
  ➢ Subsystems and linkages integrated
  ➢ Exogenous factors incorporated in the system

2.7. Linkages. Officials must ensure that subsystems and linkages work:
  ➢ Appropriate technology
  ➢ Sound warning system actor behavior
  ➢ Practice makes perfect

2.8. Eliminate system actor's personality.
  ➢ Believe myths (e.g., panic) and withhold warnings
  ➢ Downplay risk as communicate "up" an organization
  ➢ Individuals (not procedures) determine actions

2.9. Use "complete" evidence-based messages.
  ➤ Officials who do not know research findings on warning messaging may say
    something else ("canned" messages would help)
  ➤ Officials should prepare for "ending" a protective action

2.10. Guarantee repetitive messaging. Few officials know to say it many times

2.11. Eliminate conflicting information.
  ➤ Address wrong information given by others by monitoring what others are saying
    and adjusting your next message accordingly
  ➤ Render inconsistent information consistent
  ➤ Focus public on "best" warnings
  ➤ Give "official warning" to other warning providers to upgrade what they say

2.12. Reach everyone at risk. Use diverse devices and channels to avoid missing
audience segments and reach all special populations.

2.13. Communicate to people not at risk:
  ➤ Safe members of public who are near
  ➤ Other warning providers (many are non-local)

2.14. Change what is said based on response:
Warnings should not be "static" but an "adapted" conversation based on monitoring
public response.

2.15. Solve technological communication problems with technological solutions:
Compatibility: problems observed since 1950s
Overload: inevitable
Electrical supply: some warnings go out after impact
Fail safe: has to work when needed
Mutually exclusive/redundant: more than one
Dedicated: available when needed
Customized: for special populations

2.16. Solve social communication problems with social solutions:

Between organizations:
  ➤ Organizations who don't communicate routinely are disinclined to do so during
    warnings
  ➤ Staff who don't communicate to centralized personnel routinely don't do so
    during warnings
To the public:
  ➤ Install ways to reach marginalized sub-populations

3.0 Warning System Planning

The following guidelines for planning, training, and exercising are derived from NUREG 0654, available from http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0654/.

3.1. Integrated Planning. No state, city, or county public warning plan should exist in a vacuum or in isolation. The public can best be protected when warning and response planning and evaluation are integrated. All relevant organizations, roles, and responsibilities should be identified, and provisions for continuous communication between these organizations should be made.

3.2. Clear and Concise Planning Documents. While no specific format for planning documents is required, an effective plan should make clear what is to be done in an emergency, how it is to be done, and by whom. Those with public warning responsibility should be identified by title and name, and their role and responsibilities should be clearly identified.

3.3. Continuous Readiness. Communities should ensure continuous readiness through routine public warning training, scenarios, and exercises. Public warning capabilities should be available 24-hours a day and periodically tested for reliability under different conditions. Spokespersons and briefing locations should be specified in advanced of an emergency.

3.4. Succession. Communities should identify a line of succession for public warning officials and identify the conditions under which shifts in roles and responsibilities may occur.

3.5. Emergency Classification and Action Scheme. Each community should establish an emergency classification and action scheme taking into account conditions that exist at the time of an emergency.

3.6. Public Preparedness Information. Communities should ensure that the public is provided with easily accessible (in electronic and paper form) emergency preparedness and response educational information, contact information, protective measures information, and information for those with special needs.

3.7. Exercises, Drills, and Training. Periodic (monthly) exercises and drills involving public warning systems should occur to identify and correct any deficiencies. Public understanding of the content of messages should be assessed. Officials should be trained in public warning protocols and practices under different emergency conditions.

Appendix A

Social and behavioral science research on the topic of public response to warnings of pending community-wide disasters has been conducted for over a half-century. This research has explored how variation in a range of factors including both the content of messages and alternative message delivery approaches impact motivating people at risk to take effective and timely protective actions. This white paper synthesizes these research findings.

Scientific Study of Human Response to Warnings
Four alternative knowledge bases are currently used to inform the practice of issuing warnings to endangered publics. Knowledge can be based on personal "experience." Warning practitioners gain knowledge about public response to warnings based on warning events personally experienced. Emergency managers often refer to this knowledge base as "lessons learned." Knowledge can also be based on "revelation." Revealed knowledge is when someone tells you something. This way of knowing is often referred to as "best practices" in the emergency management community. Knowledge about public warnings is often based on "intuition." Intuited knowledge is when something just seems like a "good idea." The last available knowledge base is knowledge gained through the use of "science". The scientific method generates knowledge by testing hypotheses to determine if "A" predicts "B" and it then uses systematic empirical observations to reach conclusions. What is reported in this white paper is knowledge about public warning response gained by use of the scientific method. Consequently, what follows may or may not conform to reader's knowledge accumulated through personal experience, revelation, or intuition. Scientific evidence-based approaches for public disaster warnings are, in fact, rarely used.

Scientific research into public warning response spans the last half-century. There are now some 350 publications that report findings from events studied around the world. All of these publications have been read and summarized in a 350 page long annotated bibliography that describes each piece of research and reports on some key findings. It is available at:
www.colorado.edu/hazards/publications/informer/infrmr2/pubhazbibann.pdf

This research literature includes public warning response research in many different nations. Some are Austria, Bangladesh, Bhopal, Canada, China, Colombia, Greece, Great Britain, Italy, Japan, Malaysia, Mexico, the Netherlands, Peru, the Philippines, Polynesia, and others. However, by-far, most studies have been done in the US. This research literature covers most disaster types for which warning is possible including most types of natural hazards, hazardous materials, technological accidents, and acts of terrorism. Over the years, several have attempted to synthesize knowledge from this published research record (McLuckie 1975; White and Haas 1975; Mileti 1999). The most recent and by far most complete published synthesis (Mileti and Sorensen 1990) is titled "*Communication of Emergency Public Warnings: A Social Science Perspective and State-of-the-Art Assessment*" and it reports on the organizational elements of warning systems, preparedness, historic sources of system failures, and summarizes all research

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findings on the factors that influence public warning response. These include both how warning messages are worded and delivered. Although now somewhat out-of-date particularly in reference to the descriptions of the warnings systems that exist in the US, it remains the most comprehensive synthesis currently available. It can be accessed by all at:
http://emc.ornl.gov/EMCWeb/EMC/PDF/CommunicationFinal.pdf

The scientific research record provides strong evidence for two general conclusions about public warning and subsequent protective action-taking. These are important to keep in mind as this paper is read. First, *people stay people despite differences in the hazards being investigated*. In other words, "people knowledge" transcends hazard type because the same factors that influence public warning action in response to one type of hazard apply to warnings of other hazard types. These factors have often been modeled, reduced to mathematical equations, and "the same equations apply" across different hazards and events. Consequently, the general knowledge that is available from the all-hazards research set is available and useful to those charged with issuing warnings for any particular hazard. The second conclusion is that differences in the "*quantities*" for the factors in the equations that predict public warning response do exist across different events, nations, and cultures. It is these differences that account for some of the very different public warning action outcomes that are observed. But those differences do not negate that the same equations and the list of factors in them apply in almost all events and circumstances.

Public Warning Response Myths
Before anything else, it is vital to address three very prevalent "world-wide myths" about public response to warnings of disasters. These myths have had a large and negative impact on issuing timely and effective public disaster warnings and belief in them continues to cost lives worldwide. A myth exists when: (a) it is believed to be true, but it's not; (b) when people think they have evidence for something, but they do not; and (c) when people will not stop believing it no matter what they might read to the contrary.

Myth one: panic. The concern that a warning could start a public panic is found around the world, across our nation, and it exists across time. It has repeatedly constrained providing an endangered public with effective warnings. The myth has delayed warning dissemination until there is more certainty that an event will actually happen as warning decision makers delay warnings so as to not unnecessarily create a public panic. It has also led to down-playing risk in warnings for the very same reason. Impacts like these rob the public of both the time and motivation that they need to act. People can, in fact panic, but panic has *never* resulted from issuing disaster warnings.

Panic is a *very rare* form of human behavior. It only occurs when four conditions are present. First, people are in a confined space like in closed-in room or in a theater. Second, escape routes are present. Third, people are convinced that death is certain if they do not traverse the escape routes to safety. But convincing people that death is certain is almost impossible before an event has happened. Most people must see others dying i*n situ* to believe that they too might die, for example, as might be observed during

a fire in a confined room. When these conditions exist, people sometimes "panic" to compete with each other to traverse the available escape routes to preserve their own life. But panic is actually rare even when these four necessary but not sufficient conditions for it to occur exist.

Belief in the panic myth may never be replaced with the reality. There are two reasons why. The first is that non-panic is taken as evidence of panic. For example, news reporters go to disaster events expecting to see, report on, and photograph panic. They observe "non-panic", but they do see people with heightened awareness, concern, and stress. They report this as people in a state of "near panic." Others read the story and "near-panic" is equated to "panic" resulting in the perpetuation of the panic myth. The second is an error in inference. For example, rare cases of panic do occur, but in events characterized by the conditions listed above. Panic in these non-warning events is incorrectly taken as evidence of the potential for panic in response to warnings.

Myth two: short warnings. The idea that public warnings must be short is all pervasive and found across our nation and even around the world. Advertisers know to communicate in simple language and in few words. These attributes are needed to keep an audience's attention, sell products, and keep air-time costs low. This practice is often incorrectly transferred to public disaster warnings. Warning messages should be simply worded, but short public warning messages do not adequately motivate public protective actions. In fact, short messages actually slowdown public action-taking because they create an "information starved" public. People at risk want to know as much as they can about pending events for which warnings are issued, and they are naturally drawn to media and to each other to find out more before protective actions are begun. And all people, as was first discovered by Drabek (1969), need to confirm warnings and the appropriateness of protective actions before acting. Short warnings that do not tell the public everything they need to hear spark people at risk on a search for more information before they take protective action. The information they find as a result of this search can be wrong and inconsistent. And searching for more information because of short official warnings lengthens the time between getting a warning and starting a protective action. This unnecessarily leaves some members of the public at risk longer which can be a problem in rapid onset events.

Myth three: cry wolf. Worldwide, people believe that the public is less inclined to act on disaster warnings after events for which warnings were issued that did not occur. In reality, people do respond after events for which warnings were issued but impacts did not materialize, but perhaps differently. Research documents that events like these can actually facilitate subsequent public warning response if they are followed by efforts to educate the public. But this happens only when the reason for warnings not followed by impact is explained to the public. Explanations like these happen rarely. The real issue is not that such events decay future public response but that they anger local government because they cost them money that they did not need to spend.

The Public Warning Challenge
Reality for human beings is what people "think" is real. Human mental constructs of reality relate to "objective" reality to the extent that personal objective experiences shape perceptions. But most people rarely, if ever, experience nature's extremes in the form of natural and other disaster types. The result is that most people do not perceive risk. Instead, most think they are safe from nature and other violent forces. Research into human risk perception concludes that most people think disasters will not happen in the near future, and if they do, that they will happen to someone else and not to them. The rare exceptions are found in human populations that "repetitively" experience disasters, for example, human settlements along rivers that frequently flood. The general inclination is that most people go through their lives believing that they are safe. This poses a large problem for those who might issue public disaster warnings. Warnings must overcome people's natural belief to think that they are safe, and then guide them to take protective actions that are inconsistent with their perceptions of safety. This is the "prime pubic warning challenge".

There is elaborate research-based empirical evidence on the topic of what it takes for warnings to help people to shed their safety perceptions and then take timely and effective protective actions. Here is what has been learned. People do not immediately respond to early warnings because they first "search" for additional information to "confirm" that they are really at risk. This search response happens despite the technology used to give warnings. Searching is a social phenomenon. It involves talking things over with others and seeking to hear the same warning over and over and from different sources before safety perceptions are relinquished. Warned people turn to friends, relatives, and strangers to determine if they agree that risk is present and if protective actions are warranted. This process--constructing new perceptions of risk out of existing perceptions of safety--adds time before protective actions are taken, it is fundamental to human beings worldwide, and it simply is not going to change. Public warnings work best when they facilitate the process and speed it along. Ignoring this basic human element in providing public disaster warnings has and will continue to cost human lives.

Wording Warning Messages
What is said and not said in a public warning message has a profound effect on what people think and then do in response to hearing that warning message. Research evidence, accumulated and replicated over decades, can be summarized as follows. Three topics are vital to address in a public warning message to maximize the odds that the endangered public takes timely and effective actions. These are: source, content, and style.

Source. Emergency warning planners around the world embark on quests for a "credible" warning spokesperson because they think source credibility will generate public warning belief. But, in reality, there is no single credible spokesperson to be found. There are three reasons why. First, different people in the public have different ideas about who is and who is not credible. Second, people's ideas about credibility change over time. Third, spokesperson credibility and warning message belief are different, and the former does

not guarantee the latter. In fact, if one relies on spokesperson credibility to foster warning belief the entire warning enterprise may be is destined to fail from a public response viewpoint. Here is an example why. The single most credible source of warning information in the US is firefighters. They have the highest sole-source credibility with 35 percent of the nation's population. But even they leave 65 percent of the population behind. The most credible early warning source is not a single spokesperson at all. It is a group of different people and organizations. For example, a group that includes a scientist from the scientific organization that detected the pending risk, the local mayor, the Red Cross or Red Crescent because so many people in the public associate them with disasters, a familiar local media announcer, and more. Creating a mixed panel to be the source public warnings requires that many agree to partner to be a warning co-source long before a particular events occur. Consequently, it falls into the domain of pre-event emergency planning.

Content. Research also documents the need for four additional items to be in a warning to facilitate public protective action taking. First, and most important, is to give people "guidance about exactly what they should do" using words that paint the picture of what their response should look like. For example, and in reference to the protective actions of evacuation, it is less effective to say "evacuate" or "get to high ground" than to say "by evacuate to high ground we mean climb the slopes around town until you are higher than the tallest downtown buildings". Second, warning messages should tell people about "the timing" of their actions. Warnings have a higher probability of being followed by appropriate public response it they tell people when they should start and by when they should complete the recommended protective action. For example, "begin evacuating now, do not delay, evacuate now and be on ground higher than the tallest buildings in town no later than 4:15 p.m. this afternoon". Third, warnings tend to work better when the tell people "who does and who does not have to take the protective action" and also explains why. People in harm's way need to clearly understand that you are talking to them. And people who are safe need to be told so. For example, "if you are in the city limits and south of the Red River evacuate now, if you are not in this area there is no reason for you to do anything because other areas will not flood". Last, people are more apt to take protective actions if the warning informs them about the pending hazard's "consequences and how the protective action will cut their pending losses". But research does not conclude that warnings should provide people with a science lecture about the phenomenon that is about to occur. It does conclude that the basis for protective action recommendations should be clear to the people being warned. For example, "the area of town south of Red River will be hit by a wave of water higher than all the rooftops that will be moving at 40 miles per hour; relocating to areas that will not flood will keep you safe".

Style. Warning message style is about how the warning is "worded and spoken" and it too influences public response. Research documents five style elements to use (Mileti and Sorensen 1990). The first is "clarity." Research clearly documents that simply worded messages work best. Jargon should never be used. A good rule of thumb to use in wording a public warning is that you should say it another way if your grandmother could not understand it. For example, a warning for an accident at a nuclear power plant should

not say "a breach in containment may result because of a transient excursion of core materials from the containment vessel". Instead, it should say "radiation may leak out of the building and into the air". The second important style element is to be "specific." Warning information that is precise and non-ambiguous works best. For example, it could cost lives if you advise people to evacuate and do not explain what you mean because the word evacuate will mean different things to different people. For example, "go north away from the coat line until you are 10 blocks inland and at least past the Intercontinental Highway". A third style element to include is "certainty". This means provide authoritative and confident language about what you tell people. One may wonder how to be certain about the uncertain disaster forecasts that so often come from scientists. Here is how you do it. Tell people "we cannot know if the tsunami will actually reach our coastline or exactly how high it may be if it does, but all the experts agree that it's likely enough that everyone should evacuate now. "Accuracy" is the fourth warning style element to affect public response. The people you warn need to think that they are being given accurate information. Inaccurate information or errors in information confuse people and their response. An example is provided by the 1979 accident at the one of the Three Mile Island nuclear reactors when a spokesperson for the US Nuclear Regulatory Commission stated that there would be an explosion at the power plant. He was referring to a gas bubble exploding inside a pipe in the reactor building but did not say so. Many people around the plant thought he meant that the plant would explode like a nuclear bomb. Information accuracy means telling people the truth. But it also means thinking about how people will interpret what you say. The final warning style element is "consistency." Consistent information works best. Inconsistent information can leave people with too much choice about the risk and protective action-taking. And given the choice, most people prefer selecting information that says they are safe and not at risk. Consistency is applicable to a single message itself, and also applies across messages. Changes from past messages should be explained in subsequent messages. Why what you are saying is different from what others have said also needs to be explained. And inconsistencies inside a message should be removed. For example, it is inconsistent to say "a dirty bomb has just been exploded downtown, don't worry". People should be worried about such an event. Telling them to not worry--likely because someone hopes to avoid starting a panic--gives them inconsistent information that erodes warning effectiveness.

Warning Message Delivery
How warning messages are delivered to the public also influences public action-taking because the delivery method impacts the amount of time it takes people in the public to convert pre-warning "perceptions of safety" into "perceptions of risk". Research documents three message delivery factors that impact people's warning response. These are the number of communication channels used, the type of channels used, and the frequency with which the warning message is communicated to the public.

Put simply, the more different channels of communication are used to communicate the warning message to the same public the better. The types of communication channels available in a society depend on many things, for example, level of development. But all societies have multiple and diverse channels to use. For example, in societies with

elaborate available technologies, early warnings heard over many different television channels, different radio stations, reverse 911 telephone call out systems to homes and over cell phones, texted messages, and so on result in giving the public more multiple warning message exposures. And doing so shortens the time people need to have "perceptions of risk" replace "perceptions of safety" resulting in more timely public protective action taking. When communication channels are selected, consider that personal channels are the most effective of all. Warnings delivered to people at the front door, a police car broadcasting a message on someone's street, or that comes over the kitchen telephone make it easier for people to conclude that they are among those being warned.

As the number of times that people hear the same warning message increases, the more likely they are to become convinced that they are at risk and then take a protective action. In fact, the more a warning is heard over and over the better. This key research finding is easily converted into warning plans: repeat the warning, then repeat the warning again and again, and do not stop repeating it.

Appendix B

Example Warning Message

This is a MANDATORY EVACUATION ORDER from the Yellow County Sheriff's Department AND Fire Authority. There's a high risk of CATASTROPHIC MUDSLIDES & DEBRIS FLOWS due to rain on BURNT SLOPES. After consulting with the U.S. Geological Survey and the National Weather Service, WE issue a mandatory evacuation order for the following people in Yellow County:

- If you LIVE IN or ARE IN an area BELOW or NEAR burnt slopes, evacuate now. Do not delay. This is a MANDATORY EVACUATION ORDER. Evacuate. Evacuate NOW.
- What we mean when we say evacuate is: GET OUT OF ALL CANYONS, and get out of them NOW.
- If you don't live in or aren't in an area below or near burnt slopes, you don't need to do anything.

If you have CHILDREN IN A SCHOOL located in a canyon:

- DO NOT GO THERE TO GET THEM. They won't be there when you arrive.
- All school children in all canyon schools are currently being evacuated to (insert the name, address, and telephone number).
- You can pick them up there once you have completed your own evacuation.

There's HIGH RISK of catastrophic mudslides and debris flows due to rain on BURNT SLOPES:

- Mudslides and debris flows could occur NOW, and they could be large enough to COMPLETELY BURY homes, roads, and lives.
- They can occur WITHOUT NOTICE.
- The amount of rain needed to start a catastrophic mudslide or debris flow is SMALL. Don't think you're safe because the rainfall you see is slight.
- The risk of catastrophic mudslides and debris flows below all burnt slopes in all Yellow Country is REAL.

If you LIVE IN or ARE IN an area BELOW or NEAR burnt slopes EVACUATE NOW.

- Evacuate WITHOUT DELAY. Evacuate NOW.
- This is a MANDATORY EVACUATION ORDER.
- There's a Red Cross shelter at Monroe High School in the town of Yellow.
- Bring your pets and keep them with you. Larger animals can be brought to the Yellow County Fairgrounds.
- If you have questions or require assistance, please call 123-456-7890.
- New information will be made available as it becomes available on this same station/channel.