THE WINSTON CHURCHILL MEMORIAL TRUST OF AUSTRALIA

Report by       Ian Mannix - 2012 Churchill Fellow

THE CHURCHILL FELLOWSHIP

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Signed       Ian Mannix

Dated November 16, 2012
Warning centres, emergency warnings and evacuations in the US and Canada

November 16, 2012

Bushfire country, Manton, Sierra Mountains, California. All Pics: ian Mannix
Contents

PROGRAM ........................................................................................................................................... 4
INTRODUCTION ....................................................................................................................................... 5
EXECUTIVE SUMMARY .......................................................................................................................... 6
CONCLUSIONS AND RECOMMENDATIONS .......................................................................................... 7
Federal agencies set standards and monitor implementation. .............................................................. 8
Community obligation .............................................................................................................................. 9
Partnerships between the private sector, emergency agencies and the broadcast media ...... 9
Use of smart phones to issue warnings ................................................................................................. 9
Evacuation ............................................................................................................................................... 10
Community awareness programs ........................................................................................................... 10
THE US WARNING SYSTEM .................................................................................................................. 12
BROADCAST COMMUNITY PARTNERSHIPS IN THE US .................................................................. 15
US WEATHER SERVICE RADIO ............................................................................................................. 19
US NATIONAL WEATHER SERVICE AND EXTERNAL PARTNERSHIPS ............................................ 21
BUSHFIRE EVACUATIONS ....................................................................................................................... 24
WARNINGS IN ACTION ............................................................................................................................ 28
The Ponderosa fire .................................................................................................................................. 28
Joplin tornado .......................................................................................................................................... 36
Landslides ............................................................................................................................................... 42
Tsunami warnings in Washington State, USA ......................................................................................... 47
THANKS ................................................................................................................................................ 52
## PROGRAM

<table>
<thead>
<tr>
<th>Date</th>
<th>Location/Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Sept</td>
<td>California Emergency Management Agency</td>
</tr>
<tr>
<td>24 Sept</td>
<td>California Warnings Centre</td>
</tr>
<tr>
<td>25-26 Sept</td>
<td>Manton, Cal</td>
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<td></td>
<td>Tahoma County EMA (Reading, Cal)</td>
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<tr>
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<td>KQMS Talk Radio (Reading, Cal)</td>
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<td>National Weather Service (Kansas City)</td>
</tr>
<tr>
<td>28 Sep</td>
<td>Joplin</td>
</tr>
<tr>
<td>1 Oct</td>
<td>National Weather Service (Washington)</td>
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<td>2 Oct</td>
<td>FEMA</td>
</tr>
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<td>3 Oct</td>
<td>National Forest Service</td>
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<td>9 Oct</td>
<td>American Broadcasting Corporation (New York)</td>
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<tr>
<td>12 Oct</td>
<td>British Columbia EMA</td>
</tr>
<tr>
<td>15 Oct</td>
<td>CBC Victoria, BC</td>
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<tr>
<td>18 Oct</td>
<td>Pierce County, Washington State</td>
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INTRODUCTION

Australians are increasingly expecting a warning from an emergency agency when they are responding to a natural or man made disaster. Warnings give context to the threat and advise what action experts want people to take, and importantly they are disseminated at a time that is useful to the listener. They therefore differ from “information”. Effective warnings can come via a radio broadcaster, normally ABC Local Radio, or mobile phone, or social media, TV, road signs, phones, or megaphone, but nearly always they are ignored until verified by a second or thirds trusted source.

Although the Bureau of Meteorology (BoM) has been issuing weather warnings for decades, the expectation from the community that they will receive all warnings, is a recent phenomenon, brought about by the commitment of ABC Local Radio to issue bushfire warnings in Victoria in 1997, a decision which was rolled out nationwide in 2006.

The US and Canada have range of risks which have resulted in them creating, 60 years ago, an all-nation all-hazard warning system. It’s recently been modernised.

The Churchill Fellowship was aimed at examining how American and Canadian emergency agencies provide information and warnings to communities under threat from fires, floods, tornadoes and tsunamis. A variety of technical warning systems have been put in place to deal with these contingencies, many of which have not been considered in Australia.

In addition it appears from reading media and literature their communities are highly motivated to evacuate, a process only now being considered in Australia.

Discussing warnings with the national, state and county emergency agencies, as well as the National Weather service, and commercial broadcasters, and then comparing their plans with actual on-the-ground events such as fires, tornadoes and floods, will give a very real indication of the value of warning services in the US and Canada.

I am grateful to many people who assisted with this project, including those from The Federal Emergency Management Agency; The National Weather Service; The Washington EMA; California EMA; British Columbia EMA; Pierce and King Counties; The US National Forrest Service; and the American Broadcasting Corporation and Canadian Broadcasting Corporation.
EXECUTIVE SUMMARY

The United States and Canada have national disaster warning services which have been in place since the 1950’s. The platforms in the US are now used widely by emergency agencies at state and county level. The Canadian system isn’t as robust, but is being improved. Australia does not need to replicate the North American warnings systems, as we don’t face the same range of threats.

The US warning platform includes the “Emergency Broadcast System;” the telephone based “Wireless Emergency Alert” system; and National Weather Service Radio. Each relies on a partnership with commercial Radio and TV broadcasters or telecommunications providers. The content is created by emergency or weather professionals at national, state and regional level, through local, weather warning offices, or state and county warning centres and emergency operation centres.

The US system is supported with legislation, community obligation, and co-operation and forms the basis of what could be an effective whole of community warning process. The Canadian system is being rebuilt to include modern telecommunications as the principal platform for communicating to the community.

The opportunities for Australia identified by this visit are contained within the various chapters in this report. They are numerous but principally lie in the following areas:

- Federal agencies setting standards and monitoring implementation.
- A better understanding of community obligation by the private sector.
- Partnerships between the private sector, emergency agencies and the broadcast media.
- Use of smart phones to issue warnings.
- Evacuation procedures.
- Community awareness programs.

The shortcomings of the system are those inherent problems of any warnings – they rely on accurate personal risk assessment to motivate change in human behaviour; the networks and content need to be integrated but often aren’t, and the community planning and practice is essential but often ignored.

The US and Canadian systems could be improved with an approach similar to that taken by The Australian Broadcasting Corporation and Australian emergency agencies which graduate warnings as the threat increases, and directs information at the most personal and local level. This doesn’t occur in North America. There is no universally accepted Standard Emergency Warning Signal in the US, although it would create opportunities to cut through the noise of North American media.

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CONCLUSIONS AND RECOMMENDATIONS

Australia does not have a national warning system. It has a diverse range of warning procedures and guidelines on multiple, separate platforms, with no accountability and little legislation guiding disseminators. At best the warning system can be described as ad hoc, voluntary, and based on good will.

Of course Australia does not have the history of North America which built a national warning system around threats posed by the cold war and nuclear power, and modified it in response to the massive growth of population near natural disaster risk areas (Which include significant earthquake risk on the west coast).

Australia does not have the range of risks which confront North America, nor the population density, so there has been no momentum here for a national warning system.

Indeed it can be argued that Australia doesn’t need a national platform for the dissemination of warnings, although a catastrophic level tsunami on the populated sections of the east coast, which would require an immediate, cross border response, might change people’s thinking.

However there is much to be gained from having a national framework or authority for warnings, which is evident in the North American experience.

A national approach to warnings would improve cross-border co-operation; set standards and directions; co-ordinate review and research, and enable urgent changes to mechanisms should short-comings become obvious through catastrophic level disasters.

Under Australian practice State based agencies are responsible for emergency response. Piece-meal warning systems have grown up around agencies, rather than populations, with each being designed to meet a specific hazard response.

The Bureau of Meteorology warns of storms, floods and cyclones; bush fire agencies have a variety of systems loosely based around the National Bushfire Warnings framework.

These agencies can issue warnings but do not control the dissemination of the warnings, therefore often responsibility for issuing warnings lies with the disseminator, which does not have any obligation to do so.

A recent development, using the telecommunication network to support agency needs for issuing warnings, known as the Emergency Alert System, has grown without legislation that requires integration, and has been enacted in different ways in all states. It is not integrated with other warnings platforms and arguably, from the North American experience, is expensive and cumbersome.
The evidence from the US shows that this ad hoc approach to issuing warnings has resulted in great loss of opportunity and potential, reduces the number of people who can effectively be warned by an emergency agency or the BoM, and it does not lead to momentum for world’s best practice or further innovation or development.

The Australian process has specifically precluded development of partnerships, which are so powerful in the US.

In addition with one important exception, warning platforms are expensive. The exception is the warnings platform of The ABC.

The American system is expensive and is not universal. It is based on technology, not researched best-warning practice, which starts with “personal” and “local.” The systems created by the BoM and the ABC, of graduated warnings, better prepares the public for response to disasters, than the one-off information bulletins do in the US.

The following key points emerged as areas for further evaluation from my visit to the US and Canada.

*Federal agencies set standards and monitor implementation.*

In North America responsibility for the national warning system sits with the Federal Emergency Management Agency, or the Department of Community Safety in Canada.

This provides over-arching legislation, and brings together all Federal Departments, particularly the departments responsible for the broadcast media, the internet and telecommunications. It specifically encourages partnerships.

The approach is to make all technology “open-source” and to encourage as many users as possible. This results in innovation at the private and broadcast media sector.

It has resulted in the US encouraging smart-phone media companies to build the Wireless Emergency Alert system, so, as of June 2012, all smart phones are pushing warnings to users.

Australia does not have a similar body charged with developing the warning system, therefore opportunities are being lost.

It does have a series of loose alliances called “trusted information sharing networks” which form the basis of technical advice to the Federal Government, but they meet irregularly and do not appear to be given responsibility for development and strategy.
Community obligation

The overarching interest from federal agencies in the work of broadcast media starts with the concept that the airwaves are a public good, and therefore those who are given the opportunity to use them, even while being licensed, should use them for community good. In North America this attitude which has resulted in nearly all radio and TV companies becoming closely involved in issuing warnings.

This attitude is not always prevalent in Australia, despite the fact that the commercial radio licence agreements contain provision for radio and TV stations to issue warnings if requested.

A partnership based on mutual benefit would likely encourage the commercial media to join The ABC in developing improved systems for issuing warnings to the whole community.

Partnerships between the private sector, emergency agencies and the broadcast media

Emergency agencies in the US base their relationships on three-way partnerships between the private sector, the Government sector and the community.

“The private sector owns 90 percent of all the community assets,” is a phrase regularly repeated by US and Canadian Emergency agencies. This results in regular partnership meetings between the three sectors, and the experience has resulted in a sophisticated understanding of how to share resources across County borders.

As an example State and County warnings centres have email alert systems which include as many government and media recipients as private sector contacts. This engages the three sectors at the outset of a disaster, and it creates a culture of shared obligation which is hard to recognise in the Australian context.

The obligation is taken up by the private sector, including the media, which chairs County, State and federal co-ordination bodies, directs innovation of emergency alert and shares responsibility for issuing warnings and responding to disasters.

Use of smart phones to issue warnings

In June 2012 the US began operating the Wireless Alert System, in which warnings are pushed out to owners of smart phones. This is being done for free, an extraordinary development compared to the Australian experience where telecoms providers are charging the Federal Government $30-60 million to roll out the same system.

Emergency agencies are buying off-the-shelf products to distribute warnings to their communities. They are using the “one-to-many” cell phone broadcast system, which is less
cumbersome and speedier than the one-to-one system based on phone numbers, presently used in Australia.

As Australians have embraced the use of smart phones at a rate even greater than the US, it seems it can’t be long before this system would be widely available, should a Federal Government Agency mandate it.

Evacuation

The long experience with evacuations, and the expectation that evacuations will involve tens or hundreds of thousands of people, has resulted in a sophisticated system in the US.

Local planning authorities have developed evacuation routes; and signposted them which results in emergencies being constantly top of mind. The procedure is for graduated evacuation warnings, with residents being told: “get ready to evacuate,” and “evacuate in a short period of time” followed by “evacuate immediately.”

This compares to the experience in Australia which has been “evacuate now, or it’s too late.” This ignores researched evidence that people don’t respond to warnings until they have been validated. It does not allow for the frail and vulnerable to receive warnings earlier than others in the community and it puts great pressure on the disseminators of warnings (radio, TV or the phone system) to work urgently to get warning messages out.

Community awareness programs

Community engagement activities in the US are similar to those in Australia, and are seen as essential to an effective warning system.

However Australians have been reluctant to engage whole of community exercises in which there is great disruption to people as they undertake these exercises.

The “great Earthquake Shake-out” community engagement activity is an example which shows that all-of community engagement is not only possible, but important.

13 US states participate in the shakeout activity twice a year. British Columbia in Canada participated for the first time in 2012, as did Italy and New Zealand. (Right: Sonia Woolford, Victorian BC EMA with her Shakeout shirt)

The scale of the event is impressive: train systems will be delayed 5-15 minutes during the day as carriages are brought to an emergency stop and passengers involved in a mock
evacuation. Offices grind to a halt; and millions of students drop under their desks and hold on for three minutes.

In Pierce County in Washington State an additional community evacuation is practiced to educate the community about the threat from lahars (Volcanic mudflows), and each year roads are closed, schools evacuated and sirens sounded.
THE US WARNING SYSTEM

Threats of nuclear war, nuclear meltdown, and catastrophic level natural disasters have resulted in the US creating an integrated warning service that is effective, reliable, flexible, and comprehensive.

The Integrated Public Alert and Warning System (IPAWS) includes several major components: the Emergency Alert System (EAS) (not to be confused with the phone-based local warning system operating in Australia under the same name) which leverages the reach of radio and television broadcasting; the Commercial Mobile Alerting System (CMAS) which communicates to cellular phones, and an interface to the US’s National Weather Service’s All Hazards Weather Radio network.

In 1951 the US legislated to create a public early warning system in response to the threat of a nuclear armed attack from the Soviet Union. It was assumed the US President would need to be able to address the population immediately. The first system was set up under the electro-magnetic radiation bill because AM and FM transmitters were used for targeting of warheads, so it came under this legislative sphere. It was first called CONELRAD: (CONtrol of ELectromagnetic RADiation, 1951)

In 1963 it was refined and called the Emergency Broadcast System (EBS)

EBS was established as a contingency platform to be used only if normal broadcast communication failure.

It was updated again in 1997 to take advantage of new communications mechanisms and renamed the Emergency Alert System (EAS), and after Hurricane Katrina, legislation was modified yet again, to allow local authorities to use the platform to deal with local disasters and emergencies, including AMBER alerts (Child kidnapping) and all local hazards.

In 2012 it was modified yet again to allow telecoms to connect, and the mobile phone system is now an important disseminator.

The nature of US society, the culture driven by private ownership, and the technology available to the US, has driven the developments.

Initially the system was simple and elegant – radio and TV transmitters would be connected to a control room operated by The Federal Emergency Management Agency (or its then equivalent) and the President would be able to speak to the public within ten minutes.
It was robust and virtually fail safe. The signal was provided to multiple and numerous “primary” radio and TV broadcasters in any or all regions. They would then be responsible for rebroadcasting instantly and at least two other broadcasters in their region, connected to the primary transmitter, would be expected to retransmit. Those broadcasters then rebroadcast as well, until nearly all radio and TV stations were connected. They called it a “daisy chain” which describes it nicely. There are 20,000 transmitters attached to the system.

It was tested nationwide for the first time in November 2011 and while something like 20 percent of the broadcasts at the hyper-local level failed, the test was deemed a success because technical strengths and weaknesses were identified and can now be addressed.

Broadcasters were required to install the reception equipment at their own cost and as part of the broadcast license agreement, but stand by generators for the primary stations were funded by a government program. While this was initially pushed as a public service function for broadcasters, in reality competitive forces have ensured that all the major broadcasters and telecoms providers take the EAS seriously.

The National Weather Service Radio, which transmits weather warnings, was connected to EAS in 2006. In this way National Weather alerts are monitored, and frequently rebroadcast, on all radio and TV stations.

The guiding principles have since been extended to the internet and mobile platforms. In this way the system has become what’s now known as the Integrated Public Alert and Warning System (IPAWS).

One of the major principles of IPAWS is that it is an open network. All emergency agencies, as well as the National Weather Service, are able to use its operating standards and protocols to issue warnings.

Approximately 400 commercial mobile service providers have licensed for content, and 100 are already broadcasting warnings messages to those who choose to buy handsets which are emergency warning connected. Embedded data enables all outlets to be automated.

“Disseminators” receive data in the same way at the same time for redistribution.

This has become vital to the system’s flexibility.

The system has never been used for a Presidential address. Antwane Johnson, the Director of IPAWS, says it doesn’t mean there has never been widespread threat to warrant that.

“It’s a contingency system and was only ever to be used if other telecommunications systems failed,” Mr. Johnson told me. “The telecommunications and broadcast industry has never failed, so was not used in the missile crisis, or the 9/11 Al Qaeda attacks.”
Mr. Johnson works for the Federal Emergency Management Agency (FEMA) which is a division of the Department of Homeland Security. “Our goal is to improve the nation’s capability to ensure under all conditions the President can talk to the public, but when the President isn’t using the system, local officials can use the capabilities to send alerts to their local citizens to enhance public safety. We develop, maintain and operate the system.”

Manny Centeno, a program manager for IPAWS, says the standard is to be able to broadcast to the entire nation in ten minutes, and participants or disseminators are required to be able to rebroadcast almost instantly when a new alert is received. The system is automated: “We can do much better than 10 minutes if not better. It’s virtually instant.

“Although the legislation provides that we make the system available for Presidential messages, almost all of the use is currently at the local and state level, and through NOAA weather warnings.”

“The only mandatory requirement is that the system be in place for a Presidential address. All other content is voluntary, but there is tremendous private sector involvement, being driven by their license requirement to serve the public interest – that’s the primary reason the US allocated spectrum to broadcasters.

“Some broadcasters were initially worried about liability, for carrying warning messages, and for failure to carry them, and for hoaxes.

“Senders of alert messages are validated in the IPAWS Open Platform for Emergency Networks, or IPAWS-OPEN system, through a series of cyber security protocols before rebroadcast but there are no other filters.”
BROADCAST COMMUNITY PARTNERSHIPS IN THE US

The media and broadcasters in the US are highly valued partners in disseminating information and warnings about all hazards.

There are three elements on which the partnerships are based which serve the US well – legislation, obligation and co-operation.

Legislation:

The US set up CONtrol of ELectromagnetic RADiation, (CONELRAD) in 1951, and the Emergency Broadcast System, or EBS in 1963 to deal with the threat posed by the Cold War. Legislation was passed which compelled radio stations to participate in the program at their own cost, and to ensure they could carry all Presidential level warnings and addresses.

“It is a condition of their license agreement now that TV and radio broadcast companies serve the public interest,” says Manny Centeno, the Program Manager of the Integrated Public Alert and Warnings system with the Federal Emergency Management Agency. “They are using public airwaves, the public owns them.”

Jim Bremer, the program director at KQMS Newstalk Radio backs up the observation,“We’re licensed to serve the public.”

The Commercial Mobile Alert System is one of several systems within IPAWS. The Commercial Mobile Service Providers’ decision to broadcast alerts and warnings is voluntary. “We have 400 telecommunications providers in the US, and within a few months
of the process being set up, we already have over 100 providers who’ve opted in,” said Manny Centeno.”

The cost to send these alerts: “Nothing at all, they do it voluntarily.”

Phone companies will receive alerts via the IPAWS Open Platform for Emergency Networks, or IPAWS-OPEN, and then broadcast them to the public in areas which have been geo-targeted by emergency alerting authorities.

To ensure the process is smooth, the Federal Communications Commission and FEMA set standards and protocols, and developed a common operating system for emergency agencies, and they provide training. The FCC requires a monthly test of the system.

In addition, the National Weather Service was provided with funding to set up its own radio network – the National Weather Radio. With more than 1100 transmitters, it’s a robust and comprehensive system, which has come to be relied upon by a sizeable proportion of the US community.

**Obligation**

Legislation alone cannot compel organisations to ensure that all aspects of their content meet the requirements of Federal Government or the needs of their communities. Only the “Presidential Address” is obligatory, all other warning content is carried voluntarily. But the competitive nature of the private sector has ensured that all participants feel obliged to participate. The telecommunications companies created demand for phone handsets that are warning compatible.

The radio and TV stations know that in an emergency their competitors will be broadcasting warnings, and they can’t afford to ignore the possible impact on their audience reach.

TV stations play the most important role, with weather presenters being the go-to people when an emergency begins. TV watching seems to be universal. Homes, clubs, bars,
restaurants, schools, public gathering places like airports all seem to have TV networks switched on 24/7.

Jim Bremer from KQMS estimates that his company spends $20,000 on the hardware to receive EAS content, and there are numerous stations in his comparatively small company.

**Co-operation**

“Tremendous private sector involvement is the key to the success of CMAS and EAS,” says Wade Witmer, FEMA’s Deputy Director of the Integrated Public Alert and Warning System.

There is no doubt that emergency managers are grateful for the support they are receiving from broadcasters.

But to ensure the process is integrated, there has to be high level and frequent co-operation. FEMA and the Federal Communication Commission have a monthly meeting with national broadcasters and telecommunications companies, to ensure the systems remain technically robust and to create a standard for sharing of information between emergency agencies and the disseminators.

“You have to engage the broadcasters. A lot of them don’t trust each other” says Manny Centeno, in a phrase that will resonate with broadcasters and emergency agencies everywhere. “But some broadcasters do call themselves first responders, which show they are fully engaged.”

In addition to the nationwide meetings, each state has a meeting of State broadcasters and their emergency management agencies each month.

The National Weather Service also reflects the expectation that there will be leadership and co-operation. Warnings’ broadcasters meet their local and regional broadcasters frequently to extend understanding. Additionally, the NWS set up NWSchat, to talk directly to broadcasters to ensure their message is well understood and useful.

Howard Price, the emergency manager at the American Broadcasting Corporation, which runs radio and TV stations and networks across the US, sums up the three elements: “It’s about public interest, convenience and necessity.” The public interest is obvious but why convenience? “Because FEMA, NWS and FCC created the platforms which we plug into to receive all the warnings and content.” Necessity? “That’s just competition to retain listenership and audience.”

The partnership model was started by the private sector. “Richard Rudman, the Director of Engineering at CBS started the “Partnership for Public Warning” says Howard Price. “We also started the Media Security and Advisory Council after 9/11. During Hurricane Katrina,
Entercom, which owns one of their local stations never went off air. They set the gold standard for emergency broadcasting."

“EAS is a good system, but it has to be defended, and the local stations have to practice using it. The total cost for ABC to implement the mandatory system on its own network runs to five figures, and no-one here has ever suggested the Government should pay.”

Nevertheless the companies retain editorial control. “We put warnings on every TV and Radio station. It’s good for the warnings to be on during kids’ watching time as their parents are often watching with them. But the ABC never puts an unverified warning to air. No talk station in their right mind will do that.”
US WEATHER SERVICE RADIO

The US National Weather service has a multi-faceted approach to community safety which includes creation AND dissemination of warnings and information.

In addition to the usual weather forecasters the NWS has in its 120 or so regional offices a “warnings officer” who works on disasters. The NWS has its own terrestrial weather radio system, which fills the gap when commercial radio doesn’t issue warnings. It’s both another level of complexity, and another level of certainty.

The NWS Radio network consists of 1013 transmitters dotted around the country each with a range of about 60km. It’s estimated that 98 percent of all people are within range of NOAA Weather Radio. (NOAA, the National Oceanic and Atmospheric Administration, runs the National Weather Service.)

That makes it an important part of the US natural hazards warning system, so knowing a little about it can be useful in comparing and contrasting different warning platforms.

Weather radios are widely available for homes, office, schools or business. Prices can vary from $20 to $200, depending on the model. The frequency on which they transmit is much higher than the commercial AM and FM bands, so the public are required to buy a special “weather radio.”

Features vary a little but generally they are activated when a tone alarm is broadcast by the NWS for “warning” or “watch” messages delivered by the NWS. The audio is recorded. It’s a bit monotone, and will play on a loop, at various intervals (not continuous) determined by the event.

The tone (1050MHz) will activate all the receivers which are equipped to receive it, even if the audio is turned off. This is especially useful for warnings which occur during the night when most people are asleep.

Many are geocoded, so the owner can opt to receive messages at county or city level, and can opt out of some message categories. For example, a person in a coastal County, but not right at the beach, might not care about Coastal Flood Warnings. This feature may also be called “Event Blocking” or “Defeat Siren.”
Warning centres, emergency warnings and evacuations in the US and Canada

November 16, 2012

Most are AC adapted with battery backup for power outages. Some receivers come with an external antenna jack (normally in the back of the unit) to connect to a larger antenna (which can be indoors or outdoors).

NWR broadcasts are in the Public Service VHF frequencies, just above FM radio and between the current TV channels 6 and 7 – so the radios are usually sold as AM/FM/Weather radio. They can be used in cars.

Some radios have a jack to plug-in external notification devices, such as strobe lights or bed shakers, which can be useful for those with special needs.

Weather Radio puts responsibility in the hands of the National Weather Service for both creating AND disseminating warnings. The system is robust, and many weather service warning teams allow the service to broadcast a range of other non-weather related warnings.

The highlight of the system is the “sleep” mode, in which the audio is only turned on when needed. This puts it in a special place, above all existing radio and TV; all online media and most mobile platforms.

It meets the “UN Guiding Principles for Effective Early Warnings”, particularly with respect to accessibility, if the strobe lights and vibrating beds and chairs are attached.

The coverage is extensive, but might not be top-of-mind for all Americans. In Manton, California, no-one mentioned Weather Radio; and in Joplin, Missouri, in “tornado alley” only a couple of people mentioned they had one, although one turned it off when it became too intrusive. The receptionist/manager at my Washington DC hotel had never heard of it, and said there were none in the building.

James Bremer, the program director and senior engineer at KQMS in Redding told me his station could add Weather Radio broadcasts to their automatic Emergency Alert content if they thought it might be warranted “but often it’s too repetitious.”

National Weather Radio type-infrastructure might be a barrier to creating these systems in other countries, but in reality new servers/codecs can direct audio to EXISTING AM and FM radios, and an inaudible tone could switch the radios on, so the system would these days be much less capital intensive.

Local government in Australia, which has embraced the concept of tourist radio on the FM band in Australia, and which has over the years enthusiastically supported community radio, might find this a useful local communications system. It would cost less than giving very household three different coloured rubbish bins.
US NATIONAL WEATHER SERVICE AND EXTERNAL PARTNERSHIPS

The National Weather Service in the US has a symbiotic working relationship with the broadcast media, which far surpasses anything in Australia.

Although The ABC has wonderful and often personal relationships with the Bureau of Meteorology, the US NWS systemises the process.

The central pillar behind the success of the NWS relationship is the Integrated Warning Team, but there are other very important elements.

1) Warnings officers in all 122 regional forecasting centre who have an emergency and community education role.

2) Direct access between warnings officers, forecasters and broadcasters.

A very important component of this approach is “NWSchat” - the “real-time interactive communications system” (https://nwschat.weather.gov/) which would be well worth considering in Australia for all emergency agencies and the Bureau of Meteorology. It allows direct communications with experts “off line” seeking more information, more urgently, raising questions, and providing feedback. To quote the NWSchat home page:

“NWS partners can use NWSChat as an efficient means of seeking clarifications and enhancements to the communication stream originating from the NWS during a fast-paced significant weather or hydrologic event. NWSChat is an Instant Messaging program used by NWS operational personnel to share critical warning decision expertise and other types of significant weather information essential to the NWS’s mission of saving lives and property.”

Mike Hudson, the warning specialist at Kansas City, Missouri, says it helps to ensure that the messages being broadcast over multiple platforms are consistent: “If people receive more than one message at a time it can lead to paralysis. Inconsistent messaging leads people to “shop” for information, taking up valuable time to see if other radio and TV stations are carrying the same message.”

Real time chatroom content between the duty warnings forecaster and all media (or between emergency agency duty officers and the warnings media ) would enhance understanding at critical times.

NWSchat is linked directly to the local warnings officers.
The use of Instant Messaging (IM) and chatrooms has proved to be valuable for this type of communication internally in many businesses, but to open them to various partners, like the NWS has done, is a bold step, which reflects the relationship between broadcasters and the NWS.

The technical details are online and the following information is edited from the site:

(Insert link: https://nwschat.weather.gov/NWSChatSecurityWhitepaper.pdf) NWSchat is maintained by the National Weather Service and is situated behind a firewall. NWSChat is comprised of a pair of servers configured in a resilient primary/backup configuration, and receives auto-updates for all operating system patches and bug-fixes. The systems are scanned quarterly to identify and correct IT security vulnerabilities as required by NOAA IT Computer Security policy.

Individual user accounts are required for NWSChat; shared or group accounts are disallowed. A standardized account naming syntax is also enforced for manageability. To register with NWSChat, users must submit an online form. Once submitted, the selected primary office receives an email of the request, and will approve or deny authorization for each user. Once approved, the requesting user is notified via email and then must complete online training for NWSChat.

Most multi-user chatrooms on NWSChat are open to NWS partners once they are authorized by the NWS. However, certain rooms are restricted for “members-only” access. This is necessary to secure information in specific chatrooms intended for certain partners only. For example, some information may be required by emergency managers that is not appropriate for media partners due to the sensitivity of and timeliness of emergency operations. As a result, a members-only chatroom would be provided limiting access to NWS and authorized emergency managers exclusively, for a given location.

In order to participate in NWSChat, you must meet at least one of the following standards:

- Be a member of the emergency management (EM) community: Members of the EM community includes public safety officials who serve as employees or contract agents of a government agency at the federal, state, local, or tribal level and are charged with protecting the public from hazards that are influenced by weather or weather-related events. Other members of this community include: safety and emergency personnel, from universities or other large entities with large populations, whose roles are functionally equivalent to the public safety officials described above, and Amateur Radio Emergency Services.
- Be a government partner of a NWS office: This includes Government partners who have missions that require close coordination with the NWS. Government partners include (but are not limited to) the FAA, and water and land management officials.
- Be a member of the electronic media: Members of the electronic media are parties, and contract agents of parties who:
  - Have a need to actively participate in discussions with NWS Forecast Offices on imminent weather or other hazards, and
o Operate systems that routinely and rapidly relay weather and water watches, advisories, warnings and forecast information to a significant part of the population served by an NWS office; via electronic information distribution such as radio, television, internet, cellular, and other wireless means.

Note: Individuals, companies, or other entities involved in ‘chasing’ weather events and posting or streaming video or pictures of the event, but do not otherwise have a need to communicate with NWS do not meet the qualifications for this Service.
BUSHFIRE EVACUATIONS

Evacuations from hazardous areas are a standard part of the tool kit of the US emergency manager. The protocols vary from place to place, and they are still ironing out some of the problems in some areas but it is clear that the system in place leads to clear understanding by the community of their responsibilities.

But it is equally clear term “mandatory evacuation” is perceived to be optional.

Evacuation route in Washington DC. The public is expected to know when a “snow emergency” is declared, and then not to park on these routes to enable the snow ploughs to operate unimpeded. Cars would be towed away.

Tsunami evacuation route sign in San Francisco
There are many times an evacuation isn’t possible: tornadoes and rapidly moving fires come to mind and it is understood that the chance of evacuation using roads immediately after an earthquake will be determined by the level of damage.

Like Australia police have various laws they can use to force people to evacuate, but in reality, they will be very reluctant to physically remove a person from their home if they want to try and defend it. Persuasion is their most effective tool. One Canadian emergency manager said: “There are laws that can be put in place to remove children from dangerous places. That soon convinces parents to follow.”

An American emergency agency staff member said one other phrase has been found to be particularly persuasive: “Before I go I need to know how tall you are so I can bring the right size body bag back.”

The law is outlined in Community Wildfire Protection Plans, which are implemented in nearly all fire prone regions. This is from Lane County in California:

**THE LAW**

A county, city or municipal corporation may authorize an agency or official to order mandatory evacuations of residents and other individuals after a declaration of a state of emergency within the jurisdiction is declared. An evacuation under an ordinance or resolution authorized by this section shall be ordered only when necessary for public safety or when necessary for the efficient conduct of activities that minimize or mitigate the effects of the emergency

(ORS 401.309). BE AWARE; after a mandatory evacuation order goes into effect emergency responders will not risk their lives to save you should you choose to stay at your home after the order.

Evacuation procedures need to be planned and trained for. Many roads have warning signs along them which are opened only when an evacuation is in place, restricting travel on the whole road to one direction. Other road signs are left permanently on display, which
serves as a useful community education tool that constantly advises road users of the perceived risk.

The public needs to know when to evacuate, and where to go. Clearly this needs good local pre-planning. Doug Gantt, Fire Manager Officer with The US Forest Service says:“You have to front load all this stuff.”

Emergencies are handled by Counties.

In the case of bushfires the Incident Controller will advise the Sheriff that the fire threatens homes or a community, and the evacuation is carried out by law enforcement officers.

During the Ponderosa Fires, Shingletown was issued with a “voluntary evacuation notice,” which was superseded about two hours later by a “mandatory evacuation notice.” This two level evacuation procedure reflects the same benefits of the graduated warning system for fire risk used in Australia.

At Manton when the fire was out of control and time was much shorter, things worked a little differently. One genteel soul told me (after advising me to cover my ears) “The sheriff’s car drove into my drive, sounded the siren, and he yelled:“You’d better get the f… outta here.”

However next door in Washington State there is a three level evacuation procedure for fires (but not for lahars).

This is how the evacuation notices unfolded for the multiple fires in the Wenatchee Fire complex in Washington State from September 11, 2012. The Washington State EMA web site contains all the details of the way the evacuations launched, ramped up, and then gradually were downgraded.

This is the warnings content of the excellent fire web site called Inciweb, set up by Federal fire authorities to be used by state and county emergency agencies.

**Incident: Wenatchee Complex Wildfire**

**Released: 9/11/2012**

*Level 1, 2, and 3 Evacuation Status is akin to a “Ready, Set, Go” level of evacuation notices with Level 1 asking residents to be ready to evacuate if conditions change, Level 2 means residents should be set to go at a moment’s notice, Level 3 means authorities are advising residents to evacuate because their homes are in imminent danger (under Level 3, residents will not be allowed to return to their homes until fire danger decreases).*

*Evacuations remain in place for the following areas affected by the Byrd Canyon Fire:*
Downey Canyon – Level 1

State Route 971 Navarre Coulee Road (east side) – Level 2

State Route 971 Navarre Coulee Road (west side) – Level 3

State Route 97A Tunnel to Davis Canyon – Level 3

State Route 97A from Byrd Canyon to State Route 971 – Level 3

The explanations at the top of the warning were inserted because fire managers weren’t confident the community was fully aware of the evacuation procedures. No survey has been done about how many people evacuated, or when, but no-one died or was injured.

Over time the evacuation levels were reduced.
WARNINGS IN ACTION

The Ponderosa fire

The Ponderosa fire started by lightening in August 2012, a few kilometers from the town of Manton, in the Californian Sierra Mountains. It burnt out 57 homes, tens of thousands of acres of dense mountain forest, and resulted in the urgent evacuation of 3,000 people from a subdivision near Shingletown.

The residents of Manton, close to the fire ignition zone, relied on community word of mouth, and to a certain extent Facebook, for warnings. Local Sheriff Department officers were able to warn people verbally. Residents further afield, who had some hours to prepare, and received telephone based evacuation alerts. Local radio stations carried news of the warnings in news bulletins.

Some roads were closed by Sheriff’s department officers before residents knew there was a fire, suggesting that the warning system did not work well in the initial stages.

When the fire put up smoke mid morning on the Ponderosa Way, about five kilometres out of town, retired power worker Tom Carter might have been among the first to see it, from the ridge he lives on. He saw the smoke and drove to Ponderosa Way immediately! The fire was just getting started at 1030.

Someone alerted California Fire and the local fire trucks raced through town with their sirens on.
“You have to let the community know what’s going on,” said Tom. He hit Facebook, loaded pictures, and began chatting. “A picture is worth a thousand words, everyone reposted the pictures. I’ve convinced many people to get on Facebook and help each other.”

“Word of mouth is important.”

Christine Case is the post manager. She tucks herself away in a weatherboard building five and half days a week (The post office in the US is open Saturday mornings, and there’s a terrific public battle on between the government, which wants to reduce costs, and the community, which wants Saturday deliveries.)

Her first warning was on wheels. “I saw the California Forestry fire truck go past, so I knew they’d been alerted. In the next three hours I saw more and more fire trucks.” Christine debated whether to stay in town and help out, or go home, which is an hour drive away.

The local radio station, K-shasta, 104.3fm, carried a news item about the fire. Christine heard the report, but doesn’t recall hearing any other radio based warnings. No-one called her with advice or questions. “I didn’t really know exactly where the fire was,” says Christine. “As I left town the California Highway Patrol was closing the roads and I couldn’t get back for three days.”

Sharon Borden is a frail elderly woman who lives on Ponderosa Way. Someone called her to tell her about the fire. “Word of mouth gets around quickly” she says. Sharon expects a call in a situation like this, but is a little confused about where it might come from.
She did the first thing everyone does: looked for more information. She turned on the radio and the local fire radio scanner. She alerted friends who lived in a trailer (caravan) in her back yard, who immediately went to look at the fire. They returned shortly after with good news.

“They said they’d seen the fire and it was moving away.” Then the wind changed.

“A law enforcement officer pulled up in my driveway, blasted his siren and said: (She apologises for the language) “You might want to get the f... out of here or you will die, the fire’s less than ten minutes away.”

“I was going to stay and fight, we have a good defensible space, but he seemed to give me no choice.”

“I have a lot of faith. I am a member of St Johns Orthodox Church, and my house is heavily blessed. I was told by a monk from the local monastery that my house would always be safe.”

Sharon relies quite a bit on her friend, Nancy Neal, who lives 30 minutes away.

“I wanted to call Sharon as soon as I knew there was a fire. I called her, the store, the fire station, the diner and I couldn’t get through on any of the phones. I was scared to death.

“It was very upsetting, so I drove down, but the roads were closed.”

Sharon’s home paddock was burned; one of her three goats died, 40 chickens perished in their shed, and the corner of her house was damaged, before the fire fighters doused the flames.
Regrowth, Ponderosa Way, 6 weeks after the August 2012 bushfires. Pic Ian Mannix
The fire occurred on the day of the Manton roast, an annual thanksgiving style event where the whole town comes together.

Sue and Gary Young, who owned a fly fishing tourist venture about 10.5 km east of the town, were not at the roast, but a lot of people they would normally expect a message from, were. The day was quiet for them.

Sue described her home in the forest quite lovingly: “Our property consisted of dams and trees, firs, oaks, cedars, historic apples and pines.

“These were full grown trees some more than 150 years old. They’d never been in a fire.”

They listened to the fire radio scanner and knew there was a fire in the area somewhere. “The scanner doesn’t have anything specific about fires or their locations,” says Sue, “we never knew which way the fire was coming from.”

But previous experience and many years living in the area meant that Gary was not overly concerned.

“Normally in these parts,” he says, “if a fire was four miles away we’d have a couple of days to prepare. We’ve had false alarms, and I wasn’t overly concerned. They continued to look for signs of fire, but they didn’t receive any warnings.

But suddenly they saw the flames about a kilometre away, “and we only had 20-30 minutes to prepare and get out.”

The house and ten outbuildings were destroyed. “We built the house in 1981. It was redwood, with a fire retardant asphalt roof, but it didn’t quite work the way it has been planned.

"It looks like the surface of the moon there now. But the fish are still there.” Gary and Sue are still wondering if they will rebuild.
Fanned by strong winds, the fire raced towards the regional centre, Shingletown, and its outlying development community of Lake Macumber.

It was moving so quickly that evacuations were ordered that afternoon.

Shingletown farmer Elaine Wusstig lives seven kilometres west of the town, and was never threatened. “When I saw that big plume of smoke I thought Mt Lassen had blown up,” she recalls. “I would have thought I would get a reverse 911 call or something like that, but we didn’t get any warnings at all.”

Farmer Elaine Wusstig in Shingletown serves Julia Pritchard (who owns the diner at Manton)

Majka Hikel is a real estate agent at Shingletown. She was in her office all day. She lives at the Lake Macumber development, among 200 or so houses each deep in the forested area.

“I closed the office at 4pm, and it was mostly clear blue skies on the way home. But when I got home debris started falling from the sky.

“It was chunks of branches and small embers.”

They received a 911 call suggesting they consider evacuating, and they began preparing. “It took another couple of hours, and I did it so fast, I left my make-up bag.”

A mandatory evacuation alert was phoned through at 6pm, and they left to go to a friend’s house.

“The fire looked very close, and we were very scared.” They turned the radio on and listened to information throughout the night and the next day.”
56 homes were destroyed between Manton and Shingletown but the big sub-divisions were saved.

“We have an awesome fire fighting service,” says Majka. Her home wasn’t damaged.

Never mind, we understand.
Conclusion

The wild fire threat to Manton, and eventually lake Macumber and Shingletown, was very similar to that experienced in Australia every summer.

Initially local emergency agencies tried to deal with the event alone, and only when it became clear they would not control the fire, did the control escalate to County level, and eventually to the State Warning Centre. At this time the full resources of the state were brought to bear and widespread warnings were issued using the emergency alert system. The SWC also created a blog and all available information was brought to one location, although no-one in these communities mentioned they visited the site for information. It did however contain comprehensive and immediate information that the news media used to good effect. The local K-Shasta radio station was not staffed on the weekend and did not automatically carry the warnings.

The best warning therefore initially came from families and friends, and it proves again how important it is to have a well connected and motivated community able to act even when there is no official warning.

In the absence of any other warning, the evacuation notices delivered from the state warning centre via the telephone alert service were effective.

In Australia ABC Local Radio would have been available to issue alerts and warnings should the incident controller create them. This would have resulted in warnings being disseminated while the fire was at Manton. ABC Local Radio would automatically issue warnings on line and social media.

The comprehensive Inciweb blog created by the State Warning Centre is an advance on the Australian experience where police, fire, ambulance and others create their own sites, and busy, or even sometimes extremely stressed residents, have to visit numerous sites seeking comprehensive information.
Joplin tornado

The Joplin, Missouri, tornado neatly encapsulates all the problems inherent with multiple, simultaneous, complex emergencies. The US National Weather Service (NWS) was widely praised for its work. The relationship between the warning providers and the disseminators is crucial.

It is fair to say there is much soul searching at the NWS in the US when people die in weather related disasters. It’s the same in Australia, and no doubt everywhere else. Weather forecasters are scientists but they understand their work, at its best, will save lives.

The problems confronting the forecasters at Joplin were the same as those wherever multiple simultaneous complex weather events occur. (I call these MSC events) For most of us that’s thunderstorms and hail forecasts, but the same problems were experienced by fire fighters during the Black Saturday Bushfires in Victoria in 2009 and to a lesser extent in the flash flooding of Grantham in Qld in 2011.

In the case of the Joplin tornado the public had to contend with the following bewildering array of events – and many in the disaster community will have an understanding of exactly this type of scenario:

- No big tornado for a generation, even though the town is in :”Tornado alley.”

- Thunderstorm forecasts consistently for two days

- Thunderstorm and hail forecasts all day

- Tornado watches issued a couple of hours before the main event

- Multiple tornadoes

- Two blasts on the town tornado warning sirens.

These events create massive uncertainty and warnings, unless very carefully compiled and placed in context and with a sense of priority, will lead to confusion and the public quite naturally will hesitate to act.
(Above) Typical Joplin Street before the tornado.

Joplin after the tornado (PIC: NWS)
This is how the NWS reported on warnings from the Joplin tornado – taken from its review. (Items in brackets are mine)

“A series of complex meteorological events and interactions took place during the afternoon hours of May 22 that eventually resulted in the devastating EF-5 tornado. A Tornado Watch was issued at 1.30 pm for all of southwest Missouri.

A routine Area Forecast Discussion (a type of weather service “heads up”) was issued at 2.37 pm as well as at 3.47 pm. Forecaster focus remained on very large hail as the main severe weather threat, but isolated tornadoes were also deemed a possibility due to the very unstable air mass in place and sufficient low level wind structure. The first thunderstorms of the day developed between 2 pm and 3 pm over southeast

As severe storms moved east, forecasters became increasingly concerned about their tornado potential and issued the first Tornado Warnings of the day at 4.25 pm and 4.51 pm for counties west of Joplin. At 4.33pm forecasters briefed the Jasper County (which encompasses Joplin) Emergency Manager on the severe storms to the west.

A tornado Warning was issued at 5.09pm for western Jasper County, including the northeast part of the city of Joplin but was for a different storm than the one that eventually hit the city.
This alert was followed by a new Tornado Warning at 5.17pm for the next storm to the south for southwestern Jasper County and portions of neighboring counties which included all of Joplin. (Another coordination call was made to the Jasper County Emergency Manager at 5.25 pm to update him on the Tornado Warning and latest information concerning the storm.)

At this point, the severe thunderstorm west of Joplin had become the dominant thunderstorm in the region and was poised to produce a violent tornado. Based on storm surveys and radar imagery, it was estimated that initial tornado touchdown occurred just west of Joplin at 5.34 pm, moved into western portions of Joplin around 5.36 pm. The town had 17 minutes of lead time for touchdown and 19 minutes lead time before the tornado entered Joplin.

The first indication of a confirmed tornado was issued via another Severe Weather Statement at 5.39 pm that stated,

“At 534 pm CDT...trained weather spotters reported a tornado near Galena” and that “This storm is moving into the city of Joplin.” The tornado eventually dissipated around 6.12 pm.

Unfortunately, the tornado developed rapidly on the southwestern outskirts of a densely populated area and had moved through much of the city before the size and violence of the tornado was apparent to warning forecasters. They could not issue a Severe Weather Statement with a “Tornado Emergency.”

Amongst the general public, the majority of residents had little idea there was a threat of severe weather prior to Sunday, May 22. About half of those interviewed, reported learning of the possibility of severe weather in the hours leading up to the tornado. Just less than half reported their first indication of a severe weather threat was in the moments just prior to the tornado.

According to the (Joplin Emergency Manager, IM) the first 3-minute siren activation, at 5.11 pm resulted primarily from funnel cloud reports to the west of Joplin in southeastern Kansas (Elsewhere in the report is stated that this activation was not based on NWS advice – Ian Mannix)

Residents heard the initial siren activation and then the warning details were provided by the emergency telephone system and assumed the activation was for the area to the north. In one example, a man was clearly confused by the string of warning information he received and processed from various sources.

1. Heard first sirens at 511 pm CDT (estimated 30-35 minutes before tornado hit).

2. Went to the TV and heard NWR warning from TV override that indicated tornado near airport drive 7 miles north of his location.
3. Went on porch with family and had a cigar. Looked like a regular thunderstorm.

4. Heard second sirens (estimated 27 minutes later).

5. Thought something wasn’t right so went inside and turned local TV stations on.

6. Saw on TV several colored counties for tornado warnings, but regular programming was still on and thought the threat was still to the north.

7. Heard his wife yell “basement,” Grabbed the cat and told son to put his shoes on.

8. Tornado hit as they reached the top of the basement stairs, destroying their home.

Conclusions

Australia is unlikely to ever be subject to an F5 Tornado. It is argued that there are some disasters which are so severe that deaths will always result and F5 tornadoes are in this category. Almost no buildings can withstand the wind and there is not always enough time between touch down and arrival to allow people to seek shelter. Knowing this, the people of Joplin have not embraced tornado shelters, although some modern buildings are including them in strong areas.
Many people reported they called their families and friends, which is a well-known part of the informal warning system. The NWS bulletins warned of impending tornadoes, but did not advise residents what to do –i.e.: seek shelter in a basement or a hardened part of a building.

The entire incident was over in 30 minutes, so it is hard to argue that emergency agencies and broadcasters can do much more than assist with recovery.

Ultimately the only mitigation emergency authorities could develop would be to create a culture in which many more warnings are issued, and issued earlier, and that public responds every time, but doesn’t become complacent. This would require greater community leadership and co-operation than is present in most communities anywhere.
Landslides

The people of Pierce County, just south of Seattle, who live at the foot of the almost magical Mt Rainier (4393m) are preparing for the day the magic turns to a nightmare, when their beautiful playground turns nasty.

There are many lessons from the planning and activities at Pierce County for what would be a catastrophic disaster which might usefully inform judgments about warnings, sirens, evacuations and preparations in other areas.

Mt Rainier (above) is classed as an active volcano, in an earthquake zone, subject to throwing off catastrophic mudslides, known as “lahars.” (pro: la-hars). It is usually referred to as America’s most dangerous volcano although it last erupted in 1894, and there’s no evidence of present volcanic activity. It is earthquakes generating lahars which are of more concern.

“Eruptions usually have some sort of lead time as they can be forecast,” says Tom Sharp of Pierce County, which is planning to support its community if a catastrophic event occurs... “If our system detects a lahar, the people have to go. They don’t have a choice. And they have to be out of the area in 30 minutes,” says Tom, who’s responsible for the lahar detection and warning system.
Wikipedia says:

*Lahars have the consistency, viscosity and approximate density of concrete: fluid when moving, solid at rest. Lahars can be huge. A lahar of sufficient size and intensity can raze virtually any structure in its path, and is capable of carving its own pathway, making the prediction of its course difficult. Conversely, a Lahar quickly loses force when it leaves the channel of its flow: even frail huts may remain standing, while at the same time being buried to the roof line in mud. A lahar’s viscosity decreases with time, and can be further thinned by rain, but it nevertheless solidifies quickly when coming to a stop. With the potential to flow at speeds up to 100 kilometres per hour, and distances of more than 300 kilometres, a lahar can cause catastrophic destruction in its path. Lahars from the 1985 Nevado del Ruiz eruption in Colombia caused the Armero tragedy, which killed an estimated 23,000 people, when the city of Armero was buried under 5 metres of mud and debris. A lahar caused New Zealand’s Tangiwi disaster, where 151 people died after a Christmas Eve express train fell into the Whangaehu River.*

Geological evidence reveals Mt Rainier has thrown off previous lahars extraordinary in scale. Wikipedia says the Osceola lahar produced by Mount Rainier 5,600 years ago resulted in a wall of mud 140 metres deep in the White River canyon, and which covered an area of over 330 square kilometres. The mountain blew off 500 metres of its top, which flowed down to the sea at Tacoma, 60 km away.

Tom Sharp studied the Columbian del Ruiz event. “An unheralded lahar could be generated by a volcanic eruption, but it doesn’t have to be a big one, it could be a minor eruption which loosens the mountain edge. The side of the mountain might give way in a weak area, particularly after heavy rain. They can also be caused by an earthquake.”

“They start small and get bigger as they gather up debris.” There are 40,000 people at risk of lahar in Pierce Country, about 7,000 of whom live in the town of Orting. The Washington State fair occurs in the region each year, and attracts 50,000-100,000 people.

The warning systems rely on technology, and are based on the premise it will remain intact (say, after an earthquake). The lahar warning system installed in 2000 is simple. Pierce Country has five monitors on each of two rivers on the mountain which detect vibration. “I can read an animal walking past them or a human jumping up and down” says Tom. “They don’t have false alarms.”

When the detection is made Tom has 30-40 minutes to clear the region of people. The plan is to have a warning to the public within five minutes. “In practice we can do it in two minutes from time of detection,” he says. A series of sirens scattered through the community will sound, triggered at the Pierce County Warning Centre. But they are outdoor sirens, and might not be heard over the car radio or inside.
The sirens (above, in Orting, seen about 50 km from Mt Rainer) are always accompanied by a voiced message. These messages are kept short, with just the most basic information and a warning to leave the area immediately. “The messages can’t go for more than a minute. If they go for two minutes, that’s one less minute people will have to evacuate.” Says Tom. “We’ve been practicing these recorded messages for about ten years and the feedback from the public has given us a good understanding of what the people want.”

The Pierce County Warning Centre will alert all emergency agencies and utilities via phone/email/cell/pager. Police will immediately stop all traffic from entering the region, allowing all vehicles to travel on all lanes out. The public will follow well sign posted evacuation routes. An automated warning will be posted on the US emergency alert system (EAS), which will be picked up by people with National Weather Radios. That will also trigger a series of warnings which go to radio and TV stations, which are expected to broadcast the information immediately, or in some cases, that will occur automatically.

The Country has its own phone alert system and will rely heavily on phone messaging. “Pierce County Alert is an opt-in system for residents, but we also subscribe to the Sheriffs reverse 911 phone subscriber list. We think we can get a phone message to about 85 percent of our community,” says Pierce County Emergency Co-ordinator Ken Parrish.

“The County can deliver thousands of simultaneous calls a minute. “We issued 26,000 in five minutes for a winter storm a few years ago.” The County is a big supporter of the private warning and alert developer, Everbridge, which developed their phone system and which is
now creating feedback loops. “They are without doubt the world leaders in mass notification” says Ken.

“No alert system is perfect so we cover as many bases as we can. EAS is a powerful tool, but only for those watching TV or listening to the radio.”

By ensuring that the messages are distributed multiple ways, the natural human reticence to avoid acting until the threat has been validated means there are multiple channels for the warnings that will confront people very quickly.

Evacuation routes are permanently signposted. There was some debate about having signage that can be opened when needed, and closed for the rest of the time. “But we won’t have time to open them when needed, and anyway, it puts the issue right in the faces of people who live here, so they know constantly they are at risk,” says Tom.

Evacuation signs in Pierce County

“At first real estate agents were concerned about property values, but we don’t hear from them anymore.”

The public have to get to higher ground, so those who live along the edge of the valley don’t have to travel very far. “The school kids, aged seven or eight, practice their evacuation each year, and although they’ve got small legs, they can get to safer high ground in 30 minutes, but they have to walk fast or run to do that.”
The schools use all available means to evacuate – their own buses, staff cars, but many of the kids will have to walk out. "It’s important the kids practice this system, as they take home the messages to their parents. Ideally people should be practicing their evacuation monthly, as roads might change due to maintenance work, or be impassable for any other reason."

“They won’t have time to go and retrieve anything. They will get what they have and just go.”

Ken Parrish describes the approach as:"multi layered defense with back up."

“Our preparations are better than most Counties," Ken says, but he isn’t boasting. "We are energetic and robust and we’ve won awards for our education and planning.”

The warning system is focused on the chance of a lahar caused by an earthquake, which are common in the region. But the system, including the sirens, is designated “all hazards.” Floods, fires, all weather related emergencies, chemical spills, nuclear accidents, snow emergencies, and that most modern and unfortunate human hazard known by emergency managers as “the active shooter.”

So, what happens if the technology fails? The public must be prepared for that too. They should know from their training, practicing and available literature, that if the ground shakes it is possible a lahar was generated and they should leave the region, without waiting for a warning.

The community earthquake awareness exercise “Big Shakeout” was practiced by 750,000 people in Washington State on October 18 (and millions more in a dozen US states, Canada, Italy and New Zealand) warns that if the vibrations occur for more than about two minutes, then the public should assume the worst, and not wait for a warning about a lahar, or other emergency. They are very real issues in this part of the world.

Conclusion

Rapid on-set catastrophic disasters require whole of community planning and response. Ideally people shouldn’t live in the valley, but it’s a hard argument to make with a one in 5000 year recurrence.

The widespread installation of sirens is an effective measure, and certainly keeps lahars and volcanic activity in the forefront of the minds of drivers, and therefore travelers.

The County practices evacuation regularly and with a high level of motivation. The County has an integrated warning system which alerts broadcasters, emergency agencies and the community simultaneously. The use of sirens, which contain verbal instructions, makes the infrastructure personal and versatile.
Tsunami warnings in Washington State, USA

“We set off 54 sirens today” said a quietly pleased Robert Purdom from the Washington State Emergency Operations Centre (EOC) in Camp Murray on the day of the great “Shake out,” the bi-annual earthquake drill practiced by millions of Californians for the past few years, and now hundreds of thousands of people from a dozen other US states and even Canada, Italy and New Zealand.

The sirens are one of the principle tools designed to alert the community to a tsunami. And the threat is very real. The western states lie on a variety of fault lines which are quite active. In written history of the North America region there have been numerous very damaging earthquakes and accompanying tsunami. But the alert system now is based on an event which occurred at 9pm, January 26, 1700. There are no written records in the US of this earthquake, but there are in Japan.

“We had a Magnitude 9 rupture of the Cascadia Subduction fault line at 9pm on January 26, 1700,” says John Schelling, the Earthquake/Tsunami/Volcano Program Manager at Washington State EOC. “We know the exact time and date from historical records in Japan. The tsunami washed up in Japan the next day, without warning and flooded fields and washed away homes. They called it the “Orphan Tsunami” as they knew it wasn’t caused by an earthquake in Japan.”

An earthquake of that magnitude almost certainly will cause a tsunami along the American coast. The records from tree rings show the “Orphan tsunami” submerged great areas of coast, and stopped the trees growing. Washington State is preparing its warning system for another event, with the belief they need people to respond within 30 minutes or less.

Chris Utzinger points to the earthquake resistant piles the Washington EOC is built on. The building will move as though it was on water.

The warning system is based around getting quality advice about the tsunami, and then using a variety of means to alert residents and emergency agencies. Local familiarisation and training is critical to the success of the system. “We were pleased that we had 700,000
people register to participate in our first Great Earthquake Shake Out” says John. “But we hope for many more next year.”

If an earthquake occurs and generates a tsunami the warning system will be activated.

The US Pacific or Alaskan Tsunami monitoring centres operated by The National Weather Service, will generate a report, which is immediately public.

The report will be received at the Washington State Emergency Operations Centre, (EOC) which is responsible for alerting all emergency and response agencies and organisations which are likely to be affected. There is one nuclear power plant in the state.

Simultaneously the EOC will activate the siren system.

“We have about 100 phrases pre-programmed onto a voice chip and the sirens can be programmed to announce anything that the voice chip has available, but we’ve only ever activated it from the EOC for a tsunami siren test” says Telecommunications Field Engineer Robert Purdom. “Each event consists of voice recording as well as the siren sound. We will generate the alerts every few minutes for about 40 minutes.”

But although the sirens are tested regularly, they are not considered effective without explanation, or context.

“Every time the siren sounds there must be a combination of siren and voice material,” says John Scheling, Earthquake Program Manager (Mitigation and Recovery). “We know a siren alone won’t make people change their behaviour.”

The announcement begins with the heart stopping words: “This is not a drill.”
“The sirens are for outdoor use only,” says John Schelling. “They are for people on the beach and in the streets. They won’t be heard indoors, so people have to be aware they might not hear the sirens when a tsunami alert is generated.”

It’s expected the police will drive through towns and neighbourhoods using loud hailers attached to their vehicles warning people of the tsunami.

In addition the “Emergency Alert System” will carry the tsunami warnings to emergency broadcasters, including radio, TV, and digital platforms, and US phone carriers will activate their alerts to mobile devices using CMAS – the Commercial Mobile Alert System.

If the electricity and land lines are damaged by the earthquake, each siren can be activated locally by a county or city emergency agency professional via VHF or UHF radio.

But the awareness messages stress that people must not wait for an alert. “The ground shaking, that’s the warning” says John. “Our messages are straightforward and each has a call to action: ‘If the ground starts shaking, you run. If you see the sea receding, you run. If you hear a siren, you run.’”

The population is expected to seek higher ground, with awareness plans in place to try to raise understanding that the public should not expect to be able to use roads. “An earthquake is likely to damage roads. We expect people will walk or run to higher ground,” says John.
The Mayor of Long Beach, which is a marine spit in the north east on the Pacific Coast, built at water level and with no nearby hills, says “goodness knows which way the warning signs will be pointing after an earthquake.”

Washington State is trying a Japanese idea: “vertical evacuation.” This can include towers, buildings and berms. Vulnerable communities are encouraged to become involved in considering these developments, drawing up plans and seeking federal funding.

“The community is asked if they would like a “vertical evacuation plan” and where they would like the hill or high ground to be built,” says John. This called “Project Safe Haven” and it is an attempt to get the community thinking what kind of structure might help them survive a tsunami.

It might be a berm, reinforced dirt structure, a little like a big river levee, that can be built close to population centres. They could be 10 metres high or more, and will cost $250,000 – to $1 million each. They are an active feature of Japanese tsunami response.

Engaging the whole community in its design and placement results in widespread understanding of what the berm is for; and solid community buy-in. A berm could wrap around a sporting field and create new and useful lines of visibility or it could create an amphitheatre for public events in a community.

John says it’s still just a concept: “No vertical evacuation structures exist yet, so we are hoping to build the first one in the U.S. in coming years. Additionally, funding is not yet available, but we hope to use a combination of federal, state, and local funds to implement the results developed by each community. It’s ambitious, but the issue calls for an open mind.”

The public will have to rely on existing infrastructure in the meantime.

“The siren towers cost about $50,000 each, and the cost is shared between state and local counties.” says John.

The Federal Emergency Management Agency in the US has tried to evaluate the cost of natural hazards. In addition to the infrastructure costs, it has estimated each death from natural hazard results in costs of about $5 million. A few hundred thousand dollars for some sirens, and a million or so for a berm, pales into insignificance if they save hundreds or thousands of people.
Conclusion

The earthquake and tsunami threat is very real in this region of North America and an effective warning system is mandatory.

While the tsunami threat in Australia is not considered great enough to warrant tsunami infrastructure, lessons can be learned from the approach to the hazard.

The sirens are activated after the verbal warning, which is not the practice in Australia.

The sirens are considered useful only for people outdoors. They are integrated with the entire warning system, so multiple warnings will be issued simultaneously.

The warning system is integrated with escape routes and other signage. The community practices evacuation, and is actively involved in on-going planning.
THANKS

I would like to thank the The Winston Churchill Memorial Trust for accepting my nomination and assisting me with planning, and the itinerary.

The Trust has surely contributed a great deal to the intellectual capacity of Australia over the years through these types of visits.

I would like to thank The ABC for allowing me to undertake this tour. Naomi Brown and Bruce Esplin endorsed the visit.

Arranging meetings like this can be onerous, particularly coming as it did in the middle of the bushfire and tornado season. Nevertheless I was greeted with warmth and open-hearts and I would like to thank the following people, in no particular order, and assure them that I feel the time we spent together as extremely valuable. I hope to repay any kindness if asked.

1) **American Broadcasting Corporation**
   Howard Price

2) **Public Safety Canada**
   Jeff Boyczuk,

3) **Emergency Management British Columbia**
   Tim Trytten
   Sonia Woolford

4) **Canadian Broadcasting Corporation**
   Peter Hutchinson

4) **California Emergency Management Authority**
   Monica Vargas
   Kelly Huston
   Tina Walker
   Randy Schulley
   Michael Crews
   Jim Brown
   Moustafa Abou-Taleb

5) **Federal Emergency Management Agency**
   Antwane Johnson
   Charles McCobb
   Wade Wittmer
   Manny Centeno
   Brittany Trotter
   Kimberly Hayward
   Jessica Steinbeck
Warning centres, emergency warnings and evacuations in the US and Canada

November 16, 2012

6) **LA County**
   Ken Kondo

7) **US Forest Service**
   Brenda Dean
   Doug Gantt
   Jason Steinmentz

8) **National Weather Service**
   Jennifer Lewis
   Mike Hudson
   Chris Maier
   David McKinnie
   Michael Angove
   Heath Hockenberry
   Aaron Sorensen
   Suzanne Lenihan
   Elliott Jacks
   Jen Sprague
   Ted Buehner

9) **Seattle Office of Emergency Management**
   Laurel L Nelson

10) **Pierce County, Washington**
   Tom Sharp
   Ken Parrish.

11) **WA State Emergency Operations Center**.
   Jaye Compton,
   John Schelling
   Bob Purdom.
   Robert Harper

12) **Everbridge**
   Gary Phillips

   The people of Manton, Shingletown and Joplin who are not named in every case, but who were open and generous despite their circumstances. It is great to know the good people of our two great countries have much in common – laughter, openness, resilience, loyalty for their for their country; concern for their neighbours, love for their family and friends.

Ian Mannix
November 2012.