Submission to the
Queensland Floods Commission of Inquiry
with reference to the
"adequacy of forecasts and early warning systems particularly as they related to the flooding events in Toowoomba, and the Lockyer and Brisbane Valley"

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Submission Applicability

This submission to the Queensland Floods Commission of Inquiry addresses the Order in Council containing Terms of Reference, COMMISSIONS OF INQUIRY ORDER (No.1) 2011, Section 2.e, being *adequacy of forecasts and early warning systems particularly as they related to the flooding events in Toowoomba, and the Lockyer and Brisbane Valleys*. Specifically this submission addresses the adequacy of the early warning system.

Executive Summary

The current Queensland Early Warning System is highly reliant on the receiving device being on and the recipient monitoring the content. For many people, daily life does not involve regular monitoring of radio, television and websites. Mobile phone SMS and e-mail may increase the number who receive the alert, but this method depends on signal coverage and regular checking of messages. All of these systems fail to alert a recipient if they are asleep. There are other concerns with coverage and accessibility, but the inability to warn a sleeping population is sufficient to require changes to the early warning system. The United States of America (USA) has a system of warning sirens, an ability to break into all radio and television channels, and the NOAA Weather Radio system. While all three should be considered for Queensland, the NOAA Weather Radio system itself provides a significant early warning capability which would overcome the significant limitations of the current Queensland system.

Current Early Warning System

Throughout Queensland the dissemination of warning information, in this case meteorological, is via the alerting agencies website, radio and television. Some regions have implemented services to have those alerts relayed via the mobile telephone SMS protocol, and e-mail. All of these mechanisms rely on the members of the public being actively engaged in the reception of these alerts. In the case of radio and television that requires that they have a receiving device, it is switched on, tuned to the appropriate frequency and they are listening/watching when the alert is issued. Warning tones may be used to draw attention under guidance from the issuing agency. In the case of SMS and mobile phones the potential recipient must have a suitable receiving device that must be powered on and the SMS or e-mail must be read. There is no warning tone capability. In addition, due to the underlying technology, there must be sufficient capacity in the network to distribute the alert to all parties in a timely manner. Unlike broadcast methods, such as radio and television, SMS and e-mails exist as individual entities on the network each consuming a level of resource thus reducing overall capacity.

Assessment of Current Early Warning System

During the events of January 2011, one can only speculate as to what percentage of the population received the issued alerts and it would be difficult to identify the distribution of when the alert was first received, not just at the device level but in a conscious way by the intended recipient, as a function of time since initial release of that alert. These would be key metrics of the adequacy of the early warning system. In the absence of these metrics one can assess the adequacy of the early warning system by: reviewing the response by the public to those alerts, by benchmarking the system against similar systems around the world, or by conducting an analysis of the system against high probability scenarios. This submission will not address the first of these other than to highlight that the public response will be a combination of both the suitability of the early warning system and the information contained in the alert.

There are at least three high probability scenarios that will “stress test” the adequacy of an early warning system. They are:

1) How will the general public be alerted to a critical event at 1 AM, when the alert event will occur before normal waking hours and before sunrise?
2) How will members of the general public who are temporarily in a region be alerted, particularly when they have low familiarity with the region?
3) How will members of the public who are undertaking activities remote from "conventional" infrastructure be alerted, such as those hiking and camping?

The first of these is the most telling. The early warning system available in Queensland would fail to alert the general population during conventional sleep hours. As stated previously, all current mechanisms to distribute alerts rely completely on the receiver and recipient being active. These requirements on the receiver and recipient are also the short coming in addressing scenario two. If you are unfamiliar with local radio stations, in particular those tasked specifically with broadcasting alerts, you would be at a significant disadvantage. As a State with a significant tourist industry it is essential that the early warning system is not significantly reliant on local knowledge. The final scenario can also be expanded to include those whose regular daily routine does not allow regular access to radio and television, or those members of the public who choose to enjoy non broadcast forms of entertainment. Again the requirement for active engagement with the alert mechanism is its greatest weakness.

Another weakness of the SMS and e-mail mechanisms for alert distribution is that it is not broadcast. Each SMS or e-mail consumes network resources and that is not trivial when an SMS and/or e-mail is being sent to a large portion of the population. At the same time that the alerts are being sent, normal human reactions will see an increase in contact between family and friends over the same network. This response will place even larger demands on network infrastructure. It is also worth noting that the same network infrastructure will most likely be required by emergency responders. If the emergency responders are given priority access it will reduce the capacity available for sending alerts, and if no priority is given the emergency responders may be impacted. Mobile network coverage is based on percentage of population covered, which is very different to percentage of geographic (land area) coverage. An early warning system must have a large percent of geographic coverage to ensure that all members of the public have the ability to receive the alert.

A side note relates to the introduction of Digital Radio. As Australia moves from analogue to digital radio services, the nature of the underlying receiver technology changes. A digital receiver will use more power compared to an analogue receiver, with an associated impact on battery life. Current digital radios have relatively short battery lives which will have an impact on access to information during periods of electrical blackout. The batteries used by digital radios tend to be specialised rather than standard batteries found in local stores. Radio broadcasts will remain an essential method of information distribution during emergency response periods and as such it would be prudent to implement design standards to ensure they have a suitable battery life and there remains a readily accessible supply of those batteries.

Findings on Current Early Warning System

The current mechanisms for distribution of alerts are adequate in that they enable dissemination of the alert to a portion of the general public, but either individually or collectively they are not sufficient. The current early warning system is too reliant on the receiver and recipient to be active participants in the process. The current system provides no alert capability to a sleeping population. Current mechanisms should not be eliminated, rather they should be supplemented.

Discussion of Alternate Early Warning Systems

A review of the early warning systems available in the United States of America (USA) would be relevant. The USA experiences a range of severe weather phenomena from tropical storms to tornadoes to severe snow and ice events. These weather phenomena have forecast periods ranging from days to hours. The USA has three major alerting mechanisms in addition to those discussed in the Australian context: sirens located throughout population centres, technology that breaks into radio and television broadcasts on all channels, and weather radio. The first two have significant merit, and should be given consideration. This submission will focus on the weather radio system.

NOAA Weather Radio System

Details of the NOAA Weather Radio system can be found at the http://www.weather.gov/nwr/ website, with a summary provided at Annex A. The key capabilities of this early warning system are:

1. The receiver technology is only in a sleep mode and is always “listening” for alert broadcasts.
2. The receiver technology can be programmed to respond to regional information, with varying resolution.
3. The alert will be “announced” by an alarm if required.
4. The receiver technology can be a sub-system of another device such as a conventional radio.
5. Standards exits for the receiving technology and qualification against those standards is conducted to ensure compliance.

The NOAA Weather Radio system can be used by people operating in remote areas with minimal size and weight impact, and will be silent unless an alert is issued. The system will activate during the night in a manner that will wake the intended recipient. The functionality is the most important attribute and not the implementation. A new Queensland or Australian implementation taking into account local requirements, conditions and changes in technology may result in a different system. Equally, to ensure cost efficiency and rapid implementation it may be desirable to use the same or similar technology to the USA.

The implementation of a NOAA Weather Radio like early warning system would see a range of products like car radios, bedside clocks, “transistor radios”, iPods, mobile phones and the like all having the capability to “wake up” and inform their user of alerts. This technology is not reliant on the recipient or the device to be in an active state (noting that sub-systems of the device would be in a low power sleep state “listening” for alerts). In order to address the tourist scenario it would be necessary for hotels, etc to ensure devices such as bedside clock radios were programmed for their region. Ultimately public information on the early warning system would be required in hotel guides, airport arrival literature, public signage, etc. The general public should be as aware of National and State early warning systems as they are in fire and general evacuation procedures.

Recommendations

The following recommendations are made:

1) Implementation of key functionality found in the USA NOAA Weather Radio system (http://www.weather.gov/nwr/).
2) Consideration of sirens located throughout population centres as well as technology that allow alerts to break into radio and television broadcasts on all channels.
3) Public education and information on the early warning system.
4) Any significant use of network infrastructure (mobile, cellular or otherwise) that is not broadcast in nature must through regulation and standards be sized to consider the emergency alert capacity requirements, as well as survivability of the infrastructure during an alert event and the minimum percentage of geographic coverage.
5) Development of standards for broadcast receivers to ensure they remain suitable for emergency communications (consideration of battery life and availability would be key elements).

Submitted for your consideration.

Annexes:

A. Overview of NOAA Weather Radio System

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Annex A

Overview of NOAA Weather Radio System

The following NOAA Weather Radio system summary information has been copied from: http://www.weather.gov/nwr/nwrrcvr.htm.

Residential Grade Radios and Features

Prices can vary from $20 to $200, depending on the model. Many receivers have an alarm feature, but some may not. Among the more useful features in a receiver are:

Tone alarm: The National Weather Service will send a 1050 Hz tone alarm before most warning and many watch messages are broadcast. The tone 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. (*Public Alert ™ - required*)

SAME technology: SAME, or Specific Alert Message Encoding allows you to specify the particular area for which you wish to receive alerts. Most warnings and watches broadcast over NOAA Weather Radio are county-based or independent city-based (parish-based in Louisiana), although in a few areas of the country the alerts are issued for portions of counties. Since most NWR transmitters are broadcasting for a number of counties, SAME receivers will respond only to alerts issued for the area (or areas) you have selected. This minimizes the number of "false alarms" for events which might be a few counties away from where you live. (*Public Alert ™ - required*)

Selectable alerting of events: While SAME allows you to specify a particular area of interest, some receivers allow you to turn off alarms for certain events which might not be important to you. For example, if you live in a coastal county, but not right at the beach, you might not care about Coastal Flood Warnings. This feature may also be called "*Event Blocking*" or "*Defeat Siren*". (*Public Alert ™ - optional*)

Battery backup: Since power outages often occur during storms, having a receiver with battery backup can be crucial. However, unless you have a portable unit which you will use away from other power sources, an AC power connection is recommended to preserve battery life. (*Public Alert ™ - required for radios, optional for other devices*)

External antenna jack: While most receivers come with a whip antenna which can usually be extended out from the unit, depending on your location you may need an external antenna to get a good reception. Some receivers come with an external antenna jack (normally in the back of the unit) which will allow you to connect to a larger antenna (which can be indoors or outdoors). You can often purchase these as accessories at the same place where you bought your receiver, or from most stores with an electronics department. NWR broadcasts are in the Public Service VHF frequencies, just above FM radio and between the current TV channels 6 and 7 - so an antenna designed for analog VHF televisions or FM radios should work. Or, you can make your own antenna. Go to this web site for more information. (*Public Alert ™ - optional*)

External device jack (special needs): 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. (*Public Alert ™ - required for institutional receivers, optional for consumer receivers*).

Receiver Types and Models

NWS does not endorse a specific make or model of receiver. The lists below, which contain just some of the many NOAA Weather Radio/EAS receiver manufacturers and resellers, is provided as a convenience not an endorsement.

- Residential receivers
- Industrial/commercial grade receivers

Depending on the information you want to access, and how and where you plan to access our broadcasts, you have many options. There are standalone Weather Radio receivers as well as multi-band/function receivers with the weather band included. If you are want to be alerted to Warnings and Watches day or night, a standalone receiver might work best for you. If you just want to be able to tune to in the weather broadcast and do not care about receiving alerts, a general multi-band/function receiver could be better.

Standalone Receivers: Standalone receivers might also come with AM/FM bands, but their primary use will be to receive Weather Radio broadcasts. You can choose between handheld and desktop models, depending on whether you plan to take your radio with you when you go out. There are many choices from a number of manufacturers with prices ranging from around $20 to over $100, depending on the number of features included.

Multi-Band/Function Receivers: These receivers bundle a number of features. Weather Radio is just one of many frequency bands included. You can find the Weather Radio band included in:

- AM/FM radios
- Shortwave receivers
- CB radios
- VHF Marine radios
- Scanners
- GMRS/FRS 2-way radios
- Car radios
- TV/Radio combinations*