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**Organisational responses to warnings of
impending hazards: What can be learned
from the September 2009 and February
2010 warnings in New Zealand?**

Belinda Yvette Beets

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Abstract

Organisational responses to warnings of impending hazards: What can be learned from the September 2009 and February 2010 warnings in New Zealand?

The purpose of this study was to investigate organisational response to two tsunami warnings issued for New Zealand in September 2009 and February 2010 following off-shore earthquakes: Samoa and Chile respectfully. Communication was at the forefront of the investigation with the aim to discover how communication could potentially affect response, coordination and planning.

Four methods were applied using semi-structured questionnaires to obtain qualitative and quantitative information, literature reviews and reviews of technical and debriefing reports. Seventy nine organisations were approached to participate. Twenty five questionnaires were sent out to six organisations in various regions for staff to complete with 18 returned. Interviews were organised and were conducted, with 5 completed. One debriefing report provided relevant information and was treated as an interview.

The results of the study indicated the majority of respondents (71%) considered their organisational response to the tsunami warnings in 2009 were effective (53%) and very effective (18%). The majority did encounter problems during the September 2009 tsunami warning with 29% indicating a less than effective response. In 2010, improvements were seen with 44% indicating the response was effective and 38% thought it was very effective and 19% indicating it was less than effective.

Interagency communication was very effective for 14% in 2009; slightly increasing to 19% in 2010. In 2009 it was effective for 29%; increasing to 56% in 2010. Interagency communication was somewhat ineffective for 43% in 2009 reducing to 19% in 2010. Terminology was one issue raised by all respondents as this did cause confusion amongst response agencies.

Intra-agency communication was believed to be very effective (12%) and effective (41%) in 2009; improving in 2010 (31% and 50% respectively). Some (41%) who did believe intra-agency communication was somewhat ineffective in 2009; reducing to 13% in 2010. Some indicated it was ineffective in 2009 (6%) and 2010 (6%).

Planning issues were identified in 2009 by 71% of respondents and in 2010 this reduced to 64%. Others indicated no issues (28%) with planning in 2009. In 2010, 36% indicated no planning issues. The roles and responsibilities of the EOC and primary emergency services communication centres indicated more planning and transparency was required.

Coordinated incident management was required with 81% indicating it was fully utilised and 19% did not fully utilise or use coordinated incident management (CIMS) in 2009. There was little change in 2010 with only 80% fully utilising CIMS and 20% either not utilising it fully or not using it at all.

In 2009, 72% believed the warning to be a good reminder of New Zealand's vulnerability to natural disasters; dropping to 53% in 2010. In 2009, 39% believed it to be a good training exercise; increasing to 47% in 2010.

Interviewees indicated lateral and vertical communication pathways were not always implemented. Coordination was not always functional. The results also revealed that the warnings sufficed as a good training exercise due to the urgency and requirement to respond. This allowed organisations to test their procedures and identify gaps in knowledge and plans.

The principle conclusion was that communication can affect response, coordination and planning. Communication has to work in its entirety. When gaps appear in communication pathways, this has an effect on planning, response and coordination. All response organisations need to re-evaluate the current CIMS structure, training, terminology used, and communication pathways to improve response.

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LIST OF ACRONYMS

| | |
|------------------|---|
| CDEM: | Civil Defence and Emergency Management. |
| CDEMA: | Civil Defence and Emergency Management Act 2002 |
| CDEMG: | Civil Defence and Emergency Management Groups. |
| ECC: | Emergency Coordination Centre (see GEOC). |
| CEG: | Coordinating Executive Group |
| CIMS: | Coordinated incident management system. |
| EMO: | Emergency management officer employed by the regional, district, or local council. |
| EOC: | Emergency Operations Centre. |
| GEOC: | Group Emergency Operations Centre |
| IAP: | Incident action plan |
| ICP: | Incident control point |
| IMT: | Incident management team |
| InterCad: | Computer method of sharing information between Fire, Police and Ambulance also known as I/Cad. |
| L.A.: | Local Authority (a regional council or territorial authority - includes regional, city and district councils, and unitary authorities). |
| LESLP: | London Emergency Services Liaison Panel |
| MCDEM: | Ministry of Civil Defence and Emergency Management |
| NCMC: | National Crisis Management Centre |
| Sitrep: | Situation report |
| SOP's: | Standard operating procedures |
| 4R's: | Reduction, Readiness, Response, Recovery |

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GLOSSARY

Adaptability. The ability to adjust easily to new or changing environmental conditions.

Auditability. A systematic assessment, especially of the efficiency of effectiveness of an organisation or process, typically carried out by an independent assessor.

Communication. Exchanging information between people or organisations by means of speaking, writing, or other common systems including technological devices such as paging, phone texting, public announcement warning systems.

Confirmability. Similar findings have been confirmed in previous studies.

Creditability. Bringing credit or worthiness to the research field.

Emergency Service Communication Centre. Also known as control rooms or dispatch centres where emergency calls are received and appropriate resources are dispatched to emergency incidents.

Intercad. A software programme used to provide incident reports to New Zealand Police, Fire and Ambulance services. These incidents can be updated informing each agency of updates to a situation where multiple agency events occur.

MCDEM. Ministry of Civil Defence and Emergency Management

Primary Emergency Services. For this thesis, primary emergency services include New Zealand Fire Service, New Zealand Police and Ambulance Service.

Risk. The chance of something going wrong and will result in loss occurring.

Risk Communication. The ability to exchange information pertaining to the risk to provide communities and organisations with the ability to make appropriate decisions appropriate to their situation, including when and where to evacuate.

System. A method or set of procedures for achieving inter- and intra-agency goals during multi-agency incidents.

Transparency. An honest way of doing things that allows other people to know exactly what you are doing.

Tsunami. A very large wave, or series of waves, caused by something such as an earthquake moving a large quantity of water typically in the ocean.

Chapter 1

1. OVERVIEW AND RESEARCH PROJECT

1.1 Background and justification

This thesis begins with an overview of the research project, the author's professional background and justification for this undertaking. The overall objectives of the project are presented and the key objectives of the thesis are introduced. The thesis comprises 6 chapters that document the background methodology, results and interpretation of the study.

The project explores communication processes following a declared national warning as a result of two tsunami warnings, issued by the Pacific Tsunami Warning Centre in Hawaii, spawned by an 8.1 magnitude earthquake in Samoa on the 30th September, 2009 and an 8.6 magnitude earthquake in Chile on the 27th February, 2010.

1.2 Professional Context

The author is a senior communicator with the New Zealand Fire Service within a co-located communications centre with New Zealand Police. On occasion the author has the responsibility of relieving as a shift manager for shift manager absences. The centre in Wellington covers a vast area stretching from the Awakino Gorge, north of New Plymouth on the west coast of New Zealand; Hicks Bay, north of Tolaga Bay on the east coast and the 'Three Sisters' on Desert Road north of Waiouru and everything south of these regions to the South Coast of the Wellington region. We have the responsibility of responding brigades, rural, urban and military, to emergency calls received in our centre. The New Zealand Fire Service Communication Centres also have a responsibility of assisting during civil defence emergencies including evacuation of communities during major natural and/or man-made disasters.

Within the last 14 years, coordinated incident management (CIMS) has been introduced, particularly for smaller scale multi-agency incidents and training exercises. The overall perspective indicates that CIMS will be implemented seamlessly during larger scale incidents. However, following the two tsunami warnings, CIMS does not appear to be as transparent as it should be. If it is, then the communication pathways did not appear to be fully utilised.

The author was in the process of completing her Massey University Graduate Diploma in Emergency Management when multiple agencies were required to respond to a national warning for a threat of a tsunami around New Zealand coastal regions. One important aspect of any multi-agency incident was communication inter- and intra- agency. The author started to ponder why our communications centre was not being kept in the loop when fire resources responded to coastal regions to assist local authorities to evacuate. In some cases communications centres were advised that evacuations were taking place and in other instances, evacuations took place without communication centre staff knowledge.

The author started to question the ability of the communication centre to maintain business as usual if they did not know what was happening to fire service resources. This included the location of resources after they evacuated, if evacuations occurred or not, and what records will be available for a post-incident audit should the occasion arise.

The author believed that communication was an integral part of a system to prevent failures of any sort during multi-agency incidents. Not only is communication important, it is necessary for the primary emergency services (fire, ambulance and police) to be able to maintain business as usual during these types of incidents and know their resources are being protected. This motivated the author's interest for more transparency, particularly with communication, to prevent or reduce the risk of system failures during response phases. Transparency during multi-agency incidents requires communication so seamless

coordination between the primary emergency services and civil defence authorities can occur.

These events provided the author with the desire to undertake the Master of Philosophy degree in Emergency Management. This undertaking has enriched her professional understanding of the complexity of comprehensive emergency management and the component parts that need cohesion and transparency to work seamlessly and effectively across all agencies and their respective communications centres using practical common sense and best practice solutions.

1.3 Objectives of this study

The objectives of this study are to:

1. Identify issues in communication processes between Civil Defence Emergency Management Groups, Emergency Operations Centres and primary emergency service communication centres.
2. Compare and contrast communication processes utilised inter- and intra- agency to assist in deriving professional practice based on optimal aspects of both approaches.
3. Develop communication processes that can be integrated into current communication processes used by diverse agencies.

This thesis will explore communication processes used inter- and intra- agency to identify if there are issues from the primary emergency services perspective. It will discuss the difficulties associated with emergency communication centres across the response agencies with differing structures or organisational cultures that may be governed by statute or memorandum of understanding.

1.3.1 Research Questions

The research questions were broad in nature and to a degree, personal. Although some of the questions may be deemed to be leaning towards personal opinion, this should not be ignored. The reasons for this are:

1. The people who are working at lower levels in the emergency management arena, do so under the auspices of more senior staff who often make decisions based on past and personal experiences. As emergency management is an emergent profession, it is necessary to take on board the ideas of junior staff of how emergency management practices can be altered and improved. After all, decisions and policies are not made by one person, rather a delegation of people from various agencies.
2. Organisations encourage their staff to take ownership of their decisions and roles and responsibilities so they will develop with their position. To do this, their opinions need to be heard and if practicable, employed as part of their operating procedures. This can assist in staff development and improved productivity in the work place.
3. Decision making processes may be in line with the organisational standard operating procedures. However, they may not have been tried and tested which can identify flaws in the communication pathways or in the procedures the organisations believe staff should follow.

The questions were designed to elicit information, both personal and professional to establish various aspects of organisational response to tsunami warnings in September 2009 and February 2010. If research is being conducted to improve future response to disasters, personal and professional opinions should not be ignored.

1.4 Structure of the thesis

This thesis is presented in 6 chapters. The first chapter introduces the background issues that initiated this study. It introduces emergency management communication as it relates to the levels of incidents which will allow understanding of integrated response and response processes that are discussed within the body of the thesis.

The second chapter reviews literature from within New Zealand and globally, exploring the themes for failures within a system, particularly risk communication and communication inter- and intra- agency response frameworks and the understanding of the emergency operation centre roles and responsibilities.

Chapter 3 discusses research methodology used in the thesis to examine how communication proved to be successful or not, and if primary emergency services could conduct business as usual during large scale, national crises.

Chapter 4 presents the results of the semi-structured surveys, including responses from across the agencies interviewed in order to evaluate organisational response and communication at the time of the tsunami warnings. The self-directed questionnaire and interview questionnaire are found in Appendices 1 and 2 respectively.

Chapter 5 comprises the main discussion with expansion on the key findings from the questionnaires and interviews.

Chapter 6 discusses the significance of the project, summarises the conclusions of the study and makes recommendations that have been generated from current research.

1.5 Introduction to the events following two earthquakes: 30th September, 2009 and 28th February, 2010 (NZDT).

On the 30th September, 2009 an 8.1 magnitude earthquake centred off-shore of Southern Samoa spawned a tsunami. The tsunami devastated southern areas of Samoa and American Samoa and other Pacific Islands in its proximity. The Pacific Tsunami Warning Centre (known as the PTWC from here on) issued a tsunami warning. New Zealand Fire Service received the warning at 1804Z time (Appendix 3).

On the 27th February, 2010 an 8.8 magnitude earthquake centred off-shore of the Chilean coastline spawned a tsunami. The New Zealand Fire Service received an initial advisory from the PTWC at approximately 2000 hrs on the 27th February. This initial advisory did not indicate a tsunami threat to New Zealand. However, just on 1045Z time (NZDT), the PTWC issued a warning, and potential threat to New Zealand (Appendix 4).

The northern communications centre for the Fire Service has the role of notifying the Ministry of Civil Defence and Emergency Management and using a template to decide if there is a threat to New Zealand. The PTWC initiate the warning and local emergency management staff are notified and they decide if the threat is imminent. They then proceed to put into action, their procedures to protect coastal communities that may be at risk of inundation.

1.6 Comprehensive emergency management

Emergency management is a complex area involving many agencies including government and non-government. During non-declaration periods, emergency management requires comprehensive planning between response agencies that would normally respond to civil defence emergencies whether local or national. Planning during this phase is important to identify risks for various natural and man-made disasters that can occur and what each agency has the capability to do

during such events. Through this planning phase agencies need to identify their role and responsibilities during each phase of any small or large scale incident. These agencies need to determine what terminology will be used, what level of threat the incident poses to communities and how these relate to the reduction, readiness, and response and recovery phases (4R's).

1.6.1 Definitions

Britton (1986) suggested that emergencies and disasters could be differentiated in relation to their consequences and their level of disruption in relation to:

1. The number of people involved and their relationships to the victims.
2. The nature of and extent of the involvement of the population within the affected 'social system'.
3. The nature and extent of destruction, dislocation and disruption exerted on the social system.

Civil Defence Emergency Management

The Civil Defence Emergency Management Act 2002 defines civil defence emergency management as

- “(a) ...the application of knowledge, measures and practices that
- (i) are necessary or desirable for the safety of the public or property
 - (ii) are designed to guard against, prevent, reduce or overcome any hazard or harm that may be associated with any emergency; and

- (b) includes without limitation the planning, organisation, coordination and implementation of those measures, knowledge and practices.”

Communication

Communication is defined as the exchange of information between people, i.e. by means of speaking, writing, or using a common system of signs or behaviour.

Coordinated Incident Management Systems (CIMS)

The development and implementation of coordinated incident management systems by the New Zealand Fire Service in 1998 was done to primarily improve the management of multi-agency responses to emergency incidents by improving coordination between the primary emergency services (Fire, Police, Ambulance, Rural Fire and Civil Defence Emergency Management) and between other organisations that also have involvement in escalating incident responses (Territorial Local Authorities (TA's), NZ Defence Force (NZDF), NZ Forest Owners Association (NZFOA), Department of Conservation (DoC) and Maritime New Zealand (MNZ), etc) (MCDEM, 2005).

A coordinated incident management system in New Zealand has several key components to assist in improved coordination of multi-agency responses to emergency incidents of any size. The nature of the incident will determine how many agencies are involved, but the majority of the time a single agency response will occur. According to MCDEM (2005, Section 14.1, pp. 2-3) the key elements of CIMS are:

- Management structure is formed with the following:
 - Incident control
 - Operations

- Planning and intelligence
- Logistics
- Incident facilities
- Levels of incident management
- Changeovers
- Action planning

Incident management includes:

- Establishing command and control
- Ensuring responder safety
- Assessing incident priorities
- Determining operational objectives, aims/mission
- Developing and implementing the incident action plan (IAP)
- Developing an appropriate organisational structure
- Maintaining a manageable span of control
- Managing incident resources
- Coordinating overall incident activities
- Coordinating the activities of outside agencies
- Authorising the release of information to the media
- Monitoring costs

Disaster

A disaster is defined as an event that causes serious loss, destruction, hardship, unhappiness, or death.

Emergency

An emergency is defined as an unexpected and sudden event that must be dealt with urgently.

Emergency Operations Centre

An emergency operations centre is defined as a place for agencies to meet and discuss strategies for emergency situations within a community involving multiple response agencies.

Primary Emergency Services

Primary emergency services relates to fire, police and ambulance services who are usually the first responders in emergency situations.

Risk

Risk is defined as the possibility of something unpleasant or dangerous might happen.

System

A system is defined as a combination of related parts organised into a complex whole i.e. a social system; the use or result of careful planning and organisation.

1.6.2 The 4 R's: The basis of comprehensive emergency management (MCDEM, 2009, Section 1.1, p. 24)

Reduction: Identifying and analysing long-term risks to human life and property from natural or man-made hazards; taking steps to

eliminate these risks if practicable, and, if not, reducing the magnitude of their impact and the likelihood of their occurring.

Readiness: Developing operational systems and capabilities before a civil defence emergency happens, including self-help and response programmes for the general public, and specific programmes for emergency services, lifeline utilities, and other agencies.

Response: Actions taken immediately before or directly after a civil defence emergency to save lives and property, and to help communities recover.

Recovery: The co-ordinated efforts and processes used to bring about the immediate, medium-term, and long-term holistic regeneration of a community following a civil defence emergency.

Chapter 2

2.0 Literature Review

2.1 Introduction

Emergency services are the primary responders to emergency situations. Therefore, it is deemed they work well together with pre-defined multi-agency plans. However, when major incidents do occur, there appears to be a lack of communication and coordination in the response. This section will consider issues that may result in failed multi-agency responses from past research and linking it to this study.

Auf de Heide (1989) identified issues when conducting research to develop an emergency management plan for his medical interns. He discovered that emergency management planning was not for an individual agency to undertake alone. He concluded emergency management planning was only going to be successful if multiple agencies likely to be involved in major incidents were involved in the planning phase. Perry and Lindell (2003, cited in Alexander, 2005) are united with Auf de Heide indicating that emergency management planning is a multi-agency responsibility and should not be considered a means to an end, but a continuous process. Furthermore, a systems approach is recommended to study and manage crises (Bowander and Linstone, 1987; Pauchant and Mitroff, 1992 cited in Pearson and Clair, 1998).

As a result of the demands from major disasters that have occurred over recent years, there appears to be a requirement for response agencies and disaster researchers to identify areas that require improvement and implement them into an all-hazard plan. Alexander (2005) advocates a one-plan system for all-hazard planning as this reduces the risk of conflicts and ambiguities. It encourages response organisations that will be a part of the planning and development to use common terminology; and establish roles and responsibilities for each phase of

readiness, reduction, response and recovery in crisis management. Without inter-agency cooperation, failures can occur within the system.

Research conducted thus far has identified common themes into why failures may occur. The most common appears to be communication failure during major, multi-agency incidents. According to Abkowitz (2008) ten basic factors need to be considered when analysing disasters as human involvement can lead to either successful outcomes or catastrophes. These ten factors can potentially alter the outcomes of disaster when they occur. The ten factors include "...design and construction flaws..."; "...deferred maintenance..."; "...economic pressures..."; "...schedule constraints..."; "...inadequate training..."; "...not following procedures..."; "...lack of planning and preparedness..."; "...communication failure..."; "...arrogance..." and "...stifling political agendas..." (pp. 2 – 7). Eyerman and Strom (2008) also found four common obstacles to interagency coordination. These were "...communication, leadership, cultural differences, and legal and structural differences..." (p.9).

Communication is paramount with any incident whether it is the business as usual incidents for emergency services or major incidents involving multiple agencies. It assists with interagency coordination, and also in resource allocation to maintain business as usual for the emergency services. This chapter will focus on communication failure within the system. In addition, it will consider the effects of communication on disaster response, coordination and planning.

Communication failure within the system has been identified in research. Therefore it is important to consider the theoretical perspectives that have determined how these systems succeed and fail to develop an understanding of how and where improvements are needed. There are indications the way research is conducted may not be in the best interests of actually improving these systems. Identifying where improvements need to be made may assist in the future direction

of research that may assist in improving systems during multi-agency incidents.

2.2 System Failures

System failures have been identified as issues contributing to failures during major, multi-agency incidents. These issues can recur from one disaster to another if system failures are not addressed and improved. Auf der Heide (1989) indicated the lack of coordination and recurrence of disaster response failures are due to problems within the system. He suggested that inter-agency variances for communication can result in underlying communication issues not being readily available to emergency and disaster responders. Shrivastara (1993, cited in Pearson and Clair, 1998) indicated that while researchers adopt a multi-disciplinary approach to disaster research, others analyse the causes, consequences and management of organisation response from a uni-disciplinary perspective; resulting in the same topic being discussed using different idioms for diverse issues and audiences. This can result in confusion amongst response organisations and communities alike resulting in mistakes being made.

In addition, Auf de Heide suggested the same mistakes are made from disaster to disaster. Furthermore, if mistakes are being made from one disaster to another, these can reflect in community response and recovery, further complicating an already complex situation. Pearson et al. and Eyerman et al. suggested the lack of systematic inclusion and comparison of multi-disciplinary views can impede organisational response increasing the risk of mistakes being made. In addition, Auf de Heide signified mistakes as attitudes where communication problems during a disaster camouflage coordination problems. In contrast, smaller communities work well together and usually lack the resources that are available to larger urban regions. Disasters generate a requirement for coordination between all the emergency services and other agencies. Although smaller communities may not have the

resources available to them, they still need to communicate their needs and expectations during the four phases of readiness, reduction, response and recovery before it becomes chaotic.

Conversely Miskel (2006) indicated that system failures are due to chaos experienced during the response and recovery of major incidents. He also suggested that this chaos is probably introduced due to the complicated divisions of responsibility among federal, state, local and private sector organisations and agencies. In addition, Miskel implied that at each of these levels, responsibilities are separated among large numbers of organisations and individuals. This is further complicated, when many federal and state agencies have interests in more than one area of disaster response and recovery due to their involvement with different organisations with various capabilities, traditions and expectations.

Pearson et al. concur with Miskel, suggesting that useful principles regarding control exchanges and organisational incentive schemes can be manipulated by the views of management. Correspondingly, managerial abilities to deal with risk may impact leadership as related to apprehensions that exceed the customarily reasonable constraints of their organisation's traditions. This could potentially "blind" individuals to their primary task in decision making processes and how these are communicated during major, multi-agency incidents.

A hearing conducted by the United States Government (2006) found similar tendencies to recognise the quality of leadership as being in control and coordinated even though this may not be the case. Roberts (2005) indicated a serious lack in leadership after Hurricane Katrina when the federal government, state and local officials were blaming each other for the failed response. In truth, none of these organisations were prepared for such a catastrophic event. When Hurricane Andrew was examined for Federal Emergency Management Agency (FEMA) response and compared to the Katrina response, similar issues arose (United States Government). As Miskel (2006) indicated, it is

discovering what works and what doesn't work and improving the latter. Miskel also identified the most important feature of success to multi-agency response to major incidents is communication. Additionally, he suggested that communication needs to be both vertical and lateral.

The failure in vertical and lateral communication can also be seen in a study conducted by Becker, Johnston, Paton, Hancox, Davies, McSaveney and Manville (2007) where information failed to be passed on across agencies as it was from first responders through to agencies when residents noticed breaching of a landslide dam that failed. Although no one was killed in this incident, the potential for serious harm to residents was present. Becker et al. also indicated the failure to network residents into the system that would have allowed residents to advise their neighbours of impending or actual danger. These findings overlap research conducted by Basher (2008) who highlighted the importance of risk communication. This will be discussed further, later in the chapter.

2.3 Disaster Response Structure: How it may affect response and recovery

Part of the reason for these issues and failures arising could be, in part, due to the structure of incident management systems being based on civil defence. Following major incidents, civil defence in the United States was reviewed and replaced with incident management systems which are more in line with emergency management procedures. Civil defence in the United States of America, and globally, has been structured on the military concept of command and control hierarchy (McEntire, 2007). This allowed one person to make decisions with the assumption the general population could not make appropriate decisions for themselves during major incidents (McEntire). Contrary to this inference, most people were able to fend for themselves and their communities, and were, in fact, integral to the response and recovery

following major incidents affecting their communities (McEntire; Miskel; Becker et al.). However, there are strengths and weaknesses in the civil defence or traditional model of disaster response and recovery.

Miskel also recognised the government is integral in the participation of disaster response operations and they must be prepared to respond with the civil defence model. Other strengths recognised by Miskel include the presence of standard operating procedures and hierarchy that provide direction for responders in a crisis situation. This hierarchy is important if lives are going to be protected and recovery operations are to succeed. Miskel suggests that the hierarchy is necessary to provide orders which are advantageous allowing response to be efficient.

However, Miskel also identified weaknesses in this model. The issues identified include the fact that the government is not the only organisation to respond to disaster. Standard operating procedures are limited to some disaster situations, not all types are covered by these procedures which is highlighted in the failed response during Hurricane Katrina. Natural and technological disasters are more common and although there may be order in the chaos created by these disasters, it is impossible to control them. The approach to disasters needed change to incorporate more than what the civil defence model provided.

The beliefs that contributed to the development of civil defence procedures for man-made or natural disasters resulted in fallacies which needed addressing to bring about change. Although civil defence was a starting point to protect civilians, it was insufficient. After failures in the system, changes saw the development of incident management systems and organisations to steer emergency management from a different aspect to involve first responders, other organisations and agencies likely to be involved in response and recovery. Its basis was inter-organisational and known as the all-hazards, networking, collaborative, problem solving, or public administration model (Miskel).

The theory to involve organisations and agencies in the planning phase of emergency management strategies of readiness, reduction, response and recovery appears to go so far to address issues during an incident. Problems that need to be resolved are identified in a post-mortem following the incident during debriefings and investigations or research. These reforms fail to accomplish their objectives leaving communities without ownership of a disaster relief system capable of responding quickly and effectively, resulting in recurring errors from one disaster to another, and one community to another (Auf de Heide; Miskel). This was highlighted with the failed response to Hurricane Katrina and has the potential to be repeated in other major man-made or natural disasters (Miskel).

These issues are also emphasised with the natural occurrences that could result in disasters such as the breach of the landslide dam (Becker et al., 2007) and the failure to respond to warnings (Johnston, Paton, Houghton, Becker and Crumbie, 2002) showed that emergency management planning still has a long way to go in New Zealand and globally. Although hierarchical relationships may not be possible, they still need to exist in some form to enable a broader view of a disaster to be taken.

Incident management systems provide for a lead agency to take control depending on the type of disaster; therefore, a hierarchy exists in some way. It indicates that communication is an integral part of emergency management planning otherwise it will not work in its entirety (McEntire, 2007; Miskel; Leonard, Saunders & Johnston, 2007). Although these incidents did not have the catastrophic results encountered in New Orleans or Indonesia there was potential for disaster to occur. Although this could be due to the fact that incident management systems in emergency management planning are still in their infancy, adjustments are required to ensure they work well. For this to occur, risk communication needs to be addressed. Risk communication can allow for all at-risk communities to develop holistic

approaches to the risks they are potentially exposed too, preparing them for any adverse incident that arises (Leonard et al.). It can also prepare organisations and agencies likely to respond with the risks they may face in the event of an incident occurring.

2.4 Risk Communication: How it can improve systems

Basher (2008) highlighted the importance of risk communication, characterising disasters into 3 characteristics. The first characteristic focuses on the relative uncommonness and uncertainty of disasters for most people and places. This could often lead to a lack of awareness and understanding resulting in complacency or denial of risks by individuals and policy makers alike. This characteristic is commonly found in many undertakings by researchers.

The second characteristic is the complex interaction between human and natural worlds that requires a diverse range of knowledge. This knowledge needs to include engineering, environmental, ecological, social and cultural authorities and many others to communicate with each other to reduce the risk. For example, in particular, land-planning can have a significant effect on human and environmental risk.

The third characteristic focuses on disaster reduction requiring multi-sector and multi-level input for reduction policies to be implemented. All these characteristics require communication across agencies and from communities. This effectively requires both vertical and lateral communication to occur. Basher acknowledged that linking different types of knowledge and the diverse range, methods and tools for disaster reduction could be challenging. Although it may be challenging, it should not be avoided and vertical and horizontal communication can achieve more in disaster reduction if it is conducted effectively.

Vertical communication is what is communicated from the incident by first responders such as the emergency services through the

communication channels through to other hierarchical agencies and vice versa. This type of communication can go through the ranks within an agency or between agencies. Failure within the vertical communication pathway could, therefore be attributed, but not limited to; to hardware problems which include radio incompatibility between agencies (Paton, 1994; Miskel; Basher). Miskel suggested a remedy for communication improvements was the purchase of robust, standardised communications equipment which should be interoperable between agencies. However, this is normally driven by the economical status and agreements of communities and response organisations likely to need and use such equipment to assist with horizontal communication.

Horizontal communication occurs across the agencies. This can be likened to first responders arriving at an incident and requesting assistance from other organisations. The relevant emergency communication centres notify respective agencies either by phone, paging or intercad (technological system used between Fire, Police and Ambulance to share information regarding incidents these services are co-attending in New Zealand). Miskel indicated that the potential failure in horizontal communication could be contributed to the lack of knowledge on how a disaster relief system is supposed to operate in its entirety; or it could be attributed to the lack of robust, standardised communications equipment that is inter-operable across response agencies.

Risk of man-made or natural disasters need to be communicated in such a way that everyone at all levels understand (Becker et al., 2007; Basher). Risk communication can take on other methods to warn communities of hazards. These include using warning systems that are readily available and in use (Whitman and Matford, 2007). This includes meteorological warnings, tsunami warning sirens, telephone trees, e-mails, PA systems on emergency service vehicles, door knocking, paging, short messaging systems such as text messages. The use of warning systems as outlined by Leonard, Saunders and Johnston

(2007) suggested that more than one system is necessary. This allows for failures in one or more system where communities will still be notified of impending hazards so they can prepare or take action.

However, communities and organisations have to be able to understand the warning systems being used and then interpret them correctly to enable an appropriate response to impending or actual hazards (Johnston, Paton, Houghton Becker and Crumbie, 2002; Johnston, Leonard, Becker, Saunders and Gowen, 2009; Becker, Johnston, Lazrus, Crawford, and Nelson, 2008; Leonard, Johnston, Paton, Christianson, Becker and Keys, 2008). Becker et al. also indicated the advantages of using traditional knowledge when interpreting natural signs of impending hazard.

Natural signs in the Indonesian tsunami in 2004 were present and people still failed to understand what was happening. However, native residents on Simeule Island and in the Andaman Islands fled to higher ground after either feeling the earthquake or seeing the sea receding or both. According to Becker et al., this was due to the ancestors passing on information through stories. Effectively, they were using risk communication with success, albeit on a spiritual basis. Conversely, more developed countries are relying more and more on technology to advise their populations of the risks they may face.

Regardless of the method used to communicate risk. In developed countries, further improvements have assisted with inter-agency risk communication with the development of emergency operation centres. These centres assist in the facilitation and liaison between responding agencies during the response and recovery phase of any major incident affecting a community.

2.5 Emergency Operations Centres (EOC)

The availability of technology can provide organisations with early warnings where they may activate their emergency operations centre.

This is where senior staff from multiple response agencies can meet to discuss response plans and prepare to respond to an impending or actual disaster. They can communicate with each other about their roles and responsibilities and availability of resources that may be required. Ideally, standard operating procedures for the emergency operation centre would have been established with input from all these response agencies.

Regular briefings would clarify roles and responsibilities of each agency as the incident unfolds. The EOC is also a place where knowledge can be shared to resolve disaster specific questions using diverse methods and tools. According to Kendra and Wachtendorf (2003), Perry (1995, 2003) and Quarantelli (1997) the EOC is a place for planning disaster response and supporting response implementation. They suggested the concept of the EOC allows for inter-agency communication to occur using technologically supported information systems. This allows the representatives at the EOC to communicate directly with response teams at an incident or in another place within their organisation.

While there may be representatives from various organisations with varying areas of expertise and knowledge in the EOC, the emergency services communications centre appears to be somewhat ignored when local emergency services are responded by the EOC to assist communities experiencing adverse events. Furthermore, there does not appear to be a lot of research done to link the emergency communications centres (also known as control rooms or dispatch centres) to the EOCs'. In addition, there does not appear to be any research on the roles and responsibilities for these centres during multi-agency incidents once the EOC has activated.

The role of the emergency operation centres is to develop strategies to communicate this risk to communities, involving response agencies to assist. Nevertheless, when front-line responders are not involved in the planning phase, they too become reliant on the emergency operation

centres for information. Their relevant communications centre may also be left out of the loop, and unable to advise front-line staff of their requirements in the response as per multi-agency response standard operating procedures developed in the EOC.

Drabek and McEntire (2003) highlight the challenges faced by emergency managers are varied, and in the midst of communication being received, disseminated and passed on can result in information overload for the emergency manager. However, Basher indicated that challenges exist with the linkage between different types of knowledge and the methods and tools used to mitigate the effects of a disaster. This brings into question, what the roles and responsibilities of the EOC and responding agencies are during a declared state of emergency. Perry (1995, 2003) and Quarantelli (1979, cited in Perry, 1995) provided insight on the roles and responsibilities of emergency operation centres, suggesting six functions for the emergency operations centre. These are coordination, policy making, operations, information gathering, public information and hosting visitors.

Coordination requires the assessment of the disaster risk and organising response agencies to perform together, making each aware of each other's roles and responsibilities throughout the response and recovery process, at the same time maintaining flexibility to a potentially changing situation (Mendonça, Beroggi and Wallace, 2001; Eyerman and Strom, 2008). For effective coordination to occur, risk communication has to be accurate, timely and provided to responders and members of the community alike.

Pearson et al. showed the dissemination of accurate information can assist in successful outcomes in response and coordination. This required good communication skills that need to be multi-directional (lateral and vertical communication). As Perry (1995, 2003) and Ulmer, Sellnow and Seegar (2011) indicated, risk communication needs to be addressed by everyone, including stakeholders of organisations, and members of the public to effect risk reduction; it is not a one-way

process. D'Aventi and MacMillan (1990, cited in Pearson et al.) suggested that if critical information is not shared between all stakeholders, failure can occur.

Nonetheless, if there is a gap in risk communication in the emergency operations centre, it is likely stakeholders and members of the public are going to become frustrated and may decline taking part in future risk reduction strategies (Ulmer et al.). In addition, Ulmer et al. advocated effective crisis management involves listening to stakeholders and communities about their concerns before and after crisis response. They also suggested that once these concerns are heard, "...gaps can be narrowed between what is being done and what is expected by stakeholders and communities..." (p. 49).

Narrowing gaps in risk communication can assist in the establishment of emergency operation centres to guide overall community response and coordination to disaster events with confidence the community will participate. Policies can be developed based on listening to the concerns and ideas of community members and response organisations (Ulmer et al.). By ensuring these policies are specific to the incident, not too broad in nature and flexible to adapt to changing situations, can result in effective response and coordination to disaster incidents.

In contrast, as Perry (1995) suggested, the creation of policies to assist in the guidance of communities tend to be broad which can affect the nature of the response itself, rather than specific operational decisions. Policies established by an emergency operations centre represent managerial and strategy decisions requiring approval from elected officials (Mendonça et al.; Perry 2003). These decisions are then disseminated to response agencies and often involve information gathered from a variety of sources (Kendra et al.). However, there needs to be more involvement in strategy decision making from stakeholders, responders and the public for effective coordination and response to occur, reducing the likelihood of failure (Ulmer et al.).

Involvement and flexible strategies can enhance resilience within the community and responders (Weick et al., 1999, cited in Kendra et al.).

Nevertheless, these strategies also need to include emergency service communication centres. These centres undertake the role of emergency communications for the emergency services. They also make decisions on who may need to be evacuated from calls received from members of the public which can then be passed on to the EOC. However, by not including the emergency services communication centres, this can effectively retard the flow of information to initiate responses from response agencies such as the fire, police and ambulance services. Mendonça et al. suggest unexpected incidents (as in the Samoan and Chilean tsunami warnings for New Zealand) could impact on other responses that arise during response operations.

Perry (1995, 2003) pointed out that even though the EOC is responsible for operations during and after a major civil defence incident, the operations are limited to the implementation of a response strategy to cope with the demands placed on the community emergency management system. These demands include those generated by the impact of the disaster itself, and those generated by the needs associated to organising the response to the disaster (Mendonça, et al.; Bigley and Roberts, 2001). These demands will change over time, with some response agencies being required at the start of the incident and other agencies joining the relief effort after initial responders have left. These initial responders tend to be fire, police, ambulance, and specialist services including search and rescue, power, gas and other utility services.

As the environment affected by disaster will change, it is necessary to continually monitor the situation, and if necessary respond appropriate resources, or review and redeploy resources to other affected regions. This includes the relocation of the EOC in the event the EOC becomes affected by the incident as it unfolds which occurred during the 9/11 World Trade Centre attacks (Mendonça et al.; Kendra et al.; Bigley et

al.). In the majority of incidents the initial responders to such events, such as fire and police tend to have more knowledge of what is happening than the EOC during this phase (Perry, 2003). These agencies have their own communication centres and information can be relayed from the front-line through their respective communications centre.

Using the respective communications centre during the initial phases of a major disaster, can increase the amount of information an EOC can gather, particularly if the incident has been generated from a local cause such as an earthquake. Off-shore incidents such as the Samoan and Chilean earthquakes generated tsunamis in 2009 and 2010 respectively, allowed EOCs' to gather information allowing analysis to identify at-risk communities before they required some form of response from respective frontline agencies, i.e. fire and police services (Appendices 1 and 2). Perry (2003) acknowledged the type of incident can result in a full or partial activation of the EOC based on the information received from frontline staff (i.e. fire or police officers) and what resources and functions will be required.

Frontline organisations can provide vital information on any incident including who they have evacuated, damage assessment, and inundation of townships following flood, landslide, or tsunami, and what other resources they are likely to need. This information can be relayed to their respective communications centre and then on to the EOC or paged to the appropriate emergency management office of the local authority (Perry, 2003). When responding agencies such as the fire and police services attend incidents, an incident report is generated with their respective communications centre. This becomes an accurate record for the EOC to collect and collate in order to identify areas that need to be improved, particularly those related to coordination and roles and responsibilities of responding organisations.

Perry (1995) indicated that the coordination function is related to the EOC, relaying information to respective organisations that have

computer aided dispatch functions, allows these centres to make specific deployment and strategy decisions for their respective front-line services. Using existing services and their technology can simplify the task of record-keeping which, according to Perry should be seriously considered and employed during major, multi-agency incidents. During the 9/11 World Trade Centre attacks, the EOC lost all its documentation and facilities within the World Trade Centre, which required teams to adopt flexibility and creativity to continue operating in fallback locations (Mendonça et al.).

Disaster management is complex and can become tangled in a web of multiple and conflicting messages. However, it is necessary to disseminate what the threat is and initiate a response if needed in a timely manner to prevent stress on EOC staff and first responders (Mendonça et al.; Bigley et al.; Paton and Flin, 1999). It is also necessary, during this time, for the EOC to establish a point of contact for media. This allows the communication centres for responding agencies to focus on what their responders are doing and at the same time the EOC is receiving and disseminating all information they can supply to the media for public announcements and organisational representatives situational awareness reports.

According to Perry (1995) and Ulmer et al. this prevents any confusion amongst community members and the greater population who may be concerned about relatives and friends living in disaster zones. With the advent of internet, news travels fast. Risk communication is imperative and disseminating accurate information can alleviate demands on emergency response systems by ensuring everyone knows where the disaster is and where friends and family members are relative to the disaster area.

Furthermore, public information that is disseminated to at-risk populations also needs to be disseminated by response agencies to determine the level of risk they are also facing. The public information officer needs to be able to share responsibility with other organisations

responsible for warning, evacuating and sheltering communities. The lack of accurate dissemination of such information may result in communities feeling they are safe, not responding when the opposite may be true and vice versa as was the case with Three Mile Island (Perry, 1995; Miskel; Ulmer et al.). In addition, Perry identified the definition for risk may be inappropriate that can be the cause of such confusion that can result in devastating effects on the response system. Appropriately defined terminology and coordinated information dissemination efforts can substantially reduce challenges facing emergency managers (Perry, 1995; Pearson et al., Mendonça et al.). This includes unnecessarily evacuating communities causing traffic jams, and overwhelming emergency shelters.

The last function of the EOC is hosting. Many visitors go through the EOC. These include response agencies or their managers, politicians and other elected officials and other important people where they can meet to discuss and plan for impending or actual disaster events (Kendra et al.; Eyerman et al.). The EOC must be able to cope with these visitors whether there is an emergency situation or not. However, as Perry indicates, the number of visitors to the EOC will undoubtedly increase significantly during a disaster situation and the EOC must have the capacity to cope with this influx. More to the point, the EOC should be able to accommodate these visitors without impinging on the operations of the centre during disaster situations. They should not, however, impede the centre trying to achieve its goals.

Although this function has little to do with the communication process between EOCs' and responding agencies and their respective communication centres, politicians and policy-makers need to be able to see what actually happens or doesn't happen in reality. This may provide information for legislative changes to occur taking into consideration how disasters are managed in the EOC for future planning.

2.6 Theoretical Approaches to Disaster Response and Recovery

Emergency management involves many theoretical approaches, particularly those based around sociology. Sociological theory considers situational responses by communities, individuals, and organisations. Furthermore, other theories have emerged from the sociological perspective in the attempt to find ways of improving disaster response and recovery. These have included social exchange, network systems and emergent theories. These theoretical perspectives assist in connecting the issues surrounding disaster research, response and recovery effectiveness. Disaster research is not limited to these theoretical perspectives. They could assist in improving disaster response and recovery if combinations of these theories are used to develop a holistic system.

Social exchange theory considers how organisations and communities come together in disaster situations. It has been further discussed by Kapucu (2005) as a network that is developed by organisations. Within these networks, separate organisations work independently to maintain autonomy at the same time working together to reach the same goals. This theory provides a relative understanding of what emergency managers and emergency services want to achieve during any emergency situation. However, Cook and Whitmeyer (1992) discuss exchange theory and network analysis as two separate concepts and therefore are different due to the position of the links between the two. In their view, exchange theory emphasises the exchange characteristic that binds; insisting that the most suitable network in any investigation is the one that includes all the relevant exchange connections. Analysing networks are more likely to have wide-ranging characters between the links.

Social exchange theory could also be considered an emotional response theory. Lawler and Thye (1999) indicate that this theory relies on self-interested people to interact with other, similar people. In emergency management, social exchange is necessary for multiple organisations to

be able to exchange ideas, resources and most importantly utilise this theory to plan for multi-agency incidents where resources may be required from various regions. It also allows interested parties to discuss who is doing what and when: the roles and responsibilities of each organisation during the different phases of an incident. Lawler and Thye suggested that emotions can be the determinant in the decision making process using the social exchange theory. This may be the case when warnings are issued and people act in response to them due to fear or other emotion.

Furthermore, Drabek and Evans (2004) explained that many theories have been formulated over the years to guide emergency management. These theories may be useful for certain aspects of human behaviour during disaster situations and assist the emergency managers to guide response and recovery efforts. In addition, Drabek et al. also indicated that many emergent theories could provide significant research schemas in the future. This is partly due to the all-encompassing nature of emergent theories and the characteristics and attributes of communities and individuals within the community and the event itself.

Following a longitudinal, multivariate study, Drabek et al. indicated the usefulness of developing an emergent theory: “A theoretical model of disaster response effectiveness” (p. 7). Although this is not yet a theory, but a model, Drabek et al. also suggested that there is potential for this model to be developed. It has the potential to guide emergency managers through an all-hazard approach that change over time as do the phases of disaster change. In addition, Drabek et al. was critical of past disaster research due to being “predominantly westernised and urban...” (p. 8). There may be many reasons for research being conducted in urban areas, and that could very well be the higher risk of damage and death due to the type of building structures and high populations.

However, the goal of research needs to be adaptable to any situation regardless of its location. Failures in systems could also be due to more

focus on one type of theory than another. However, as Drabek and Evans suggested, emergent theories may tend towards encompassing many theories into one where a more holistic approach to emergency management may one day be possible.

Conducting research in this thesis will venture more into emergent theories to assist in the identification of what can be learned from the tsunami warnings and evacuations of coastal regions in New Zealand in 2009 and 2010. The focus will be on organisational response. Although, it is important to listen to community concerns and how they feel incidents have been managed by organisations; it is also important to gain knowledge on organisational response. This allows detection of any improvements that can be made to reduce any impacts on emergency services, their respective communications centres and, ultimately, communities they serve.

2.7 Methodologies in Past Research and Consideration for the Future

Many studies have a sociological framework and have consisted of surveys and interviews of communities regarding planning and preparation for disaster events (Johnston, Paton, Houghton, Becker and Crumbie; Auf der Heide). Other studies include surveys and interviews of communities after they have experienced a disaster. Becker et al. (2007) indicated more personal surveys and interviews, other than the organisational interviews conducted, would have provided more personal aspects on individual decision making.

Conversely, Auf der Heide suggested quantitative and comparative studies are necessary to show whether improvements in emergency management response to disasters have occurred. Auf der Heide was critical of how disaster research has been conducted in the past, suggesting that a disaster undergoes a disaster response autopsy which becomes a written paper to highlight any lessons that can be learned. He is critical of this as, invariably, the autopsy recounts what happened,

rather than analysing what occurred to improve systems for future events. This raises the dilemma of “What should happen?” versus “What does happen?” This applies to how the disaster unfolded, how the information was collected post disaster, and who was involved in supplying the information. Auf der Heide believed these issues can affect the accuracy of the information researchers are trying to gather and interpret.

For this thesis, a comparative study will be conducted concerning organisations involved in the tsunami responses in September 2009 and February 2010. Individuals within the organisations need to be surveyed for their personal input that assisted them with their decision making after a tsunami warning was issued indicating coastal communities may be at risk of tsunami and evacuation is probably necessary for some of these communities. Although Auf de Heide criticised disaster autopsies, they are necessary to resolve the dilemma of what should happen versus what does happen so recommendations can be formulated to improve systems in the future, preferably before the next disaster occurs.

2.8 Synthesis of Past Research

Research points toward issues that may be inherent within organisations that can affect the preparation and response to disasters. Further investigations have added the need for effective communications for vital inter-organisational coordination and decision making processes. Disaster response and recovery requires a number of agencies to be able to work together to achieve the best outcomes for affected communities. This involves complex systems to function well together. It may also mean combining a number of theoretical approaches to develop a holistic plan for an all-hazard approach to emergency management.

It is within these systems where failures occur. Any area that fails within the system can result in a dominoes affect where a catastrophe occurs as in New Orleans and Indonesia. It appears that a common

failure in inter-agency communication during large scale multi-organisational incidents affects more than just one part of the system. It can affect many facets of the system including coordination, business as usual for emergency services, resource allocation and community response. The theoretical approaches that could be utilised to improve the system are the emergent, social exchange and sociological theories. However, a modified grounded theory utilising conceptual frameworks will be the method of choice to capture how organisations communicate with each other and within each organisation.

Emergency management structures have changed significantly from a flawed civil defence model. The new system required multi-organisation input into planning, reduction, and response and recovery phases of an all-hazard emergency management approach. This would not be achieved if organisations did not network with each other, exchange ideas and compromise. Communities were also seen as an asset in disaster preparedness, reduction, response and recovery. It is only through research, education and communicating with community members that organisations were incorrect about what communities could actually do during disaster situations. These communities were considered by response agencies as being incapable of helping themselves or others and were most likely to participate in undertaking criminal activity such as looting.

Emergency management is definitely an emergent profession that relies on strong networks, social exchange and sociology between communities and organisations. The new structure of emergency management aligned more agencies with their roles and responsibilities during and after an incident. However, there are still flaws that need to be addressed.

There appears to be a gap in research that does not address how emergency service communications centres are accommodated during a multi-agency incident. The emergency service communications centres may have a representative in the Emergency Operations Centre, but

there appears to be no research, thus far, of what the roles and responsibilities are of emergency services communication centres during situations where their resources are being utilised for multi-agency, civil defence incidents.

These services have a commitment to maintain business as usual and respond to everyday emergencies, but who is responsible for these services when mass evacuations occur and multi-agency incidents are under way? Who is responsible to advise the respective communications centres of what is being used and where? Furthermore, who is responsible to capture reports of what happened, when and who did what for individual response agencies (i.e. fire and police)? These questions need to be researched further in order to find the answers.

2.9 Critical Analysis

Although all the components of a system may not fail, major components do. One of the most dominant features that appear to fail is communication. Communication failure can be attributed to the failure in technology, how risk is communicated to both responding agencies and responders alike, and the structure of the system. Communication is integral to provide information to all areas of disaster response and recovery, and the communities involved. Communities affected or likely to be affected are important assets to disaster response and recovery, but still they are left out of the planning phase when developing strategies to reduce or prevent harm from natural or man-made disasters.

In addition, the way information is disseminated can affect the way emergency services conduct their business as usual procedures during a large scale incident. This is something that needs further investigation as it is paramount that front-line emergency services are able to operate normally during and after major incidents. Furthermore, there appears to be a lack of research conducted regarding the strategies of response

to include emergency communication centres responsible for responding resources in any one region.

There is an understanding of what emergency operation centres are there for. However, there is a lack of information to indicate how these centres communicate and maintain communication throughout disaster situations with emergency service communications centres. Therefore, more research needs to be conducted to identify how this oversight can be improved, so emergency services can maintain their business as usual during such events.

It has also been suggested that autopsies of disasters conducted by researchers and analysts do not work if changes are not implemented; hence the same mistakes are made from one disaster to another and from one community to another. However, due to the infrequent nature of major natural or man-made disasters, there is no better way to conduct research, except through interviews and surveys to observe what happened during an event. These surveys and interviews need to include organisations, community members and individual members of organisations to develop a holistic view of who did what, when and why they made certain decisions prior too, during and after an incident.

For these changes to be made, politicians need to take them on board, legislating changes that will work. It is also inherent among many societies and political groups that disasters do not happen frequently enough to warrant priority. This could result in reduced capacity of community resources when a major incident does occur as these resources maybe redundant or allocated to other, busier regions to maintain business as usual for that responding agency.

2.10 Linking Past Research to this Study

This chapter has reviewed literature about how and why disaster response may fail, or if it fails. Although the common theme throughout the literature was system failure that was responsible for

failings in disaster response and recovery; communicating risk and communication between organisations appears to be flawed. These failings, can affect the way incidents are coordinated and resources allocated. It can also impact on the way organisations and communities respond to warnings of impending hazards. It does not matter if the old civil defence structure was being used or the newer emergency management structure; if communication is failing, the system will fail.

Moreover, there needs to be inclusion of emergency services communications centres in the communication loop so they can respond their resources to particular incidents, both ‘business as usual’ and infrequent, civil defence incidents. There needs to be more communication between the emergency operations centres and emergency services communication centres. In addition, the roles and responsibilities of emergency service communications centres need to be clearly defined before future, multi-agency, civil defence incidents.

The author proposes to investigate some of the communication issues discussed and ways to improve these communication issues between emergency service communications centres and emergency operation centres during potential or actual major incidents that could affect business as usual for emergency services and how this can ultimately affect at risk communities. To do this, the following will be conducted:

- Interview community organisations recently affected from evacuations following tsunami warnings to have input into how they think their organisation should respond to impending hazards.
- Compare the responses from the 30th September 2009 Samoan Earthquake generated tsunami with the response from 28th February 2010 Chilean Earthquake generated tsunami and identify areas that improved and areas that still need to be considered for improvement.

- Compare both tsunami warning responses to the MCDEM and emergency services process to identify areas that may require any improvements.

Chapter 3

3.0 Materials and methods

3.1 Introduction

The purpose and focus of this study is described in this section, along with the rationale for the use of a mixed method approach which includes both a qualitative and quantitative methodology; the method of data collection and interpretation of the results. A qualitative survey was developed with semi-structured questions to gather information from personnel from various agencies. A quantitative survey was also developed with semi-structured questions to gather qualitative and quantitative information from a wider group of people within these agencies.

Ethical aspects were considered along with an explanation of the factors required to ensure that the qualitative and quantitative research remained objective. Several agencies that may have responded to either one or the other or both tsunami warnings in September, 2009 and February, 2010 were asked to participate in either the qualitative interview or quantitative questionnaire in late 2010 and early 2011. These agencies were the Ministry of Civil Defence and Emergency Management, New Zealand Fire Service, New Zealand Police, Regional and territorial authorities, Civil Defence and Emergency Management Groups, ambulance services, district health boards and ports in New Zealand.

The number of responses received was minimal with some that can be attributed to adverse natural incidents occurring at the same time participation was being asked for. Some refused to participate on the grounds they did not do anything in their regions as their location did not require participation in the national warnings. The NZ Police Research and Evaluation Committee declined access to police staff for participation in this study.

3.2. Purpose and focus of this study

The hypothesis for this study is:

“Communication failure within the emergency management system can interfere with planning, response and coordination for multi-agency incidents resulting in confusion and inadequate and/or inappropriate response of resources.”

Through the interviews and survey questions and their interpretation, the supposition was tested with the thesis proposing practical recommendations that began with a hypothetical approach. A mixed method approach was used to gather the necessary information; reading reports and interviewing civil defence emergency management group managers, coordinators, other emergency management staff and staff from primary response agencies and their respective communication centres, and media releases.

3.3 Research approach and methodology

Information for this study has been derived from four major sources:

1. Reports from responding agencies
2. Literature and comparative studies
3. Interviews and surveys with primary response agencies and civil defence emergency management groups and their staff.
4. The report used for this study was a debriefing report from a regional council emergency management group.

A number of key individuals were interviewed with semi-structured questions that were considered suitable in evaluating the direction of the research. These interviews allowed the researcher to assess multi-organisational relationships (Schneider, Elliott, LoBiondo-Wood and Haber, 2002) by examining responses of personnel from a number of different agencies, in addition to response from the internal perspective

of one agency: The New Zealand Fire Service. This allowed a multi-agency view of how communication occurred during multi-agency incidents and not only what occurred with the one agency. This would be pointless when the study is trying to understand processes to improve inter- and intra- agency communication during large scale emergencies. Seventy nine agencies were approached seeking permission for staff participation in the research. This resulted in 5 interviews and 25 surveys being dispatched for completion by members of the organisations. However, 7 surveys were not returned.

Interviews and written communications were held with:

- Civil defence emergency management officers from local and regional authorities.
- Some civil defence line managers to gain an organisational perspective.
- Emergency service personnel, including senior staff from the New Zealand Fire Service.
- Communication staff from the primary emergency services (Fire).
- Regional Managers.
- Senior members from the Ministry of Civil Defence and Emergency Management.

All participants in the interviews gave their consent to be interviewed or participate in the survey questionnaire and were not known to the author or were known to the author on a professional basis. The interviews were designed to gather information on both positive and negative perceptions of declared emergency responses. The interviews provided insight into organisational thinking prior to, during and post incident and current thinking into integrated planning for future declarations of national emergency incidents that are tantamount with

the Civil Defence Emergency Management Act (2002) and its amendments.

3.4 Ethical considerations

Ethical committees consider the issues that protect the rights of human participants, protect the safety of the researcher, the university, the benefits that come out of the research, any risks in a study, obtaining informed consent and the submission of the research proposal for institutional or external review.

The protection of human rights involves applying good judgment to maintain the participant's self-dignity and the right to his or her self-determination and volunteering their involvement in research. For this thesis each participant in the interview process gave informed consent to be involved in the project interviews. Informed consent is one important method of protecting the rights of the individual participating in the research (Sieber, 2009, in Bickman and Rog, p. 121).

Sieber (in Bickman et al., p.122) also indicated that privacy of thoughts can be influenced if the researcher asks the participant what other members of their group "...may consider private in relation to the intended study..." Participants' thoughts given at the interview were reflections of their organisational thinking at the time of the declared emergency incidents. For this study, no individual or their position from and within the organisation has been named allowing the contribution of information to the study to be shared without constraint. Furthermore, agencies have been clumped together, for example there are several regional councils but all participants have been placed under the umbrella of 'regional council' regardless of the regional council they work for to eliminate any possibility for participant identification.

The ethical screening questionnaire was completed and judged by peer review by the Massey University Human Ethics Committee. It was necessary to prepare and submit a full ethics submission based on the

fact that the author is an employee of the New Zealand Fire Service and this was an agency the author intended to use in her study. Due to the nature of the researcher's position in the Fire Service, she knew some of the participants on a professional basis. The author is responsible to maintain ethical conduct of the research with all the people interviewed and any confidential reports submitted by any agency.

Furthermore, letters went out to the New Zealand Police, and only then was the author advised to complete a full application to the Police Research and Evaluation Committee to conduct research involving their staff. This was completed to uphold the ethical perspective of this research. The police would then assign an officer to assist the author in her research if they approved the application. However, the Research and Evaluation Committee declined access to police staff on the basis of timing, interviews would take too long, and the questionnaires were repetitive.

3.5. Research methods

Four methods were applied to gather information for this thesis. The first method was a literature review on the topics of response and risk communication. The second method involved semi-structured interviews with key stakeholders from various agencies nationally. The third method was a semi-structured survey with participants selected from various agencies nationally. The fourth method involved reading debriefs and technical reports and extracting relevant information as though this was gained through conducting one-on-one interviews with the participant; only one debrief report was relevant. A content analysis was conducted to ascertain prominent themes that could assist in finding what worked and what didn't. The second and third methods are considered as mixed methods where the researcher combines the two major methods of quantitative and qualitative methods into one mixed method (Symonds and Gorard, 2010).

These representatives were interviewed in early 2011 to assist in the evaluation of their understanding of organisational response for the two tsunami warnings issued in September, 2009 and February, 2010. All interview participants were required to sign consent acceptance letters to be involved in this study. Employers, willing to assist in the distribution of self-administered questionnaires to their staff, provided the researcher the confidentiality and impartiality required to protect the anonymity of the participants. These participants were supplied with a stamped, self-addressed envelope to return the completed questionnaire to the researcher. Completion and return of the questionnaire implied informed consent.

Representatives from 5 agencies were interviewed (4 in-person interviews and 1 debriefing report) with 73 questions posed around central themes (Appendix 2). The interviews were qualitative and evaluative in nature. Interviews occurred with participants representing their agencies and organisations, lasting between 1 to 3 hours.

Qualitative methodology encourages interaction linking the researcher's understanding, ethics, ideas and facts to transpire (Cutcliff, 2000). Therefore, for qualitative research to have any integrity, data must be resourced from those who work together within the confines of the research topic. A deductive approach used in this study allowed the researcher to carefully consider ideas and theories using a modified grounded theory approach in the course of proficient research (Heath and Cowley, 2004). Exploring relationships and analysing suppositions can assist in finding solutions to problems using deductive reasoning. According to Heath and Cowley this can also result in emergent theories in which comparative methodology is based (Heath et al.) due to the use of deduction and verification of ideas. Glaser (1978, cited in Heath et al., pp. 141-150) indicated that ideas needed to be placed into data and categories without the risk of forcing data.

This study was attempting to compare organisational response from a communications perspective inter- and intra- organisation during the

two tsunami warnings in New Zealand on the 30th September, 2009 and 28th February, 2010. For that reason, basic themes were sought in this thesis to correspond to the requirements of readiness and response of the Civil Defence and Emergency Management Act, 2002. Analysis involved serious consideration of what the interviewees were saying and comparing the survey data with their responses. Although important aspects appeared as a result of the response and interviews, they were not included in this research as they did not fit into the main objectives.

According to Morse and Niehaus (2009), grounded theory can be employed to recognize what occurs or what has occurred within a specific incident to assist in the improvement and articulation of change, whilst simultaneously being conscious of the procedures crucial to that change. Heath et al. reinforced the idea of Glaser (1978, cited in Heath et al., pp. 141-150) and Cutcliff that data cannot be forced to 'fit' the research. This will only result in the loss of integrity for the research and preventing verification for the research hypothesis.

This thesis compared organisational response for two specific events: Tsunami Warnings in September, 2009 and February, 2010. To accomplish this, a modified grounded theory approach was the most appropriate tool to do a comparison study. Furthermore, Morse et al. indicated the use of grounded theory in a mixed method design, must be used as the principal component and not an additional component. Additionally, Bogdan and Taylor (1975) suggest that researchers do not attempt to find and provide evidence for their theories, but simply attempt to show credible support for them. For this to occur, the correct balance between theory and method needs to be maintained for the duration of the research.

Questions contained within the interview are aimed at evaluating outcomes following the two tsunami warning events. The interview process required transcribing answers given by the interviewee. The evaluation of these interviews was driven by objectives. Interview

processes provided an opportunity for the researcher to record both intended and unintended effects. These effects may, or may not, provide credible support for the research. The outcome of the evaluation questions, when analysed, will determine the outcome of the research and whether there had been an enhancement for future, all-hazard, CDEM emergencies.

The quantitative questionnaire allowed 18 participants from 6 agencies to take part in a self-administered questionnaire that consisted of 44 questions posed around central themes (Appendix 1) was developed in conjunction with the qualitative questionnaire (Appendix 2). This questionnaire was semi-structured to allow participants to comment on their answers. This allowed further analysis to occur and a comparison between interviewee responses and the debriefing report.

Employers were asked if they would distribute the questionnaires to protect the identity of the participants. Employers were given a number of participant packs containing the information sheet, the questionnaire and a stamped and self-addressed envelope so they could distribute these to those who volunteered to take part. This was to allow participants to complete the questionnaire with anonymity to the researcher and to their employer. Although practical steps were taken by the author to maintain anonymity, participants were provided with the author's contact details by their employer, in some cases, if they chose to participate. Separate packs were sent directly to the participant.

Each questionnaire and envelope had a code to protect the ID of the participant. The participant could quote the code should they decide to withdraw his or her participation in the research. The return of the completed questionnaire implied consent so no consent forms were required to be completed by these participants. Participants were given a date in which the questionnaire needed to be completed and returned to the researcher. It was estimated the questionnaire should take approximately 1 hour to complete.

Quantitative methodology encouraged a systematic practical exploration of quantitative characteristics and phenomena and the relationships between the two. The objective of quantitative research was to develop and employ scientific concepts and hypotheses pertaining to these phenomena. This procedure of measurement was vital to quantitative research as it provided the essential connection between observation and scientific expression of quantitative relationships. For this reason, quantitative research needs to be reliable if it is going to have any credibility.

According to Fink (2009) “...reliable survey provides a consistent measure of important characteristics despite background fluctuations...reflects the “true” score – one that is free from random errors...” (p. 41). However, the use of quantitative methods has limitations and can invalidate, prejudice or bias the results. The limitations include, but are not limited to, participant withdrawal from the survey, the selection process of participants and the researcher aiming for “...a true experiment but doesn’t quite manage it (Fink, p. 72).” Although participants may consent to doing the survey, there is always the possibility of a high non-response rate.

To reduce the risk of non-response, the author piloted the questionnaire and alterations were made. Participants were given a date to return the questionnaire and they were provided with a return-addressed and stamped envelope. Therefore, no costs would be incurred by the participant to post the questionnaire back to the author for analysis.

Quantitative research provides a methodology that can be followed by future researchers. It can be compared and contrasted to qualitative data collected to test the theory. To do this both sets of data can be used to examine, analyse and interpret observations for the purpose of discovering any underlying meanings and patterns of relationships, including classification of different types of phenomena and entities via the process of triangulation (Amaratunga, Baldry, Sarshar and Newton, 2002; Morse et al.; Davis, 1997). The analysis of the quantitative

questionnaire were gathered and entered into a Microsoft excel program and percentages and number of responses recorded for each quantitative question.

Triangulation occurs when two or more methods are used to explore phenomena from different aspects and at the same time compensate for each method's deficiencies providing validation (Amaratunga et al.; Greene, Caracelli, Graham, 1989; Morse et al.; Davis). In addition, Morse et al. explain, the two methods come together at a "point of interface" in either the data analysis or in the results description. Using both methods can provide a wider explanation or provide a description that single methods cannot access. It can also provide more valuable information, producing results that are more significant and broad in nature (Amaratunga, et al.; Morse et al.).

Although a distinction is commonly drawn between qualitative and quantitative aspects of scientific investigation, it has been argued that the two go hand in hand. For example, based on analysis of the history of science, Kuhn (1961, p. 162) concludes that "large amounts of qualitative work have usually been prerequisite to fruitful quantification in the physical sciences".

Qualitative research is often used to gain a general sense of phenomena and to form theories that can be tested using further quantitative research. For instance, in the social sciences qualitative research methods are often used to gain better understanding of such things as intentionality and meaning, for example, the speech response and body language of the participant and why did this person or group say or do something and what did it mean to them? This can then be quantified in later research or simultaneously using mixed methodology. Regardless of the method used, issues of rigour need to be considered to enable the research to be reliable and valid.

Due to the nature of this study, multi-level mixed method sampling was conducted. According to Tashakkori and Teddlie (2009, in Leonard et

al., pp. 283-317), this type of sampling is a common sampling strategy. The use of multi-level mixed methods allowed purposive sampling techniques to be utilised. This allowed the capture of responses from various participants with varying ranks within the emergency management arena. The use of mixed methods can result in either conflicting information or it can complement qualitative data.

There are also advantages of using mixed methodology. Some of these include the use of both quantitative and qualitative questionnaires providing the opportunity to develop a sequential mixed design in which multiple research strands can be derived. In this study two research strands were determined: quantitative – qualitative (QUAN-qual). According to Tashakkori et al. (in Leonard et al.; Morse et al.) this type of mixed method design can provide advantages of both similar and orderly processes. The larger the number of participants can assist in improving the validity and reliability of the data, allowing for the ability to differentiate the true nature of a situation (Tashakkori et al.).

3.5.1 Interview objectives

The objectives of the interviews were:

- To determine emergency management thinking.
- To elicit each agency's response to the warnings.
- To evaluate the processes of inter- and intra- agency communication planning for declared emergencies.
- To elicit opinions of various agencies on their roles and responsibilities that may assist in improving communication.
- To establish effective communication processes inter- and intra-agency to improve partnerships that will ultimately benefit both agencies and communities alike.

- To identify the issues surrounding the use of coordinated incident management systems, the development of communication plans and response from a multi-agency perspective.

3.5.2 Interview and survey process

Only agency members who participated in either/or, or both tsunami warning events were invited to participate in interviews or complete a quantitative questionnaire. As the warnings were national, the author decided it was necessary to include all the civil defence emergency management groups and emergency services throughout the country. All fourteen Civil Defence Emergency Management Groups (CDEMGS), as listed on the MCDEM website were sent emails for initial contact to find out who were the principle emergency management officers and the main point of contact for local and regional authorities. This process was also completed for the primary emergency services, district health boards, port authorities, and so forth.

When contact was made with appropriate persons within the agencies, they were sent a letter with information sheets and asked if they would participate with the interview questionnaire or self-administered questionnaire. Those who agreed to participate in the interview were sent a letter of consent, which the author collected at the time of the interview, and a copy of the interview questions. The interviews and surveys needed to be completed prior to the 31st May, 2011, with interviews being scheduled between January and May, 2011.

Each agency was offered the opportunity to participate. The main contact between the researcher and the participants was by email after the letters they received seeking staff to participate in either the interview or self-administered questionnaire. Most agencies responded positively, although not all agencies participated in the research due to excessive workloads or they did not do anything during the warnings. Each interviewee was sent an information sheet and consent form two

weeks prior to the interview explaining the scope of the research, along with a copy of the questions to be asked. The questions were designed to elicit organisational thinking rather than the thinking of the individuals being interviewed. The interviews lasted between 1 to 3 hours and carried out at each interviewee's organisation premises in relaxed, informal or semi-formal surroundings.

Participants who agreed to complete the survey questionnaire were sent an information sheet, questionnaire and return-addressed and stamped envelope either directly or through their employer. It was estimated that the questionnaire would take approximately 1 hour to complete. Consent occurred when the questionnaire was completed and returned to the author.

Chapter 4 contains a summary of responses from the various agencies as well as interpretation of the themes derived from the interviews. The responses from the agencies are aligned to coordinated emergency management concepts of reduction, readiness, response and recovery.

3.5.3 Issues of rigour in mixed method research

Mixed method research, as in this study, involved both a qualitative and quantitative perspective. Qualitative and quantitative research in this study resulted in a methodology audit trail that can be followed by future researchers. In addition, Jackson, Daly and Chang (2003) stated the issue of rigour must be addressed regardless of the design or approach used in research. The criteria for judging scientific rigour according to Sandelowski (1995) and Lincoln and Guba (1985) are creditability, auditability, fittingness and confirmability. These four elements for qualitative research rigour have a counterpart for quantitative research (Table 1). These elements are internal validity, external validity, reliability and objectivity.

Alternatively, Onwuegbuzie and Johnson (2006) suggested validity is not limited to quantitative measurement, nor is it about particular

legitimacies. They suggested validity in research comprised of different parts of the research, the conclusions reached and the applications based on it can be either high or low in quality, or somewhere in between. Furthermore, they indicated that quality or validity can contain subjective, inter-subjective and objective elements and controls. However, for this thesis, the four elements for qualitative and quantitative research shown in Table 2 will be discussed as issues of rigour for mixed methodology.

Table 1: Four elements for rigour in qualitative research and their counterparts in quantitative research

| Qualitative Research | Quantitative Research |
|----------------------|-----------------------|
| Creditability | Internal Validity |
| Fittingness | External Validity |
| Auditability | Reliability |
| Confirmability | Objectivity |

Creditability refers to the reliability of a given questionnaire and the responses received. It relies on honest descriptions and/or interpretations from participant experience that can be easily recognised by others reading the information in which responses were elicited from the questionnaire (Davis). In addition, Bryman, Becker and Sempick (2008) indicate creditability as having believable findings and control of personal prejudices.

In quantitative research internal validity eliminates alternative hypotheses which include, but not limited to, testing effects, regression, instrumentation and selection of participants. Internal validity also relates to the validity of the testing instruments and considers content, criterion and construct validity (Davis; Bryman et al.).

Fittingness refers to findings "fitting" into contexts outside the study situation and when the audience views the findings as meaningful and applicable in terms of their own experience (Davis).

On the other hand, external validity is used in quantitative research and considers the generalisability of findings and the representativeness of participants, instrumentation used and testing conditions the participants are in (Davis; Bryman et al.). The focus of this research is on organisational response; therefore it is the representativeness of these organisations rather than the general public that was needed.

Auditability refers to other researchers being able to clearly follow the assessment path used by the initial researcher in which the results are the same or comparable and do not contradict conclusions reached by the initial researcher's facts, point of view and circumstances (Davis; Bryman et al.).

Reliability in quantitative research refers to the consistency, solidity, and soundness of a test or testing process. According to Bryman et al., reliability refers to explicitness, transparency and accuracy of the methods used in the research process and the results can be proven statistically.

Confirmability is the findings that reflect the performance of creditability, auditability and fittingness standards and could be responded by the same methodology. According to Davis qualitative research is primarily based on subjectivity rather than objectivity. Subjectivity occurs when engagement occurs between the researcher and the participants with emphasis on the views of the participants they have drawn from their life experiences to find the truth.

Objectivity is similar to confirmability. It draws on the outcome of establishing internal and external validity and reliability. Relationships that occur between the researcher and the participants

are reserved and based on etiquette, concepts and instruments used to conduct the research.

3.6 Data Analysis: Thematic content analysis

The data analysis process followed a semi-structured interview and self-administered, semi-structured questionnaire using a simple modified thematic content analysis, as described by Lacey and Luff (2009). The interview responses resulted in a detailed and systematic recording of themes and the issues identified were then linked with the literature review. Questions were broken down into broad categories prior to the interview, e.g. overall perspectives of the two tsunami events, response, communication, coordination and planning. These were further broken down to specific questions relating to topics such as, but not limited to incident reporting, who communicated with whom, response times, and information received and disseminated, and training. Each agency was analysed to see if there was any potential flaws in the way response, coordination, planning and communication was conducted that could lead to system failure during national warning situations (Appendices 1 and 2).

The interview and self-administration processes generated themes from the data that was collected. Each question was recorded in hard copy with key phrases or words noted. The key phrases or words were summarised and tabled into an excel program. The process was slow as the phrases and words had to be taken out of the interview answers. Analysis of the data occurred during the same period as new data was being collected from organisations.

The quantitative data allowed for percentages to be taken. This was done by counting the number of responses per question then dividing this number by the total number of respondents who answered the question and multiplied by 100. In some cases just the number of responses was recorded. Only the questions pertinent to the organisation and the participant (absent for one but not the other

tsunami warning) were answered. These were coded into 4 groups or themes. Percentages were calculated from the number of responses in relation to themes from the self-administered surveys. These were charted. The key findings that came from each interview and debrief report were tabled using key words and phrases, described in chapter four. A second tier to the content analysis was to identify the meanings of responses given by the participants, ensuring they were interpreted in an organisational context.

3.7 Reflections on the research methodology

The study comprised mixed methods engaging qualitative and quantitative approaches using semi-structured questionnaires. The qualitative, semi-structured process collected data from 5 agencies involved in the two tsunami warnings using face-to-face interviews and one debrief report. A copy was sent to the interviewee for verification of accuracy. Notes were taken during the interview process to capture any issues not raised that may be relevant to the current study or for future research to be undertaken. Interview questionnaires and self-administered questionnaires needed to be completed by 31st May, 2011.

To encourage careful, thoughtful, and reasoned responses each organisation was sent the questionnaires two weeks prior to conducting the interview. The author was endeavouring to review organisational communication systems from an emergency management perspective and not the thoughts of individuals and if communication can impact on multi-agency response, coordination and planning. All participants remained anonymous so information could be shared without constraint. In contrast to the timing, some parts of the warnings did remain constant between those who participated. These were based on “adverse” or “negative” comments from the first warning to “improvements” in the second warning under investigation.

3.8 Limitations of the research

The purpose of research is to compare organisational response to two tsunami warnings to identify any communication issues arose during the response phase. The method used to obtain information can either answer the research question or hypothesis, or it can indicate the need for further research in areas not yet considered.

The research design was unique to the researcher and her own perspective on the issues. These issues may not be evident to various organisations and considered the response to have worked well. It could limit the study to perceived problems within one organisation or a multitude of organisations. Alternatively, the design may indicate an endemic problem that needs to be addressed to prevent failures within communication systems for future, all-hazard incidents that may not have been thought about by the researcher.

Resources can be limited by time and can influence the scope of the researcher. The author had intention to try and complete the questionnaires by the 20th October, 2010 when a national exercise was planned involving tsunami warnings and agency response. Due to the civil defence emergencies that arose before this date and the submission of a full ethics application the interviews and self-administered questionnaires were delayed well past this date. The reason for the researcher to complete these questionnaires by this date was to prevent any potential confusion between the two events and a national desktop tsunami exercise.

In addition to submitting an ethics application to the University, and application was also required by the New Zealand Police Research and Evaluation Committee which was subsequently rejected, therefore members of the police force were not allowed to be approached for either interview or self-administered questionnaire further limiting the number of potential participants in the investigation.

Also major incidents may occur at anytime as it did during the tenure of this thesis. As the researcher was making contact with various authorities, a 7.1 magnitude earthquake struck Christchurch with a multitude of after-shocks, and a few days later, the Manawatu-Wanganui region was being inundated with flood waters and more recently flooding in the South Island and Cyclones in the North of the North Island.

In addition, a 6.3 magnitude earthquake occurred in Christchurch in February, 2011, which limited the study with potential participants in the research having to undertake more important tasks in Christchurch due to the severity of displaced communities, lives lost and destruction of the city. This meant the cancellation or postponement of any interviews already arranged so organisations can tend to more important tasks with the occurrence of natural hazards and their consequences on their communities. Other agencies either did not respond or responded with no intention of participating due to the fact they did not have any involvement in the two tsunami warnings when they were issued. Some agencies supplied debriefing and/or technical reports instead.

Due to such recent incidents occurring, and the time from the tsunami warnings to interview or self-administered questionnaire increasing, could lead to contamination of memory for one event over another with what happened with the tsunami warnings to what has occurred in the way of recent disasters, including the recent tsunami warnings issued following a 8.9 magnitude earthquake in Japan.

3.9 Summary

This chapter described the methods utilised in carrying out research involving agency perspectives on emergency management procedures, particularly communication (based on organisational priorities) that may have arisen from integrated emergency management processes. Ethical considerations were considered as part of the research and three methods of research are described in analysing written records of the

planning process and executing semi-structured interviews and structured surveys. The objectives of the interviews were described and issues of rigour in mixed methodology were considered. Data analysis was carried out using a simple modified thematic content analysis.

The goal of this research was to get between 100 - 200 survey questionnaires to participants and 10 - 20 interviews completed. However, this was impeded by limitations. The limitations incurred during the information seeking and gathering stage for this research project included major incidents occurring at the time contact was being made with organisations nationally to seek employer approval to approach staff to participate in either the interview or postal survey. These incidents included the Christchurch earthquakes and the flooding in the Manawatu-Wanganui region and the South Island and cyclones in the north of the North Island. These adverse events resulted in the lack of availability for staff to participate. Others had not responded or those that did respond declined to participate due to the fact they did not participate in the warnings.

Election for the local and regional authorities were also held at this time and resulted in loss of contact with people who were prepared to participate as employees of the councils. This loss of contact was due to a couple of factors in which the author had major spinal surgery and when she able to continue making contact with these organisations, there was no response. Police in the communication centres and police stations that were willing to participate had to be postponed until the New Zealand Police Research and Evaluation Proposal Committee either permitted or declined for police to be involved. They decided the latter citing time and the Christchurch earthquake where staff would not be able to participate. They also cited that the questionnaires were too long and somewhat repetitive.

Chapter 4

4.0 Results

4.1 Introduction

This chapter represents the interview and self-administered surveys. Three organisations provided debriefing reports instead of having an interview or completing a self-administered questionnaire. Representatives from 8 organisations involved with the tsunami warnings were interviewed and included debriefing reports (n=5) or completed a self-administered questionnaire (n=18). Some organisations declined to take part due to the fact their geographic location did not require a response as the threshold was not met, or they were not likely to be affected by any tsunami surge. Others were busy with natural disasters occurring within their communities. Organisations that agreed to take part in this project were:

1. Primary Emergency Services:
 - New Zealand Fire Service.
2. Local Authorities:
 - Porirua City Council, Lower Hutt City Council and Central Hawkes Bay District Council
3. Regional Councils:
 - Hawkes Bay Regional Council, Taranaki Regional Council, and Environment Canterbury.
4. Government Organisations:
 - Ministry of Civil Defence and Emergency Management

Of those who took part, some were involved in only one or the other tsunami warning response. Some who took part in the postal survey did not fully complete the questionnaire, by not adding explanations where they could or not answering some of the questions.

A thematic content analysis extracted themes from the interviews. These themes were *communication, response, coordination, and*

planning. A comparison from the thematic content analysis was then analysed alongside the quantitative questionnaire to find a point of interface to answer the following questions:

1. What effects does communication have on response?
2. What effects does communication have on coordination?
3. What effects does communication have on planning?
4. Are all these variables dependent on each other influencing outcomes?

To answer these questions, each variable was examined separately initially, and they were considered further in the discussion section.

4.2 Overall Perspective of Response to Tsunami Warnings in September, 2009 and February, 2010.

Prior to the tsunami warnings in September, 2009, there had been very few declared national warnings for a tsunami threat to New Zealand. The survey asked for one response to get an indication of what people believed to be the most important aspect from these warnings. Respondents needed to provide one answer from the three choices. However, some answered more than one.

Figure 1 shows the overall perception of organisational response provided important information regarding what was important to organisations during the tsunami warning events. The majority of respondents (72% [13]) considered the warning in September was a good reminder of our vulnerability to natural disasters and there is a need to know what the organisational procedures are with one interviewee stating “that gaps in knowledge were identified”. Others (39% [7]) believed it to be a good opportunity to utilise this warning as an exercise, with one interviewee stating “the reality of the warning provided more urgency to them than any planned exercise”. In comparison, the February 2010 warning only 53% [10] of the respondents believed that warning was a good reminder of our

vulnerability and procedures should be known. This was less than in 2009. Furthermore, 47% [9] of respondents believed the 2010 warning to be a good exercise.

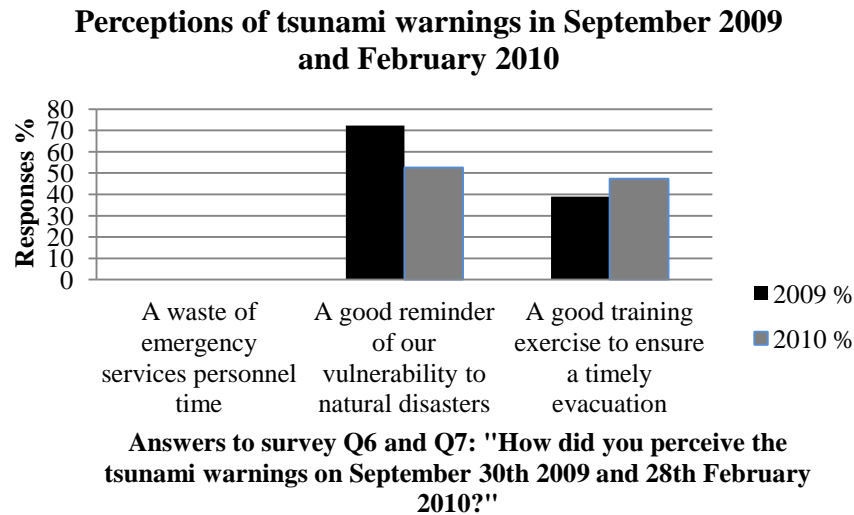


Figure 1: Summary of responses of survey participants' perception of the tsunami warnings (Although only one answer was asked for in questionnaire [Appendix 1 p. 123], in some cases more than one answer was given).

The interviews identified concerns for both the tsunami warnings. Table 2 shows some of the comments made indicating challenging issues during the warning phases in September 2009 and February 2010. In addition to these concerns raised, there appeared to be more satisfaction with organisational response with most suggesting the September 2009 warning had identified problems in which some had been resolved, but not all, before the 2010 tsunami warning.

Table 2: Summarised responses from interviewees overall perception of the tsunami warnings.

| Comments made by interviewees in response to Q1: “What are your views on the tsunami warning response in September 2009?” | Comments made by interviewees in response to Q2: “What are your views on the tsunami warning response in February 2010?” |
|--|---|
| <ul style="list-style-type: none"> ➤ Inexperience; ➤ Shaky; ➤ Problems; ➤ Inadequate communication; ➤ Data not accurate; ➤ Technology failures where large files being emailed jammed the [national warning] system; ➤ Unable to access emails or websites due to back-up processes being done for some organisations and websites being filtered therefore blocked by the organisation; ➤ Over-sensationalisation by media in 2009; ➤ A lack of planning; ➤ No post impact planning; ➤ Timing not sufficient to effect evacuations from coastal communities with only a 3 hour wave travel time for some organisations; ➤ Confusing terminology; ➤ Lack of input from Civil Defence Emergency Management Groups. | <ul style="list-style-type: none"> ➤ Lack of interest from senior management; ➤ Information variances; ➤ Problematic vertical communication; ➤ Lack of planning inter-organisation; ➤ Inadequate horizontal communication; ➤ Technological limitations ➤ Uniformed personnel are more likely to be listened too by members of the public; ➤ Primary emergency services response is dependant on workload at the time of incident; ➤ Lack of confirmation systems - DART buoys; ➤ Previous experience (Samoa and Vanuatu) helped in improving performance; ➤ Improved response time compared to Samoa; ➤ Public criticism; ➤ Smooth, calm response due to familiarity; ➤ Action plans in place as a result of Samoa; ➤ Smoother implementation of preparation measures. |

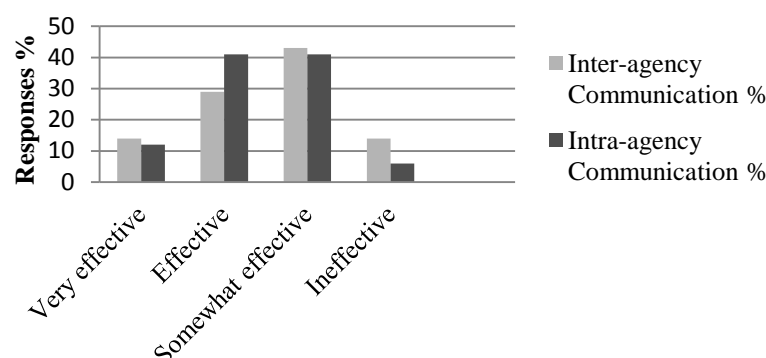
4.2.1 Theme 1: Communication

Implementation of vertical and lateral communication pathways should occur as part of the coordinated incident management system. This needed to be effective in their delivery to ensure all responders received the same information to affect an appropriate response for the level of threat. Several methods used to communicate between organisations and within the organisation included paging, telephone, radio-telephone, text messaging, face-to-face, fax, and email. With improved pathways for both inter- and intra- organisation communication, the dissemination of accurate information should have assisted in improved planning, response and coordination.

After issuing the tsunami warning in September 2009, communication did not appear to be adequate, whereby all responding organisations did not really know or understand what was happening or what to do. As this was a multi-organisation incident, consideration was given to both inter- and intra- organisation communication. Figure 2 shows a relatively even distribution of responses where communication was more effective within their own organisation than between organisations. The majority suggest that communication was very effective or effective within and between agencies (12% [2] and 41% [7] intra-agency and 14% [2] and 29% [4] inter-agency respectively) which could determine the effectiveness of the response itself following the issue of the September 2009 tsunami warning. This also suggested communication was better intra-agency than inter-agency.

Interviewees indicated issues with both inter- and intra- organisational communication which may support the findings from the surveys. Table 3 indicates that communication was somewhat effective with better communication within the organisation than between organisations.

Level of Effective Communication Inter- and Intra-agency in 2009



Answers in response to Q10 and 11: "Was communication between and within agencies effective during the tsunami warnings in 2009 and 2010?"

Figure 2: Summarised responses from survey participants indicating the level of effectiveness of communication between and within response organisations in 30th September, 2009 (Open-ended question allowing participants to explain their answers [Appendix 1, p. 123]).

Table 3: Summarised comments made by interviewees regarding inter- and intra- agency communication 30th September, 2009 (This covered 2 sections of the questionnaire and information was taken from both these sections covering several questions) (Appendix 2).

| Answers to Section 1, Q1 – 8; Section 5, Q41 – Q52: Inter-organisational communication | Answers to Section 1, Q1 – 8; Section 5, Q41 – 52: Intra-organisational communication |
|--|--|
| <ul style="list-style-type: none"> ➤ Problems with the issue of the message ➤ Adverse publicity ➤ Not accurate ➤ Passed on information to other organisations ➤ Local police did not receive notifications ➤ Expect more useful information from CDEMG | <ul style="list-style-type: none"> ➤ Communicated with relevant communication/contact centre as part of SOP's ➤ Liaised with coordinator to verify information and whether the EOC will activate or not ➤ Used council website to update communities ➤ Liaised with communication centre to advise them of what actions needed to be done by them, and they know what we were doing at a local level ➤ Held teleconference after the stand-down between responding brigades and communications centre for a debrief |

There appeared to be notable differences between the 2009 and 2010 tsunami warnings issued and the effectiveness of communication between and within organisations. Figure 3 indicates notable differences in communication between and within organisations following the issue of the February 2010 tsunami warning. There appears to be a higher distribution for more effective intra-organisation communication than there was in September 2009. There also appears to be some improvement from “effective” to “very effective” in 2010 for both inter- and intra- agency communication (17% [3] and 50% [9] respectively). Table 4 also indicates improvements in communication between and within organisations for the 2010 tsunami warning with fewer negative comments made.

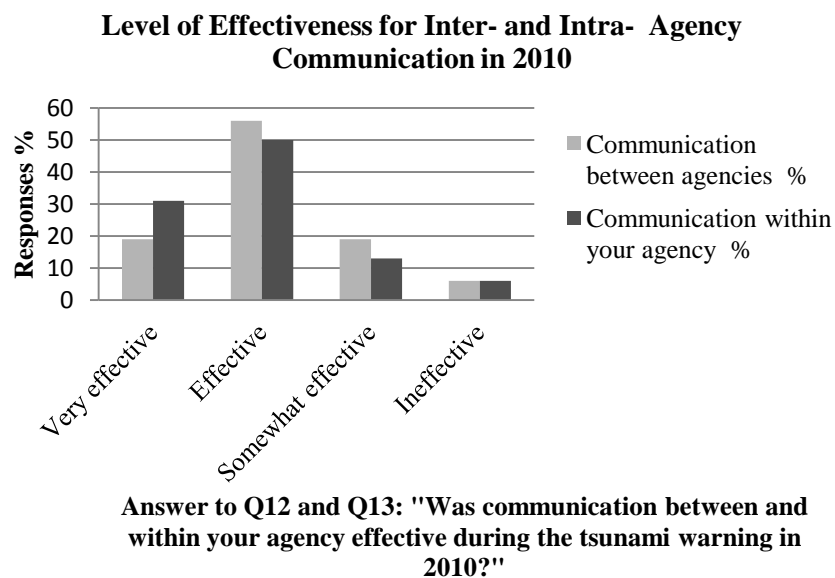


Figure 3: Summary of survey participant responses to the level of effectiveness for communication between and within organisations 28th February, 2010.

Table 4: Summarised responses by interviewees to inter- and intra-organisational communication for the tsunami warning issued on the 28th February 2010.

| Answers to Section 1, Q1 – 8; Section 5, Q41 – Q52: Inter-organisational communication (Refer Appendix 2) | Answers to Section 1, Q1 – 8; Section 5, Q41 – 52: Intra-organisational communication (Refer Appendix 2) |
|--|--|
| <ul style="list-style-type: none"> ➤ Information disseminated in a timely manner ➤ Stand down issued in timely manner ➤ Down-grade better ➤ Provision of information that can be applied locally ➤ Once we received information we were able to pass it on to other organisations assisting in the EOC ➤ Warnings were out in the way we expected to see them ➤ Did not know if warnings had gone out to ships at sea ➤ Conflicting information from National Warning System and CDEM Group being passed on, lack of leadership and understanding of local procedures. | <ul style="list-style-type: none"> ➤ Once warning issued, response was good ➤ Warning issued in a timely manner ➤ Provided me with an indication of whether evacuations were necessary and provided information to communications of our intentions so they knew what we were doing ➤ Information was more uniform ➤ Unable to update council website due to backups being done ➤ Utilised uniformed staff to liaise and advise beach-goers of the risk and to evacuate ➤ Although 3 hours delay in getting initial warning out, had plenty of time to evacuate if necessary ➤ Horizontal communication was inadequate |

4.2.2 Theme 2: Response

Issuance of the warning to organisations initiated a response allowing organisations to identify which, if any, coastal area within their region was at risk of inundation by potential tsunami surges. For some communities a response of some level was necessary for both warnings in 2009 and 2010, particularly along the East Coast of New Zealand. This section is attempting to identify any issues that may have arose in 2009 with organisational response and if any improvements had been made before the 2010 warning.

Figure 4 shows differing levels of effectiveness for organisational response in 2009. This suggested communication of the tsunami warnings was effective to some degree to allow organisations to initiate

a response. Issues relating to the 2009 tsunami warning that resulted in a less than effective response (29% [5]), and 71% [12] also included interviewee responses: “level of urgency required for the threat level”; “confusion at national level regarding local plans and procedures”; “uncoordinated and poorly led”; “misunderstanding of the tsunami plans”; “technological issues with paging groups not being set up correctly”; and “widespread confusion over knowledge of procedures”.

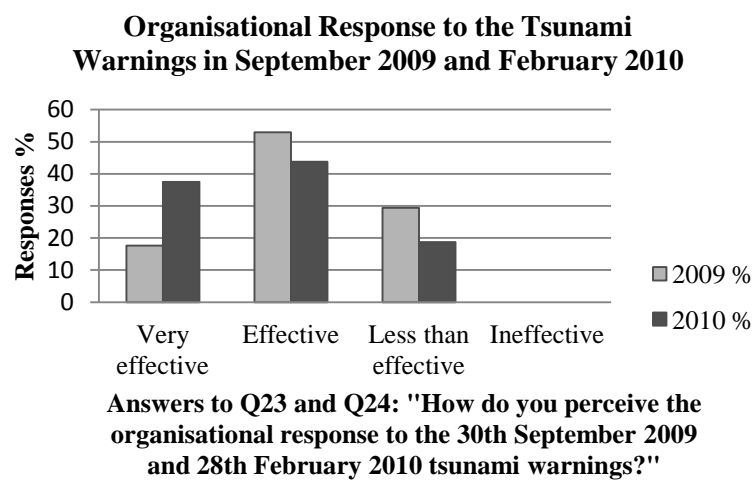


Figure 4: Survey participant feedback to organisational response to the tsunami warnings in September 2009 and February 2010.

Respondents who believed the response was effective (53% [9]) suggested there was “room for improvement relating to the activation of public information management (PIM), welfare roles and staff availability”; “appropriate response for the level of threat”; “no issues”; “followed procedures”; “timely notification, senior officer notification and liaison, region/area coordination”; “operations between communication centres and coastline communities was effective”.

Those who considered their organisational response to be very effective (18%, [3]) indicated their procedures “worked like clockwork”, or they

made no comment. Table 5 shows comments made by interviewees indicating problems in 2009, with the response still being managed to some degree although it was not as seamless as it should be.

Although there were concerns surrounding the response during the 2009 tsunami warning, there appeared to be some improvements in 2010. Figure 4 points toward improvements with fewer respondents (19% [3]) suggesting the response in 2010 was less than effective; 44% [7] suggested it was effective and 38% [6] indicated it was very effective. Respondents who indicated the response was less than effective did identify some improvement with one respondent commenting on “improved coordination but improvement was still needed”.

Others indicated no resolution had occurred since the 2009 warning and included “misunderstanding of tsunami plans”; “paging groups still not set up correctly”; “widespread confusion over knowledge of procedures”. Although there were fewer respondents suggesting the response was effective, more considered the response to be very effective in 2010. The comments made by these respondents included, “all relevant personnel informed and responded or placed on stand-by”; “better understanding at national level of need for local decisions, plans, etc”; and “worked like clockwork”.

Table 5: Summarised responses from interviewees to organisational response following the September 2009 and February 2010 tsunami warnings.

| Answers to Q25: “Was there ample time to respond to effect a successful evacuation?”; Q30(b): “Did the response work as planned?” in 2009 | Answers to Q25: “Was there ample time to respond to effect a successful evacuation?”; Q30(b): “Did the response work as planned?” in 2010 |
|---|--|
| <ul style="list-style-type: none"> ➤ Media oversensationalised the response making it more difficult for responders ➤ Response went as planned, with some hiccups ➤ Key element to the response was being able to determine the wave height and whether they posed a threat to the public ➤ Uncertainty over the 3 hour time frame to effect a successful evacuation ➤ Local police did not respond as they were unaware of the situation ➤ Accurate information is necessary to initiate an appropriate response ➤ Able to provide safety advice to beach-goers ➤ Needed representatives to respond to the EOC, i.e. police and fire executive staff when the warning was issued. ➤ Response worked as planned ➤ Not a lot of, if any, infrastructure affected by the so prioritised workload accordingly and still able to work as business as usual. | <ul style="list-style-type: none"> ➤ Effective and well coordinated ➤ Previous tsunami warnings (Samoa and Vanuatu) had improved our performance ➤ Response was quite smooth ➤ Response time was shorter, smoother and more effective ➤ Response was in accordance with response plans ➤ Able to advise response organisations of their roles and responsibilities from the EOC ➤ Effective response allowed communities to be informed using different methods of communication ➤ Went a lot more smoothly, calm and relaxed due to familiarity and improved plans ➤ Smoother implementation of preparation measures ➤ Ample time from notification to effect evacuations if needed ➤ Longer time frames to effect evacuations if needed than for the Samoan tsunami warning in 2009 |

4.2.3 Theme 3: Coordination

During any multi-organisation incident, whether it is on a national or local scale, requires coordination of resources. Each organisation has a role and responsibility within this diverse group, which may differ from their business as usual workload. The common outcome in a multi-organisation, coordinated incident is protection of life, property and the environment in the public safety arena.

Coordination requires cooperation and structure within and between organisations. In New Zealand, the adoption of the coordinated incident management system (CIMS, see Chapters 1 and 2) occurred

to enable organisations to plan, communicate and respond as a unified group to multi-organisation incidents. All participants (100%) understood and utilised CIMS. As CIMS is the method used for multi-organisation incidents in New Zealand to aid coordination of resources; it is important to identify if any participant understood the role of CIMS for these incidents.

Furthermore, it was necessary to identify participants who utilised CIMS during these incidents if they understood CIMS in its entirety. The participants then had an opportunity to explain what they believe to be CIMS and how it worked for multi-organisation incidents. Figure 5 indicates that 81% [17] of participants utilised CIMS for the 2009 tsunami warning and 80% [16] in 2010. The remaining 19% [4] and 20% [4] respectively, did not use CIMS or did not believe CIMS was being utilised as it should have been. For these warnings, multi-organisation responses required some coordination of the resources resulting in CIMS being utilised to some degree.

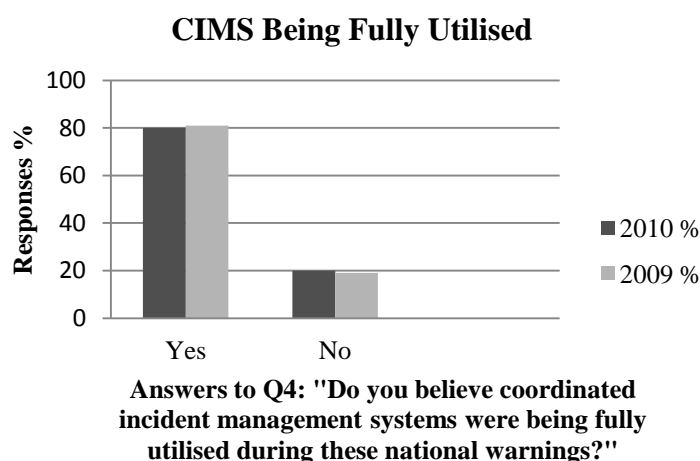


Figure 5: All respondents indicating whether full utilisation of CIMS was implemented for the two tsunami warnings in 2009 and 2010.

In addition, when participants explained their understanding of CIMS, the responses provided a level of doubt as to whether they actually do understand CIMS in its entirety. Table 6 shows that some respondents

do not fully understand CIMS. Understanding CIMS is an important aspect to have an effective coordinated response in either a single or multi-organisation incident.

One interviewee indicated that although CIMS was utilised, it was not necessary to implement full CIMS structure due to the level of threat, indicating logistics was not required for these incidents as part of the CIMS structure as evacuations did not take place for that region.

Table 6: Responses provided by all participants indicating understanding of CIMS. (Open-ended question asking participants to explain their understanding of CIMS [Appendices 1 and 2]).

| <p>Answers from interviews Q30: “Was coordinated incident management procedures implemented?” and Q31a: “If not, why not?” (Discussed what they believed CIMS was from these questions. Answers from survey Q5: “Do you know what coordinated incident management systems involve?” and Q5(a): “If yes, explain your understanding of coordinated incident management”; Q5(b): “If not, why not (id training, infrequent multi-agency incidents)?</p> |
|--|
| <ul style="list-style-type: none"> ➤ A lead organisation directs the course of the incident making requests from response organisations to conduct their roles at the incident ground, reporting back to their communications centre who pass on information to the lead organisation. ➤ All organisations working together. ➤ Full vertical and horizontal management across all organisations. ➤ Following standard operating procedures, notifying the appropriate authorities and ensuring public safety. ➤ Control down through own organisation and coordination across multiple organisations. ➤ When an incident happens, a managed system is in place ready to react. ➤ MCDEM. ➤ MCDEM and firecomm were effective command points managing the incident. ➤ It’s a multi-organisation – seamless process that creates structure to bring it together as one. ➤ Coordinated incident management. ➤ At council level, mobilising local civil defence and rural fire resources. ➤ As per CIMS Blue Book – Incident/Event management system with clearly defined roles and reporting lines; modular in concept. ➤ Can be single organisation or multi-organisation collaboration and coordination of joint resources. ➤ Where different organisations/groups work together in an effective way. ➤ A system to ensure multiple organisations responding to an event do so in the best possible way. ➤ A systematic action plan having allocated post where singular or multi-organisation collaboration occurs. ➤ The coordinated response and management of emergency services/organisations to emergency incidents. ➤ CIMS implemented, structure and action plan put in place. |

4.2.4 Theme 4: Planning

Planning is essential for effective emergency management. Planning alone requires input from multiple sources not just from the emergency services. It requires input from planners, government officials, scientists, emergency services, health authorities, utility services and communities.

For the purposes of this research, discussion of planning, or a lack of it, from the responding organisations point of view may assist in identifying any issues that may, or may not, have influenced the response and coordination of these warnings. It is necessary to be able to communicate, using common terminology, when planning and plans need to be adaptable to all-hazard incidents.

Furthermore, communication needs to flow in a coordinated fashion to reduce the likelihood of confusion between and within organisations. Response organisations also need to be aware of each other's roles and responsibilities within the multi-organisation, or coordinated incident management system, to reduce the likelihood of confusion. Figure 6 indicates planning issues were present in 2009 (77% [10]) and only a fraction less in 2010 (64% [39]) suggesting some improvements had occurred. Planning is important for multi-organisation incidents to reduce the likelihood of confusion and inappropriate responses.

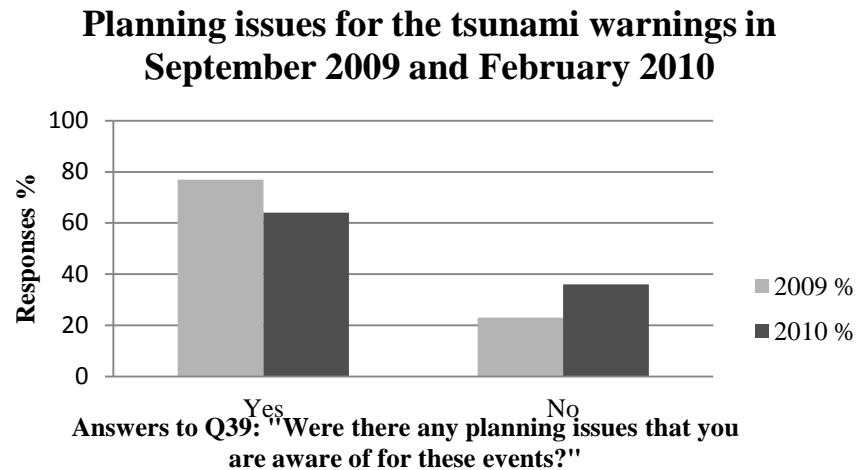


Figure 6: Survey participants indicated planning issues were present for the tsunami warnings in September 2009 and February 2010.

All participants were asked to explain what issues, if any, they had with the planning for both warnings. In 2009 some participants (23% [3]) (fig. 6) did not have any issues with planning. In 2010 there appears to be a marginal increase in participants (36% [5]) (fig. 6) not experiencing any planning issues - some of which had no issues in 2009 and others had improved plans since the 2009 tsunami warning.

Table 7 provides some insight into the problems experienced by the participants whereby some doubt can be eliminated with effective planning prior to similar events occurring. These comments highlight the need to plan for adequate evacuation locations, training needs analysis to identify and plan for appropriate training of staff, improvements to SOP's, impact and inundation modelling for various scenarios, and coordinated incident management planning for improved inter-organisation communication and response.

Table 7: Summarised responses* from interviewees indicating planning issues were identified for both tsunami warnings in 2009 and 2010.

| Answers to Q61: “ Were there any planning issues that you are aware of for both the 2009 and 2010 tsunami warnings?” and Q61(a): If yes, explain what these issues are?” (2009) | Answers to Q61: “ Were there any planning issues that you are aware of for both the 2009 and 2010 tsunami warnings?” and Q61(a): If yes, explain what these issues are?” (2010) |
|--|---|
| <ul style="list-style-type: none"> ➤ Internal activation procedure poor, national emergency and tsunami pager groups don't work. ➤ Excellent response time in generating national warning. ➤ Widespread misunderstanding of what is required of fire brigades. Self mobilisation of crews caused confusion and made managing the situation difficult. ➤ Widespread confusion over knowledge of procedures ➤ Each agency appeared to do their own thing in areas requested to evacuate. Communication centres did not really have any idea what was happening at the local level. ➤ Don't know if local crews had adequate time to evacuate as this was not communicated to the communications centre. ➤ Everyone needs to receive the same information at the same time to prevent confusion and frustration. Need to be more proactive to prevent complacency in future events. ➤ To be more coordinated, use CIMS more effectively. Communication centres responsible for local brigades to respond were very much kept out of the loop. ➤ No information was passed on from local crews except Tokomaru Bay crews, to allow communications to maintain BAU. ➤ Getting information from external sources than from our own agency. ➤ The lack of common terminology between the organisations caused confusion. ➤ Lack of understanding of the tsunami plans. ➤ Needed someone to be available when asked for, i.e. fire and police commanding officers. ➤ Would not be able to work as business as usual if we evacuated. | <ul style="list-style-type: none"> ➤ Slow response to activate national warning. Poor decision in waiting for morning. ➤ Nothing was done overnight when public could have been alerted during prime time viewing. ➤ SOP pages updated after event to make process easier. ➤ Our designated secondary location is sh*t. ➤ Lack of impact modelling. ➤ Timing of evacuations still needs more work and practice. ➤ Not all towns are working effectively; better CD coordination and people needed. ➤ Well practiced and known by all organisations. ➤ Lack of relevant information to enable accurate prediction of impact. ➤ Wasn't aware of details for deployment prior to the warning in 2010. ➤ CIMS needs to be readdressed to include communication centres in the planning process so they are aware of their roles and responsibilities during these events. ➤ No real post impact planning. ➤ More activation and response training needed. ➤ Need future training or multi-organisation exercises to improve response to future tsunami warnings, particularly evacuation and impacts. ➤ Need improved planning assistance from other response agencies. ➤ The lack of information can waste important time for planning. ➤ Appears to be a lack of succession planning with other agencies. ➤ Don't get much practice in receiving and disseminating warnings, there are regular unplanned national event warning system tests, but they are only sent out once. The real event information was gold - the more |

| | |
|--|--|
| <ul style="list-style-type: none"> ➤ Inundation mapping needs to be better matched with MCDEM. ➤ Uncertainty due to a lack of planning. ➤ Need future training or multi-organisation exercises to improve response to future tsunami warnings, particularly evacuation and impacts. ➤ SOP's not fully developed or tested. ➤ No real post impact planning. ➤ Needed someone to be available when asked for, i.e. fire and police commanding officers. ➤ In 2009, ensuring all times described appropriately (GMT; NZDLST). ➤ Not all towns are working effectively; better CD coordination and people needed. ➤ Our designated secondary location is sh*t. ➤ Lack of impact modelling. ➤ Timing of evacuations still needs more work and practice. ➤ The lack of information can waste important time for planning. ➤ Need future training or multi-organisation exercises to improve response to future tsunami warnings, particularly evacuation and impacts. | <ul style="list-style-type: none"> information allows you to plan. ➤ No planning issues but training issues - multi-organisation CIMS training. ➤ Planning needed to be established further. ➤ Inundation mapping needs to be better matched with MCDEM. ➤ Needed someone to be available when asked for, i.e. fire and police commanding officers. ➤ Would not be able to work as business as usual if we evacuated. ➤ Identified potential safe areas from inundation but these areas could be isolated from medical and other lifeline utilities if inundation occurred. |
|--|--|

** Names of organisations have been removed and replaced with agency, agencies, crews or response crews where necessary to maintain participant anonymity.*

Although planning issues were directed at response, training, evacuation and impact, one respondent indicated planning needed to include the role of the communication centres for the emergency services. All respondents were asked to indicate what they thought the roles and responsibilities were for the EOC that would indicate the direction required for some of the planning issues. Figure 7 shows that the majority of respondents (96% [22]) recognised the EOC as a place to coordinate resources, 87% [20] suggested liaison with responding agencies and gather information; 74% [17] believe the EOC is responsible for providing information to the public; 91% [21] indicated liaison with emergency services should occur here with 87% [20] suggesting the EOC requests responses from the emergency

services and 65% [15] believed the EOC mobilise the emergency services.

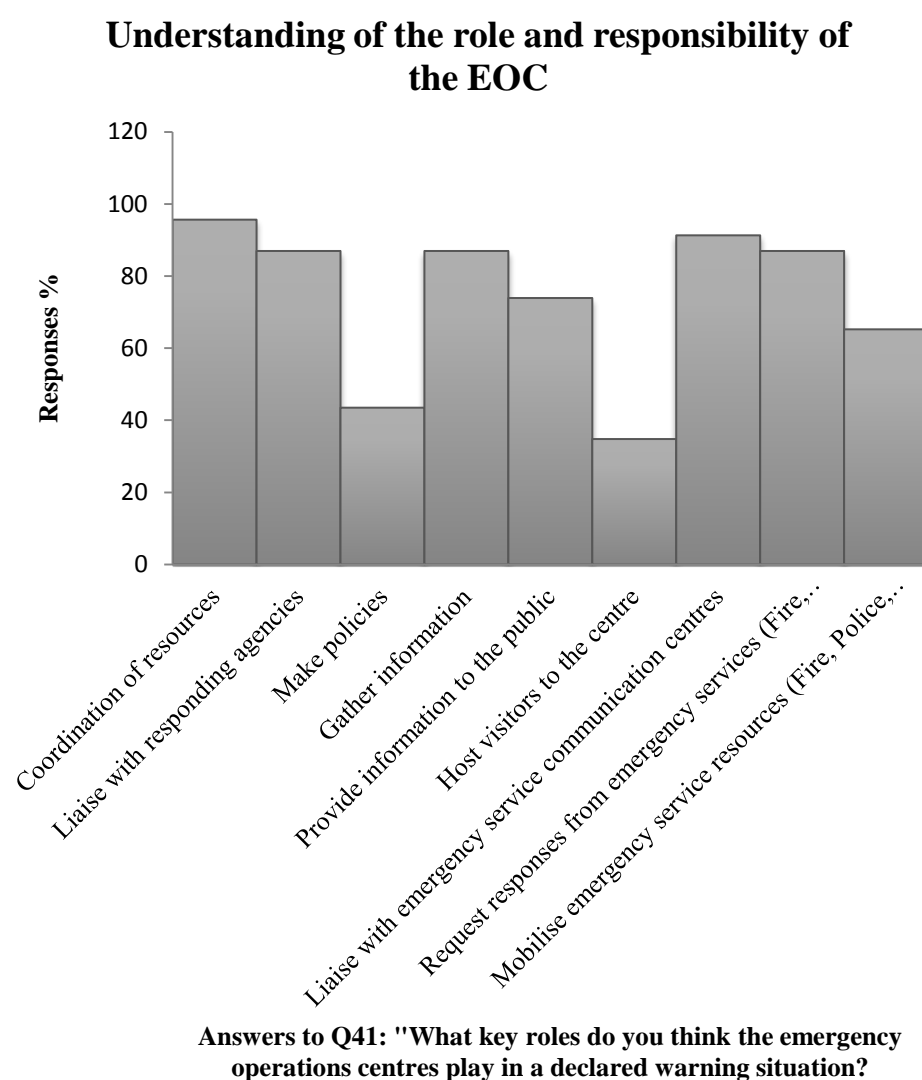


Figure 7: Responses by all participants indicating what the roles and responsibilities of the EOC.

When respondents were also asked what they believed the role of the primary emergency services communication centres was. Figure 8 shows 60% [12] believed it was their responsibility to mobilise staff and resources as business as usual events, with 40% [8] indicating they should be able to advise staff in their jurisdiction of what they need to do.

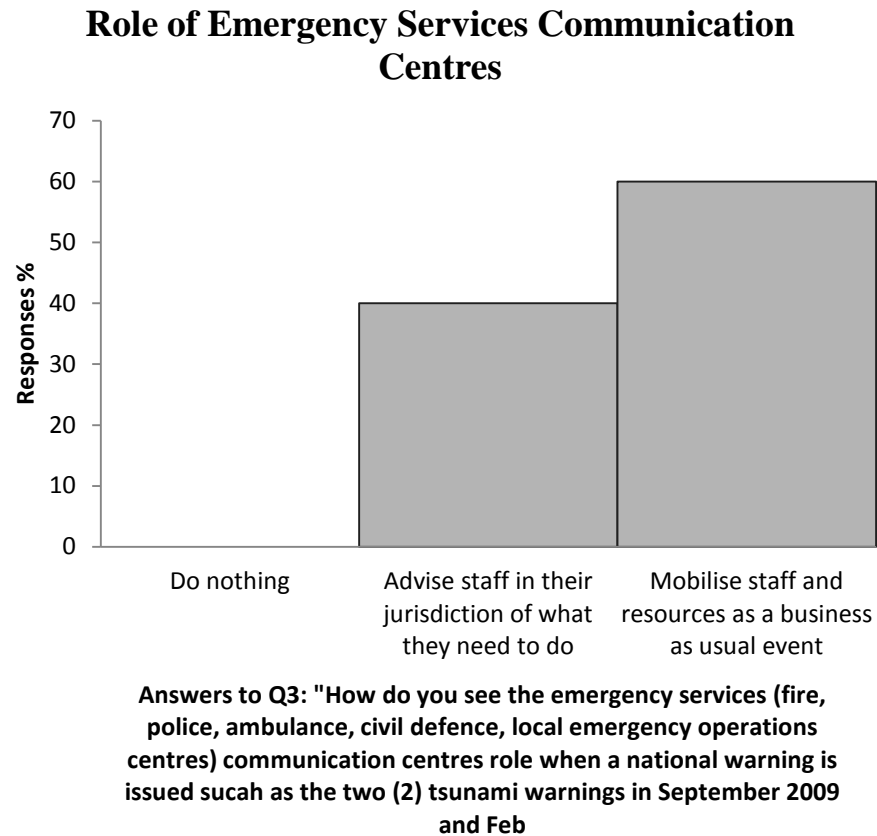


Figure 8: Overall indication of the role of the emergency services communication centres given by all participants.

4.3 Summary

Although participants acknowledged the tsunami warnings are a good exercise, most also believed it was a good reminder of the vulnerability of New Zealand tsunami events and organisations should know their procedures. These procedures require communication to occur within and between organisations. Although there appeared to be problems in 2009, some of them were resolved before the 2010 tsunami warning. However, most participants in both the interviews and surveys did indicate communication was not the only problem that arose, but that there were also problems with response, coordination and planning. Furthermore, there appears to be conflict between roles and responsibilities when it comes to responding emergency services to incidents, particularly between the emergency services communication centres, the EOC and some local services who self-responded.

Although communication is necessary for all aspects of emergency management and planning, those who respond also need to communicate within and between their organisations. Coordinated Incident Management Systems used for multi-organisational incidents requires communication within and between organisations to enable holistic planning and the determination of common terminology to be used, and responses required. The development of CIMS for multi-organisational incidents does mean planning and planning requires communication whereby all response agencies can discuss response strategies that can be used in the event of large-scale, multi-organisational incidents. These issues will be discussed further in chapter 5.

Chapter 5

5.0 Discussion

5.1 Introduction

This chapter discusses communication, response, coordination, and planning for the tsunami warnings issued in September 2009 and February 2010. There were significant issues that led to a lack of multi-agency planning and readiness, response and coordination, particularly in 2009 with some improvements in 2010. Response, coordination, and planning for emergencies can be challenging. It involves consideration of risk factors, timing, level of urgency, resources available, impacts and damage disrupting infrastructure support that is necessary for response and coordination. Attention will be given to the effects of communication on response, coordination and planning prior to, during and post tsunami warnings, with consideration to some, if not all, the ten factors outlined by Abkowitz (2008) and the four areas outlined by Eyerman and Strom (2008).

It is, therefore, necessary to consider factors such as inter-agency dependencies, multi-agency authority and personnel involvement; high demand for timely information and the ability for primary emergency services to maintain operational readiness for business as usual incidents when planning for multi-agency response and coordination. All of this requires effective lateral and vertical communication inter- and intra- agency.

5.2 Communication

Communication is defined as the exchange of information between people by means of speaking, writing, or using a common system of signs or behaviour and symbolic means (Federal Emergency Management Agency, 2010). In addition, the exchange of information also depends on technology and can include, but not limited to, telephones, pagers, email, fax, internet and warning systems such as

sirens and public announcement systems on emergency service vehicles. Natural signs can also be a form of symbolic communication with ancestral knowledge passed on to their descendents (Becker, Johnston, Lazrus, Crawford, and Nelson, 2008). Figure 9 shows natural communication of tsunami activity: the sea receding from shore, and visible discolouration caused by current disturbances.



Figure 9: Sea receding from the shoreline with visible discolouration caused by tsunami wave action in Gisborne, February 2010 (photo taken by Nicky Moreland).

There were some concerns identified in the effectiveness of communication particularly inter-agency communication in 2009 and 2010 (figs. 2 and 3; Tables 3 and 4). However, intra-agency communication was not immune to problems, although respondents indicated it was better than inter-agency. These results could indicate staff familiarity with intra-agency communication pathways influencing its' effectiveness. The lack of knowledge of other agencies communication procedures could hinder communication between agencies. This includes issues of terminology and technology used. It could have also indicated a lack of understanding of the roles and responsibilities of other organisations when the national warnings were declared (figs. 7 and 8). This failure in communication did not fail on its own, but rather influenced by several factors outlined and included

design and construction flaws, lack of planning and preparedness, and communication failure (Abkowitz; Eyerman et al.).

For communication to be effective, vertical and lateral communication pathways (design and construction), or networking, needed implementing with accurate dissemination of information (communication) to other response agencies in order for these agencies to make appropriate decisions (planning and preparedness) for the level of threat (Auf de Heide; Miskel; Becker, et al., 2007; Abkowitz; Eyerman et al.). Examining the levels of effectiveness for inter- and intra- agency communication and the reasons provided to gain understanding of respondents either being satisfied with communication processes or not can assist in identifying any issues that may have occurred in the vertical and lateral communication pathways for both warnings.

5.2.1 Inter-agency Communication

In 2009, 14% of survey respondents indicated that inter-agency communication was ineffective and 43% suggested it was somewhat effective (fig. 2). Communication appeared to be an issue for a number of agencies with suggestions that it could have been better and improvements needed (Table 3). However, this was the first real use of the national warning system for a tsunami event that had the potential to affect coastal communities of New Zealand. It could be considered by Abkowitz as inadequate training and a lack of planning and preparedness as part of the 10 factors that could lead to failure. One respondent indicated communication issues arose from the lack of leadership and understanding at regional and national level for local procedures in 2009 (Table 4).

Abkowitz indicated arrogance as a possible reason for failure. The lack of understanding of local procedures from regional and national government bodies could be, in part, due to arrogance. For effective and successful outcomes from any potential or actual disaster situations,

arrogance needs to be eliminated and regional and national government agencies need to have some understanding of local procedures and their capabilities. The United States Government (2006) raised a similar issue, whereby they discovered tendencies to recognise the quality of leadership as being in control and coordinated even though this was not the case. This shows a certain level of arrogance of being in control and coordinated, when, in fact, the opposite was true.

One respondent indicated more autonomy be allowed for appropriate responses to be effective. In addition, autonomy may result in effective responses locally; communication still has to be effective to instigate a response in the first place from the source (i.e. MCDEM). However, there are associated problems by allowing too much autonomy for local areas. These include self-response from organisations such as local response crews (Table 7).

This caused problems with the ability of communication centres not knowing where their resources were in the event of conducting business as usual. In addition to not knowing where resources were or what they were doing, can also jeopardise the safety of local crews as it will not be known if they are up-to-date with incident information they are self-responding too. In addition, the members of the community may see dysfunctional organisations, where they may be told differing information from the self-responders, to what they may be hearing through the media.

Interviews conducted, indicated that the information being passed on through the vertical communication pathway from MCDEM to CDEMG had been altered making it less accurate when it reached local CDEMs' during both the 2009 and 2010 tsunami warnings (Table 2). Miskel suggested vertical failure could be due to hardware and technological incompatibility between agencies (Paton, 1994; Basher, 2008). However, from the data collected, it would appear hardware and technological incompatibility were not entirely the issues in these cases, but the result of human intervention, and possibly not fully

understanding the implications of his or her actions (Tables 2 and 3). This could indicate there is too much autonomy at regional level, where many may not fully understand or know local hazards or their procedures, or believe they can adjust information issued by scientists believing this to be more accurate before passing it on to local areas.

The altered dissemination of information resulted in CDEMs' bypassing CDEMGs' and receiving information directly from MCDEM. The suggestion of inter-agency variations for communication by Auf de Heide may be apparent with one group (i.e. CDEMG) altering information before passing it onto another (i.e. CDEM). Consequently, failure to provide accurate, readily available information to emergency managers at local level and disaster responders alike occurred. This can also be attributed to Abkowitz factor of not following procedures and communication failure that had the potential to cause a failure within the emergency management system at local level for these warnings.

Altering information effectively hindered the response at local level resulting in local CDEMs' seeking information from MCDEM to ensure accuracy. The information supplied to by some respondents could not be verified by CDEMGs' for some areas as they declined to participate in either the interview or survey. However, with 3 respondents indicated dissatisfied with the altered information from CDEMGs' there is reasonable cause for vertical processes to be revisited with inter-agency discussions verifying what information should be disseminated for effective responses for future incidents. This can be aligned to Abkowitz factor of a lack of planning and preparedness where the information has been altered without prior planning and preparedness involving the recipients of the information. If the information was not meant to be altered, then the factor of not following procedures needs to be considered.

Gaps in communication between organisations were also apparent. Some (60%) participants indicated the police were not aware of the

situation or what plans had been implemented by the local EOC for their particular regions. Other interviewees (40%) indicated police were completely unaware of the situation for both warnings (Tables 3 and 5). In 2010, some (40%) found it difficult to contact a senior police officer so the police could have representation in the local EOC (Table 5). The researcher was unable to verify information from the police due to their Police Research and Evaluation Committee declining access to police staff.

One interviewee responded to the lack of police presence in the EOC by taking the information to the local police station to enable staff to keep up with the events as they unfolded. Whilst this may have been the best option under the circumstances, anything could have changed whilst that person was out of the EOC which may have resulted in disruptions to the response and the ability to coordinate effectively.

Abkowitz indicated that failures in the disaster arena can be attributed to schedule constraints, not following procedures and a lack of planning and preparedness. It would appear the response to both tsunami warnings could easily fit into several categories outlined by Abkowitz from the point of view the police were unavailable could be due to schedule constraints as they were attending to business as usual incidents. Their inability to be available resulted in an EOC staff member adjusting to the situation which was unplanned for. The first tsunami warning that was issued in September 2009 also indicated time constraints for coastal communities requiring evacuation (wave arrival between 3 – 4 hours). Any evacuations would require police involvement to ensure evacuation routes remained patent and traffic controlled; without it, chaos could occur. What's more, evacuation routes and traffic control measures had not been planned for in their entirety and were still work in progress for some areas.

Other gaps identified were in the standard operating procedures established by MCDEM for the NZFS as a MCDEM agent. The standard operating procedures are a written form of communication

for others to follow and adhere to. However, the 2009 tsunami warning identified a flaw in the SOP's whereby the MCDEM believed NZFS would notify them immediately of the tsunami warning issued by PTWC. However, this did not occur resulting in a delay in getting a national warning out. This was resolved by 2010.

By the time the issuance of the February 2010 warning, some of the problems incurred in 2009 had been resolved. Although Auf de Heide suggested previous research indicated the same mistakes made from one disaster to another, attempts to remedy issues as they arose occurred to some degree. However, when considering comments from all aspects of the emergency response system, some methods of communication were not successful; nor were they remedied. One participant suggesting paging groups were not set up properly for the September 2009 tsunami warning; nor were the problems fixed by the time the February 2010 warning was issued.

With the failure in one method to notify multiple organisations and communicate with them about impending hazards, it is important to be able to consider the use of multiple systems. This is no different when considering what system would be the best to notify the members of a community. The failure in the email system, the national warning system albeit brief, and difficulties with paging, means that more than one system was required to effectively get the warning out. The design of the templates caused email failures due to the size of the files and the large number of email recipients being sent the file (Table 2). Again, Abkowitz suggested design and construction flaws as a reason for failure to occur, and template design could be considered under this heading. However, the template design had been remedied prior to the February 2010 warning, which did work well.

Leonard, Saunders and Johnston (2007) also endorse the use of multiple systems indicating more than one system is necessary as it provides for failures and allows for preparation and response to occur.

Respondents also indicated they rely on more than one system to receive warning notification and to disseminate warnings to their respective communities. The use of many systems requires significant planning and political input to finance such systems. Due to the economic climate and infrequency of events, these systems may be deemed a low priority, falling under the categories of economic pressures and stifling political agendas (Abkowitz).

Additionally, terminology used in the disaster arena needs to be common and understood amongst all response organisations. In 2009, it was apparent that terminology did pose some challenges resulting in confusion. The Ministry of Civil Defence Emergency Management acknowledged the confusion caused by the stand-down / cancellation issued when in fact the warning had been down-graded to an advisory (Table 2). The New Zealand Fire Service used colour coding for its alerting system using colours: green, amber and red (Table 2; Appendices 5 and 6). This also caused some confusion amongst EOC staff and other response organisations (Table 3). These terminology issues were resolved by the time issuance of the February 2010 tsunami warning was issued (Table 4),

The use of common terminology requires communication, planning and cooperation amongst agencies that will be using it. According to Paton, Johnston and Houghton (1998) inter-organisational differences in terminology make any interactions difficult. However, it is important that inter-agency communication occurs during planning enabling common terminology to be discussed and agreed to. This is even more important if one organisation takes the lead and exercises authority over the operations of other agencies. All those involved need to understand what is being said.

Failure to communicate and plan regarding common terminology to be used inter-agency can result in failed responses and coordination efforts (Abkowitz; Eyerman et al.). As McEntire (2002) showed, the representative in the EOC during a tornado at Fort Worth in the

United States, has a role to play during inter- and intra- agency communication. In this case the dispatch centre for the fire department, the EOC and the fire department were able to work within and across organisations enabling them to meet the demands generated by the situation. For the response to be successful, everyone involved would have to be familiar with the terminology used as part of multi-agency incident management.

5.2.2 Intra-agency Communication

Whilst inter-agency communication indicated the presence of problems, intra-agency communication was not immune. However, intra-agency communication appeared to be more effective in 2009 with improvements noticed in 2010. Over 50% of respondents indicated that communication was effective, or better, in 2009 and 2010 (figs. 2 & 3, Tables 3 & 4) as the pathways were easier to follow due to their standard operating procedures. This indicates that familiarity with operating procedures as a form of communication vastly assists with communication processes.

Familiarity occurs with constant usage of SOP's and training for emergencies. This, in turn, should improve intra-agency response and coordination. According to McEntire (2002), familiarity of intra- and inter- agency roles through training and regular exercising assisted in coordination of responses. Although this may be the case, communication is necessary for agencies to know what occurs within and between agencies for multi-agency responses. The failure to communicate between those responding and those in the EOC and/or dispatch centres could, unwittingly, send responders into high risk environments unnecessarily (McEntire).

The differences between business as usual response for the emergency response teams and response to the tsunami warnings is quite complex, even though it may appear to be. Firstly, each individual organisation requires a capability to respond to business as usual events as these do

not stop in the face of a national warning and pending adversity. Secondly, well-trained organisations are equipped to deal with everyday, business as usual incidents without any indication of chaos. Both vertical and lateral communication can work successfully within the organisation hence the reason why many probably believed it to be effective in both 2009 and 2010 (Tables 3 and 4). Where this may be sufficient to meet the needs of a single agency, it may not be appropriate for multi-agency responses.

According to Kuban, MacKenzie-Carey and Gagnon (2001) a failure to achieve cooperation and coordination of activities can result in a breakdown of communications. Furthermore Kuban et al. also indicated this failure affects the allocation of resources, disjointed operational tasking and the inability by any single organisation to effectively meet its response objective. This is where Auf de Heide could be referring to coordination issues concealing communication issues.

Furthermore, the lack of complete understanding of the roles and responsibilities of the emergency services communication centres is still apparent following survey results with 11% (fig. 3) of surveys returned indicated communication within the organisation was not or was somewhat effective. There appeared to be a failure to advise the communications centres of which crews assisted, and the location crews were assisting with evacuations and/or road closures. This could result in a somewhat disjointed response (Kuban et al.). Some organisations self-reported and some EOCs' responded crews without advising the appropriate communication centres of who was doing what and where. This reflects the discourse of Kuban et al. when communication fails, single organisations lack the ability to meet response objectives effectively.

Failing to factor in emergency services communication centres in the coordinated incident management system (Abkowitz' design and construction flaw) for multi-agency response effectively reduces their

ability to maintain a level of cover for each area likely to be affected by the tsunami warnings that were issued (Abkowitz' lack of planning and preparedness) resulting in communication failure between these communication centres, EOC's and local crews assisting in the response.

If evacuations were to take place, and they did in some regions, discussions at the EOC could evaluate the methods they would use to effect these evacuations (Kuban et al.). All this required scientific input, monitoring, and above all, effective communication, both laterally and vertically. Serra, Tabara and Chabay (2011) indicate the importance of vertical and lateral communication from the top down and vice versa with the inclusion of communities to effect successful communication of impending and occurring hazard events that may need or need immediate action from local groups and communities. Information needed to be accurate, unambiguous and timely for the appropriate response to be undertaken (Table 6) (McEntire, 2002; Bharosa et al.). In 2009 and 2010, information supplied to CDEM's was altered and, in some cases, not accurate enough resorted in those receiving and using information directly from MCDEM.

Miskel indicated that failure in communication could be a lack of knowledge about how disaster relief systems work in their entirety. With response training, knowledge can be gained and there would be more understanding of disaster relief systems (Abkowitz; McEntire, 2002). The risk of business as usual incidents for organisations is usually calculated and predetermined turnouts established as a result. However, with the uncommonness and uncertainty of events, such as the tsunami warnings, could have had the potential to create an element of chaos within an organisation if important aspects of the response do not include the relevant communication centres (Kuban et al.; McEntire). These centres still have to be able to conduct business as usual in a timely manner. Without communicating with these centres

about who did what and where could have compromised the response to incidents that arose outside of the tsunami warning responses.

5.3 Response

Response defined as complete measures undertaken during and immediately after disaster impact to resolve, as soon as possible, time critical problems including, but not limited, to damage assessment, debris removal and search and rescue efforts, to address short-term, direct efforts of an incident involving actions to save lives, protect property, and meet basic human needs. It involves the ability to execute emergency response plans and mitigation activities to reduce the effects of disaster outcomes. Response activities governed by the situation, requires intelligence and other information to reduce the effects or consequences of an incident. This may involve increased security, ongoing investigations into the nature and source of a threat and so forth (Federal Emergency Management Agency, 2010; Bharosa, Lee and Janssen, 2009). The fire chief involved in the Fort Worth tornado was also able to monitor responses to ensure resources being used were not committed to one area alone, thus allowing resources to be directed to other regions as the circumstances changed (McEntire, 2002).

Both the 2009 and 2010 tsunami warnings required a response from all response agencies involved in emergency management. Some agencies considered the level of threat to be non-existent for their regions and no further response was required. Others activated their emergency operations centres and required senior staff from response agencies to attend, representing their organisation. This allowed discussions to take place as to what the threat meant and what resources would be required should the level of threat escalate to involve evacuations of coastal communities. The London Emergency Services Liaison Panel has preset levels of response: Gold, Silver and Bronze (Eyerman et al.). This can be likened to the response levels of New Zealand's own response agencies for differing levels of emergency: National

(MCDEM/NCMC), Regional (CDEMG's) and Local (CDEM). This should provide clear leadership and guidelines to the response.

Respondents who believed the response to be somewhat effective in 2009 (29%) (fig. 4) provided reasons that indicated flaws in the response system and included the lack of coordination, poor leadership, technological issues, confusion over operating procedures and confusion at national level regarding local plans and procedures (Table 5). In 2010, 19% of respondents believed the response to be less than effective citing similar issues that occurred in 2009 (fig. 4; Table 5). Auf de Heide and Miskel suggested that these recurring errors in disaster response can impact future response. Furthermore, Solomons (2007), suggests the lack of, or weak acquiescence with plans (i.e. CIMS), can result in some agencies initiating their own independent plans (i.e. self response; Table 7) due to incompetent leadership. This can result in confusion and impaired response and coordination. However, in 2010 participants indicated the response was more effective, allowing communities to be better informed.

In addition, even though these respondents believed the response to be less than effective, there was some improvement in the coordination of the response itself between 2009 and 2010 (Table 7). Those who believed the response was very effective increased from 18% in 2009 to 38% in 2010 (figs. 4 and 5). The differences included improved communication and personnel informed of the situation were either placed on standby or responded; improved coordination, previous experience (i.e. Samoa and Vanuatu, 2009). McEntire (2002) indicated several reasons for improved coordinated responses that include "...political support, preparedness measures, networking and cooperative relationships, technology and the nature and use of the emergency operations centre..." (p. 376).

Improved knowledge of local procedures at national level and local procedures improved response than that experienced in September 2009 (Table 5). This also indicated familiarisation can improve response as

procedures become better known for multi-agency incidents. Although Auf de Heide and Miskel suggested recurring errors happen from one disaster to another; improvements, even in small steps, can reduce problems with future response. McEntire (2002) and Eyerman and Strom (2008) reinforce response success being attributed to networking and cooperation using training exercises and the development of shared assistance agreements and providing comprehensive resource lists that can be employed in disasters. This level of agreement, networking and cooperation does not occur unless communication is fully utilised both vertically and horizontally.

5.3.1 Effects of Communication on Response

Response is somewhat affected by communication issues. This was highlighted in 2009 and 2010. Response delays in 2009 occurred when the national warning system became jammed. Other problems included technological issues; particularly the backing up of computer systems at the time the warning was issued did not allow EOC staff to check their emails (Table 2). Technological or equipment failures are not exclusive to these warnings. McEntire (2002) discovered failures in equipment causing challenges in communication processes and therefore information dissemination. Some technological issues were corrected before 2010 tsunami warning resulting in the national warning system working well. Also, having more than one system to receive the warning in February 2010 allowed EOC staff to respond appropriately. Miskel indicated the most important feature of any successful response is communication. While no catastrophes occurred during the tsunami warnings in 2009 and 2010, this was more likely due to good fortune rather than good emergency management as no significant waves arrived on-shore in New Zealand.

The failure of some CDEMGs' to respond to the warnings could be due to, as Basher (2008) suggested, a lack of understanding or a denial of the risks. Whatever the reason for the CDEMGs' not to activate their

EOCs' cannot be answered here, and will require further investigation beyond this thesis. However, it was noted that the failure of CDEMGs' to respond as expected by local CDEMs' did not go unnoticed. For the CDEMs' this non-response made non-constructive impressions on the CDEM staff. The expectation was for the CDEMGs' to respond and would be there to support the local CDEMs' providing accurate information in a timely manner. Challenges do occur during response phases of emergency situations, and being able to rely on one's support mechanisms (i.e. CDEMG) is essential to the response. These challenges need to be discussed and shared between the two groups.

However, Basher and McEntire (2002) acknowledge these challenges can be overcome if organisations communicate with each other horizontally and vertically. This allows everyone to use the same plans and procedures for disaster response. However, if policy makers and multi-organisational managers are not heeding the concerns of responders in the first instance, it implies vertical communication only goes so far within the communication chain or they have failed to apply vertical communication in its entirety. This can result in inappropriate responses to multi-agency incidents (McEntire; Kuban et al.; Paton et al.).

Improved communication during the 2010 tsunami warning allowed smoother implementation of procedures. It also indicated that multi-organisational responses to major incidents require specific standard operating procedures for such incidents. Miskel indicated that although SOP's are important in the response phase, they are somewhat limited to some disaster situations and not all disaster situations are covered. Miskel suggested the failed response to Hurricane Katrina was, in part, due to the limitations of standard operating procedures. Again this provides the necessity to be able to use more than one system of communication to initiate appropriate response and coordination for disasters.

5.4 Coordination

The definition of coordination is an act or process of bringing command and control to organisations through the regulation of diverse elements into an integrated and harmonious operation. The degree of performance of coordination is usually congruent to the level of threat, taking into consideration the action required across communities, organisations, individuals and time (Federal Emergency Management Agency).

On the other hand, Miskel also indicated that divisions of responsibility can be complicated amongst response organisations (this could be a reason for confusion about who responds the emergency services: the EOC or the relevant communications centre). This suggests that communication of roles and responsibilities within a multi-agency incident needs to be determined prior to any disaster occurring (Eyerman et al.). McEntire suggested this can be resolved when there is sufficient “...political support, preparedness measures, networking and cooperative relationships, technology and the nature and use of the emergency operations centre...” (p. 376).

The inception of coordinated incident management systems (CIMS) (see Chapters 1 and 2) in New Zealand was brought about after emergency services, who regularly work together, needed more alliance at local, regional and national levels (Ministry of Civil Defence Emergency Management, 2005). At the same time, each service needed to retain command and control within their own structure and be able to cooperate with other organisations. This brought about the identification of lead agencies that will take charge of specific incidents during the readiness, reduction, response and recovery phases.

As CIMS became the forefront for multi-agency responses in New Zealand, there was, and still is, a requirement to develop terminology that would be understood by all stakeholders and participants in the CIMS arena. This was to reduce confusion and enhance response and coordination during multi-agency incidents. In 2009, confusion arose

over the use of terminology used by MCDEM, the Pacific Tsunami Warning Centre and the New Zealand Fire Service. Confusion occurred when the PTWC issued a cancellation of the tsunami warning, when, in fact, it should have been downgraded to an advisory in New Zealand. Confusion also occurred when the New Zealand Fire Service used their own colour-coded alerting system that other response agencies did not understand. Paton et al. indicated that differences in terminology can make coordination difficult, “...particularly if it becomes necessary for an external agency to exercise some authority over the activities of an organisation...” (p. 6).

In addition, CIMS was to incorporate the rapidly changing technological environment, a recommendation raised by Miskel was to utilise robust, standardised communications equipment that is interoperable between agencies to improve communication. He believed that the improved equipment, or hardware, can improve vertical and lateral communication pathways. This may also assist in the coordination of resources if different organisations can communicate with each other using the same radio frequencies and same, or similar, but compatible technology. Communication can occur through the use of similar radio networks and other primary emergency services radios installed in the EOC that can be monitored. The ability to hear what is happening outside of the EOC can assist EOC staff with coordination of the response itself. McEntire (2002) indicated in the Fort Worth study that command and control actually hindered coordination efforts with some agencies overstepping their authority during the incident by failing to allow other agencies to participate in the response.

Inadequate communication was identified as an issue for most interviewees (Table 2) with the suggestion that this may have been attributed to the lack of availability of police radios to communicate with police and computer access to keep track of fire service incidents during the 2009 and 2010 tsunami warnings. They believed that

coordination would have been more seamless if they had access to this technology and methods of communication. Conversely, McEntire (2002) also indicated technology and other methods of communication proved to be a hindrance to the coordination of response to the Fort Worth tornado with TV antennas being lost, disrupting information going into the EOC; police radio systems going down due to overuse; and cell phone outages occurred for a short time. These issues indicated communication failure can potentially alter outcomes of disasters (Abkowitz).

Paton et al. also suggested the inadequacy of coordination methods could challenge coordination efforts. However, coordination methods can be communicated between agencies so each agency knows their roles and responsibilities during multi-agency incidents. This was identified by McEntire when he examined the Fort Worth tornado. The clarification of organisational roles in disaster occurred on a frequent basis (approximately every 3 months), training to build response capacity, incident command training and other training projects assisted in all levels of staff understanding roles and responsibilities of other agencies during disaster situations, thus improving coordination. The London bombings in July 2005 also proved that multi-agency coordination worked well when agencies communicated what their capabilities were. Agreements were reached as to roles and responsibilities of each agency during multi-agency incidents prior to the London bombings allowing seamless implementation of the response system (Eyerma et al.).

As many responders are being trained in CIMS as a requirement to enhance response and coordination within the response structure, it was necessary to identify if the participants understood the role of CIMS during multi-agency incidents, if it was being fully utilised and how they understand CIMS. All participants (100%) indicated they understood the role of CIMS during multi-agency incidents. Only 81% believed it was being fully utilised in 2009 and 80% in 2010 (fig. 6).

When participants were asked what they understood CIMS to be, an element of doubt was raised about whether or not they completely, or partially, understood the role of CIMS. Comments made did not indicate full understanding of CIMS (Table 6). However, these results do not factor in the level of experience or training of the respondents. McEntire (2002) indicated that incident command system training assists with emergency operations staff and other department leaders to understand field operations. However, to understand any incident management system, communication has to be transparent and well-organized (Maier-Sperdelozzi et al., 2007; Eyerman et al.).

5.4.1 Effects of Communication on Coordination

The tsunami warnings in 2009 and 2010 required an appropriate level of response that needed to be timely and coordinated. There are societal expectations whereby response organisations need to be seen to be effective and working together to achieve common outcomes to protect life, property and the environment to the best of their abilities. Three interview participants indicated that having access to NZFS incident reports would have been useful to provide them with the ability to see what fire service resources would be available and what business as usual incidents they attended during the tenure of the warning phases. The lack of police presence and their radios made it more difficult to coordinate the response for some EOCs', hindering direct communication between the police and some EOCs' during the initial phases of the tsunami warnings in September 2009 and February 2010.

Auf de Heide indicated communication variances can result in underlying communication issues resulting in the lack of coordination. He also suggested that communication problems during disaster situations conceal coordination problems. However, if communication is not effective, how can coordination be effective during multi-agency incidents utilising the CIMS response structure? Researchers have identified coordination as being problematic during multi-agency

response (Auf de Heide; McEntire, 2002; Paton et al.; Bharosa et al.). The question is what causes it to be problematic? Communication or the lack of it, between agencies can be a significant issue for effective coordination. An example of this during the tsunami warnings in New Zealand occurred at the beginning of the response phase when all response agencies should be having input into the response and coordination processes. The lack of input from local, senior police officers during the initial stages of the tsunami warnings occurred as they did not receive the initial communication of the warnings, therefore they were unable to respond to the EOC for briefing.

The inability to communicate with the police could potentially hinder the ability to conduct evacuations or even enforce road closures in a timely manner, affecting coordination. When this occurs, it could have a flow on effect with initial delays closing roads and beginning evacuations of residents if necessary could put responders in high risk situations especially if the wave arrival time frames were as short as the Samoan tsunami of 3 to 4 hours (Mendonça et al.) (Appendix 3).

Effective coordination requires effective communication, clearly defined roles and responsibilities within the multi-agency incident (Maier-Sperdelozzi et al.; Eyerman et al.). Without clear cut guidelines, confusion can occur, communication fails, and effective response and coordination either does not occur, or appears chaotic. This can only lead to frustration (Kendra and Wachtendorf, 2003) and each response agency resorting to doing what they do best: respond in the capacity of the organisation they represent only; not as a part of a unified multi-agency response. Eyerman et al. indicated that if communication is not effective and timely, multi-agency planning and response is hampered. They also suggested that due to agencies developing and using their own jargon that is pertinent to their specialised field and internal structure, inter-agency communication becomes confused due to the lack of common terminology. This occurred during both the 2009 and 2010 warnings with the NZFS using

its own terminology to escalate or downgrade the tsunami warnings (Appendices 5 and 6).

The lack of common terminology can also affect coordination and response efforts of emergency responders. The issuance of the “cancellation” from PTWC and then MCDEM in 2009 was proof in point. The advisory informs response agencies that although there will be no damaging waves, there will be disturbances to the oceanic currents that could affect beaches, therefore, beachgoers need to be aware of the risks (Appendix 5). With this information, response organisations can coordinate and respond appropriately.

There was some level of understanding of CIMS by respondents, indicating, accurately, that the lead agency was MCDEM for the tsunami warnings. However, what some participants (35%) failed to identify the command and control structure within the organisation. This could explain, to some degree, why emergency services communication centres were very much left out of the loop when their resources were responded by EOCs’ rather than the communication centres, at the request of the EOC agency representative as part of the internal command and control structure of the emergency services.

Figure 10 shows the structure and the divisions of CIMS with each response organisation falling under the umbrella of the Operations Section. It does not delve further into each organisation’s command and control structure. Where it says “Agency EOC” does not mean the communication centres for that agency. Nevertheless, those working for a response agency should understand their own procedures and how communication works within their own organisation. To improve inter- and intra- agency communication members participating in the EOC need to be aware of and know how the primary emergency services operate in order for the emergency services communication centres to monitor the whereabouts of their resources. This allows the communication centres to respond their resources to business as usual incidents. After all, these services have to maintain a level of service to

be able to provide normal services regardless of a declared state of emergency according to chapter 6.2 Principles common to emergency services; Section 21 (4):

“The responsibility of each service for its primary functions (law and order, fire suppression, and health services) is in no way transferred or modified by the declaration of a state of emergency (staff continue to work under their service’s command structures and established procedures) (Ministry of Civil Defence Emergency Management, 2009, p. 4).

According to figure 2 communications within the agency was somewhat effective and ineffective in 2009 (41% and 14% respectively) with improvements in 2010 (13% and 6% respectively, fig. 3). Although this may be the case, coordination was still problematic (Tables 5 and 7). Once a response was initiated, organisational representatives meet at the EOC (fig. 10) to discuss an impending situation as they did for the tsunami warnings in 2009 and 2010. Once the response was officiated at local and regional levels; the organisational representatives should have communicated what was required from his or her organisation so the response could be in line with the organisations standard operating procedures. This should include identifying resources that will be required to assist in road closures, evacuations and so forth. These resources should then be dispatched normally via the appropriate communication centres.

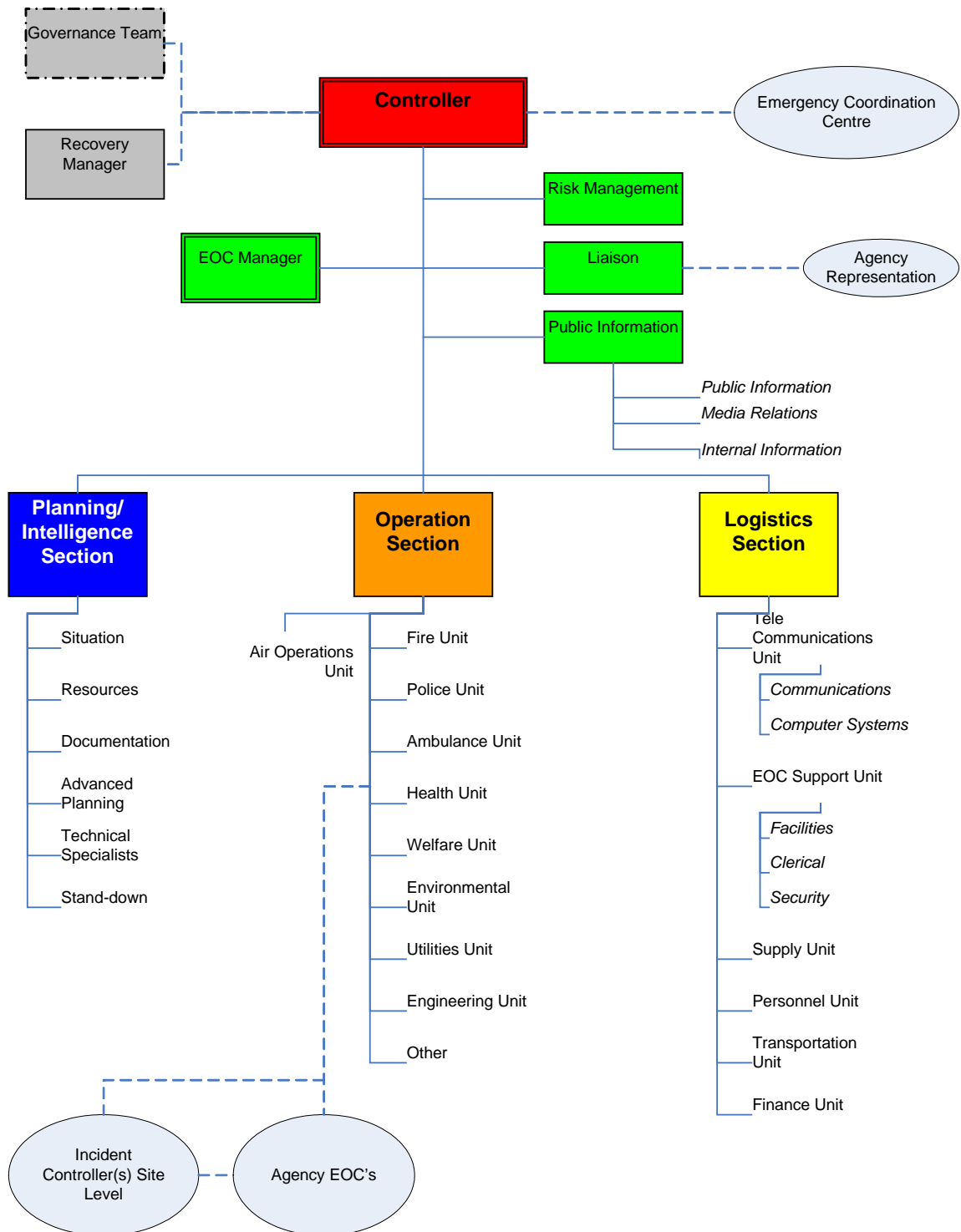


Figure 10: Diagrammatic view of coordinated incident management for multi- agency incidents from the emergency operations centre perspective (Canturbury Regional Civil Defence Emergency Management Group, 2007). The “Agency EOC” is not the Agency communication centre.

Interestingly, the London bombings study indicated that the division of roles and responsibilities into “...strategic, tactical, and operational...” (p. 100) with each level being multi-agency worked very well with the coordination of resources across three policing jurisdictions. This, in part, could be the result of effective communication prior to the bombings and the establishment of “LESLP Major Incidents Procedures Manual” (London Emergency Services Liaison Panel, 2004, cited in Eyerman et al.). This manual contains standard operating procedures and plans that enhance effective coordination of the response agencies’ combined endeavours (Eyerman et al.).

When this process is implemented, each response organisation will have a record of what was done, when and by whom. If the representative at the National Crisis Management Centre (NCMC) requests information from the respective communications centre, he or she can be provided with an accurate update. In addition to being able to provide information, the crews conducting tasks at the request of the EOC can provide situation reports (sitreps) on what they are doing or have done; what is happening at local level; and if they need further resources or not. Not only does this improve vertical and horizontal communication processes, it provides a document that can be used during debriefings (Perry, 1995), identifying areas that need improvement, accurate timeframes and legal documents in the event of a Royal Commission of Inquiry being held (as in the 22nd February, 2011 Christchurch earthquake).

In reference to Auf de Heide in regard to communication variances resulting in the lack of coordination, or communication problems concealing coordination issues, it is possible that both occur within the disaster field. Eyerman et al. also indicated that the Federal Government had failed to achieve reciprocating communications amongst emergency responders at all levels, and as a result, has been hampered by insufficient multi-agency coordination which coincides with Auf de Heide’s comments. However, with effective

communication these issues can be resolved and coordination improved (Eyerman et al.).

There does not appear to be any research done in the area of response and coordination for primary emergency services communication centres during declared states of emergency for potential or actual major incidents. This lack of research and exclusion can affect the coordination of resources from the emergency services communication centres perspective. Nonetheless, as a result of the tsunami warnings in September 2009 and February 2010, it does appear that planning needs to be improved to include primary emergency services communication centres in CIMS planning and in action plans, responding their own resources at the request of the EOC (figs. 8 and 9; Table 7).

5.5 Planning

According to Federal Emergency Management Agency (2010), planning is the "...deliberate, critical tasks and activities necessary to build, sustain and improve the operational capability to prevent, protect against, respond to, and recover from domestic incidents." Planning permits communities and organisations alike to be prepared for any situation they may be confronted with, whether it is natural or man made disasters. In addition, it provides for measures to be taken including the establishment of policies before any incident. Therefore reduction, readiness, response and recovery can be considered prior to any major incident, where each response agency knows their roles and responsibilities during each phase and when they are no longer required.

Preparing communities and organisations means providing warning systems, planning evacuation routes and areas suitable for relocation if necessary, storing of supplies to enable communities to be self-sufficient for a number of days, ensuring temporary shelters are available, formulate management strategies and conduct disaster evacuation drills and exercises (i.e. as they do for fire drills every 6

months), and develop multi-agency, all-hazard standard operating procedures. To achieve this all aspects of disaster planning needs to be communicated both intra- and inter- agency. Although plans for each organisation would have been in place for business as usual incidents, multi-agency incident planning began in earnest with the adoption of the coordinated incident management system. Planning assists in identifying what works during disaster response, what doesn't work and, by communicating and working cooperatively with multiple agencies to improve the latter (Auf de Heide; Miskel).

Eyerman et al. clearly identified the LESLP manual (2004) and the 2004 Civil Contingencies Act as significant in the ability to plan for major multi-agency incidents. The LESLP manual (2004) was agreed to upon communication amongst agencies and the 2004 Civil Contingencies Act legislated and enacted to provide clear guidelines including the roles and responsibilities of responding agencies. Furthermore, these documents provided "...the basis for effective performance assessment..." (p. 101). Following the London bombings in 2005, the 2004 Civil Contingencies Act proved its worth with the requirement for multi-agency planning, training, and exercising (Eyerman et al.).

The advent of the tsunami warning in 2009, 71% of respondents (fig. 7) indicated issues with planning and included, but not limited to, misunderstanding of roles and responsibilities, poor internal activation procedures, widespread confusion over procedures, timing, accurate information dissemination, inadequate coordination within the CIMS structure, lack of common terminology, conflicts between local and scientific modelling for tsunami inundation mapping, no post impact planning, and so forth. Although some improvements had been made by the time the tsunami warning was issued in February 2010, 64% of respondents (fig. 7) still indicated many issues remained (Table 7).

Respondents who did not have any issues (28% in 2009 and 36% in 2010) suggested that everything they had planned for worked like

clockwork, with one survey respondent indicating terminology used in the alerting system by the New Zealand Fire Service did cause confusion amongst agencies in 2009 but this was resolved by 2010. Many respondents also indicated that widespread confusion occurred when MCDEM issued a stand-down following a cancellation by the PTWC when, in fact, it had been downgraded to an advisory and tidal currents could still cause havoc for those entering the water. This highlighted the importance of developing and using terminology that everyone understands during the planning phase. Additionally, these issues are usually identified when they have been tested during multi-agency exercising.

Plans can be improved through exercising and testing of procedures (Eyerman et al.). The tsunami warning issued in 2009 did provide much needed awareness of the necessity for response and planning, if effective evacuations were required for at-risk coastal communities. This provided response organisations the impetus to improve their response plans soon after the Samoan tsunami warning in 2009. Improving plans provided a smoother and calmer response to the Chilean tsunami warning in 2010 with an overall improvement in response (fig. 4; Table 5). The fact that 39% of respondents did believe that the Samoan tsunami warning was a good training exercise and 72% believed it to be a good reminder of our vulnerability to natural disasters and the need to be aware of procedures indicated the need to have robust, multi-agency standard operating procedures and plans in place.

In 2010, however, 53% of responses indicated the Chilean tsunami warning was a good reminder of our vulnerability to natural disasters and 47% believed it to be a good training exercise to ensure timely evacuations (fig. 4). With this in mind, there appears to be good cause to implement realistic training and exercising involving all levels of response organisations. The fact that many respondents (39% in 2009 and 47% in 2010) believed both the tsunami warnings were a good

training exercise underpins the need to conduct realistic multi-agency exercises to be conducted on a regular basis.

Regular exercising does not have to include all agencies at all levels all the time. However, exercising plans assists in identifying risk, and more importantly the risks associated with incidents that occur infrequently and pose uncertainty for communities and responders alike (Basher; Bharosa et al.). In addition, Eyerman et al. indicated that multi-agency exercising on a regular basis was a primary reason for the coordination model's success in London. Furthermore, they suggested the regularity of exercising reinforced and continually improved multi-agency coordination. Eyerman et al. went on to suggest the type of scenarios used were "...practical...and wide-ranging incidents that required in-depth planning and response duties..." (p. 102).

Planning can also identify any interaction issues between organisations. It is necessary to consider the way communication is conducted, how knowledge is linked and how policies are implemented within the organisation to ensure the best outcomes are achieved (Basher; Miskel; Auf de Heide). Interaction issues were identified by respondents from local CDEMs' with regional CDEMGs' whereby information being provided was less than adequate or they did not respond as expected by the CDEMs' (Table 2). Eyerman et al. signified that multi-agency cooperation for disaster planning and response is necessary for agencies to become familiar with the roles and responsibilities placed on different levels of command.

With this in mind, some of the issues raised by CDEMs' regarding the performance, or what appeared to be a lack of it, from CDEMGs' could be overcome in the planning phase. The reason for this is the CDEMs' would fully understand the roles and responsibilities of national, regional and their own local civil defence emergency management organisations. Furthermore, CDEMGs' would benefit as they would also understand what the CDEMs' expectations are during declared warning phases.

Evacuation planning is also important to ensure communities are aware of the routes they need to take to reach safety and to reduce or prevent traffic problems by clogging roads with people trying to leave high risk areas. Nonetheless, as emergency managers and councils, both local and regional, concentrate on evacuation routes for communities, the relocation site for EOCs' also needs to be adequate if they are to continue with full functionality (Mendonça et al.).

One survey respondent did indicate the secondary location where they were expected to be evacuated to and continue working from was less than adequate (Table 7). Some interview participants also pointed out that if they had to evacuate from their current EOC, they would have lost some functionality. Secondary evacuation locations do need to be considered from the point of view the council is capable of operating continuously (Mendonça et al.; Kendra et al.). Due to the technical equipment that would be required to be fully functional, EOCs' and their locations need to be planned for, well before any major incident occurs (Kendra et al.). This includes mobilising EOCs' so they can move more readily and set up immediately or within a very short period of time (Mendonça et al.; Kendra et al.). It is not impossible to incorporate the use of, or develop something similar to, the modern command units used by the New Zealand Fire Service, mobilising fully functional EOCs'.

5.5.1 Influence of Communication on Planning

Communication can influence planning. If issues are not raised as concerns at the time of an incident or during exercising, it can be deemed the plan being used is flawless. If they are raised at the time or soon after an incident they can be explained and changes made as necessary. The terminology used by both the MCDEM and NZFS in 2009 caused confusion amongst other response agencies. This was raised and corrected by the time the tsunami warning was issued in 2010. Although the alerting levels used by the NZFS remained the

same, it was understood by other agencies in the multi-agency arena. MCDEM also made changes to announcing cancellations issued by the PTWC by changing downgrades to advisories which indicated that the threat of a tsunami wave arriving on shore will not occur but the currents can remain disturbed for some time (Appendices 5 and 6).

Communicating who does what and when in a plan can allow for a more seamless, transparent, effective response and improved coordination of resources during an incident (Eyerma et al.). Quantantelli (1997) suggested the planning of multi-agency incidents should be centred on the EOC. This is a place where multiple organisations can meet (fig. 10) and communicate how incidents can be managed, with the focus on coordination, policy making, operations, and information gathering. In addition, the primary emergency services can provide valuable insight into how their emergency service communication centres operate from receiving a call, to dispatching resources, situation reports and so forth, which can then provide benefits to the EOC post incident when debriefings are conducted to identify issues for future planning.

However, this information is not limited to the primary emergency services, any organisation participating as part of the response team at an EOC can communicate with other members regarding what they have to offer as a response organisation, how this can be achieved and the benefits to the EOC response effort. Using the EOC to plan in this way initiates both lateral and vertical communication processes. Furthermore, it allows each organisation to understand each others roles and responsibilities during the different phases of disaster management.

Conversely, Renn (1998) identifies inconsistencies between public perception and expert analysis of risk. The role of the EOC is to develop strategies to communicate risk to communities, with the assistance of response agencies. However, if front-line responders are not involved in the planning phase; once a state of emergency has been declared, they may be unable to communicate with members of the

public the actual risk, based on scientific information and the reasons evacuations may be necessary and/or why people should stay out of the water for extended periods of time (i.e. senior staff from the police and fire services not attending the EOC at the time activation occurred, missing initial briefings in the early phases of the tsunami warning). Planning in its own right is designed to reduce risk and unless everyone, including stakeholders, response organisations, and community members can communicate their concerns and ideas for risk reduction, planning can fail as can any risk reduction strategy developed by the EOC (Renn; Perry, 1995, 2003; Ulmer et al.).

Eyerman et al. suggested response agencies meet informally, developing independent conformity between agencies to assist in addressing coordination problems. They suggest this is the initial process in developing coordination regimes that can be used "...to develop guidelines for a general coordination model..." (p.93). They believe this model assists in reducing competition between the response organisations and improving coordination. In addition, this can be achieved by joint planning sessions by organisational leaders where they can define specific concerns and geographic jurisdictions; recognition of primary emergency services primary roles and responsibilities; promotion of cooperation through improved inter-agency communication at an operational level and recognition of the importance of coordination from senior management with acceptance of response goals by all key staff (Eyerman et al.). Once this is achieved risk can also be assessed and planned for from a multi-agency perspective. Communities and responders alike will be able to respond more effectively during infrequent, adverse incidents.

5.6 Summary

Communication occurs using many different methods from vocal, technological, behavioural, and natural symbolic signs. Regardless of the methods used to communicate, those giving and receiving the

information need to be able to interpret this information in order to respond. If there is a failure in the interpretation of the information, a response will either not occur, or will be inappropriate. This is no different for emergency management during multi-agency incidents. During multi-agency incidents such as the tsunami warnings in 2009 and 2010 highlighted issues in communication where it could have had significant impacts on the response.

Concerns were raised about CDEMGs' altering information forcing local CDEMs' to access information from MCDEM as it was more accurate. Accurate information communicated to response organisations was important to enable them to initiate appropriate responses to the tsunami warnings. Access to inter-organisational technology, i.e. fire service incident information and police radio, in the EOC was suggested, as this could provide a source of communication that would assist in the coordination of the response to the warnings. As it was, the lack of senior police and fire staff in the EOC in 2009 and 2010 proved to be a hindrance to the response and coordination of resources for some EOCs'. However, even though some agencies were absent for the initial phases of the warnings, the response did go relatively well with many suggesting they were good training exercises.

Intra-agency communication was not without some problems albeit was not a complete failure. Many respondents did indicate that the use and familiarisation of standard operating procedures influenced the positive outcomes of their organisational response. However, even with the use of standard operating procedures, there was a failure for some areas to notify the emergency services communication centres about what they were doing and what resources they were using. The failure to include emergency services communication centres in the response, in its entirety, could have reduced the capability of these services to respond to business as usual incidents; ultimately affecting the ability to effectively coordinate resources to incidents, including those generated by the EOC.

However, the familiarisation of standard operating procedures and plans for such warnings indicated the importance of realistic exercising and training for multi-organisational response. Exercising and training can identify issues that can be resolved before a real incident occurs allowing for modification and improvements to plans for future use. The role of the EOC would also benefit as a meeting place for all response agencies to communicate and plan for future all-hazard incidents where they can communicate organisational capabilities and the procedures used to respond their own resources to assist the EOC for incidents such as the tsunami warnings in 2009 and 2010. For EOCs' to be fully functional consideration needs to be given to its current and secondary locations and the facilities it has to remain functional at all times.

Above all, communication is important for multi-agency response, coordination, and planning. Without it, response, coordination, and planning will malfunction and can place front-line responders, and the communities they serve, in high risk situations.

Chapter 6

6.0 Conclusions and Recommendations

6.1 Conclusion

The tsunami warnings in September 2009 and February 2010 did prove to be challenging and made response organisations aware of their state of readiness, or lack of it, for such incidents occurring in New Zealand from off-shore events. Although some areas succeeded with their well planned, coordinated response at local level, issues were raised about how communication occurred between and within agencies and the effects it had on response and coordination in general. Issues were also raised about planning. Consideration was given to how communication affected response, coordination and planning, if it had any impact at all.

Previous research has indicated that communication can conceal coordination issues. It is a bit like what comes first the chicken or the egg in the sense of communication or planning, coordination or response. Communication has to come first. Pre-existing response and coordination issues have to be the result of failed communication in the first place. However, some may say that it was failed planning. What one has to remember, emergency management involves multi-agency input to achieve the best outcomes for responders and communities alike. To do this, communication has to occur inter- and intra- agency and within communities. The introduction of CIMS in New Zealand assisted in directing coordination for multi-agency responses to incidents, but it does not recognise the importance of communication centres for the emergency services. This reflected a flaw in the lateral communication pathway.

However, if no, or inadequate communication occurs, response and coordination will be affected. In argument to response and coordination issues being concealed, it is the lack of communication of the risk and organisational roles and responsibilities that can prevent, or hinder,

effective response and coordination occurring in the first instance. The London Emergency Services Liaison Panel manual and the Canadian methods adopted to improve coordination and response to multi-agency incidents are worth some consideration as they are tried and tested systems and have succeeded during multi-agency, major incidents. They both have been developed through multi-agency communication and agreements.

To be able to identify coordination issues, they have to be communicated first to resolve them. Communication consists of every aspect of daily lives, both personal and professional. It can be verbal, physical, technological, or symbolic. Regardless of the type of communication, if it is not heeded too, failures will occur.

Issues were raised regarding horizontal and vertical communication pathways being inadequate or, in some cases, non-existent. This can be reflected in inadequate planning. Once again, standard operating procedures need to be communicated. This includes how response and coordination will occur and what the roles and responsibilities will be for each response agency at different levels. Having preset levels of response can assist in the decision making process of who needs to respond, when they need to respond and where they will be needed. It also allows for response planning; for example, when resources need to be drafted into regions more likely to be affected by a particular incident at any given time.

Nevertheless, planning needs to be communicated and as a result of the consultation process, plans can be developed. Once these plans have been developed it is necessary to test them to ensure they work well and any flaws can be addressed before any major incident occurs. All this involves multi-agency communication for planning, response and coordination to be effective.

6.2 Recommendations

- All response agencies need to re-evaluate the current CIMS structure and consider taking information from the Canadian emergency response system and the London emergency services liaison panel manual to develop effective communication channels to improve response, coordination and planning issues. Lessons can be learned from other countries responding to major, multi-agency incidents and implemented into the New Zealand coordinated incident management system making the response more seamless and transparent.
- Incorporate emergency services communication centres in the response and coordination planning to alleviate any confusion for these centres knowing where their resources are and what they are doing. This will also assist in improving vertical and horizontal communication inter- and intra- agency. After all, this is a procedural process that needs to be agreed to and implemented during the multi-agency planning phase.
- All response agencies need to develop and agree to terminology that can be fully utilised within the multi-agency environment for disaster situations. This will help alleviate inter-agency confusion. However, intra-agency terminology can remain the same i.e. when giving situation reports to their relevant communication centres. This allows each response agency to maintain some autonomy within their own agency but aligns inter-agency jargon, assisting agencies to work as a cooperative, coordinated unit.
- All response agencies need to consider and participate in regular exercising every 3 months for desktop exercises and at least one multi-agency, large scale, realistic exercise every 6 to 12 months. The more realistic the training the more likely, flaws are going to be identified in the decision making process. This

allows agency managers to reflect and revise issues arising through exercise debriefings.

- All senior managers of response agencies need to listen to what end-users of policies and strategic development have to say; regardless of rank, they can have very valid suggestions to assist with improvements to response and coordination for multi-agency incidents.

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Appendices

Appendix 1: Tsunami Warning Survey

The findings from this study will be used to help local and national organisations better prepare for future tsunami warnings, reducing risk communication and coordination failure. Please complete the survey **even if you were not in a coastal location on the days of the Samoan and/or the Chilean tsunamis**. The first set of questions relate to general perceptions of organisational response when multi-agency incidents occur.

General questions about these two (2) events:

Q1 Do you belong to more than one organisation likely to be involved in multi-agency events such as the national tsunami warnings?

☐₁ Yes

☐₂ No

Q1(a) Which organisation(s) do you belong to? (Please tick ☒ all that apply):

☐₁ Local civil defence

☐₂ Ambulance Service

☐₃ Fire Brigade

☐₄ Police

☐₅ Civil Defence

☐₆ Other (please indicate): _____

Q2 How do you see your role in the event of a tsunami warning being issued?

(Please tick ☒ only one):

2009

☐₁ Business as usual

☐₂ Activate local warning system

☐₃ Evacuate your region

2010

☐₁ Business as usual

☐₂ Activate local warning system

☐₃ Evacuate your region

Q3 How do you see the emergency services (fire, police, ambulance, civil defence, local emergency operations centres) communication centres role when a national warning is issued

such as the two (2) tsunami warnings in September 2009 and February 2010?

- ☐₁ Do nothing
- ☐₂ Advise staff in their jurisdiction of what they need to do
- ☐₃ Mobilise staff and resources as a business as usual event

Q4 Do you believe coordinated incident management systems were being fully utilised during these national warnings?

- | 2009 | 2010 |
|---|---|
| <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₁ Yes |
| <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₂ No |

Q4(a) If yes, explain how it was being utilised.

Q4(b) If not, please explain how it could have been utilised.

Q5 Do you know what coordinated incident management systems involve?

- | 2009 | 2010 |
|---|---|
| <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₁ Yes |
| <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₂ No |

Q5(a) If yes, explain your understanding of coordinated incident management.

Q5(b) If not, why not (*i.e. training; infrequent multi-agency incidents*)?

Q6 How did you perceive the tsunami warning on 30th September, 2009? (*Please tick ☒ only one*):

- ☐₁ A waste of emergency services personnel' time
- ☐₂ A good reminder that we are vulnerable to natural disasters and need to be aware of what our procedures are when these warnings are issued
- ☐₃ A good training exercise to ensure we can evacuate within a set time frame if the need arises in the future?

Q7 How did you perceive the tsunami warning on 28th February, 2010? (*Please tick ☒ only one*):

- ☐₁ A waste of emergency services personnel' time
- ☐₂ A good reminder that we are vulnerable to natural disasters and need to be aware of what our procedures are when these warnings are issued
- ☐₃ A good training exercise to ensure we can evacuate within a set time frame if the need arises in the future?

Q8 Do you encourage your service and/or community to participate and practice emergency evacuation training procedures regularly for such events?

- ☐₁ Yes ☐₂ No

Q8(a) If yes, how often?

_____ weeks / _____ months / _____ years

Q8(b) If not, why not?

The Tsunami Warning Events
(30th September, 2009 and 28th February, 2010)

The next questions will focus on communication during these warnings.

Q9 Do you think communication was effective during the following tsunami events between agencies and within your own agency?

Q9(a) Between Agencies: **2009 2010**

| | |
|---|---|
| <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₁ Yes |
| <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₂ No |

Q9(b) Within your agency: **2009 2010**

| | |
|---|---|
| <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₁ Yes |
| <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₂ No |

Q10 Was communication **between** agencies effective during the **2009 Samoan earthquake generated tsunami?**

☐₁ Very Effective ☐ Effective ☐₃ Somewhat Effective ☐₄ Ineffective

Q10(a) Please explain.

Q11 Was communication **within** your agency effective during the **2009 Samoan earthquake generated tsunami?**

☐₁ Very Effective ☐ Effective ☐₃ Somewhat Effective ☐₄ Ineffective

Q11(a) Please explain.

Q12 Was communication *between* agencies effective during the **2010 Chilean earthquake generated tsunami**?

☐₁ Very Effective ☐ Effective ☐₃ Somewhat Effective ☐₄ Ineffective

Q12(a) Please explain.

Q13 Was communication *within* your agency effective during the **2010 Chilean earthquake generated tsunami**?

☐₁ Very Effective ☐₂ Effective ☐₃ Somewhat Effective ☐₄ Ineffective

Q13(a) Please explain.

Q14 What do you think worked well during the 30th September, 2009 tsunami warning?

(Please tick ☒ all that apply)

- ☐₁ Inter-agency communication
- ☐₂ Communication within your agency
- ☐₃ Local procedures (i.e. the use of warning systems)
- ☐₄ Emergency service response to evacuate at-risk communities
- ☐₅ Other (*please explain*): _____

Q15 What do you think worked well during the 28th February, 2010 tsunami warning?

(Please tick ☒ all that apply)

- ☐₁ Inter-agency communication
- ☐₂ Communication within your agency
- ☐₃ Local procedures (i.e. the use of warning systems)

- ☐₄ Emergency service response to evacuate at-risk communities
- ☐₅ Other (*please explain*): _____

Emergency Warning System (National Warning Centre [NWC])

Q16 How did you learn about the **September, 2009** tsunami warning? (**Please tick ☒ only one**):

- ☐₁ Paging ☐₂ Telephone ☐₃ Radio
- ☐₄ Television ☐₅ Fax ☐₆ Email
- ☐₇ Local Police ☐₈ Local Fire Station ☐₉ Local Ambulance Service
- ☐₁₀ Local CD Officer ☐₁₁ Local EM Officer
- ☐₁₂ Other – please describe: _____

Q17 How did you learn about the **February, 2010** tsunami warning? (**Please tick ☒ only one**):

- ☐₁ Paging ☐₂ Telephone ☐₃ Radio
- ☐₄ Television ☐₅ Fax ☐₆ Email
- ☐₇ Local Police ☐₈ Local Fire Station ☐₉ Local Ambulance Service
- ☐₁₀ Local CD Officer ☐₁₁ Local EM Office
- ☐₁₂ Other – please describe: _____

Q18 Who did you receive official notifications from for the **September, 2009** tsunami warning? (**Please tick ☒ only one**):

- ☐₁ MCDEM ☐₂ CDEM/Local Authority
- ☐₃ Fire Communication Centres: ☐_{3a} North ☐_{3b} Central ☐_{3c} South
- ☐₄ Police Communication Centres: ☐_{4a} North ☐_{4b} Central ☐_{4c} South
- ☐₅ Ambulance Communication Centres: ☐_{5a} North ☐_{5b} Central ☐_{5c} South
- ☐₆ **Other (*please specify*):** _____

Q19 Who did you receive official notifications from for the **February, 2010** tsunami warning? (**Please tick ☒ only one**):

- ☐₁ MCDEM
 ☐₂ CDEM/Local Authority
- ☐₃ Fire Communication Centres:
 ☐_{3a} North ☐_{3b} Central ☐_{3c} South
- ☐₄ Police Communication Centres:
 ☐_{4a} North ☐_{4b} Central ☐_{4c} South
- ☐₅ Ambulance Communication Centres:
 ☐_{5a} North ☐_{5b} Central ☐_{5c} South
- ☐₆ **Other (please specify):** _____

Q20 Was there plenty of time to respond to effect a successful evacuation if needed after you received official notification of the **September 2009** tsunami warning?

- ☐₁ Plenty of time
 ☐₂ Adequate time
 ☐₃ Less than adequate time
 ☐₄ Inadequate time

Q20(a) Explain: _____

Q21 Was there plenty of time to respond to effect a successful evacuation if needed after you received official notification of the **February 2010** tsunami warning?

- ☐₁ Plenty of time
 ☐₂ Adequate time
 ☐₃ Less than adequate time
 ☐₄ Inadequate time

Q21(a) Explain: _____

Organisational Roles and Responsibilities During
the Tsunami Warnings in September 2009 and
February 2010

Q22 Who did you liaise with to verify your information and operating procedures in:

Q22(a) September 2009: _____

Q22(b) February 2010: _____

Q23 How do you perceive the organisational response to the **September 2009** warnings?

- ☐₁ Very effective ☐₂ Effective ☐₃ Less than effective
☐₄ Ineffective

Q23(a) Explain:

Q24 How do you perceive the organisational response to the **February 2010** warnings?

- ☐₁ Very effective ☐₂ Effective ☐₃ Less than effective
☐₄ Ineffective

Q24(a) Explain:

Q25 What did you do for the **30th September, 2009** tsunami warning?

- ☐₁ Responded to the National Crisis Management Centre (NCMC)
☐₂ Responded on the advice of the Emergency Operations Centre (EOC)
☐₃ Responded on the advice of the local civil defence officer
☐₄ Self-responded to your organisation's station / CD office
☐₅ Responded as a business as usual event generated by your respective communications centre
☐₆ Other (*please specify*): _____

Q26 What did you do for the **28th February, 2010** tsunami warning?

- ☐₁ Responded to the National Crisis Management Centre (NCMC)

- ☐₂ Responded on the advice of the Emergency Operations Centre (EOC)
- ☐₃ Responded on the advice of the local civil defence officer
- ☐₄ Self-responded to your organisation's station / CDEM office
- ☐₅ Responded as a business as usual event generated by your respective communications centre
- ☐₆ Other (*please specify*):
- _____

Risk Communication

Q27 Did you ask your respective communications centre to create an event for either the September 2009 and/or February 2010 tsunami warning incidents?

2009

2010

☐₁

Yes

☐₁

Yes

☐₂

No

☐₂

No

Q27(a) Why?

Q28 Did you advise your respective communications centre of **when you were starting** to evacuate during the September 2009 and/or February 2010 tsunami warnings?

2009

2010

☐₁

Yes

☐₁

Yes

☐₂

No

☐₂

No

Q28(a) Why?

Q29 Did you advise your respective communications centre of where you were ***after*** you evacuated?

| 2009 | | 2010 | |
|---------------------------------------|-----|---------------------------------------|-----|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ | Yes |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ | No |

Q29(a) Why?

Q30 Did you receive a stand down from the tsunami warnings in a timely manner?

| 2009 | | 2010 | |
|---------------------------------------|-----|---------------------------------------|-----|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ | Yes |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ | No |

Q30(a) Why?

Q30(b) What could have been done differently, if anything, to ensure you can return to normal as soon as possible following a downgrade for tsunami alerts?

Interagency Communication and Coordination

Q31 What method(s) were used to communicate between the responding organisations in **2009**?

- ☐₁ Radio-Telephone ☐₂ Telephone ☐₃ Fax
☐₄ Email ☐₅ Face-to-Face
☐₆ InterCad (Fire/Police/Ambulance Communications Centres Only)

Q32 What method(s) were used to communicate between the responding organisations in **2010**?

- ☐₁ Radio-Telephone ☐₂ Telephone ☐₃ Fax
☐₄ Email ☐₅ Face-to-Face
☐₆ InterCad (Fire/Police/Ambulance Communications Centres Only)

Q33 What were your expectations of responding organisations to the tsunami warnings (i.e. type of response, timing, roles and responsibilities)?

Q33(a) 2009:

Q33(b) 2010:

Q34 Did you understand what the roles and responsibilities were for other agencies responding to the tsunami warnings?

2009

2010

- | | |
|--|--|
| <input type="checkbox"/> ₁ Fully Understood | <input type="checkbox"/> ₁ Fully Understood |
| <input type="checkbox"/> ₂ Understood | <input type="checkbox"/> ₂ Understood |
| <input type="checkbox"/> ₃ Partially Understood | <input type="checkbox"/> ₃ Partially Understood |
| <input type="checkbox"/> ₄ Did not Understand | <input type="checkbox"/> ₄ Did not Understand |

Q35 Was interagency communication coordinated for the whole response during the tsunami warnings?

2009

2010

- | | | |
|---------------------------------------|--|---------------------------------------|
| <input type="checkbox"/> ₁ | Coordinated throughout | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | Somewhat coordinated, but understood | <input type="checkbox"/> ₂ |
| <input type="checkbox"/> ₃ | Somewhat coordinated, but confusing at times | <input type="checkbox"/> ₃ |
| <input type="checkbox"/> ₄ | Very uncoordinated, very confusing | <input type="checkbox"/> ₄ |

Q36 What method(s) did you use to evacuate your community during the tsunami warning?

2009

2010

- | | | |
|---------------------------------------|-----------------------------|---------------------------------------|
| <input type="checkbox"/> ₁ | Tsunami Warning Siren | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | PA System on Fire Appliance | <input type="checkbox"/> ₂ |
| <input type="checkbox"/> ₃ | PA System on Police Vehicle | <input type="checkbox"/> ₃ |
| <input type="checkbox"/> ₄ | Door Knocking | <input type="checkbox"/> ₄ |
| <input type="checkbox"/> ₅ | Telephone Tree | <input type="checkbox"/> ₅ |
| <input type="checkbox"/> ₆ | No evacuation took place | <input type="checkbox"/> ₆ |
| <input type="checkbox"/> ₇ | Other (<i>Explain</i>) | <input type="checkbox"/> ₇ |

Explain: _____

Q37 How effective was the method you used to evacuate your community during these warnings?

2009

2010

- | | |
|--|--|
| <input type="checkbox"/> ₁ Very effective | <input type="checkbox"/> ₁ Very effective |
| <input type="checkbox"/> ₂ Effective | <input type="checkbox"/> ₂ Effective |
| <input type="checkbox"/> ₃ Somewhat ineffective | <input type="checkbox"/> ₃ Somewhat ineffective |
| <input type="checkbox"/> ₄ Very ineffective | <input type="checkbox"/> ₄ Very ineffective |

Why?

Q38 Is there a response plan for all-hazard events involving multiple agencies?

☐₁ Yes

☐₂ No

Q38(a) If not, why not?

Q38(b) If so, did you know the response plan?

2009

☐₁ Fully Understood

Understood

☐₂ Understood

☐₃ Partially Understood

Understood

☐₄ Did not Understand

Understand

2010

☐₁ Fully

☐₂ Understood

☐₃ Partially

☐₄ Did not

Q38(c) If not, why not?

Q39 Were there any planning issues that you are aware of for both these events?

2009

☐₁ Yes

☐₂ No

2010

☐₁ Yes

☐₂ No

Q39(a) If yes, what are these issues?

Q40 Do you see a need for future training including multi-agency exercises to improve awareness of and response to future tsunami warnings?

☐₁ Yes

☐₂ No

Q40(a) If yes, what type of training and/or exercises do you think you need to improve awareness and response to multi-agency events?

Q41 What key roles do you think the emergency operations centres play in a declared warning situation? (*Please tick ☒ all that apply*)

☐₁ Coordination of resources

☐₂ Liaise with responding agencies

☐₃ Make policies

☐₄ Gather information

☐₅ Provide information to the public

☐₆ Host visitors to the centre

☐₇ Liaise with emergency service communication centres

☐₈ Request responses from emergency services (fire, police, ambulance, etc)

☐₉ Mobilise emergency service resources (fire, police, ambulance, etc)

Communication Within Your Organisation

Q42 Do you have any concerns about communication procedures used in September 2009 and/or February 2010?

2009

2010

☐₁ Yes

☐₁ Yes

☐₂ No

☐₂ No

Q43 If yes, what are your concerns?

(a) **2009:** _____

(b) 2010:_____

Q44 Do you have any suggestions, if any, to improve communications?

Thank you for taking the time to complete this questionnaire.
Please post the questionnaire
in the envelope provided.

Appendix 2: Questionnaire used to conduct and guide interviews

Organisational responses to warnings of impending hazards: What can be learned from the September 2009 and February 2010 warnings in New Zealand?

Overall Perspective of the tsunami warnings and organisational response to these warnings

Q1. What are your views on the Tsunami warning response in September **2009** following the earthquake in Samoa?

Q2. What are your views on the tsunami warning response in February **2010** following the earthquake in Chile?

Q3. Which organisation(s) do you belong to? (Please tick ☒ all that apply):

☐₁ Local civil defence/CDEM

☐₂ Ambulance Service

☐₃ Fire Brigade

☐₄ Police

☐₅ Rural Fire

☐₆ Other (please indicate): _____

Q4. Were there any issues:

Q4a. **Prior** to the tsunami warnings:

Q4a(i). September **2009**: -

Q4a(ii). February **2010**:

Q4b. **During** the tsunami warnings:

Q4b(i). September **2009**:

Q4b(ii). February **2010**:

Q4c. **After** the tsunami warnings were downgraded:

Q4c(i). September **2009**:

Q4c(ii). February **2010**:

Q5. What decisions did you make during the tsunami warning phase?

Q6. Why did you make these decisions?

Q7. Did your decisions assist in the community being aware of the risk to them?

Q8. What would you like done differently, if anything, the next time a tsunami warning is issued?

Q9. Were the timeframes from receiving the tsunami warnings to evacuation of your community adequate?

2009 **2010**

☐₁ Yes ☐

☐₂ No ☐

Q9(a). Please explain what, if any, differences that may have affected or improved your evacuation times:

Q10. Did you use more than one warning system to communicate with your community?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐

Q11. What warning system(s) did you use to warn your community of the tsunami?

Tick the system(s) you used in 2009 and 2010.

2009

2010

☐₁ Siren

☐ Siren

☐₂ PA system

☐₂ PA system

☐₃ Television Announcements

☐ Television Announcements

☐₄ Radio Announcements

☐ Radio Announcements

☐₅ Emergency Services Vehicle Sirens

☐₅ Emergency Services Vehicle Sirens

☐₆ Door knocking

☐ Door knocking

☐₇ Telephone Tree

☐ Telephone Tree

☐₈ Other: _____

☐₈ Other: _____

Q12. Which system do you believe worked well for your organisation in assisting your community to evacuate? Explain.

Q12(a) **2009:**

Q12(b) **2010:**

Q13. What, if any, differences occurred between the **2009** and **2010** tsunami warnings that you are aware of?

Q14. Other agencies, both public and private, may be called upon to assist in warnings and evacuation of towns. Who did you contact to get these services to respond?

Q15. Who did you communicate with during the response phase?

Q15(a) **2009:**

Q15(b) **2010:**

**Events: Evacuations following tsunami warnings on 30 September
and 28 February**

Q16. Considering the warnings issued on **September 30th 2009**, and **28th February 2010**, how did it unfold? (i.e. timing of warning notifications, wave arrival times, evacuation times, evacuation period before returning to home/work)

Q16(a) **2009:**

Q16(b) **2010:**

Q17. Was it what you expected?

Q17(a) **2009:**

Q17(b) **2010:**

Q18. Do you think these events should have been managed differently?

| 2009 | | 2010 |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |

Q18(a). Explain (i.e. planning – standardised operating procedures, training, communication, coordinated incident management):

Q19. Do you think you could have responded to normal ‘Business as usual’ incidents during and post evacuation?

| 2009 | | 2010 |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |

Q19. Why?

(a) **2009:**

(b) **2010:**

Q20. Did you communicate with your relevant communications centre?

| 2009 | | 2010 |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |

Q20. Why?

(a) **2009:** _____

(b) **2010:** _____

Emergency Warning System (National Warning Centre)

This section considers how useful the warning system was for your organisation and if this was successful for your organisation to effect an appropriate response within your community.

Q21. Who received warnings from the PTWC?

(a) **2009:** _____

(b) **2010:** _____

Q22. When did you first receive notification of the tsunami warnings?

(a) **2009:** _____

(b) **2010:** _____

Q23. In what order were notifications given?

(a) **2009:** _____

(b) **2010:** _____

Q23. How did you receive notifications of these warnings?

(a) **2009:**

- ☐₁ Paging ☐₂ Telephone ☐₃ Radio ☐₄ Television
☐₅ Fax ☐₆ Email ☐₇ Local Fire Brigade
☐₈ Local Police ☐₉ Local Ambulance ☐₁₀ Local Civil Defence Officer
☐₁₁ Local Emergency Management Office

(b) **2010:**

- ☐₁ Paging ☐₂ Telephone ☐₃ Radio ☐₄ Television
☐₅ Fax ☐₆ Email ☐ Local Fire Brigade
☐₈ Local Police ☐₉ Local Ambulance ☐₁₀ Local Civil Defence Officer
☐₁₁ Local Emergency Management Office

Q24. Who did you receive the notifications from?

(a) **2009:**

- ☐₁ MCDEM ☐₂ CDEM/Local/Regional Authority
☐₃ Fire Communication Centres: ☐_{3(a)} North ☐_{3(b)} Central ☐_{3(c)} South
☐₄ Police Communication Centres: ☐_{4(a)} North ☐_{4(b)} Central ☐_{4(c)} South
☐₅ Ambulance Communication Centres: ☐_{5(a)} North ☐_{5(b)} Central
☐_{5(c)} South
☐₆ Other (*explain*): _____

(b). **2010:**

- ☐₁ MCDEM ☐₂ CDEM/Local Authority
☐₃ Fire Communication Centres: ☐_(a) North ☐_(b) Central ☐_(c) South
☐₄ Police Communication Centres: ☐_(a) North ☐_(b) Central ☐_(c) South
☐₅ Ambulance Communication Centres: ☐_(b) North ☐_(b) Central
☐_{5(c)} South
☐₆ Other (*explain*): _____

Q25. Was there ample time to respond to effect a successful evacuation if needed?

2009 2010

- ☐₁ Yes ☐₁
☐₂ No ☐₂

Q25. If not, why not?

(a) **2009:** _____

(b) **2010:** _____

Q26. Who did you liaise with to verify your information and operating procedures?

(a) **2009:** _____

(b) **2010:** _____

Q27. Was your response to the warnings in accordance with your response plans?

2009 2010

- ☐₁ Yes ☐₁

☐₂ No ☐_b

Q27. If not, why not?

(a) **2009:** _____

(b) **2010:** _____

Organisational Roles and Responsibilities

The following questions relate to roles and responsibilities of organisations during the tsunami warnings on the 30th September 2009 and 28th February 2010.

Q28. When the tsunami warnings were issued, describe what you did for both events noting any differences in your role and responsibility?

(a) **2009:** _____

(b) **2010:** _____

Q29. What did your organisation expect you to do when the tsunami warnings were issued?

(a) **2009:** _____

(b) **2010:** _____

Q30. Was coordinated incident management procedures implemented?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q30(a). If not, why not?

(i) **2009:** _____

(ii) **2010:** _____

Q30(b). If so, did the response work as planned?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q31. Was there a clear chain of command to follow when you were required to respond to the warnings?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q31(a). If not, what is your perception of how the chain of command should work during multi-agency events?

Q32. Did the response go as planned for your organisation prior to, during and post tsunami warnings?

2009 **2010**

☐₁ Yes ☐₁
☐₂ No ☐₂

Q32. If not, why not?

(a) **2009:** _____

(b) **2010:** _____

Q33. How do you see the role of the National Crisis Management Centre?

Q34. What are the procedures to move from normal to crisis management in your organisation?

Q35. What implications exist for transferring the decision making authority and resources to the NCMC and local EOC's?

Q36. Was there any accountability issues?

2009 2010
☐₁ Yes ☐₁
☐₂ No ☐₂

Q36. If so, what were these issues?

(a) **2009:** _____

(b) **2010:** _____

Q37. How many people from your organisation were involved?

2009: _____ **2010:** _____

Q38. What were their roles and responsibilities?

(a) **2009:** _____

(b) **2010:** _____

Risk Communication

Q39. Did you have to work with other organisations directly in a coordinated manner during the response to these tsunami warnings (i.e. CIMS)?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q40. Have you trained with these people before these events occurred?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q41. Where did they fit in with the chain of command and information sharing/dissemination during these events?

(a) **2009:** _____

(b) **2010:** _____

Q42. Where did they receive this information and from whom did they receive it?

(a) **2009:** _____

(b) **2010:** _____

Q43. What was in the information you received?

(a) **2009:** _____

(b) **2010:** _____

Q44. Was the information disseminated in a timely fashion so response could be carried out without causing undue panic, stress, etc?

2009 2010

☐₁ Yes ☐₁

☐₂ No ☐₂

Q44(a). If no, explain:

(i) **2009:** _____

(ii) **2010:** _____

Q45. How did this information relate to your role and area of responsibility?

(a) **2009:** _____

(b) **2010:** _____

Q46. With your role and responsibilities, were they dependent on relationships with others (i.e. emergency service communications centres, EOC's)?

| 2009 | | 2010 |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |

Q46(a). If not, why not?

(i) **2009:** _____

(ii) **2010:** _____

Q46(b). If so, who were you dependent on?

(i) **2009:** _____

(ii) **2010:** _____

Q47. Were you able to provide information?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q47. If so, what information was you able to supply that would have been beneficial to the response?

(a) **2009:** _____

(b) **2010:** _____

Q48. Did other agencies/organisations/individuals rely on you for information or input?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q48. If so, who relied on you for information or input?

(a) **2009:** _____

(b) **2010:** _____

Q50. Did agencies / organisations / individuals require input from multiple information sources to make decisions during the warning phase?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q50. If yes, what sources did you require information from?

(a) **2009:** _____

(b) **2010:** _____

Q51. Was the information disseminated in a timely manner to enable responses to occur during the tsunami warnings?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q51. If not, why not?

(a) **2009:** _____

(b) **2010:** _____

Q52. Was the stand down from the tsunami warnings issued in a timely manner to allow a return to normal?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q52. If not, why not?

(a) **2009:** _____

(b) **2010:** _____

Inter-Agency Communication and Coordination

Q53. What method(s) were used to communicate between the responding organisations?

| 2009: | 2010: |
|---|---------------------------------------|
| <input type="checkbox"/> ₁ Radio-Telephone | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ Telephone | <input type="checkbox"/> ₂ |
| <input type="checkbox"/> ₃ Fax | <input type="checkbox"/> |
| <input type="checkbox"/> ₄ Email | <input type="checkbox"/> |
| <input type="checkbox"/> ₅ Face-to-Face | <input type="checkbox"/> |

Q54. What were your expectations of responding organisations to the tsunami warnings (i.e. type of response, timing)?

(a) **2009:** _____

(b) **2010:** _____

Q55. Did you know what the roles and responsibilities were for the other agencies responding to the tsunami warnings?

| 2009 | 2010 |
|---|---------------------------------------|
| <input type="checkbox"/> ₁ Yes | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ No | <input type="checkbox"/> ₂ |

Q55. If not, why not?

(a) **2009:** _____

2010: _____

Q56. Was communication coordinated for the whole response, or on an individual/organisational basis?

2009 2010

☐₁ Yes ☐₁

☐₂ No ☐

Q56. If not, why not?

(a) **2009:** _____

(b) **2010:** _____

Q57. Was the method used to evacuate during the tsunami warning adequate for a response to occur within a timely manner?

2009 2010

☐₁ Yes ☐₁

☐₂ No ☐₂

Q57. If not, why not?

(a) **2009:** _____

(b) **2010:** _____

Q58. What warning systems did you use to warn your community of the potential tsunami threat in September 2009 and February 2010?

2009 2010

☐₁ Face-to-Face ☐

☐₂ Warning Siren ☐₂

☐₃ PA System ☐₃

☐₄ Door Knocking ☐₄

| | | |
|---------------------------------------|----------------|---------------------------------------|
| <input type="checkbox"/> ₅ | Telephone Tree | <input type="checkbox"/> ₅ |
| <input type="checkbox"/> ₆ | Text Message | <input type="checkbox"/> ₆ |
| <input type="checkbox"/> ₇ | Other | <input type="checkbox"/> |

If other (*please explain*):

2009: _____

2010: _____

Q59. Did you have any issues with warning and/or notification systems you used?

| | | |
|-------------|--|-------------|
| 2009 | | 2010 |
|-------------|--|-------------|

| | | |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
|---------------------------------------|-----|---------------------------------------|

| | | |
|---------------------------------------|----|---------------------------------------|
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |
|---------------------------------------|----|---------------------------------------|

Q59. If yes, explain the issues you had.

(a) **2009:** _____

(b) **2010:** _____

Q60. Was there a response plan for tsunami warnings for your organisation?

| | | |
|-------------|--|-------------|
| 2009 | | 2010 |
|-------------|--|-------------|

| | | |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
|---------------------------------------|-----|---------------------------------------|

| | | |
|---------------------------------------|----|---------------------------------------|
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |
|---------------------------------------|----|---------------------------------------|

Q60(a) If yes, did you know the plan?

| | | |
|-------------|--|-------------|
| 2009 | | 2010 |
|-------------|--|-------------|

| | | |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
|---------------------------------------|-----|---------------------------------------|

| | | |
|---------------------------------------|----|---------------------------------------|
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |
|---------------------------------------|----|---------------------------------------|

Q60(b). If not, why not?

Q60(c). If yes, are they useful for future, all-hazard events?

| 2009 | | 2010 |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |

Q60(d). If not, why not?

Q61. Were there any planning issues that you are aware of for both the 2009 and 2010 tsunami warnings?

| 2009 | | 2010 |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |

Q61(a). If yes, explain what these issues are:

Q62. Were there any educational or training issues that could improve your response to multi-agency incidents? Explain.

| 2009 | | 2010 |
|---------------------------------------|-----|---------------------------------------|
| <input type="checkbox"/> ₁ | Yes | <input type="checkbox"/> ₁ |
| <input type="checkbox"/> ₂ | No | <input type="checkbox"/> ₂ |

If yes, explain:

(a) **2009:**

(b) **2010:**

Q63. Do you see a need for future training or multi-agency exercises to improve response to future tsunami warnings?

☐₁ Yes

☐₂ No

Q63(a). If yes, what type of training and/or exercises do you think you need to conduct?

Q64. Were there any issues with the chain of command with either or both of the tsunami warnings?

2009 2010

☐₁ Yes ☐₁

☐₂ No ☐₂

Q64. If yes, can you identify the issues you had with the chain of command?

(a) **2009:** _____

(b) **2010:** _____

Q65. Some organisations have a loss of skills and knowledge when experienced staff leave your organisation. Was this a problem for your organisation in either **2009 or 2010**?

2009 2010

☐₁ Yes ☐₁

☐₂ No ☐₂

Q65(a). If yes, do you have any suggestions on improving this situation?

Q66. Did you have any formal training or education before the tsunami warnings were issued?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q66(a). If not, why not?

Q67. Did your role in response to the tsunami warnings have any benefits for your routine work duties or for the organisation?

2009 **2010**

☐₁ Yes ☐₁

☐₂ No ☐₂

Q67(a). If yes, can you explain what these benefits are?

Q68. What training issues arose that indicated improvements in the response capability of your organisation?

(a) **2009:** _____

(b) **2010:** _____

Q69. Do you have any ideas about the frequency of future training needs / education / exercises (i.e. how often you should train for multi-agency, all-hazard incidents?

☐₁ Every 3 months ☐ ₂ Every 6 months ☐ ₃ Every 9 months

☐ ₄ Every 12 months ☐ ₅ Every 18 months ☐ ₆ Never

Q70. Explain what you have learned from these two events for your organisation?

Q71. Explain what you have learned from these two events for your personal development?

Q72. Will you use these experiences as the basis for your future development in the role of emergency responder?

☐ ₁ Yes

☐ ₂ No

Q72(a). If yes, how will you use these experiences?

Q72(b). If not, why not?

Q73. What key roles do you think the emergency operations centres play in a ***declared*** warning situation? (***Please tick ☒ all that apply***)

- ☐ ₁ Coordination of resources
- ☐ ₂ Liaise with responding agencies
- ☐ ₃ Make policies
- ☐ ₄ Gather information
- ☐ ₅ Provide information to the public
- ☐ ₆ Host visitors to the centre
- ☐ ₇ Liaise with emergency service communication centres
- ☐ ₈ Request responses from emergency services (fire, police, etc)
- ☐ ₉ Mobilise emergency service resources (fire, police, ambulance, etc)

Appendix 3: Copy of the initial Pacific Tsunami Warning Centre “Tsunami Warning” 30th September, 2009, 1804Z. All countries that received this message showing projected wave arrival times have been removed, except New Zealand, for this thesis.

TSUNAMI BULLETIN NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1804Z 29 SEP 2009

THIS BULLETIN APPLIES TO AREAS WITHIN AND BORDERING THE
PACIFIC OCEAN AND ADJACENT SEAS...EXCEPT ALASKA...BRITISH
COLUMBIA...
WASHINGTON...OREGON AND CALIFORNIA.

... A TSUNAMI WARNING AND WATCH ARE IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

AMERICAN SAMOA / SAMOA / NIUE / WALLIS-FUTUNA / TOKELAU /
COOK ISLANDS / TONGA / TUVALU / KIRIBATI / KERMADec IS /
FIJI / HOWLAND-BAKER / JARVIS IS. / **NEW ZEALAND** / FR.
POLYNESIA / PALMYRA IS.

A TSUNAMI WATCH IS IN EFFECT FOR

VANUATU / NAURU / MARSHALL IS. / SOLOMON IS. / JOHNSTON
IS. / NEW CALEDONIA / KOSRAE / PAPUA NEW GUINEA / HAWAII
/ POHNPEI / WAKE IS. / PITCAIRN / MIDWAY IS.

FOR ALL OTHER AREAS COVERED BY THIS BULLETIN... IT IS FOR
INFORMATION ONLY AT THIS TIME.

**THIS BULLETIN IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES.
ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE
AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE
OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN
RESPONSE.**

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY
PARAMETERS

ORIGIN TIME - 1748Z 29 SEP 2009
COORDINATES - 15.3 SOUTH 171.0 WEST
DEPTH - SHALLOWER THAN 100 KM
LOCATION - SAMOA ISLANDS REGION
MAGNITUDE - 7.9

EVALUATION

IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS
WARNING IS BASED ONLY ON THE EARTHQUAKE EVALUATION. AN
EARTHQUAKE OF THIS SIZE HAS THE POTENTIAL TO GENERATE A
DESTRUCTIVE TSUNAMI THAT CAN STRIKE COASTLINES NEAR THE
EPICENTER WITHIN MINUTES AND MORE DISTANT COASTLINES

WITHIN HOURS. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THIS CENTER WILL MONITOR SEA LEVEL DATA FROM GAUGES NEAR THE EARTHQUAKE TO DETERMINE IF A TSUNAMI WAS GENERATED AND ESTIMATE THE SEVERITY OF THE THREAT.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WARNING AND WATCH AREAS ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.

| LOCATION TIME | FORECAST POINT | COORDINATES | ARRIVAL TIME |
|------------------|----------------|--------------|-----------------|
| NEW ZEALAND | EAST CAPE | 37.7S 178.5E | 2044Z |
| 29 SEP | | | |
| | GISBORNE | 38.7S 178.0E | 2100Z |
| 29 SEP | | | |
| | NORTH CAPE | 34.4S 173.3E | 2112Z |
| 29 SEP | | | |
| | NAPIER | 39.5S 176.9E | 2140Z |
| 29 SEP | | | |
| | WELLINGTON | 41.3S 174.8E | 2150Z |
| 29 SEP | | | |
| | AUCKLAND(E) | 36.7S 175.0E | 2212Z |
| 29 SEP | | | |
| | AUCKLAND(W) | 37.1S 174.2E | 2239Z |
| 29 SEP | | | |
| | LYTTELTON | 43.6S 172.7E | 2255Z |
| 29 SEP | | | |
| | NEW PLYMOUTH | 39.1S 174.1E | 2317Z |
| 29 SEP | | | |
| | NELSON | 41.3S 173.3E | 2323Z |
| 29 SEP | | | |
| | DUNEDIN | 45.9S 170.5E | 2331Z |
| 29 SEP | | | |
| | MILFORD SOUND | 44.6S 167.9E | 2358Z |
| 29 SEP | | | |
| | WESTPORT | 41.8S 171.6E | 2359Z |
| 29 | | | |

BULLETINS WILL BE ISSUED HOURLY OR SOONER IF CONDITIONS WARRANT.

THE TSUNAMI WARNING AND WATCH WILL REMAIN IN EFFECT UNTIL FURTHER NOTICE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE PRODUCTS FOR ALASKA...BRITISH COLUMBIA...WASHINGTON...OREGON...CALIFORNIA.

Appendix 4: Copy of the Pacific Tsunami Warning Centre “Tsunami Warning” 27th February, 2010, 1045Z (NZDT). All countries that received this message showing projected wave arrival times have been removed, except New Zealand, for this thesis.

TSUNAMI BULLETIN NUMBER 005
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1045Z 27 FEB 2010

THIS BULLETIN APPLIES TO AREAS WITHIN AND BORDERING THE
PACIFIC OCEAN AND ADJACENT SEAS...EXCEPT ALASKA...BRITISH
COLUMBIA...
WASHINGTON...OREGON AND CALIFORNIA.

... A WIDESPREAD TSUNAMI WARNING IS IN EFFECT ...

A TSUNAMI WARNING IS IN EFFECT FOR

CHILE / PERU / ECUADOR / COLOMBIA / ANTARCTICA / PANAMA /
COSTA RICA / NICARAGUA / PITCAIRN / HONDURAS / EL SALVADOR
/ GUATEMALA / FR. POLYNESIA / MEXICO / COOK ISLANDS /
KIRIBATI / KERMADec IS / NIUE / **NEW ZEALAND** / TONGA /
AMERICAN SAMOA / SAMOA / JARVIS IS. / WALLIS-FUTUNA /
TOKELAU / FIJI / AUSTRALIA / HAWAII / PALMYRA IS. /
TUVALU / VANUATU / HOWLAND-BAKER / NEW CALEDONIA /
JOHNSTON IS. / SOLOMON IS. / NAURU / MARSHALL IS. /
MIDWAY IS. / KOSRAE / PAPUA NEW GUINEA / POHNPEI / WAKE
IS. / CHUUK / RUSSIA / MARCUS IS. / INDONESIA / N.
MARIANAS / GUAM / YAP / BELAU / JAPAN / PHILIPPINES /
CHINESE TAIPEI

**THIS BULLETIN IS ISSUED AS ADVICE TO GOVERNMENT AGENCIES.
ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE
AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE
OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN
RESPONSE.**

**AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY
PARAMETERS**

ORIGIN TIME - 0634Z 27 FEB 2010
COORDINATES - 36.1 SOUTH 72.6 WEST
DEPTH - 55 KM
LOCATION - NEAR COAST OF CENTRAL CHILE
MAGNITUDE - 8.8

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

| GAUGE LOCATION | LAT | LON | TIME | AMPL |
|----------------|-------|-------|-------|-------|
| PER | | | | |
| ----- | ----- | ----- | ----- | ----- |
| ----- | | | | |

| | | | | |
|--------------------------|-------|-------|-------|---------------|
| IQUIQUE CL 72MIN | 20.2S | 70.1W | 0906Z | 0.27M / 0.9FT |
| ANTOFAGASTA CL 52MIN | 23.2S | 70.4W | 0941Z | 0.49M / 1.6FT |
| ARICA CL 44MIN | 18.5S | 70.3W | 1007Z | 0.94M / 3.1FT |
| DART LIMA 32412 36MIN | 18.0S | 86.4W | 0941Z | 0.24M / 0.8FT |
| CALDERA CL 20MIN | 27.1S | 70.8W | 0843Z | 0.45M / 1.5FT |
| TALCAHUANO CL 88MIN | 36.7S | 73.4W | 0653Z | 2.34M / 7.7FT |
| COQUIMBO CL 30MIN | 30.0S | 71.3W | 0852Z | 1.32M / 4.3FT |
| CORRAL CL 16MIN | 39.9S | 73.4W | 0739Z | 0.90M / 2.9FT |
| SAN FELIX CL 08MIN | 26.3S | 80.1W | 0815Z | 0.53M / 1.7FT |
| VALPARAISO CL 20MIN | 33.0S | 71.6W | 0708Z | 1.29M / 4.2FT |

LAT - LATITUDE (N-NORTH, S-SOUTH)
 LON - LONGITUDE (E-EAST, W-WEST)
 TIME - TIME OF THE MEASUREMENT (Z IS UTC IS GREENWICH TIME)
 AMPL - TSUNAMI AMPLITUDE MEASURED RELATIVE TO NORMAL SEA LEVEL.
 IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
 VALUES ARE GIVEN IN BOTH METERS(M) AND FEET(FT).
 PER - PERIOD OF TIME IN MINUTES(MIN) FROM ONE WAVE TO THE NEXT.

EVALUATION

SEA LEVEL READINGS CONFIRM THAT A TSUNAMI HAS BEEN GENERATED WHICH COULD CAUSE WIDESPREAD DAMAGE. AUTHORITIES SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS THREAT. THIS CENTER WILL CONTINUE TO MONITOR SEA LEVEL DATA TO DETERMINE THE EXTENT AND SEVERITY OF THE THREAT.

A TSUNAMI IS A SERIES OF WAVES AND THE FIRST WAVE MAY NOT BE THE LARGEST. TSUNAMI WAVE HEIGHTS CANNOT BE PREDICTED AND CAN VARY SIGNIFICANTLY ALONG A COAST DUE TO LOCAL EFFECTS. THE TIME FROM ONE TSUNAMI WAVE TO THE NEXT CAN BE FIVE MINUTES TO AN HOUR, AND THE THREAT CAN CONTINUE FOR MANY HOURS AS MULTIPLE WAVES ARRIVE.

FOR ALL AREAS - WHEN NO MAJOR WAVES ARE OBSERVED FOR TWO HOURS AFTER THE ESTIMATED TIME OF ARRIVAL OR DAMAGING WAVES HAVE NOT OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN CONTINUE FOR SEVERAL HOURS DUE TO RAPID CURRENTS. AS LOCAL CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT FORECAST POINTS WITHIN THE WARNING AND WATCH AREAS ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN SUCCESSIVE WAVES CAN BE FIVE MINUTES TO ONE HOUR.

| LOCATION TIME | FORECAST POINT | COORDINATES | ARRIVAL TIME |
|------------------|----------------|--------------|-----------------|
| ----- | ----- | ----- | ----- |
| NEW ZEALAND | EAST CAPE | 37.7S 178.5E | 1918Z |
| 27 FEB | | | |
| | GISBORNE | 38.7S 178.0E | 1922Z |
| 27 FEB | | | |
| | DUNEDIN | 45.9S 170.5E | 1952Z |
| 27 FEB | | | |
| | NAPIER | 39.5S 176.9E | 1954Z |
| 27 FEB | | | |
| | WELLINGTON | 41.3S 174.8E | 1955Z |
| 27 FEB | | | |
| | MILFORD SOUND | 44.6S 167.9E | 2005Z |
| 27 FEB | | | |
| | NORTH CAPE | 34.4S 173.3E | 2010Z |
| 27 FEB | | | |
| | BLUFF | 46.6S 168.3E | 2030Z |
| 27 FEB | | | |
| | LYTTELTON | 43.6S 172.7E | 2040Z |
| 27 FEB | | | |
| | AUCKLAND(E) | 36.7S 175.0E | 2056Z |
| 27 FEB | | | |
| | NELSON | 41.3S 173.3E | 2127Z |
| 27 FEB | | | |
| | WESTPORT | 41.8S 171.6E | 2129Z |
| 27 FEB | | | |
| | AUCKLAND(W) | 37.1S 174.2E | 2140Z |
| 27 FEB | | | |
| | NEW PLYMOUTH | 39.1S 174.1E | 2219Z |
| 27 FEB | | | |

BULLETINS WILL BE ISSUED HOURLY OR SOONER IF CONDITIONS WARRANT.
THE TSUNAMI WARNING WILL REMAIN IN EFFECT UNTIL FURTHER NOTICE.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE PRODUCTS FOR ALASKA...BRITISH COLUMBIA...WASHINGTON...OREGON...CALIFORNIA.

Appendix 5: Copy of the NZFS Tsunami Alert System Issued for Fire Service Personnel on 30th September, 2009.

Email from NZFS Representative at the NCMC:

Sent: Wednesday, 30 September 2009 09:05
Subject: TSUNAMI WARNING
Importance: High

NZFS TSUNAMI CODE RED WARNING

NATIONAL TSUNAMI CODE RED WARNING FOR THE FOLLOWING REGIONS:

**EASTERN
BAY WAIKATO**

ACTION:

**IMPLEMENT LOCAL PROCEDURES
REPORT ANY INUNDATIONS TO NATIONAL
COMMANDER'S GROUP VIA COMCEN or
NZFS1_NCMC@FIRE.ORG.NZ
THIS MESSAGE HAS BEEN SENT BY PAGER TO THE
REGIONS LISTED ABOVE**

ADDITIONAL INFORMATION SHOWN BELOW:

Estimated wave arrival times and wave heights:
The time of arrival of the first wave to impact on New Zealand coastal area(s) is estimated to be at: 0922 NZDT at Bay of Plenty/East Cape

According to information received, a tsunami of 1.5m was generated in Samoa as a result of this earthquake. Waves can be expected to be smaller in New Zealand, estimated at 1m at the East Coast and Bay of Plenty. Wave heights outside of these regions will be advised as soon as possible, but territorial authorities may need to extrapolate using this initial information. It is unlikely that they will need to consider a wave of any height higher than 1m.

Note: Historical records have shown that arrival times may be 60 minutes earlier or later than estimated, and that the first wave may not be the largest. Waves may manifest in a series of waves that can be dangerous for several hours.

Downgrade issued by NZFS Representative at NCMC:

Sent: Wednesday, 30 September 2009 11:10

Subject: TSUNAMI WARNING DOWNGRADE to CODE AMBER

CODE AMBER – NZFS TSUNAMI WARNING DOWNGRADE

NATIONAL TSUNAMI CODE AMBER MESSAGE FOR THE FOLLOWING REGIONS:

**EASTERN
BAY WAIKATO**

ACTION:

REMAIN VIGILANT AND MONITOR COMMUNICATION CHANNELS

FURTHER INFORMATION FROM MCDEM

A wave recording of 40cm was recorded at the East Cape tidal gauge. However, the first wave is sometimes not the largest. We recommend local areas remain vigilant. The threat of strong currents also remains.

.....

Sent: Wednesday, 30 September 2009 11:16

To: MCDEM Comms

Subject: National Advisory – Tsunami: Potential threat to NZ

National Advisory Tsunami Potential Threat to NZ

No: 05

Action: Refer to fax or email.

Tsunami advisory in effect:

There is still a potential threat of a tsunami impacting on New Zealand coastlines.

This tsunami advisory will remain in effect until a cancellation message is issued by the Ministry of Civil Defence & Emergency Management.

Analysis of threat:

The Ministry of Civil Defence & Emergency Management (MCDEM) is assessing information further with the assistance of scientific advisors. There has been a wave reading at Raol Island that indicates there is another wave which is larger than the first. Initial estimates of this second wave are a maximum height of one metre. This wave is likely to impact the East Cape at 1115 hours NZDT on 30 September 2009. Scientific advice is that there may be further waves.

The Pacific Tsunami Warning Centre (PTWC) has cancelled the warning for New Zealand. However, our advice is to remain in potential threat mode.

NCMC status: The National Crisis Management Centre is activated.

Next steps:

Subsequent information or a cancellation message will follow this Advisory via the National Warning System.

Issued by: Message 169 authorized by the National Controller, Civil Defence Emergency Management.

.....
Copy of Email sent by NZFS Representative at the NCMC to NZFS Personnel:

Sent: Wednesday, 30 September 2009 13:28
Subject: Tsunami alert update

This is a general update FYI.

NZFS warning alert status remains at **AMBER** for the coastal areas of the Bay-Waikato and Eastern Fire Regions.

.....
Cancellation sent from NZFS Representative at NCMC to NZFS Personnel:

Sent: Wednesday, 30 September 2009 15:32
Subject: Code Green- Tsunami Cancellation Message

CODE GREEN – NZFS TSUNAMI WARNING CANCELLATION

**NATIONAL TSUNAMI CODE GREEN MESSAGE FOR THE
FOLLOWING REGIONS:**

**EASTERN
BAY WAIKATO**

ACTION:

STAND DOWN LOCAL ACTIVITIES

Appendix 6: Copy of the NZFS Tsunami Alert System Issued for Fire Service Personnel on 28th February, 2010.

First of several Code Red alerts sent by NZFS Representative at the NCMC to NZFS Personnel:

Sent: Sunday, 28 February 2010 01:16

Subject:

TSUNAMI - NATIONAL WARNING CODE RED

EASTERN REGION AND SOUTHERN - NOTE ARRIVAL TIMES AND COMMENTS FOR YOUR REGIONS - BELOW IN RED

Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

A tsunami warning is in effect for New Zealand:

The tsunami warning will remain in effect until a cancellation message is issued by MCDEM.

An earthquake has occurred with these parameters:

| | |
|---------------|-----------------------------|
| Origin time: | 0634Z 27 FEB 2010 |
| NZ time: | 1934 NZDT 27 FEB 2010 |
| Co-ordinates: | 36.1 SOUTH 72.6 WEST |
| Depth: | 55 KM |
| Location: | NEAR COAST OF CENTRAL CHILE |
| Magnitude: | 8.8 |

The above magnitude is provisional and may be increased or decreased as more seismic data becomes available.

Summary:

The Pacific Tsunami Warning Centre (PTWC) has issued a Tsunami Warning in response to the above earthquake.

Only messages issued by MCDEM represent the official warning status for New Zealand. Local civil defence authorities may supplement these messages by applying local threat assessments.

Confirmation has been received that a tsunami was generated. A wave measuring 2.34 metres was measured in Talcahuano, Chile.

The first wave to arrive to New Zealand will be in the areas around Chatham Islands (Waitangi) at approximately 0705 NZDT, Sunday 28 February 2010. The first wave may arrive later and may not be the largest. Strong currents and unusual tidal effects may continue for several hours.

Based on preliminary modelling and comparison with historical events the interpretation of the Tsunami Experts Panel is that a marine threat (i.e. threat to beach and small boats) exists for the entire east coasts of the North and South Islands from Puysegur around to Cape Reinga and extending south to Ahipara. Some land threat also exists (i.e. wave heights between 1 and 3 metres) for the Chatham Islands and Banks Peninsula. Wave height refers to maximum water level relevant to the normal sea level at the beach. This does not take tides into account. Based on historical events it is expected that the greatest wave heights will occur between 6 and 12 hours after the initial arrivals.

People in coastal areas should:

1. Stay off beaches
2. Stay out of the water (sea, rivers and estuaries, including boating activities)
3. Do not go sightseeing
4. Share this information with family, neighbours and friends
5. Listen to the radio and/or TV for updates
6. Follow instructions of your local Civil Defence authorities.

MCDEM and scientific advisors are closely monitoring the situation to determine the severity of the threat to New Zealand.

This warning has been issued to all local civil defence authorities, emergency services, other agencies and media.

Information for emergency managers:

Estimates of expected wave arrival times are as follows:

Note: These times are provisional and based on the best

information available. Arrival times may be as much as one hour later and may be adjusted in subsequent messages.

| Location | Estimated Wave Arrival Time |
|-----------------------------------|------------------------------------|
| Chatham Islands-Kaingaroa | 0722 NZDT 28 February 2010 |
| Chatham Islands-Waitangi | 0705 NZDT 28 February 2010 |
| North Cape | 0854 NZDT 28 February 2010 |
| Whangarei | 0915 NZDT 28 February 2010 |
| Auckland (North Head) | 1022 NZDT 28 February 2010 |
| Mt Maunganui | 0834 NZDT 28 February 2010 |
| East Cape | 0754 NZDT 28 February 2010 |
| Gisborne | 0759 NZDT 28 February 2010 |
| New Plymouth | 1056 NZDT 28 February 2010 |
| Napier | 0823 NZDT 28 February 2010 |
| Wanganui | 0949 NZDT 28 February 2010 |
| Wellington | 0825 NZDT 28 February 2010 |
| Nelson | 1005 NZDT 28 February 2010 |
| Marlborough Sounds (Tory Channel) | 0838 NZDT 28 February 2010 |
| Westport | 1008 NZDT 28 February 2010 |
| Greymouth | 0950 NZDT 28 February 2010 |
| Christchurch (New Brighton) | 0905 NZDT 28 February 2010 |
| Timaru | 0837 NZDT 28 February 2010 |
| Milford Sound | 0905 NZDT 28 February 2010 |
| Dunedin | 0829 NZDT 28 February 2010 |
| Bluff | 0858 NZDT 28 February 2010 |
| Stewart Island | 0921 NZDT 28 February 2010 |

Local civil defence emergency management is advised to:

1. Activate appropriate response arrangements
2. Alert potentially at-risk communities as appropriate
3. Stand by for further information
4. Inform the NCMC of actions taken.

Local emergency services should act in coordination with local Civil Defence Emergency Management.

MCDEM has activated the Memorandum of Understanding (MoU) with public broadcasters to broadcast this warning.

Sent: Sunday, 28 February 2010 17:29

Subject: FW: National Advisory - Tsunami remains in effect overnight
UPDATE 17

**NATIONAL ADVISORY CODE AMBER – POTENTIAL
TSUNAMI THREAT: Remains in effect overnight**

No: 17

Issued at 1710 hours on 28 February 2010.

**Issued by the Ministry of Civil Defence & Emergency
Management (MCDEM).**

A tsunami advisory is in effect for New Zealand:

The tsunami advisory will remain in effect until a cancellation message is issued by MCDEM.

Summary:

Monitored tidal gauges continue to show wave action of up to 1 metre on the east coast of the North and South Islands and at the Chatham Islands. There is no indication of any decrease in wave amplitude.

Scientific advice is that there is still a likelihood of surges and rapid sea level changes over the 24 hours after the initial wave arrivals. Wave heights could be larger than what we have currently experienced but within the threat levels and wave height estimates that have been previously forecast. The Ministry of Civil Defence & Emergency Management will keep the advisory in place overnight and will review this at 0800 hours on Monday 1 March 2010.

Strong currents could still be expected in harbours and restricted waterways. The Chatham Islands and Banks Peninsula could still expect wave heights of between 1 and 3 metres. The risks to people in boats and on beaches for coastal communities in the east coast of the North and South Island and particularly Chatham Islands and Banks Peninsula remains.

Only messages issued by MCDEM represent the official warning status for New Zealand. Local civil defence authorities may supplement these messages by applying a local threat assessment.

Sent: Monday, 1 March 2010 08:42

Subject: FW: National Advisory: Tsunami- Potential Threat to NZ
CANCELLATION

National Advisory: Tsunami code green

Potential threat to New Zealand Cancellation - Advisory now cancelled

issued at 0835 hours on 01/03/2010.

Issued by the Ministry of Civil Defence & Emergency Management (MCDEM).

Tsunami advisory cancelled:00.

Based on scientific assessment a decision has been made to cancel the Tsunami Advisory in place over night. Sea level data indicate the peak of activity has passed. There will be ongoing sea level fluctuations and tidal effects for the rest of the day throughout the country. People are advised to continue to take caution in coastal areas.

Summary:

This is the last message via the national warning system for this event.

This cancellation message has been issued to all local civil defence authorities, emergency services, other agencies and media.

This cancellation message is also being sent to the media.

NCMC status:

The National Crisis Management Centre (NCMC) is standing down from 0900 hours on 01/03/2010.