

Disaster waste management: New Zealand experiences and future planning

EQC Project 10/U608

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April 2012

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1 Introduction

In April 2010, I was awarded an EQC grant to carry out a hypothetical case study on the likely waste management challenges facing Wellington following a large scale earthquake as part of my PhD research on Disaster Waste Management. As a result of the Christchurch earthquakes and my involvement in the response effort I abandoned plans to carry out the Wellington case study.

As an alternative use of the EQC grant, as outlined in my funding amendment proposal (dated November 2011), I proposed that I undertake some field work in the north island. The field work would not just inform my PhD research but would also be used in the development of some national disaster waste management guidelines which I have been engaged (by Environment Canterbury / Ministry of Civil Defence and Emergency Management) to write. Specifically the aims of the field work were:

- To learn from communities that had dealt with small scale disasters;
- To disseminate the findings of my research and to encourage councils / CDEM groups to plan for management of disaster waste; and
- To ensure the proposed guidelines are transferable to different scale and types of events.

The two week field trip was carried out between 1 -16 March 2012. I targeted local regions which had recently (within the last 20 years) dealt with waste producing civil defence emergencies. The persons interviewed were a mix of contractors and regional and local council staff involved in both waste management and emergency management. In total 22 persons were met with in 8 regions. Table 1 below shows the locations visited and the corresponding disaster event¹. The number of persons interviewed is also indicated. In accordance with the research approval gained from the University of Canterbury Human Ethics Committee I have not included the names of the participants (or companies where it may identify the participants). If necessary, approval could be sought from the interviewees for their names to be released. Summaries of the field work, by location, are included in Section 2.

¹ Note that in my proposal I indicated I would visit Whakatane to discuss the 2004 flooding; however, I was unsuccessful in arranging a meeting with anyone.

At the end of the field trip, I held a full day seminar in Wellington. The seminar was divided into two sessions: Session 1) Operational Management and Planning and Session 2) Policy and Planning. The Wellington seminar is summarised in Section 3.

In addition to the above work I was also able to use some of the grant to fund travel and accommodation to co-facilitate a workshop at the WasteMINZ conference in Hastings. This is outlined briefly in Section 4.

Last, the key research findings as well as suggested guidelines improvements are discussed in Section 5.

Table 1 Field trip schedule

Date	Location	Disaster event	Organisation (and number of persons interviewed*)
1-Mar	Auckland	2011 Albany tornado	Auckland Council (1 in person, 1 by phone)
2-Mar	Auckland		
3-Mar			
4-Mar			
5-Mar	Tauranga	2011 Rena oil spill	Contractors (2)
6-Mar			
7-Mar	Gisborne	2007 earthquake and 2011 Rena oil spill	Gisborne District Council (4)
8-Mar	Hawke's Bay	2011 flooding	Central Hawke's Bay District Council (3)
9-Mar			
10-Mar			
11-Mar			
12-Mar	Ruapehu	1995 eruption	Rotorua District Council (3)
13-Mar	Taranaki	2011, 2007 tornadoes	New Plymouth District Council (5) and Taranaki Regional Council (1)
14-Mar	Manawatu	2004 Manawatu / Ragitikei / Wanganui floods	Horizons Regional Council (1)
15-Mar	Wellington	Disaster Waste Management Seminar - Wellington	25 participants from a range of local and territorial authorities, contracting companies and consultancies.
16-Mar	Wellington	n/a	Hutt City Council (1)

* Note that the names and positions of interviewed persons has not been included in accordance with the University of Canterbury Human Ethics Committee approved research approach. If necessary approval could be sought from the participants to release their names.

Note that a report from the Christchurch earthquakes has not been included here as a full length case study analysis has been carried out as part of my PhD thesis. This report will be available publicly later this year.

2 Disaster and location summaries

2.1 Auckland

2.1.1 2011 Albany tornado

In general the waste generated from the 2011 Albany tornado was small in quantity. The major damage was on commercial properties with minor damage through a residential area. The majority of commercial debris was managed through insurance and property owner arrangements. Some skip bins were provided in residential areas for the mainly vegetative debris and small structural items (e.g. roof irons, garden furniture). Council waste contractors also cleared some debris from public areas (including roads and reserves). 1.62 tonnes were collected. There appeared to be some confusion over whether or not waste on private property was Council responsibility or not. It appeared that Civil Defence personnel and waste management personnel had differing views.

Costs for managing the waste were claimed back by Civil Defence through national disaster funds.

2.1.2 2012 Glen Eden floods

About one week before my visit to Auckland, a community in Glen Eden, Auckland, was flooded after heavy rainfall and the subsequent failure of a major stormwater pipe. The event was highly localised and no state of emergency was declared. The event was heavily publicised, likely due to a major contributing factor being the suspected failure of a council service. The affected residents were largely uninsured and residents used the media coverage to appeal for assistance with the clean-up.

Auckland Council, facilitated by the Civil Defence team, provided skip bins for the residents. Non-council contractors were employed to provide the skip bins and waste was disposed of at the council transfer station. Some waste separation was carried out at the transfer station. More than 18 skip bins and 3 large truck loads were collected over a period of several weeks which was greater than anticipated.

There is concern that residents are taking advantage of the free skip bins. Items from a damaged furniture store were collected and disposed of. However, prior to collection the contaminated furniture had to be 'slashed' to ensure they were not salvaged and reused. This was important

from a health and safety point of view (to ensure others would not inadvertently become exposed to contaminants) and as a requirement of insurers (to ensure the products would not re-enter the market after they had been written-off).

As there was no declared state of emergency the costs will not be recovered from national disaster funds.

It has been identified that there could have been better coordination between Council waste managers and Civil Defence personnel. Council waste managers will in the future be consulted in the early stages of waste collection (as opposed to just regarding disposal as in this case). This will allow for greater integration between the business-as-usual waste systems and disaster waste specific waste management approaches (including facilities and contractors).

2.1.3 Future planning

Lessons have been learnt from the responses to the above emergencies. The primary lesson is the need to develop and maintain relationships between waste management and emergency personnel.

While some thought has been put into contingency planning for waste management operations, there are currently no written plans for management of waste following a disaster event. Both civil defence and waste managers recognise that it is an important emergency management issue and are looking to include it in their respective plans.

2.2 Tauranga

2.2.4 2011 Rena Oil Spill

Maritime New Zealand has an established oil response operations plan, title the 'National Marine Oil Spill Contingency Plan'. Oil spill response preparedness is required under the international Oil Preparedness, Response and Co-operation 1990 (OPCR) Convention (Maritime New Zealand, 2011a). Maritime New Zealand has defined three levels of oil spill response: Tier 1, 2, and 3. Regional councils are required to prepare plans for Tier 2 responses and the National Marine Oil Spill Contingency Plan is prepared and maintained by Maritime New Zealand for Tier 3 response. The National Marine Oil Spill Contingency Plan includes details on the incident command system, roles and responsibilities, funding, response phases, health and safety, as well as technical spill containment, dispersal, and (marine and shore-line) collection techniques.

Within the Tier 3 plan is a short section devoted to management of oil spill waste. The section includes basic management principles, and disposal options.

As part of the planning and preparedness, Maritime New Zealand has developed a National Response Team (NRT) that is made up of 60 specialists trained in all aspects of oil spill response and sits above a broader team of 400 trained personnel from the 16 Regional Council areas. The NRT also has yearly meetings / exercises. It appears that the planning and training were useful tools for an effective response to the Rena Oil Spill, particularly in the development of relationships before the event.

The Rena oil spill was a Tier 3 response and therefore Maritime New Zealand established an Incident Command Centre to manage the response. Included in the ICC was a waste management team. Under the current arrangements, the costs incurred during the clean-up are recovered from the polluter (in this case the Rena's insurance company).

The waste team included representatives from both Tauranga City and Environment Bay of Plenty. These representatives were under Maritime New Zealand mandate but were still able to offer perspectives and knowledge from their business as usual role as well as local knowledge. This arrangement aided communication and relationships between the ICC and the regulatory authorities and appeared to work effectively. The biggest organisational challenge with this arrangement was the change of staff as personnel were required to periodically return to their business as usual roles.

The waste management operations primarily consisted of:

- Collection and disposal of oily beach waste (oil contaminated sand). This waste was collected in skip bins at designated hardstand areas (e.g. carparks) along the beach and taken to a local landfill. Approximately 1000 tonnes of oily waste was disposed of (Maritime New Zealand, 2011b).
- Establishment and operation of operating areas (including decontamination units, hand and boot washing facilities and portaloo). The decontamination units were designed, constructed and operated by local waste contractors.
- Disposal of personal protective equipment (worn by beach clean-up personnel). As for oily waste from the beach, this was collected in skips and taken to the landfill.

- Collection and treatment of wastewater from the wildlife rescue centre.

The beach clean-up itself was not organised by the waste team. Over 8,000 volunteers registered to help with the clean-up and 120 New Zealand Defence Force troops were on the ground at any one time (Maritime New Zealand, 2011b). Maritime New Zealand has their own health and safety team and there are stringent health and safety regulations to follow. There was a slight delay in mobilising volunteer teams after the oil came ashore as they needed to ensure all the appropriate PPE was available.

One of the 'advantages' of an oil spill over other disaster events is that there is a lead-in time before the oil reaches the shore and modelling also gives an approximate location where the oil will land and resources can be deployed to that site. The advantage in this case, however, was slightly reduced because the lead-in time fell on a Sunday and the logistics of organising extra equipment and PPE was difficult because business telephone numbers on record were not being answered or were answered overseas. Efforts had to be made to find contact details for through Company Directors from the Companies register. In future out of hours contact details will likely be included in the plan. In addition, it may be useful to have contact details in the response plan of contractors who are willing and able to be on call to any Maritime New Zealand requirements in future. Maritime New Zealand could also consider pre-approving contractors suitable to manage oil spill related wastes.

Oily waste disposal operations (the stages after the beach clean-up) were carried out by contractors. Shortly after the *Rena* stranding the ICC contacted two waste contracting companies. The contractors were asked to submit a statement of capabilities and a schedule of fees. The clean-up works were subsequently shared between the two companies to minimise costs and to support local businesses and labour. Generally the two companies worked well together, however there were some discrepancies between the approaches taken to certain tasks. For example, the design and operation of decontamination units differed between companies which was sometimes confusing (and potentially concerning) for clean-up personnel who were moving between clean-up sites. Most of the sites were managed by one contractor however at one of the sites the two contractors supplied different operations (vehicle wash and people decontamination unit). This created some confusion and resource duplication generated by the

two contractors looking after different aspects of the same site. Having one contractor manage each site so there was a single point of contact and responsibility is desirable.

Determining a disposal / treatment method for the oily waste was an important planning step. Primarily this decision involved determining the level of hazard in the waste and the cost and consent conditions of available and nearby disposal and treatment facilities. Since the oil was bunker oil (had never been used before) and was mostly mixed with sand, it was determined that Hampton Downs could accept the waste under existing resource consent conditions. The more expensive option of treatment was deemed too expensive. Land application in Taranaki and material reuse for roading applications was also considered. Land application was dismissed due to consent issues and the roading application option was discounted due to consent requirements for temporary storage, potential liability issues and the possibility of the material being rejected if it did not meet the required specifications. While the waste team could have used emergency powers to breach consents they wanted to avoid it if possible both for liability concerns and to avoid public discontentment.

The waste team issued a purchase order (signed off by the manager or the NOSC if over \$100,000) for works and the contractors submitted invoices at the end of the month. It was very important to have thorough records and invoices to enable Maritime New Zealand to claim expenses from the ship's insurance company. The procurement approach differed between the two contractors.

While the National Marine Oil Spill Contingency Plan outlines the activities that need to be carried out from the waste management perspective, many of the technical solutions had to be developed specific to the Rena response. For example there was an effort to clean equipment (spades/shovels/rakes) and PPE for reuse and find the appropriate cleaning agents to remove the oil. Equipment and PPE that was too heavily stained was disposed of.

Salvage operations (including container debris management) are the financial and operational responsibility of the ship owner in New Zealand. In this case, international salvage experts Svitzer were engaged to carry out the salvage works (remove the oil and containers from the ship) and Braemar Howells to arrange collection and disposal of the containers. In terms of containers there were 1,368 containers, including 121 with perishable foodstuffs and 32

containers with dangerous goods (Maritime New Zealand, 2011b). Some containers were washed ashore (from Coromandel round to Napier), some lost at sea, while others were salvaged and taken by barge to Tauranga Port. The containers were then taken to Te Maunga transfer station (managed by one of the waste contractors). A facility was designed and established to process the materials. All containers were logged on receipt and photographed. All the container contents were tracked (by weight) either to landfill disposal, chemical waste disposal, or beneficial reuse. It was the requirement of the container recovery salvage contractor that any goods from the containers which were able to be diverted from landfill to beneficial reuse must do so as a priority, and that any contents recovered for reuse or recycling must not be sold into a market which would compete with the market destination of the original contents. -For example, dimensional timber was chipped for boiler fuel or cut up for firewood before it could be on-sold.

The difference in responsibility between the container waste and the oily waste caused some confusion where container waste and containers had washed up onshore:

- 1) The organisational responsibility for this waste was unclear. For example, one contractor was sent to clean up the waste at a particular location by at least two different organisations;
- 2) The community did not understand the distinction of responsibilities and thus misdirected their frustration when there were delays in the container clean-up;
- 3) The international container recovery contractors carried out community consultation independently of local authorities, and Maritime New Zealand. This resulted in some duplication of consultation, conflicting messages and a significant impact on the recovery timeframe. For example, on 10 January, 12 containers washed up on both Waihi Beach and Matakana Beach. With collective and supportive dialogue between community and contractors at Waihi Beach, the containers were removed within two days. By comparison, on Matakana Island, the container and debris recovery took in excess of five weeks. The delay on Matakana Island was attributed to the local community desire and efforts to use local resources and equipment. (Note that it is unknown whether the delay in clearing materials had any negative effect on the environment, economy or on the community.); and
- 4) Public and environmental health hazards were, evidently, not always managed efficiently by the container recovery contractors. For example, in the early stages of the

container and debris recovery process the ICC waste team had to arrange for the collection and disposal of putrescible wastes from some containers.

It is interesting to note that in Australia the Maritime authority also includes management of container waste. This approach may be worth investigating further as the implications of mismanaged container waste will ultimately rest with Maritime New Zealand and regional authorities. In the case of the *Rena* the same contractors were working for both the Salvors and Maritime New Zealand, therefore including both streams of work under a single authority would have not impacted the operations but instead would have stream-lined the communication and coordination processes as well as giving responsibility to an entity with long-term vested interest in the quality of the work.

The importance of good communication was a key issue that arose in the interviews. Communication between Maritime New Zealand and the container/debris recovery contractor and with the public could have been better coordinated.

Inter-organisation communication: As above, there were some instances where multiple organisations sent contractors to clear the same container waste. With improved communication between organisations (i.e. ICC, Environment Bay of Plenty and the international container/debris recovery contractors) these instances could have been avoided. There was also confusion caused due to personnel changeovers within the operations. At the clean-up sites there was often not a clear command which was difficult for waste contractors as they did not have an obvious and authoritative point of contact. Personal phone numbers were also used (rather than site phones) and this caused some frustration. Generally the waste contractors had a single point of contact at ICC (for the oily waste) and this worked very well.

Public communication: There were reported instances where contractors had been instructed to take equipment to a certain location only to find that the community had not been advised that clean-up operations would be taking place in that location. In some cases, communities also wanted to participate in the clean-up operations. As discussed above, this need for communication was highlighted where international container/debris recovery contractors were involved with local communities and did not carry out coordinated consultation with Maritime New Zealand and subsequently there was significant community opposition and delays.

Defining lines of communications and firmly establishing responsibilities were identified as potential areas for improvement. One option proposed was to include contractors in the daily ICC briefings.

2.2.5 Future planning

As after every major oil spill events, the National Marine Oil Spill Contingency Plan will be updated to reflect lessons learnt during the response to the *Rena*. One specific preparedness measure that has been developed since the *Rena* was the construction of portable decontamination units which are now held in storage along with the other response equipment at Maritime New Zealand's Maritime Pollution Response Service HQ at Te Atatu to be used in the event of a spill in the future.

2.3 Gisborne

2.3.6 2007 Earthquake

There were no specific issues identified regarding waste management following the 2007 Gisborne earthquake. The majority of the waste was managed through insurance companies and private contractors using business as usual waste management approaches.

2.3.7 Future planning

I met with a range of civil defence and waste managers from the unitary authority to discuss the guidelines and future planning. The guidelines were very well received and the representatives offered to test the draft guidelines. I have since been advised that they have set up a working group to formulate a plan for managing disaster waste.

The representatives offered a number of suggestions for the guidelines, including:

- Ensure it is clear the guidelines are for any scale event
- Include hazardous and non-hazardous liquid waste disposal (e.g. wine, milk)
- Suggest the option to pre-approve potential demolition and debris clearance contractors
- Include septic tank (and contents) waste management
- Revise the section discussion Public Private Partnerships to be more general risk sharing (as this can be done by means other than the PPP which may be more appropriate post-disaster)

2.4 Central Hawke's Bay

2.4.8 2011 Flooding

The May 2011 flooding event in Central Hawke's Bay led to a number of waste management challenges. Predominantly the issues were clearing slips and debris on roads, removing detritus from private properties in Kairakau, Blackhead, and Pourerere, and removing debris from beaches.

Road clearance

More than 100,000 m³ of slip material was cleared from roadways. Some material was temporarily moved to the side of the road to open access. Eventually all the slip material was disposed of on:

- Private farmland
- Beach areas
- Closed landfills (cover material)

The major issue with finding areas following the floods was identifying areas which could be readily accessed with the wet ground conditions. The major expense was the transportation of the material to sites with suitable access roads. For example, one closed landfill, 30km from the affected area, received approximately 1000 trucks which were enough to cap a 3 hectare site with 3 m of soil.

Generally there were no regulatory issues in identifying potential disposal sites after this particular event. The regional council did not allow disposal in some proposed disposal areas due to the ecological sensitivity of the area (e.g. wetland areas) but were flexible in approving other sites for disposal.

The slip material was very difficult to handle. It was very wet and slippery (the soil is a bentonite based material) and was difficult to dewater. Once it lost moisture it became glue-like. Much of the slip material on the closed landfill is still wet - 9 months after the event.

The slip material removal works were carried out by both the existing roading contractor and additional contractors. The existing roading contractor had emergency clauses in their contract for this sort of work but the contract also included a limit which enabled the council to engage additional contractors where necessary. The additional work was tendered and awarded as a lump sum. Disposal sites for material managed under this lump sum contract were identified

collaboratively between the contractor and the District Council. All disposal sites used had no disposal costs.

NZTA funded 87% of the roading clearance as per its emergency funding formula (this fund starts at a base rate and is increased depending on the level of damage). The Hawke's Bay District Council also has a 'catastrophic events' fund and an 'adverse events' fund for disaster clean-ups / recovery.

It took approximately 3 months to move all the slip material.

Kairakau, Blackhead, and Pouterere residential clean-up

Kairakau, Blackhead, and Pouterere were the residential areas most affected by the floods. The major issue was determining the responsibility for managing sludge and debris that had slipped down onto private property. Much of the slip material in this area was contaminated with sewage due to disruption and flooding in the sewage network. There was also a significant amount of private property damage due to flood waters entering properties.

Despite the silt being on private property (and technically the responsibility of the private property owner) the District Council offered private property owners the opportunity (at the Council's expense) to use council contracting resources to clear silt from their properties. In Pouterere silt material was removed and placed on the beach to allow for a clean-up by natural forces.

Residents in Kairakau, Blackhead, and Pouterere were instructed to place damaged household materials (in Kairakau this included silt) at the front of their property and council contractors provided a kerbside collection service. Access to some of the affected areas was restricted and vehicles in and out of the area had to be escorted along the unstable road. This would have made it near impossible for residents to remove their own waste from the area.

The household debris included fridges and freezers full of rotting food resulting from up to 2 weeks without power. All the household waste was disposed of at the district council's municipal landfill. There was no attempt to recycle the material due to the damaged nature of the waste, degree of mixing and potential contamination. The collection service was time limited

(by 1 July 2011) so that residents would clean-up their properties as soon as possible. There was some concern that some residents may have taken advantage of the free disposal service and disposed of non-flood generated waste.

Some residents failed to manage the waste within the time limit and have since requested additional service from the Council. The Council considers these requests on a case by case basis. In some cases residents have cited delays in insurance assessments and or red-placarding of buildings as reasons why they could not meet the clean-up deadline. The total amount of waste collected was in the order of 100m³.

Beach debris

Another significant waste stream was the predominantly vegetative debris that ended up on the beaches. It is estimated that there were tens of thousands of cubic metres of debris on the beach in Kairakau alone (2-3m high over 300m). The debris included animal carcasses and some other non-natural materials (e.g. metal, plastic). There were differing opinions on a) who was responsible for this material and b) what the best management approach was. The District Council understood it was the Regional Councils responsibility given the waste was on a beach and had limited resources to manage the waste. The Regional Council wanted to leave the waste to be managed by natural forces. The residents eventually took matters into their own hands and removed the debris from the beaches to restore the river opening and piles of the saturated debris were burned. The action removed an almost certain public health hazard. It is believed that it would not have been possible or appropriate to mulch the material given the level of contamination and the high salt content in the wood and disposal would have been prohibitively expensive.

2.4.9 Future planning

In a future event kerbside collection would be considered by Central Hawke's Bay District Council after a similar event as it was timely and it took away the problem from the residents. Consideration will need to be made as to how much public funding is available for private property debris management and establishing this as a policy for budgeting purposes.

Central Hawke's Bay District Council is currently trying to identify future temporary disposal sites for natural material (i.e. for road slips) as discussed above. They are investigating a range of private and public locations with the main concern being access in wet weather conditions. The council are considering whether natural material disposal sites could be established in

conjunction with farmers: for example, where council could construct a haul road to a disposal site on private land. Many farmers are keen to receive material to fill low lying areas on their farms and will generally accept this material for free.

Management of non-natural materials for large scale events is still being considered – including options for recycling materials and temporary staging areas to reduce waste to landfill.

Currently Central Hawke's Bay District Council does not have a waste management 'plan'. Several steps have been taken towards increasing preparedness for managing disaster waste, such as identification of temporary storage facilities. However, a plan is not considered in great detail due to the diversity of scenarios that could be encountered. The interviewees also noted that the small size of their organisation makes decision-making in a crisis situation relatively straightforward.

The interviewees were, however, very receptive to the development of the national guidelines, in particular to help communities to begin to work through the likely issues that they are going to face post-disaster. The interviewees indicated that the national guidelines being drafted needed to be as flexible as possible, that is that strict standards and approaches were not proposed which may inhibit actions being taken to effectively restore essential services and facilitate community recovery.

2.5 Rotorua

2.5.10 1996 Ruapehu eruption

Unfortunately none of the interviewees were directly involved in the clean-up following the 1996 Mt Ruapehu eruption. It is understood that there was only a few millimetres of ash over the town and it was believed that there was no formal clean-up operation other than the clearing of roads for safety purposes. It is believed that there were some minor issues with people washing away the ash with water and gutters and pipe systems becoming clogged.

2.5.11 Future planning

The Rotorua District Council has a basic plan for management of ashfall in the future as part of their Engineering Emergency Procedures Manual. There was discussion amongst the group that the proposed approach in the current plan (that is for residents to place waste in municipal waste

collection bags for collection by the council) may not be practical and there is a general desire to update the plan.

Key issues in future ashfall events identified by the group included:

- Loads on roofs (roof collapses)
- Ash in pipe systems (from residents washing ash away)
- Ash on roads
- Disposal points

There was some discussion around how much to wet the ash during the clean-up operation – trying to balance the challenges of minimising dust and reducing the abrasions when clearing the ash and also minimising the amount of ash being washed into stormwater and sewer pipes.

Pre-identification of temporary storage sites for ash disposal had been considered in the past but had been discounted. Rotorua District Council has limited public land available and were reluctant to pre-identify private land in the event that this might affect land values and/or there might be some contractual expectation that waste would be received when it may not be possible after a given event. I have now included this issue in the guidelines and made suggestions to Rotorua District Council that developing a guide for how to identify a site post-event is also a useful step.

Currently there are no waste management plans for managing waste from other hazard events; however, this is something that will be considered in the future. Rotorua District Council expressed interest in the proposed national disaster waste management guidelines.

2.6 New Plymouth

2.6.12 2007, 2011 Tornadoes

In 2007 a swarm of tornadoes impacted several residential areas in and around New Plymouth. While the overall impact of the tornadoes was not severe, the number and geographical spread of the tornado damage made the waste management response challenging. A local state of emergency was declared.

To clean-up the waste, the New Plymouth District Council provided (free of charge) skip bins for residents to dispose of waste. The council also coordinated the collection and disposal of the

waste. The skip bins were provided by existing council waste collection contractors and were placed in easily accessible public spaces near the affected areas. Approximately 200 tonnes of waste was collected. There was later some suspicion that residents also took advantage of the free disposal and were disposing of non-tornado generated debris. Some road clearing was also required immediately after the tornadoes to allow access and restore utilities. The largely vegetative debris from road clearance was taken up to the nearby council wastewater treatment plant for temporary storage.

The same service was provided in 2011 following the impact of two tornadoes in a commercial and residential area of New Plymouth city. However, the debris was much less.

Prior to the tornadoes there was no policy on whether or not a private property debris collection service would be provided to residents following an event. The decision to provide the service was made at the time of the tornadoes. A discretionary public waste disposal fund, available to the water and waste team, was able to cover the relatively low costs of that service. It is unclear what the approach would be following a larger scale event where the management costs were higher. This is likely to depend on what sort of emergency declaration has been made and what funds are available as a result of that. The Manager Water and Wastes has a level of delegated financial authority which can be utilised in emergency situations but it is likely to be insufficient in a large scale event.

2.6.13 2005 Landfill collapse

In 2007 there was a landfill collapse at the New Plymouth District Council Landfill. The collapse was due to a number of factors namely: a build up of temporarily stock-piled waste within the site due to delayed construction of a new liner, multiple contractors sharing the site and wet weather. The collapse led to the temporary closure of the landfill for three months. An alternative disposal site had to be opened. The former landfill site at Inglewood was identified as a contingency site and waste was diverted there while investigations and repairs were undertaken at the main landfill site. Learning from this experience, the council has now obtained a resource consent to allow Inglewood landfill to be used in emergency situations. The total cost of this temporary diversion and repair was \$500,000.

Moving the landfill site also highlighted another constraint in the current municipal waste collection system's ability to manage waste in an emergency situation: the collection trucks could

not travel significant distances for prolonged periods (due to a low gear ratio). Thus council is aware that if, for whatever reason, waste is required in the future to be transported significant distances then alternative transportation and/or a transfer station system may be required.

2.6.14 Future planning

Municipal waste management contingencies are already well developed. The water and waste team have an incident response plan which was first issued in 2004 and is updated yearly. The plan is split into response levels based on impact levels (financial and physical): Level 1 and 2 are dealt with internally, Level 3 generally requires CEO involvement and Levels 4 and 5 are where the regional emergency operation centre is in operation. Every year the plan is tested in a simulated emergency exercise and the document is refined based on lessons learned from the yearly exercises. The plan has a section devoted to solid waste issues. The section mainly includes contingencies for managing disruption to the municipal solid waste collection and disposal services. The consented emergency disposal site discussed above is part of the contingency plan.

A plan for large scale disaster debris management is currently being prepared by Taranaki Regional Council. This will link with the New Plymouth District Council Incident Response Plan. As part of the plan a number of temporary storage sites have been identified such as old landfill sites, cleanfills and quarries. Consideration has also gone into possible skip bin set-down areas for community waste collection operations.

The Taranaki lifelines group is currently considering whether waste should be included in their lifeline utility planning.

2.7 Manawatu

Unfortunately I was unable to meet anyone who was directly involved in the waste management after the 2004 Manawatu floods. The civil defence representative I spoke with indicated that they believed most of the territorial authorities affected (5 or 6 in total) offered a kerbside collection service. It was unknown what scope of service was provided (i.e. residential and/or rural). Hundreds of animals died in the event. Horizons Regional Council managed the carcass disposal including collection and disposal. As many carcasses as possible were taken to be rendered, however after 72 hours the carcasses could no longer be rendered and were buried in a

local landfill. Carcass disposal was a major issue following the floods and we agreed that the proposed national guidelines being drafted needed to include information on carcass removal.

In general the civil defence representative I spoke with was interested in the guidelines and indicated that they were considering addressing waste management in the recovery plan which was due for a review.

2.8 Hutt City, Wellington

The purpose of my visit to Hutt City Council was to discuss their draft disaster waste management plan. The Civil Defence Group has taken ownership of the creation of the plan. It appeared that achieving buy-in from / collaboration with the waste managers at the council was difficult.

3 Wellington Seminar

The seminar in Wellington was well attended. The morning session “Operational management and planning” was attended by 25 people. The afternoon session “Policy and Planning” attracted 12 participants (largely carrying on from the morning session). The session was advertised widely amongst solid waste and emergency personnel using networks such as Ministry of Civil Defence and Emergency Management (Civil Defence Regional Groups), WasteMINZ, Wellington Waste Managers Group, IPENZ, Wellington Lifelines Group. The poster advertising the seminar is shown in Appendix A. The seminar presentations are available on request.

The session programme was:

Session 1 Operational management and planning

- | | |
|---------|---|
| 9:30am | Introductions, house rules, session objectives |
| 9:45am | Guest speaker: Rangi Lord (CWS). Christchurch earthquake industry perspective |
| 10:30am | Morning tea |
| 11:00am | Planning (disaster impacts, waste description, waste quantification, waste sources, waste streams, collection, transportation, disposal, waste handling facility operations, recycling, human resourcing, environmental & public health risk management, communication and a pre-event checklist) |
| 12:30pm | Lunch |

Session 2 – Policy and planning

1:30pm	Introductions (new people), session objectives
1:45pm	International examples
2:00pm	Strategic Management
2:30pm	Funding Mechanisms
3:00pm	Afternoon Tea
3:30pm	Legislation & regulation (incl. environmental & human health risk management)
4:00pm	Wrap-up

The first session included one guest speaker from Christchurch: Rangi Lord from Canterbury Waste Services, see Figure 1. The seminar was originally planned to include two guest speakers but one had to pull out the day before the seminar. Rangi's presentation was interesting and well received. Rangi offered an industry perspective and gave a good overview on the sort of issues that face both industry and government authorities. Rangi's presentation illustrated the link between peace-time waste system design (degree of coupling or redundancy and flexibility) and the ability for a system to manage disaster waste. For example, the Kate Valley transportation system relies on hooklift bins to transport the waste and the limited number of bins and distance to the landfill created a temporary bottleneck in the waste management. Waste had to be transported 22 hours a day for the first two weeks to clear the waste at transfer stations. The remainder of session one was spent discussing the basics of planning for disaster waste management.

The second session was a much more interactive session than the first. Participants were divided into three groups and given disaster waste scenarios (Appendix B). Then for each policy topic (strategic management, funding and legislation) I gave them some questions to consider for their respective scenarios. This session allowed the participants to apply some of the principles of the first session and to think more freely about the potential policy implications of disaster waste management (see Figure 2).

The participants in general indicated that the seminar was worthwhile and interesting. Many individuals indicated that they would like a copy of the national guidelines when they are available.

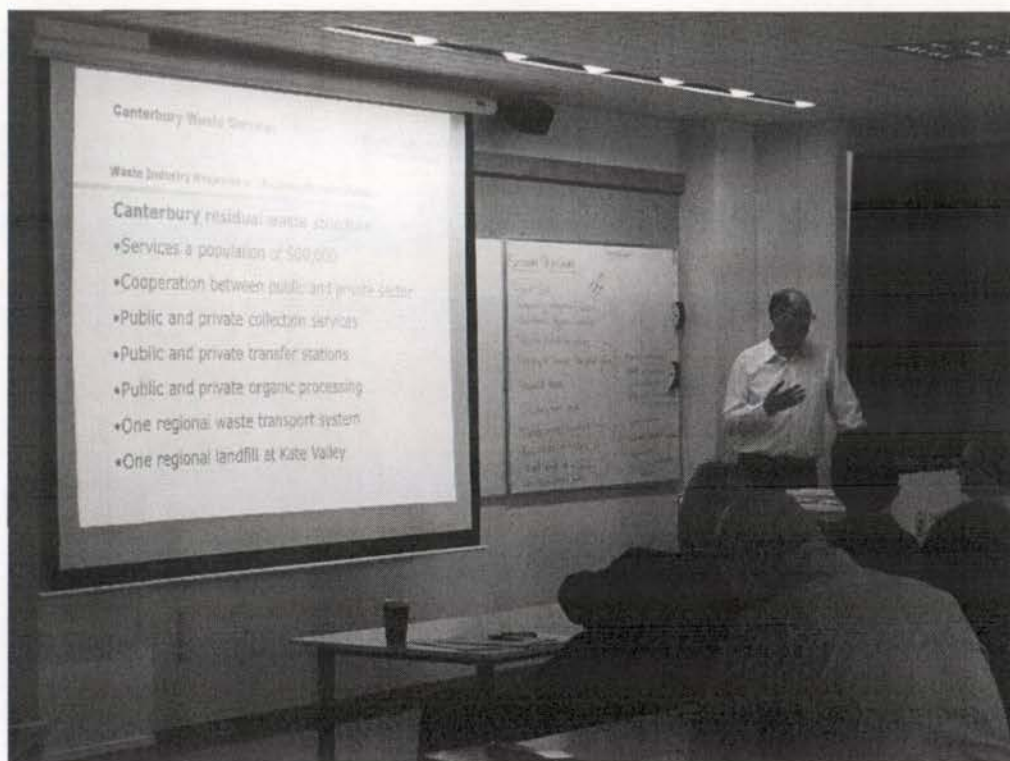


Figure 1 Disaster waste management seminar: Rangi Lord presenting about the Canterbury earthquakes



Figure 2 Disaster waste management seminar: Breakout groups in the afternoon session

4 WasteMINZ TA forum

After hearing about my seminar in Wellington, WasteMINZ (Waste Management Institute of New Zealand) invited me to co-facilitate a workshop in May in Hastings on Disaster Waste Management. The workshop is for Territorial Authority waste managers and will be co-facilitated by one of the waste officers at Christchurch City Council. WasteMINZ were unable to provide airfares and accommodation so I have used some of the money from this EQC Grant to travel to and stay in Hastings as it is another forum under which to disseminate my research and to encourage territorial authorities to plan for disaster waste.

5 Summary of key findings

This field work has uncovered a number of key issues that need to be considered when managing disaster waste. In addition I have received a number of specific recommendations on how the national guidelines could be improved. These are outlined below.

Key issues

Planning is currently not widely practiced in New Zealand but there is general interest in planning. Of local or regional authorities that were planning, they indicated that there was insufficient guidance available on how to plan for disaster waste. Plans are being prepared by either civil defence or waste management groups, but generally not jointly. This may introduce organisational issues in the event of a disaster as currently it is very unclear as to where responsibility for disaster waste management would lie. As part of planning, authorities need to consider strategic management and operational roles and responsibilities for disaster waste management. Organisational processes need to be stream-lined, where possible, to avoid potential organisational inefficiencies or confusion over responsibilities. For example, Maritime New Zealand may wish to consider accepting responsibility for container waste as well as oily waste management to avoid the confusion generated with the beached container waste experienced following the *Rena*. There is also significant value in assigning these roles pre-event so that organisations and individuals can start to develop working relationships which would be called on in a disaster event.

It is beneficial to include industry in planning for disaster waste management. Private industry can provide a number of practical insights during the planning stage. However, care must be

taken to ensure that industry remains impartial during this process. For some specific post-disaster activities formal / commercial agreements, such as stand-by contracts for emergency road clearance or urban search and rescue assistance, can be put in place during planning. However, it is important to appreciate that the exact disaster impact, location and nature are not known. Contracts must allow for circumstances where other entities may be better placed to provide services than those contracted. Identification of temporary storage sites should also be considered; however, it is important to note that where the proposed location is privately owned formal identification of land may affect the future land use and value of the land.

Consultation and communication were consistently identified as issues in post-disaster situations: both inter and intra-organisational. Failure to adequately communicate and consult with the public and Iwi can lead to disruption in the recovery process.

Local authorities need to consider, in more detail, to what extent public funding will be provided for private property clean-up in a disaster response / recovery. As a general principle, high risk waste management activities should be managed through low risk funds. Many of the above disaster events led to the local authority providing a detritus material collection service (generally via skip bins) to affected communities. If this is to be a regular post-disaster service then funding policies and adverse event budgets (whether local or national) need to be set to include this service. As demonstrated in the US, FEMA has determined that debris management costs between 2002 and 2007 made up 27% of total response costs by FEMA (FEMA, 2007).

When designing waste management systems in peace time it is important to consider their capability in a disaster (minimise coupling, that is, maximise redundancy and flexibility). Waste managers need to consider limitations of existing waste collection infrastructure such as maximum truck travel distance or dependence on specialised trucks and equipment such as the hooklift bins used in Kate Valley.

Guideline improvements

The following are likely draft Disaster Waste Management Guideline improvements as a result of this field work:

- Ensure it is clear the guidelines are for any scale event.
- Include hazardous and non-hazardous liquid waste disposal (e.g. wine, milk).
- Suggest the option to pre-approve potential demolition and debris clearance contractors.

- Include septic tank (and contents) waste management.
- Revise the section discussing the use of Public Private Partnerships post-disaster. The section refers specifically to PPPs which can be time impractical to set up post-disaster. Some more general advice regarding various methods of risk sharing may be more practical.
- Include medical waste.
- Consider whether roading access should be included as an indicator.
- Ensure lifeline coordination is included in the protocols for emergency demolition.
- Consider including the distinction used in building management between tall (critical buildings) and others, as in Christchurch.
- Recommend that emergency contracts have a time and/or scope limit within which the contract can be renegotiated and/or additional contractors can be engaged.
- Include hazards such as pandemics (which will produce large volumes of hazardous (biomedical) wastes).
- Recommend that emergency contact details for resources in the plan should be a phone number which is available 24 – 7 e.g. company Director.
- Emphasise the importance of access when identifying waste handling (staging and disposal) facilities.
- Emphasise the importance of keeping records for claiming expense reimbursement.
- Contact lists must include out of hours contact details.

6 Acknowledgements

I would like to thank the EQC for their generous funding of this work. Disaster waste management has been overlooked for a number of years. However, as we have seen in Christchurch, there can be some significant issues arising from waste management which can affect wider disaster recovery. I would like to thank Richard Smith (MCDEM) for providing contacts for all the case studies. Thank you to my primary supervisor Associate Professor Mark Milke who has been very supportive of all my research efforts. Last, I would like to thank all those that participated in interviews and shared their experiences so openly and honestly.

7 References

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Appendix A Disaster waste management seminar poster

Disaster Waste Management Seminar

Date: Thursday 15 March 2012

Location: Massey University Campus, Wellington



Session One: 9:30am - 12:30pm Operational management and planning

This is an introductory session to planning for disaster waste management in Wellington / New Zealand. There will be two guest speakers presenting on their experiences managing waste following the Christchurch earthquake. The session will also introduce the basic steps in planning for disaster waste management. This session will be of most interest to local government and waste industry personnel.

Session Two: 1:30pm - 4:30pm Policy and planning

This session will focus on organisational structures, funding mechanisms, legislative and regulatory issues facing disaster waste managers. This session will be of most interest to local, regional and national government policy makers.

Participants are welcome to join either or both sessions. Lunch will be provided.

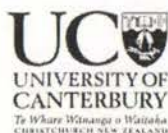
Seminar facilitator:

The seminar will be facilitated by Charlotte Brown. Charlotte is just completing her PhD thesis in Disaster Waste Management. Charlotte was also involved in the 22 February 2011 Christchurch earthquake response.

For further information and to register for this seminar please email Charlotte at:

charlotte.brown@pg.canterbury.ac.nz

(Please register by 13 March 2012)



*There is no cost to attend this seminar.
Funds provided by EQC.*



Appendix B Disaster waste management seminar scenarios

Scenario One: Wellington earthquake: 'the big one'

There have been hundreds of deaths. 90% of the community has been directly affected and 30% of commercial structures must be demolished and an estimated 10,000 homes. The earthquake has generated the equivalent of 20 years worth of municipal waste volume. Roads in and out of the region are blocked by slips and will not be open for up to 3 months. Many local roads are impassable due to slips also. Piped water supplies will not be available for at least one month and even then the flow and pressure will be limited. Wastewater networks and treatment facilities will be disrupted for many months. Aftershocks are expected to go on for years.

Scenario Two: Tsunami in Gisborne

There have been no deaths but 10% of Gisborne is affected. Power and water were largely restored within 2 days. About 20% of the estimated 500,000 tonnes of debris has been washed into the marine environment. Approximately 100 houses will need to be demolished, a further thousand or so homes have flood damage (water depth of 1m affecting soft furnishings and wall linings etc) but are repairable. Some industrial areas have been affected and there is concern that the tsunami sediments are contaminated with this as well as contamination from flooded sewer systems. Residents with damaged structures have largely left the area.

Scenario Three: Auckland volcanic eruption

Rangitoto has unexpectedly sprung to life showering Auckland with volcanic ash. The ash spreads up to 50km north and 200km south of central Auckland. Ash depths range from 200mm around the shores of the Waitemata harbour reducing in depth exponentially with distance from the source. The drinking water reservoirs in Auckland have been severely affected. Electrical equipment (substations and rural areas) have been also heavily impacted. Some structures have collapsed under the weight of saturated ash (from rain following shortly after the eruption). The rain also washed considerable volumes of ash material into the pipe network. The saturated ash creates a dense hard to handle material. (Note that light ashfall (<5mm) can generally be left on impervious surfaces such as gardens and lawns without detrimental effect).