FIRST 4 SAFETY
Practical assurance for your workplace

Standardisation of Kerbside Collections

Health and Safety Review

Prepared for Ministry for the Environment

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First 4 Safety Ltd is a Health and Safety consultancy specialising in providing advice and assistance to business owners wanting to develop their safety systems to ensure their employees are safe and their business is protected.

First 4 Safety Ltd has a broad range of experience in the provision of occupational safety and health advice and assistance across a variety of industry including commercial industrial and residential waste and recyclables collection, disposal & processing, portable sanitation services, waste disposal facility operations, contaminated site remediation and the collection, treatment and disposal of hazardous liquids, chemicals and medical waste.

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1 Executive Summary

In February 2020, the Ministry commissioned a project to undertake research and make recommendations for the standardisation of kerbside collections in Aotearoa New Zealand. The final report recommended commissioning robust health and safety research to understand the risks an automatic or manual system of kerbside collection presents and how these can be minimised, mitigated, and managed.

The recommended health and safety research project was undertaken during 2021 by First 4 Safety Ltd, Eunomia Research and Consulting Ltd and Rangiriri Consultants Ltd. This report details the various systems currently in use in Aotearoa New Zealand to collect waste and recyclables from residential households. We include details of the risk profile of kerbside collections, and activities in materials recovery facilities (mrf's) along with suggested control options and a discussion on common risks. This includes:

- Injury risks of different systems, including to households, pedestrians, collection crew, and mrf operators.
- Fire risks of different systems from e-waste being incorrectly included in recycling bins
- Risks to each system in the event of a pandemic.

Appended to this report is a review of published academic literature, an overview of the New Zealand health and safety legislative framework and examples of good practice health and safety guidance from both New Zealand and international waste industry sources.

We also provide details of stakeholder engagement events with representatives from local government, and operators within the Aotearoa New Zealand kerbside collection and recycling system. The aim was to gather information related to the management of health and safety risks and associated controls inherent in their collection and processing operations.

Outcomes from both the literature review, and from the stakeholder engagement events identified seven (7) key risks present in kerbside collections and mrf operations along with proposed solutions as outlined below.

Working on the road (includes driving, runners, interaction with other road users, roading environment)

Working on the road has been a concern for the industry for several years. Recent changes, such as undertaking kerbside collection from the left-hand side of the road only, were introduced as a direct result of poor health and safety performance, including incidents with fatal outcomes. The act of driving and working around operating vehicles is a well-known risk in most industries. According to WorkSafe NZ, vehicle incidents are currently the biggest

contributor to work related deaths in New Zealand. In the kerbside collection industry, these vehicle related risks are created through interaction with other road users, pedestrians, cyclists, e-scooter users, and other vulnerable people.

For some kerbside collection drivers, cognitive overload is a risk. Operators of waste collection vehicles are exposed to a high level of in-cab information provided by camera monitors, equipment alarms, run sheets, and vehicle management systems. They also are required to drive a large vehicle safely in a range of roading environments whilst monitoring the behaviours of other road users and bystanders. This risk of mental overload has the potential to take their attention away from the driving task. When designing a collection activity, the primary function that should be considered by all parties is the ability of the driver to conduct the task to ensure key activities like safe driving and safely operating the collection equipment can be done with minimum distractions.

In terms of the roading environment, stakeholders highlighted risks in urban environments created by cycle lanes, narrow roadways, and increased on street parking by residents. In rural settings, stakeholders discussed the increased risks for kerbside collection workers caused by higher-speed roads and visibility issues due to blind corners and other visual obstructions. It was also highlighted that there is a lack of suitable areas off main carriageways where drivers can safely pull off the road to undertake collections or for residents to leave bins, bags and/or crates. While existing roading and community infrastructure is unable to be changed easily, when designing new urban environments it is imperative that there is early engagement between waste operations contract managers and their colleagues in traffic engineering and town planning. This will ensure the environment needed to undertake safe and efficient kerbside collection activities are included in design parameters.

Runners continue to be used across the industry. Stakeholders that contributed to this project generally felt that this risk was one that could be effectively managed with existing industry controls such as collecting from the left-hand side of the road. The practice of runners riding on the outside of a collection vehicle or trailer or in an unsecured manner outside of the cab of the truck still occurs. The efficacy of existing controls to manage this risk is low, meaning this practice should be discontinued, and runners should instead travel in the cab of a truck or walk or run the distances between collections.

Machinery (compaction equipment, bin lifters, hydraulically operated rear doors, mrf equipment)

Use of machinery associated with kerbside collections (mainly rear-load compactors) has been a contributor to a number of historical fatalities and serious injuries in the waste industry. The main items of machinery that has caused harm in the industry has been compaction equipment and there have been initiatives introduced over a number of years to minimise the risk of exposure to harm from the use of compaction equipment such as such as two-handed controls and increased guarding however, the risk of worker exposure to injury from compaction equipment still exists.

Some regions have recently seen an increase in incidents where pedestrians have been struck by wheelie bin lifters in operation. This is a seriously concerning issue and it may not be easy to further minimise the risk as many existing controls are in place to assist the operator with all round visibility from their operational position in the cab of a truck. In addition, accepted industry controls have been developed and implemented by some collection companies which highlight to pedestrians that there is a bin lifter operating e.g. bin lifting mechanism painted in a highly visible colour different to that of the truck. Additional controls that could be considered include lighting systems that further highlight the bin lifter to people using the footpath.

In a mrf environment, guards and other isolation, engineering and emergency response controls have been implemented to protect staff from exposure to plant and equipment risks. Full 'Health and Safety by Design'[1] approaches have been undertaken by some in the industry, although there is evidence suggesting that the machinery risks at some mrf's are managed through the less effective administrative control methods such as training, procedures, and signage, and using Personal Protective Equipment (PPE). Organisations should undertake robust risk assessments on all mrf machinery and consider control options that either substitute, isolate or use other engineering controls if risks are unable to be eliminated. The sole reliance on administration and PPE methods of control would not be considered a robust approach to the management of machinery related risk.

Manual Tasks / Manual handling

Two thirds of rubbish collection provided by territorial authorities in Aotearoa New Zealand is undertaken using an automated method, while just over 50% of recycling collections is undertaken using a fully automated approach.

[1] 'Health and Safety by Design' is the process of managing health and safety risks throughout the lifecycle of structures, plant, substance or other products.

International literature, research and some local guidance highlight manual handling as an inherent risk in kerbside collection work. International research concludes that the types of manual handling found in kerbside collection activities are not significant and can be effectively managed.

For manual collections, the key risks are the lifting, carrying, and throwing aspects, which are thought to be the biggest contributor to injuries based on feedback from stakeholders. This is consistent with research by the UK based Health and Safety Executive's (HSE) analysis of musculoskeletal disorders[2] in the waste industry in 2020[3]. Research published in the British Medical Journal (Rushton 2003)[4] concluded that waste management workers have an increased incidence of accidents and musculoskeletal problems, higher than that of the general workforce.

For manual collection activities for recyclables and food waste, the design of the collection container and the vehicle can reduce the impact of manual task risks. Research in 2015[5] into the proposed Auckland Council food waste collection system, provided recommendations around caddie design and collection vehicle receptacle design. These recommendations addressed the various manual task risks of awkward postures along with work practices and work organisation that contribute to other health and safety risks. More of this type of in-depth ergonomic research would be valuable for the industry to better understand the human impact of repetitive and physically demanding tasks associated with manual kerbside collections. Research could include user trials and design testing to quantify the impact of repetition and bin, bag, and crate weights on workers musculoskeletal system.

Automated collections DO NOT fully eliminate manual tasks, with operators at times needing to manually handle wheelie bins during their collection route. Another manual task risk associated with automated collection, is the repetitive nature of the use of the joystick that operates the bin lifter. Repetitive joystick use and the sedentary nature of the role were identified by stakeholders as significant risks for the operator of an automated bin collection vehicle. Workstation assessments of the in-cab environment could be undertaken for automated bin collection operators along with education and promotion of regular stretching and movement to reduce the risk of harm from the overuse risks inherent in this activity.

In respect of a materials recovery facility various manual task activities occur, these include pushing, pulling, reaching, and throwing tasks as materials travel along a sort line. Repetitive movement is a risk that workers are exposed to in

2 WorkSafe NZ Factsheet - Preventing manual handling injuries – "Manual handling can harm your musculoskeletal system (your bones and muscles) slowly, so the injury gets worse over time (a chronic injury)".

3 Health and Safety Executive (HSE) Waste statistics in Great Britain, 2020

4 Health hazards and waste management British Medical Bulletin 2003; 68: 183–197

5 Integrating ergonomics into the design of Auckland Council's food waste only collection service. Health & Rehabilitation Research Institute / Centre for Occupational Health & Safety Research Auckland University of Technology

this environment with stakeholders agreeing that conducting a workstation assessment for workers is a reasonably practicable step that could be taken.

MRF operators stated that they experienced non-conforming waste (medical, sharps, human and animal body fluids and faeces) coming over sort lines, multiple times on a daily basis. Exposure to unpleasant items e.g. blood, human waste, can cause distress to workers. There is also a risk of workers accidentally handing non-conforming items such as needles or human waste, which could lead to the worker being infected with biological diseases such as Hepatitis or HIV Aids. Public education provided by territorial authorities on what is acceptable to leave out for recycling collection is the main way to reduce this problem. Enforcement for putting out harmful items could also be considered in extreme cases such as injury being suffered by a collection or process worker. A degree of monitoring by collection workers may also be useful.

Mental health

While the mental health of front-line staff is a known risk, industry representatives felt that it is not managed effectively. Worker mental health can be affected by a range of both work and non-work-related issues. Reasons for this are varied, with workload, bullying and supervisor relationships, along with personal challenges in people's lives all known to be contributors to poor mental wellbeing. Organisational culture surveys can identify areas that might be contributing to poor worker mental health, and this can direct a business in what control methods might be suitable in their situation.

Aggression and violence towards waste and recycling collection workers is experienced across Aotearoa New Zealand, with increased frequency since the COVID-19 pandemic emerged in early 2020. Waste collection workers have been abused, threatened, or put in harmful situations by members of the public. Targeted training in conflict avoidance is useful for workers operating in a public domain.

There are a number of approaches organisations are finding effective in contributing positively to the mental wellbeing of their workforce. Examples of controls that are found to be effective include, integration of the Te Whare Tapa Whā model[6] into workplace culture. Other controls include the provision of awareness training for workers in areas such as financial literacy, cardiovascular health, nutrition, hydration, health, fitness, and relationships, all of these areas are

[6] Provides a Māori perspective on health. It refers to a wharenui (or meeting house) to illustrate the four dimensions of wellbeing: taha tinana (physical health), taha hinengaro (mind), taha whānau (family) and taha wairua (the spiritual dimension). With four walls, the wharenui is a symbol of these four dimensions.

known to contribute to poor mental health outcomes. There is also the provision of employee assistance programmes (EAP) which provide independent support for workers struggling with wellbeing issues via access to counselling services.

Health Risks

Work related health risks in kerbside collections, such as exposure to biological hazards, musculoskeletal disease, hazardous levels of noise, and respiratory risks are well known in the industry and various controls exist to manage these.

Significant links between exposure to domestic waste and the risk of contracting the Hepatitis B virus is highlighted in research[7] and is a known issue for the waste industry to manage. Vaccination is a standard control in the industry along with other methods to reduce risk against exposure such as hygiene protocols and the use of PPE.

Vibration has been highlighted as a risk in mrf's that can cause Whole Body Vibration Syndrome, and there are controls which can be put in place to manage this. Regular maintenance of equipment and the use of anti-fatigue matting can reduce this risk, and this can be supported by health monitoring of workers operating in areas where vibration is present.

Noise exposure was highlighted by stakeholders as the biggest health risk in a mrf environment. It can lead to Noise Induced Hearing Loss (NIHL). Controls to reduce noise levels can include replacement of old equipment, isolation of items that are the source of noise, regular maintenance on equipment and the use of suitable PPE. Noise can only be effectively managed if the level of noise is known, and this is done through environmental monitoring to determine the actual noise emissions that are created in the workplace. The results can determine the type of controls needed including the implementation of those previously discussed along with the provision of the correct grade of hearing protection and through ongoing health monitoring of workers hearing.

Exposure to dust is a risk in a mrf environment with microorganisms, predominantly fungi and bacteria, forming part of the airborne dust in recycling plants, these could cause respiratory allergies and infection. Like the management of noise, environmental monitoring should be undertaken to quantify the existence of respirable airborne particles. Monitoring results inform decisions on the implementation of controls to eliminate or minimise the risk of dust

[7] Is waste collection associated with Hepatitis B infection? A meta-analysis. Mol M.P.G., Cairncross S., Greco D.B., Heller L.

exposure. Controls could include misting systems over sort lines, local exhaust ventilation or extraction systems. The use of PPE, for example masks, contributes to minimising worker exposure to dusts in a mrf. Where a health risk is unable to be eliminated, health monitoring is required to track potential exposure.

Pandemic

Over the last 18 months the emergence of the COVID-19 virus has had a marked impact on the waste industry, with kerbside collections and mrf operations equally impacted.

Keeping pace with the changes in the profile of viruses is something that needs to be continually monitored as variants change. The risk from the Alpha variant of COVID-19 pointed to surface contact being a high-risk transmission route, whereas the Delta variant that emerged in 2021 shows person to person exposure via aerosolisation of the virus is the key area of risk. Effective controls at present are the use of masks, physical distancing, and vaccinations. This does not negate the need for continued vigilance around hygiene, both from a personal perspective and the need to regularly clean high touch surfaces in a workplace. The industry will need to keep up with the changing environment in relation to COVID as the emergence of other variants may introduce different risk profiles and therefore changes in the effectiveness of existing controls.

Fire risks of different systems

There is a risk of fires in collection vehicles and mrf's through inappropriately disposed of E-Waste and specifically lithium-Ion batteries. Stopping batteries of this nature entering the waste or recycling stream would reduce the risk of fire. Areas of Aotearoa New Zealand that have successfully introduced and promoted public battery return schemes (Canterbury and Marlborough) have seen a decrease in fire events.

Where batteries do enter the waste or recycling stream, effective controls to reduce damage or harm from a fire include water dousing systems installed on trucks. This should be supported by the provision of training in how workers can respond when a fire is identified in a truck. Typical approaches to this are to either compact the waste to remove oxygen, or before hydraulic systems are damaged, tip the waste out onto the ground where the fire can be extinguished. In a mrf, emergency preparedness plans should detail the response required when a fire occurs including evacuation procedures. In both cases emergency services should be contacted, and if safe to do so workers can attempt to extinguish the fire with firefighting equipment.

The seven key risks discussed above are those inherent in the kerbside collection process and mrf operations. During the completion of this project we identified two other factors that are not traditionally considered as contributing to health and safety risk. These are the *procurement process* and the *management of the contract.* When these are not included as part of what is a good practice approach to risk management they can contribute to poor health and safety outcomes. Organisations who are contracted to provide a kerbside collection service or mrf operation must ensure these form part of the overall approach to the management of risk.

An effective contractual relationship between the Territorial Authority (TA) and collection companies or mrf operators is critical in ensuring good health and safety outcomes. When discharging their overlapping duty obligations territorial authorities and collection companies should engage on the following:

- The TA's response and expectations when collection company capacity is affected due to equipment breakdown or other reasons for delays in collection.
- Defining collection routes and timing to minimise collections around key facilities (e.g. schools) or during peak traffic periods.
- Consideration and negotiation to reducing bin numbers in high density housing (multi-unit dwellings) by changing from individual household bins to a communal waste collection system.

In terms of procurement the focus should be on having fit for purpose plant and equipment, this means:

- Ensuring vehicle specifications are planned well in advance of contract start dates.
- Using Health and Safety by Design workshops to inform procurement decisions with both parties engaging in collaborative sessions to agree on design criteria.

In conclusion, the seven risks highlighted here are those that can cause life changing outcomes for workers if they are exposed to those risks without effective controls in place. PCBU's are required to implement a robust approach to the management of risk in workplaces which includes asking questions such as "can we eliminate this risk?". If this is not possible, a defined approach to minimising risk is mandated in law with a selection of control methods described. The solutions highlighted here are some of those controls which have been found to be effective by those carrying out kerbside collections or mrf operations.

2 Introduction

Waste management is a growing industry in Aotearoa New Zealand which can be attributed to increases in waste generation from population growth and subsequent economic activity. There is also an increasing focus on trying to reduce the impacts of waste through recovering discarded materials. This has led to a wider range of services being provided, with an increase in the number of methodologies utilised by operators. This constantly evolving set of methodologies requires different types of collection vehicles, containers, sorting equipment and practices, each with associated risk profiles. With increasing activity in the waste sector, there are also more workers employed, resulting in a higher risk exposure.

While changes in waste quantities have been occurring over time in line with population and economic growth, changes in waste practices have also evolved, albeit in response to some different drivers. The key changes in the last 20 years or so have included[8]:

- An increased presence of the private sector, providing kerbside collections on behalf of Territorial Authorities (TAs) and the offering of private services
- A decentralised model for kerbside collection service provision, which has resulted in a lack of standardisation
- Increasing competition in the sector, particularly between the large service providers. While this has resulted in efficiencies it has also favoured lower cost models, which can create a tension between efficiency and safe practices
- A growing awareness within the sector of the importance of healthy and safe work practices, and moves (enforced by legislation) to attempt to integrate these into work cultures
- Increased provision of food waste collections

Territorial authorities (TAs) are responsible to provide waste services[9]. Due to a number of local and national drivers, most TAs offer kerbside recycling collection, and increasing numbers of councils are also offering organic waste collections – either food only, food and garden waste mixed, or garden waste only.

To preserve the value of collected recyclable material, and enhance the economic viability of the system, requires materials to be separated and remain uncontaminated from other materials. The extent to which this happens depends on many factors in the waste management system. Some factors include who owns the materials once

[8] Eunomia (2021) *Waste Infrastructure and Services Stocktake*, Report for the Ministry for the Environment
[9] Waste Minimsation Act 2008, [WMA], Part 4

collected, the types of receptacles, the type of collection vehicle(s) used, and the location and access to processing infrastructure and markets (e.g., glass markets are different in the South Island to the North Island due to the distances involved). Other factors include the price of landfilling[10] versus the market price of the recovered material, and other external circumstances such as international regulation[11], the Basel Convention[12] and the COVID-19 pandemic.

2.1 Kerbside Collection Systems in NZ

Kerbside rubbish collections generally occur through either a plastic bag or wheeled bin. The bag systems tend to work as follows:

- A single operator using a left-hand drive low entry vehicle (LEV). The operator loads the bags into a hopper at the side of the vehicle by hand, or
- A driver with one or more runners, using a truck fitted with a rear loading compaction unit where bags are loaded into a hopper that feeds the compactor, or
- A driver with one or more runners, loading bags into a side load compactor

The wheeled bin systems are typically operated with one of the following methodologies:

- A single operator using a fully automated side arm loader. The truck driver operates the side arm loader, from within the cab of the truck. The mechanical sidearm is used to pick up, empty, and return the wheeled bin to its stowed position. Being fully automated means the provision of the service can be conducted without the use of a runner.
- A single operator using a fully automated side arm loader with a runner. The truck driver operates the side arm loader from within the cab of the truck. The runner manoeuvres the bins from outside the households (or on a property) to a position where they can be collected by the side arm. The mechanical sidearm is used to pick up and empty the wheeled bin and the runner then returns the bin to a safe location. This method is used in narrow streets with lots of on-street parking, for on property collections, or where user pays tags need to be manually removed.

[10] Wilson et al. (2017). *The New Zealand waste disposal levy. Potential impacts of adjustments to the current levy rate and structure* [Final Report]. Eunomia Research & Consulting Ltd. http://eunomia.co.nz/wp-content/uploads/2017/06/WDL-Final-Report-30-05-17.pdf

[11] Wang et al. (2019). Current influence of China's ban on plastic waste imports. *Waste Disposal & Sustainable Energy*. https://doi.org/10.1007/s42768-019-00005-z

[12] The Basel Convention is an international treaty that aims to reduce the movement of hazardous waste between different nations. New Zealand ratified this convention in 1994.

- A driver (or runner) descends from the truck and manually fetches and returns the wheeled bin and empties via a bin-lifter. This method may be used on rural routes where there is not a reliable berm to place the wheeled bin, or where bags and bins are collected in the same vehicle.

There are multiple methodologies when it comes to recycling collections due to the wide variety of materials collected by different TA's[13]. Recycling is either collected in a wheeled bin (containing a mix of all or certain recyclables), an open crate or boxes and bags for paper and cardboard. Bags and containers are collected by a range of trucks with varying numbers of collection workers, with many different methodologies used between TAs (refer Table 1). In some regions kerbside foodwaste collections occur (e.g., Hamilton, Raglan, Papakura, New Plymouth, Ruapehu, Tauranga, Western Bay of Plenty), using a small 23 litre container that is emptied into a collection vehicle. Collections of food and garden waste combined in wheeled bins, also occur in several centres (Christchurch, Selwyn, Timaru, Waimate and Waimakariri), as do collections of garden waste only (South Taranaki, Whakatane and Kawerau).

Recycling collection systems can be subdivided in two main groups, either with kerbside sorting or automated collection using wheeled bins. For collections using manual kerbside sorting of materials one or more runners collects and delivers the contents of the recycling crate to the truck parked at the kerb, where a stationary worker located in a caged section of the truck actively sorts the collected recyclables into dedicated receptacles (refer figure 1).

Figure 1. Recycling Collection System with Manual Kerbside Sorting with On-Vehicle Stationary Sorter

[13] WasteMINZ. (2020). *Recommendations for standardisation of kerbside collections in Aotearoa*. https://environment.govt.nz/publications/recommendations-for-standardisation-of-kerbside-collections-in-aotearoa/

Another version of manual sorting at the kerbside involves the driver and/or a runner depositing the various materials from the crate directly (while standing at the kerbside) into the dedicated compartments within the vehicle (Figure 2).

Figure 2. Recycling Collection Sorting System with Manual Sorting from Outside the Vehicle

Source: Whangarei District Council,
https://www.wdc.govt.nz/Services/Rubbish/Rubbish-Collection

Automated recycling collection occurs using wheeled bins either with the collection of all materials mixed in one wheeled bin (comingled) or where specific materials are collected from within a wheeled bin (e.g., plastic, paper, and metal), with other material (e.g., glass) collected separately, possibly in a crate.

Wheeled bins are collected with a sideload vehicle fitted with a mechanical bin lifter. Sometimes this method requires the use of a runner, depending on circumstances such as the type of equipment used by the service provider or the geography of the collection route such as width or gradient of the streets.

In all cases collected recyclable materials are delivered to a mrf where workers and/or automated sorting systems remove contamination and sort the materials into their respective streams.

2.2 Collection Methods

2.2.1 Rubbish Collection

About 93% of TAs provide kerbside rubbish collection, albeit not always to all households within the TA as rural areas and central business districts can be excluded. From those that do receive these services (whether council or private), about 33% is collected in bags and 67% in wheeled bins of varying sizes, (refer Table 1).

Table 1 Rubbish Collection Methods

Rubbish Collection Method	# TAs	# Households
Bags	26	448,800
Bags or 80-l bin	1	3,600
Wheeled bin or bags	6	99,900
N/A	10	135,700
120-l Wheeled bin	3	61,500
140-l Wheeled bin	2	20,900
240-l Wheeled bin	1	12,700
Wheeled bin	18	1,035,700
Grand Total	**67**	**1,818,800**

Note: Data is adapted from Eunomia (2020) National Resource Recovery – Infrastructure and Services Stocktake, Report for the Ministry for the Environment. Data is subject to limitations - Information based on responses in 2020. Number of households is estimated and does not necessarily include complete information from private waste collectors.

2.2.2 Recycling collection

Within NZ, recycling collection methods vary, with about 7% of households using a bag, often in combination with another method. There are 43% of households that set out one or more recycling crates and 85% of households use one or more wheeled bins, or a combination of a wheeled bin and crate or bag, (refer Table 1).

Table 2 Recycling Collection Methods

Recycling Collection Method	# TA	# Households
Any container	1	7,200
Bags	2	14,800
Bags / Crates	1	24,800
Bags / Crates / Wheeled bins	1	79,400
Crates	17	229,400
N/A	1	300
Wheeled bin (s)	20	1,019,400
Wheeled bin and Crate (s)	24	443,500
Grand Total	**67**	**1,818,800**

Note: Data is adapted from Eunomia (2020) National Resource Recovery – Infrastructure and Services Stocktake, Report for the Ministry for the Environment. Data is subject to limitations - Information based on responses in 2020. Number of households is estimated and does not necessarily include complete information from private waste collectors.

These various ways of collecting kerbside rubbish and recycling have different types of health and safety risks associated with them.[14] It is imperative for TAs to consider such risks in addition to other relevant aspects involved with these different types of collection when deciding how to respond to the future demands for waste management.

2.2.3 Kerbside collection injury data

The way in which kerbside rubbish and recycling is collected and sorted determines the risks and hazards which workers are exposed. There is limited literature and data available on the specific injuries and work loss suffered specifically by kerbside collection workers in Aotearoa New Zealand. However, ACC data indicates that over a 20-year period (2000 – 2020), $61.5 million has been spent on injuries and long-term absences because of incidents that occurred during waste related work.[15] ACC data separates claims information into four (4) overarching classification units (CU) broadly covering waste treatment and disposal, solid waste collections, waste remediation, materials recovery services and waste collection services (not elsewhere classified). These CU's mean that for any meaningful analysis to be conducted of specific injury causation related to tasks such as kerbside collections, individual analysis of claims data from ACC 45 information would be required.

[14] Kuijer, P. P. F. M., & Frings-Dresen, M. H. W. (2004). World at work: Refuse collectors. *Occupational and environmental medicine*, *61*(3), 282-286.
[15] OIA response, 2021, Waste Management Industry Claims, A-1270

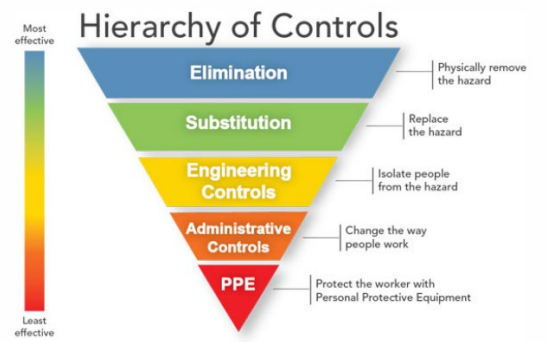
3 Management of Risk

3.1 Health and Safety at Work (General Risk and Workplace Management) Regulations 2016

Supporting the Health and Safety at Work Act 2015 (HSWA) is the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016 (GRWM).[16] The Regulation defines a framework that describes key components related to the management of risk in a workplace setting. This includes details on duties to identify reasonably foreseeable hazards that could cause harm to a person's health and safety.

It also expands on the use of the hierarchy of controls. This hierarchy is shown in graphical form in Figure 3 and describes the effectiveness of mitigation methods, with elimination being the most effective method to control exposure to the identified hazard.

Figure 3 – Hierarchy of Controls



3.2 Reasonably Practicable

The Health and Safety at Work Act 2015 introduces the concept of reasonably practicable, this is in relation to the duties of a PCBU. The term means that duty holders must do "*that which is, or was, at a particular time, reasonably able to be done in relation to ensuring health and safety, taking into account and weighing up all relevant matters*" (HSWA 15 s22). In further defining the meaning of reasonably practicable the following needs to be considered in respect of hazard or risk management.

[16] New Zealand Government. (2021, May 27). *Health and Safety at Work (General Risk and Workplace Management) Regulations 2016.* Retrieved from legislation.govt.nz: https://www.legislation.govt.nz/regulation/public/2016/0013/latest/DLM6727530.html?src=qs

- the likelihood of the hazard or the risk concerned occurring; and
- the degree of harm that might result from the hazard or risk; and
- what the person concerned knows, or ought reasonably to know, about the hazard or risk; and
- ways of eliminating or minimising the risk; and
- the availability and suitability of ways to eliminate or minimise the risk; and
- after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

In respect of the management of risks in a workplace, if a hazard cannot be completely removed (eliminated), a PCBU must use the minimisation strategy prescribed in the GRWM Regulations 2016 i.e., use one or more of substituting, isolating, and/or putting in place engineering controls. If the risk still remains, then a PCBU would progress to the second tier 'administrative and/or PPE controls'. Combined, these make up 'first-line of defence' controls.

Our analysis will consider risks across a framework that include the following aspects, ***refer Table 3.***

1. Particular Risks - those defined in law
2. Critical Risks - those that cause life changing outcomes
3. Variability or Change - those that change the normal status of a risk
4. Site Specific - those relevant to specific workplaces

3.3 Risk Types

3.3.1 Particular Risks

A risk management process is mandatory for high risk activities prescribed in Part 2 of the General Risk and Workplace Management Regulations (GRWM 2016). These are known as 'particular risks'. For kerbside collection these could include risks associated with remote and isolated work, raised, and falling objects, and hazardous substances, (refer table 3). WorkSafe NZ provides guidance on approaches PCBU's must consider when designing control methods to eliminate or minimise exposure to these risks.

3.3.2 Critical Risks

In addition to those risks listed in the GRWM Regs 2016, the kerbside collection industry has other serious (critical) risks inherent in its operation. This report has identified seven (7) of these which include.

- Working on the road (includes driving, runners, interaction with other road users, roading environment)
- Machinery - compaction equipment, bin lifters, hydraulically operated rear doors, mrf equipment
- Manual Tasks - manoeuvring MGB's, lifting, carrying, and throwing, kerbside sort, repetitive operation of in-cab controls (joysticks)
- Mental stress and cognitive overload
- Health risks – musculoskeletal, biological, physical
- Pandemic
- Fire

In most cases a great deal is already known about such hazards and risks. The wider waste industry has described them in its guidance material[17]. Additionally, the regulations and codes of practices published by Worksafe NZ have set out management approaches that can (or must) be used in relation to the hazards and risks.

When identifying hazards that could give rise to work health and safety risks, a PCBU should focus on the critical risks inherent in their activities first, before managing less serious risks. A review of work activities should be undertaken on an ongoing basis to identify any new risks that need to be managed. This approach helps to identify what could harm the health or endanger the safety of one or more workers or others (e.g., visitors, bystanders). This harm can present itself in various forms such as:

- Acute – occurs immediately and/or
- Chronic – occurs slowly over a long period of time and/or
- Catastrophic – low frequency, high consequence

3.3.3 Variability and Change

Risk Management must consider what can change at the worksite. While a situation or thing (the hazard) may ordinarily be low risk, a 'variability' or 'change factor' might alter its risk profile dramatically.

[17] Health and Safety Guidelines: for the Solid Waste and Resource Recovery Sector (Complete)

Variability and change, plays a big part in a risk profile by modifying the risk profile of hazards already identified, essentially producing upset conditions[18].

3.3.4 Site Specific

A waste collection company often has special knowledge of hazards and risks that relate to the site-specific aspects of their work. For example, things known about the specific collection environment, work done in the same area or region or using the same methodology over many years. Site specific hazards are likely to be made up of risks identified as "particular", "critical" or related to variability or change, see figure 3.4.

3.4 Conclusion

Legislation is a key part of the system that requires PCBU's to operate not only a compliant business, but also one that puts worker health and safety at the centre of their decisions. In terms of the management of risk, a PCBU must not only be mindful of known safety risks but also consider those that introduce health related risks to workers. The hierarchy of controls (figure 3) directs our approach to risk and hazard control efforts ensuring particular focus is given to the implementation of controls that are described as "above the line". Elimination, substitution, isolation or engineering-based controls are considered the more effective methods to apply when minimising risk. This approach is then supported by "below the line" controls of administration and the use of personal protective equipment[19]. The decision-making process of which controls to select are driven by the reasonably practicable test, see clause 3.2.

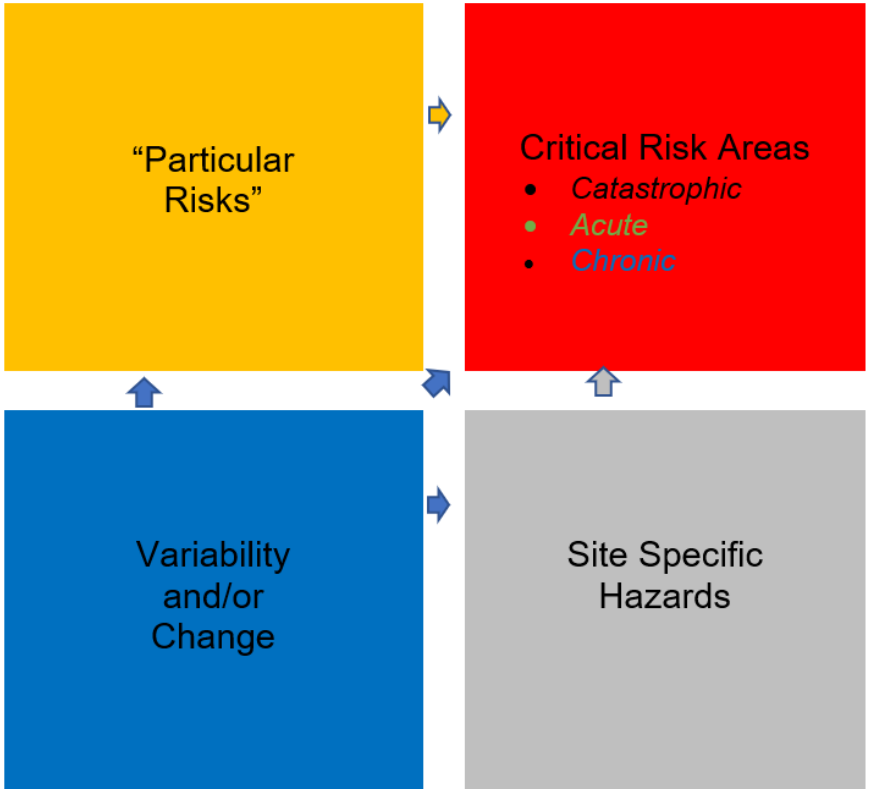
[18] Upset condition means a **failure, breakdown, or malfunction of any piece of process equipment** or pollution control equipment that causes, or has the potential to cause, excess emissions.
[19] https://www.worksafe.govt.nz/assets/dmsassets/zero/839WKS-5-HSWA-identifying-assessing-managing-work-risks.pdf

3.5 Table 3 - Kerbside Collection Risk Profile[20]

Prescribed by Regulations:

- Remote and isolated work
- ~~Atmosphere – Ignition Explosion~~
- Raised objects
- Falling objects
- ~~Liquid containers – drowning~~
- ~~Enclosed (Silo) loose material~~
- Hazardous substances

(GR & WM Regs Part.2)



High Likelihood/Consequence:

- Other road users, including cyclists, e-scooters
- The roading environment, visibility, speed, lack of berms, cycle lanes.
- Working on the road, including the use of runners / riding on a vehicle
- Machinery, bin lifters, compaction equipment, hydraulically operated rear doors.
- Manual tasks, lifting, carrying, throwing, repetition
- Psychosocial
- Occupational illness (biological, physical, respiratory)
- E-Waste
- Pandemic

Identifying change factors:

- Resources – Equipment, worker skill
- Urban design
- Contract management & design
- Absenteeism
- Work environment – hindrance
- Adverse events e.g. weather
- Changes to plan – demand
- Stored energy
- Pressure to finish
- Impairment (fit mind/body)

Environment & Existing

- Aggressive public
- Compaction equipment
- Bin lifting mechanism
- High speed road
- Pedestrians, including vulnerable (children, disabled, elderly, animals)
- Falls from height
- Utilities – overhead power, other assets
- Infectious disease (needles, biohazards)

[20] It is noted that Particular Risks in table 3 have risks which are crossed out, these while described in GRWM Regulations but are deemed not applicable for kerbside collections.

3.6 Kerbside collections and materials recovery facility risk and controls register

The information in the following tables detail controls for the various risks that waste collection company's, mrf operators and TA's have described as being implemented as methods to either substitute, isolate or provide engineering solutions. Administrative methods and PPE to minimise exposure to the risks is also included. A risk assessment has been applied for each risk on both an uncontrolled and controlled state.

The registers should be read as follows.

- 3.5.1 – Table 4 - Kerbside collections, generic risk register
- 3.5.2 – Table 5 - Automated collections risk register
- 3.5.3 – Table 6 - Manual collection risk register
- 3.5.4 – Table 7 - Materials recovery facility risk register

Description of content

- Risk – describes the identified risk, including activities that cause this risk to exist
- Risk type – describes the risk type as detailed in the kerbside collection risk profile – Table 3
- Risk exposure impact – describes the types of harm and/or damage or loss that could result from exposure to the risk, along with examples of direct causes of the harm.
- Uncontrolled risk level – shows the level of risk in an uncontrolled state, refer key.
- Above the line controls – eliminate, substitute, isolate, engineering. (More effective in reducing risk)
- Below the line controls - administration, PPE. (Less effective in reducing risk)
- Controlled risk level – shows the reduction in risk based on implementation of controls[21]

Low	Monitor and manage as appropriate.
Medium	Implement action plan/s if reasonably practicable to reduce the level of risk.
High	Develop and implement detailed action plans/s to reduce, the level of risk.
Extreme	Eliminate, avoid, implement detailed and systematic action plans/procedures to reduce where the level of risk

[21] The assessment does not take into account how effectively each control is implemented or changes in residual risk due to worker behaviour or their level of literacy or understanding which could lead to mistakes.

3.6.1 Table 4 Kerbside collections, generic risks

These risks apply to all kerbside collections. This list is not exhaustive and PCBUs are required to undertake a full hazard and risk assessment as per the requirements of the Health and Safety at Work Act 2015. The first step of such an assessment would be to consider whether the risk can be eliminated. A targeted risk assessment may result in the implementation of a combination of physical, behavioural, and engineering controls.

Risk – generic	Risk type P / CR / VC / SS	Harm/damage/loss and examples of direct causes.	Uncontrolled risk level L / M / H / E	Above the line controls (eliminate, substitute, isolate, engineering) – More effective	Below the line controls (administration, PPE) – Less effective	Controlled risk level L / M / H / E

Working on the road.
• Driving
• Other road users
• Runners & helpers
• Vulnerable users (Pedestrians, cyclists, mobility, scooters, elderly, children, e-bikes/scooters)
• Pedestrians' behaviour near the collection vehicle.
• Visibility & Speed.
	CR	Death / serious injury / damage.
		• Collection truck vs vehicle or structure
		• Collection truck or lifting device striking pedestrian / vulnerable road user.
		• Driver of collection truck struck by traffic.
		• Runners struck by traffic or waste collection vehicle.
		• Cyclists being struck when undertaking a left turning truck, or
			Extreme	• Reversing cameras fitted
				• Cameras / mirrors mounted at suitable locations to enable driver to observe whole of truck operations.
				• Mirrors in place to enable driver views whole of truck operations. *Also mirror to show front of cab.*
				Note: Both the above need to consider visibility from left- and right-hand side operation – identifying potential blind spots
					• Traffic Management Plan – signed off annually by the Road Controlling Authority.
					• Implement KCTL[23] requirements
					  • Beacons on trucks (2 @ rear / 1 @ front)
					  • Chevrons across the rear of the truck
					  • Advanced Warning Pass with Care sign
					  • CoPTTM Compliant Hi Visibility clothing
						High

[23] Kerbside Collection Traffic Leader – Qualification achieved by a driver of a kerbside collection vehicle after attendance at a prescribed training course.

• Getting in and out of the cab into a live lane (right hand side).		riding on left hand side of truck when lifting device in use • Users of other mobile devices operating on footpath or road, i.e. scooters, mobility. • Distracted road users striking runners, helpers or a waste collection vehicle		• Use left hand drive design and technology (dual drive) to minimise frequency of alighting and entering a cab from live lane. • Nonslip surfaces on cab access steps • Collection company to report to TA where collection locations do not have Clear Sight Distance[22] can't be maintained, collect from a safer location. • Front bumper sensors • Artificial Intelligence (AI) technology cameras	FIRST 4 Practical assurance f • Consider signage at rear of truck to warn against cyclist's undertaking • Ensure operating with clear sight distance • Register for NZTA Driver Check or TORO system to monitor driver licence currency and status. • Training, awareness around three points of contact, exit/entry in backwards, not to jump out of cab. • Procedure requires left hand side collection only, workers not to cross the road or work in a live lane • Use the runner as a spotter to guide the truck when it is reversing • Share the road campaign training – blind spot awareness with Cycling Advocacy Network (CAN). • Hi visibility clothing worn	

[22] Clear Sight Distance (CSD) A distance calculated that defines whereby there is a safe distance to enable oncoming traffic to see and a roadside hazard. CSD = 3 x posted speed limit)

Roading environment • Not fit for waste collection vehicles • Urban Design – doesn't consider waste collection. • Collection vehicle required to straddle cycle lanes to complete collections	V/C	Death / serious injury / damage • People injured or vehicles damaged trying to overtake a collection truck in narrow roads • Striking objects or people while collection vehicle reversing in cul de sacs • Damage to private roads not designed for large trucks. • Road users colliding with collection truck due to lack of room to pull off live lane to collect (automated & manual)	Extreme	• Where private road residents have a centralised consolidation point – residents provided with towing attachment to fit tow bar and wheelie bin. • Bespoke vehicle design (refer figure 4 page as an example) to meet changing roading design and increasing urbanisation. (Narrow streets in new developments / multi-unit dwellings). • Waste Teams in Territorial Authorities engage with roading engineers and planners to highlight collection requirements in new developments.	• Cul de sac intersections with no parking yellow lines painted for easier truck • access to the cul de sac. ***Territorial Authority action.*** • Council mandate that collections not undertaken on private road. ***Territorial Authority action.*** • If there is a real need for private road collections, then an indemnity process (against damage) is entered into with all effected residents. • Collections only proceed if all residents sign up to the indemnity. ***Territorial Authority action.*** • TA to negotiate with resident to leave bin at alternate location if collection point deemed unsafe by collection co. • Use a spotter to guide the driver when reversing a truck.	High
Hydraulically operated rear doors. • Catastrophic failure of hydraulic system	CR	Death / serious injury • Being struck/crushed by falling door while positioned under	Extreme	• Physical struts / body props in place when doors raised, and workers required to enter between door and truck body.	• Suitable preventative maintenance inspections on hydraulic systems. • Prestart checks include looking for evidence of hydraulic hose damage or leaks.	High

		raised door (cleaning / clearing debris)		• 20 second descent time on rear doors. Tamper proof, checked as part of preventative maintenance. • Audible alarms when door raising & lowering and/or not securely closed.	• Good practice rule, promoted during induction, training and regular discussions about not working between a raised door and truck body. • Signage to indicate crush risk • Confined Space entry protocols if entry required for cleaning of maintenance • Use brushes and other long-handled cleaning devices to avoid need to walk under raised door.	
Driver / Operators skills • Lack of skills • Lack of appropriately skilled workers in labour market	V/C	Death / serious injury / Minor injury / illness • Driver / operator not fit for purpose • Lacks skill requirement for job • Lacks understanding due to ESOL / other	Extreme	• Consider skills needed to operate a bin collection vehicle – industry experience suggests workers from the following fields have good cross over skills – concrete truck drivers, machine operators (yellow gear), bus drivers. • Promote the waste industry to have visibility at career development days. • Literacy Programmes to ensure training delivery considers literacy and comprehension abilities of trainees. • Consideration of Personality and Attitude as part of recruitment.	• Pre employment medical – musculoskeletal health, vision, (including drug tests) • Psychometric testing – attitude towards safety and risk management. • Company induction / site specific induction (where required) • Driver assessment (in cab) allow time to observe emergence of habits. • Hazard and risk management training (external or internal courses) • Kerbside Collection Traffic Leader (KCTL) • Fatigue management awareness training • Work time & logbook requirements • Licence development training i.e. Class 2, 3, 4	High

					• Specialist training, relevant to task (buddy training)	

Remote and Isolated Work
 	
• Rural areas with lack of cell phone coverage
• Working alone in remote areas.
• Working in high-risk environments at night
	P	Serious injury
		
		• Physical attack / abuse.
		• Unable to get help with work related injury
		• Unable to get help due to health-related issue, i.e. heart attack
			High	• Have two persons + always working together.
				• Remote / Isolated worker communication and monitoring systems/ Man Down alarms.
				• Testing protocols in place to ensure monitoring system is working.
				• Satellite phones - in no cell coverage areas. Use cell network providers maps to identify at risk areas.
				• GPS monitoring on vehicles
					• Training in Risk Assessment for remote / isolated work.
					• Communication Procedures
					  ○ Notify supervisor / office when leaving for a job
					  ○ Contact supervisor / office at scheduled times during day e.g. 10, 12 & 3
					  ○ Notify supervisor / office when finished job
					  ○ Notify supervisor / office when back at safe location (office / home)
					  ○ supervisor / office enacts emergency protocols if worker does not report in.
					• Training in emergency procedures
					• Carry appropriate supplies including suitable first aid equipment.
						Medium

Psychosocial
 	
• Bullying / abuse
• Pressure to finish
• Workload
	CR	Psychologically unsafe workplace
		
		• Work Related Stress
			High	• Targeted programme at enhancing worker mental & physical wellbeing.
				  • Financial Literacy
				  • Cardiovascular Health
					• Workplace Culture surveys
					• EAP Services (counselling)
					• Reporting systems
						Medium

• Traffic volumes • Change in plan		• Personal related stress		• Health and Fitness • Nutrition & Hydration • Relationships • Comprehension	FIRST 4 Practical assurance f	
Fires in waste stream or truck • Lithium-ion or Lithium polycarbonate batteries. • Hot ash	CR	Serious Injury / significant damage • Fire in waste load from inappropriately disposed of e-waste	High	• Battery disposal / drop off system **(Territorial Authority Action)** • Public education on battery disposal **(Territorial Authority Action)** • Cameras on trucks to monitor waste entering hopper. • Water dousing system installed on trucks.	Emergency Response plan – Fire in body of truck, considerations • Safety of operators / public • Damage to hydraulics etc, stopping door opening/ compactor working. • Action to consider – compact load, discharge load. • Contact Emergency Services • Safe Place to park truck • Fire Fighting Equipment in & on truck • Regular cleaning protocol for residual waste that might collect in hot areas of truck (engine bay, exhaust, turbo) • Relevant territorial authority to provide public education and enforce responsibility on public to comply with the waste and recycling criteria.	Medium
Pandemic • Community Spread of a virus.	CR	Death / serious illness / minor illness	High	Not undertaking Manual Collections of glass in crates or food waste at Alert Level 4 or 3 if risk assessment shows risk of transmission. • Use of Wastewater Testing results to contribute to risk assessment as to	• Site specific safety plan for COVID-Alert level. • Risk Assessment to determine whether it is safe to undertake manual	Medium

				whether manual collections occur under level 4 and 3.
				• Use of publicly announced COVID Cases by geographical location to contribute to risk assessment as to whether manual collections occur under level 4 and 3.
				• Use of publicly announced locations of interest by geographical location to contribute to risk assessment as to whether manual collections occur under level 4 and 3.
				• Personal hygiene protocols
				• Hygiene protocols –clean vehicle cabs, equipment and high touch equipment.
					collections of glass in crates or food waste at Alert Level 4 or 3.
					• Controls as mandated by Ministry of Health. Consider all operations and introduce controls methods in the following areas.
					  • Prior to workers attending the workplace – (Alert Level dependant / Essential Services Status)
					  • Worker entering the workplace.
					  • Workers undertaking work tasks
					  • Workers Leaving the Workplace.
					• Contact tracing protocols in place QR code / manual entry)
					• Split shift arrangements
					• Promotion of vaccination
					• PPE (masks / gloves / disposable clothing / face shield) / hand and vehicle sanitiser.
					• Commercially laundered clothing	

Health risks • Working outdoors • Exposure (ingestion,	V/C	Health issues • Exposure to ultraviolet light (sun) - Skin disease.	High	• Vaccination Programme (Hep A, B, Tetanus, COVID-19).	• Promote good hygiene. • Issue sunscreen to workers	Medium

inhalation, absorption) of contaminated items. • Effects of Drug or Alcohol use		• Exposure to infectious disease (Tetanus, Hep A, B HIV. Needles, human waste, virus)		• Long sleeves/pants uniform. (Note, consider unintended consequences / such as heat stroke)	FIRST 4 Practical assurance f • Provide education on nutrition and hydration • Health monitoring programme in place. (Annual checks – skin, blood, hearing) • Emergency Response protocols in the event of workers suffering needlestick injury – consult with GP, blood tests for HIV / Hep. • Drug & Alcohol testing • PPE – Gloves, forearm protectors, visors, neck protectors, hats.	

3.6.2 Table 5 - Automated collections risks

Risk – Automated Collections	Risk Type P / CR / VC / SS	Harm/damage/loss and examples of direct causes.	Risk Level L / M / H / E	Critical Controls (Above the line) (Eliminate, Substitute, Isolate, Engineering)	Individual Controls (Below the line) (Administration, PPE)	Controlled Risk Level L / M / H / E
Raised and Falling Objects – Particular Risk as per GRWM Regs 16						

Machinery
• Bin lifters – automated sideload operation.
	P	Serious injury
		• Pedestrians and cyclists struck by bin lifter.
			High	• Cameras mounted at suitable locations to enable driver to observe bin lifter.
				• Mirrors in place to enable driver views of bin lifter.
				Note: Both the above need to consider visibility from left- and right-hand side operation - identifying potential blind spots.
				• Bin lifters painted a different colour to the rest of the vehicle (vibrant to highlight moving equipment)
				• Lighting systems on arms to highlight moving equipment to pedestrians.
					• Risk assessment conducted against Australian Standard - AS 4024 – Safety of Machinery.
					• Driver training to include situational awareness (peripheral vision important).
					• Driver training to include
					  • Protocols when members of the public in the vicinity.
					  • Risk of pedestrians coming from behind the driver
					  • Lack of awareness by pedestrians due to distractions (phones, headphones etc)
					  • Joggers / cyclists / scooter / mobility scooters
						Medium

Manual Tasks / incl Manual Handling
 	
• Moving bins out from behind parked cars or other obstructions.
• Lifting bags off the top of bins.
• Use of the in-cab joystick to operate bin lifter.
	CR	Musculoskeletal injury
		
		• Repetitive use of equipment.
		• Sedentary role (seated all day)
		• Manually handling bins to enable bin lifter access
			Medium	Automation of manual tasks where it is reasonably practicable
				• MGB collections
				
				Public education about how to best present a bin at the kerbside i.e.
				• Not blocked by parked cars
				• Not left behind or near other assets (power poles, transformers)
				• In MUD, not leaving multiple bins right next to other bins, leaving room for bin lifter.
				• Not to place bags or other items on top of the MGB.
				
				Territorial Authority action
					• Undertake a workstation assessment for the operator and make appropriate adjustments to minimise overuse discomfort.
					• Risk Assessment to identify manual tasks, use of Manual Handling Approved Code of Practice to identify risk factors such as,
					  • Load / Weight / Handles / Hazardous items
					  • Environment / Slippery / carry distance
					  • People / Postures / fitness
					  • Task / Repetition / Duration / Vibration
					  • Management
					
					<u>Training</u>
					• Use of qualified/competent physiotherapists to guide workers on habitual awareness of (pushing, pulling, bending, leaning, reaching, bending, lifting, twisting, gripping, carrying,
						Low

					sustained postures, working above shoulder height) • Training needs to be targeted and industry specific. • Internal training on handling techniques for crates. **<u>Personal Protective Equipment (PPE)</u>** • Fit for Purpose Gloves – consider • Dexterity • Differences in hand size • Work with a reputable glove supplier and undertake trials with workers to identify the most effective, fit for purpose glove. • Enforcement activity's where waste/recyclable items left for collection cause harm to waste collectors (unwrapped sharps, non-conforming items etc) **Territorial Authority action.**	

3.6.3 Table 6 - Manual collection risks

Risk – Manual Collections	Risk Type P / CR / VC / SS	Harm/damage/loss and examples of direct causes.	Risk Level L / M / H / E	Critical Controls (Above the line) (Eliminate, Substitute, Isolate, Engineering)	Individual Controls (Below the line) (Administration, PPE)	Controlled Risk Level L / M / H / E
LEV Operations (left hand side operator) • Swapping between right- and left-hand drive. • Standing position when operating in left hand drive • Moving between different levels when alighting/ entering left hand side of cab (standing position & kerb)	CR	Death / serious injury. • Ejection from left hand side driving position. • Slips/trips/falls when alighting vehicle • Exposure to physical abuse from members of public	Extreme	• Reversing cameras fitted • Cameras / mirrors mounted at suitable locations to enable driver to observe whole of truck operations. • Ensure camera monitor can be seen by operator in left side position. • Mirrors in place to enable driver views whole of truck operations. *Also mirror to show front of cab.* *Note: Mirror placement needs to consider visibility from left- and right-hand side operation and the driver's ability to identifying potential blind spots.* • Barrier arm or gate system to protect operator from falling from cab. • Nonslip floor covering in operator area in cab.	• Left hand side collections only. • Training and procedures describe the following criteria. ○ Collections to STOP when pedestrians are in the vicinity of the collection activity. ○ Operator positioning in the cab, not to use barrier arm or gate as a support arm to lean on. ○ Runners do not ride on the outside of the vehicle while it is reversing. ○ No exit and entry of cab from right hand side into live traffic lane. ○ Operator alights cab only when the vehicle is stationary.	Medium

				• If a bin lifting device is fitted, two handed controls to operate.	FIRST 4 Practical assurance f ○ When operator is able to use vehicle in left hand mode (during collections) and when ○ right hand mode must be used (before & after collections or when driving longer distances between collections. • Training in conflict avoidance • Mirrors and cameras to be set up to ensure appropriate visibility from both right- and left-hand operations.	
Runners • Collecting waste / recycling receptacles (bins, bags, crates, caddies) from kerbside, carrying to truck. • Manually loading receptacles into a rear loader.	CR	Death / serious injury / minor injury. • Struck by other road users • Exposure to physical abuse from members of public	Extreme	• Install an MGB lifter • Reversing Cameras fitted • Cameras mounted at suitable locations to enable driver to observe whole of truck operations. • Mirrors in place to enable driver views whole of truck operations. *Also mirror to show front of cab.* • *Communication device between rear of truck and driver.* *Note: Mirror placement needs to consider visibility from left- and right-hand side*	• In cases where a runner is used, the driver ○ Is the supervisor ○ Briefs the team daily on hazards / controls ○ Must remain aware at all times of the location of the runner ○ Ensure clear communication & visibility – stop operations if the driver is unsure of the runner's location	High

				operation and the driver's ability to identifying potential blind spots.	• Training in safe work zones (observe traffic when working at back of rear load truck). • Training in conflict avoidance • Left hand side collection only. • Hi Visibility clothing, suitable footwear, wet weather gear, sunscreen, hats, • Gloves used when handling waste/recycling receptacles • Lower leg protection to protect from cuts (sharps in bag)	
Riding on a vehicle • Running boards on rear loaders • Sentry boxes on LEV trucks • Running board on trailers • Riding in truck body or trailer as an onboard sorter	CR	Death / serious injury. • Falling from a moving vehicle.	Extreme	• Removal of running boards on vehicles/trailers - elimination • Speed limited vehicles when a person is riding on a vehicle and is not secured by a seatbelt in the cab. • Cameras mounted at suitable locations to enable driver to observe whole of truck operations. • Mirrors in place to enable driver views whole of truck operations. *Also mirror to show front of cab.*	• When riding on a vehicle person must not alight a moving vehicle. • Hand holds installed • Training and procedures require that runners do not ride on the outside of the vehicle while it is reversing. • Policy around limiting distance travelled by a truck when a person is riding on the vehicle. • Anyone riding within the body of a truck or trailer as an onboard sorter must be secured, through use of a harness system.	High

				Notes: • *Mirror placement needs to consider visibility from left- and right-hand side operation and the driver's ability to identifying potential blind spots.* • *Vehicle passengers should have at least the same protections as the operator.*	• Seatbelts worn when travelling to and from work site start/finish of runs.	
Machinery • Compaction equipment. (Rear loader)	CR	Death / serious injury • Crush injuries/fatal by being drawn into the hopper by compaction blade. • Limbs caught in compaction blade pinch points	Extreme	• Fully enclosed system (rear load hopper) allows for auto cycle. (No other system should use auto cycle) • Single cycle compaction system. • Two handed deadman controls – ensure distance between controls requires two hands. • Guarding on side of hopper between control panel. • Removal of running boards on rear load vehicles.	• Risk assessment conducted against Australian Standard - AS 4024 – Safety of Machinery. • Labelling on control panel – in English • Training includes a "once it's in the hopper it stays there" approach. • Emergency equipment and protocols in place	High
Consolidation bins on truck for tipping collected recyclables into truck	CR	Death / serious injury • Caught in lifting mechanism. • Limbs caught in pinch points	Extreme	• Two handed deadman controls – no auto or semi auto cycle. • Emergency stops and emergency pull cords	• Truck to remain stationery when sorting and bin lifting is in process. • Risk assessment conducted against Australian Standard - AS 4024 – Safety of Machinery. • Labelling on control panel – in English • Emergency equipment and protocols in place • Training of workers in the use of the equipment and protocols when the equipment fails or becomes jammed.	High

Items Hazardous to health – Particular Risk as per GRWM Regs 16						

Substances hazardous to health
 	
• Non-conforming waste put into the waste stream.
• Sharps – unwrapped glass
• Needles
• Human waste
• Animal waste
• Medical waste
	P	Serious illness / minor illness
		
		• Exposure to infected items in waste
		• Cuts and lacerations from poorly disposed of items
		• Exposure to transmittable disease from non-conforming items (needles, human waste etc)
			High	• Cameras mounted at suitable locations to enable driver to observe non-conforming items in bin.
				• Sharps container part of truck inventory – arrangements for periodic medical waste disposal.
				• Vaccinations – Tetanus, Hepatitis A & B
					• Training – Identification of hazardous substances. Consider Chemicals in recycle crate, sharps, including needles in recycle crate.
					• Emergency Response Plan in event of hazardous substances identified in waste stream. Include protocol where substance is unable to be identified.
					• Spill plans – (truck mechanical issue & liquid in waste)
					  • Spill kit on board
					  • Identification of spill, notification to company, council (TA & Regional, if required)
					  • Emergency services
					  • Site safety, Clean up
					  • Replenishment of spill kit
					• Suitable PPE provided – suitable mask, slash proof / puncture resistant gloves.
					• Response Plan includes medical protocols in event of actual exposure – medical testing post needlestick injury,
						Medium

					• inhalation, ingestion, absorption or irritation due to hazardous substance. • Relevant territorial authority to provide public education and enforce responsibility on public to comply with the waste and recycling criteria. • Enforcement activity's where waste/recyclable items left for collection cause harm to waste collectors (unwrapped sharps, non-conforming items etc) ***Territorial Authority action.***	

Manual Tasks / incl Manual Handling
 	
• Carrying crates from the location they have been left to the collection vehicle.
• Restraining bin between body and truck while sorting.
• Sorting glass recyclables at the kerbside –repetitive action.
• Sorting glass recyclables at the kerbside – exposed to sharps.
	CR	Musculoskeletal injury
		
		• Cuts, puncture wounds & lacerations
		• Biological disease exposure (Hep A, B, HiV, Tetanus)
		• Cuts scratches, foreign body in eye from flying objects (breaking glass)
		• Shoulder injury from repetition or if tipping/throwing over shoulder height
			High	• Automation of manual tasks where it is reasonably practicable – i.e. MGB collections
				• Vaccinations – Tetanus, Hepatitis A & B
				• Crate/caddy criteria to provide best ergonomic design. (Consider, crate/caddy size (volume), lids, handles.
					• Risk Assessment to identify manual tasks, use of Manual Handling Approved Code of Practice to identify risk factors such as,
					  • Load / Weight / Handles / Hazardous items
					  • Environment / Slippery / carry distance
					  • People / Postures / fitness
					  • Task / Repetition / Duration / Vibration
					  • Management
					• Weight limits on bags / crates mandated by council bylaw, collection companies
						Medium

• Tipping crate, caddy or throwing bag into collection vehicle					• aware of the requirement, enforcement by council.
					• Warm up conducted before starting
					
					<u>Training</u>
					• Use of qualified/competent physiotherapists to guide workers on habitual awareness of (pushing, pulling, bending, leaning, reaching, bending, lifting, twisting, gripping, carrying, sustained postures, working above shoulder height)
					• Training needs to be targeted and industry specific.
					  • Internal training on handling techniques for bags of unknown weight / lack of handles / risk of sharps/other hazardous items.
					  • Internal training on handling techniques for crates.	

					Personal Protective Equipment (PPE) Fit for Purpose Grade 5 cut gloves (minimum standard) – also consider • Dexterity • Differences in hand size • Puncture Grade / Slash proof • Work with a reputable glove supplier and undertake trials with workers to identify the most effective, fit for purpose glove. • Full arm and leg cover • Safety Glasses for kerbside glass sort / consider double eye protection (glasses and a visor) • Hearing protection must be worn	

3.6.4 Table 7 - Materials recovery facility risks

Risk – Materials Recovery Facility	**Risk Type P / CR / VC / SS**	**Harm/damage/loss and examples of direct causes.**	**Risk Level L / M / H / E**	**Critical Controls** (Above the line) **(Eliminate, Substitute, Isolate, Engineering)**	**Individual Controls** (Below the line) **(Administration, PPE)**	**Controlled Risk Level L / M / H / E**

Mobile Plant
• Delivery trucks
• Bucket loaders
• Forklifts
	CR	Death / serious injury / damage
		• Mobile plant striking workers on foot (pedestrians).
		• Collection truck drivers being struck by mobile while walking around site.
		• Mobile plant running into structure or equipment
		• Exposure to diesel/LPG fumes.
			Extreme	• No pedestrians in areas where mobile plant is operating.
				• Ventilation Systems in sort area.
				• Hard physical barriers to separate mobile plant from pedestrians.
				• Soft barrier systems to highlight no pedestrian zones.
				• Warning devices fitted to mobile plant (lights, buzzers, alarms)
				• Red/Green lighting system on machine to indicate safe for pedestrian to proceed.
				• Exclusion zones when trucks emptying off/fork hoist/loader in operation
				• A key fob, for operating powered mobile equipment (loaders, forklifts etc) *A fob is a small security hardware device with built-in authentication*
					• Site traffic management plans –
					  • One-way systems
					  • Give way rules
					  • Mobile plant horn operation when moving through doorways
					  • Painted walkways
					• Training of communication protocols if pedestrians have to enter an area where mobile plant is operating
					  • Eye contact with operator
					  • Radio communication between pedestrian and mobile plant operator
					  • Move machine into neutral
					  • Drop bucket to floor
					  • Indicate person is safe to proceed
					  • Hi visibility clothing
						High

				*used to control and secure **access** to machinery, equipment and systems.*		
Machinery • Conveyors • Balers • Shredders • Magnets • Screens	CR	Death / serious injury. • Caught in moving items • Crush / amputation from pinch points	Extreme	• Entire sort area gated off, lock out system in place, authorised personnel only access • Individual guards on machinery • RFID system on operators – breach of exclusion zone/s machine shuts down – Conveyors • Sensors on conveyor systems • Interlocked Guards used where required • Eddy current for seperation of nonferrous metals	• Machinery Assessment to identify machinery that requires additional safety measures. • Training for staff about the hazards of machinery. • Signage in place to warn of hazardous machinery • Signage to warn of risk to those with pacemakers near magnets.	High
Manual Tasks / incl Manual Handling • Pushing, pulling, reaching, bending for items on conveyor • Repetitive actions – sorting recyclable content into bins • Exposure to needles, glass, other sharps • Exposure to contaminated biological items	CR	Musculoskeletal injury • Cuts, puncture wounds & lacerations • Biological disease exposure • Psychological distress	High	Automation of manual tasks where it is reasonably practicable. • Optical sorting systems – glass colour sort and plastics. • Use of magnets for steel separation • Air pressure systems in conjunction with optical sort	Risk Assessment to identify manual tasks, use of Manual Handling Approved Code of Practice to identify risk factors such as, • Load • Environment • People / Postures • Task / Repetition / Duration / Vibration • Management Job rotation to ensure workers are not undertaking the same repetitive tasks for whole shift.	Medium

(human, animal waste
• Exposure to other hazardous substances
					Training
					Use of qualified/competent physiotherapists to guide workers on habitual awareness of (Pushing, pulling, bending, leaning, reaching, bending, lifting, twisting, gripping, carrying, sustained postures, working above shoulder height)
					Internal training on handling techniques
					
					Personal Protective Equipment (PPE)
					• Fit for Purpose Gloves – consider
					  • Dexterity
					  • Differences in hand size
					  • Puncture Grade / Slash proof
					  • mrf operators may benefit from elbow length gloves	

Items Hazardous to health – Particular Risk as per GRWM Regs 16						
Substances hazardous to health Non-conforming items in recycling stream • Sharps, incl Needles. • Items of human waste • Animal waste / carcasses	P	Serious illness / minor illness • Exposure to infected items in waste • Cuts, puncture wounds and lacerations needles, glass and sharps • Exposure to transmittable disease		• Emergency stop systems on conveyor system. • Relevant territorial authority to provide public education and enforce responsibility on public to comply with the waste and recycling criteria. • Tools and equipment available to deal with non-conforming waste, (sharps containers, tools to handle items with)	• Training – Identification of hazardous substances. Consider chemicals, human/animal waste, sharps, including needles. • Emergency Response Plan in event of hazardous substances identified in waste stream. Include protocol where substance is unable to be identified.	

• Lithium-Ion Batteries • Compressed gases		from needles, human waste etc • Mental distress from seeing or being exposed to needlestick injury, human waste/fluids, dead animals) • Fire from Lithium-Ion batteries or compressed gas canisters		• Sharps containers at sorting stations • Public Education about conforming items that can be recycled • Street Auditing to identify non-conforming items	FIRST 4 Practical assurance f • Suitable PPE provided – suitable mask, slash proof / puncture resistant gloves. • Response Plan includes medical protocols in event of actual exposure – medical testing post needlestick injury, inhalation, ingestion, absorption or irritation due to hazardous substance. • Reporting system when non-conforming waste identified at mrf (report to TA and collection company. • Relevant territorial authority to provide public education and enforce responsibility on public to comply with the waste and recycling criteria. • Counselling services for situations where non-conforming waste could cause mental distress for sort staff (needlestick injury, human waste/fluids, dead animals) • Vaccinations for Hepatitis (A and B) and Tetanus	
Noise	CR	Nosie Induced Hearing Los (NHIL)		• Machinery Assessment to identify machinery that has noise issues that could be mechanically reduced.	• Preventative maintenance programme in place to keep machinery maintained and suitably fit for purpose.	

				• Repairs and maintenance to fix noise problems	• Environmental monitoring to enable exposure levels to be quantified. • Suitable hearing protection used based on environmental monitoring results. • Health Monitoring programme includes hearing test • Maintenance system in place for PPE	
Dust	CR	Respiratory Illness.		• Misting systems over sort lines • Dust extraction systems placed at sort lines	• Environmental monitoring to enable exposure levels to be quantified. • Suitable masks used based on environmental monitoring results. • Health Monitoring programme includes lung function testing • Maintenance system in place for PPE	
Vibration	CR	Whole Body Vibration Syndrome (WBV)		• Safety in Design process considers vibration as a possible hazard and design controls in early. • Vibration mats placed at sort stations	• Job Rotation process in place to limit time spent where vibration risk exists • Environmental monitoring to enable exposure levels to be quantified. • Health Monitoring programme includes whole body vibration testing	

4 Discussion on kerbside collection and mrf risks

The following themes evolved from the research including the feedback from the various stakeholder engagement events (refer appendix G), literature review and industry guidance (refer appendix A - D). We detail the seven (7) generic risks inherent across all collection methods and mrf operations and discus existing and recommended control options for managing these risks.

4.1 Working on the road (includes driving, pedestrians, runners and the roading environment)

Working on the road has been a concern for the industry for several years. Risks are created by the behaviour of other road users (speed), pedestrians, cyclists, e-scooter users, other vulnerable people, high-speed rural roads, and lack of visibility in some rural areas. Lack of public awareness of the risks (bin lifters, left hand drive vehicles etc) created by kerbside collections should also be considered. Recent changes in industry standards such as undertaking kerbside collections from the left-hand side of the road only, were introduced as a direct result of poor health and safety performance including incidents with fatal outcomes. There is also the continued use of dual drive or LEV type vehicles which substitutes the risk of drivers alighting and accessing the right-hand side of a vehicle from a live lane. In addition these trucks remove the risk of operators working at the back of a rear load truck with traffic approaching from behind.

In terms of the driving tasks, operators report that their drivers experience multiple near miss events each day, which can mean incidents become routine and go unreported. One operator who uses in cab technology to monitor vehicle related incidents reported more than 100 alerts per day. (This technology highlights G force exceedances due to heavy braking or hard cornering).

Cognitive overload

One of the specific risks discussed by stakeholders was cognitive overload experienced by the operators of waste and recycling collection trucks. This is due to an apparent increase over recent times of technology that the driver is required to monitor while undertaking collections. This includes camera monitors to check when reversing, checking content of bins going into the vehicle for non-conforming waste or recycling items and following a route sheet. Waste and recycling collection trucks also have various alarms and bells in place to alert drivers of specific situations related to their truck or the ancillary equipment like bin lifters and packer blades. This is all added to the standard in-cab requirements of operating a large truck safely on the road. Consideration needs to be given to the tasks the operators of a truck need to do other than driving. Health and Safety by Design workshops or learning team events are effective methods of understanding the realities of *work* from the workers perspective.

Skilled staff

Like many in the transport industry, there is difficulty in attracting skilled people to take on a kerbside collection role. The industry views those in control of waste and recycling collection vehicles as no longer being classed as "drivers". Given the broad range of vehicles, plant, and equipment they operate, these workers are considered **operators** and require specific skills to undertake this task effectively and safely. This means the recruitment process is targeted at individuals with a wider range of skills than simply that of a truck driver. This does have an impact on the pool of suitable people in an industry (road transport) which is short of candidates. Collection companies are looking at bus drivers, concrete truck drivers and operators of large construction machines, i.e. excavators, as a source of workers to operate waste collection vehicles. Recruitment targets candidates for their specific skills in driving in urban environments, operating other equipment along with a steering wheel and using ancillary equipment that requires a degree of hand eye coordination and the ability to undertake precision work (operating a bin lifter using an in-cab joystick). Long-haul drivers may not necessarily have the skills to perform the additional tasks associated with kerbside collections.

The roading environment

The roading environment in both urban and rural areas is a significant contributor to increased health and safety risk in kerbside collections. The emergence of design criteria for new or developing residential areas with narrower streets means there is less room for manoeuvring collection vehicles. Added to this, high density housing which provides only limited off-street parking and little consideration of space for waste receptacles to be left (bins, crates, or bags) has led to health and safety related issues that have not been present previously. This is leading to a situation where in some cases larger trucks are being replaced with smaller vehicles with uniquely designed handling equipment, evidence of this is seen in a recent social media post, *refer figure 4.* Issues such as cycle lanes (some with raised kerbs between the live lane), which can mean increased manual handling, even for automated collections, is also an area of concern for the kerbside collection industry. The Waste Management Institute of New Zealand (WasteMINZ) recently published guidance on undertaking collections where cycle lanes are present. This guidance indicates that collection trucks should straddle cycle lanes, however not all Road Controlling Authorities agree with this approach. Waste collection companies need to take a "share the road" approach when designing kerbside collections and include how they intend to undertake collection when there is a marked cycle lane. This information should be detailed in any traffic management plan and risk assessment documents to enable Road Controlling Authority sign off.

Figure 4 – Multi Unit Dwelling Collection Vehicle - Source – Envirowaste LinkedIN page 14th August 2021

The vehicle started servicing multi-unit dwellings where residents are using stacker crates.

In a rural setting there can be a lack of locations for trucks to safely pull off the road to undertake collections and in urban areas there is increased roadside parking by members of the public[24]. On some narrow roads, the only option is for a collection truck to reverse in or out of the street. These are examples where there is increased risk to the work of the collector. In urban areas some controls that have been found to be effective in improving accessibility of trucks into narrow streets or cul de sacs include applying yellow “no parking” lines on the road edgeway on the intersections of such roads.

In multi-unit dwellings (MUD), each dwelling is issued with a waste collection receptacle, this results in a high density of bins at the kerbside restricting kerbside real estate and therefore access by side arm collection trucks.

There seems to be a disconnect between urban planners, developers, and council waste operations teams. Increased collaboration between waste teams in TA’s and roading engineers and planners is needed to enable requirements of kerbside collections to be highlighted when there are new urban development’s being designed.

There is also a need for greater engagement between TA’s and residents that occupy properties on private roads. To address the liability risk potentially held by the collection company for damage to a private road, TAs could mandate that collections are not undertaken on private roads.

[24] Increased roadside parking was highlighted as an increased risk during periods of COVID-19 alert level four lockdowns, when many people were at home.

If there is a real need for private road collections, then an indemnity process (against roading damage) can be entered into with ALL affected residents. Collections would only proceed if all residents signed up to the indemnity. Further, TAs could negotiate with residents to leave bins at an alternate location if the collection point is deemed unsafe by the collection company. Where private road residents have a centralised consolidation point, residents can be provided with a towing attachment to fit to a vehicle tow bar which enables a wheelie bin to be towed to the collection point.

Using runners

While there has been a move by many councils towards automated collections, the use of manual collections and those using runners remains an approach across the industry. Stakeholders that contributed to this project generally felt that this risk was one that could be effectively managed with existing industry controls such as collecting from the left-hand side of the road.

The practice of runners riding on the outside of a collection vehicle or trailer or in an unsecured manner outside of the cab of the truck still occurs. The Ministry of Business, Innovation and Employment (MBIE) has recently released a draft document outlining Health and Safety at Work reform which will see the introduction of new regulation detailing the risks and controls required to manage plant and structures. One area of focus is working with mobile plant, with the proposed regulation requiring that passengers in vehicles are given the same protections as the driver. This could have an effect on the current industry approach of having workers riding on the outside of a vehicle. The efficacy of existing controls to manage the risk of workers travelling on the outside of a vehicle in an unsecured manner is low, meaning this practice should be discontinued, and runners should instead travel in the cab of a truck or walk or run the distances between collections.

Our observations of the impact of this recommended change is that workers riding on the outside of a vehicle occurs mainly with smaller operators in small towns or rural areas, with many of the larger waste collection companies already having made policy decisions on the removal of running boards from their collection vehicles. This means such a change is not an industry wide requirement, more one that would affect a smaller number of operators throughout the country. To be clear, the change would not require a change in basic methodology, with existing equipment still being able to be used, it would mean that running boards would simply be removed from these vehicles.

4.2 Machinery Safety / Equipment Design

Use of machinery associated with kerbside collections (mainly rear-load compactors) has been a contributor to a number of historical fatalities and serious injuries in the waste industry. While there have been several industry standards introduced over time to lessen the risk of injury, the risk has not been able to be effectively eliminated and the risk of harm resulting from the use of compaction equipment still exists. Controls such as guarding, increased height of hoppers, single cycle compaction systems, two handed (deadman) controls and labelling of controls in English are all industry standard approaches to minimise the risk of exposure to harm from the use of machinery.

Similarly, hydraulically operated rear doors (top hinged) have also contributed to a fatality and introduce an extreme risk when uncontrolled. Industry controls to minimise catastrophic failure of hydraulics were introduced in the late 1990's to protect against this risk. These include physical struts to hold doors open, timing systems on door opening and closing, alarm systems to warn and procedures requiring workers to not enter the space between an open door and the body of a collection truck.

In terms of exposure to compaction equipment and hydraulically operated rear doors, the level of risk in a controlled state still remains high. There is an element of human behaviour that is required for the standard industry controls to be effectively implemented and used. Behaviours that could lead to harm being suffered could be caused by lack of training in the use of the equipment, lack of understanding or comprehension of any training given or simply the worker making a mistake and coming into contact with the machinery. These behaviours and underlying causes are relevant in all areas where a worker is required to take an action to use or apply a control to minimise a risk.

In terms of the risk of exposure to drivers, runners, operators, and pedestrians to bin lifting equipment, it is mainly pedestrians that are at a high risk of injury when this equipment is not effectively managed. The potential risk from this equipment could meet the definition of raised or falling objects under the GRWM Regulations 2016. Some regions have recently seen an increase in incidents where pedestrians have been struck by wheelie bin lifters in operation. In an automated collections context, the bin lifter is working behind the operators position in the cab. While there are mirrors and cameras in place as well as the driver's peripheral vision, events where pedestrians are struck have occurred.

This is a seriously concerning issue and it may not be easy to further minimise the risk as many existing controls are in place to assist the operator with all round visibility from their operational position in the cab of a truck. In addition, accepted industry controls have been developed and implemented by some collection companies which highlight to

pedestrians that there is a bin lifter operating e.g. bin lifting mechanism painted in a highly visible colour different to that of the truck.

An additional control that could be considered includes a lighting system that further highlights the bin lifter to people using the footpath. Bin lifters on LEV and rear load trucks are less likely to injure pedestrians as the operation of these lifters is generally undertaken by a worker standing outside the vehicle next to the lifting device and therefore any pedestrians are more likely to be seen and work can stop until the person is at a safe distance.

Some LEV trucks are fitted with large bins into which either comingled recyclables are placed, directly from a crate or where mixed glass is colour sorted at the kerbside into a container fixed to the truck, which is then lifted hydraulically, and the contents tipped into the collection body. Exposure to this type of equipment introduces high risks and has been a factor in a recent fatal accident. Assessment of this type of machinery is needed to consider control options around guarding, interlocking and controls systems. An assessment of what the worker is expected to do if the machinery suffers a mechanical failure or if there is a blockage that needs clearing should also be a consideration.

Operators of mrf's have implemented guarding and other isolation, engineering, and emergency response controls with some using a Health and Safety by Design approach at the design stage. As has been previously highlighted in the risk management section of this report, this approach is considered more effective than relying only on administration and PPE based controls.

As Councils change collection systems to improve the quality and quantity of material recycled, current equipment designs may need to be adapted. Collaborative Health and Safety by Design approaches involving all stakeholders (territorial authorities, collection companies, truck manufacturers and builders, worker representatives) should be used to understand not only the lifecycle risks of the equipment but also to gain a better understanding of work as it is actually done. This enables risks to be considered early in the project design phase.

4.3 Manual Tasks

Manual task risk is an emerging term to replace the often-used term of ergonomics. Manual tasks are prevalent across all forms of kerbside waste and recycling collections even when using automated methods. Two thirds of rubbish collection provided by territorial authorities in Aotearoa New Zealand is undertaken using an automated method, while just over 50% of recycling collections are undertaken using a fully automated approach.

When considering manual task risk we need to drill down and determine if there are specific issues related to the load, postures required to complete the task, repetitive nature of the task, duration of the task or exposure to vibration.

Load, posture, repetition and cardiovascular risks

Research by the Health and Safety Laboratory in 2006 looked at recycling collections and provided guidance on crate weight limits and receptacle size based on good ergonomic design aimed at limiting the risk of musculoskeletal injury, refer 7.2.1.

Limited academic research has been conducted in Aotearoa New Zealand focussing on manual tasks related to kerbside collection. One academic research project was undertaken on the Auckland City Council Food Waste Collection in 2015[25]. The research provided recommendations around caddie design and collection vehicle receptacle design to address the various manual handling risks of awkward postures along with work practices and work organisation that contribute to other health and safety risks.

Repetitive tasks

Research by the Health and Safety Laboratory in 2006 also looked at repetitive tasks such as sorting glass. A range of findings and recommendations were made related to design of the container and truck along with task design considerations, refer Appendix B, 7.2.1.

The repetitive nature of the colour glass sort was not deemed an area where there was too much concern by those stakeholders who participated in this Aotearoa New Zealand project with only a small number suggesting it was a contributor to harm.

Cardiovascular

The pure physicality of the job is also a factor to consider where one person operators are both driving the collection vehicle and undertaking collections. Research in the UK conducted by the Health and Safety Laboratory, 2002, found that for bag collections, while this task requires a significant amount of walking daily, the cardiovascular demands did not appear to be substantial for normally fit workers. Refer to section 4.5 for more commentary on the sedentary nature of a collection truck drivers' role, and Appendix C for information on research into the physical nature of a waste collector role.

[25] Integrating ergonomics into the design of Auckland Council's food waste only collection service. Health & Rehabilitation Research Institute / Centre for Occupational Health & Safety Research Auckland University of Technology

Automated collections don't eliminate manual handling

There is industry acknowledgement that an automated collection in no way eliminates manual handling risk, however many stakeholders felt that in most cases the residual manual tasks in automated collections were able to be managed sufficiently safely. This includes tasks such as retrieving wheelie bins that are unable to be accessed by the bin lifter due to obstructions such as parked cars or other assets like power poles or transformers.

Collection operators also experience times where multiple bins put out at MUDS are positioned so close to each other it is difficult to empty them, meaning they must be manually separated. At times residents place items on top of wheelie bins such as rubbish bags and other heavy items to ensure lids don't blow open or to lessen the risk of animals scavenging for food in refuse bags, these then need to be manually lifted by the operator to enable the bin to be emptied.

Linked to the automated collection and manual tasks is the repetitive nature of the use of the joystick to operate the bin lifter. Workstation assessments of the in-cab environment could be undertaken for automated bin collection operators along with education and promotion of regular stretching and movement to reduce the risk of harm from the risks inherent in this activity. This approach would also be useful to undertake in a mrf environment for sort line workers.

Manual collections include a variety of manual tasks

When considering manual tasks associated with manual collections there are several areas where this is relevant. Actions include retrieving waste and recycling receptacles from the kerb, lifting, throwing, holding, and sorting either a crate, bag, caddie, or recyclable item. The lifting, carrying, and throwing aspect was thought to be the biggest contributor to injuries based on feedback from stakeholders.

The industry has discussed the issue of bags vs bins over several years and there has been various research and analyses of this question in Aotearoa New Zealand[26]. In 2010, a report commissioned by WasteMINZ and completed by Morrison Lowe, (An assessment of the health and safety costs and benefits of manual vs automated waste collections) found that there was "*a marked difference in the injury rates between manual and automated collection methods, with manual methods more likely to result in injury*".

[26] WasteMINZ Position Report "An assessment of the health and safety costs and benefits of manual vs automated waste collections"

A subsequent review of this report found that the source data that had been used to determine injury rates had been overstated and the report concluded that there was little data to prove one way or the other that either system had better a health and safety performance. Further, research published in the British Medical Journal (Rushton 2003)[27] concluded that waste management workers have an increased incidence of accidents and musculoskeletal problems, higher than that of the general workforce. While international literature research and some local guidance highlight manual handling as a risk to be managed it also found that the types of manual handling found in domestic collection was not significant and could be effectively managed.

Manual task activities in a mrf environment

Various manual task activities occur in a mrf environment, these include pushing, pulling, reaching, and throwing tasks as materials travel along a sort line. To manage the risk of the repetitive nature of a mrf sort line, the concept of task rotation is effectively implemented at some mrf locations to enable the risk of repetition to be something workers are less exposed to. Somewhat aligned to this is the concept of ergonomics and the relationship between the worker and the task or working environment. Operators agreed that it is reasonably practicable for a workstation assessment to be carried out on workers on a mrf sort line.

MRF operators stated that they experienced non-conforming waste (medical, sharps, human or animal body fluids or faeces) coming over sort lines, multiple times on a daily basis. Exposure to unpleasant items e.g. blood or human waste, can cause distress to workers. There is also a risk of workers accidentally handing non-conforming items such as needles or human waste, which could lead to the worker being infected with biological diseases such as Hepatitis or HIV Aids. Public education provided by territorial authorities on what is acceptable to leave out for recycling collection is the main way to reduce this problem. Enforcement for putting out harmful items could also be considered in extreme cases such as when an injury is suffered by a collection or process worker. A degree of monitoring by collection workers may also be useful.

Solutions

Similar to the Health and Safety by Design approach discussed in the machinery section of this report, the same approach can be considered during the design of a task. This takes into account the manual handling requirements of the activity in question along with other risks such as vibration and noise and how those risks may be mitigated early in the design stage of a new or redesigned mrf.

[27] Health hazards and waste management British Medical Bulletin 2003; 68: 183–197

Workers in kerbside collections, including mrf operations, are exposed to the risk of musculoskeletal injuries resulting from hazardous manual handling techniques such as lifting items over shoulder height, twisting and container and bag weights. In addition there is risk of injury from exposure to sharps including broken glass, needles, and sharp edges on cans. The type of in-depth ergonomic research undertaken by Auckland Council for its food waste collection would be valuable for the industry to better understand the human impact of repetitive and physically demanding tasks associated with manual kerbside collections. Research could include user trials and design testing to quantify the impact of repetition and bin, bag, and crate weights on a worker's musculoskeletal system.

PPE use is an area that forms part of the suite of controls to minimise risk for kerbside collectors and mrf workers. Operators should ensure glove design provides workers not only with slash, cut and puncture protection but also with sufficient sensory awareness. Other PPE considerations for these types of environments and roles should include forearm protection from exposure to sharps. Face and eye protection may be necessary along with typical items such as safety footwear and hearing protection.

4.4 Mental health

While the mental health of front-line staff is a known risk, industry representatives felt that it is not managed effectively. Worker mental health can be affected by a range of both work and non-work-related issues. Reasons for this are varied, with workload, bullying and supervisor relationships, along with personal challenges in people's lives all known to be contributors to poor mental wellbeing. Organisational culture surveys can identify areas that might be contributing to poor worker mental health, and this can direct a business in what control methods might be suitable in their situation.

Aggression and violence towards waste and recycling collection workers is experienced across Aotearoa New Zealand, with increased frequency reported since the COVID-19 pandemic emerged in early 2020. Waste collection workers have been abused, threatened, or put in harmful situations by members of the public. There are reports of this occurring more frequently in some regions during holiday periods. Targeted training in conflict avoidance is useful for workers operating in a public domain.

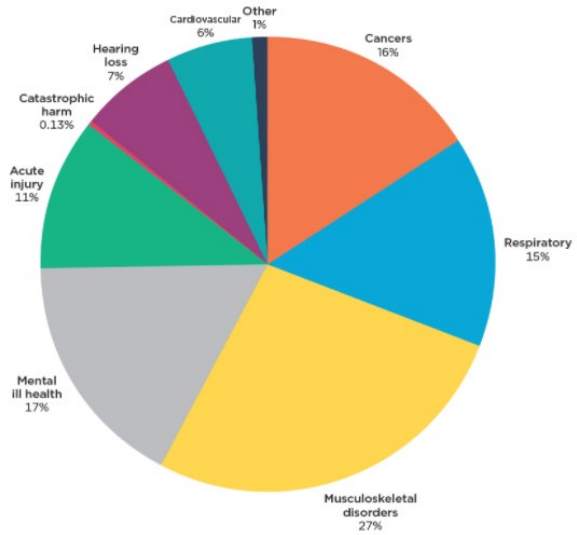
There are a number of approaches organisations are finding effective in contributing positively to the mental wellbeing of their workforce. Examples of controls that are found to be effective include, integration of the Te Whare Tapa Whā

model[28] into workplace culture. Other controls include the provision of awareness training for workers in areas such as financial literacy, cardiovascular health, nutrition, hydration, health, fitness, and relationships. All of these areas are known to contribute to poor mental health outcomes. Employers can also provide access to employee assistance programmes (EAP) which offer independent support for workers struggling with wellbeing issues via access to counselling services.

4.5 Health Risks

Health risks in workplaces is an area that requires more attention than it currently receives. The incidence of heath related harm, estimated at up to 900 deaths per year[29] far outweighs harm caused by safety related hazards. Worksafe NZ use a measure called disability-adjusted life years (DALYs) and puts a value on the burden of harm from work-related ill-health and injury. It shows that acute injuries (including fatalities) account for 11% of annual work-related DALYs lost. If we measure this against the DALY figure for the various risks in New Zealand workplaces, *refer figure 5*, we see that musculoskeletal harm accounts for 27%, mental health harm 17%, cancers 16% and respiratory harm 15%. These chronic outcomes outweigh the acute figures.

Figure 5 – WorkSafe NZ DALY Profile (Disability adjusted life years)



[28] Provides a Māori perspective on health. It refers to a wharenui (or meeting house) to illustrate the four dimensions of wellbeing: taha tinana (physical health), taha hinengaro (mind), taha whānau (family) and taha wairua (the spiritual dimension). With four walls, the wharenui is a symbol of these four dimensions.
[29] https://www.worksafe.govt.nz/topic-and-industry/work-related-health/about-wrh/

In managing health risks organisations need to consider the relationship between work related health risk and non-work-related health risk, this relationship, shown in figure 6, describes how work has the potential to harm a person's health, and a person's health can affect safety at work. Work related health risks in kerbside collections, such as biological exposure, musculoskeletal disease, (refer section 4.3), noise and respiratory risks are well known in the industry and various controls exist to manage these risks, refer table 4.

Hepatitis B

Significant links between exposure to domestic waste and the risk of contracting the Hepatitis B virus is highlighted in research[30] and is a known issue for the waste industry to manage. Vaccination is a standard control along with other methods to reduce risk against exposure such as hygiene protocols and the use of PPE. Of course the COVID-19 situation has introduced an additional consideration for how this risk is managed, refer section 4.6. This is a risk for both kerbside collection workers and those sorting in a mrf environment. Other health related risks are inherent in a mrf environment such as vibration, noise and dust.

Vibration

Exposure to harmful levels of vibration can cause Whole Body Vibration Syndrome, and there are controls which can be put in place to manage this. Regular maintenance of equipment and the use of anti-fatigue matting can reduce this risk. Some stakeholders reported they had a fully integrated approach to managing vibration including health monitoring.

Noise

Noise exposure and the subsequent potential of Noise Induced Hearing Loss (NIHL) was highlighted by stakeholders as the biggest health risk workers are exposed to in a mrf environment. Controls to reduce noise levels can include replacement of old equipment, isolation of items that are the source of noise, regular maintenance on equipment and the use of suitable PPE. Noise can only be effectively managed if the level of noise is known, and this is done through environmental monitoring to determine the actual noise emissions that are created in the workplace. The results can determine the type of controls needed including the implementation of those previously discussed along with the provision of the correct grade of hearing protection and through ongoing health monitoring of workers hearing.

[30] Is waste collection associated with Hepatitis B infection? A meta-analysis. Mol M.P.G., Cairncross S., Greco D.B., Heller L.

Dust

Exposure to dust is a risk in a mrf environment with microorganisms, predominantly fungi and bacteria, forming part of the airborne dust in recycling plants, which can cause respiratory allergies and infection. Like the management of noise, environmental monitoring should be undertaken to quantify the existence of respirable airborne particles. Monitoring results inform decisions on the implementation of controls to eliminate or minimise the risk of dust exposure. Controls could include misting systems over sort lines, local exhaust ventilation or extraction systems. The use of PPE, for example masks, contributes to minimising worker exposure to dusts in a mrf. Where a health risk is unable to be eliminated, health monitoring is required to track potential exposure.

Sedentary Role

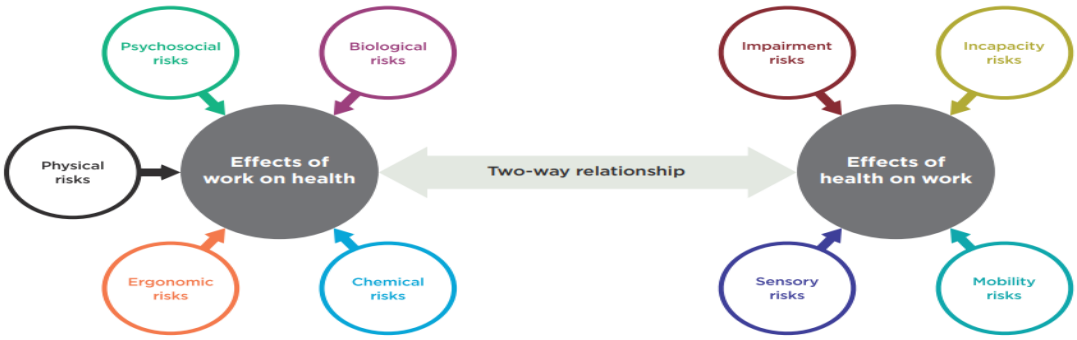
The automated bin collection operator is in a sedentary role (sitting in the cab of a truck all day). According to Axiom Training, a specialty truck driver training organisation in Aotearoa New Zealand, two thirds of our truck drivers are classified as obese[31]. In an article in New Zealand Trucking Magazine (8 February 2021) it is stated that "*Improving the health of our drivers should be a top priority for improving the wellness and profitability of the trucking industry*"[32]. They highlight issues such as raising awareness about healthy choices and personal risk factors, smoking cessation, physical activity and better sleep as some of the tool's organisations can use to improve the overall wellbeing of its truck drivers.

Non-work-related health conditions

Where a worker has a non-work-related health condition, refer figure 6, this can create additional risks in the workplace. It is important that there is dialogue between the PCBU and the worker in terms of the inherent risk in the business or a particular task to ensure both exposure risk and the impact of pre-existing health conditions are discussed. While a worker isn't required to provide such information, without it the PCBU together with the worker has less ability to manage the risk of exposure.

[31] https://axiomtraining.co.nz/updates/the-growing-issue-of-truck-driver-obesity
[32] https://www.nztrucking.co.nz/truck-driver-health-an-industry-issue/

Figure 6 Work related health risk – Health related safety risk.



WORK-RELATED HEALTH RISKS ('EFFECTS OF WORK ON HEALTH')					HEALTH-RELATED SAFETY RISKS* ('EFFECTS OF HEALTH ON WORK')			
Biological risks	Chemical risks	Ergonomic risks	Physical risks	Psychosocial risks	Impairment risks	Incapacity risks	Mobility risks	Sensory risks
Blood borne viruses (eg Hep C)	Asbestos	Manual handling	Noise	Bullying and work behaviours	Fatigue	Poorly controlled diabetes	Physical frailty	Colour vision deficiency
Animal bacteria (eg Leptospira)	Solvents	Shift work	Vibration	Excessive workload	Stress or mental distraction	Poorly controlled heart disease	Bone and/or joint conditions	Reduced visual acuity
Bacterial infection	Pesticides	Job design	UV radiation (eg sun exposure)	Lack of autonomy	Drugs/alcohol consumption	Poorly controlled high blood pressure	Severe obesity	Reduced hearing capability

FIGURE 3: Examples of work-related health risks and health-related safety risks

* Health-related safety risks are specific to the tasks, situation and work environment that they exist within and are not a risk in all circumstances.

4.6 Pandemic

Over the last 18 months the emergence of the COVID-19 virus has had a marked impact on the waste industry, with kerbside collections and mrf operations equally impacted.

Keeping pace with the changes in the profile of viruses is something that needs to be continually monitored as variants change. The risk from the Alpha variant of COVID-19 pointed to surface contact being a high-risk transmission route, whereas the Delta variant that emerged in 2021 shows person to person exposure via aerosolisation of the virus is the key method of transmission. Effective controls at present are the use of masks, physical distancing, and vaccinations. This does not negate the need for continued vigilance around hygiene, both from a personal perspective and the need to regularly clean high touch surfaces in a workplace.

In April 2020, a report was issued to WasteMINZ[33] discussing the risk factors associated with the COVID-19 virus when undertaking the collection of kerbside refuse and recycling. The research identified the risk factors according to the methodology used to undertake the specified collections.

The methods included,

- Wheelie bins using automated collection technology
- Refuse bags via manual collection
- Recycling crates via manual collection

[33] Dearsly, G. 2020. Residential Refuse and Recycling Collections: COVID-19 Worker Risk Factors by Collection Methodology. Commissioned by WasteMINZ. Auckland: First 4 Safety.

- Processing of waste directly from the public at Refuse Transfer Stations (RTS)
- Processing of recyclables at mrf's
- Illegal dumping collections (fly tipping)
- Public litter bins

The report found that a primary risk was transmission via surface contact and that various surfaces such as plastic, steel and cardboard had different timeframes over which the virus remained viable. At the time of writing the supply of PPE items (gloves, masks, sanitiser) to protect individuals against the virus was problematic. It is noted that since the early stages of the virus being present in New Zealand (March 2020), mask use has become a more relevant method of protection with this being compulsory on public transport and largely required in all indoor environments.

Subsequent to the above report New Zealand experienced the emergence of the Delta variant of the COVID-19 virus. Further study has since found that surface contact presents a low risk, and the more significant transmission route is that of person to person via aerosolisation of the viral droplets. This means that masks and physical distancing are the key controls in managing the spread of COVID-19 Delta variant. Taking a conservative approach through continued good hygiene and surface cleaning is something that should remain, however.

The industry will need to monitor the ever-changing COVID-19 environment to understand the impact of different variants as they emerge which may introduce different risk profiles. There should also be an ongoing focus on the effectiveness of existing controls including the vaccination.

4.7 Fire risks – (Lithium-Ion Batteries within the waste stream)

Lithium-ion batteries are becoming the go-to power source for portable tools, equipment, electronics, and motor vehicles. The issues surrounding the disposal of these batteries is becoming better known and documented. The structure and chemistry of lithium-ion batteries means that while they are safe for consumers to use, they can start fires when discarded and damaged in residual and mixed recycling waste streams. Documentary evidence suggests the greatest source of damage is in the waste collection and treatment systems due to the physical harshness with which we treat our waste[34].

[34] Fogelman, R. (2021). *4th Annual Reported Waste & Recycling Facility Fires in the US/Canada* . West Bloomfield MI: Fire Rover.

There are three significant issues with battery fires:

1. The battery poles[35] from adjacent batteries may come in contact creating an energy release that may reach 1000˚F (538˚C) thus creating an ignition source for other combustible materials in the vicinity.
2. Lithium metal will spontaneously ignite on contact with water. This reaction creates highly flammable hydrogen gas which ignites due to the heat of reaction. ($2Li + 2H_2O \rightarrow LiO_2 + 2H_2$)
3. Toxic Hydrogen Fluoride (HF) gases are released during a thermal runaway[36].

The collection and treatment of waste and recycling can cause batteries to become damaged therefore it is not surprising that the highest number of fires, whose origins are lithium batteries, is in the waste industry. Unfortunately, the cost of these is almost entirely borne by the waste industry operators.[37]

Eunomia has estimated the cost of lithium-ion battery fires in the UK to be about 150 million-plus British pounds[38]. If we translate this into New Zealand dollars and calculate pro rata by population, fires from lithium-ion batteries are estimated to cost New Zealand $22 million annually.

Veolia UK stated in 2020 that the average UK resident throws away around 24.5 kilograms of electronics annually, and only 43 percent of the public is aware that lithium-ion batteries can spark fires. [39]. We can translate this into the Aotearoa New Zealand setting through calculating the pro rata quantity based on population to 1.8Kg per head of population or approximately 10 million Kg nationally per year.

An Austrian study[40] (Nigl T., 2020) found clear evidence that most lithium-ion fire incidents occur within collection vehicles, on tipping floors, during consolidation and processing. This study also estimates the risks associated with the possible hazards of lithium-ion batteries within the domestic waste streams. Table 8 below reproduces the information published in this report.

[35] There are two types of poles: positive (+) and negative (−). This represents the electric potential at the ends of a circuit. A battery has a positive terminal (+ pole) and a negative terminal (− pole).
[36] Thermal runaway begins when the heat generated within a battery exceeds the amount of heat that is dissipated to its surroundings. If the cause of excessive heat creation is not remedied, the condition will worsen. Internal battery temperature will continue to rise - causing battery current to rise - creating a domino effect. The rise in temperature in a single battery will begin to affect other batteries in close proximity, and the pattern will continue, thus the term "runaway." Larsson, F. A. (2017). Toxic fluoride gas emissions from lithium-ion battery fires. Sci Rep 7, 10018 (2017).
[37] Fogelman, R. (2021). *4th Annual Reported Waste & Recycling Facility Fires in the US/Canada .* West Bloomfield MI: Fire Rover.
[38] Brown M., H. M., & S., C. (2021). *Cutting Lithium-ion Battery Fires in the Waste Industry.* Bristol UK: Eunomia Research & Consulting Ltd.
[39] Veolia UK. (2020, January 15). *Press Releases.* Retrieved from Veolia UK: https://www.veolia.co.uk/press-releases/preventing-battery-fires
[40] Nigl T., B. M. (2020). Lithium-Ion Batteries as Ignition Sources in Waste Treatment Processes—A Semi-Quantitate Risk Analysis and Assessment of Battery-Caused Waste Fires,. *Processes*, 49.

Table 8. Qualitative risk assessment of possible hazards and threats of portable batteries (waste stream: residual household waste).

Facility Area/Process	Possible Hazards and Threats	Risk Assessment
Collection bins	Damage due to external short-circuit	low
Loading activity	Damage due to external short-circuit	low
Collection vehicle	Mechanical damage due to compaction	medium
Unloading activity	Mechanical damage due to tip-off	low
Waste bunker/input storage	Damage due to external short-circuit Damage due to external heating (self-heating of waste)	medium–high
Waste transfer activity	Mechanical damage due to (wheel) loader or gripper	medium
Treatment facility	Mechanical damage due to pre-shredding process Mechanical damage due to post-shredding process Dangerous heat generation after damage Carry-over through the processing facility	high–very high
Output storage	Damage due to external short-circuit Damage due to external heating (self-heating of waste) Dangerous heat generation after damage	low–medium

The study referred to above indicates the risk to operators of kerbside collection vehicles is rated medium while another report states "*small domestic lithium batteries, such as AA and AAA batteries, are unlikely to pose a significant risk. However, larger batteries, such as those used in mobile phones, laptops and other computing and similar devices, e.g. power tools, may pose significant risks*."[41].

The question remains how do we reduce the risk of fire in collection vehicles? A number of initiatives have been proposed to stop batteries of this nature entering the waste or recycling stream, which eliminates the risk of fire. These include banning the disposal of batteries in the domestic waste stream[42] and providing separate collection vessels for lithium-ion batteries and increasing public education on the disposal of them. Some regions have adopted public drop off points for batteries including Canterbury, Marlborough, and Hawke's Bay. These regions noting the well-publicised way these have been promoted and used, reporting a noticeable downturn in battery related fires. Commentary from waste company's and territorial authorities across the rest of the country state that incidents involving batteries in the waste stream is an issue with a contributing factor being both a lack of good promotion of existing drop off facilities or the region not having a drop off facility at all.

In terms of bulk transportation of batteries the key consideration is that lithium-based batteries especially should be protected from damage and from being shorted since they are able to deliver currents capable of causing fires. Specific

[41] Waste Industry Safety and Health. (2019). *Fire risk and lithium batteries as waste transfer, recycling and recovery operations"* . Scotland: WISH.
[42] https://www.stuff.co.nz/environment/300430688/landfill-fires-lead-to-council-plea-not-to-throw-batteries-into-kerbside-bins

requirements around road transport of batteries are included in the Land Transport Rule – Dangerous Goods 2005 – Rule 45001/1. Courier and freight companies will have their own policies around the transportation of batteries.

Where batteries do enter the waste or recycling stream, effective controls to reduce damage or harm from a fire include water dousing systems installed on trucks. This should be supported by the provision of training in how workers can respond when a fire is identified in a truck. Typical approaches to this are to either compact the waste to remove oxygen, or before hydraulic systems are damaged, tip the waste out onto the ground where the fire can be extinguished. In a mrf, emergency preparedness plans should detail the response required when a fire occurs including evacuation procedures. In both cases emergency services should be contacted, and if safe to do so workers can attempt to extinguish the fire with firefighting equipment.

4.8 Procurement, & management of the contract

These areas all contribute to health and safety outcomes and were all high-profile areas of discussion with stakeholders. When questions were posed about relationships between the TA and collection companies, the significant majority agreed it was critical that the two parties had an effective contractual relationship and that this would contribute towards improved health and safety outcomes. Some of the face-to-face meetings where TA's and the contractor were together verified that this was their experience.

In terms of procurement in this context it's about plant and equipment being fit for purpose for the contract. This means ensuring vehicle specifications are planned well in advance of contract start dates. Health and Safety by Design workshops are a great way to inform procurement decisions and both parties (TA & collection companies) could engage in collaborative sessions to agree on design criteria. This links directly with the requirements to ensure vertical supply chains are included in procurement processes (designers, suppliers, importers, manufacturers etc).

From a contractual management perspective, areas where Territorial Authorities and collection companies can engage on in discharging their overlapping duty obligations includes issues such as:

- Response when capacity is not available due to breakdowns or other reasons for delays in collection.
- Redefining collection routes and timing to minimise collections around key facilities (e.g. schools) during peak activity periods.
- Ensuring engagement between TA contract manager and also traffic engineers and town planners.
- Possible reduction of bin numbers in high density housing / apartments by changing from individual bins / unit to a community waste collection system.

5 Conclusions and Observations

In identifying the key risks that are inherent in the kerbside collection process and operational aspects of a mrf environment, it is clear there is a range of risks that apply across the various collection and processing methods. In applying the prescribed risk management approach from the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016, we have in partnership with industry representatives including waste and recycling collection companies, territorial authorities, and other stakeholders identified the known risks and documented controls using the "Hierarchy of Controls".

In expecting controls to be applied, particularly those described in this report as "below the line" it needs to be recognised that human action and decision making is required for these controls to be effectively implemented and used. All stakeholders responsible for the management of risk must accept that workers make mistakes, and these mistakes could be caused by a range of factors from lack of training in the use of equipment to a lack of understanding or comprehension of any training given. Therefore, it is critical that any planning and design of a task, item of plant or equipment, process or work environment must consider this risk of mistakes being made.

There are a few key areas where the industry needs to continually improve its approach to some of the activities it undertakes to conduct kerbside collections. While the use of runners was broadly accepted by most in the industry as a manageable risk the issue of runners riding on the outside of a vehicle found much less acceptance as a task that could be carried out safely, even using existing controls to manage this risk. Added to this latter issue is the soon to be introduced (end of 2022) regulation under the Health and Safety at Work Act which will likely introduce a need for those who are passengers of a vehicle to be given the same level of protection as the driver. This could mean that passengers must be secured, in this context we are referring to runners as passenger. We can look to the temporary traffic management industry for examples of what this might look like such as those staff laying out road cones from a vehicle being required to use a harness. Simply put, the regulations may require that runners could not ride on a vehicle, by travelling on a running board, unless they could be secured. Our assessment is that controls of this nature would likely make current collection methodologies where a running board is used impractical.

This regulation, discussed above, more broadly is focussed on safety of plant and structures, meaning machinery used in the kerbside collection and mrf processing activities of the waste sector will be covered by this new regulation. While there has been a lot of investment by the industry in machinery used, there is also a lot of old equipment that may not have had a robust risk assessment process completed on it to ensure it is safe for use. This is an area individual

companies will need to look closely at during 2022 to ensure their machinery has been assessed and robust risk control methods applied.

Protection of the public from kerbside collection activities, while not a new issue has become a more visible one in recent years due to fatalities and serious incidents involving members of the public. The industry will need to keep monitoring the situation of pedestrians and their behaviour around kerbside collection vehicles. Distraction, use of headphones and mobile phones along with vulnerable people (children) and a distinct lack of understanding of the kerbside collection process by members of the public needs to be a continual area of focus. Similarly, the risk to operators undertaking kerbside collection activities from members of the public is a growing area of concern. This due to the increase in violence and abuse towards workers across many sectors (not just waste collection).

The physical nature of the work covered by this report is a significant aspect that does need good risk management applied. Whether we are focussing on the physical nature of being a runner, the sedentary nature of some driving roles or the repetitive nature of some manual handling tasks, these are all areas that require a partnership to be formed between the PCBU and the worker to keep people safe. Good equipment design, job design, worker engagement, leadership and good overall approaches to risk management can see a suitably safe activity carried out using the various collection methods that create some of these risks. Quantification of the risks and associated harms could be verified through targeted academic and ergonomic research specific to the waste industry in Aotearoa New Zealand.

Linked to some of the above is the ongoing attention that collection companies and mrf operators need to give to the risk to worker health. Whether that risk is causing harm to workers hearing, musculoskeletal systems, respiratory systems or indeed worker mental health and wellbeing this is an important area that requires more attention and focus by the sector. The health risks present in kerbside collections and mrf processing are not new, and the industry needs to work hard to provide increased attention to improving outcomes in this area to reduce the, sometimes unseen, health related harms that occur. While there will be traditional approaches to minimising or eliminating some of these risks, like guarding, local exhaust ventilation, machinery design, supported by health monitoring and PPE, the mental health aspect is more about organisational culture and relationships within the workplace. Organisations in the future will need to focus more on creating partnerships with their workers to ensure safer and healthier work outcomes.

6 Glossary of Terms

Term	Meaning
Anti-fatigue matting	An anti-fatigue mat is a mat that are specifically designed to reduce fatigue while standing for long periods of time. They provide a cushioning that helps to reduce fatigue caused by standing or walking on hard surfaces such as cement or hard tile.
Chevron	A hatched retro-reflective panel (red/white) placed across the rear of the vehicle. Gaps and variations are permitted where the vehicle's rear section is broken by loading features. Where hatching cannot be placed the full width of the vehicle, additional depth of hatching i.e. 300-500mm, should be applied, where practicable.
ESOL	English for speakers of other languages
Grey literature	Grey literature is information produced on all levels of government, academics, business and industry in electronic and print formats not controlled by commercial publishing.
Health and Safety by Design	Health and Safety by Design' is the process of managing health and safety risks throughout the lifecycle of structures, plant, substance or other products.
Kerbside Collection Traffic Leader	This is a unique qualification for drivers of trucks in the kerbside waste and recycling collection industry.
Live lane	A lane available for use by a class or classes of vehicles.
Local Exhaust Ventilation	Local exhaust ventilation is an extract ventilation system that takes airborne contaminants such as dusts, mists, gases, vapour or fumes out of the workplace air so that they can't be breathed in.
Musculoskeletal disorders	Musculoskeletal Disorders or MSDs are injuries and disorders that affect the human body's movement or musculoskeletal system (i.e. muscles, tendons, ligaments, nerves, discs, blood vessels, etc.). Common musculoskeletal disorders include Carpal Tunnel Syndrome. Tendonitis. Muscle / Tendon strain.
New Zealand Transport Agency – Also known as Waka Kotahi - NZTA	The NZ Transport Agency (NZTA; Waka Kotahi) is a New Zealand Crown entity tasked with promoting safe and functional transport by land, including the responsibility for driver and vehicle licensing, and administering the New Zealand state highway network.
Noise Induced Hearing Loss (NIHL)	Permanent damage to the tiny hair cells in your ears, known as stereocilia, from loud sounds. Hazardous levels of noise produce vibrations in the hair cells that are so powerful they are damaging—sometimes permanently.
Closed systems: (In relation to rear load compaction vehicles).	A rear load truck compaction system that is fully guarded and physically prevents access to the compaction mechanism while compaction is underway shall be deemed a closed system.
Compaction mechanism: (In relation to rear load compaction vehicles).	The mechanism used to compact, and transfer collected waste from the hopper into the body – either by a single or double rotational paddle movement, or by the sweeping backward and forward movement of a moving plate.
Compactor operating cycles: (In relation to rear load compaction vehicles).	Several possible compactor operating cycles are evident. The following are the main definitions used: • AUTO (Continuous cycle) is one that continually cycles until stopped by an independent action. This is only acceptable in a closed system. • SINGLE cycle is one that cycles once and then stops automatically.

	• MULTI cycle is one that cycles for a given number of times and then stops automatically. • CTRL (Controlled cycle) is a single cycle controlled by the operator, by depressing one single button or lever from the start until any pinch point has been passed. Thereafter the cycle will be completed automatically, even if the button or lever is released. • SEMI (Intermittent cycle) is a cycle where the compaction mechanism is automatically stopped at least 500 mm before the rave rail. A hold to run control is required to run the compaction mechanism for that part of the cycle where a pinch point is created up to the end of the cycle.
Road Controlling Authority	A Road Controlling Authority is the body responsible for the care, control, or management of roads within a given jurisdiction.
Sedentary	(of work or a way of life) characterized by much sitting and little physical exercise.
TORO	Transport Organisation Register Online (TORO). A Waka Kotahi system that organisations can use to check that they only have licensed drivers driving their company vehicles.
Whole Body Vibration Syndrome	WBV occurs when vibration (including bumps, shocks, and jolts) passes through someone's body from the surface they are sitting or standing on.

7 Appendices

7.1 Appendix A – Academic Literature Review

This section presents the results of a review of existing literature to identify hazards to health, biological effects, and occupational illnesses for workers in the waste collection sector. We draw on academic literature and reports from other countries to add to the risk profiles presented in this report based on various collection systems.

The scope of our review relates to known health and safety risks to the currently applied kerbside collection systems in Aotearoa New Zealand, including manual sorting and automated wheeled bin collections. Bulky waste, medical waste and greenwaste collection were not included.

7.1.1 Methodology

A systematic review of international waste management literature was conducted to address the question as to what is known about injuries relating to waste management workers. Relevant papers were retrieved from the Scopus database covering the period from 1997 to 2021. Keywords used included: “waste”, “collection”, “system”, “health and safety”, and “injuries”, combined with Boolean operators (i.e., AND, OR, NOT, or AND). We excluded topics relating to landfills, incineration, and waste practices specific to developing countries (e.g., waste pickers). The process followed the PRISMA statement, and the search was restricted to peer-reviewed publications in English only. To complement the Scopus search and to identify relevant grey literature (e.g., non-peer reviewed reports and technical papers), literature was added from experts and publications resulting from internet searches.

7.1.2 Results

After checking for relevance, the search process for waste management health and safety articles led to 71 citations from mainly medical databases for the period from 1997 through 2021. From this selection, we chose eight meta-analysis articles for further review***, refer table 9.***

Table 9 Articles Retrieved from Scopus and Selected for Literature Review

Author(s)	Title	Year
Emmatty F.J., Panicker V.V.	Ergonomic interventions among waste collection workers: A systematic review	2019
Asante B.O., Trask C., Adebayo O., Bath B.	Prevalence and risk factors of low back disorders among waste collection workers: A systematic review	2019
Poole C.J.M., Basu S.	Systematic review: Occupational illness in the waste and recycling sector	2017
Mol M.P.G., Cairncross S., Greco D.B., Heller L.	Is waste collection associated with Hepatitis B infection? A meta-analysis	2017
Binion E., Gutberlet J.	The effects of handling solid waste on the wellbeing of informal and organized recyclers: A review of the literature	2012
Kuijer P.P.F.M., Sluiter J.K., Frings-Dresen M.H.W.	Health and safety in waste collection: Towards evidence-based worker health surveillance	2010
Rushton L.	Health hazards and waste management	2003
Rogers J., Englehardt J., An H., Fleming L.	Solid waste collection health and safety risks - Survey of municipal solid waste collectors	2002

7.1.2.1 Injuries, illnesses, and acute physiologic responses described in studies - Waste and recycling general

Waste collection workers are frequently exposed to significant occupational hazards, with significantly higher prevalence of injuries and fatalities than in other industries, except agriculture, forestry, and fishing (Poole and Basu, 2017). In 2019/2020, the fatality rate in the UK was 7.71 out of 100,000 workers compared to an overall industry rate of 0.42 per 100,000 workers.[43]

Waste collectors from the public and private sector in Florida showed high rates of lacerations, contusions, strains, sprains, and illnesses, with 75% of the workers reportedly having been injured in the prior 12 months (Rogers et al. 2002).

[43] Health and Safety Executive (2020). *Waste statistics in Great Britain, 2020* www.hse.gov.uk/statistics/industry/waste-recycling/waste-recycling.pdf

7.1.2.2 Bioaerosols[44] – acute bodily response

A meta-analysis of 50 studies retrieved from PubMed and Embase to assess work demands, acute physiologic responses, illnesses, and injuries amongst waste workers, found the greatest number of studies on work demands and/or acute bodily responses addressed the risk of exposure to bioaerosols. Strong evidence is available that exposure to bioaerosols exceeds recommendations (Kuijer et al. 2010).

One study evaluated inflammatory processes in blood and in the respiratory tract as a result of exposure to a heterogeneous mixture of bioaerosols. They concluded that inflammatory changes in waste collectors are detectable in the content of IS biomarkers, exhaled NO, and serum CC16, which all are influenced by the smoking habit. No significant differences in biomarkers are detectable between current and former waste collectors (Raulf et al. 2017).

7.1.2.3 Musculoskeletal Disorders - injuries

One of the most common injuries amongst waste workers, and most researched topics, are those of musculoskeletal disorders, especially lower back issues which are the most significant cause of physical absence from work. Rushton (2003) concluded that waste management workers have an increased incidence of accidents and musculoskeletal problems. According to UK data, most of these results are from slips, trips, or falls (30%), injuries while handling, lifting, or carrying (27%) or being struck by a moving/flying/falling object (12%).[45]

Asante et al. (2019) found that a systematic review of 13 studies showed that 16 -74% of waste workers reported lower back issues during a one-year period. However, none of those articles quantified or qualified relationships between risk factors (hypothesized to include repetitive motion, manual handling, work duration, physical workload, vibration and awkward posture) and the lower back disorders reported. Furthermore, lower back disorders had different descriptions, a known issue in the literature, making comparisons difficult. None of the authors of these studies made recommendations for waste workers with regards to awkward posture, repetitive motion, and work duration.

A meta-analysis to assess health and safety in waste collection showed moderate evidence for an increased risk of musculoskeletal injuries. Amongst others, compression forces on the lower back were compared between two-

[44] Bioaerosols can be defined as **fine particles ranging in size and composition** that are suspended in the air and considered to be derived from a biological source or to affect a biological target (1). Such particles can contain or consist of bacteria, fungi, organic and inorganic particulates, toxins, and viruses.
[45] see footnote 35

wheeled containers (300 – 2,654 N), four-wheeled containers (4,991-5,810 N) and bags (2,312 – 5,179N). (Kuijer et a.2010). The rate of injuries appeared high and varied amongst studies from 17% to 41%, with most injuries resulting from bumping or being hit by goods, vehicles or objects. Additionally falling from a higher elevation, overloading of body or internal organs, stepping on or making contact with a sharp object and stumbling also contributed to injury rates. One study showed that 88% of injuries occur outside the company area.

7.1.2.4 Skin, Gastrointestinal, Hearing Loss and Respiratory Conditions – health complaints

There was an increased prevalence and moderate evidence of respiratory and skin complaints in waste workers, in particular those exposed to compost (Poole and Basu, 2017, Asante et al. 2019). Compost workers may also be at increased risk of extrinsic allergic alveolitis, allergic bronchopulmonary aspergillosis, occupational asthma, and abnormalities of lung function. In addition, cases of occupational asthma have been reported in association with wood and paper recycling. Limited academic evidence exists for gastrointestinal disorders and hearing loss in waste workers.

7.1.2.5 Hepatitis B

A meta-analysis on Hepatitis B virus (HBV) infection in workers who are exposed to domestic and healthcare wastes showed a statistically significant association between exposure to solid waste, whether healthcare or domestic, and positive HBV infection markers (Mol et al, 2017).

7.1.2.6 Other – E-waste

Workers involved with the recycling of batteries and cables may be at risk of lead poisoning and exposure to other heavy metals. There were case reports of mercury poisoning from the recycling of fluorescent lights. The recycling of e-waste may cause exposure to heavy metals and organic pollutants, such as polybrominated diphenyl ethers, dioxins and polyaromatic hydrocarbons, which have been associated with damage to DNA and adverse neonatal outcomes.

7.1.3 Recommendations from the literature

- Even though ergonomic interventions can mitigate occupational hazards, only a few studies have attempted to study the importance of such interventions. The authors proposed a hierarchical framework for the implementation of ergonomic interventions in waste associated occupations (Emmatty and Panicker 2019).
- Waste workers in Florida recommended focusing on management and supervision of workers, communication among route workers, public education regarding risks to collectors from local vehicular traffic and improper disposal, and the design of safety equipment to ameliorate health and safety risks for waste workers. (Rogers et al., 2002). Assessment and monitoring were also recommended by Rushton (2003).

- Asante et al. (2019) concluded that "*In light of these risks and future growth in this industry, the lack of high-quality studies and investigation of risk factors highlight the need for more research in this sector which will support future [musculoskeletal disorder] prevention efforts*".
- Immunization against HBV is recommended as the chief preventive measure for all solid waste workers (Mol et al 2017).

7.2 Appendix B - International Industry Guidance

This section presents the results of a review of existing grey literature to identify health and safety related risks and control methods to protect waste collection workers from harm. We draw on international guidance to add to the risk profiles presented in this report based on various collection systems.

In Great Britain, the Health and Safety Executive has issued information and a tool to assist local authorities in assessing specific risks associated with commonly used systems.[46]

7.2.1 Health and Safety Laboratory

In 2002 the Health and Safety Laboratory conducted research into urban kerbside collection of refuse, their objective was to review the scientific literature on manual handling in refuse collection and identify risk factors for musculoskeletal disorders[47].

Key findings from the research included.

- A range of factors related to socio economic, the built environment, road layout, traffic and other factors can contribute to the type of manual handling undertaken in the waste industry.
- Postural analysis using OWAS[48] showed that in general, stressful postures were used in only small percentages of tasks with almost all falling into Action Category 1 (Normal Posture). This category is deemed to require no action to reduce the risks.
- Weights of refuse bags were between 4 and 6kg. There was less than 10% at 12kg and it was described as rare that a bag weighed more than 20kg.
- Lifting and throwing of bags was described as a dynamic activity normally undertaken while the operator was still walking.
- Heights at which bags had to be thrown were such that half the working male population would struggle to throw the heaviest bags into the truck.
- Hazardous items were sometimes found in bags (sharps, broken glass, syringes).
- For bag collections, while this task requires a significant amount of walking daily, the cardiovascular demands did not appear to be substantial for normally fit workers.

[46] https://www.hse.gov.uk/waste/municipal.htm
[47] https://www.hse.gov.uk/research/hsl_pdf/2002/hsl02-21.pdf
[48] OVAKO Working Posture Analysis System (OWAS)

- In 2006 the Health and Safety Laboratory conducted further research[49] into the kerbside collection and sorting of recyclables, their objective to identify musculoskeletal risk factors where recycling box[50] collections were undertaken and provide recommendations to reduce those risks.

Key findings from the research included.

- Weight differences between glass only and comingled boxes, with the highest weight recorded at 22.1kg for a comingled box. Weight reductions were seen with weekly collection frequency.
- Box design is a contributor to weight and handling, this included volume, handles and whether a box had a lid. Boxes of no more than 40 litres were deemed a maximum capacity, with a lid being an effective method of weight control, as it limits the quantity of recyclables that can be put in the box. Handles that are separate from the box rim were preferred
- A compressive force of 3.4kn was deemed to be the maximum on L5/S1 intervertebral discs after which the risk of injury increased for some. The laboratory found that at 13kg this 3.4kn rate was reached when lifting in a stooped position.
- The laboratory found that boxes at 11.38kg's would be deemed acceptable to lift by 90% of the British Male Population and 20% of the British Female Population
- Lifting over shoulder height and twisting were key to increased injury causation factors.
- A range of factors contributed to slip, trip or fall events such as stepping into/onto a truck while handling a box and reduced visibility.

A key recommendation across both the 2002 and 2006 research is that where possible it would be more appropriate to use wheeled bins for the collection of refuse and recyclables.

7.2.2 Waste Industry Safety and Health Forum (WISH)

The UK based Waste Industry Safety and Health Forum (WISH) exists to communicate and consult with key stakeholders, including local and national government bodies, equipment manufacturers, trade associations, professional associations, and trade unions. The aim of WISH is to identify, devise and promote activities that can improve industry health and safety. The forum has produced a range of research related to kerbside waste and recycling collections produced as either Case Studies, Information, and other forms of documented guidance.

[49] Health and Safety Laboratory, Manual handling in kerbside collection and sorting of recyclables Pinder Dr A.
[50] For clarity, the use of the term box in the UK is the term we use in New Zealand for a crate.

WISH Formal Guidance document "Safe Waste and Recycling Collection Services" details the management control methods that should be used to achieve a safe collection, these options included:

- Design of the service, including routes, vehicle, geography, reduced reversing, pedestrians, noise, collection crew competence, single or double side collections, flexibility to allow for changes in legislation, vehicle standards and industry practice.
- Tendering process
- Assessment of collection route risks and hazards
- Controls covering crew competence, vehicle safety, procedures, environment.
- Communication
- Supervision, monitoring and review
- Worker consultation and engagement
- Accidents, incidents and near miss/hits

WISH have produced a case study document[51] which details incidents where the waste collector has been struck by or entangled in machinery associated with bin lifters where the incident has occurred during the tipping cycle. In their associated guidance document "Safe use of refuse collection bin lifters and bins"[52] they discuss protective measures related to bins and bins lifters and how they are both to be used. Four common injury causation risks are highlighted including.

- Struck by the bin, still attached to the bin lifter, as it returns to ground level
- Struck by a bin falling from the bin lifter
- Becoming entangled in the bin lifter during the tipping cycle
- Injured when releasing a waste bin 'hung up' on the bin lifter, or lost in the back of the hopper

Key issues related to the safe design and use of this equipment is highlighted as being design and compatibility of equipment, maintenance, and safe use.

Another relevant document is "Safety in driver only commercial waste and recycling collections." [53] While this document refers to commercial collections many of the focus areas would be relevant for residential kerbside collections undertaken by a single operator model. This document highlights various considerations including risk assessment, individual capability, and training requirements for driver only collections. It also covers other areas such as remote and isolated work, communication, and vehicle security along with worker engagement, supervision and monitoring. The document includes the risk of poor visibility (for the driver), promotes low entry cabs to reduce fatigue, the ergonomic set up of the cab in relation to operational controls and emergency communication.

[51] WISH Waste Industry Safety and Health Forum Case studies: bin lifters and bins on waste collection lorries
[52] WISH Waste Industry Safety and Health Forum Safe use of refuse collection bin lifters and bins
[53] WISH Waste Industry Safety and Health Forum Safety in driver only commercial waste and recycling collections

7.2.3 Centre for Health and Environment Research and Expertise (CHERE)

Research undertaken by the Centre for Health and Environment Research and Expertise (CHERE)[54] looked at collection schemes in Wales and found that the use of crates does not introduce any risk associated with this collection method that cannot be effectively managed or controlled. They go on to say that the safety issues associated with crates are less significant than the safety issues associated with bag collections mainly in relation to weights and lifting and carrying methods.

[54] A Health and Safety Study of Kerbside Recycling Schemes using Boxes and Bags 2006 CHERE (Centre for Health and Environmental Research and Expertise) and Cylch (Wales Community Recycling Network).

7.3 Appendix C – NZ Waste Industry Guidance

This section presents the results of a review of existing New Zealand produced grey literature to identify health and safety related risks and control methods to protect waste collection workers from harm.

In New Zealand, specific health and safety information in relation to waste collection includes WorkSafe NZ guidelines on manual handling.[55] and various studies and guidelines issued by the Health and Safety Sector Group of WasteMINZ.[56]

Health and Safety Guidelines for the Solid Waste and Resource Recovery Sector

WasteMINZ is the industry body for the wider waste industry in Aotearoa New Zealand. In 2002 it formed a working group made up of industry volunteers to focus on health and safety issues present in the industry. In 2009 it began the creation of a set of guidelines (Health and Safety Guidelines for the Solid Waste and Resource Recovery Sector – parts one, two, three, four and five)[57] related to health and safety matters that its members could reference based on the work activities the company might undertake.

A significant component of the guidelines is related to kerbside collections including guidance on the use of the various vehicle types used for this activity and the specific service type in use (MGB, crate, bag, inorganic collections) along with post collection activities at materials recovery facilities.

The document has been updated a number of times including in 2016 as a result of the introduction of the Health and Safety at Work Act 2015 and more recently in 2020 when the Low Entry Vehicle module of the guidelines was reviewed and updated.

The WasteMINZ Guidelines includes the following specific guidance related to kerbside collections.

- Bag collection
- Bin collection
- Crate collection
- Low entry collection vehicles
- Rear loading collection vehicles
- Side loading collection vehicles
- Materials Recovery Facilities

[55] https://www.worksafe.govt.nz/topic-and-industry/manual-handling/preventing-manual-handling-injuries-acop
[56] https://www.wasteminz.org.nz/pubs/health-and-safety-guidelines-for-the-solid-waste-and-resource-recovery-sector-parts-one-two-three-and-four/
[57] https://www.wasteminz.org.nz/wp-content/uploads/2014/05/H-S-Guidelines-parts-1-2-3-4-5-FINAL-January-2021-1.pdf

There is also a range of generic subjects which could also be relevant in a kerbside collection setting, including.

- Contractor management
- Design and operation of plant
- Drugs & Alcohol
- Emergency preparedness
- Fatigue
- First Aid
- Hazard ID and management
- Infection control
- Lockout-tagout (LOTO) isolation procedures
- Machine guarding and controls
- Manual handling
- Noise
- Personal protective equipment (PPE) and signage
- Pre employment health screening and monitoring
- Truck driving
- Young people at work.

In addition to the industry health and safety guidelines there have been a number of one-off studies

In 2005 a research paper looking at the costs associated with manual handling in the New Zealand waste industry was released.[58] In terms of the physicality of the job, reference in this research highlighted exceedances of maximum recommended $V0^2$ max[59] levels by waste collection workers collecting refuse bags. It states that the recommended level for optimal energetic workload is between 23% and 30% of $V0^2$ max that should not be exceeded by workers involved in repetitive lifting over an eight-hour day. Studies of waste collections workers found that during bag collections measurements of up to 59% $V0^2$ max were identified.

Health and Safety of manual vs automated waste collections

In 2010 a report was released by Morrison Lowe called "An assessment of the health and safety costs and benefits of manual vs automated waste collections". The report highlighted a clear variance in the injury rates between the two main collection methods for kerbside waste and recycling, being manual and automated collections. The report goes on to state that manual methods are more likely to result in injury. Eunomia undertook a review of this report as part

[58] https://www.wasteminz.org.nz/pubs/the-cost-of-manual-handling-injuries-in-the-nz-waste-industry/
[59] VO_2 max is the maximum (max) rate (V) of oxygen (O_2) your body is able to use during exercise.

of a project commissioned by the Waste and Resource Action Programme (WRAP) on behalf of the Welsh Assembly Government (WAG), their review concluded that,

> "*There has been much debate in the industry about the relative merits of kerbside sort, two-stream and comingled collections in terms of whether one system is inherently 'safer' or 'healthier' than another. Statements that one system is safer than another are often missing the point, as a holistic approach is required when managing risks."*

The report concludes that more research is needed to quantify any connection to injury rates and various different collection methods.

In 2016, following research into the food waste collection service being designed by Auckland Council, representatives from Auckland University of Technology (AUT) presented their findings into ergonomic assessments of the proposed methodology to collect food waste using 23-25 litre containers. The objective was to identify ergonomic guidelines for the design of the collection truck and food waste receptacle. Observation of the tasks included awkward postures, work practices, work organisation, bin design, truck access and egress and driving visibility.

Recommendations were provided around design of the bin and receptacle on the collection truck for receiving waste from the collection bin. Recommendations for the bin were related to volume, structural integrity, and handle design. It was also highlighted that the project needed to consider aspects outside of physical design such as behavioural and organisational change related to both collection organisations and residents, and that training, and education was critical.

Safety with cyclists

In 2018 WasteMINZ published guidance related to waste and recycling collections that need to be conducted in locations where a cycle lane or path is located between the live lane and the kerbside[60]. The guidance aimed to address the ever-growing use of cycling and the hazards and risks this presented in relation to the interaction between an operational kerbside collection vehicle and an individual (s) using cycle lanes or paths. The guidance lists several associated hazards including.

[60] WasteMINZ. (2018). *https://portal.wasteminz.org.nz/Member%20Portal/health-and-safety-private.* Retrieved from www.wasteminz.org.nz: https://portal.wasteminz.org.nz/files/Health%20and%20Safety/Good%20practice%20guidelines%20for%20collecting%20waste%20on%20cycle%20lanes%20-%20FINAL.pdf

- waste collection operatives being struck by people on bikes
- riders colliding with stationary waste collection vehicles,
- riders colliding with the extended arm of an automated collection vehicle
- cars parking in cycle lanes blocking access to the waste receptacle
- waste receptacles being placed in the cycle lane
- riders leaving the cycle lane and entering a live lane due to the cycle lane being blocked

Standardisation report

WasteMINZ's recommendations for Standardisation of Kerbside Collections in Aotearoa[61] to the Ministry for the Environment in 2020 highlighted health and safety risks collated from stakeholder feedback related to source separated kerbside sort systems. Those risks being manual handling injuries, high speed rural roads and a stakeholder belief that WorkSafe will make it more difficult to use LEV trucks. The use of bags for refuse collection was also highlighted as a health and safety concern.

[61] https://www.wasteminz.org.nz/pubs/standardising-kerbside-collections-in-aotearoa/

7.4 Appendix D – New Zealand Health and Safety Legislation

7.4.1 Health and Safety at Work Act 2015

In Aotearoa New Zealand, the Health and Safety at Work Act 2015 (HSWA) describes the duties of a Person Conducting a Business or Undertaking (PCBU) in respect of the provision of safe and healthy workplaces. The concept of the PCBU is a distinct notion used to define the various types of working arrangements which are commonly referred to as a business. This applies to all business types whether small, large, corporate entity or sole trader and expands across both profit making and non-profit making entities. The law requires that a PCBU has a duty of care to ensure the health and safety of a range of people who carry out work for the PCBU or whose work is influenced by the work of the PCBU. This duty extends to the work environment including welfare facilities, the plant, structures, and substances used and the provision of safe systems of work.

The HSWA also describes duties of other participants in a workplace setting including officers and workers, officers being defined as "*any person occupying the position of a director of the company any partner in a partnership (other than a limited partnership), in a limited partnership, any general partner and in a body corporate or an unincorporated body, any person occupying a position in the body corporate that is comparable with that of a director of a company*". An officer is also defined as "*any other person occupying a position in relation to the business or undertaking that allows the person to exercise significant influence over the management of the business or undertaking (for example, a chief executive)*"[62].

The HSWA defines a worker to mean "*an individual who carries out work in any capacity for a PCBU, including work as an employee, a contractor or subcontractor, an employee of a contractor or subcontractor, an employee of a labour hire company who has been assigned to work in the business or undertaking, an outworker (including a homeworker), an apprentice or a trainee, a person gaining work experience or undertaking a work trial, a volunteer worker, or a person of a prescribed class*".

Further to this HSWA includes a range of other duty holders that exist in a workplace setting. These include PCBU's who manage or control a workplace including those who manage fixtures, fittings, or plant. Those who design,

[62] New Zealand Government. (2021, May 27). *Health and Safety at Work Act 2015*. Retrieved from legislation.govt.nz: https://www.legislation.govt.nz/act/public/2015/0070/latest/DLM5976660.html?search=ts_act%40bill%40regulation%40deemedreg_health+safety+work_resel_25_a&p=1

manufacture, supply or import plant, substances, or structures and where a PCBU installs, constructs or commissions plant, substances or structures. All of these PCBU's have specific duties related to health and safety.

Of key importance to the waste and recycling industry and particularly the kerbside collection part of the sector is the closeness in which it interacts with the public. The HSWA includes a duty on PCBU's to "*ensure that the health and safety… of other persons is not put at risk from work carried out as part of the conduct of the business or undertaking*".

The HSWA also describes the approach to be taken in terms of the management of risk, although the legislation does not provide a definition of risk[63]. In this context, those that hold duties in the HSWA are required to "*eliminate risk to health and safety, so far as is reasonably practicable and if it is not reasonably practicable to eliminate risks to health and safety, to minimise those risks so far as is reasonably practicable*". This duty is further expanded to mean that "a *person must comply with this risk management duty to the extent to which the person has, or would reasonably be expected to have, the ability to influence and control the matter to which the risks relate*".

A key duty of a PCBU is that they must consult with other PCBU's who may have the same duty. This is commonly known as overlapping duties and this concept uses a framework of consult, cooperate, and coordinate in relation to situations where there is an overlapping duty. This means that no one PCBU holds all the responsibility for health and safety where there are overlapping duties and that there must be this process of consultation to ensure clarity of the roles and responsibilities for all participants in the supply chain. The ability that individual PCBU's have to influence and control a situation is an aspect that should be included in this consultation process.

7.4.2 Land Transport Act 1998

As part of the suite of legislation, regulation and rules covering activities on the road the key piece of legislation is the Land Transport Act 1998 and as part of this the Land Transport (Road User) Rule 2004. This latter document provides guidance across a number of road, pedestrian and vehicle related aspects, many of which are relevant to kerbside collections. Of key importance is the specific rule which discusses the risk of "*riding dangerously*"[64]. The rule states that:

[63] The definition of risk for the purposes of this report will be based on that provided in AS/NZS ISO 45001:2018. The effect of uncertainty.
[64] New Zealand Government. (2021, May 1). *Land Transport (Road User) Rule 2004*. Retrieved from legislation.govt.nz: https://www.legislation.govt.nz/regulation/public/2004/0427/latest/DLM302188.html?src=qs

- *A person must not ride in or on a vehicle, or in or on an object conveyed on a vehicle, in a manner or position that may be liable to cause injury to that person.*
- *A driver must not permit a person to ride in breach of subclause (1).*
- *A person must not alight from or board a moving motor vehicle or light rail vehicle.*
- *A driver must not operate a motorcycle (other than a motorcycle fitted with a sidecar) on a road while it is carrying more than 2 persons.*

This specific rule explains how a person must or must not ride in or on a vehicle and is specifically relevant to kerbside collection activities that use low entry vehicle, rear loaders with running boards, collection trucks with trailers or any vehicle where a person rides in or on the vehicle other than in the normal driving position.

In relation to land transport laws internationally, the Solid Waste Association of North America (SWANA) cite the Slow Down to Get Around[65] based legislation that has been implemented to some degree in up to 30 states in the USA. This legislation is aimed at requiring impatient drivers who get caught behind refuse truck that are "working" to slow down when moving past solid waste collection vehicles. SWANA state that waste collection workers being hit by vehicles is the leading cause of death for waste collectors. Anecdotal evidence in New Zealand would suggest this is not as significant of an issue.

Waka Kotahi – Code of Practice for Temporary Traffic Management

Waste Industry guidance has been included in the Waka Kotahi – New Zealand Transport Agency's Code of Practice for Temporary Traffic Management (CoPTTM) for several years. Recent changes have meant that the industry is about to take over more control of the kerbside collection related content of COPTTM and a review of this content has been undertaken by the WasteMINZ Safety Sector Group. In addition, a Good Practice Guideline document is currently out for consultation from WorkSafe NZ targeted at Road and Roadside Workers Health and Safety. Kerbside collection is a target audience for this document, and it is highlighted in the DRAFT version that the use of automated collections is a method that reduces the risk of manual handling.

[65] https://swana.org/initiatives/safety/slow-down-to-get-around

7.5 Appendix E - Other Publications

An article published in the New Zealand Herald 12th August 2015[66], highlights eleven (11) fatalities that occurred in the waste industry between 2001 and 2015. Of the 11 fatalities highlighted, nine (9) appear to be related to residential waste or recycling collections. Based on the descriptions in the article and the author of this reports own knowledge it appears that the following immediate causes may have been relevant.

- Fatalities caused by the worker being struck/run over/crushed by their own vehicle – 5 cases
- Fatalities caused by machinery or equipment associated with the vehicle - 2 cases
- Road traffic accidents, either truck vs other vehicle/object, or person associated with the collection truck being struck by another road user – 2 cases

In 2016 Statistics New Zealand published information[67] that suggested that people working in "*elementary occupations*" which included rubbish collectors were amongst the riskiest occupations in 2015. The data suggesting there were 238 claims per 1000 full time equivalents. This result pushed previous occupations such as forestry and fishing off the top spot for the first time in the previous eight (8) years.

On the 9th of December 2020 the Minter Ellison Rudd Watts review of workplace health and safety was published[68] and highlighted the Electricity, Gas, Water and Waste sector as having the highest fatality frequency rate per 100'000 FTE workers for the 2020 year. It is not noted in this publication the percentage of these four sectors that contributed to this result so the information should not be relied upon in terms of highlighting the extent of the claims specific to the waste industry.

[66] https://www.nzherald.co.nz/nz/rubbish-truck-crash-11th-fatal-in-industry-since-2001/U5MSDFWIX7ZUT2RDRL4J4JQH4U/
[67] https://www.stats.govt.nz/news/risky-business-the-most-dangerous-occupations
[68] https://www.minterellison.co.nz/our-view/workplace-health-and-safety-2020-in-review

7.6 Appendix F – ACC Data

An Official Information Act (OIA) request was made to the Accident Compensation Corporation (ACC) to provide data on injury rates in the waste management sector. The OIA data received, (GOV- 010963) provides a range of claims data based on the employer classification units linked to the waste industry[69]. Unless otherwise stated all quoted data relates to the period 01/01/2000 – 20/05/2021 (21-year/ 5-month period).

The following caveats apply in terms of data interpretation.

1. The classification unit (CU) represents the business activity of the claimant's primary employer. This may differ from the activity the claimant performed as part of their job.
2. Classification units for this industry have changed over the period of time covered by this report. In 2007/08 three new CUs were introduced.
3. Claims where the attributed employer is a proxy (i.e., because ACC don't know or cannot identify the client's employer) have been excluded from the report.
4. Accredited employer claims aren't included, ACC doesn't receive the accident description data for these, so none of them will match keywords in tables 13 - 17.

Data Included

- Count of various types of new work-related claims in the waste management industry, by classification unit and calendar year of claim lodgement.
- Count of new work-related claims in the waste management industry, by accident location, classification unit, and calendar year of claim lodgement.
- Count of new work-related claims in the waste management industry, by primary injury diagnosis, classification unit, and calendar year of claim lodgement.
- Count of new work-related claims in the waste management industry that matched one or more keywords from the provided list, by classification unit and calendar year of claim lodgement.
- Count and cost of active work-related claims in the waste management industry, by classification unit and calendar year of payment.

[69] The data in this report are based on accepted work-related claims where the employer's classification unit is one of the following:
- 96340 Waste treatment and disposal services
- 96350 Solid waste collection services
- 96370 Waste remediation and materials recovery services
- 96380 Waste collection services (not elsewhere classified)

The data received does not identify the specific activity being undertaken at the time and therefore the direct cause of the injury and subsequent claim is unable to be attributed to a particular activity. The closest assessment to claims related to kerbside collections can be made by interpreting the data provided by a keyword search. The following keywords were used to identify claims, this is not foolproof but there are some words that can only be attributed to kerbside collections and mrf activities.

Key words used: *Bag, bale, baler, baling, bin, cardboard, compactor, conveyor, crate, foodwaste, glass, kerbside, lifting, mrf, needle, organic, packer, paper, plastic, recycle, recycling, refuse, residential, rubbish, runner, running board, sorting, throwing, tin, wheelie bin.*

- There were a total of 2858 claims against keywords that could be related to kerbside collections for the 21.5-year period. This equates to an average of 132.93 claims per year, which is 11 claims per month.
- There was a total of 4610 claims against keywords that could be related to material recovery facilities, this keyword search was done across the various employer classification units of waste treatment and disposal services and waste remediation and materials recovery services for the 21.5-year period. This equates to an average of 214.41 claims per year, which is 17.86 claims per month.
- The total cost of claims across all classification units in the waste sector for the 21.5-year period was $61.5 Million.

As with both scenarios, (kerbside collections and mrf operations) over the claim period work methods have changed and the size of the industry has changed with it. To enable claims data to provide meaningfull information, a detailed analysis of the data including individual assessment of ACC45 documents to quantify actual source of harm, which would confirm relevance specifically to kerbside collections and mrf activities, would need to be undertaken.

7.7 Appendix G – Stakeholder Engagement

7.7.1 Stakeholder Engagement

As part of the Standardisation of Kerbside Collection Health and Safety Review, stakeholders were identified and asked to contribute via either face to face sessions, webinars, site visits and in some cases phone interviews or through the provision of a written submission.

During June 2021 emails were sent to a database of individuals who had previously been invited to attend events related to the wider project. In addition contact was made with a wider group of potential contributors via newsletter distribution issued by both WasteMINZ and the New Zealand Institute of Safety Management.

7.7.2 Face to Face events

- During the period 29th June – 16th July 2021, five (5) face to face stakeholder engagement sessions occurred across Aotearoa New Zealand. Table 10 shows the list of attendees by company name, where a number appears in brackets this signifies multiple attendees from the same organisation. Attendees were given a brief overview of the project and a series of discussion points were introduced which were related to risks that form part of the kerbside collection and mrf sorting processes.

Table 10 - Stakeholder company attendees

- Note: Disabled Person Assembly and Te Rōpu Marutau o Aotearoa both provided feedback via phone interview and written submission.

Waste Collection Organisations	National and Local Government	Charities, Not for Profit & Other
EnviroNZ (5)	Ministry for Environment (2)	Morrison Lowe
SMART Environmental (4)	WorkSafe NZ (3)	Disabled Person Assembly,
Waste Management (5)	Auckland Council (2)	Te Rōpu Marutau o Aotearoa
Northland Waste (3)	Hauraki District Council	
Low-Cost Bins	Tauranga City	
Xtreme Zero Waste (2)	New Plymouth District Council	
Visy	Palmerston North City Council (3)	
Eco Central	Hastings District Council (2)	
Bond Contracts Ltd	Napier City Council	
Kaicycle	Wellington City Council	
	Marlborough District Council	
	Waimakariri District Council	
	Dunedin City Council	

Table 11 shows the stakeholder engagement events that occurred over the 3-week period in late June early July 2021.

Face to Face events				
Location	**Day/Date**	**Time**	**Address**	**Attendees**
Auckland	Tuesday 29th June	0930 – 1200	Ministry for the Environment Auckland	20
Palmerston North	Tuesday 6th July	1100 - 1300	Palmerston North City Council	10
Wellington	Wednesday 7th July	0930 - 1200	Ministry for the Environment Wellington	9
Christchurch	Thursday 15th July	1000 - 1200	Waste Management NZ offices	6
Dunedin	Friday 16th July	1000 - 1200	Dunedin Library rooms	7

7.7.3 Webinar events

Four webinars were delivered during 3 weeks in July, these followed a similar approach to the face-to-face sessions by discussing key risks inherent in the kerbside collection and mrf processing industry. To enable a level of participant feedback various polls were undertaken related to each of the risks discussed, results and analysis have been analysed and feedback is included as part of the overall discussion and findings in this report.

Each webinar had a different focus area which delivered on the premise that this project was not about bags vs bins, but more about accepting that there are various collection methods currently used and aiming to understand the health and safety issues and control methods in place by the various collection companies.

The four webinars, while focussing on much of the same content as the face-to-face sessions, each had a targeted area of focus on specific collection methodologies and environments, with one webinar solely focussed on a mrf operation. The four webinars, including their focus areas are shown in Table 12. In Table 13 details of webinar attendees is shown.

Table 12 – Webinar details

Webinars	Day/Date	Time	Focus area	Risk Focus Area	Registrations	Attendees
Webinar 1	Friday 9th July	1000 - 1100	Automated collections	• Other road users and working on the road • Interaction with machinery • Urban Design • Manual Task • Psychosocial • Contract Management & Design • Manual Handling • E-Waste • Pandemic	25	17
Webinar 2	Monday 12th July	1330 – 1430	Manual Collections	• Manual Task / Manual Handling • Psychosocial • Pandemic	23	13

				• Other road users and working on the road • Runners / Riding on a vehicle • Interaction with machinery • Urban Design • E-Waste • Contract Management & Design		
Webinar 3	Tuesday 13th July	1000 - 1100	Urban vs rural collections	• Roading Environment • Visibility • Speed • Runners • Riding on a vehicle • Manual Task • Psychosocial • Pandemic • E-Waste • Contract Management & Design	20	10
Webinar 4	Tuesday 20th July	1000 - 1100	mrf sorting	• Manual Task • Workstation set up • Vibration • Work Environment • Machinery • Biological & Hazardous Waste • Psychosocial • Pandemic • E-Waste	28	13

Table 13 – Webinar attendee companies

Waste Collection Organisations	National and Local Government	Charities, Not for Profit & Other
SMART Environmental (17)	Wairoa District Council	WasteMINZ
Waste Management (7)	Stratford District Council (2)	Eunomia (2)
	South Waikato District Council (2)	Other (4)
	Queenstown Lakes District Council (4)	Ministry for the Environment (2)
	Whangarei District Council (3)	3R
	South Taranaki District Council (3)	
	Palmerston North District Council	
	Waikato District Council	

7.7.4 Site Visits

Three site visits to mrf's were undertaken which included the Eco Central mrf in Christchurch, the Palmerston North City Council mrf and the Wellington City Council mrf in Seaview operated by Oji. Observations were undertaken of operations at all three locations which included a walk around of all sites specifically in the areas where either automated or manual sorting of recyclable products from kerbside collections occurred. Details of information gained from discussions and observations during these site visits are incorporated into the risk registers and discussion sections 3.6.4 and 4.

While no time was spent on kerbside collection trucks, representatives from First 4 Safety Ltd have undertaken this activity many times, most recently during the early part of 2021 when observations from a health and safety and operational perspective were made on a range of collection trucks. This included

- an LEV recycling collection with a kerbside glass sort in a rural setting,
- a refuse bag collection using a large rear load collection vehicle with a runner undertaken in an urban setting and
- a recycling collection in a small town using a small rear load collection truck fitted with a trailer and using multiple runners and a sorter located in the trailer.

Like the mrf visits, details of information gained from discussions and observations during these site visits are incorporated into the risk registers and discussion sections 3.6 and 4.

7.7.5 Other stakeholder submissions

7.7.5.1 Māori

Feedback was sought from Te Rōpu Marutau o Aotearoa (TRMA) (Māori Health and Safety Association) on their views on health and safety matters related to residential waste collection. TRMA members have provided the following from a Māori perspective relating to health, in particular mana Hinengaro (spiritual and mental wellbeing) and mana Tinana (physical wellbeing), as a result of paru (unclean) decomposing waste and rodents.

Paru - Standardised waste may not be suitable for Māori or Pacific people's households.

TRMA highlight a not uncommon approach by Māori and Pasifika peoples to live in multiple family and unrelated person households, and in the current housing situation this is sometimes done as a matter of necessity. These living arrangements may not be conducive to the standard approach that territorial authorities use to supply containers for setting out waste and recycling. The living arrangements can mean that one bin may not be sufficient for extended families and can potentially result in an overflow of refuse or recyclables due to the lack of bin capacity. They comment that the solution may not be trips to the waste centre as families cannot afford those costs or cannot travel as frequently to avoid stockpiling and managing the risk of rodents and odour problems.

This potential overflow of waste may cause problems for large households, and they believe this will result in risk to Māori and Pacific people's health and the health of entire communities where overflow is common.

Tapu Maheuheu – Biological waste and products that have been associated with biological waste.

TRMA highlight Māori tikanga of Wehi and Ihi, the ideological Māori beliefs that respect or lack of respect for an entity or oneself will result in consequences good or bad depending on the situation, which has an effect on Mana (perception of status) and Mauri (balanced elements of wellbeing) of the involved entity or persons. In this context they discuss that being exposed to biological waste and products, for Māori workers is Tapu (Sacred) because the waste or products have come into personal contact with another person, whose association with that waste may afflict Wehi or Ihi on the Māori worker who becomes associated with that biological waste or product. TRMA acknowledge that most human biological waste would likely come from hospitals and medical centres however items such as clothing, hair, band-aids, shaving products, deodorants, hygiene products, bedding and the list goes on, are all Tapu and are all contained within general household refuse.

TRMA go on to say that if Māori who are Tikanga aware are constantly struggling with issues of Tapu and core spiritual beliefs, this could lead to issues with mental health, communication and trust of employer, whanau morality and ethical issues. The solution to this, regardless of the adoption of standardised domestic kerbside collection, is that Local Authorities, Worksafe NZ and Iwi (with assistance from TRMA if required to identify Tangata Whenua Kawa) need to meet and set protection for Māori working in this industry.

There are a number of Tikanga practices that have been identified as interventions to reduce the risk of the above issues, these include:

- Opportunities to discuss concerns and other practices with PCBU and Local Authority.
- Training for staff to perform daily Karakia approved by local Iwi for worker protection.
- Karakia carried out by local Iwi to lift the Tapu from process machinery and equipment.
- Separation of PPE and other plant and a process for restoration

7.7.5.2 Disability sector

A phone interview with a representative from the Disabled Persons Assembly sought feedback on behalf of those in the community with access needs and found that there was a spectrum of issues and methods used to address these. Based on individual abilities the following aspects were deemed relevant.

- Individuals who cannot manage to put out or collect their waste having to rely on others for this.
- Some found bags easier to handle as they were physically unable to manouver a wheelie bin.
- Locating their own bin after collections can be a problem for people with sight issues.

A guide has been published to assist blind and vision impaired people to identify, sort and reduce household waste,[70] this resource provided some guidance and other information to provide improved access to blind people in respect of kerbside waste collections.

The resource recognised the issues related to post collection identification of waste bins for vision impaired people and references a textured sticker for bins to improve the ability to identify the bin after it has been emptied. Other options include stickers directed at the waste and recycling collection driver to ensure individual bins are returned to the exact same place they were collected from.

[70] Blind Citizens NZ (Auckland Branch). (2017, August). Feeling Rubbish. *A guide to reducing waste for blind and vision impaired Aucklanders*. Auckland, New Zealand: Blind Citizens NZ (Auckland Branch).

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