Monitoring Research Quarterly, MRQ is the newsletter of Auckland Council’s Research and Evaluation Unit, RIMU. The newsletter reports on RIMU’s current work including information about recent publications, research, facts and trends about Auckland. RIMU publications are available on council’s research information website, Knowledge Auckland www.knowledgeauckland.org.nz

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Introducing Eva McLaren Manager, Research and Evaluation

Given my experience in an academic and applied research environment, my expertise has been sought in areas such as the review of the Bachelor of Arts (Social Sciences) programme at AUT; I’ve served as a member of the Social and Economic Sub-Group of the Professional and Applied Research Expert Advisory Group for the 2012 Performance-Based Research Fund Quality Evaluation; and I am currently a member of the NZ Work Research Institute Advisory Board.

RIMU’s strength is in its diversity and the unique skills and insights brought by highly competent, committed, creative and inspirational scientists, researchers and analysts. It’s a real privilege to lead the Unit. I see it as my role to ensure that RIMU continues to go from strength to strength, that our influence and peer esteem widens, that our brand strengthens, and that our work is strategically aligned, relevant and has maximum impact and influence.

As a Unit we endeavour to ensure that our value is recognised in the provision of high-quality evidence through research, monitoring and evaluation to support Auckland’s decision-makers in the achievement of Auckland Council’s priorities. I look forward to working with you all.

Ngā mihi nui

Kia ora koutou

Most of you know me as the Manager of RIMU’s Economic and Social Research and Evaluation Team – a role I’ve been in since 2010. However, on Lucy Baragwanath’s departure, I took on the acting RIMU Manager role and have recently been appointed to that position.

With an MA in Sociology and other qualifications in industrial relations and interior design, I spent several years working in labour relations, interior design and self-employment before embarking on my extensive research career.

For the last 16 years or so I’ve managed multi-disciplinary research programmes and teams at both Massey University and Auckland Council.
Recent research activities

RIMU's scientists, researchers, technical specialists and analysts have assisted with many Auckland Council projects over recent months. A list of recent publications and research related activities follows. The reports noted here are available on the Knowledge Auckland website.

New reports

- Auckland air emissions inventory 2016 – home heating, TR2018/018
- Auckland air emissions inventory 2016 – industry, TR2018/019
- Auckland air emissions inventory 2016 – sea transport, TR2018/017
- Auckland air emissions inventory 2016 – transport, TR2018/016
- Kia māia te whai Dare to explore evaluation 2017/18, TR2018/022
- Long-term trends in Auckland’s business demographics, TR2018/024
- Marine water quality state and trends in the Auckland region from 2007 to 2016, TR2018/015
- Tree loss in the Waitāmatā Local Board over 10 years, 2006-2016, TR2018/021
- Water quality investigations: Christmas Beach, Green Bay, Foster Bay and Huia Bay, Auckland, TR2018/020
- Waiheke Community Survey. Results from a 2018 survey of Waiheke residents, TR2018/014

Other reports expected soon

- Air quality and societal impacts from predicted climate change in Auckland
- An assessment of vulnerability to climate change in Auckland
- The impacts of transport emissions on air quality within Auckland’s central business district
- Quality of life survey 2018: Auckland report. TR2018/023

Behavioural insights in local government

Dr Jesse Allpress spoke to the Wellington City Council Elections Team on the use of behavioural insights in local government. Jesse talked about his recent elections related research findings and how they will be used for encouraging Aucklanders to vote in the 2019 local elections. Increasing voter turnout using behavioural insights, an Auckland Council technical report, is available on Knowledge Auckland.

Human Participants Ethics Committee

The Human Participants Ethics Committee (HPEC) is being reviewed. The review provides an opportunity to reflect on the efficacy of the committee’s processes, its membership and the extent it contributes to the development of ethically-designed human participants’ research at Auckland Council. HPEC is co-chaired by Dr Jacob Otter and Dr Jennifer Joynt.

Inquiries to HPEC@aucklandcouncil.govt.nz
Queen Street is one of the busiest streets in New Zealand with over 10 million pedestrians counted in 2017. With rapid economic growth, social changes and major residential development expected to continue apace, policy and planning decisions are currently under consideration that will future-proof Auckland’s CBD as a place where people want to live, work and play.

However, Queen Street also records the highest levels of harmful air pollutants such as nitrogen dioxide ($\text{NO}_2$) and fine particles in the air known as $\text{PM}_{2.5}$ (Figure 1) – concentrations have sometimes exceeded regional and global guidelines for $\text{NO}_2$. The main reasons for high air pollution levels in Queen Street are:

- The high buildings in Auckland’s CBD reduce air flow, allowing air pollutant concentrations to increase close to the ground.
- There are more buses in the CBD and buses use diesel which emits far greater concentrations of pollutants – $\text{NO}_2$ and $\text{PM}_{2.5}$ – than petrol vehicles.
- The emissions from the active port and ferry terminal centred in the heart of the city.

Over the past decade air pollution concentrations have fallen, largely due to cleaner fuel, engine improvements and changes in traffic management. More recently, however, this downward trend has reversed, with concentrations on Queen Street now on the rise once again. What has changed?

A first consideration is that there may be more traffic on the streets. This appears to not be the case for the CBD because Auckland Transport data shows that the number of private vehicles travelling into the city each day has dropped from 40,000 in the late 1990s to less than 30,000 vehicles today.

If it’s not traffic volume, then clues must be sought from air pollution data. To investigate further, several different data sources needed to be considered together. These include different types of air quality measurement studies from numerous research groups as well as traffic data from Auckland Transport.

The key emission sources of air pollutants can be identified through source apportionment techniques. This method attributes elemental concentrations from particles captured on a filter medium and links them to specific emission sources.

Ten years of filters from Queen Street show that diesel emissions make up almost 40 per cent of the $\text{PM}_{2.5}$ mass but 66 per cent of black carbon (BC) (Figure 2). Black carbon consists of very small ultra-fine particles ($\text{PM}_1$ or less) not much larger than viruses. These can travel deep into lung tissue, into the bloodstream and then become deposited in the heart or brain tissue with detrimental health impacts.

This research has found that concentrations of black carbon from Queen Street are high. – Over three times higher than Canadian cities and twice as high for concentrations in major European, UK and North American cities. This means that diesel emissions are an important part of this air pollution puzzle.
University of Auckland research findings identified buses as a key source of ultra-fine particles within the CBD (Lim et al. 2015). The graph on the left in Figure 3 shows the peak number of ultra-fine particles emitted from a bus. It should be noted that newer buses tend to emit far less particulates than older buses and electric buses completely eradicate these emission “plumes”. NO\textsubscript{2} concentrations across a wider part of the city CBD are shown in Figure 4 (red dots). They cluster near the waterfront, Britomart area, and next to major road junctions within the CBD. These locations are consistent with major bus stops and road junctions with traffic lights. The stop-start nature of traffic flow is important to pollution levels.

The lowest concentrations were near Albert Park and High Street. Finally, traffic counts show constant vehicle numbers between 4000-5000 vehicles per day along Queen Street during 2016 and 2017. For lower Queen Street, buses are four per cent of the fleet. However, at the K Road end of Queen Street buses are between 11 and 12 per cent of the fleet. The Auckland average is two per cent. Also, the air flow is important for Queen Street as the prevailing south-westerlies, typical for Auckland, draw air from the top of Queen Street towards the waterfront and this includes emitted pollutants.

**Conclusions**

Queen Street air pollution data identifies diesel emissions as a significant contributor to high pollution levels in the CBD. The peak concentrations of NO\textsubscript{2} are found close to Customs Street, with a busy four-lane road and bus terminal close by. Pollution emitted further up Queen Street might also flow down the Queen Street valley and further increase concentrations within the waterfront area. The major sources of diesel emission are older buses, trucks, large goods vehicles, ferries and shipping. These are all essential vehicles for delivering goods and services to the CBD, therefore, retrofitting vehicles with cleaner fuel systems, modernising fleets with cleaner engines or electrification would all help reduce hazardous air pollution concentrations on one of New Zealand’s most densely populated streets.

For more information, please contact Nick Talbot, Air Quality Scientist
nick.talbot@aucklandcouncil.govt.nz

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**References**


Lim, Shanon; Kim N. Dirks, Jennifer A. Salmond and Shanju Xie. 2015. Determinants of spikes in ultrafine particle concentration whilst commuting by bus. *Atmospheric Environment* (112) 1-8

Urban pest monitoring project

Invasive mammals have a big impact on native flora and fauna in Auckland, both in large forested areas such as the Waitākere and Hunua Ranges, as well as in our smaller urban parks and reserves. Many of these urban reserves have pest control programmes in place, carried out by both council staff and volunteer community groups. These programmes target several species, such as possums, rats and mice which are all significant conservation pests.

An important aspect of any pest control programme is ongoing monitoring. RIMU undertakes a range of pest monitoring as part of our regional terrestrial monitoring programme. The monitoring is designed to detect any changes in population or species composition and provides an early indication of any new species present. This allows a better understanding of the response in the targeted area and the effectiveness of the control techniques that are being used.

Chew cards and tracking tunnels are two methods that are used to monitor pests in forest environments (see figures 1 and 2 on page 6). Tracking tunnels have been specifically designed for monitoring small mammals in New Zealand. They are a black, corrflute tunnel, and over one night a peanut butter baited ink pad is placed inside. As mammals or insects walk through the tunnel to investigate the bait, they leave behind prints, which can then be used to identify species as well as provide an indication of abundance. An alternative pest monitoring approach uses chew cards. Peanut butter filled chew cards are fixed to trees and left for one to seven days, attracting mammals that leave behind distinctive tooth or bite marks as they gnaw at the corrugated plastic cards.
Currently, there is no information for deciding which of these methods is more suited to monitoring in urban reserves. Differences may be observed depending on the time of year monitoring is done, the number of nights chew cards are left out (this can affect their chance of detecting different types of pest), and whether chew card damage is correlated with the density of mammalian pests.

All these factors can have significant influences on monitoring results. For example, some pests show species interference, a process where an animal may not visit a chew card if another species has been there first.

Some pests may take time before their presence is detected, due to a sparse population, or because the animals are ‘trap shy’ and wary of interacting with chew cards or tunnels.

Another possible source of measurement error comes from early bite markings on chew cards being covered or obscured over time by larger scale browsing by later visitors. Leaving tracking tunnels out for longer than one night, in order to attract those shy or sparse pests, risks the ink markings becoming congested and hard to identify, or wet weather causing the markings to smudge and become undetectable.

RIMU has begun a project at four randomly selected urban reserves to assess monitoring methods. The major aims of the study are to:

- a) determine the method most suited for effective pest monitoring in urban Auckland parks and reserves
- b) investigate if the time of year monitoring takes place affects results
- c) determine the most effective number of nights to leave out chew cards
- d) examine the relationship between pest density and chew card damage.

This information will benefit pest control programmes in urban Auckland, providing recommendations on methodology and timing for pest monitoring, leading to better informed decisions around effective pest control measures.

For more information about the monitoring urban pests programme, please contact Hamish Allen, Environmental Specialist hamish.allen@aucklandcouncil.govt.nz

For more information about Auckland related research, data and monitoring programmes visit the Research Unit’s websites:

Knowledge Auckland
www.knowledgeauckland.org.nz

Auckland Counts, census data
www.censusauckland.co.nz


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