

ATTACHMENT C:

Background information on air pollution in Auckland

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1 Sources of Auckland's particulate air pollution

Auckland's particulate air pollution is generated by human activities including transport, use of indoor fireplaces, and industrial and rural activities (called anthropogenic air pollution). There is also a contribution from natural sources, such as pollen, dust and sea spray.

In Auckland's urban area, transport and indoor fireplaces generate similar amounts of air borne particulates on an annual basis, as noted in Table C1 and Figure C1. The data shows that both have declined over a ten year period from 2006 to 2016.

Table C1: Estimated anthropogenic PM₁₀ emissions in Auckland - 2006 and 2016 (tonnes per year)

	Regional			Urban		
	2006	2016 (estimated)	% contribution in 2016	2006	2016 (estimated)	% contribution in 2016
 Indoor domestic fires	1495	962	40%	1290	830	42%
 Transport emissions	1213	1063	44%	1100	964	49%
 Industry	465	379	16%	212	173	9%
Total (tonnes per year)	3174	2404	100%	2626	1967	100%

Source of data: *PM₁₀ in Auckland: Independent Audit*, Report prepared by Emission Impossible Ltd for Auckland Council, June 2015

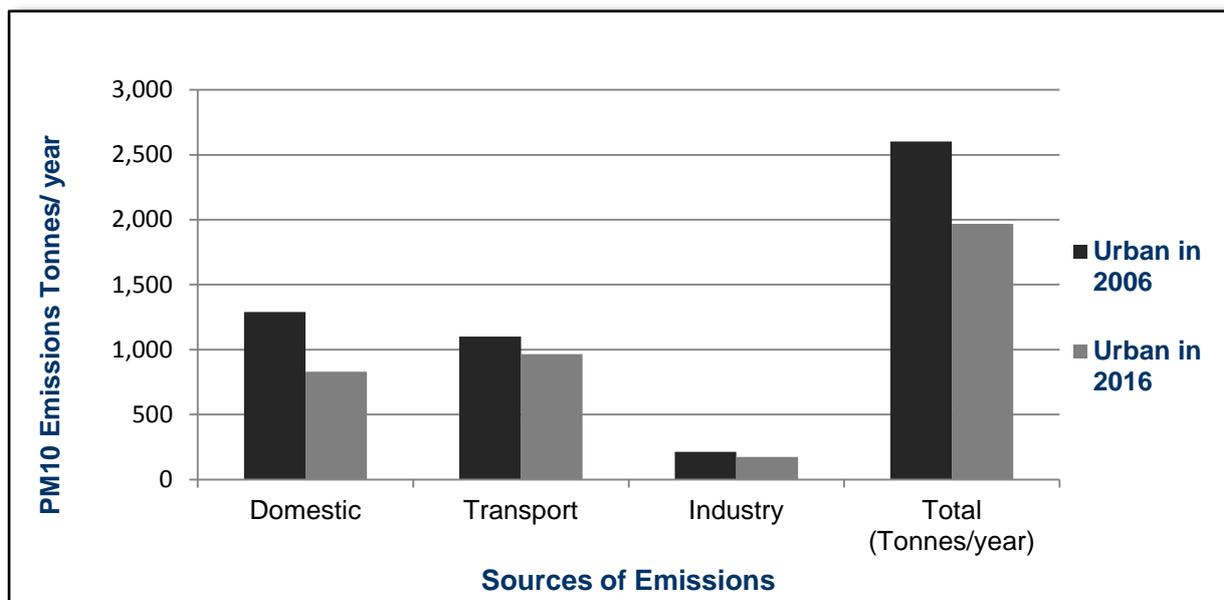


Figure C1: Annual PM₁₀ emissions in the Auckland urban area (the Urban Air Shed) - 2006 and 2016

Source of data: *PM₁₀ in Auckland: Independent Audit*, Report prepared by Emission Impossible Ltd for Auckland Council, June 2015

Note to figure: **Domestic** refers to emissions from indoor domestic fires

2 The national PM₁₀ standard and how it applies in Auckland

New Zealand's air quality regulations specify the maximum level for PM₁₀ particulate air pollution as a 24-hour average of 50 µgm of particulates per m³.¹

Under the national regulations, Auckland is allowed to exceed the maximum PM₁₀ level once a year. Exceeding that level more than once in a year breaches the national PM₁₀ standard.²

If an exceedance of the PM₁₀ standard is considered to be caused by sources outside the council's control (such as a forest fire), then the council can seek an exception from the Ministry for the Environment.

In 2013, Auckland's urban area exceeded the daily PM₁₀ level three times. On the second exceedance in June 2013, Auckland then became classified as a "polluted air shed".

The consequences of being a polluted air shed include a ban on installing new indoor open fireplaces that burn solid fuel (i.e. wood and coal) and a limit on additional particulate

¹ In the Resource Management (National Environmental Standards for Air Quality) Regulations 2004.

² The national air quality regulations currently allow some other cities in New Zealand to exceed the daily PM₁₀ level more frequently, before "breaching the national standard". The national regulations allow them more time to achieve the PM₁₀ standard because of their historical air pollution levels; the timelines for complying are specified in Clause 16B of the Resource Management (National Environmental Standards for Air Quality) Regulations 2004.

pollution from new industry.³ These restrictions apply for five years from the time the national standard was breached.

In Auckland the impacts of breaching the national standard in 2013 were mitigated by the following factors:

- A ban on installing a new open fireplace was already in effect in Auckland, as solid fuel open fireplaces generally do not meet Auckland's regional emission standard of 4.0 g/kg of fuel burned. From 2010 to 2016, the regional emission standard was specified in the *Auckland Council Regional Plan: Air, Land and Water* and is now included in the *Air Quality Bylaw for Indoor Domestic Fires 2017*. Open fires that burn gas are exempt from the standard as they are clean burning and produce very little particulate air pollution.
- The regulatory restrictions on new industrial emissions happened at the same time as a decline in heavy industrial activity in Auckland.

Auckland's available air quality data show that the city has met the national PM₁₀ standard from 2014 to mid-2017. Data for the second half of 2017 are not yet available.

If Auckland's air quality continues to meet the national PM₁₀ standard over the period July 2017 - June 2018, Auckland will no longer have the status as a polluted air shed.

3 The health impacts of particulate air pollution

Of the common pollutants present in air pollution, significant health impacts have been attributed to particulate matter (PM₁₀ and PM_{2.5}). Therefore the national air quality standards in the Resource Management (National Environmental Standards for Air Quality) Regulations 2004 and Auckland's Unitary Plan include a limit for air borne particles less than ten microns (PM₁₀).

In most parts of New Zealand, domestic indoor fireplaces dominate the health impacts associated with anthropogenic air pollution. However, in Auckland the contribution to PM₁₀ levels from vehicle emissions and domestic indoor fireplaces, and their associated health impacts, are roughly similar (see Table C1).

Susceptibility to the effects of air pollution depends on the level of exposure and factors that are unique for each individual. However, national research on the health impacts of air pollution, published in the 2012 report *Updated Health and Air Pollution in New Zealand Study* (known as the "HAPINZ study"), has identified that certain groups within the population are more affected by air pollution than others⁴, including:

- older people
- children (including babies, infants and unborn babies)
- people with pre-existing heart or respiratory conditions

³ The national regulations limit the increase in the ambient PM₁₀ level caused by new industrial emitters to no more than 2.5 µg per m³.

⁴ Kuschel *et al.* (2012). *Updated Health and Air Pollution in New Zealand Study, Volume 1: Summary Report*, Prepared by G Kuschel, J Metcalfe, E Wilton, J Guria, S Hales, K Rolfe & A Woodward for Health Research Council of New Zealand, Ministry of Transport, Ministry for the Environment and NZ Transport Agency (March 2012).

- diabetics
- pregnant women
- Māori.

Short-term health effects can include premature death in susceptible individuals, but the major impact of air pollution exposure on life expectancy is through the gradual, cumulative effects of chronic disease.

Because both acute and long-term exposure need to be addressed to protect human health, the Auckland Ambient Air Quality Standards in the Unitary Plan have limits for both short and long-term exposure to PM₁₀, PM_{2.5}, NO₂ and SO₂.

The most recent estimates of the health costs associated with anthropogenic PM₁₀ air pollution in Auckland were prepared for the Proposed Auckland Unitary Plan Hearings process. That work estimated that in 2014 Auckland's health costs were as follows:

- An estimated 266 premature deaths, 174 hospital admissions and approximately 700,000 restricted activity days
- A total cost of \$1.10 billion per annum or \$779 per Auckland resident (in 2014 dollars).

The cost estimates for Auckland in 2014 were based on findings in the HAPINZ study. To estimate Auckland's health costs in 2014, the estimates in the 2012 HAPINZ study were updated to reflect Auckland's recent air quality data and 2013 census data.

4 Changes in the use of indoor fireplaces in Auckland

Table C2 shows the estimated changes in the use of indoor fireplaces in Auckland over the period 2001 to 2017.

The table shows that the number of indoor fireplaces decreased from 115,850 in 2001 to 99,435 in 2017, as homeowners shifted to other types of home heating.

Many of the city's older types of indoor fireplaces, which emit relatively high levels of particulate air pollution, have been replaced by more modern, lower emissions technology. Some key trends include:

- The number of open fireplaces that burn solid fuels (wood and coal) has decreased from 28,100 in 2001 to 11,817 in 2017
- The number of older wood burners that were installed before 1991, has decreased from 41,350 in 2001 to 6192 in 2017
- Since 2005, new wood burners have had to meet the higher national standards set in 2004. The number of post-2005 wood burners increased from zero in 2005 to 37,744 in 2017.

Since 2005, Auckland households that have chosen to install or replace a wood burner for home heating have been required to install new fireplace technology with lower particulate emissions, particularly in the urban area. Upgrading to modern, lower emissions fireplaces has contributed to improvements in Auckland's air quality.

The overall result is that from 2001 to 2017, the level of particulate air pollution from Auckland's indoor fireplaces has decreased from 13,855 to 8,828 kg per day (stated as a daily average), a reduction of 36 per cent.

Table C2: Changes in the type of indoor fireplaces used in Auckland 2001 – 2017

Number of indoor fireplaces that burn solid fuels – by type	Year				
	2001	2005	2006	2010	2017 (estimated)
Pre-1991 burners	41,350	The new national design standards for enclosed wood burners have applied from Sept 2005 - see Attachment A	29,294	Auckland's regional emission standard for new fireplaces has applied from 2010 - see Attachment A	6192
Post-1991 burners	46,400		50,198		42,211
Post-2005 burners	0		5141		37,744
Multi-fuel burners - no data available	0		0		0
Indoor open fire	28,100		26,668		11,817
Pellet burners	0		610		1472
Total number of indoor fireplaces that burn solid fuels; gas fires excluded	115,850		111,911		99,435
Total amount of particulate air pollution from indoor fireplaces (stated as a daily average, averaged over the whole year)	13,855 kg/day	13,014 kg/day	12,804 kg/day	11,147 kg/day	8828 kg/day

Source of data: Data collated and modelled by Emission Impossible Ltd for Auckland Council, October 2015

Notes to table: The modelling is based on home heating data from the council's home heating surveys and from the NZ census, including 2013 census data. Data for 2017 are estimated.

The data relate to indoor fireplaces that burn solid fuels, as these generate particulate air pollution, but no data are included for multi-fuel burners.

Gas fireplaces are not included, as they generate very little particulate air pollution.

Other types of home heating (e.g. heat pumps) are not included in this analysis.

5 Trends in Auckland's particulate air pollution

5.1 Seasonal patterns

Auckland's particulate air pollution has a strong seasonal pattern, as demonstrated by Figure C2 and Figure C3:

- While the levels of PM₁₀ emissions from transport and industry are fairly constant over the year, air pollution from indoor fireplaces peaks in the winter months when households use fireplaces for home heating
- In 2011, Auckland's typical weekday emissions of PM₁₀ pollution in summer was 4.4 tonnes per day, but increased to over 15 tonnes per day in winter.

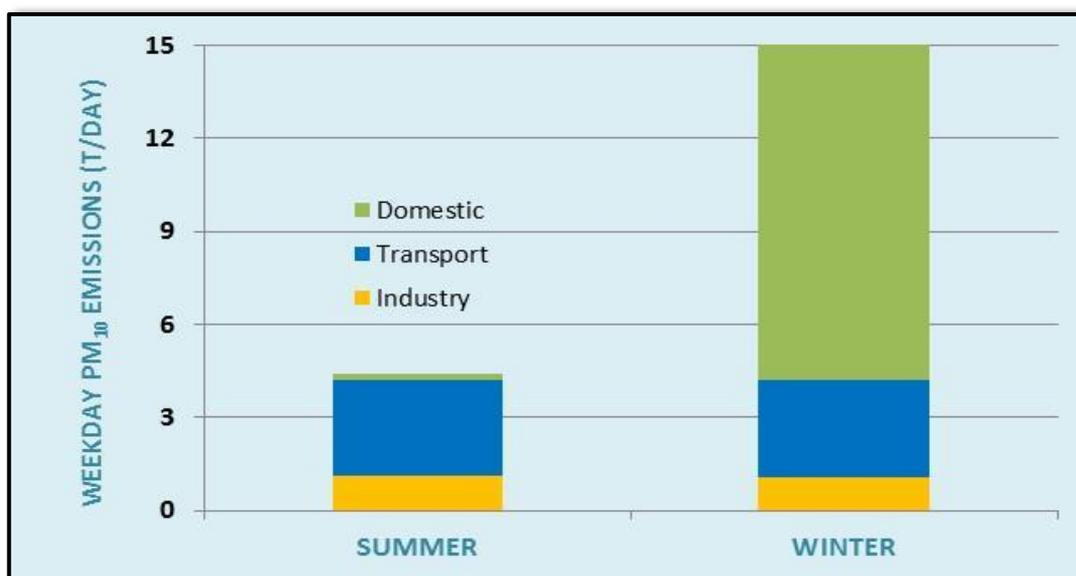


Figure C2: Seasonal differences in PM₁₀ emissions in Auckland (2011 data)

Source of data: *The Health of Auckland's Natural Environment in 2015*, Auckland Council (Oct 2015)

Note to figure: Domestic refers to emissions from indoor domestic fires

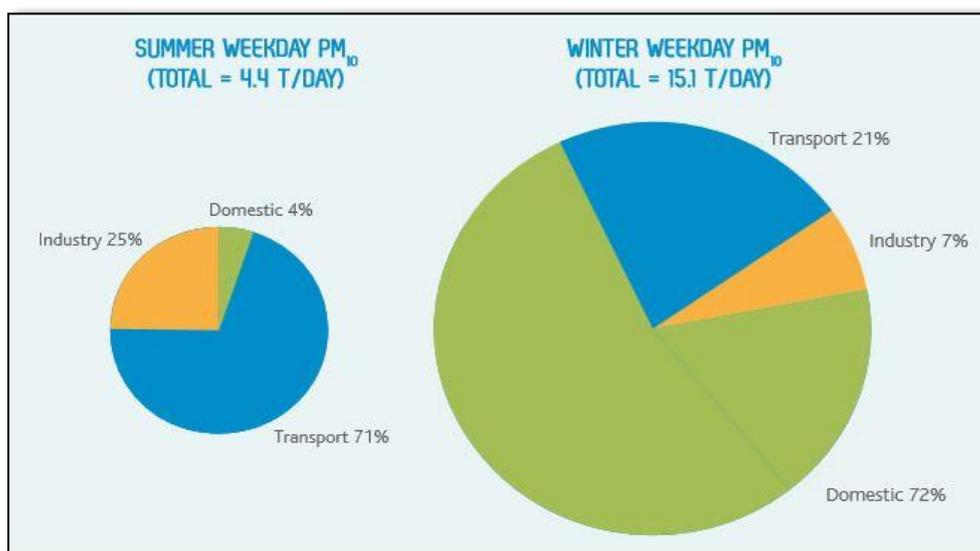


Figure C3: Seasonal differences in PM₁₀ emissions in Auckland (in 2011)

Source of data: *The Health of Auckland's Natural Environment in 2015*, Auckland Council (Oct 2015)

Over the last 20 years, approximately half of Auckland's exceedances of the national PM₁₀ standard have occurred in winter (Figure C4).

There have been exceedances at other times of the year for a range of reasons, including dust from road works or agricultural activities, and one-off events such as firework displays. There have also been occasions when smoke from Australian bush fires has been blown to New Zealand by the prevailing westerly winds.

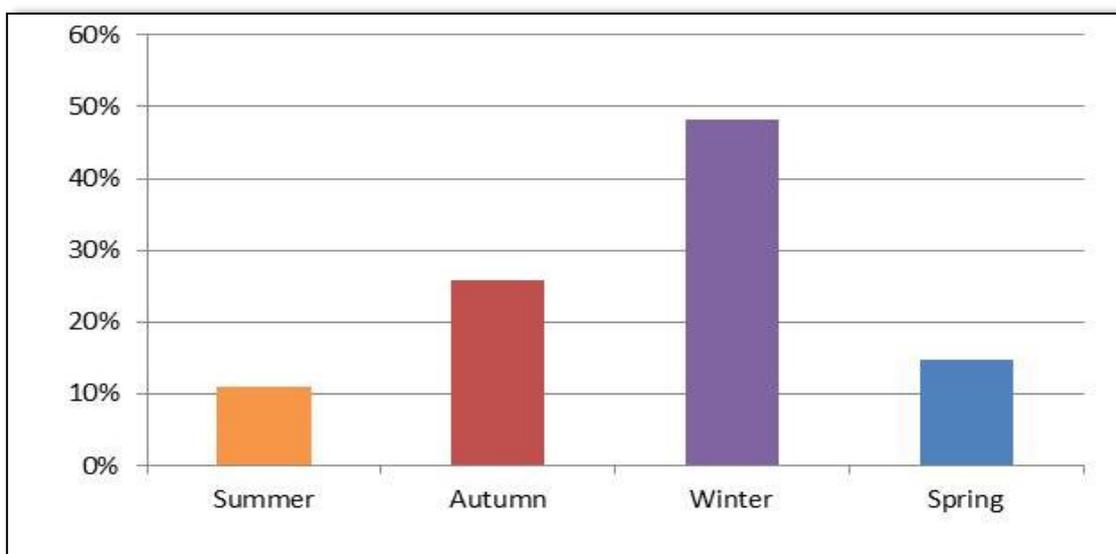


Figure C4: PM₁₀ exceedances by season in Auckland for 1995-2013

Source of data: *PM₁₀ in Auckland: Independent Audit*, Report prepared by Emission Impossible Ltd for Auckland Council, June 2015

Note to figure: Spring = Sep–Nov; Summer = Dec–Feb; Autumn = Mar–May; Winter = Jun–Aug

5.2 Changes in Auckland's particulate air pollution over time

Figure C5 shows the number of times Auckland's urban particulate air pollution has exceeded the national PM₁₀ standard over the years 2005 to 2016. The last time the city did not meet the national standard for particulate air pollution was in 2013.

Table C3 notes the highest PM₁₀ pollution levels recorded in Auckland's urban areas over the years 2012 to mid-2017.

Data for July – December 2017 are not yet available.

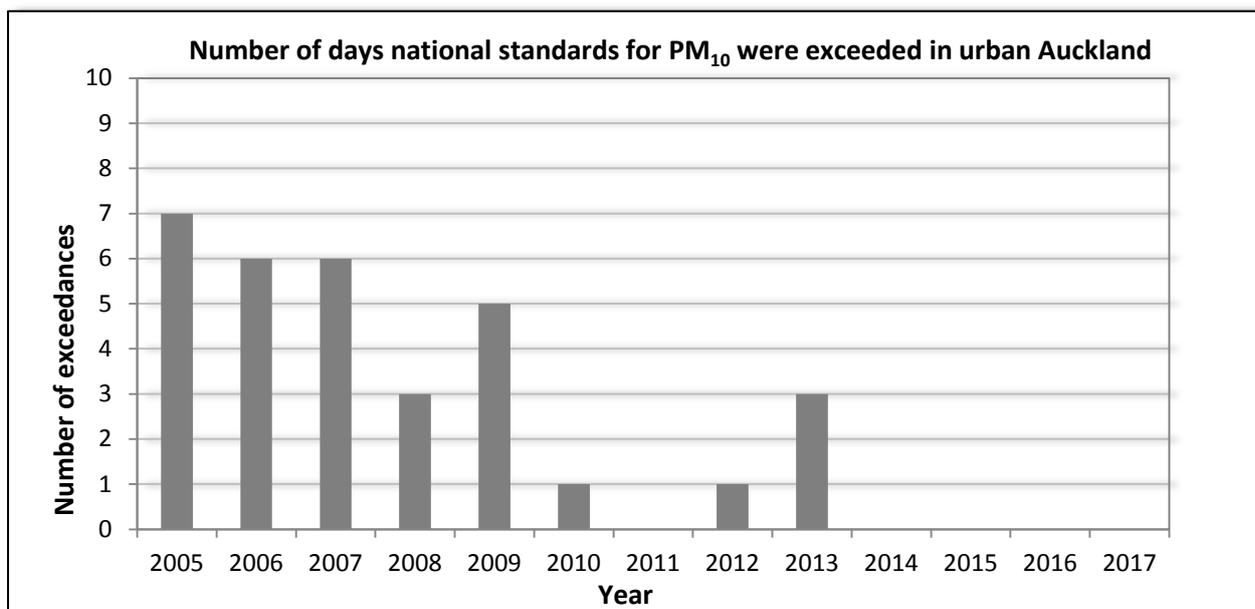


Figure C5: The number of days that national standards for PM₁₀ pollution were exceeded in Auckland’s urban area over 2005-2017

Source of data: Auckland Council’s Research & Evaluation Unit (RIMU)

Note to figure: Data for July-December 2017 are not yet available

Table C3: Maximum PM₁₀ levels recorded since 2012

Time and season	Max PM ₁₀ level	Comparison to the national PM ₁₀ standard - 50 µgm of particulates per m ³ (24-hour average)	Location of monitor
July 2012 – winter	57	Exceeded the national standard	Pakuranga
March 2013 - autumn	77	Exceeded the national standard	Kyber Pass
June 2013 – winter	51	Exceeded the national standard	Pakuranga
Oct 2013 – spring	53	Exceeded the national standard	Kyber Pass
March 2014 – autumn	45	Met the national standard	Orewa
July 2014 – winter	45	Met the national standard	Pakuranga
Oct 2015 – spring	39	Met the national standard; all the air quality monitors recorded elevated PM ₁₀ levels that day	Penrose
July 2016 – winter	39	Met the national standard	Pakuranga
Jan 2017	30	Met the national standard over Jan-June 2017 Data not yet available for July-Dec 2017 ⁵	Penrose

Source of data: Auckland Council’s Research & Evaluation Unit (RIMU)

⁵ In July 2017, there was a change in the way the council’s air quality data is managed. This change has created a temporary delay in accessing the data the council has collected since July 2017. Council staff expect air quality data for 2017 to be available in the next few weeks.

5.3 Future air quality and the influence of local weather conditions

In order to meet the national PM₁₀ standard and to reduce the health impacts of particulate air pollution, Auckland's particulate air pollution will need to continue reducing at a rate that at least matches the city's growth.

- Air quality modelling completed in 2015 predicted that under the current regulatory environment and expected urban growth, there is likely to be a gradual improvement in Auckland's particulate air quality. The modelling assumed that there will be a gradual replacement of older vehicles and old home heating technologies by lower emissions technologies, as has been the case over the last 20 years.
- While the 2015 research is quite optimistic overall, Auckland's air quality will still be at risk in winter when there is more pollution from indoor fireplaces; and in low wind conditions when air pollution tends to accumulate.