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**Prepared for:** Technical Committee  
**Report No.** EHS1839  
**Activity:** Environmental - Ambient Air Quality Monitoring & Reporting  
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## PURPOSE

- [1] In 2018, significant new air quality programme activities included the adoption of a new air quality strategy and implementation plan, inclusion of PM<sub>2.5</sub> monitoring into the State of the Environment (SoE) network, and working collaboratively with the Cosy Homes Trust (CHT). These activities provide the foundation for future air quality management in Otago.
- [2] This annual report highlights these new air quality activities as well as reporting on the State of the Environment and the status of the National Environmental Standard for Air Quality (NESAQ) review.

## RECOMMENDATION

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*That the Council:*

- 1) **Receives** this report.
- 2) **Considers** the Arrowtown air quality programme be a prototype for the development of future local air quality programmes.

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## THE STATE OF ENVIRONMENT

- [3] Air in Otago is informed by the current 8-station monitoring network deployed across the region. Sites in the network include: Alexandra, Arrowtown, Clyde, Cromwell, Central Dunedin, Mosgiel, Milton, and Balclutha. Historically, these 8 sites have measured PM<sub>10</sub><sup>1</sup>; this year, a PM<sub>2.5</sub><sup>2</sup> monitor was installed alongside the PM<sub>10</sub> monitor in Central Dunedin.

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<sup>1</sup> PM<sub>10</sub> refers to particulate matter in the atmosphere that have an aerodynamic diameter of less than 10 microns.

<sup>2</sup> PM<sub>2.5</sub> refers to particulate matter in the atmosphere that have an aerodynamic diameter of less than 2.5 microns.

[4] The NESAQ (2005, revised 2011) set a standard for PM<sub>10</sub>; the NESAQ is currently under review. There are also guideline values for PM<sub>10</sub>. Standards and guidelines consist of several components:

- Averaging period (24-hour and/or annual averages)
- Concentration limit (measured in micrograms per cubic metre of air)
- Number of allowable exceedances of the concentration limit in a 12-month period (only applicable to standards, not guidelines)

[5] NESAQ pollutant guideline values are recommended levels while standards are mandatory environmental regulations. All NESAQ standards and guidelines apply to ambient (outdoor) air. Regional councils have a duty to ensure that standards are met within the region under the Resource Management Act (RMA).

[6] The standards and guidelines for PM<sub>10</sub> are given in Table 1. (NB: there is currently a standard for daily average PM<sub>10</sub>, and a guideline for annual average PM<sub>10</sub>).

**Table 1: Standard and guideline values for PM<sub>10</sub>.**

Pollutant	Averaging Time	Standard		Guideline	
		Value	Allowable # exceedances	Value	Allowable # exceedances
PM <sub>10</sub>	24-hour	50	1 per annum		
	Annual Average			20	Not Applicable

[7] Compliance with the NESAQ requires continuous monitoring in those gazetted airsheds where PM<sub>10</sub> levels are likely to exceed the standards. Public reporting of all exceedances of the standards are also required; this requirement is fulfilled through monthly public notices in the local newspaper.

[8] Other relevant indicators include the winter average PM<sub>10</sub> value and the 2nd highest daily PM<sub>10</sub> value. As one daily exceedance is allowed, the 2nd highest day gives some indication of compliance with the standard.

[9] A summary of key indicators of PM<sub>10</sub> and their comparison to last year's values are given below (Table 2).

**Table 2: Key PM<sub>10</sub> indicators for 2018 and 2017**

	# Exceedances		2 <sup>nd</sup> highest day		Winter average		Start of continuous record
	2018	2017	2018	2017	2018	2017	
Alexandra – original site <sup>1</sup>	35	43	114	98	42	53	2005
Alexandra – current site	2	3	61	67	23	25	2017
Arrowtown	30	45	104	132	38	47	2007
Clyde	6	23	61	64	22	32	2008

<sup>1</sup> These data are modelled using an equation developed from the 2016 co-location of monitors between the original and current site: PM (original site) = 1.886(PM(New site)-0.49).

Cromwell	14	41		81	100		27	43	2008
Dunedin	1	0		40	37		15	15	2006
Mosgiel	4	9		62	83		26	26	2005
Milton	16	48		78	137		32	46	2008
Balclutha	5	14		55	69		26	34	2011

- [10] In virtually every town, air quality was significantly better in 2018 than in 2017. In fact, this year some of the lowest PM<sub>10</sub> levels were recorded as compared to each site's long-term record (since the start of continuous monitoring).
- [11] The cause of this difference between years is attributed to the winter weather last year. According to the National Institute of Water and Atmospheric Research<sup>1</sup>, the neutral condition of the equatorial Pacific (neither El Nino or La Nina) influenced jet stream flows across New Zealand in such a way that there were a higher number of north-westerly flows than normal; this flow pattern served to keep the South Island warmer than usual with more unsettled weather. In addition, because the polar jet stream was weaker than normal, there were fewer cold settled periods of weather over the South Island. The result of these patterns is that temperature inversions were fewer and weaker, leading to enhanced dispersion of pollutants.
- [12] Four sites operated year-round in 2018, providing data for an annual average: Alexandra, Arrowtown, Dunedin and Mosgiel. These towns reported the following annual average PM<sub>10</sub>:
- Alexandra: 14  
Arrowtown: 18  
Dunedin: 15  
Mosgiel: 19
- [13] Based on the monitoring data, all towns met the annual average guideline for PM<sub>10</sub> (20µg/m<sup>3</sup>) recommended in the NESAQ. It is estimated that the original site in Alexandra (the former Girl Guide building at 65 Ventry Street) would have had an annual average of 26µg/m<sup>3</sup>, above the guideline value.

## NATIONAL UPDATE

- [14] This year the Ministry for the Environment (MfE), in conjunction with Stats NZ, released its air quality domain report, Our Air 2018. This second air domain report utilises PM data from airsheds around New Zealand for the years 2014 through 2016, inclusive.
- [15] The Our Air 2018 report notes that the 3 New Zealand towns with the greatest number of exceedances of the air quality standards during the 2014-2016 period were all located in Otago: Alexandra (51 days), Arrowtown (48 days), and Cromwell (48 days). These exceedances were all recorded during winter 2014.
- [16] Table 3 provides some context with the other years covered in the report, along with the typical number of exceedances.

<sup>1</sup> NIWA, Climate Summaries, Seasonal, Winter 2018.

**Table 3: Number of days exceeding the NESAQ**

	2014	2015	2016	Typical Year
Alexandra	51	22	38	43
Arrowtown	48	30	32	31
Cromwell	48	27	34	33

- [17] The elevated PM levels during 2014 highlights what the report notes about an airshed's climate, topography and geography influencing air quality. All of these towns experience very cold winter climates with weather systems that often lead to strong temperature inversions. PM levels vary year to year depending on the weather; 2014 was obviously an unusual year, as was 2018.
- [18] In October, in a statement related to the release of Our Air 2018, Minister Hon. Nanaia Mahuta announced the review of the NESAQ, along with the intention of releasing a consultation document mid-2019. ORC staff have attended several preliminary workshops with MfE related to the review of the NESAQ and have provided feedback to the MfE in response to an initial targeted engagement session held during July 2018. It is still likely a revised NESAQ will include some form of a PM<sub>2.5</sub> standard.

### PM<sub>2.5</sub> DATA

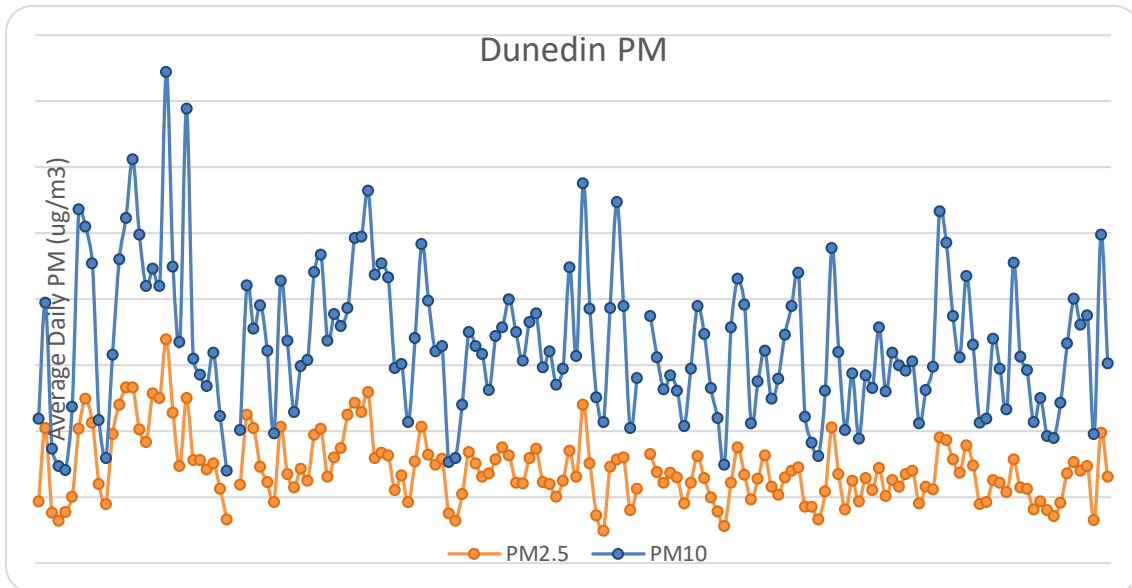
- [19] There are currently no New Zealand standards or guidelines for PM<sub>2.5</sub>. The World Health Organisation (WHO) guidelines for PM<sub>2.5</sub> are given below:

**Table 4: WHO guidelines for PM<sub>2.5</sub>**

Averaging period	Guideline value (µg/m <sup>3</sup> )	Acceptable number of annual exceedances
Daily	25	3
Annual	10	--

- [20] In May 2018, a report on the implications of a PM<sub>2.5</sub> standard on air quality management in Otago was presented to the technical committee.<sup>1</sup> In that paper, ratios of PM<sub>2.5</sub>-to-PM<sub>10</sub> supplied by MfE were used to model daily PM<sub>2.5</sub> data to examine what the likely consequences would be in Otago airsheds in terms of compliance with a PM<sub>2.5</sub> standard. The paper projected that Dunedin would likely not exceed the daily guideline value of 25µg/m<sup>3</sup>, but may struggle to meet the average annual value of 10µg/m<sup>3</sup>.
- [21] In July 2018, an MfE-compliant PM<sub>2.5</sub> monitor was installed in Dunedin. A graph of average daily PM values (both PM<sub>2.5</sub> and PM<sub>10</sub>) from August through the end of the calendar year shows that PM<sub>2.5</sub> generally comprise about 45% of all PM<sub>10</sub>. (NB: The MfE ratio was 55% for year-round average).

<sup>1</sup> Paper presented to the Technical Committee, 2 May 2018, #11.1 *Implications of a PM<sub>2.5</sub> standard on air quality management*



**Figure 1: Average daily PM values for PM<sub>2.5</sub> and PM<sub>10</sub> in Central Dunedin**

[22] To date, the daily PM<sub>2.5</sub> value has not exceeded the WHO guideline daily value of 25µg/m<sup>3</sup>. Data collection is ongoing and a report on annual PM<sub>2.5</sub> will be presented to council at a later date.

## OTHER ACTIVITIES

### Burner Replacements

[23] Over FY17/18, a total of 51 non-compliant and/or inefficient solid-fuel appliances were replaced by homeowners through ORC's Clean Heat Clean Air programme. Of those, the breakdown of how many were installed, and their location, follows:

Alexandra:	16
Arrowtown:	3
Clyde:	1
Cromwell:	13
Milton:	18

[24] In each case, the replacement appliance was another solid-fuel wood burner. It is estimated this changeover has the potential to reduce each home's PM emissions by up to 40% - from 300g to 125g a night – if operated correctly and using dry fuel.

[25] There is approximately \$200,000 remaining in the reserves for the purpose of upgrading eligible burners. Using the current funding criteria (\$1,500 for general application and \$2,000 for Community Services Card holder applications), this equates to being able to upgrade approximately 100 burners. It is estimated that there are at least 1000 burners still in need of upgrade in Air Zone 1 and Milton.

[26] This year the criteria for Clean Heat Clean Air funding is under review to ensure that the programme aligns with the new air quality strategy and provides the best value outcome. A paper is being presented to the Financial Committee regarding recommendations at this round.

## **Collaborative Work**

- [27] This year the ORC engaged in several collaborative efforts. Two projects involving external stakeholders are a partnership with the Cosy Homes Charitable Trust, and participation in NIWA's "What's in your Air, Alex?", a Ministry of Business, Innovation and Employment-funded Curious Minds programme in Alexandra.
- [28] During Long-Term Plan discussions in June 2018, Council decided to fund the Cosy Homes Trust (CHT) for three years (\$45,000 per annum) for a coordinator to assist in the delivery of Council's Clean Heat Clean Air programme. In November 2018, a Memorandum of Understanding (MoU) between the two organisations was signed, and work begun on coordination. CHT will apply lessons learned from a previous pilot project run in Milton last year to developing and delivering a work programme in Central Otago towns. Development of these activities is being done in consultation and collaboration with ORC staff and external stakeholders.
- [29] Last winter NIWA began a multi-year "What's in your Air, Alex?" programme, a school-based, MBIE-funded project with a focus on air quality. NIWA used a low-cost monitoring network to gain information about the spatial distribution of pollutants across town. In addition, they enlisted primary school students to monitor air quality inside their homes and keep diaries related to perceived air quality and health. ORC staff participated with the launch and wrap-up of the project and has been engaged with NIWA in further project development discussions.

## **Air Strategy and Implementation**

- [30] Council adopted a new air strategy in June 2018; the strategy prioritises the adoption of cleaner domestic heating options and reducing reliance on outdoor burning. The mechanisms for achieving these goals centre on:
- Developing tailored local air quality programmes
  - Actively engaging with communities and relevant industry sectors
  - Working and partnering with city and district councils, and central government
  - A full review of the Air Plan
- [31] An implementation plan was tabled at the Policy Committee meeting held 29 November 2018. Decisions made at that meeting initiated Option #2, with a review during the FY19/20 Annual Plan process. Option #2 promoted an accelerated implementation with a primary focus on non-regulatory methods.
- [32] During 2018, implementation work began on three streams of the strategy:
1. Development of a local air quality programme in Arrowtown. This work is being done in collaboration with community leaders and other external stakeholders.
  2. A review of the Clean Heat Clean Air programme is underway with the goal of aligning the subsidy programme with the new air strategy's objectives.
  3. Collaboration with stakeholders across several sectors has begun through a series of meetings with the Cosy Homes Trust, the Southern District Health Board, Arrowtown community members, Queenstown Lakes District Council personnel, and NIWA.

[33] A draft of the Arrowtown air quality programme is attached; this work is currently under development and ongoing.

**Attachments**

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