VAGO

Victorian Auditor-General's Office

Improving Victoria's Air Quality

March 2018

Independent assurance report to Parliament
2017–18:11

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Victorian Auditor-General's Office

The Hon Bruce Atkinson MLC
President
Legislative Council
Parliament House
Melbourne

The Hon Colin Brooks MP
Speaker
Legislative Assembly
Parliament House
Melbourne

Dear Presiding Officers

Under the provisions of section 16AB of the *Audit Act 1994*, I transmit my report *Improving Victoria's Air Quality*.

Yours faithfully

Andrew Greaves
Auditor-General

8 March 2018

Contents

Acronyms and abbreviations

APS	Annual performance statement
AS/NZS 3580.1.1	Australian/New Zealand Standard 3580.1.1:2007 *Methods for sampling and analysis of ambient air—Part 1.1: Guide to siting air monitoring equipment*
BAM	Beta attenuation monitoring
DDO11	Schedule 11 of the Design and Development Overlay
DELWP	Department of Environment, Land, Water and Planning
EPA	Environment Protection Authority
IARC	International Agency for Research on Cancer
ICT	Information and communications technology
Monitoring Plan	*Ambient Air Quality NEPM Monitoring Plan Victoria*
NEPC	National Environment Protection Council
NEPM AAQ	National Environment Protection (Ambient Air Quality) Measure
NEPM NPI	National Environment Protection (National Pollutant Inventory) Measure
OPLE	Officers for the Protection of the Local Environment
PM	Particulate matter
ppm	Parts per million
SEPP AAQ	State Environment Protection Policy (Ambient Air Quality)
VAGO	Victorian Auditor-General's Office
WHO	World Health Organization

Audit overview

Clean air is important for health and wellbeing, and is an issue of community concern. The World Health Organization (WHO) reports that statistically significant evidence supports the correlation between poor air quality and negative health impacts.

The air we breathe primarily contains nitrogen, oxygen, carbon dioxide, water vapour and various inert gases. It also contains pollutant components, such as ozone and particulate matter (PM), which arise from human and natural processes and can affect human health.

In Victoria, the Environment Protection Authority (EPA) is the agency primarily responsible for monitoring, regulating and reporting on the state's air quality. EPA is subject to a range of legislation including the *Environment Protection Act 1970* (the Act) and state environment protection policies that incorporate national standards on ambient air quality.

EPA undertakes three types of air monitoring:

- ambient air (external air environment) quality monitoring that provides EPA with information on general air quality and regional pollution at designated monitoring stations
- campaign (local condition or investigation) monitoring that provides information on local air quality and pollution issues
- emergency (incident) monitoring, as part of the Victorian emergency management system, to respond to major pollution events.

The Act provides EPA with a number of tools to regulate the activities of commercial and industrial operators, including licensing and approvals, compliance monitoring and enforcement instruments.

This audit assessed whether Victoria's air quality meets ozone and PM standards. We examined EPA's monitoring of, reporting on and regulation of air quality during the audit, including an analysis of EPA's air quality monitoring data from 2010 to 2016.

Conclusion

EPA's annual air quality monitoring reports state that ambient air quality is generally good and within national standards. However, while this is true for the parts of the Port Phillip and Latrobe Valley regions that it monitors, EPA's limited air monitoring coverage does not provide it with information on air quality for most of the state, including many parts of metropolitan Melbourne. This relates to both ambient air quality and localised air quality conditions.

The utility of EPA's air quality reports is considerably diminished because EPA has not been able to demonstrate that the air quality data it collects and reports on is also representative of those areas it does not monitor.

Contrary to the intent of its 2001 *Ambient Air Quality NEPM Monitoring Plan Victoria* (Monitoring Plan), EPA has failed to provide a better understanding of air quality outside the Port Phillip and Latrobe Valley regions. It has not updated nor adjusted the plan over the last 17 years to reflect the changing risk profiles that accompany both considerable population growth and changes in industrial activities across the state.

In addition, while infrequent, we found some inaccurate assessments against PM air quality standards—all of which overstated air quality, and so serve to undermine confidence in publicly reported data.

The roles and responsibilities of agencies that contribute to air quality management in the state also remain unclear and not well understood. Consequently, attempts to address air quality issues have not always been well coordinated and implemented. Nor has EPA kept itself fully informed of and updated on air pollution sources. As a result, EPA risks not focusing its resources on those air discharges that adversely impact air quality and potentially human health.

More positively, EPA regulation of air pollution sources has begun to improve. It has achieved this through better embedding its risk-based approach into its licensing requirements and developing programs to enhance its compliance efforts—for example, with its major industry assessments and annual performance statement (APS) audits.

Findings

Monitoring air quality

Ambient air quality monitoring

EPA cannot demonstrate that its current monitoring provides a representative measure of ambient air quality across the state.

Victoria's State Environment Protection Policy (Ambient Air Quality) (SEPP AAQ) and EPA's Monitoring Plan require EPA to put in place a monitoring network that provides a representative measure of the quality of air that Victorians are likely to experience.

However, EPA does not collect information on the quality of ambient air for most parts of the state, including many parts of metropolitan Melbourne. Its network of ambient air quality monitors is limited to parts of the Port Phillip and Latrobe Valley regions.

The Monitoring Plan requires EPA to monitor ambient air quality at all urban centres with a population of at least 25 000. In 2001, using 1996 Australian Bureau of Statistics data, EPA identified eight regions in the state where ambient air monitors should be located. This has not occurred.

PM10 are inhalable particles, 10 µm in diameter or smaller. Examples include a combination of coal and fly ash, calcium carbonate, sodium chloride, mould and spores.

PM2.5 are fine inhalable particles, 2.5 µm in diameter or smaller. Examples include sulfates, nitrates, ammonium, organic compounds, elemental carbon, metals and trace elements.

EPA does not measure ambient air quality in six of the eight regions it identified. EPA explained that, based on previous assessments of these regions, it expects pollution levels to be well below the standards outlined in the National Environment Protection (Ambient Air Quality) Measure (NEPM AAQ). However:

- EPA's assessments were done at least 10 years ago and do not necessarily reflect current conditions
- not all indicator pollutants were monitored, with Mildura and Shepparton monitored for only one pollutant (PM10)
- all stations recorded exceedance levels for at least one of the indicator pollutants
- EPA has not monitored PM2.5 levels in any of these regions to date—the NEPM AAQ required assessment against PM2.5 standards from 2016.

EPA has previously acknowledged the need for more extensive monitoring in these regions but this has not occurred to date. Its 2006 air quality monitoring report indicated that regional campaign monitoring continues to record elevated concentrations of PM10 and, therefore, future monitoring of this pollutant should be considered.

Further, using 2016 Australian Bureau of Statistics data we identified some 40 urban centres with populations of at least 25 000 that are not covered by EPA's ambient air monitoring network.

Campaign and emergency monitoring

Many of EPA's campaign monitoring stations have been in operation for several years, such as the ones at Wangaratta and the Brooklyn Industrial Precinct. In comparison, emergency monitoring stations operate for shorter durations as required by the particular emergency incident.

Results from these other monitoring stations do not form part of EPA's annual air quality monitoring reports, as the data they record reflects conditions specific to local issues and emergency events. EPA does, however, publish reports on air quality results from time to time for some of these monitoring stations. EPA also provides some air monitoring results on its EPA AirWatch website.

However, publicly reported data is not quality reviewed for accuracy and reliability, nor are any limitations clearly identified and explained. The AirWatch website does not always clearly indicate units of measurement, and we found some inconsistencies between the validated raw data provided to us by EPA and the website data.

Routine public reporting of all the air quality information collected would improve transparency and provide the community with additional insights about the air pollution risks to which they are exposed.

Recommendation 6.3 of the 2016 EPA inquiry report

In 2016, a Ministerial Advisory Committee appointed by the then Minister for Environment, Climate Change and Water completed its inquiry into EPA. The committee's report recommended that EPA 'assess the adequacy of its air and water monitoring networks, particularly in relation to air quality' and 'consider options to improve data sharing and accessibility, and community communication'.

In early 2017, the Victorian Government supported these recommendations, and EPA is currently working on them through its Reform Project Plan: Environmental Monitoring Capability Review. EPA advised that the project plan aims to deliver a draft business case for proposed enhancements to its monitoring capability.

Reporting on Victoria's ambient air quality

EPA's annual air quality monitoring reports publish EPA's assessment of collected air data against NEPM AAQ standards. Air quality meets or complies with NEPM AAQ when:

- the relevant standard was exceeded no more than the allowed number of times
- data was available for at least 75 per cent of each quarter of the year.

Air quality monitoring reports indicate that for the period 2010 to 2016, in the parts of the Port Phillip and Latrobe Valley regions that EPA monitors, air quality met ozone and PM NEPM AAQ standards for all seven years, except in 2015 for PM10. Assessment against the NEPM AAQ standards for PM2.5 was not required until 2016.

EPA's 2015 air quality monitoring report states that possible causes for the PM10 exceedances include localised or regional dust storms, smoke from bushfires, planned or agricultural burning, motor vehicles or domestic wood heaters.

Inaccurate assessments

Our analysis of EPA's annual air quality monitoring reports against the actual underpinning data shows that EPA's assessments do not always accurately reflect whether Victorian air quality complies with NEPM AAQ standards. For example, in 2013, EPA assessed PM10 levels in Geelong South as meeting the standard even though there were eight days when levels exceeded the standard and EPA had sufficient data to report this.

We found three further instances of inaccurate assessments by EPA over the seven-year period we reviewed, where EPA should have reported a finding of 'not met' but instead reported a rating of 'met' or 'not demonstrated'. In a fifth instance, contrary to the requirement of the NEPM AAQ, no assessment was made for PM2.5 in 2016. A 'not met' assessment should have been given in this instance.

During the audit, EPA acknowledged that all five instances we raised should have been assessed as 'not met'.

These findings reflect weaknesses in EPA's processes for assuring the accuracy of its assessment and reporting.

Negative values included when assessing air quality

In computing average pollutant concentrations, EPA includes recorded values that are below zero. EPA advised that this is consistent with NEPM AAQ procedures.

Logically, however, the lowest possible value for air pollutant concentrations is zero. Either it is present, even if in very small amounts, or it is not. Negative values are an artefact of the measurement and recording process.

Leaving negative values in the data introduces a negative bias, which potentially under represents actual concentrations of pollutants. We noted a considerable number of negative values recorded. For example, in 2016, negative values comprised 5.3 per cent of recorded hourly PM2.5 values, and 1.3 per cent of hourly PM10 values. When we excluded negative values from the calculation of one-day averages, there were five more exceedance days for PM2.5 and one more for PM10 during 2016.

Quality of EPA's raw data

We found that EPA's air quality data is not as reliable as would be expected. Basic sample checking showed inconsistencies between EPA's raw data and what was published in its AirWatch historical data. EPA acknowledges weaknesses in this historical data and advised that it intends to eventually remove it from its website.

Moreover, when we highlighted a significantly high PM2.5 hourly value recorded in 2015, EPA informed us that this was an error due to an instrument fault, and that it should have removed this value from its air quality dataset. EPA further advised that this was true for three other PM2.5 hourly values recorded on the same day from the same monitoring station.

However, despite EPA identifying the instrument fault in 2015 on the same day on which the data was recorded, the data was not tagged as inaccurate. Instead, the data remained in EPA's air quality dataset until it was provided to us for the audit nearly two years later in mid-2017.

EPA advised that it subsequently removed the invalid data from its system but is unable to specify exactly when it made this correction. This is contrary to EPA's data validation procedure, which requires details of changes to air quality data to be recorded.

EPA is also unable to provide advice on the number of air quality data changes made on a yearly basis, or the reasons for any changes made.

Monitoring equipment, and information and communications technology infrastructure

Ambient air quality monitors are designed to be located a certain distance from direct pollution sources. While EPA's ambient air quality monitoring stations and equipment generally comply with NEPM AAQ standards, most monitors are located closer to roads than is required by the standard. EPA advised that, as the Victorian population lives and works close to roads, most of their stations are in population centres next to roads. This potentially means that the air data collected is impacted by pollutants from motor vehicles to a greater extent than is envisaged by the standard.

The information and communications technology (ICT) infrastructure underpinning EPA's air quality monitors is ageing, no longer supported by vendors and subject to security vulnerabilities. This is increasingly affecting the reliability of the data collected and computed. EPA is aware of these weaknesses and reports that it has started to address the issues.

Regulating air quality

Guided by previous Victorian Ombudsman and VAGO reports, and following an EPA-initiated Compliance and Enforcement Review in 2010 and an Approvals Review in 2013, EPA has been better embedding its risk-based approach into its licensing requirements. It has also developed programs to enhance its compliance efforts—for example, through its investigations of major industries and APS audits.

EPA could achieve further improvements by ensuring it monitors all high-risk sources of ozone and PM pollutants and by reviewing its oversight of and effectiveness in addressing unlawful air discharges.

Roles and responsibilities

The responsibility for regulating Victoria's air quality rests primarily with EPA. However, a number of other government agencies undertake functions that impact air quality, including the Department of Environment, Land, Water and Planning (DELWP), local government, the Commissioner for Environmental Sustainability, VicRoads, WorkSafe Victoria, the Victorian Planning Authority, emergency services, and a host of other agencies including the Commonwealth Government.

Across the many relevant legislative and policy instruments that relate to air quality regulation, there is a lack of clarity regarding roles and responsibilities, what triggers the commencement of a particular responsibility, and when a responsibility transfers to another agency.

In July 2013, the Statutory Policy Review prepared by the then Department of Sustainability and Environment (now DELWP) and EPA acknowledged weaknesses in this regard, noting that 'a lack of coordinated and accountable implementation' of policies 'has limited their effectiveness and exposed EPA and other Victorian government agencies to legitimate criticism'. DELWP advised that it is currently considering how to progress actions to implement the recommendations from the Statutory Policy Review, to ensure that they align with the recommendations of the 2016 EPA inquiry report.

Identifying sources of air pollution—air emissions inventory

EPA last conducted an air emissions inventory in 2006. An air emissions inventory is a comprehensive evaluation that aims to understand the extent of state pollutant emissions and their sources. Relying on a 12-year-old emissions inventory is inconsistent with EPA's approach of using science to inform its activities. While EPA has other means to identify air pollution sources, the completion of an up-to-date air emission inventory is critical for EPA's understanding of statewide point and diffuse air pollution sources that require its attention.

Another consequence of EPA's 12-year-old air emissions inventory is that Victoria's aggregated air emissions data on the Commonwealth Government's National Pollutant Inventory website remains unchanged since 2006.

Identifying sources of air pollution—unlawful discharges

EPA primarily relies on the community and industrial operators to report inappropriate or noncompliant air discharges. EPA's inspections look into these reports to confirm whether any noncompliance has occurred.

Self-reporting assumes that operators have appropriate processes to reliably monitor air discharges and will voluntarily report any breaches of their licences. However, many of the operators audited by EPA between 2014 and 2016 either did not have monitoring plans, had weak monitoring processes, or under-reported breaches. Further, EPA advised that obtaining sufficient and reliable evidence to show operators' noncompliance with air discharge conditions is a major challenge for its enforcement efforts.

Improved processes

EPA has begun to embed a risk-based approach into its regulatory activities to better manage air pollutants. EPA has developed:

- a framework to review and revise all licences to ensure the currency of licence conditions and provide consistency in emission limits
- the Licensed Operator Risk Assessment model to help prioritise compliance inspections
- new guidelines to assist operators to better understand their licence conditions and how to comply with them
- new and revised internal documentation to assist staff to apply compliance and enforcement tools
- a more rigorous approach to monitoring major industry facilities, based on the scale of discharges, the quantity of materials stored or the complexity of facilities' industrial processes.

Focus on licensed operators

EPA undertook a project to reform its licensing process in 2009. One of the intentions of this reform project was to review licence discharge limits and conditions, and to continue reviewing them annually to ensure their currency and to detect any emerging issues. An EPA internal briefing shows that this did not take place due to changed organisational priorities. There are several outstanding licensing issues:

- Current licence conditions are generic, so assessing and enforcing compliance is difficult.
- Discharge indicators are not consistent for specific industry sectors.
- Current discharge limits on many of the licences are based on limitations of existing pollution treatment systems rather than what is acceptable for release to the environment.
- Numerous limit types have been used in licences without proper assessment of their relevance.
- Operators require industry-specific guidance on how to design a monitoring program to demonstrate compliance.
- The perpetual nature of EPA licences does not encourage operators to adopt the latest technology and does not reflect community expectations.

To address these issues, EPA launched a five-year periodic licence review program in 2015–16. The program aims to ensure the currency and efficacy of licences and licence conditions, and to provide consistency in emission limits and condition requirements. Following the 2016 EPA inquiry report, the Victorian Government also committed to further improve EPA's licensing activities to minimise environmental impacts from potentially polluting industrial activities.

EPA largely targets its efforts at licensed operators—those that need to obtain EPA approval to operate and commence work. In October 2017, there were 658 licensed operators in Victoria—but there are many more unlicensed operators than licensed ones, over which EPA exercises limited oversight. EPA focuses on licensed operators because it wants to direct its limited resources to the biggest sources of potential harm to the environment.

However, some of the unlicensed operators are major contributors to air pollution in Victoria. Unlicensed operators include several thousand smaller operators that discharge air pollutants in their day-to-day operations. EPA's recent investigations that involved air discharge emissions included two unlicensed premises, and we understand that EPA intends to gradually cover more unlicensed premises in its regulatory efforts as resources allow.

Case study: Brooklyn Industrial Precinct

Poor air quality arising from the Brooklyn Industrial Precinct presents a good example of the complex issues involved in air quality management. It demonstrates how EPA needs to continue developing a close working relationship with councils and other government agencies to address harmful air emissions.

Notwithstanding some improvements, the precinct continues to experience poor air quality with considerable exceedance days for PM10.

EPA and Brimbank City Council advise that up to 10 operators within the precinct continue to be sources of inappropriate air emissions and noxious odours. In response, EPA has commenced more rigorous enforcement actions, including prosecution.

Recommendations

We recommend that the Environment Protection Authority:

1. expand its air monitoring network by:
    - reviewing and updating its current Monitoring Plan to reflect its risk-based approach to environmental regulation (see Sections 2.2 and 2.3)
    - in addition to its ambient air quality monitoring for purposes of the NEPM AAQ, designing and implementing an air monitoring program that better aligns coverage with air pollution risks that Victorian communities are exposed to (see Sections 2.2 and 2.3)
2. improve its reporting on air quality by:
    - introducing a rigorous quality review process to ensure the accuracy and reliability of the state's air quality data and assessments against NEPM AAQ standards as presented across its various reporting, including on its AirWatch website (see Sections 3.2, 3.3 and 3.4)
    - developing readable and easily accessible annual reports on the results collected from all air monitoring across the state, highlighting assessments against standards and recorded exceedances (see Sections 3.3 and 3.4)

3. expand and update its knowledge of Victoria's air quality by:
    - completing a comprehensive Victorian air emissions inventory to identify current major point and diffuse sources of air pollution (see Section 4.3)
    - determining and preparing an action plan on how best to (1) oversight the air quality monitoring conducted by high-risk operators to ensure that monitoring plans are in place, and that these plans are appropriately implemented; and (2) understand and effectively respond to air emissions from lower risk sites (see Section 4.4)
4. work with all relevant councils to address air quality issues at the Brooklyn Industrial Precinct by:
    - reducing exceedance days and achieving NEPM AAQ standards for PM10, and considering the need to monitor other pollutants (see Section 4.5)
    - agreeing on the installation and location of additional air monitoring stations to measure the impact of air discharges on nearby residential communities (see Section 4.5).

We recommend that the Environment Protection Authority and the Department of Environment, Land, Water and Planning:

5. clarify the roles and responsibilities of relevant Victorian Government agencies with respect to air quality management, and develop protocols to ensure accountabilities are understood and coordination is achieved (see Section 4.2).

Responses to recommendations

We have consulted with EPA, DELWP, City of Ballarat and Brimbank City Council, and we considered their views when reaching our audit conclusions. As required by section 16(3) of the *Audit Act 1994*, we gave a draft copy of this report, or parts thereof, to those agencies and asked for their submissions or comments. We also provided a copy of the report to the Department of Premier and Cabinet.

The following is a summary of those responses. The full responses are included in Appendix A.

All four agencies welcomed the report's findings and recommendations to further improve Victoria' air quality monitoring and management.

EPA accepted all five recommendations and provided an action plan on how it will implement them.

DELWP accepted the recommendation addressed to it, noting that it will also support EPA in its acquittal of the remaining recommendations.

There were no recommendations directed toward the Ballarat and Brimbank city councils. Even so, noting that some of the recommendations have implications for councils, the Brimbank City Council advised that it will continue to work with the EPA to facilitate the implementation of these recommendations.

1 Audit context

Clean air is important for health and wellbeing, and is an issue of community concern. WHO reports that statistically significant evidence supports the correlation between poor air quality and negative health impacts.

The air we breathe primarily contains nitrogen, oxygen, carbon dioxide, water vapour and various inert gases. It also contains pollutant components, such as ozone and PM. These can arise from human sources, such as industrial operations, domestic fires and motor vehicles, and from natural processes such as lightning strikes, volcanic eruptions, and spontaneous bushfires.

In Victoria, EPA is the agency primarily responsible for monitoring, regulating and reporting on the state's air quality. EPA carries out this function in accordance with a suite of statutory instruments including the Act and state environment protection policies, which incorporate national standards on ambient air quality. The Act provides EPA with a number of tools to regulate the activities of commercial and industrial operators, including licensing and approvals, compliance monitoring and enforcement instruments.

1.1 Air quality

Air quality is good or optimal when the relative natural proportion of its nitrogen, oxygen and other gas components is maintained at safe levels and pollutant components are cleaned and filtered away through natural processes. These include dilution and dispersion by wind, biochemical breakdown of pollutants into harmless molecules, and washing out of the atmosphere by rain.

When there are too many pollutant components, and concentrations are too high for natural processes to clean and filter them away, the pollution build-up degrades air quality to levels that could affect human health and wellbeing.

Ambient air quality and beneficial uses

The SEPP AAQ defines ambient air as the 'external air environment', specifically excluding the air inside buildings.

The SEPP AAQ states that the desired outcome for improving and maintaining the state's ambient air quality is to protect the following 'beneficial uses':

- human health and wellbeing
- the life, health and wellbeing of other forms of life—that is, animals and vegetation
- visibility
- the useful life and aesthetic appearance of buildings, structures, property and materials
- aesthetic enjoyment and local amenity.

'Beneficial uses' refers to environmental values and human activities that need to be protected from the effects of pollution and waste, for the benefit of all Victorians.

Indicators of air quality

The concentration levels of indicator pollutants are monitored and measured against set standards to determine ambient air quality. The National Environment Protection Council (NEPC), comprising environment ministers of the Commonwealth, state and territory governments:

- identifies indicator pollutants on the basis of what is widely occurring in the air environment
- sets standards for each indicator pollutant, at concentration levels that are necessary to protect human health and wellbeing.

The SEPP AAQ, which incorporates the NEPM AAQ, provides standards for seven indicator pollutants as shown in Figure 1A.

Figure 1A
Victorian ambient air quality standards, under SEPP AAQ

Item	Pollutant	Averaging period[(a)]	Maximum concentration standard	Maximum allowable exceedances
1	Carbon monoxide	8 hours	9.0 parts per million (ppm)	1 day a year
2	Nitrogen dioxide	1 hour	0.12 ppm	1 day a year
		1 year	0.03 ppm	None
3	Photochemical oxidants (as ozone)	1 hour	0.10 ppm	1 day a year
		4 hours	0.08 ppm	1 day a year
4	Sulfur dioxide	1 hour	0.20 ppm	1 day a year
		1 day	0.08 ppm	1 day a year
		1 year	0.02 ppm	None
5	Lead	1 year	0.50 µg/m³	None
6	Particulate matter as PM10	1 day	50 µg/m³	None
		1 year	20 µg/m³[(b)]	None
6A	Particulate matter as PM2.5	1 day	25 µg/m³	None
		1 year	8 µg/m³	None
7	Visibility-reducing particles	1 hour	20 km	3 days a year

(a) The averaging period is the period of time over which the pollutant must not exceed the set standards. For example, the one-day average standard for PM10 is 50 µg/m³. This means that the average value of the 24-hourly PM10 readings on any particular day must not exceed 50 µg/m³.

(b) The SEPP AAQ's one-year average standard for PM10, 20 µg/m³, is more stringent than the NEPM AAQ's 25 µg/m³.

Source: Victorian SEPP AAQ.

Air toxics or hazardous air pollutants outside of the indicator pollutants included in Figure 1A are also discharged to the air environment, but at relatively lower concentrations. The State Environment Protection Policy (Air Quality Management) defines and categorises these pollutants depending on how hazardous they are. EPA has historically monitored some air toxics including benzene, toluene and xylene.

It is not possible to eliminate air pollution altogether. A range of activities necessary for humans to live and for society to function contribute to it, such as energy generation, transport and industry operations. In addition, some air pollution will occur from natural events such as bushfires or wind-blown dust.

World Health Organization air quality guidelines

In 1987, WHO developed air quality guidelines—shown in Figure 1B—to provide government policy-makers with relevant targets for managing air quality and to provide a uniform, scientific basis for understanding the effects of air pollution on human health. These guidelines, which were updated in 1997 and 2005, are based on the expert evaluation of current scientific evidence. The guidelines are currently under review for another update.

While these guidelines are not legally binding for member countries including Australia, they are regarded as authoritative.

Figure 1B
WHO air quality guidelines

Pollutant	Averaging period	Maximum concentration
PM2.5	1 year	10 µg/m³
	1 day	25 µg/m³
PM10	1 year	20 µg/m³
	1 day	50 µg/m³
Ozone	8 hours	100 µg/m³
Nitrogen dioxide	1 year	40 µg/m³
	1 hour	200 µg/m³
Sulfur dioxide	1 day	20 µg/m³
	10 minutes	500 µg/m³

Note: The SEPP AAQ is more stringent for the PM2.5 one-year average at 8 µg/m³, compared to the WHO guidelines' 10 µg/m³. The WHO guidelines also use different units of measurement for ozone, nitrogen dioxide and sulfur dioxide.
Source: WHO air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide.

Particulate matter

PM is a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air:

- PM2.5 are fine inhalable particles, 2.5 µm in diameter or smaller. Examples include sulfates, nitrates, ammonium, organic compounds, elemental carbon, metals and trace elements. The average human hair, at about 70 µm in diameter, is almost 30 times bigger than the largest PM2.5.
- PM10 are inhalable particles, 10 µm in diameter or smaller. Examples include a combination of coal and fly ash, calcium carbonate, sodium chloride, mould and spores.

PM can come directly from both natural and human sources including bushfires, dust storms, construction sites, unpaved roads, wood burning, mining, industrial processes and motor vehicles. PM may also be a secondary product resulting from combustion and chemical reactions between gases such as sulfur dioxide and nitrogen oxides, which are pollutants emitted by industrial operations and motor vehicles.

Ozone

Ozone is a colourless gas composed of three atoms of oxygen. Ozone occurs in the Earth's upper atmosphere where it forms a protective layer, shielding Earth from the sun's harmful ultraviolet rays.

At ground level, however, ozone is a harmful air pollutant. Ground-level ozone forms due to photochemical reactions where sunlight and precursor pollutants such as nitrogen oxides and volatile organic compounds are present. Bushfire smoke, motor vehicles, power plants, industrial boilers, refineries and chemical plants can release ozone.

Ozone is generally more prevalent on hot, sunny days, but can still reach high levels during colder months. It tends to linger in the atmosphere and can be transported long distances by wind. This means that even areas a fair distance from busy roads and industrial places where ozone first forms may experience high concentrations.

1.2 Health impacts of air pollutants

Limiting the harmful health impacts of air pollution is the primary objective of air quality management. Poor air quality can increase respiratory illness and cardiovascular and cardiopulmonary diseases. Research has found that this occurs even in jurisdictions considered to enjoy relatively good air quality, such as Australia. In 2003, the Australian Institute of Health and Welfare estimated that urban air pollution contributed to about 3 000 deaths in Australia.

In 2010, the Commonwealth's former Environment Protection and Heritage Council found that increased concentrations of air pollutants in Australian and New Zealand cities, including Melbourne, are significantly associated with increases in:

- mortality from cardiovascular and respiratory diseases (impacting mostly the elderly)
- cardiovascular hospital admissions for a range of diseases including all cardiac, ischaemic heart disease, myocardial infarction, and cardiac failure (again, the impact on the elderly is the strongest)
- arrhythmia hospital admissions for 15 to 64 year olds
- respiratory hospital admissions for a range of diseases including all respiratory, chronic obstructive pulmonary disease, pneumonia and acute bronchitis (the impact on children is the strongest, except for chronic obstructive pulmonary disease).

Health impacts of particulate matter

According to WHO, no threshold has been identified below which PM2.5 or PM10 pollution has zero health impact.

Because they can be inhaled easily, PM10 and PM2.5 are known to lodge deeply inside the lungs and enter the bloodstream. This means that even at very low concentrations, vulnerable members of the population—including the elderly, the very young and people suffering from respiratory infections—may experience health impacts from PM exposure.

WHO's International Agency for Research on Cancer (IARC) has evaluated PM (as a component of outdoor air pollution) as a class 1 carcinogen—that is, 'carcinogenic to humans' similar to tobacco, asbestos and ultraviolet radiation. IARC found that exposure to outdoor air pollution may cause lung cancer and may lead to increased risk of bladder cancer. WHO estimates that outside air pollution causes three million deaths annually worldwide.

Although levels of exposure and air pollution components vary significantly between locations, IARC noted that its findings on PM pollution apply to all regions of the world.

Health impacts of ozone

Short- and long-term exposure to ozone has been found to decrease respiratory and cardiovascular functions. This may cause throat irritation and inflammation, coughing and chest pain.

Ground-level ozone is known to potentially worsen bronchitis, emphysema and asthma. Children, the elderly, people active outdoors and those with existing respiratory conditions are more susceptible to the harmful effects of ground-level ozone.

WHO reports that research on short-term exposure to ozone provides evidence of its potential harmful impact on health, including deaths due to respiratory and cardiovascular causes. WHO explains that these adverse health effects were observed independent of the role of other pollutants.

1.3 Sources of poor air quality

Air pollution sources are classified as either 'point' or 'diffuse':

- Point sources are stationary and often major sources of air pollution. They include factories, power stations, incinerators, other industrial premises and commercial businesses. Some industrial point sources discharge pollutants through chimneys that are meant to be tall enough to allow for sufficient dilution before they reach human communities.
- Diffuse sources include mobile, non-stationary sources such as motor vehicles, aircraft, and bushfires. They also include more minor stationary sources, such as wood fires and smaller industrial operators.

Data that EPA collected in 2006 shows that industrial activities, particularly electricity generation, and emissions from motor vehicles are major contributors to Melbourne's air pollution.

National Pollutant Inventory

The Commonwealth Government's NPI website provides annually updated public information on emission estimates for 93 substances, including their source and location. Some of these are air pollutants, including PM and ozone precursors.

Under the National Environment Protection (National Pollutant Inventory) Measure (NEPM NPI), operators, including large industrial facilities, that exceed thresholds for the production or generation of any of the 93 listed substances must report their emissions and transfers of these substances annually.

State and territory governments estimate emissions from smaller industries, households and everyday activities in major population centres, and the Commonwealth Government includes this data in the NPI. This includes emissions from motor vehicles, wood heaters and smaller appliances such as powered garden equipment. This information is subject to availability and is not necessarily updated annually.

Victorian legislation incorporates the NEPM NPI in the 2012 Waste Management Policy (National Pollutant Inventory). EPA is responsible for collating the required emissions data from commercial operators and reporting on aggregate emissions from diffuse sources and smaller commercial operators to the Commonwealth Government.

1.4 Policy and legislative framework

The Act established EPA as the principal agency responsible for the protection of Victoria's environment, including preventing or controlling pollution such as the discharge or emission of waste into the atmosphere.

There are complementary national and jurisdictional statutory frameworks to manage air quality. The national framework:

- sets underpinning requirements, including framing legislation, where national consistency is needed but for which the Commonwealth has limited statutory authority, such as national environment protection measures
- deals with matters most effectively regulated at a national level, including certain standards for vehicles, equipment and appliances, such as Australian design rules covering certain vehicle emissions and fuel quality standards
- articulates policy and program priorities where governments have agreed that a consistent national approach is preferable, such as the National Clean Air Agreement
- provides public access to national information, such as through the NEPM NPI or annual NEPC reports.

States and territories, including Victoria, complement these national approaches through a range of activities, including:

- giving the necessary statutory effect to national standards or measures, such as the SEPP AAQ giving effect to the NEPM AAQ
- in some cases, further strengthening national requirements, such as the SEPP AAQ having a lower or more stringent standard than the NEPM AAQ one-year average for PM10, and Victorian vehicle emission regulations further limiting in-use vehicle emissions
- establishing policy and implementing statutory requirements, programs and processes to monitor, manage and reduce emissions from a wide range of sources
- providing public access to information on local air quality, such as through EPA AirWatch or emission alerts.

National Environment Protection (Ambient Air Quality) Measure

NEPC approved the NEPM AAQ in 1998 to provide national air quality standards that protect human health and wellbeing from the adverse effects of air pollution. It set ambient air quality standards as well as mandatory monitoring and reporting requirements for six indicator air pollutants.

NEPC last updated the NEPM AAQ in December 2015 to strengthen the standards for PM based on the latest scientific understanding of the health risks arising from airborne particle pollution. This update was a principal initiative under the National Clean Air Agreement.

The NEPM AAQ requires each state and territory to monitor, assess and report concentrations of seven air pollutants, including photochemical oxidants (as ozone) and particles as PM2.5 and PM10, in accordance with a specified protocol. The protocol requires that each jurisdiction:

- prepare an air quality monitoring plan
- establish a network of 'performance' air quality monitoring stations (or use equivalent means) that are located in such a way that they contribute to obtaining a representative measure of air quality that is likely to be experienced by the general population
- through these stations, monitor the concentrations of air pollutants
- evaluate the concentrations of air pollutants in comparison with standards set by the NEPM AAQ—as 'meeting', 'not meeting' or 'not demonstrated'
- report the results annually
- operate each monitoring station in the same location for at least five years.

State Environment Protection Policy

The SEPP AAQ adopts the requirements of the NEPM AAQ and includes a separate standard for visibility-reducing particles.

In July 2016, the Victorian Government revised the SEPP AAQ to incorporate the 2015 variation to the NEPM AAQ and to provide for a more stringent PM10 annual standard.

Air quality monitoring

EPA undertakes air monitoring for different purposes.

Ambient air quality monitoring

- Ambient air quality monitoring provides EPA with information on general air quality and regional pollution at designated NEPM AAQ monitoring stations.
- In 2016, stations were located at Alphington, Altona North, Brighton, Dandenong, Footscray, Geelong South, Melton, Mooroolbark, Point Cook and Traralgon.
- EPA publishes the results in annual air quality monitoring reports, as required by the NEPM AAQ.

Campaign (local condition or investigation) monitoring

- Campaign monitoring provides information on local air quality and pollution issues.
- At 30 January 2018, stations were located at Brooklyn, Box Hill, Wangaratta, Melbourne CBD, Macleod, Churchill, Moe and Morwell.
- EPA is not required to publish the results in its annual air quality monitoring reports. From time to time, EPA publishes results from its campaign monitoring stations on its website.

Emergency (incident) monitoring

- EPA conducts emergency monitoring as part of the Victorian emergency management system, to respond to major pollution events—for example, the July 2017 Coolaroo fire and the 2014 Hazelwood mine fire.
- EPA is not required to publish the results in its annual air quality monitoring reports. From time to time, EPA publishes results on its website.

The EPA AirWatch website and map present available ambient air quality information, along with some campaign and emergency air monitoring information. EPA updates this information on an hourly basis and includes health alerts where applicable.

1.5 Why this audit is important

Melbourne's population is predicted to grow by 50 per cent by 2030 and to reach 10 million by 2050. Population growth means an increase in emissions linked to domestic and business activities and, as a result, more people will be exposed to air pollution.

This audit focused on ozone and PM pollutants. This is because, while EPA monitoring shows that the concentration of many indicator pollutants has decreased considerably and they have been consistently below the standards for the last 10 years, exceedances in the levels of ozone and PM continue to occur from time to time.

The 2016 EPA inquiry report recommended that EPA assess the adequacy of its air monitoring networks, and consider options to improve data sharing and accessibility, and community communications. The Victorian Government accepted all the recommendations relating to air quality monitoring.

It is now timely to examine EPA's monitoring, reporting and regulation of Victoria's air quality.

1.6 What this audit examined and how

This audit examined whether Victoria's air quality meets the standards for ozone and PM discharges. We looked at:

- the roles and responsibilities of Victorian agencies in air quality management
- monitoring and reporting on air quality
- management of point and diffuse source discharges.

We conducted our audit in accordance with Section 15 of the *Audit Act 1994* and ASAE 3500 *Performance Engagements*. We complied with the independence and other relevant ethical requirements related to assurance engagements. The cost of this audit was $590 000.

1.7 Report structure

The remainder of the report is structured as follows:

- Part 2 examined EPA's monitoring of air quality
- Part 3 examined EPA's reporting on air quality
- Part 4 examined EPA's regulation of air pollution sources.

2

Monitoring air quality

The NEPM AAQ requires each state and territory to monitor, assess and report on concentrations of seven air pollutants, including ozone, PM2.5 and PM10, in accordance with a specified protocol. The protocol requires that each jurisdiction:

- prepare an air quality monitoring plan
- establish a network of 'performance' air quality monitoring stations (or use equivalent means) located so they collectively provide a representative measure of the air quality likely to be experienced by the general population
- operate each monitoring station in the same location for at least five years.

In this part of the report, we examine EPA's monitoring of air quality in Victoria.

2.1 Conclusion

The weaknesses we have identified in EPA's current ambient air quality monitoring means that EPA is unable to demonstrate that the air data it collects and reports provides a representative measure of the air quality likely to be experienced by most Victorian communities. This brings into question the reliability of EPA's annual air quality monitoring reports which state that the state's ambient air quality is generally good and within national standards.

EPA's Monitoring Plan aimed to provide a better understanding of air quality outside the Port Phillip and Latrobe Valley regions. It has not achieved this, and EPA has not updated nor adjusted the plan over the last 17 years to reflect the changes in population and industrial activities across the state.

2.2 EPA's monitoring network

As required by NEPM AAQ, EPA developed a Monitoring Plan, which was approved by the Commonwealth, state and territory environment ministers in February 2001.

The Monitoring Plan remains in effect, and EPA advised that it continually examines options for current and future monitoring depending on identified needs. However, to date, EPA has made no changes.

The plan states that air quality monitoring stations should be located at all urban centres with populations of 25 000 or more. EPA identified eight regions based on 1996 population data—see Figure 2A.

Figure 2A
Eight regions identified by EPA's 2001 Monitoring Plan

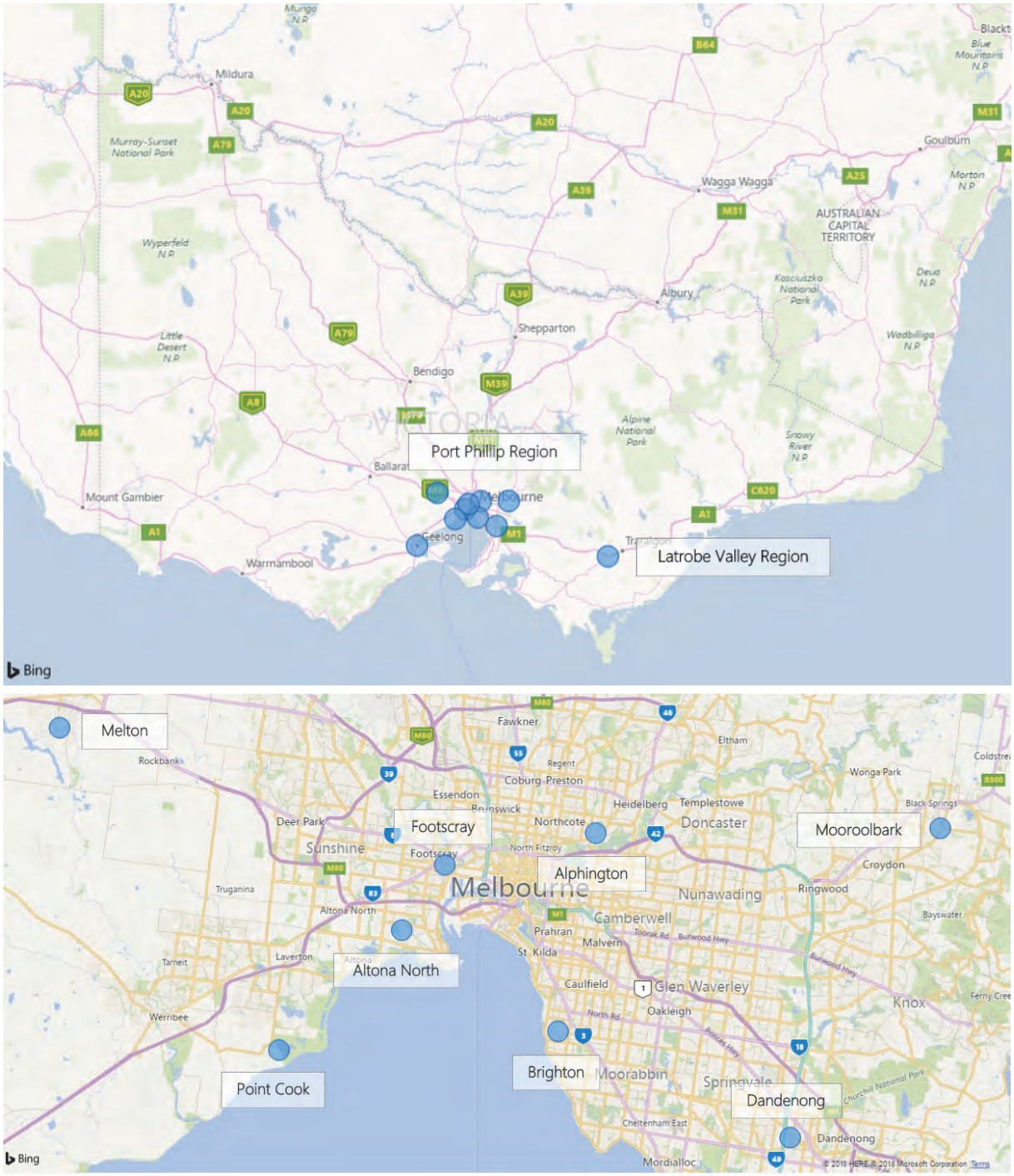
Regions for air quality assessments	Population in 1996
Ballarat	64 831
Bendigo	59 936
Latrobe Valley	130 000
Mildura	26 695
Port Phillip— Greater Melbourne and Geelong	3 450 862
Shepparton	31 945
Warrnambool	26 052
Wodonga	25 825

Source: VAGO, based on the EPA 2001 Monitoring Plan.

Monitoring coverage

Contrary to the Monitoring Plan, EPA is currently only monitoring air quality in the Port Phillip and Latrobe Valley regions, as shown in Figure 2B.

Figure 2B
EPA's ambient air quality monitoring network



Source: VAGO, based on EPA documents. Map data: © 2018 HERE, © 2018 Microsoft Corporation.

While EPA has conducted limited air quality monitoring at Ballarat, Bendigo, Shepparton, Warrnambool and Mildura, it is not currently monitoring these regions.

Identified regions not being monitored

EPA's annual air quality monitoring reports state that there is no need to monitor six of the regions identified in its Monitoring Plan—Ballarat, Bendigo, Shepparton, Warrnambool, Wodonga and Mildura. It explained that this is not required because previous monitoring showed that 'pollutant levels were reasonably expected to be consistently below the relevant standards'. EPA has not been able to provide evidence to support this position.

We found that although EPA previously conducted some air quality assessments in these regions:

- these occurred at least 11 years ago and do not necessarily reflect current conditions in the regions
- the assessments did not monitor all indicator pollutants—for example, in Mildura and Shepparton, EPA only monitored one pollutant (PM10)
- all stations recorded exceedance levels for at least one of the indicator pollutants
- EPA has not monitored PM2.5 in any of these regions to date (the NEPM AAQ required assessment against PM2.5 standards from 2016).

EPA has previously acknowledged the need for more extensive monitoring in these regions but this has not occurred to date. Its 2006 air quality monitoring report indicated that regional campaign monitoring continues to record elevated concentrations of PM10 and, therefore, future monitoring of this pollutant should be considered.

Figure 2C details the limited monitoring conducted in these six regions. Having not conducted any monitoring since 2007, EPA is unable to demonstrate that current pollutant concentrations in these regions remain below air quality standards.

Figure 2C
Air quality monitoring results for Ballarat, Bendigo, Mildura, Shepparton and Warrnambool

Region	Years monitoring operational	Pollutants assessed	Instances of NEPM AAQ exceedance
Ballarat	Feb 2002 – Sep 2003	PM10	2 PM10 one-day average
	Aug 2005 – Aug 2006	PM10, carbon monoxide, nitrogen dioxide, ozone	
		visibility	30 days visibility[(a)]
Bendigo	May 2004 – Jul 2005	PM10	3 PM10 one-day average
		carbon monoxide, nitrogen dioxide, ozone	
		visibility	1 day visibility[(a)]
Mildura	Dec 2004 – Jun 2006	PM10	38[(b)] PM10 one-day average
Shepparton	Dec 2003 – Dec 2004	PM10	1 PM10 one-day average
Warrnambool	Oct 2006 – Oct 2007	PM10	3 PM10 one-day average
		ozone	
		visibility	13 days visibility[(a)]
Wodonga	No actual monitoring conducted[(c)]		

(a) Visibility refers to 'visibility-reducing particles (minimum visual distance)'. This is an indicator pollutant under SEPP AAQ, but not NEPM AAQ. The standard for visibility is set at 20 kilometres.

(b) EPA advised that 26 of these exceedances were due to dust storms and three from bushfires, which would be considered exceptional events.

(c) No monitoring station has operated in Wodonga. EPA advised that, for a time, it relied on data from monitoring stations at Albury, New South Wales, to get an indication of air quality in this region.

Source: VAGO, based on EPA documentation.

Monitoring densely populated urban centres

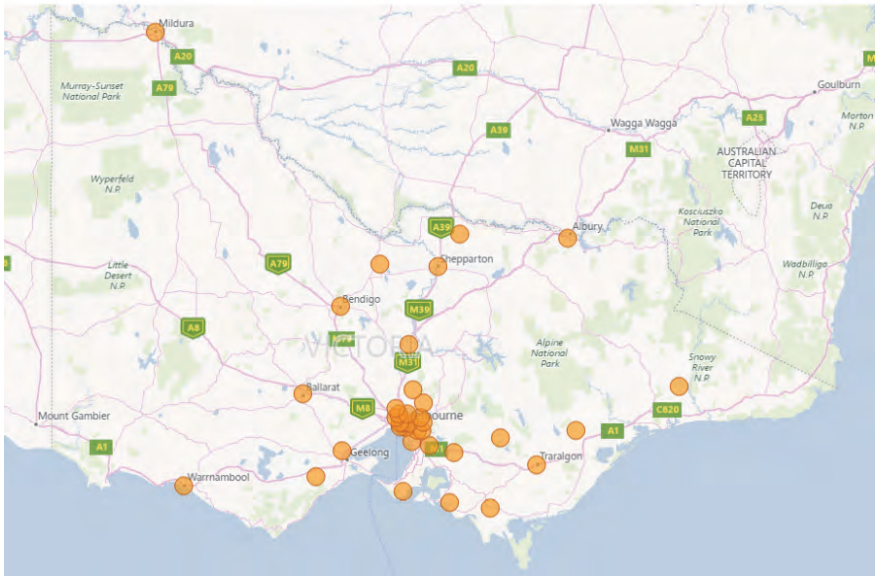
The current monitoring coverage does not comply with the requirement of the Monitoring Plan to have at least one monitoring station in urban centres with populations of at least 25 000. The population in Victoria has increased significantly since 1996.

EPA stated that, despite this requirement, its 'understanding of Melbourne's air environment and where monitoring stations should be located has improved'. It cites Casey as an example of a local government area with a population of over 25 000 that does not necessarily need a monitoring station. EPA explains that, based on its understanding of the overall Melbourne wind pattern, the air quality in Dandenong is likely to be generally representative of Casey's air quality. EPA does, however recognise the limitations of this approach, particularly where there may be previously unidentified local sources of air pollution.

The intention of the Monitoring Plan is to have monitoring stations in densely populated urban centres to get a sense of the quality of the air that Victorian communities living or working in those areas are exposed to.

Figure 2D shows that, based on 2016 population numbers, there are some 40 urban centres with populations of at least 25 000 across the state that are currently not covered by EPA's air quality monitoring network.

Figure 2D
Victorian urban centres with populations over 25 000 that are not within EPA's monitoring network



Source: VAGO. Map data: © 2018 Microsoft Corporation.

2.3 Campaign and emergency monitoring

Air quality data collected from EPA's campaign and emergency monitoring stations is not included in EPA's annual air quality monitoring reports because it is collected for purposes other than to monitor ambient air quality.

From time to time, EPA publishes reports on air quality results on its website from some of these campaign and emergency monitoring stations. EPA also provides some air monitoring results on its AirWatch website. However, EPA needs to review the accuracy and reliability of this data—units of measure are not always clearly indicated, and we found inconsistencies between AirWatch data and validated raw data provided to us by EPA.

For transparency and ease of access, EPA should consider how best to put together all the air quality information it collects from its monitoring activities. This would provide the community with additional insights into the air pollution risks that Victorians are exposed to.

2.4 Recommendation 6.3 of the 2016 EPA inquiry report

In 2015, the then Minister for Environment, Climate Change and Water established the EPA Inquiry Ministerial Advisory Committee to conduct a public inquiry into EPA. The committee's 2016 report recommended that EPA:

- assess the adequacy of its air and water monitoring networks, particularly in relation to air quality
- consider options to improve data sharing and accessibility, and community communication.

The review recommended that EPA consider the following key factors:

- developments in monitoring technology, including the capacity to link together and create an accessible network of real-time air quality data
- monitoring with sufficient geographical coverage to provide robust data for all ambient and rapid response needs
- rapid analysis and delivery of information for decision-making
- increased capability in modelling and predictive services.

In early 2017, the Victorian Government supported these recommendations, and EPA is currently working to implement them through its Reform Project Plan: Environmental Monitoring Capability Review.

EPA advised that the objective of the project plan is to deliver a draft business case for the implementation of the proposed enhancements to its monitoring capability. To achieve this, EPA is currently evaluating the effectiveness of its air monitoring network.

Separate from this process and in response to the Hazelwood Mine Fire Inquiry, EPA developed a preferred model for additional air monitoring in the region in consultation with members of the Latrobe Valley community. EPA advised that implementation of the new air monitoring network is underway.

3 Reporting on air quality

In this part of the report, we examine EPA's reporting on the information it obtains from its ambient air quality monitoring stations.

3.1 Conclusion

EPA's annual air quality monitoring reports state that Victoria's ambient air quality is generally good and within national standards. However, EPA's limited air monitoring coverage does not provide information on air quality for most of the state, including many parts of metropolitan Melbourne.

In addition, while infrequent, some inaccurate assessments against PM air quality standards in EPA's air quality monitoring reports—all of which overstated air quality—undermine confidence in publicly reported data.

Inconsistencies between EPA's air quality raw data and that published on the AirWatch website bring into question the accuracy of this data. In addition, EPA's inadequate records on the number of and reasons for changes made to air quality data further diminish its reliability.

The ICT infrastructure underpinning EPA's air quality monitors is ageing, no longer supported by vendors and subject to security vulnerabilities. This is increasingly affecting the reliability of the data collected and computed. EPA is aware of these weaknesses and reports that it has started to address the issues.

3.2 Reported air quality

EPA's annual air quality monitoring reports publish the results of air quality monitoring at designated NEPM AAQ monitoring stations. These reports assess this data against NEPM AAQ standards.

Air quality meets or complies with the NEPM AAQ if:

- the number of times the relevant standard was exceeded is no more than the allowed number of exceedances
- data was available at least 75 per cent of the time in each quarter of the year.

Figure 3A shows the NEPM AAQ standards for each air pollutant.

Figure 3A
NEPM AAQ standards for the seven pollutants

Item	Pollutant	Averaging period[(a)]	Maximum concentration standard	Maximum allowable exceedances
1	Carbon monoxide	8 hours	9.0 ppm	1 day a year
2	Nitrogen dioxide	1 hour	0.12 ppm	1 day a year
		1 year	0.03 ppm	None
3	Photochemical oxidants (as ozone)	1 hour	0.10 ppm	1 day a year
		4 hours	0.08 ppm	1 day a year
4	Sulfur dioxide	1 hour	0.20 ppm	1 day a year
		1 day	0.08 ppm	1 day a year
		1 year	0.02 ppm	None
5	Lead	1 year	0.50 µg/m³	None
6	Particulate matter as PM10	1 day	50 µg/m³	None
		1 year	25 µg/m³	None
7	Particulate matter as PM2.5	1 day	25 µg/m³	None
		1 year	8 µg/m³	None

(a) Averaging period refers to the period of time over which the pollutant must not exceed the set standards. For example, the one-day average standard for PM10 is 50 µg/m³. This means that the average value of the 24-hourly PM10 readings on any particular day must not exceed 50 µg/m³.

Source: NEPM AAQ, 2016.

A review of EPA's annual air quality monitoring reports for the period 2010 to 2016 suggests that, on the whole, Victoria's air quality is good and meets the NEPM AAQ standards. The only pollutant for which Victoria did not meet the standard is PM10 in 2015. Figure 3B shows EPA's reported assessment of Victoria's air quality.

Figure 3B
EPA's assessment of Victoria's ambient air compliance

	Compliance with NEPM AAQ standards						
Pollutant	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Ozone	Met[(a)]	Met[(a)]	Met[(a)]	Met[(a)]	Met[(a)]	Met	Met[(a)]
PM10	Met	Met	Met	Met	Met[(a)]	Not met[(a)]	Met[(a)]
PM2.5	NA	NA	NA	NA	NA	NA	— [(b)]
Carbon monoxide	Met	Met[(a)]	Met[(a)]	Met[(a)]	Met	Met[(a)]	Met
Sulfur dioxide	Met	Met	Met[(a)]	Met[(a)]	Met	Met	Met[(a)]
Nitrogen dioxide	Met	Met	Met[(a)]	Met[(a)]	Met	Met[(a)]	Met

Note: NA means monitoring was conducted, but the NEPM AAQ did not require assessment against air quality standards.

(a) A 'not demonstrated' assessment was given to at least one monitoring station that measures that pollutant.

(b) The NEPM AAQ required monitoring and assessment, but EPA did not make an assessment against air quality standards.

Source: VAGO, based on EPA air quality monitoring reports.

Comparison with other jurisdictions

When compared with other Australian states and territories, Victoria's reported ambient air quality compares favourably, with only one reported 'not met' assessment. Figure 3C shows states' and territories' reported noncompliance with the NEPM AAQ.

Figure 3C
States' and territories' reported noncompliance with NEPM AAQ standards, 2010–11 to 2015–16

States and territories	Reported noncompliance
Victoria	PM10—2015–16
New South Wales	Ozone—2010–11, 2011–12, 2013–14, 2014–15
	PM10—2010–11, 2011–12, 2013–14, 2014–15, 2015–16
Queensland	Ozone—2011–12
	PM10—2011–12, 2012–13, 2013–14, 2014–15, 2015–16
	SO2—2010–11, 2011–12, 2012–13, 2013–14, 2014–15, 2015–16
Western Australia	Ozone—2012–13
	PM10—2010–11, 2012–13, 2015–16
South Australia	SO2—2010–11, 2011–12, 2012–13, 2013–14, 2014–15, 2015–16
Tasmania	None
Australian Capital Territory	None
Northern Territory	PM10—2012–13, 2014–15

Note: A few 'not met' assessments are not included in the above table where data availability was given as the reason for the noncompliant assessments, and not because there are more exceedances than is allowed by the standards. This applies to Northern Territory and South Australia.

Source: VAGO, based on NEPC reports from 2010–11 to 2015–16.

However, these assessments do not necessarily provide a fair comparison across jurisdictions. The extent and nature of each jurisdiction's monitoring may vary significantly, despite using the same standards (NEPM AAQ). Population size and local characteristics such as topography, weather and emission sources also affect pollutant concentrations.

For example, Figure 3C shows that New South Wales has more 'not met' assessments compared to Victoria for the period 2010–11 to 2015–16. However, New South Wales's air quality monitoring network is the most extensive among jurisdictions—it has a larger area of coverage and more monitoring stations.

Reporting on PM10

EPA's annual air quality monitoring reports show that from 2010 to 2016, the PM10 one-day average standard was either 'met' or 'not demonstrated' at all monitoring stations except in 2015 at Footscray, Geelong South and Richmond.

The NEPM AAQ standards for PM10 are:

- 50 µg/m³ one-day average maximum concentration
- 25 µg/m³ one-year average maximum concentration.

Prior to 2016, the standards allowed five exceedance days per year. From 2016, the NEPM AAQ required that the PM10 one-day average should no longer have allowable exceedances, and air quality will not meet the standard if the daily average exceeds 50 µg/m³ in even one instance.

The 2016 NEPM AAQ changes also introduced a definition for an exceptional event:

> 'A fire or dust occurrence that adversely affects air quality at a particular location, and causes an exceedance of 1 day average standards in excess of normal historical fluctuations and background levels, and is directly related to: bushfire; jurisdiction authorised hazard reduction burning; or continental scale windblown dust.'

This means that to comply with the PM10 daily average standard, the 50 µg/m³ standard should not be exceeded at any time during the year, unless it is the result of an exceptional event. This also applies to the PM2.5 daily average.

Exceedances

EPA's annual air quality monitoring reports show that for the period 2010 to 2016, the one-day average standard for PM10 was exceeded 91 times, as shown in Figure 3D.

Figure 3D
EPA-reported PM10 one-day average exceedances of NEPM AAQ standards, 2010 to 2016

	Number of exceedances						
Monitoring station	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Alphington	0	1	0	0	4	0	0
Brighton	0	0	0	0	2	0	–
Dandenong	0	0	0	1	4	0	0
Footscray	4	0	3	2	6	3	0
Geelong South	1	2	1	8	9	10	5
Mooroolbark	3	1	2	0	4	0	0
Richmond	0	0	0	0	4	1	–
Traralgon	3	0	0	4	3	0	0
Total exceedances	**11**	**4**	**6**	**15**	**36**	**14**	**5**

Key: ■ 'Met' assessment by EPA. ■ 'Not demonstrated' assessment by EPA. The NEPM AAQ provides that performance must be evaluated as 'not demonstrated' if there has been no monitoring or no assessment by an approved alternative method. EPA advised, however, that it gives a 'not demonstrated' assessment generally when the data availability minimum requirement of 75 per cent was not met. ■ 'Not met' assessment by EPA.

Source: VAGO, based on EPA air quality monitoring reports.

However, in assessing against NEPM AAQ standards for PM10 one-day average, EPA gave 'not met' assessments only for 2015 at the Footscray, Geelong South and Richmond monitoring stations.

Considering the high frequency of exceedances as well as the attainment of the 75 per cent data availability, it is not clear what basis EPA used for its 'met' or 'not demonstrated' assessments for the other years.

For example:

- EPA assessed Geelong South as 'met' in 2013 even though there were eight exceedance days and data availability was at over 90 per cent throughout the year
- in 2014, Footscray and Geelong South stations recorded six and nine exceedance days respectively, with more than 75 per cent of data available, yet EPA assessed them both as 'not demonstrated'
- despite five exceedance days in 2016, EPA assessed Geelong South as 'not demonstrated' rather than 'not met', even though data availability was at more than 75 per cent across the year.

The 2013 and 2014 air quality monitoring reports referred to dust as the 'possible inferred cause' for the PM10 exceedances but did not explain why a 'not met' assessment was not given for both years.

EPA noted in the 2016 air quality monitoring report that the exceedances in March, April, May and December may be attributed to localised dust from an unsealed car park near the Geelong South monitoring station, which is used by attendees at races and market days. But, similar to 2013 and 2014, EPA did not explain why it assessed this as 'not demonstrated' instead of 'not met'.

During the audit, EPA acknowledged that this was an oversight and it should have assessed all four instances as 'not met'. EPA advised that it would revise the 2013, 2014 and 2016 reports to reflect these corrected assessments.

Reporting on PM2.5

In 2016, the NEPM AAQ introduced additional air quality maximum concentration standards:

- one-year average for PM2.5 of 8.0µg/m^3 (previously an advisory reporting standard)
- one-day average for PM2.5 of 25.0µg/m^3 (previously an advisory reporting standard).

While the NEPM AAQ required monitoring of PM2.5 concentrations from 2003, it did not require assessment against the standards until 2016. Prior to 2016, the goal was to gather sufficient data about PM2.5 to facilitate a review of the advisory reporting standards, which would inform future updates to the NEPM AAQ.

There are no allowable exceedances for the daily and yearly PM2.5 standards. To meet NEPM AAQ, recorded PM2.5 one-day average values should not exceed the standard at any time during the year, unless it is identified as an exceptional event.

EPA annual air quality monitoring reports for the period 2010 to 2016 show that, if assessment against the standard was required prior to 2016, then Victoria's air quality met the PM2.5 one-day average standard only in 2011 and 2012, noting the limited geographical monitoring of PM2.5 prior to 2016. Figure 3E shows a total of 19 exceedance days in 2010, 2013, 2014, 2015 and 2016.

Figure 3E
EPA-reported PM2.5 one-day average exceedances of NEPM AAQ standards, 2010 to 2016

	Number of exceedances						
Monitoring station	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Alphington (Partisol)	3	0	0	1	3	0	2
Alphington (BAM)	NA	NA	NA	NA	Trial	2	2
Footscray (Partisol)	0	0	0	0	2	0	1
Footscray (BAM)	NA	NA	NA	NA	Trial	0	2
Geelong South (BAM)	NA	NA	NA	NA	NA	NA	0
Traralgon (BAM)	NA	NA	NA	NA	NA	NA	1
Total	**3**	**0**	**0**	**1**	**5**	**2**	**8**

Note: 'NA' means that PM2.5 was not monitored at the station during the year. 'Trial' means EPA started using the method but did not report on results.

Note: PM2.5 is monitored using two methods—the Partisol method (every third day) and continuous beta attenuation monitoring (BAM). PM2.5 has been monitored at the Alphington and Footscray stations using the Partisol method since 2002. EPA began using the BAM method at these two stations in 2014 and at Geelong South and Traralgon stations in 2016. EPA is using the BAM method in addition to Partisol at Alphington and Footscray.

Source: VAGO, based on EPA air quality monitoring reports.

Figure 3E shows a total of eight exceedance days in 2016—four at Alphington, three at Footscray and one at Traralgon monitoring stations. However, EPA did not assess compliance against PM2.5 as required by the NEPM AAQ, as shown in Figure 3B. As the standard for PM2.5 does not allow for any exceedance days, EPA should have assessed the PM2.5 standard as 'not met' in 2016.

During the audit, EPA acknowledged this, and explained that it was an oversight that it intends to clarify in future reports. EPA also advised that it would revise the 2016 air quality monitoring report to reflect the 'not met' assessments.

Reporting on ozone

EPA's annual air quality monitoring reports indicate that the ozone standard, both for one-hour and four-hour averages, was either 'met' or 'not demonstrated' at all Victorian monitoring stations for the period 2010 to 2016.

The NEPM AAQ standards for ozone are:

- 0.10 ppm, one-hour average maximum concentration, one exceedance allowed per year
- 0.08 ppm, four-hour average maximum concentration, one exceedance allowed per year.

From 2010 to 2016, EPA's annual air quality monitoring reports show that the one-hour average standard for ozone was exceeded once in 2014, while the four-hour average standard was exceeded nine times in 2013 and 2014—or a total of 10 times, as shown in Figure 3F.

EPA noted that exceedances were due to photochemical smog linked with combustion products.

Figure 3F
EPA-reported ozone one-hour and four-hour average exceedances of NEPM AAQ standards, 2010 to 2016

	Number of exceedances						
Monitoring stations	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Alphington	0	0	0	1	2[(a)]	0	0
Brighton	0	0	0	0	1	0	–
Dandenong	0	0	0	1	0	0	–
Footscray	0	0	0	0	1	0	–
Geelong South	0	0	0	0	0	0	0
Melton	0	0	0	1	0	0	–
Mooroolbark	0	0	0	1	1	0	–
Point Cook	0	0	0	0	0	0	–
Traralgon	0	0	0	1	0	0	0
Total	**0**	**0**	**0**	**5**	**5[(b)]**	**0**	**0**

Key: ■ 'Met' assessment by EPA. ■ 'Not demonstrated' assessment by EPA.

Note: In 2016, EPA left blank the number of exceedances where data availability is less than 75 per cent.

(a) One exceedance for the one-hour average and one exceedance for the four-hour average. All other indicated exceedances in the table are for four-hour average.

(b) For 2014, there was a total of one exceedance for the one-hour average and four exceedances for the four-hour average. This means that for the period 2010 to 2016, there were nine exceedances for the four-hour average and one exceedance for the one-hour average.

Source: VAGO, based on EPA air quality monitoring reports.

Given the exceedances allowed under the NEPM AAQ standard for ozone, EPA's 'met' assessments for the ozone air quality results in its annual air quality monitoring reports are appropriate.

Other indicator pollutants

EPA's assessments show that concentration levels for the other indicator pollutants, including carbon monoxide, sulfur dioxide and nitrogen dioxide, are well within NEPM AAQ standards. Appendix B includes information on EPA's monitoring for these pollutants.

3.3 Data considered in annual air quality monitoring reports

EPA's annual air quality monitoring reports are designed to provide information on Victoria's ambient air quality as required by the NEPM AAQ. They exclude results:

- when data availability for a monitoring station is below 75 per cent
- during exceptional events such as bushfires and continental dust storms, for assessments against PM10 and PM2.5 one-day average standards.

Limited data availability

Regardless of the pollutant level detected, EPA's monitoring system records an invalid reading when data availability is less than 75 per cent for the period. This is consistent with NEPM AAQ requirements.

For example, on 25 November 2015, Alphington recorded a PM10 one-day average of 108 µg/m³, which is more than 200 per cent above the standard. This reading was excluded because data availability was 50 per cent on that date, with only 12 of the 24-hourly averages available to compute the one-day average. As a result, EPA reported zero exceedances for Alphington for 2015 and excluded this exceedance when assessing against the NEPM AAQ standard for the region.

EPA explains that, to prevent under-reporting, it considers a reading that exceeds standards but arises from data with less than 75 per cent availability in determining the monthly maximum value for individual stations. While this prevents the data from being completely excluded, the fact that it is only recorded within the body of the report means that it is easy to miss.

We acknowledge that there is a level of uncertainty associated with pollutant readings computed from less than 75 per cent data availability. However, because the harmful effects of air pollutants result from even short-term exposure, EPA should be more transparent about how it reports this data.

Negative values

There are a considerable number of negative values in the raw air quality data that EPA uses to compute NEPM AAQ pollutant values. For example, in 2016, negative values comprised 5.3 per cent of recorded hourly PM2.5 values, and 1.3 per cent of recorded hourly PM10 values.

Instead of considering these negative values as invalid data, EPA includes them in its calculation of one-day averages for pollutants. EPA's view is that excluding these negative values would introduce a positive bias into the data that would overestimate actual concentrations. EPA advised that this is an accepted practice across jurisdictions.

EPA also advised that, as it is based on relatively new technology, there is some uncertainty associated with the monitoring equipment currently being used to measure continuous PM2.5 concentration levels. As the technology improves and the uncertainty associated with the five-minute data extraction reduces, EPA expects to record fewer negative values.

We consider that negative values should not be included in the data used to determine hourly and daily pollutant averages. First, the lowest possible value for air pollutant concentrations is zero—either it is present, even if in very small amounts, or it is not. Second, we find that EPA's inclusion of these readings introduces a negative bias that potentially under-represents actual concentrations. Further, the AirWatch historical air quality data included in EPA's website does not have these negative values. EPA advised that it does not include negative values on its website because it would be difficult to explain to the public why some pollutant levels are recorded at below zero.

When we excluded the negative values from the calculation of one-day averages, there were five more exceedance days for PM2.5 and one more for PM10 during 2016.

3.4 Raw data

Quality of EPA's raw data

We analysed hourly air quality data for the period 2010 to 2016. EPA advised that this data:

- had undergone EPA's data validation process
- had been collected from EPA's ambient and campaign monitoring stations, but did not include data collected from air toxics monitoring and campaign monitoring at Francis Street, Yarraville.

We found EPA's air quality data was not as reliable as would be expected given it had been through a data validation process. Our basic sample checking showed instances of inconsistencies between the provided raw data and those published as part of EPA's AirWatch historical data.

Further, after we highlighted a significantly high PM2.5 hourly value from EPA's raw data, EPA informed us that this particular value, together with a few other hourly values recorded on the same day from the same indicative monitoring station, was invalid and should have been removed from the air quality dataset.

EPA further advised that it is not unusual for it to change data several years after its initial recording. This occurs when EPA interrogates the data in greater detail as there are sometimes data errors that are not able to be detected during the standard review and validation processes.

However, the error should have been more quickly picked up and corrected by EPA. This is because the instrument fault, to which EPA attributes the error, was identified by EPA on the same day that the data was collected in September 2015. Following EPA's validation process, the instrument fault notification should have alerted EPA staff to remove the invalid data from the system.

The invalid data stayed in EPA's system and formed part of the raw data provided to us in June 2017, nearly two years from the date it was initially recorded.

EPA advised that the invalid data was subsequently removed from its system but it is unable to specify exactly when this correction was made. This is contrary to EPA's data validation procedure, which requires details of air quality data changes to be recorded.

EPA is also unable to provide advice on the number of air quality data changes it makes on a yearly basis, or the reasons for any changes made.

PM10 and PM2.5 exceedances

Our examination of EPA's one-day average PM10 and PM2.5 data from its campaign and ambient air quality monitoring stations identified significantly more exceedances than is indicated in EPA's annual air quality monitoring reports—see Figure 3G. It is important to note that these reports only include data collected from ambient air quality monitoring stations and exclude data for exceptional events and episodes of insufficient data.

While EPA reporting complies with the NEPM AAQ, not having similar regular reporting on exceedances from campaign and emergency monitoring does not give the community an accurate picture on air quality. These incidents can affect the health of vulnerable people.

This comparison illustrates that although EPA assesses Victoria's ambient air quality as generally good, Victorians should be mindful that exceedances in pollutant concentrations occur more often than is regularly reported.

Figure 3G
PM10 and PM2.5 one-day average exceedances based on raw data, 2010 to 2016

Pollutant	Exceedances reported by EPA[(a)]	Exceedances identified from raw data
PM2.5	19	87
PM10	91	225[(b)]

Note: This analysis includes raw hourly data provided by EPA to VAGO. Data from all campaign and ambient air quality monitoring stations for the period 2010 to 2016, regardless of data availability or exceptional events, has been considered in averaging one-day PM values. Exceedances from different stations for the same day are counted separately.
(a) Exceedances as indicated in EPA's annual NEPM AAQ compliance reports.
(b) Many of these exceedances were recorded at the Brooklyn monitoring stations.
Source: VAGO, based on EPA raw data and annual air quality monitoring reports.

In determining the exceedances in the raw data shown in Figure 3G, we included results from EPA's campaign and ambient air quality monitoring stations. Moreover, contrary to NEPM AAQ directives, we included all data, regardless of data availability or exceptional events. We counted exceedances from different stations for the same day separately.

Our analysis shows that from 2010 to 2016, there were more than four times the exceedances of the PM2.5 NEPM AAQ one-day average maximum concentration level reported in EPA's annual air quality monitoring reports, and more than two times the exceedances reported for PM10.

The Victorian community has the right to know about air quality exceedances and the reasons for them, in order to ascertain their level of potential exposure and risks to their health. The Victorian community needs more transparent and specific information than that included in EPA's annual air quality monitoring reports.

While it is important to get reliable information on Victoria's ambient air quality, it is equally important for Victorians to be able to access and understand the local air quality conditions that they may be exposed to on a daily basis, especially if they live, work and commute near direct sources of air pollution.

PM10 and PM2.5 hourly data

The hourly-average PM2.5 and PM10 data collected by EPA reveals some very high concentration levels. EPA advised that significantly high PM10 concentration values are recorded at Geelong South from time to time—up to 1 837 µg/m³—because the monitoring station is located at an unsealed car park, as discussed in Section 3.2.

Although the NEPM AAQ does not have standards for hourly PM2.5 and PM10 readings, EPA identified five categories for these hourly averages, as shown in Figure 3H.

Figure 3H
PM2.5 and PM10 one-hour average air quality categories

Air quality category	PM2.5 one-hour average (µg/m³)	PM10 one-hour average (µg/m³)
Very good	0–13.1	0–26.3
Good	13.2–26.3	26.4–52.7
Fair	26.4–39.9	52.8–79.9
Poor	40–59.9	80–119.9
Very poor	≥60	≥120

Source: EPA.

Our review of EPA's hourly PM2.5 data from its monitoring stations for the period January 2014 to July 2017 reveals 1 637 poor to very poor one-hour averages. Of these, 1 059 were poor and 578 were very poor.

For the same period, the figures are higher for PM10, with 1 734 poor to very poor one-hour averages. Of these, 1 218 were poor and 516 were very poor.

The EPA AirWatch website provides hourly-updated one-hour average values for PM10 and PM2.5 where these are monitored. This is a good source of information for the Victorian community. However, EPA advised us that the reported hourly values are derived from un-validated data, and reporting is occasionally disrupted by failures in monitoring equipment or information technology systems, or planned maintenance. EPA needs to improve the reliability of its AirWatch data.

The EPA AirWatch website also provides historical one-hour averages for PM. However, the historical data is not comprehensive—that is, not all recorded one-hour PM averages are included. For example, many of the poor and very poor values indicated above are not published in the website data. We also found inconsistencies between what is recorded on the website and the raw data that EPA provided to us.

Moreover, the historical data may only be accessed one hourly value at a time. This means that to get the 24-hourly PM values for a particular day, a user would need to specify the specific day and hour 24 times. For transparency, EPA should also examine how it can make information on hourly PM values more readily and easily accessible.

Ozone hourly data

Our examination of EPA's raw data for ozone one-hour and four-hour averages did not show notable discrepancies from what EPA reported in its annual air quality monitoring reports.

3.5 Siting compliance

The NEPM AAQ requires EPA to ensure that monitoring stations comply with the Australian/New Zealand Standard 3580.1.1:2007 *Methods for sampling and analysis of ambient air—Part 1.1: Guide to siting air monitoring equipment* (AS/NZS 3580.1.1).

AS/NZS 3580.1.1 states that it is important that the sampling equipment in monitoring stations is situated to yield data that is representative of the location. It should not be influenced by immediate surroundings unless those influences are specifically being monitored, such as emissions from motor vehicles travelling along a major roadway. Appendix E outlines the siting requirements for PM10, PM2.5 and ozone sampling inlets as required by AS/NZS 3580.1.1.

We inspected two monitoring stations to assess compliance against AS/NZS 3580.1.1 and reviewed EPA's documentation on the remaining sites. We found that the monitoring stations' siting generally complies with the requirements, although there are minor exceptions relating to distance from trees and roads.

Most monitors are located closer to roads than they should be, which means that air data collected is potentially impacted by pollutants from motor vehicles. Figure 3I shows our assessment of monitoring stations against siting requirements.

Figure 3I
Monitoring stations' siting compliance with AS/NZS 3580.1.1

	AS/NZS 3580.1.1 siting requirements				
Ambient air quality monitoring station	**Height above ground**	**Clear sky angle of 120°**	**Unrestricted airflow of 270°/ 360°**	**20 metres from trees**	**Minimum distance from road or traffic**
Alphington	Y	Y	Y	N	N
Altona North	Y	Y	Y	Y	N
Brighton	Y	Y	Y	Y	N
Dandenong	Y	Y	Y	Y	N
Footscray	Y	Y	Y	Y	Y
Geelong South	Y	Y	Y	Y	N
Melton	Y	Y	Y	Y	N
Moe	Y	Y	Y	N	N
Mooroolbark	Y	Y	Y	Y	N
Point Cook	Y	Y	Y	Y	N
Richmond	Y	Y	Y	Y	N
Traralgon	Y	Y	Y	N	N

Source: VAGO, based on site inspection and EPA documentation.

3.6 ICT infrastructure underpinning monitoring

The ICT infrastructure underpinning air quality monitors is increasingly affecting the reliability of the data they collect. EPA has identified that:

- the ICT system is 25 years old and no longer supported by vendors
- database servers are running unsupported and out-of-date operating systems and database platforms, exposing EPA to multiple failure points
- the ICT system is subject to security vulnerabilities
- reliability and availability is steadily decreasing
- the limited focus on servicing and maintaining scientific data management systems has resulted in system issues and poor functionality remaining unresolved for long periods of time.

EPA is aware of the ICT infrastructure's weaknesses and, in 2017, commenced an IT refresh procurement program to address the issues. EPA's ongoing Environment Data Information System Online project aims to deliver a refreshed information and technology platform to reliably collect, analyse, store, back up and share data, as well as enabling disaster recovery.

4

Regulating air quality

In this part, we examine EPA's regulation of air pollution sources, including whether and how it identifies pollution sources, as well as how it uses its regulatory tools to manage air discharge from industrial operators.

4.1 Conclusion

EPA's regulation of air pollution sources has recently begun to improve. It has achieved this through better embedding its risk-based approach into its licensing requirements and developing programs to enhance its compliance efforts—for example, through major industry assessments and APS audits.

However, the roles and responsibilities of agencies that contribute to air quality management in the state remain unclear and are not well understood. Consequently, attempts to address air quality issues have not always been well coordinated and implemented.

EPA has not kept itself fully informed of and updated on air pollution sources. As a result, EPA risks not focusing its resources on those air discharges that adversely impact air quality and, potentially, human health.

4.2 Roles and responsibilities

There are many agencies that contribute to the protection of Victoria's air quality. In addition to EPA's central role, other key agencies include DELWP, local government, the Commissioner for Environmental Sustainability, VicRoads, WorkSafe Victoria, the Victorian Planning Authority, emergency services and a host of others, including the Commonwealth Government.

Local governments are generally the first port of call for residents raising complaints on poor air quality. The role of councils in this regard is significant, particularly where it concerns premises that are not licensed by EPA. Councils receive and often investigate alleged sources of air pollution from such sites and work with EPA on environmental issues beyond their technical capabilities.

Councils are responsible for assessing, approving and enforcing planning permits that may include environmental conditions that operators need to comply with. Councils must refer certain planning permit applications to EPA for proposals that may discharge air pollutants, such as those for landfills and materials recycling depots. However, any other planning permit referrals to EPA are at the discretion of councils.

These roles and those of other agencies are laid out in over 20 disparate legislative instruments, including Acts, policies and regulations. The most important ones are highlighted in Appendix F.

The protection of air quality requires a multidisciplinary, cross-jurisdictional approach, which may include:

- making planning decisions
- educating residents on responsible burning and use of woodfired heaters
- ensuring that the design of motor vehicles is compatible with acceptable air discharge standards
- holding those responsible for inappropriate air discharges to account.

The composite nature of air quality management and the range of legislative instruments require various agencies to work together effectively and consult with each other. However, it can be difficult to navigate the different legislative and policy instruments to determine which agencies are responsible for what. It is also difficult to ascertain what triggers the commencement of an agency's responsibility, and when responsibility transfers to another agency.

For example, when councils are assessing permit applications, the current Victorian Planning Provisions require them 'to minimise exposure to air pollution to safeguard community health'. The Act makes EPA responsible for coordinating 'all activities relating to protecting and improving the quality of the environment'. However, unless there is a specific requirement for councils to refer planning applications to the EPA, it is discretionary for councils to refer environmental concerns to EPA.

Various stakeholders we consulted during this audit advised that there is often confusion about roles and responsibilities. They referred to instances when they called EPA about a poor air quality incident and were told that they should call council instead. In turn, council advised them that it was a matter for EPA to resolve.

EPA documentation acknowledges weaknesses in current environmental policies, including air quality management. In July 2013, the then Department of Sustainability and Environment (now DELWP) and EPA conducted the Statutory Policy Review and noted that the state's environmental policies are 'complex, difficult to access and poorly understood' and that many policies are 'overdue for review, undermining stakeholder confidence and creating uncertainty for decision makers'.

The report further acknowledged that 'a lack of coordinated and accountable implementation' of these policies 'has limited their effectiveness and exposed EPA and other Victorian government agencies to legitimate criticism'. DELWP advised that it is currently considering how to progress actions to implement the recommendations from the Statutory Policy Review in light of the 2015–16 inquiry into EPA.

4.3 Identifying sources of air pollution

The Victoria's 2012 Waste Management Policy (National Pollutant Inventory), requires EPA to:

- collate information on pollutant emissions, including ozone precursors and PM, from:
  - point sources, from both EPA-licensed and unlicensed commercial operators who exceed the thresholds indicated in the NEPM NPI
  - diffuse sources or aggregated emission sources, such as motor vehicles, domestic fuel burning, smaller commercial operators, and other domestic activities
- submit the collated information to the Commonwealth Government:
  - on or before 31 December of every year for point sources
  - on or before the date agreed among participating jurisdictions for diffuse sources.

The Commonwealth receives information from all states and territories and publishes it on the NPI website, to inform communities, industries and governments across Australia, including Victoria. EPA advised that no agreement had been made between the different jurisdictions on the required frequency for submitting information on diffuse sources of air pollution.

Diffuse sources

EPA last conducted an air emissions inventory in 2006. Relying on a 12-year-old emissions inventory is inconsistent with EPA's approach of using science to inform its activities. The completion of an up-to-date air emission inventory is critical for EPA's understanding of air pollution sources requiring its attention.

EPA considers it optimal to conduct an air emissions inventory once every five years, in line with the population census. EPA advised that it was unable to develop one in 2011 due to limited resources and other pressing priorities, but it is now developing a 2016 air emissions inventory that will reference 2016 information on air discharges from point and diffuse sources, as well as other data from other relevant state and Commonwealth government agencies.

Another consequence of EPA's 12-year-old air emissions inventory is that Victoria's aggregated air emissions data on the Commonwealth Government's NPI website has not changed since 2006.

Point sources

The NPI website reports on emission data for 93 substances, including PM10, PM2.5 and oxides of nitrogen, an ozone precursor. Other substances reported in the NPI include benzene, carbon monoxide, sulfur dioxide and volatile organic compounds. These substances are classified into six categories that determine the threshold at which mandatory reporting is triggered.

This data is self-reported. Under the NEPM NPI, commercial operators must fill out a form on their emissions data. EPA collates all submitted information and validates it for completeness prior to forwarding it to the NPI website. EPA advised that it usually receives some 850 reports annually and checks up to 200 of these for completeness.

The Commonwealth Government conducted a review of the NPI in 2017, in consultation with state and territory environment protection authorities. The report for this review is scheduled for release in 2018. Its terms of reference include assessing the accuracy and reliability of industry-reported emission reports, as well as considering options to strengthen NPI compliance measures.

NPI point source data—Victoria

NPI data on air emissions from point sources provides insight on industries' contribution to air pollution in Victoria. It also provides information on where these commercial operators are across the state. EPA uses NPI point source reports to plan its compliance and monitoring activities. Figure 4A tabulates industry sectors' contribution to PM and oxides of nitrogen emissions for 2015−16.

Figure 4A
Major point sources of PM and oxides of nitrogen in Victoria, 2015–16

Industry sector	Emissions (kg)
PM10	
Electricity generation	12 000 000
Metal ore mining	6 900 000
Construction material mining	2 000 000
Ceramic product manufacturing	530 000
Other non-metallic mineral mining and quarrying	470 000
PM2.5	
Electricity generation	2 800 000
Petroleum and coal product manufacturing	220 000
Oil and gas extraction	97 000
Pulp, paper and paperboard manufacturing	70 000
Construction material mining	61 000
Oxides of nitrogen	
Electricity generation	80 000 000
Oil and gas extraction	5 100 000
Gas supply	3 000 000
Glass and glass product manufacturing	1 600 000
Petroleum and coal product manufacturing	1 600 000

Source: VAGO, based on 2015–2016 NPI information as published on the NPI website, as at 13 September 2017.

4.4 Use of regulatory tools

The Act provides EPA with a number of tools to regulate the activities of commercial operators.

All commercial operators are subject to the Act, however, based on the type and amount of pollutants they emit, some require an EPA licence and others do not. Non-EPA-licensed operators must still comply with provisions of the Act and are liable for penalties if they do not. EPA can issue directions to both licensed and unlicensed operators to remedy pollution, or take enforcement action.

Scheduled premises

The Act gives EPA the authority to issue works approvals and licences to control the environmental impacts of certain activities and to control waste discharges or emissions.

The Environment Protection (Scheduled Premises) Regulations 2017 define which commercial and industrial activities require an EPA works approval before they are built or modified, and which activities require an EPA licence to operate. These are referred to collectively as 'scheduled premises' and are identified because of the risks they pose to the environment. Identified activities include:

- electricity generation
- waste treatment and storage
- glass, paper, food and drink manufacturing
- chemical manufacturing
- piggery and poultry farming
- landfills
- printing
- production and processing of metals and steels
- cement and lime activities.

Works approvals and licences

Works approvals are required for new, modified or extended works at scheduled premises. They are a preventative tool aimed at addressing potential issues by requiring new works or modification to existing structures to meet best-practice environmental standards.

Licences, on the other hand, are an ongoing tool to manage operations by restricting and limiting discharges to levels that are not detrimental to the environment.

EPA attaches conditions to licences. These conditions may relate to discharge or emission limits, operating practices, monitoring and reporting requirements, or other specific issues.

As at October 2017, there were 658 licensed operators in Victoria, representing a wide range of commercial and industrial operations. These include electricity generation, chemicals and petroleum, animal products, metal and engineering, and waste recycling. Of these licences, 637 (97 per cent) set conditions for air discharges or emissions, including odour and dust.

Periodic licence reviews

Once issued, EPA licences remain valid until either:

- they are revoked or suspended for breach of conditions
- the operator requests a licence amendment because of a change in its operations
- the licence is surrendered if operations cease.

In contrast, the environment protection authorities of South Australia and Western Australia issue licences for fixed periods of up to five years, with operators needing to apply for renewal or reapplication. The New South Wales Government, like the Victorian Government, provides perpetual licences, but has a mandatory licence-review process once every five years.

Because the Act provides for licences to be granted in perpetuity, EPA documentation reveals that more than half of the EPA-issued licences current as at 2013 have the same discharge and emission limits as they were originally given, many from over 20 years ago.

This means there is limited flexibility to review and update licence conditions to reflect developments in industry practice, science and technology, including medical evidence on the harmful impact of poor air quality.

EPA reformed its licensing process in 2009. In this project, it intended to review licence discharge limits and conditions, and to have these reviewed annually to ensure currency and detect any emerging issues. EPA internal briefing shows that this did not take place due to changed organisational priorities. The documentation identifies the following outstanding licensing issues:

- Current licence conditions are generic which means assessing and enforcing compliance is difficult.
- Discharge indicators are not consistent for specific industry sectors.
- Numerous limit types have been used in licences without proper assessment of their relevance.
- Operators require industry-specific guidance on how to design a monitoring program to demonstrate compliance.
- The perpetual nature of EPA licences does not encourage operators to adopt the latest technology or reflect community expectations.

To address this issue, EPA launched a five-year periodic licence review program in 2015–16. The program aims to ensure the currency and efficacy of licences and licence conditions, and to provide consistency in emission limits and condition requirements. Following the 2015–16 inquiry into EPA, the government committed to a range of activities to further strengthen EPA's licensing activities.

EPA selected priority sectors for the periodic licence review for the subsequent years using the Licensed Operator Risk Assessment tool. It grouped the sectors into categories based on industry or emission type, generally found across a few sectors. EPA uses Licensed Operator Risk Assessment to prioritise its compliance and enforcement activities on licensed sites using information collected and assessed across six different criteria. The results contribute to an overall risk rating.

The schedule for EPA's periodic licence reviews is as follows:

- year 1 (2015–16)—landfills (licence review completed for 84 landfill sites)
- year 2 (2016–17)—mining/power stations (ongoing)
- year 3 (2017–18)—waste
- year 4 (2018–19)—air-related issues (air discharges, odour risks, fire risks)
- year 5 (2019–20)—wastewater discharges.

It is encouraging that EPA has developed the five-year licence review program. This should put it in a good position to more effectively exercise its regulatory role of setting relevant licence conditions for operators.

Monitoring compliance

EPA becomes aware of potentially inappropriate air discharges or emissions from:

- complaints received from members of the community
- commercial operators, who:
    - are required to immediately notify EPA of noncompliance with any licence condition
    - through their APS are required to make a statement on whether they have breached any licence condition during the financial year
- its own or councils' compliance and enforcement activities.

On receiving a complaint or notification, EPA undertakes an investigation to identify or determine noncompliance. EPA operating procedures intend inspections to be undertaken by authorised officers (AOs) who are then required to complete a report. However, there are instances when non-AOs carry out inspections, such as when AOs are not available. In these situations, there is a risk that reports are not appropriately completed and, therefore, not able to be referred to for future compliance efforts.

EPA also conducts an audit of APSs to assess the accuracy of commercial operators' responses on the compliance or noncompliance of licence conditions. In their APSs, licence holders provide their annual environmental performance for the previous financial year including air emission information. APSs are public documents and may be accessed through the EPA website.

EPA selects operators to be audited on the basis of information it receives, including the log of pollution complaints from the public, and sanctions it has applied previously.

For the period 2010–11 to 2015–16, EPA audited the APSs of 37 licensed operators with relevant air discharge licence conditions. Figure 4B summarises the APS audits conducted to date.

Figure 4B
APS audits with relevant air discharge licence conditions

Year APS submitted	Licensed operators audited
2010–11	2
2011–12	16
2012–13	6
2013–14	7
2014–15	0
2015–16	6
Total	**37**

Note: EPA advised that it has undertaken 173 APS audits to date. Of these, 37 contained conditions related to discharges to air.
Source: VAGO, based on EPA documentation.

EPA did not identify issues in 16 of the 37 audited APSs (43 per cent). For the other 21 (57 per cent), EPA found that commercial operators:

- violated the licence condition to have a monitoring program in place
- violated air discharge licence conditions, despite previously reporting to the EPA that it complied with them
- had weaknesses in their monitoring or recording of air discharges.

Enforcement

In the event of noncompliance, EPA uses a variety of sanctions and remedial measures, including compliance advice, remedial notices, warnings, abatement notices, prosecution, injunction, and suspension or revocation of licences. Appendix D discusses these in greater detail.

EPA documentation shows that it issued 321 remedial notices related to air discharges between 2009–10 and 2016–17. Figure 4C lists the different types of notices that EPA issued during this period.

Figure 4C
Remedial notices related to air discharges by category and year

Year	Pollution abatement notices	Clean up notices	Minor works pollution abatement notices	Monitoring, rehabilitation and aftercare pollution abatement notices	Total
2009–10	5	–	–	–	**5**
2010–11	5	1	–	–	**6**
2011–12	13	1	2	–	**16**
2012–13	47	3	6	1	**57**
2013–14	53	3	13	1	**70**
2014–15	47	6	8	–	**61**
2015–16	53	4	3	1	**61**
2016–17	32	3	8	2	**45**
Total	**255**	**21**	**40**	**5**	**321**

Source: VAGO, based on EPA data.

For more serious environmental incidents, EPA may issue official warnings and infringement notices, or decide to prosecute the commercial operator. Between 2008 and 2015, EPA filed 13 cases for air discharge-related offences. These resulted in six convictions and two enforceable undertakings.

EPA advised that obtaining sufficient and reliable evidence to show operators' noncompliance with air discharge conditions is a major challenge to its enforcement efforts.

Risk-based regulatory model

EPA's risk-based regulatory model determines the course of action it takes to monitor compliance, and the sanctions it imposes in the event of noncompliance. EPA's Compliance and Enforcement Policy outlines its aim to prioritise resources where they can make the biggest difference, by addressing the biggest risks to the environment and human health.

Our review of EPA's activities over the past few years shows that it has been working steadily on regulatory reform. Keen to be an effective and modern regulator, EPA continually reviews and improves its compliance and enforcement efforts.

Improved processes

Guided by previous Ombudsman Victoria and VAGO reports and following an EPA-initiated Compliance and Enforcement Review in 2010 and an Approvals Review in 2013, EPA has worked to improve its processes and embed its risk-based approach in its licensing requirements. In recent years, EPA has developed:

- a framework to review and revise all licences to ensure the currency of licence conditions and provide consistent emission limits to better protect the environment
- the Licensed Operator Risk Assessment model to help EPA prioritise its compliance inspections using six criteria—site activities, proximity to receptors, emissions and waste, site management, compliance rating, and community engagement
- new guidance documents for business operators, including the Licence Assessment Guidelines to assist operators in preparing their APSs, and the Licence Management Guidelines to help operators better understand their licence conditions and how to comply with them
- new or revised EPA internal documentation to assist staff in applying compliance and enforcement tools—for example, guidance on reviewing air discharge limits
- a more rigorous approach for monitoring major industry facilities, which are identified by the scale of discharges, quantity of materials stored or the complexity of industrial processes—these facilities are generally complex and use specialist technical staff to oversee environmental management systems.

Major industry assessments

Following recommendations from its Compliance and Enforcement Review, EPA set up the Major Industry Program in 2015 to develop specialist resources to systematically assess the effectiveness of environmental management systems used by major industry facilities to control and minimise environmental risks.

Over the period 2015–16 to 2016–17, the group undertook 40 major industry assessments, of which 36 are now complete. Assessments of a further 13 facilities are scheduled for 2017–18.

Two of the major industry facilities assessed under the program were unlicensed premises. The assessments determined that one of these facilities was inappropriately operating without an EPA licence, since its air discharges exceeded the required threshold of Environment Protection (Scheduled Premises) Regulations 2017. Consequently, the operator was required to apply for a works approval and operating licence.

Continuing challenges

While EPA has made considerable improvements, there are continuing challenges that require increased vigilance.

First, if the operator does not report a noncompliance and it is not reported by the community or some other source, EPA is unlikely to find out about it. The onus is on licensed operators to monitor their discharges and self-report breaches of licence conditions.

This approach assumes that operators have appropriate processes to reliably monitor air discharges and that they will voluntarily report any licence breaches. However, as the APS audits show, many of the audited operators either do not have monitoring plans or have weak monitoring and/or reporting processes. Further, while EPA's compliance and monitoring practices are beginning to improve, its limited enforcement activities to date do not necessarily encourage self-reporting.

If the responsible commercial and industrial operators are not brought to the attention of the EPA for appropriate sanctions, there is a risk that the Victorian community will be exposed to unlawful air discharges.

Second, EPA's efforts are largely targeted at Victoria's 658 licensed operators. There are many more unlicensed operators than licensed ones, over which EPA exercises limited oversight.

Some of these unlicensed operators, such as closed landfill and recycling operators, are major contributors to air pollution in Victoria. These operators also include several thousand smaller operators that discharge air pollutants in their day-to-day operations, but the cumulative impact of their operations on Victoria's air quality is unknown.

Managing air discharges from unlicensed operators is problematic. Local government is primarily responsible for the oversight of these operators. While councils' environmental officers are able to initially respond to complaints from the community about smoke, dust or odour, councils rely on EPA for its specialist skills in environment management systems and air discharges.

Stakeholders we consulted for the audit informed us that getting a timely response from EPA on requests for assistance with inspections and planning permit applications is a common concern for councils.

To help address this issue, DELWP has begun implementing a $4.8 million Officers for the Protection of the Local Environment (OPLE) pilot program, by deploying 10 officers across 13 councils. The pilot is testing the viability of sharing an OPLE across two or more councils.

OPLEs are EPA employees whose primary role is to respond to lower-complexity pollution and waste issues which neither council nor the EPA can attend to. We believe that this is a step in the right direction, and DELWP and EPA should continue to work together to evaluate and further refine the program to respond to emerging council needs. This includes assisting and/or increasing councils' capability to deal with more complex pollution and waste issues, which the OPLEs are not currently able to do.

In line with our earlier findings on the limitations of EPA's current air quality monitoring network, EPA needs to consider how it could obtain and validate information on operators' air discharges as well as air quality data at and around the boundaries of industrial operators. EPA should also require operators to have independent audits on the nature and extent of their air discharges. Community complaints and self-reporting by operators should only be secondary sources of information for EPA.

4.5 Case study: Brooklyn Industrial Precinct

The poor air quality arising from the Brooklyn Industrial Precinct presents a good example of the complex issues involved in air quality management and how EPA needs to continue developing a close working relationship with councils and other government agencies to address harmful air emissions. While the precinct overlaps three city councils—Brimbank, Maribyrnong and Hobsons Bay—this case study focuses on the partnership between Brimbank City Council and EPA.

Local governments face a range of challenges in dealing with air quality management, including:

- their reliance on EPA for technical environmental expertise
- weaknesses in legacy planning schemes that have allowed for 'existing use' rights
- limited or poorly worded conditions in planning permits relating to environmental management which inhibit councils' ability to take enforcement action against operators that cause detrimental environmental impacts
- a lack of clarity surrounding the respective roles and responsibilities of EPA and local government relating to air quality management.

Industrial operators have existed in what is now the Brooklyn Industrial Precinct since the 1870s. The precinct covers an area of approximately 6.3 square kilometres. It is bounded by the Westgate Freeway to the south, Kororoit Creek to the west, Somerville Road and Stony Creek to the north, and Cemetery/Tottenham/Paramount Road to the east. The precinct covers parts of Brooklyn, Tottenham and Yarraville.

There are approximately 120 businesses operating in the precinct, including warehousing, motor repairs, transport and logistic uses, and shipping container storage. Various noxious industries—abattoirs, landfills, knackeries, tallow works, and resource and recycling—are also found in the area. Only 10 of these business operators are licensed by EPA.

Residential areas are located as close as 50 metres from the precinct, primarily to the south. Industrial activities within the precinct have the potential for significant on- and off-site impacts to the environment, including dust, odours and noise.

Historically, many of the precinct operators started when no planning approval was required or, if operators were given planning approval, the associated permits contained limited conditions regarding environmental management. Brimbank City Council advised that the inconsistent planning permit conditions issued over past decades have significantly limited the council's capacity to undertake enforcement activities.

The council advised that it was initially difficult to ascertain the division of roles and responsibilities between itself and EPA. A memorandum of understanding helped clarify their responsibilities and how they can work well together.

To this end, the council strengthened its capacity to address environmental concerns by creating an internal working group, to strategically investigate and resolve issues in the Brooklyn Industrial Precinct. This led to more targeted enforcement action against noncompliant industries. Outcomes of this sustained effort include the following:

- Brooklyn Evolution Strategy—the council commissioned the development of this strategy to plan the long-term use of the precinct and improve environmental outcomes for the area. The strategy also provides a long-term vision for the Brooklyn Industrial Precinct that incorporates community, the council and state government aspirations and addresses the key issues and opportunities for the precinct.
- Schedule 11 of the Design and Development Overlay (DDO11)—in August 2016, the council introduced DDO11 into the Brimbank Planning Scheme to require new developments, works or expansion of an 'existing as of right' industry to incorporate appropriate design measures, to protect surrounding residents and businesses from adverse visual, noise, odour or dust impacts and provide best-practice environmental design.
- Clause 8.1 of the council's General Local Law (January 2018)—stockpiles have caused excessive dust emissions which have considerably impacted air quality within the precinct. Brimbank City Council's General Local Law 2018 introduced new controls over stockpiles, requiring that land is kept free of any stockpile that adversely impacts the amenity of the property.

'Existing as of right' use occurs when land is being used in a legal way, either with an approved permit or an approved use where a permit is not required, and the planning controls now in place prohibit that use.

EPA initially focused on determining the sources of air pollution in the precinct. It conducted dust dispersion modelling in 2011 and found that Bunting and Jones roads were the single largest sources of road dust within the precinct. EPA collaborated with VicRoads and Sustainability Victoria and worked with council and local operators to have these roads sealed, as well as some private roads. Council contributed $750 000 in 2015 to seal the roads, and the Victorian Government contributed $900 000. Council confirmed that, although there continues to be dust issues, there has been a significant improvement since these roads were sealed.

EPA air quality monitoring

EPA air quality monitoring for PM10 started in Brooklyn and Yarraville in 2009. No results were published for 2009. Figure 4D demonstrates the number of exceedances of the PM10 one-day average of 50 µg/m³ as reported by EPA in its 2016 Brooklyn air quality update.

Figure 4D
Brooklyn exceedances from EPA documentation

Metric	2010	2011	2012	2013	2014	2015	2016
PM10 one-day average	40	11	21	29	26	11	9

Note: EPA documentation did not refer to exceedances in PM10 one-year average values.
Source: VAGO, based on EPA documentation.

The drop in exceedance days from 26 in 2014 to 11 in 2015 coincides with the completion of sealing Jones and Bunting roads, a major source of PM10 discharges to the Brooklyn air environment. The council and EPA did well in collaborating to effectively identify and address a major pollution source. Notwithstanding the drop in exceedance days, the council and EPA should continue to aim for zero exceedance days in order to comply with NEPM AAQ standards.

Continuing challenges

'Existing use' rights

As mentioned above, many of the operators contributing to poor air quality have been operating for many years and, as such, have 'existing use' rights under the Brimbank Planning Scheme. This means that the operator is allowed to undertake the industrial activity without either a planning permit or an EPA licence that sets limits or conditions on air discharges. Because of this, the council advised that it has been difficult to get these operators to engage in better-practice processes to minimise emissions.

Lack of resources and specialist expertise

The council advised that it does not have specialist staff to handle issues associated with dust-generating activities, and has minimal resources to inspect and monitor pollution from industrial operations. Air monitoring and evaluation requires specialist equipment and staff qualified in scientific analysis to collect and interpret results.

The council relies on expert advice from EPA or environmental consultants engaged by development proponents. Under the OPLE pilot program, the council was recently selected to share an OPLE with Hobsons Bay City Council. Brimbank City Council is optimistic that the additional resource provided by the OPLE program could play a significant role in assisting to reduce dust and odour emissions from poorly operating industries in the Brooklyn Industrial Precinct.

Air discharges from business operators within the precinct

EPA and the council advised that there remain up to 10 precinct operators that continue to be a source of inappropriate air emissions and noxious odours. EPA has commenced more rigorous enforcement actions, including prosecution.

Case study: City of Ballarat

Appendix C includes a case study on a local government unit's management of air quality. The case study shows how a regional Victorian council deals with environmental issues, particularly air discharges. It also reflects the challenge of identifying point sources of air pollution separate to complaints from the community.

Appendix A
Audit Act 1994 section 16—submissions and comments

We have consulted with EPA, DELWP, City of Ballarat and Brimbank City Council, and we considered their views when reaching our audit conclusions. As required by section 16(3) of the *Audit Act 1994*, we gave a draft copy of this report, or relevant extracts, to those agencies and asked for their submissions and comments. We also provided a copy of the report to the Department of Premier and Cabinet.

Responsibility for the accuracy, fairness and balance of those comments rests solely with the agency head.

Responses were received as follows:

RESPONSE provided by the Chief Executive Officer, EPA

Our Ref: MA007645

Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
L31, 35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves

Proposed Performance Audit Report -Improving Victoria's Air Quality

Thank you for your letter of 9 February 2018 enclosing the Final Draft Report – Improving Victoria's Air Quality.

As noted in the report, clean air is of great importance for the health and wellbeing of Victorians and is therefore an issue of significant community interest.

Environment Protection Authority (EPA) Victoria welcomes the report's findings and accepts the recommendations. EPA's actions in response to the five recommendations are attached (Attachment 1). We appreciate the report acknowledges that EPA is:

- improving its regulation of the sources of air pollution by better embedding its risk-based approach;
- taking steps to provide more assistance for local government through the Officers for the Protection of the Local Environment pilot program; and
- commencing the Environmental Data Information Systems Online project to deliver a refreshed platform to reliably collect, analyse, store and share data.

In addition, as you are no doubt aware, EPA is delivering on the biggest reform package in our 47-year history.

The Victorian Government's Response to the Independent Inquiry into the EPA recognises that our health, quality of life and world recognised liveability are dependent on clean air, water and land. The government has committed over $162 million to deliver the EPA reforms, including improvements to EPA's capacity and capability in air monitoring. These reforms have also seen the establishment of the Chief Environmental Scientist position to underpin and strengthen our science and associated areas of operation, including air monitoring and advice to the community.

Since the Hazelwood fire EPA has, with government support, invested significantly in building a new capability around air monitoring, enabling the deployment of air monitors anywhere in the state. EPA has also made significant improvements to how we make air quality data available to community through AirWatch; however, we recognise that further work on this is required.

EPA continues to build community trust and engagement on air quality from measurement through to co-design solutions with the community, as well as the adoption of benefits offered by new technologies.

EPA VICTORIA

Environment Protection Authority Victoria

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VICTORIA State Government

RESPONSE provided by the Chief Executive Officer, EPA—continued

Completion of EPA actions outlined in Attachment 1 to address the recommendations will be monitored under EPA's Audit Management Framework.

Yours sincerely

NIAL FINEGAN
CHIEF EXECUTIVE OFFICER
ENVIRONMENT PROTECTION AUTHORITY VICTORIA

23 / 2 /2018

VAGO AUDIT – IMPROVING VICTORIA'S AIR QUALITY
Attachment A

Table 1 – EPA responses to final report recommendations (for which EPA has a role and responsibilities)

Audit rec no.	Recommendation	Proposed Action	Completion Date
1	We recommend the Environment Protection Authority expand its air monitoring network by: 1.1 reviewing and updating its current ambient air quality monitoring plan to reflect its risk based approach to environmental regulation 1.2 in addition to its ambient air quality monitoring for purposes of the NEPM AAQ, designing and implementing an air monitoring program that better aligns coverage with air pollution risks that Victorian communities are exposed to	1.1 Recommendation 6.3 of the Victorian Government's Response to the Independent Inquiry into the EPA requires EPA to assess the adequacy of its air and water monitoring networks. The *Environmental Monitoring Capability Review* is well progressed, and once the air quality monitoring network component of this review is complete (action 1.2), EPA will update its ambient air quality monitoring plan. 1.2 EPA will continue to progress the *Environmental Monitoring Capability Review*. VAGO's recommendation will be factored into the review of the air monitoring network component of this current work. This review will help determine how EPA will deploy resources. EPA will work with government to determine how best to implement the findings of this review.	*Environmental Monitoring Capability Review* expected 30 September 2018 *Environmental Monitoring Capability Review* expected 30 September 2018 Any proposed changes to EPA's air monitoring program would be dependent on decisions by government, including funding.

Audit rec no.	Recommendation	Proposed Action	Completion Date
2	We recommend the Environment Protection Authority improve its reporting on air quality by: 2.1 introducing a rigorous quality review process to ensure the accuracy and reliability of the state's air quality data and assessments against NEPM AAQ standards as presented across its various reporting, including on its AirWatch website 2.2 developing readable and easily accessible annual reports on the results collected from all the air monitoring across the state, highlighting assessments against standards and recorded exceedances	2.1 **A)** EPA will, with the support of counterpart agencies in other jurisdictions, review its existing quality review process to ensure accuracy of air quality data and assessments against AAQ NEPM standards. This will be reflected in EPA's 2019 AAQ NEPM compliance report. 2.1 **B)** EPA will also complete the current process of seeking NATA certification for the Beta Attenuation Method (BAM) of monitoring PM2.5. EPA's air monitoring methods used for reporting against the NEPM AAQ standards are NATA accredited except for the BAM method.	30 June 2019 30 June 2019
		2.2 **A)** EPA will deliver a renewed data storage platform to manage Air Monitoring Data as part of its continued delivery of the Environmental Data Information Systems Online project. This project streamlines data collection, analysis, and storage while simplifying data sharing. 2.2 **B)** EPA will review its current air quality monitoring and assessment information to maximise access to clear and easily understood information in formats of most use to Victorians. For example, this may include an online portal, smartphone app or other flexible means of meeting diverse user needs.	30 June 2019 30 June 2019

Audit rec no.	Recommendation	Proposed Action	Completion Date
3	We recommend the Environment Protection Authority expand and update its knowledge of Victoria's air quality by: 3.1 completing a comprehensive Victorian air emissions inventory to identify current major point and diffuse sources of air pollution 3.2 determining and preparing an action plan on how best to (1) oversight the air quality monitoring conducted by high risk operators to ensure that monitoring plans are in place, and that these plans are appropriately implemented; and (2) understand and effectively respond to air emissions from lower risk sites	3.1 EPA is currently developing an updated air emissions inventory for major and diffuse sources. This work will identify current major point sources of air pollution.	30 September 2018
		3.2 **A)** EPA will prepare an action plan on how to increase the oversight of air quality monitoring conducted by high-risk operators. EPA will consider relevant recommendations from the Independent Inquiry into the EPA and the Victorian Government's response in the development of the plan.	30 June 2019
		3.2 **B)** EPA will complete its current review of brown coal-fired power station licences focusing on improvements in reporting transparency.	31 December 2018
		3.2 **C)** EPA's updated air emissions inventory (action 3.1), will allow better understanding of the significance of contributions of air pollutants by source types. Following the air emissions inventory update, EPA will prepare an action plan on how to respond more effectively to cumulative air emissions and impacts from lower risk sites.	31 December 2019

Audit rec no.	Recommendation	Proposed Action	Completion Date
4	We recommend that the Environment Protection Authority, work with all relevant councils to address air quality issues at the Brooklyn Industrial Precinct by: 4.1 reducing exceedance days and achieving National Environment Protection (Ambient Air Quality) Measure standards for PM10, and considering the need to monitor other pollutants 4.2 agreeing on the installation and location of additional air monitoring stations to measure the impact of air discharges on nearby residential communities.	4.1 **A)** EPA, together with Brimbank City Council and Hobsons Bay City Council, are partners in the Officers for the Protection for the Local Environment (OPLE) Pilot Program. This will enhance our collective capability to address air quality issues in the Brooklyn Industrial Precinct. 4.1 **B)** EPA will continue to work with councils, community and industry through the Brooklyn Community Reference Group to address air quality issues in the Brooklyn Industrial Precinct. 4.1 **C)** EPA will update its current Brooklyn Industrial Precinct Action Plan in consultation with relevant councils on how best to progress towards achieving compliance with state and national PM10 objectives and goals surrounding the precinct. 4.2 EPA will complete the air monitoring network component of the *Environmental Monitoring Capability Review* (action 1.1) and then update its ambient air monitoring plan, having consideration for problem sites including Brooklyn Industrial Precinct.	OPLE Pilot Program to continue to December 2018 Ongoing 31 December 2018 *Environmental Monitoring Capability Review* expected 30 September 2018 Any proposed changes to EPA's air monitoring program would be dependent on decisions by government, including funding.

Audit rec no.	Recommendation	Proposed Action	Completion Date
5	5.1 We recommend the Environment Protection Authority and the Department of Environment, Land, Water and Planning clarify the roles and responsibilities of relevant Victorian Government agencies with respect to air quality management, and develop protocols to ensure accountabilities are understood and coordination is achieved.	5.1 There are clear protocols to manage smoke during emergency incidents, when clarity of role is critical for community safety. Separate to emergency incidents, there are a number of agencies at all levels of government involved in managing air quality. In recognition of this complexity, EPA together with DELWP as lead agency will work to clarify roles, responsibilities and accountabilities, and improve coordination.	31 August 2018

RESPONSE provided by the Secretary, DELWP

Department of Environment, Land, Water and Planning

PO Box 500, East Melbourne
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delwp.vic.gov.au

Mr Andrew Greaves
Auditor-General
Level 31 / 35 Collins Street
MELBOURNE VIC 3000

Ref: SEC013412

Dear Mr Greaves

PROPOSED PERFORMANCE AUDIT REPORT - IMPROVING VICTORIA'S AIR QUALITY

Thank you for your letter dated 9 February 2018 providing the Department of Environment, Land, Water and Planning (DELWP) with the proposed performance audit report *Improving Victoria's Air Quality*.

It is critical for Victorians' health and wellbeing, and for the protection of our environment, that we have clean air. DELWP therefore welcomes the performance audit report's findings and its recommendations to further improve Victoria' air quality monitoring and management.

I note that DELWP has joint responsibility for achieving Recommendation 5. Please find attached the action the Department proposes to take to acquit this.

DELWP will also support the Environment Protection Authority (EPA) in their acquittal of the remaining recommendations, directed to EPA, and work with other agencies to continue to protect Victoria's air quality.

I welcome your staff following up periodically with DELWP to monitor our progress in implementing Recommendation 5. Please contact Kate Gavens, Director Environment Protection for any assistance you require. Kate can be contacted on 9637 8591 or by email at kate.gavens@delwp.vic.gov.au.

DELWP has appreciated the opportunity to be consulted to inform this important audit.

Yours sincerely

John Bradley
Secretary
26 / 2 / 18

VICTORIA State Government

RESPONSE provided by the Secretary, DELWP—continued

IMPROVING VICTORIA'S AIR QUALITY

Management Action Plan – Department of Environment, Land, Water and Planning

Rec #	Potential Audit Recommendation (based on provisional draft)	Actions in response to recommendation	Date of completion
5	We recommend that the Environment Protection Authority (EPA) and the Department of Environment, Land, Water and Planning (DELWP) clarify the roles and responsibilities of relevant Victorian government agencies with respect to air quality management, and develop protocols to ensure accountabilities are understood and coordination is achieved.	DELWP will act as the lead agency to implement this recommendation. DELWP will work with EPA and relevant agencies, including the local government sector, to ensure roles, responsibilities and processes for air quality management are clear and documented, and facilitate effective coordination and consultation.	31 August 2018

SEC013412 Page 2

RESPONSE provided by the Director Infrastructure and Environment, City of Ballarat

City of Ballarat

PO Box 655
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AUSTRALIA

Telephone: 03 5320 5500
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Date: 23 February, 2018

Our Ref: TD:bk

Your Ref: File No: 32977

Enquiries: 03 5320 5500

Writer's Direct Fax:

Mr Andrew Greaves
Auditor General
Victorian Auditor-General's Office (VAGO)
Level 31, 35 Collins Street
Melbourne VIC 3000

Dear Mr Greaves

RE: PROPOSED PERFORMANCE AUDIT REPORT
IMPROVING VICTORIA'S AIR QUALITY

Thank you for your letter addressed to the Mayor, Cr Samantha McIntosh, dated 9 February 2018 seeking a response to each of the recommendations directed to the City of Ballarat. This has been forwarded to me for my response.

The Council welcomes the VAGO Audit and the engagement of the City of Ballarat as a case study from a local government perspective. Your officers have acted in both a professional and thorough manner and we trust that the commitment from City of Ballarat staff was similarly valuable in resolving the report in this instance.

The City of Ballarat has no concerns or issues with the body of report or recommendations contained therein.

Again, I very much appreciate the professional manner in which the audit was carried out.

If you have any further queries, please contact me directly on 0428 335 616.

Yours sincerely

Terry Demeo
Director Infrastructure and Environment

CC: Mayor, Cr Samantha McIntosh
CEO, Justine Linley

RESPONSE provided by the Chief Executive Officer, Brimbank City Council

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PO BOX 70
Sunshine, Victoria 3020

23 February 2018

Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves,

Proposed Performance Audit Report for *Improving Victoria's Air Quality*

Thank you for providing Council the opportunity to provide comments about the proposed performance audit report for Improving Victoria's Air Quality, received by Council on 9 February 2018.

Council has reviewed the report and is satisfied that the information and facts contained within the report relating to Council have been represented accurately and fairly, particularly in the context of the Brooklyn Industrial Precinct case study.

The recommendations contained in the report are primarily directed towards the EPA and Department of Environment, Land, Water and Planning, however, there are implications for Council and from this perspective we provide the following comments:

- Council would welcome the clarification of the roles and responsibilities of relevant Victorian government agencies with respect to air quality management. Council would work with and provide any feedback or information to facilitate this process to the relevant agencies, as required.

- Council will continue to engage with the EPA to progress discussions over 2018 on how the number of exceedance days in Brooklyn can be reduced to achieve National Environment Protection (Ambient Air Quality) Measure Standards for PM10. Council can also provide any input, as required, in relation to considering the need to monitor other pollutants.

- Council will continue to engage with the EPA to progress discussions over 2018 on any installation or location of additional air monitoring stations to measure the impact of air discharges from the Brooklyn Industrial Precinct.

In general, the performance audit report highlights the importance of government agencies working together to achieve common goals or objectives, particularly when dealing with a complex issue such as air quality.

The poor air quality issues associated with the Brooklyn Industrial Precinct demonstrates the difficulties faced by Council and other government agencies to improve air quality performance. Council will be continue to work with and improve its relationship with the EPA and related agencies through forums, such as the Brooklyn Community Representative Group meetings, the OPLE pilot project and regional Council networks to pro-actively tackle the issue and work collaboratively to provide direction on this issue.

17/245273

RESPONSE provided by the Chief Executive Officer, Brimbank City Council—continued

Should you require further clarification on the above comments please contact Simon Vittorio, Strategic Coordinator Planning Compliance, on 9249 4851 or SimonV@brimbank.vic.gov.au.

Yours sincerely

Helen Morrissey
Chief Executive Officer

Appendix B
EPA reporting on other indicator pollutants

For the period 2010 to 2016, EPA reported that NEPM AAQ air quality standards were met for carbon monoxide, nitrogen dioxide and sulfur dioxide. Reported figures show that concentration levels for these indicator pollutants remain well below set standards.

Carbon monoxide

The NEPM AAQ set the standard for carbon monoxide at a maximum eight-hour average of 9.0 ppm. EPA started monitoring carbon monoxide concentrations at Alphington, Melbourne, Richmond and Geelong South in 2002, and at Footscray in 2016. Monitoring ceased at the Melbourne station in 2006 and at Richmond in 2015. To date, stations at Alphington, Geelong South and Footscray continue to monitor carbon monoxide concentrations.

For the period 2010 to 2016, the maximum eight-hour average concentration for carbon monoxide was 3.2 ppm, well below the 9.0 ppm threshold. Figure B1 shows reported maximum values for this period.

Figure B1
Carbon monoxide compliance with NEPM AAQ standards, 2010 to 2016

Year	Maximum eight-hour average (ppm)	Number of exceedances	Compliance with NEPM AAQ standards
2010	3.2	0	Met
2011	2.9	0	Met
2012	2.2	0	Met
2013	2.6	0	Met
2014	1.7	0	Met
2015	1.7	0	Met
2016	2.1	0	Met

Source: VAGO, based on EPA air quality monitoring reports.

Nitrogen dioxide

The NEPM AAQ standards for nitrogen dioxide are:

- 0.12 ppm, one-hour average maximum concentration
- 0.03 ppm, one-year average maximum concentration.

The EPA monitors nitrogen dioxide concentrations at Alphington, Footscray, Geelong South and Traralgon. For the period 2010 to 2016, the maximum one-hour average concentration for nitrogen dioxide was 0.064 ppm, or nearly half of the 0.12 ppm threshold. Figure B2 shows reported maximum values recorded for this period.

Figure B2
Nitrogen dioxide compliance with NEPM AAQ standards, 2010 to 2016

Year	Maximum one-hour average (ppm)	Number of exceedances	Compliance with NEPM AAQ standards	
			One-hour average	One-year average
2010	0.038	0	Met	Met
2011	0.046	0	Met	Met
2012	0.037	0	Met	Met
2013	0.046	0	Met	Met
2014	0.064	0	Met	Met
2015	0.043	0	Met	Met
2016	0.043	0	Met	Met

Source: VAGO, based on EPA air quality monitoring reports.

Sulfur dioxide

The NEPM AAQ standards for sulfur dioxide are:

- 0.20 ppm, one-hour average maximum concentration
- 0.08 ppm, one-day average maximum concentration
- 0.02 ppm, one-year average maximum concentration.

EPA monitors sulfur dioxide concentrations at Alphington, Altona North, Geelong South and Traralgon. For the period 2010 to 2016, the maximum one-hour average concentration for sulfur dioxide was 0.101 ppm, or half of the 0.20 ppm threshold. There were no exceedances for sulfur dioxide from 2010 to 2016. Figure B3 shows reported maximum values recorded for this period.

Figure B3
Sulfur dioxide compliance with NEPM AAQ standards, 2010 to 2016

Year	Maximum one-hour average (ppm)	Compliance with NEPM AAQ standards		
		One-hour average	One-day average	One-year average
2010	0.068	Met	Met	Met
2011	0.052	Met	Met	Met
2012	0.101	Met	Met	Met
2013	0.070	Met	Met	Met
2014	0.044	Met	Met	Met
2015	0.062	Met	Met	Met
2016	0.057	Met	Met	Met

Source: VAGO, based on EPA air quality monitoring reports.

Lead

Air quality monitoring for lead ceased in December 2006. EPA explained that this is because, since 1995, concentrations were consistently very low compared to the air quality objective of 0.50 µg/m³ as an annual average.

Appendix C
Case study: City of Ballarat

With a population of 101 686 in 2016, Ballarat is a growing regional city with generally good air quality. Residents complain of smoke and dust issues from time to time.

Complaints handling process

The City of Ballarat receives approximately 100 000 customer service calls every year, but very few of these relate to poor air quality. In the 14 years to 10 October 2017, the council received 252 complaints about smoke and/or dust.

Air quality complaints fall into two categories:

- dust/smoke from unsealed roads or burning green vegetation—this contravenes local laws
- noxious odour—infringes the *Public Health and Wellbeing Act 2008*.

The council's customer service staff log all complaints in the council's corporate information system, which is accessible to relevant council divisions.

Council officers responsible for implementing the relevant Acts, regulations and local laws investigate and validate complaints through site visits. They use a range of compliance/enforcement tools including:

- community education—where issues can be resolved by building residents' capacity to comply, for example, educating residents on responsible burning and use of woodfired heaters
- negotiating compliance, issuing verbal directions or official warnings—for less serious breaches with limited amenity impacts
- statutory compliance notices—for example, a Notice to Comply or an Improvement or Prohibition Notice, requiring the offender to remedy a contravention or take certain steps to prevent a reoccurrence
- infringement notices—a punitive measure for more serious breaches, used as an alternative to prosecution.

The council advised that it is usually able to resolve complaints relating to domestic burning or use of woodfired heaters without assistance from EPA. However, for complaints relating to material recycling licensing, transfer stations, and smoke from commercial and industrial operators, the council seeks EPA assistance for site visits, investigations and enforcement action.

Council documentation shows that for smoke complaints received from 1 January to 15 October 2017, the council's response time was 4.1 days for 75 per cent of the complaints.

Industry and air quality issues

We asked the council to provide copies of the planning permits for commercial and industrial operators located in Ballarat that reported on their air discharges to the NPI. We required this documentation to determine what air discharge limits or conditions the council required for these operators, if any.

The council advised that none of these operators have planning permits—for some, planning permits were not a requirement when they first operated, and for the others, their commercial activity does not require one.

The council was unable to provide advice on whether the activities of these operators has had an impact on air quality in Ballarat.

Appendix D
EPA remedial measures and sanctions

Figure D1
EPA's enforcement tools—remedial measures and sanctions

Tool	Description	When applied
Remedial measures		
Compliance advice	Written advice from EPA officers.	Degree of (potential) harm is minimal, with no material impact.
Remedial notices	Legal directions to carry out works, stop activities or carry out investigations.	Where works or actions required to control risk, prevent further harm or comply with the law cannot be completed in the presence of an EPA officer.
Oral or written directions by an authorised officer	Direction to remove, dispose of, destroy, neutralise or treat any pollutant, waste, substance, hazard or noise.	Where there is imminent danger to life, limb or the environment.
Sanctions		
Warnings	Official written warning.	Used to signal that further noncompliance will result in escalating the enforcement response. Breaches of works approvals, licences, notices, permits, regulations and policies are of an administrative nature, with no material impact.
Infringement notices	Imposes a financial penalty for breaches of the law or EPA requirement and can be issued by an authorised officer.	Moderate to low environment impact. Noncompliance is minor.
Notice of contravention	Formally advises recipients that they are contravening a legal requirement. If recipients are prosecuted, they will be subject to daily penalties for ongoing contravention after the date of the notice.	Major ongoing contravention where further enforcement action is planned.
Enforceable undertakings	Alternative to prosecution. Allows the alleged offender to voluntarily enter into a binding agreement to undertake tasks to settle an alleged contravention of law and remedy the harm caused.	When the offender takes active responsibility for the offence—for example, a public apology—and where it will achieve a more effective environmental outcome than prosecution.
Suspension of licence or permit	Temporarily removes the ability for a licence holder to operate—can be for a specified period or until necessary conditions are fulfilled.	The licence holder has failed to demonstrate that continued operation would not result in an unacceptable risk or harm or has history of repeated breaches of licence conditions.

Figure D1
EPA's enforcement tools—remedial measures and sanctions—*continued*

Tool	Description	When applied
Injunctions	EPA can apply for an injunction from the Supreme Court to stop a person contravening the Act or a condition of a licence, notice, works approval or permit.	For example, when a business continues to discharge or handle waste, or conduct works without or in contravention of an approval or notice from EPA.
Prosecutions	Prosecution for criminal offences.	EPA will consider prosecuting an individual or company where other enforcement measures are inadequate or unlikely to ensure ongoing compliance. EPA adopts the policies of the Director of Public Prosecutions.
Revocation of licence or permit	Revoking a licence or permit permanently removes the ability for a licence holder or waste transporter to operate.	The licence or permit holder has history of serious breaches. The holder has been convicted of an offence and is, in EPA's opinion, no longer fit to operate. Serious breaches continue after prosecution. EPA cannot be assured that the premises will continue to be safe to people or the environment.

Source: VAGO, based on EPA documentation.

Appendix E
Monitoring stations' siting requirements

Figure E1
Siting requirements for monitoring stations under AS/NZS 3580.1.1

Pollutants	Requirements
PM10, PM2.5	Height above ground: 1–15 metres
	Clear sky angle: 120 degrees
	Unrestricted airflow: 270 degrees around sample inlet
	Distance from nearest object or trees: 10 metres
	Distance from road: at least 50 metres
Ozone	Height above ground: 2–15 metres
	Clear sky angle: 120 degrees
	Unrestricted airflow: 270 degrees around sample inlet
	Distance from nearest object or trees: 10 metres
	Distance from road: at least 10 metres

Source: AS/NZS 3580.1.1.

Appendix F
Legislation and policies

Figure F1
Legislation and policy for air quality management in Victoria

Environment Protection Act 1970
Environment Effects Act 1978
Major Transport Projects Facilitation Act 2009
Planning and Environment Act 1987
Victoria Planning Provisions Planning Schemes
Occupational Health and Safety Act 2004
Dangerous Goods Act 1985
Mineral Resources (Sustainable Development) Act 1990
National Environment Protection Council Act 1994
National Environment Protection (Ambient Air Quality) Measure 2016
National Environment Protection (Air Toxics) Measure 2004
National Environment Protection (Diesel Vehicle Emissions) Measure 2001
National Environment Protection (National Pollutant Inventory) Measure 2008
National Environment Protection Council (Victoria) Act 1995
Public Health and Wellbeing Act 2008
State Environment Protection Policy (Ambient Air Quality) 2016
State Environment Protection Policy (Air Quality Management) 2001
State Environment Protection Policy (Scheduled Premises) Regulations 2017
State Environment Protection (Fees) Regulations 2012
State Environment Protection (Vehicle Emission) Regulations 2013
Waste Management Policy (Solid Fuel Heating) 2004
Waste Management Policy (Protection of the Ozone Layer) 2001
Waste Management Policy (Waste Acid Sulfate Soils) 1999
Waste Management Policy (National Pollutant Inventory) 2012

Source: VAGO.

Auditor-General's reports tabled during 2017–18

Report title	Date tabled
V/Line Passenger Services (2017–18:1)	August 2017
Internal Audit Performance (2017–18:2)	August 2017
Effectively Planning for Population Growth (2017–18:3)	August 2017
Victorian Public Hospital Operating Theatre Efficiency (2017–18:4)	October 2017
Auditor-General's Report on the Annual Financial Report of the State of Victoria, 2016–17 (2017–18:5)	November 2017
Results of 2016–17 Audits: Water Entities (2017–18:6)	November 2017
Results of 2016–17 Audits: Public Hospitals (2017–18:7)	November 2017
Results of 2016–17 Audits: Local Government (2017–18:8)	November 2017
ICT Disaster Recovery Planning (2017–18:9)	November 2017
Managing the Level Crossing Removal Program (2017–18:10)	December 2017

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