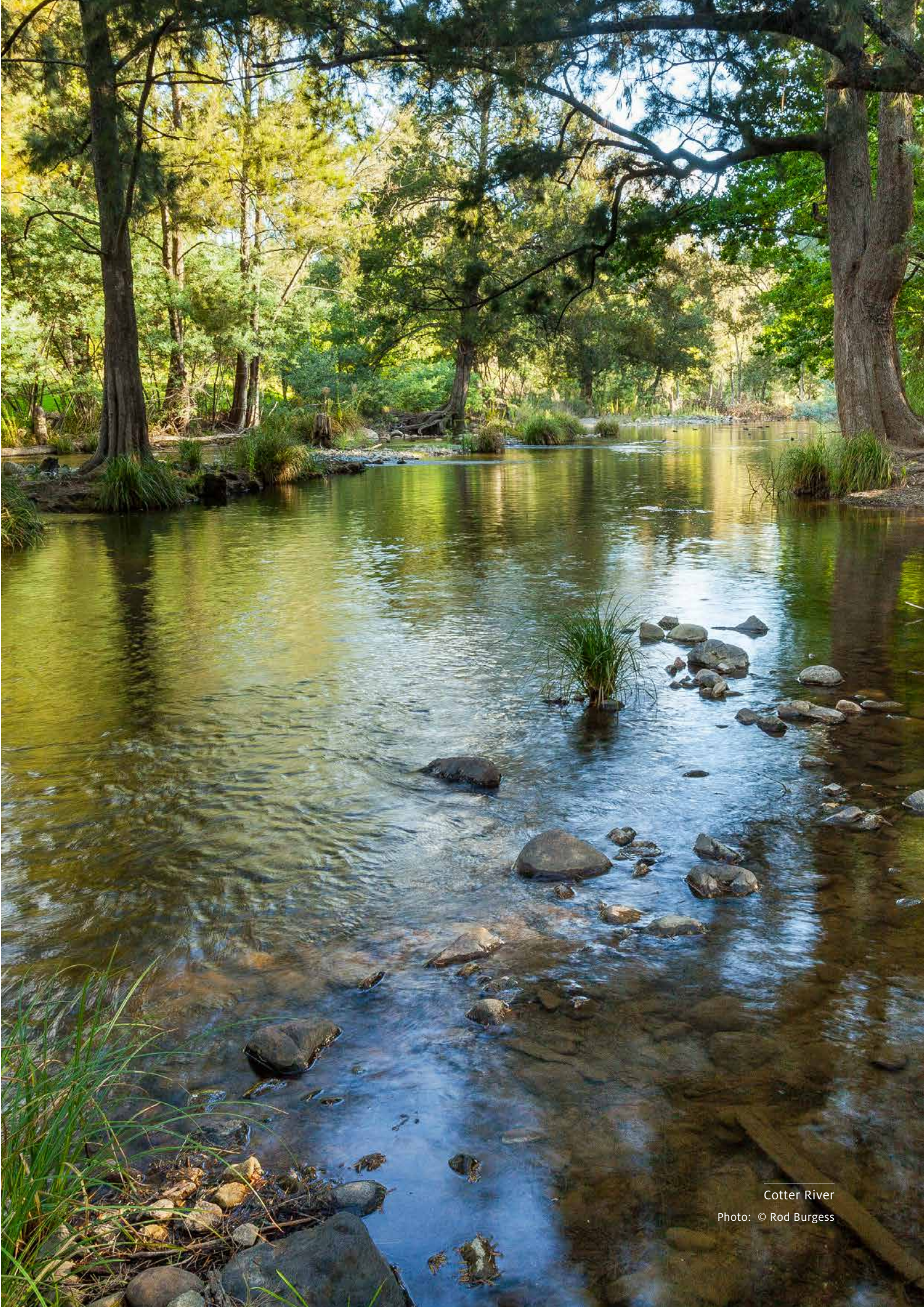
How is our environment faring?



Cotter River

Photo: © Rod Burgess

4 Air

4.1 Main findings

The Australian Capital Territory (ACT) has good ambient air quality. The results of air quality monitoring during the reporting period show excellent results and continued compliance with National Environment Protection (Ambient Air Quality) Measure standards.

Motor vehicles are still the main source of emissions in the ACT.

Pollution from wood smoke in winter is the major source of exceedances of particulate matter (PM) standards. Smoke from bushfires and hazard reduction burns, both in the ACT and New South Wales, also causes these standards to be exceeded. The ACT Government is conducting a range of programs and campaigns to reduce the number of wood heaters in homes, and to educate people about how to best use wood heaters in an effort to reduce wood smoke from domestic heating.

The Air Quality Index website was launched by ACT Health in late 2014 to provide access to real-time air quality data and allow residents to better understand how air quality may affect them.

A new monitoring station was installed during the reporting period to meet National Environment Protection Measure standards as the ACT's population grows.

Revised ambient air quality reporting measures are being considered at a national level. The likely updates are primarily concerned with PM and seek to establish variations to the standards.

4.2 Introduction

This chapter reports against a number of indicators. These indicators measure the state of ambient air quality, assess trends in the state of air quality throughout the reporting period, and look at what the pressures on air quality are in the Australian Capital Territory (ACT) and how these pressures affect our ambient air quality.

This chapter will:

- define air and air quality
- explain why air quality is important
- explain how air quality is measured
- describe the current state of air quality in the ACT
- assess whether air quality is stable, improving or declining
- describe the pressures on air quality in the ACT and the impacts these pressures are having
- assess whether these impacts are stable, increasing or decreasing
- summarise government response mechanisms.

4.2.1 What is air and air quality?

Air is essential for sustaining life. The composition of air is the result of the co-evolution of the atmosphere, geosphere and biosphere during billions of years. Air comprises mainly nitrogen (78%) and oxygen (21%). Various trace gases make up the rest. Water vapour is also present in variable amounts, depending on atmospheric conditions.

In this report, air quality refers to the quality of the ambient air, as defined by the National Environment Protection Council (NEPC) National Environment Protection (Ambient Air Quality) Measure (Ambient Air Quality NEPM): 'Ambient air means the external air environment, it does not include the air environment inside buildings or structures'.[1]

Good air quality means that the air is clean, clear and unpolluted. Clean air is essential for humans, other animals, vegetation, water and soil. Poor air quality is usually due to pollutant emissions into the air, from either human or other sources. If pollutants reach high enough concentrations, they can endanger human health and the environment. Everyday choices, such as driving cars and burning wood for domestic heating, can have a significant impact on air quality.

4.2.2 Why is air quality important?

The quality of our air is one of the most tangible indicators of the state of our local environment, and is one that directly affects human health and wellbeing (Figure 4.1). Clean air is associated with better physical and mental health, longer life and significant financial savings from reduced health-care expenses.

To understand the links between air quality and human wellbeing, it is useful to consider both the benefits of clean air, and the harms and costs associated with polluted air.

Canberra enjoys good air quality

Photo: Mark Jekabsons

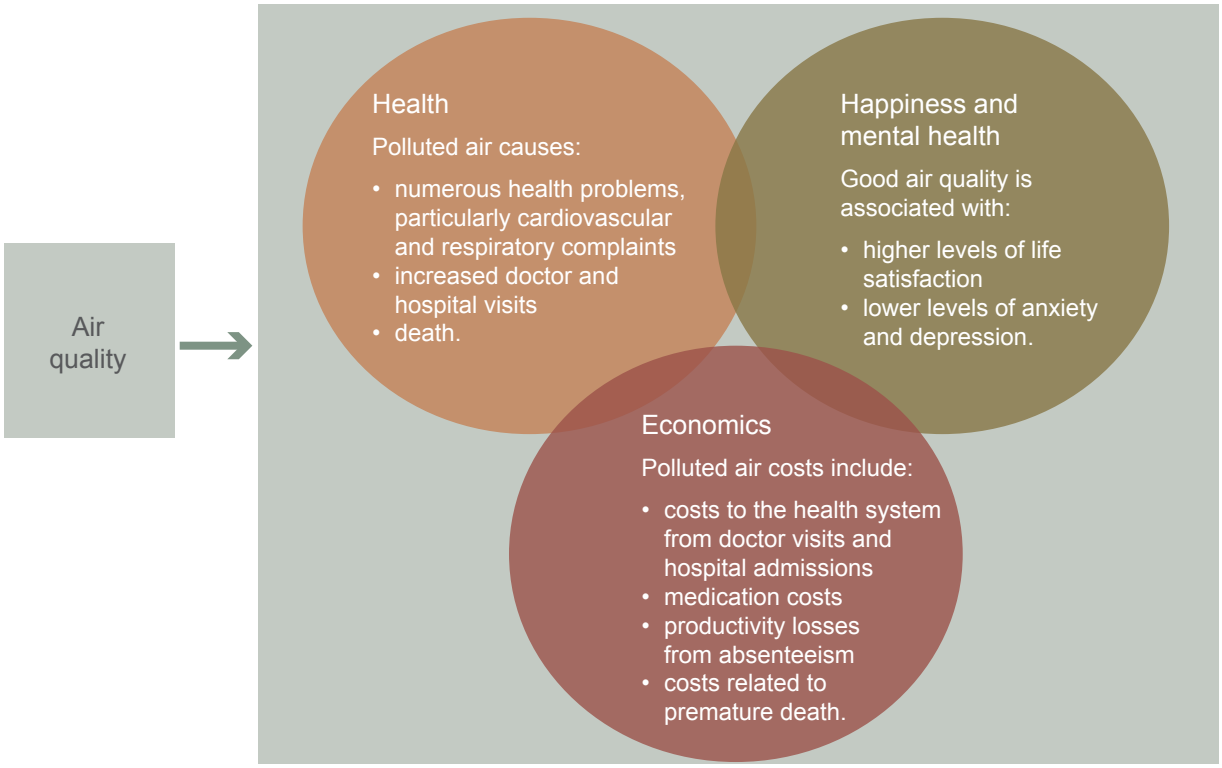


Figure 4.1 Links between air quality and human socioeconomic wellbeing

Health

Polluted air causes a range of short- and long-term negative health outcomes (Table 4.1). Many people, such as those with chronic respiratory conditions, are at greater risk of experiencing adverse health events when exposed to poor-quality air.[2] Cardiovascular and respiratory complaints are some of the most common and widespread effects, with acute cases resulting in increased doctor and hospital visits, and even death in extreme cases.[3,4] The World Health Organization estimates that 3.7 million people died prematurely as the result of ambient air pollution in 2012 worldwide, representing 6.7% of total deaths in that year. Outdoor air pollution has also recently been classified as carcinogenic to humans.[5]

Air quality has also been shown to affect people's levels of happiness and mental wellbeing. Research from around the world has shown higher levels of a range of air pollutants to be associated with lower levels of life satisfaction.[14-17] There is evidence that air pollution can lower people's cognitive function, and contribute to depression and anxiety.[18-22] Dust, smog and haze also reduce aesthetic and amenity values of outdoor areas, affecting people's enjoyment of these spaces.[23]

Table 4.1 Specific air pollutants, sources, exposure pathways and health effects

Pollutant	Source	Exposure pathway	Effects on human health
Carbon monoxide	Motor vehicles, burning of fossil fuels, bushfires, tobacco smoke	Blood absorbs carbon monoxide more readily than oxygen, reducing the circulatory system's ability to transport oxygen	Can produce tiredness, headaches and visual disturbance; impairs performance on tasks that require vigilance; aggravates cardiovascular disease; associated with low birth weight after maternal exposure during pregnancy
Nitrogen dioxide	Power stations, motor vehicles, mining and other industries	Inflames the lining of the lungs	Decreases lung function, especially for asthmatics; increases susceptibility to respiratory pathogens; exacerbates respiratory disease
Ozone	Complex reactions in the atmosphere involving nitrogen oxides, hydrocarbons and solar radiation	Irritates the lining of the nose, airway and lungs	Reduces lung function and capacity to exercise; induces coughing and chest discomfort; increases asthma attacks; causes eye and throat irritation; may negatively affect cardiovascular system; may increase mortality; long-term exposure may contribute to chronic lung disease and impair lung function development
Particulate matter as PM_{10} and $PM_{2.5}$	Motor vehicles, power stations, domestic and other fires, sea salt, airborne dust, pollen, mining, urban development	Particles are deposited throughout the respiratory tract, with a range of effects largely related to inflammation	May cause breathing difficulties; increases the prevalence of chronic respiratory disease and risk of acute respiratory disease, including lung cancer; contributes to the incidence of heart disease; some particles contain cancer-causing materials; can lead to premature death

PM_{10} and $PM_{2.5}$ = particulate matter smaller than 10 and 2.5 micrometres, respectively
Sources: Asthma Australia,[6] Brook et al,[7] Dennekamp & Carey,[8] Department of the Environment and Heritage,[9] House et al,[10] Morgan et al,[11] National Environment Protection Council,[5] Vallero,[12], World Health Organization[13]

Economics

In 2000, the health costs associated with particulate matter (PM) pollution from transport and wood heater emissions in Australia were estimated to be around $5 billion.[24] More recent studies suggest that the annual costs of air pollution in Australia may be more than $24 billion.[5]

The large costs associated with air pollution have led to significant efforts to improve air quality. Various studies have shown that substantial financial savings can be made by investing in measures to improve air quality. Australian studies estimate that the net economic benefit of four proposed new air quality standards would be $6.4–7.0 billion by 2036.[5]

I can't imagine a right more basic than the right to breathe clean air.

-Ed Begley Jr

4.2.3 How do we measure air quality?

In 1998, the NEPC set ambient air quality reporting standards and goals through the Ambient Air Quality NEPM.[1] This NEPM prescribes targets for levels of emissions of six pollutants in ambient air, as well as the methods that should be used to monitor the pollutants.

The six pollutants are carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, sulfur dioxide and particulate matter less than 10 micrometres in size (PM_{10}).[25] The ACT monitors and reports on four of these. Sulfur dioxide is not monitored due to the lack of heavy industry in the ACT, and lead levels have not been monitored since the phase-out of leaded petrol in 2002.[26] The NEPM also includes an advisory reporting standard for particulate matter less than 2.5 micrometres in size ($PM_{2.5}$).

Each jurisdiction in Australia reports annually against the NEPM standards and goals. The goal is to achieve the standards within 10 years of commencement of the measure, with less than the maximum allowable number of exceedances for each pollutant.[27]

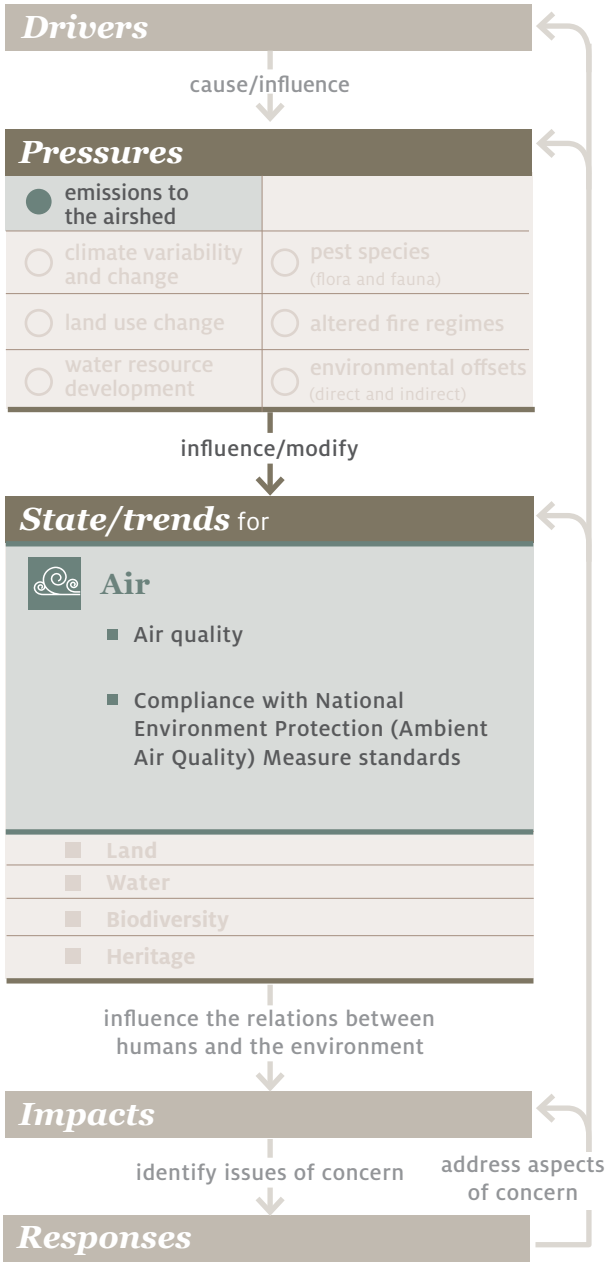
This report uses the following set of indicators to determine the state and trends of air quality and the pressures affecting it:

- state and trend
  - local ambient air quality (assesses the state and trends of levels of pollutants monitored under the NEPM)
  - compliance with NEPM standards
- pressures
  - emissions to the airshed.

Case study 4.1 talks about the Air Quality Index launched in 2014.

Links and influences

The *Driver–Pressure–State–Impact–Response* model as used in the ACT State of the Environment Report



Case study 4.1 The ACT Health Air Quality Index

The Air Quality Index, launched by ACT Health in late 2014, provides access to real-time air quality data and allows residents to better understand how air quality may affect them.

What is the Air Quality Index?

The index indicates how clean the air is. It shows the level of monitored pollutants as a percentage of National Environment Protection (Ambient Air Quality) Measure (NEPM) standards. The lower the score, the better the quality of the air.[a] For example, an index score of 50 indicates that levels of that pollutant are 50% of what the NEPM standard allows.

The index shows the levels of pollutants at each monitoring station and includes a colour-coded description of what the levels mean in terms of air quality (Figure 4.2).[b] The Air Quality Index for each site is taken to be the highest Air Quality Index of any individual pollutant.

How can the community use it?

The website[c] describes the potential health risks associated with the index levels and recommends actions that should be taken at the different levels.

As the index score increases, a larger percentage of the population is likely to experience increasingly severe adverse health effects.[d]

The website thus allows residents to have a clearer understanding of the impacts that air quality and levels of different pollutants may have on their wellbeing. This information may be particularly important for sensitive individuals.

Description	Very good	Good	Fair	Poor	Very poor	Hazardous
Air Quality Index	0–33	34–66	67–99	100–149	150–200	>200

Figure 4.2 Pollutant levels and corresponding air quality

Sources:
a http://health.act.gov.au/public-information/public-health/act-air-quality-monitoring/air-quality-index-aqi
b http://health.act.gov.au/health-services/population-health/health-protection-service/act-air-quality-monitoring/air-quality-index-aqi
c http://health.act.gov.au/public-information/public-health/act-air-quality-monitoring/air-quality-index-aqi
d http://health.act.gov.au/public-information/public-health/act-air-quality-monitoring/air-quality-index-aqi

4.3 Indicators

4.3.1 State and trends

This chapter examines the state and trends of air quality in the ACT airshed. An airshed is a body of air in an area defined by natural or topographic features.[28]

Previous State of the Environment Reports included indoor air quality indicators. Reporting on indoor air quality indicators has been limited because of the absence of data collected in the ACT. The 2011 report recommended that the Chief Health Officer consider the health impact of indoor air quality in the ACT in the 2014 Chief Health Officer's Report. ACT Health has commented in its 2013–14 annual report that:[29]

> *The Chief Health Officer decided against including health impact of indoor air quality in the ACT in the Chief Health Officer's Report 2014. It is not considered a health priority at present.*

Local ambient air quality

The report assesses the local ambient air quality in the ACT airshed by examining the recorded levels of the following pollutants during the reporting period:

- carbon monoxide (CO)
- nitrogen dioxide ($NO_{2)}$
- ozone
- PM_{10}
- $PM_{2.5}$.

Why is this indicator important?

These pollutants can have harmful effects on human and environmental health, depending on exposure time and concentration. Reporting on the level of these pollutants emitted to the airshed during the reporting period helps to track the state and trends in emissions in the long term.[30]

Current monitoring status and interpretation issues

Emissions of air pollutants are monitored and regulated in the ACT by the Environment Protection Authority (EPA), to control the impact these emissions may have on the environment and on ambient air quality. Ambient air quality monitoring is undertaken in the ACT both for reporting against the NEPM and to better communicate ambient air quality to the ACT community through an Air Quality Index.[31] The air quality monitoring network consists of two NEPM monitoring stations at Monash and Florey, and a third station at Civic that does not satisfy NEPM compliance requirements. For most of the reporting period, monitoring only occurred at Monash and Civic; the Florey station was established to comply with NEPM monitoring requirements for the ACT's growing population and became operational on 28 February 2014. These stations measure pollutant levels continuously, data are collected and stored, and daily averages for each pollutant at each station are recorded.[a]

Trend data are shown from the Monash station only, since the Civic station is not NEPM compliant and does not measure all pollutants, and Florey was not operational for the entire reporting period.

The concentration of contaminants in the airshed depends on several factors, including the rate of emissions, the weather and the topography of the area. For example, wood smoke issues are more pronounced in winter in the Tuggeranong Valley than in other areas of the ACT largely because of the topography of the area. These factors need to be taken into account in interpreting monitoring results.

a http://health.act.gov.au/public-information/public-health/act-air-quality-monitoring/data-collection-and-processing

What does this indicator tell us?

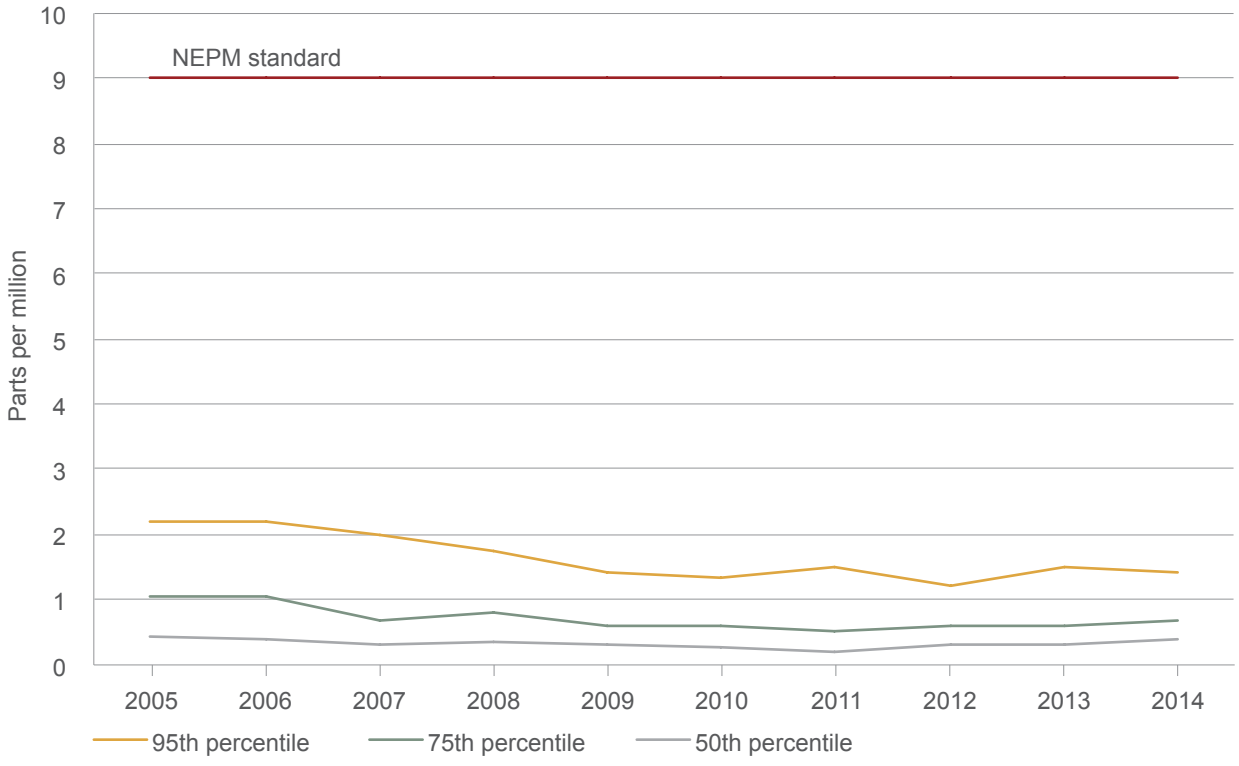
Carbon monoxide

CO is a highly poisonous, colourless, odourless and tasteless gas. It forms when carbon in fuels (petrol, wood, coal, natural gas) is not burnt completely.[32] Vehicle exhaust is the single biggest source of CO and the primary source of this pollutant in the ACT.

Levels normally present in the atmosphere are unlikely to cause ill effects; however, higher levels may affect human health, as shown in Table 4.1. Very high levels of CO may also cause the same problems for birds and animals that are experienced by humans, although these levels are unlikely to be experienced in the environment, except in extreme events such as bushfires.

CO also plays a role in climate change. Although CO is only a weak greenhouse gas, it can affect the concentrations of other stronger greenhouse gases, including carbon dioxide and methane. CO readily reacts with hydroxide (OH) to form carbon dioxide. This, in turn, increases concentrations of methane, because methane is removed from the atmosphere when it reacts with OH. The formation of carbon dioxide leaves fewer OH molecules for methane to react with, thus increasing methane's concentration.[33]

There were no exceedances of NEPM standards for CO recorded during the reporting period (Figure 4.3). All levels recorded were well within the compliance range. The *ACT Air Quality Report 2011* reported that, due to an improvement in vehicle emissions and a decline in the use of wood heaters, there was a downwards trend in CO levels; subsequent reported levels are steady.[26,27,34,35]



NEPM = National Environment Protection Measure
Source: Environment Protection Authority[26]

Figure 4.3 Carbon monoxide levels, daily maximum 8-hourly, 2005–2014 (Monash station)

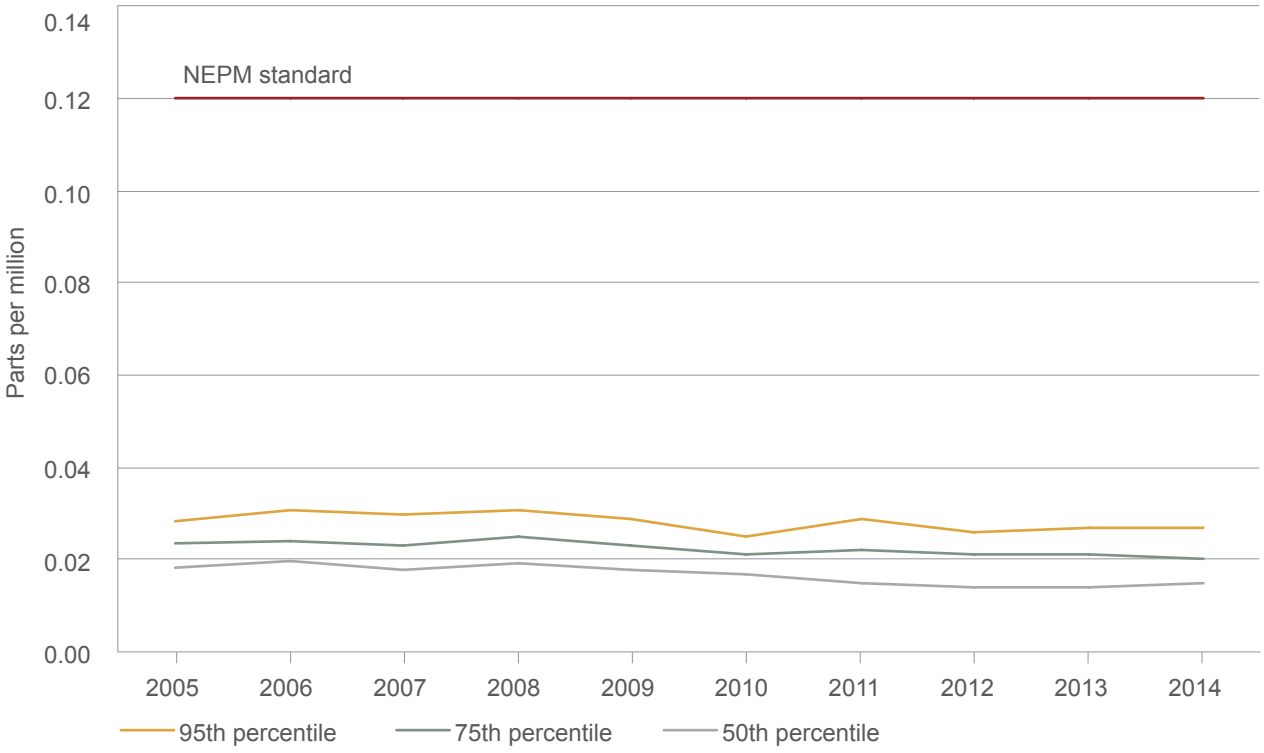
Nitrogen dioxide

The main sources of NO_2 include manufacturing industries, agriculture and forestry, vehicle exhaust and the burning of fuel for heating. NO_2 is also used in the manufacture of fertilisers and explosives for military and mining uses.[36]

Low levels of NO_2 can irritate the eyes, nose, throat and lungs of humans and animals (for more information about its health effects, see Table 4.1).

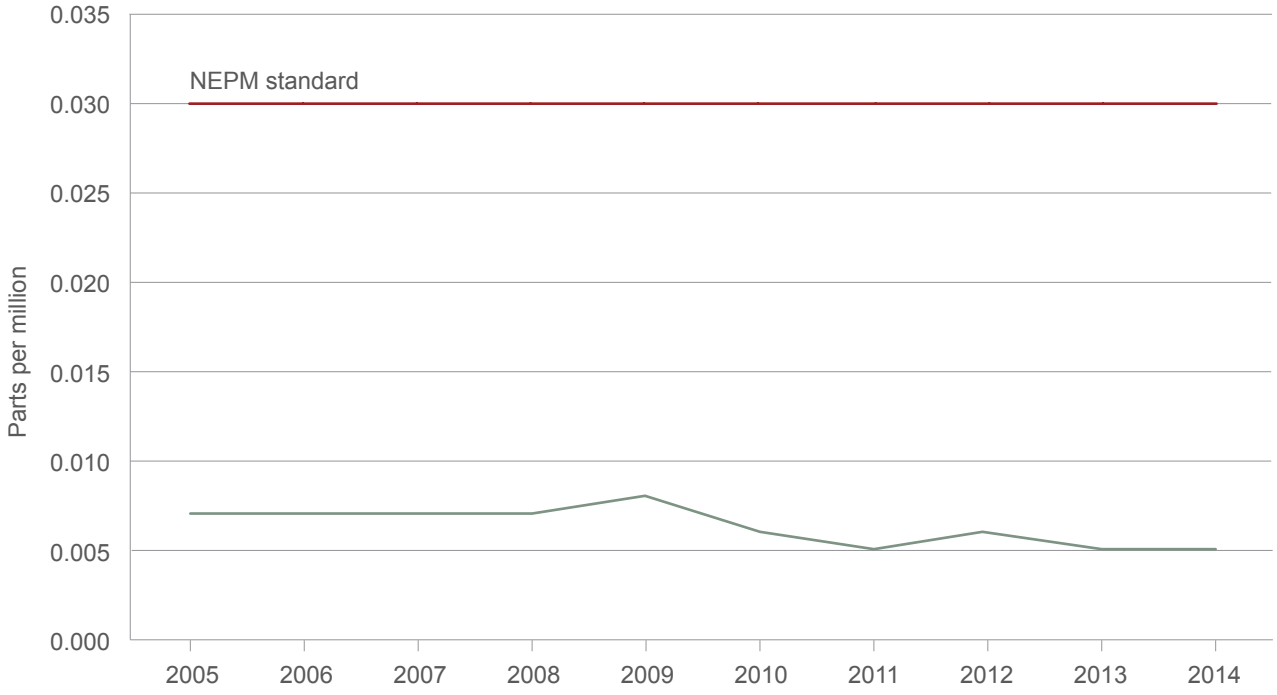
Excessive levels of NO_2 can affect the environment by killing plants and roots, and damaging the leaves of agricultural crops. Excessive levels of NO_2 can also cause an increase in rain acidity, which can harm ecosystems.

No exceedances of NO_2 standards were recorded during the reporting period (Figures 4.4 and 4.5). Recorded levels have remained well below the NEPM allowable levels and have remained stable in the ACT for the past decade.[26,27,34,35]



NEPM = National Environment Protection Measure
Source: Environment Protection Authority[26]

Figure 4.4 Nitrogen dioxide levels, daily maximum 1-hourly, 2005–2014 (Monash station)



NEPM = National Environment Protection Measure
Source: Environment Protection Authority[26]

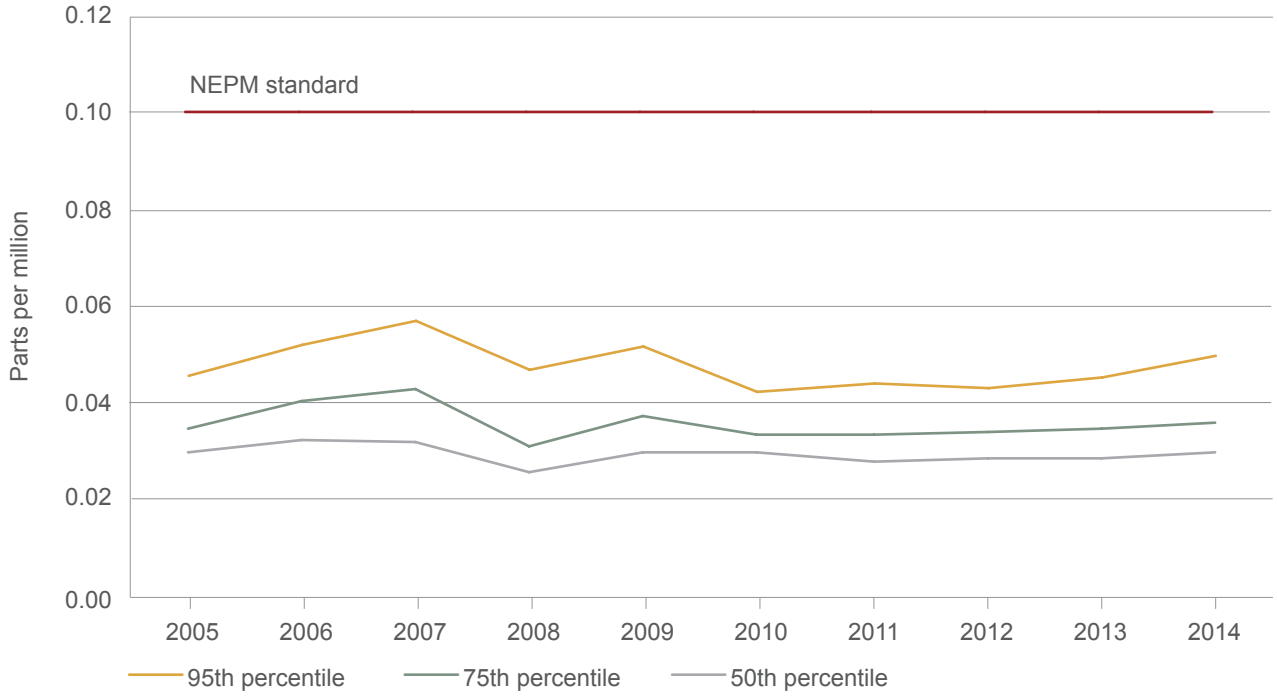
Figure 4.5 Nitrogen dioxide levels, annual average 1-hourly, 2005–2014 (Monash station)

Ozone

Ozone is a colourless, highly reactive gas formed by the action of sunlight on chemicals known as 'ozone precursors'. Ozone precursors include nitrogen oxides and other volatile organic compounds, which are emitted from a variety of sources including industrial emissions, motor vehicles and bushfires. Ozone is created when a chemical reaction takes place between these precursors and sunlight.[37]

Elevated concentrations of ozone can cause respiratory problems and other health issues (Table 4.1). Increased levels of ozone can also affect vegetation growth and ecosystems.

The NEPM standards were not exceeded for ozone during the reporting period, and maximum concentrations have remained stable (Figures 4.6 and 4.7). The level of ozone peaked in October 2013 and again in February 2014, with recorded levels at 74% and 87% of the standard, respectively. Both these peaks were due to hazard reduction burns in the region.[26,27,34,35] Ozone levels are measured one-hourly and four-hourly.

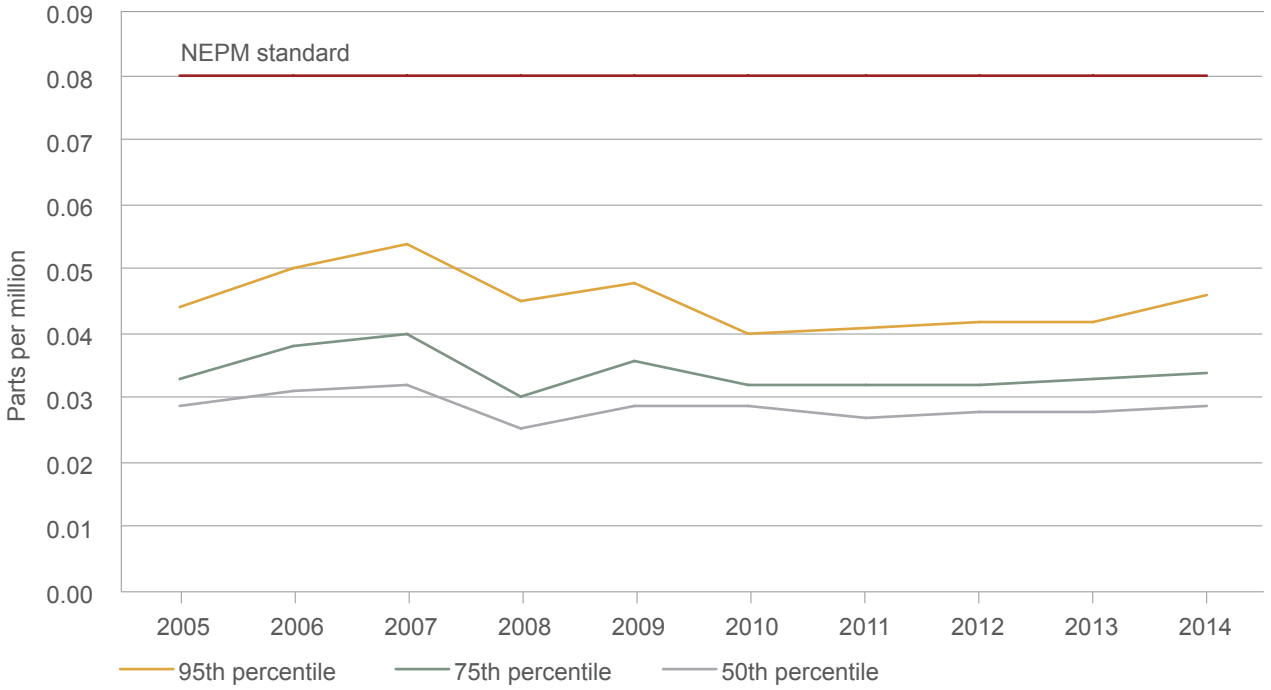


NEPM = National Environment Protection Measure
Source: Environment Protection Authority[26]

Figure 4.6 Ozone levels, daily maximum 1-hourly, 2005–2014 (Monash station)

Bushfires and controlled burns can contribute to air pollution

Photo: ACT Government



NEPM = National Environment Protection Measure
Source: Environment Protection Authority[26]

Figure 4.7 Ozone levels, daily maximum 4-hourly, 2005–2014 (Monash station)

Particulate matter

PM is produced from a wide range of sources, including industry and motor vehicle emissions. In the ACT, wood smoke from domestic heating, and from bushfires and controlled burns for fire management, is the highest emitter of PM.[38]

PM_{10} is particulate matter that is 10 micrometres or less in diameter. $PM_{2.5}$ is particulate matter that is 2.5 micrometres or less in diameter. In comparison, a human hair is about 100 micrometres, so roughly 40 $PM_{2.5}$ particles could be placed on its width.

PM_{10} is commonly present in air and may be inhaled, where the particles can have a direct effect on the lung or be absorbed into the bloodstream. Recent research suggests that there is no level of PM at which health impacts do not occur. The health impacts are many and varied, depending on the type of PM contacted (Table 4.1).

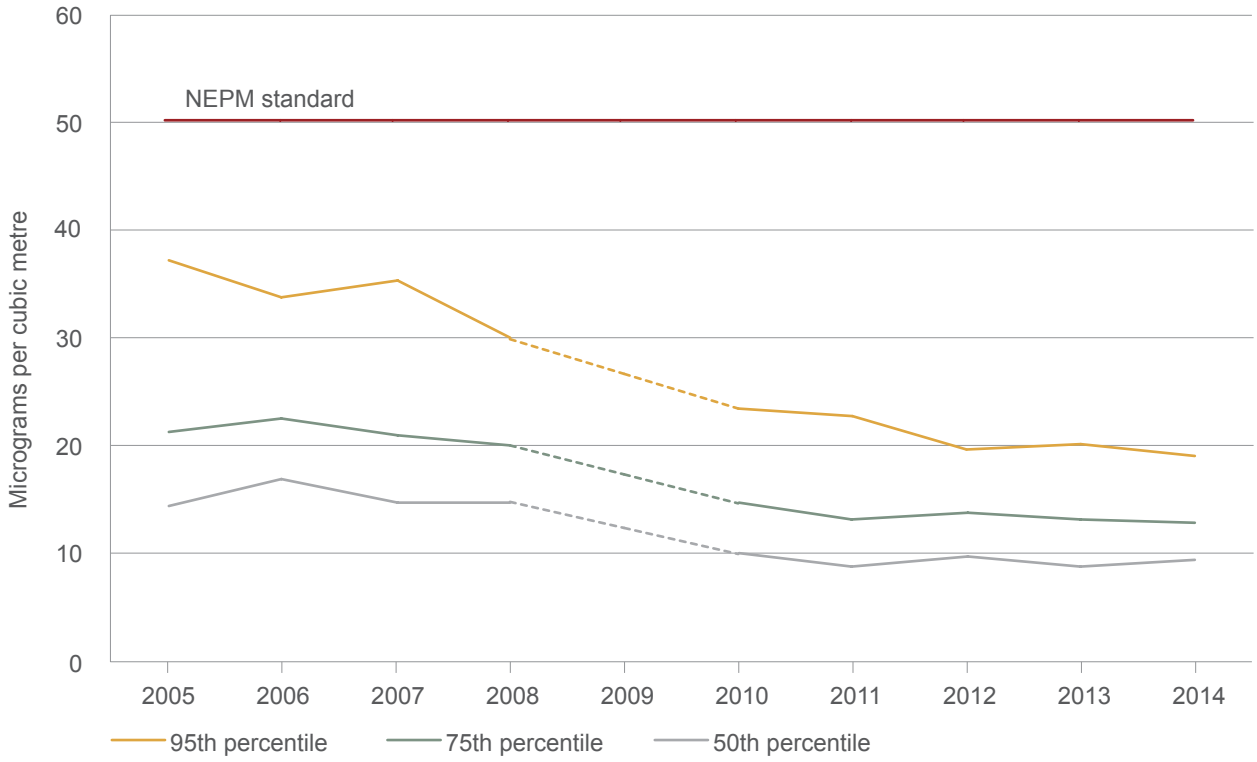
Particles in the air affect both the quality of the air and visibility.

During the reporting period, PM_{10} levels peaked in February 2014 due to hazard reduction burns. Across the period in general, levels of PM_{10} were higher during the winter months (ie between May and July) due to wood heater emissions, although this peak was less pronounced in the *ACT Air Quality Report 2014*. The most recent data show a downward trend in PM_{10} levels (Figure 4.8).[26,27,34,35]

The NEPM contains an advisory reporting standard for $PM_{2.5}$. Levels are measured at the Monash station, and from February 2014 at the Florey station. As with PM_{10}, levels are generally higher between May and July due to domestic heating with wood heaters. The advisory standard was exceeded on 17 days during the reporting period:

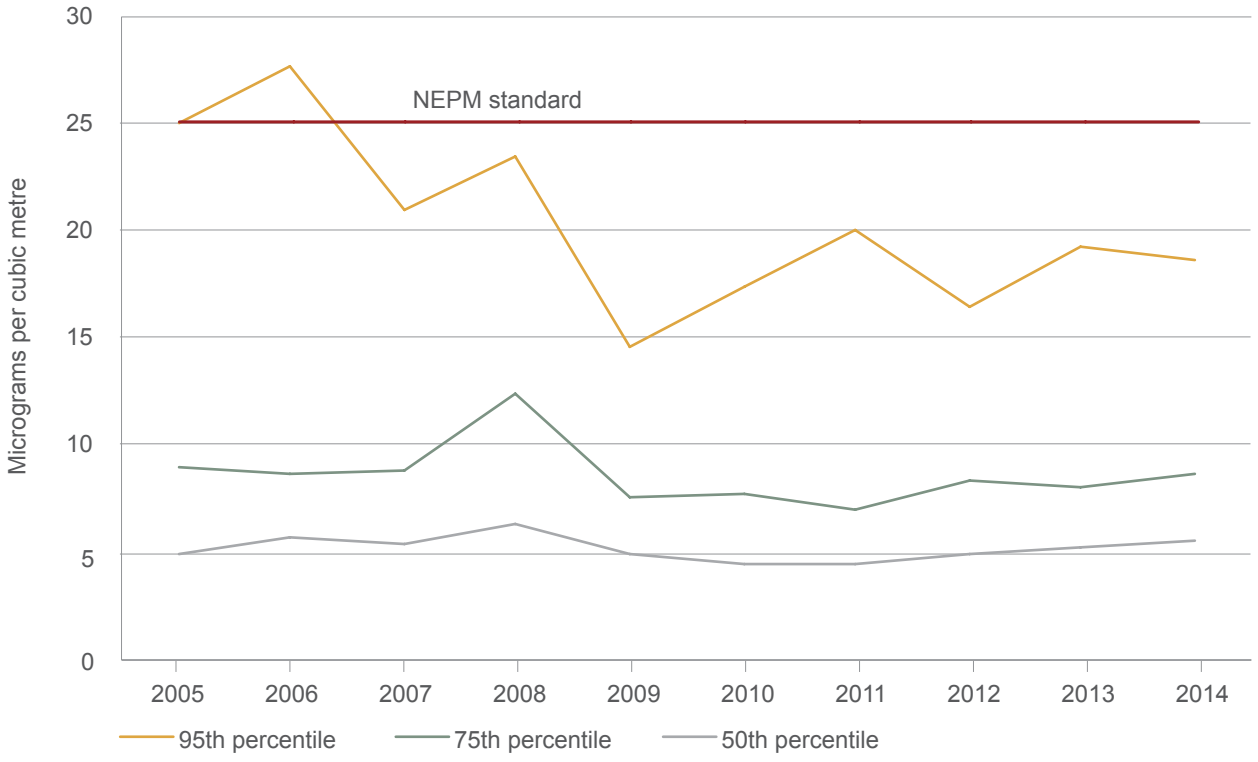
- four between May and July 2011
- three between May and July 2012
- four between May and July 2013
- two on 19 and 20 October 2013
- three in February 2014
- one in August 2014.

The winter exceedances are attributed to domestic wood heater emissions, and the October and February levels were due to hazard reduction burns in the region. Trend data for $PM_{2.5}$ indicate that, although the highest recorded levels vary across reporting periods, average recorded levels have remained fairly steady (Figures 4.9 and 4.10).



NEPM = National Environment Protection Measure; PM_{10} = particulate matter less than 10 micrometres
Note: The broken line represents insufficient data. The Monash station was closed for relocation on 26 October 2008. In addition, due to equipment failure and ongoing calibration problems in re-establishing the station, monitoring did not recommence until late 2009.[39]
Source: Environment Protection Authority[26]

Figure 4.8 ACT daily maximum 24-hour PM_{10}, 2005–2014 (Monash station)

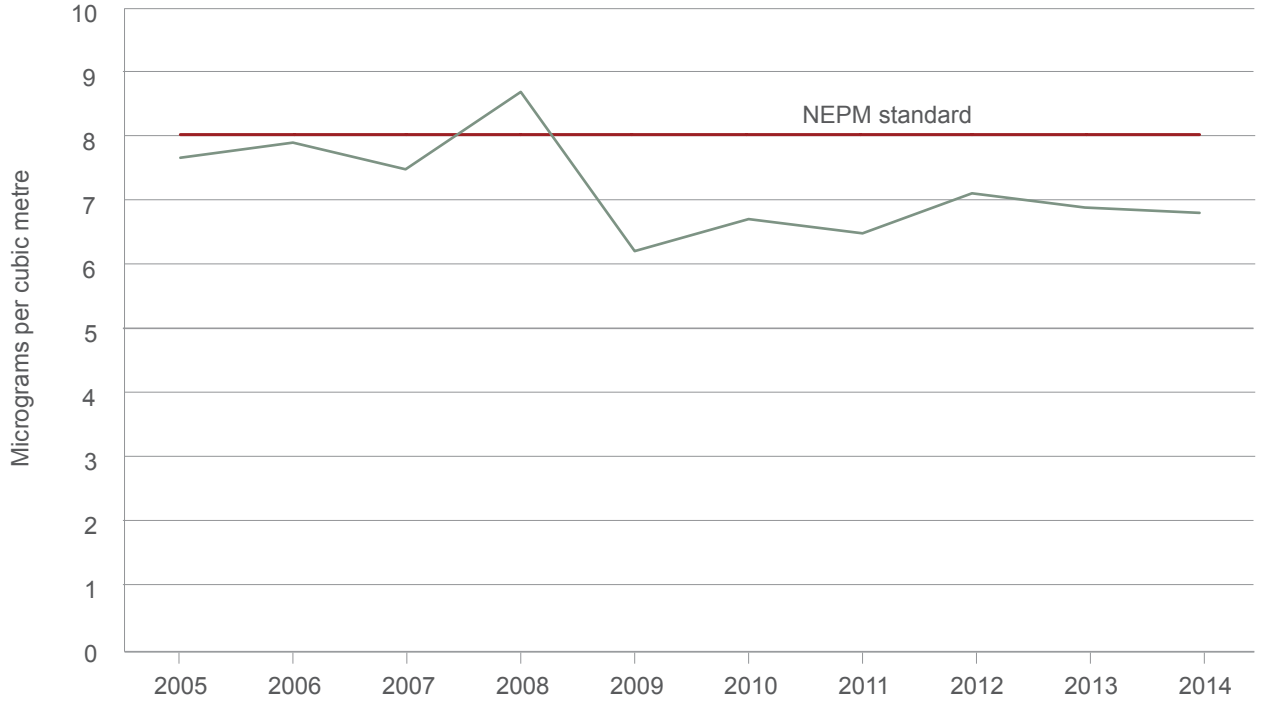


NEPM = National Environment Protection Measure; $PM_{2.5}$ = particulate matter less than 2.5 micrometres
Source: Environment Protection Authority[26]

Figure 4.9 ACT daily maximum 24-hour $PM_{2.5}$, 2005–2014 (Monash station)

NEPM air quality monitoring station at Monash

Photo: Office of the Commissioner for Sustainability and the Environment



NEPM = National Environment Protection Measure; $PM_{2.5}$ = particulate matter less than 2.5 micrometres
Source: Environment Protection Authority[26]

Figure 4.10 ACT annual average 24-hour $PM_{2.5}$, 2005–2014 (Monash station)

Compliance with the National Environment Protection Measure standards

To comply with the NEPM, the ACT Government must demonstrate that air quality meets the standards specified in Table 4.2. Compliance with these standards is evidenced through reporting on the NEPM targets in the ACT Air Quality Reports, produced by the ACT EPA each year.

Why is this indicator important?

Compliance with the NEPM standards ensures that the ACT is achieving the national environment protection standards for ambient air quality and that monitoring of NEPM pollutants is being undertaken appropriately.

Current monitoring status and interpretation issues

The ACT monitors the levels of CO, NO_2, ozone and PM in ambient air. Because heavy industry is absent in the ACT, the ACT Government has never monitored for sulfur dioxide, and lead monitoring ceased in 2002 with the phase-out of leaded petrol.[27]

The NEPM standards and goals for pollutants are shown in Tables 4.2 and 4.3.

Table 4.2 Standards and goals for pollutants other than $PM_{2.5}$

Pollutant	Averaging period	Maximum concentration	Goal within 10 years: maximum allowable exceedances
Carbon monoxide	8 hours	9.00 ppm	1 day a year
Nitrogen dioxide	1 hour	0.12 ppm	1 day a year
	1 year	0.03 ppm	None
Photochemical oxidants (as ozone)	1 hour	0.10 ppm	1 day a year
	4 hours	0.08 ppm	1 day a year
PM_{10}	1 day	50.00 µg/m^3	5 days a year
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
Lead	1 year	0.50 µg/m^3	None

m^3 = cubic metres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; PM_{10} = particulate matter less than 10 micrometres; ppm = parts per million; µg = micrograms

Table 4.3 Advisory reporting standards and goal for $PM_{2.5}$

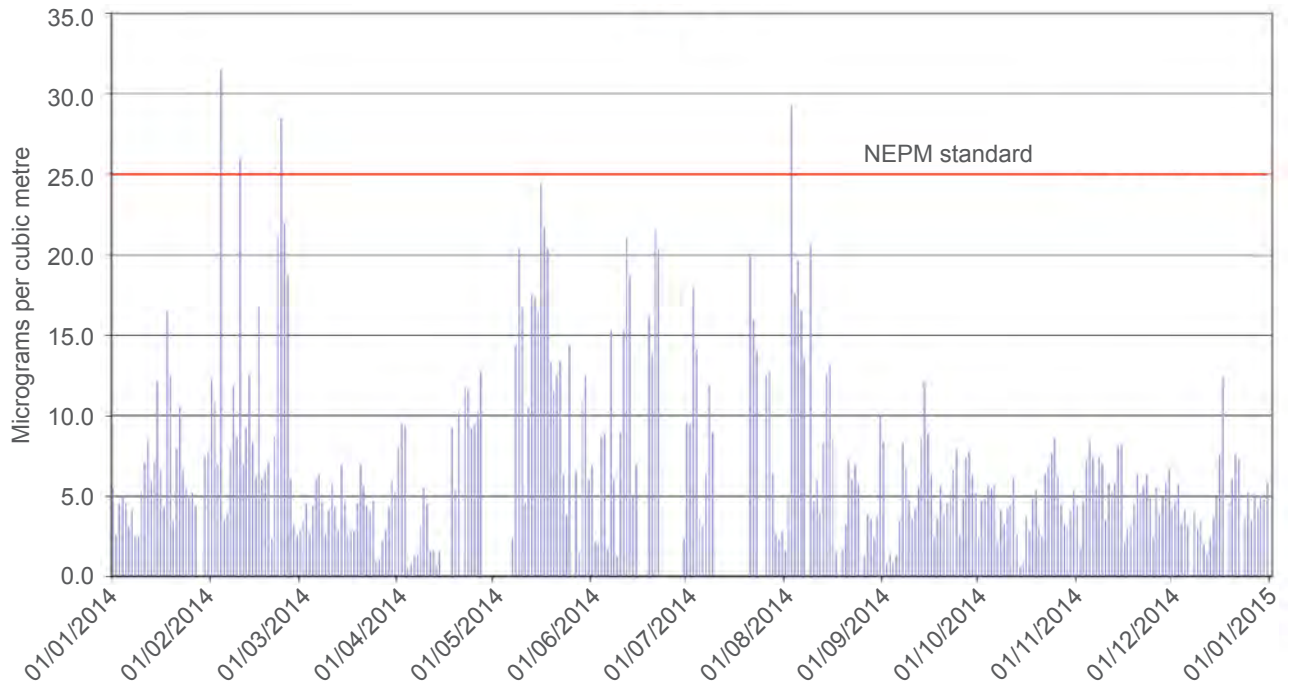
Pollutant	Averaging period	Maximum concentration	Goal
$PM_{2.5}$	1 day	25 µg/m^3	To gather sufficient national data to facilitate a review of the advisory reporting standards as part of the review of this measure scheduled to commence in 2005[a]
	1 year	8 µg/m^3	

m^3 = cubic metres; $PM_{2.5}$ = particulate matter less than 2.5 micrometres; µg = micrograms
a The review of the NEPM has taken place, and a variation is being finalised at the time of writing.

What does this indicator tell us?

During the reporting period, the ACT has met the NEPM standards. In 2011, the Monash station was not compliant for the monitoring of NO_2 due to equipment failure (monitoring stations and methods must comply with Australian Standards as set out in Schedule 3 of the Ambient Air Quality NEPM). However, apart from this incident, all monitoring stations demonstrated compliance across the period.

As detailed previously, levels for $PM_{2.5}$ have been recorded at above the maximum concentration during the reporting period; this has been due to wood smoke during winter, and bushfire and hazard reduction activity in the region. The total number of exceedances per year was within the allowable maximum.[26,27,35] However, wood smoke pollution in winter months is an issue, and measures to reduce this pollution need to be continued. Figure 4.11 shows an example of $PM_{2.5}$ levels for 2014, and illustrates the rise in peak levels across the winter months and in relation to fire activity in summer months.



NEPM = National Environment Protection Measure; $PM_{2.5}$ = particulate matter less than 2.5 micrometres
Source: Environment Protection Authority[26]

Figure 4.11 Daily maximum for $PM_{2.5}$ (Monash station)

New ambient air quality standards are being considered at a national level. A draft variation to the Ambient Air Quality NEPM follows the review of the NEPM in 2011, which identified PM standards as a priority because of the known human health impacts of exposure to PM. The likely updates to the measure seek to establish more stringent reporting standards for particles, including changing the existing advisory reporting standards for $PM_{2.5}$ to performance standards. The comment period on the draft variation closed in 2014, and the final variation is now being drafted.[5]

Other air quality issues

Extreme fire or pollution events can affect air quality for a period of time, and may cause both environmental and human health impacts. Emissions from such an event are not, however, measured as part of NEPM ambient air quality reporting.

In September 2011, a fire destroyed the premises of Energy Services Invironmental, a facility used to store, recycle and destroy polychlorinated biphenyls (PCBs) in Mitchell. PCBs are listed among a group of harmful persistent organic pollutants that cause adverse impacts on both humans and the environment. The import and manufacture of PCBs have been banned in Australia since the 1970s, and their phase-out continues.[40,41]

The fire caused a large smoke plume across parts of the ACT. The ACT Fire Brigade issued an emergency warning due to the possible toxic nature of the smoke plume. As a precautionary measure, residents in affected suburbs were asked to stay indoors, and keep doors and windows closed; schools and businesses were closed; and an exclusion zone was established around the suburb of Mitchell.[42]

The issue of indoor air quality was raised in the previous State of the Environment Report, and indoor air quality indicators were included. In response to the 2011 report recommendation that the health impact of indoor air quality be considered, the ACT Chief Health Officer came to the view that it is not a health priority at present.[29] Because of the lack of publicly available data on indoor air quality, the 2015 State of the Environment Report does not report on indoor air quality.

Assessment summaries

for air quality indicators of state and trend

Indicator	Reasoning	Assessment grade					Confidence	
		Very poor	Poor	Fair	Good	Very good	In state grade	In trend grade
Local ambient air quality	Most measures of air quality are within compliance ranges, apart from occasional increases in carbon monoxide from motor vehicles and particulate matter from wood smoke. Some measures are improving, but most are stable				—		●	●
Compliance with Ambient Air Quality NEPM standards	The ACT has met NEPM reporting standards over the reporting period					—	●	●

NEPM = National Environment Protection Measure

Recent trends: ↗ Improving; — Stable; ↙ Deteriorating; ? Unclear

Confidence: ● Adequate high-quality evidence and high level of consensus; ◒ Limited evidence or limited consensus; ○ Evidence and consensus too low to make an assessment

4.3.2 Pressures

Given the significance of air quality for human wellbeing, it is important that we understand the factors that influence air quality in our region.

To a large extent, air quality in the ACT is determined by activities and conditions within our urban areas. For instance, the number of cars being driven and the reliance on wood heaters within Canberra's urban areas are major factors influencing air quality. It is therefore important that we reduce the pollutants that are released into our local atmosphere. Air quality is also affected by the capacity of ecosystems to regulate and clean the air, and maintaining and improving these is an important way to increase local air quality.

The main pressure on ACT air quality is emissions to the airshed, which affects air quality and causes health impacts (Figure 4.12).

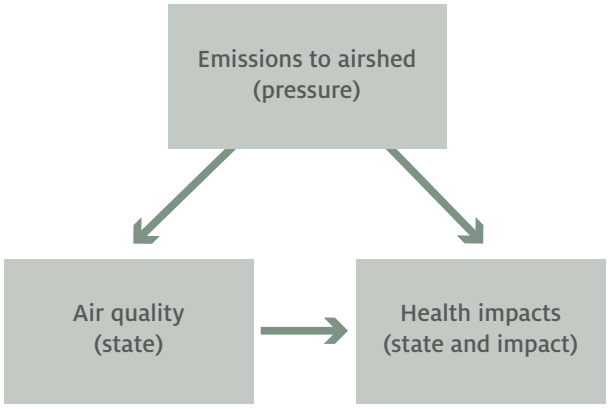


Figure 4.12 Effects of pressure on air quality

Emissions to the airshed

Why is this indicator important?

Data analysis on volumes and sources of emissions helps to identify the sources of pollutants in the ACT. This may enable us to better control and reduce levels of pollutants, and the associated risks to human and environmental health.

Current monitoring status and interpretation issues

The sources and volumes of all emissions in the ACT are assessed in comparison with the National Pollutant Inventory.[28]

What does this indicator tell us?

Table 4.4 illustrates the major sources of the emissions for each of the measured pollutants during the reporting period (data are available for 2011–12, 2012–13 and 2013–14 only).

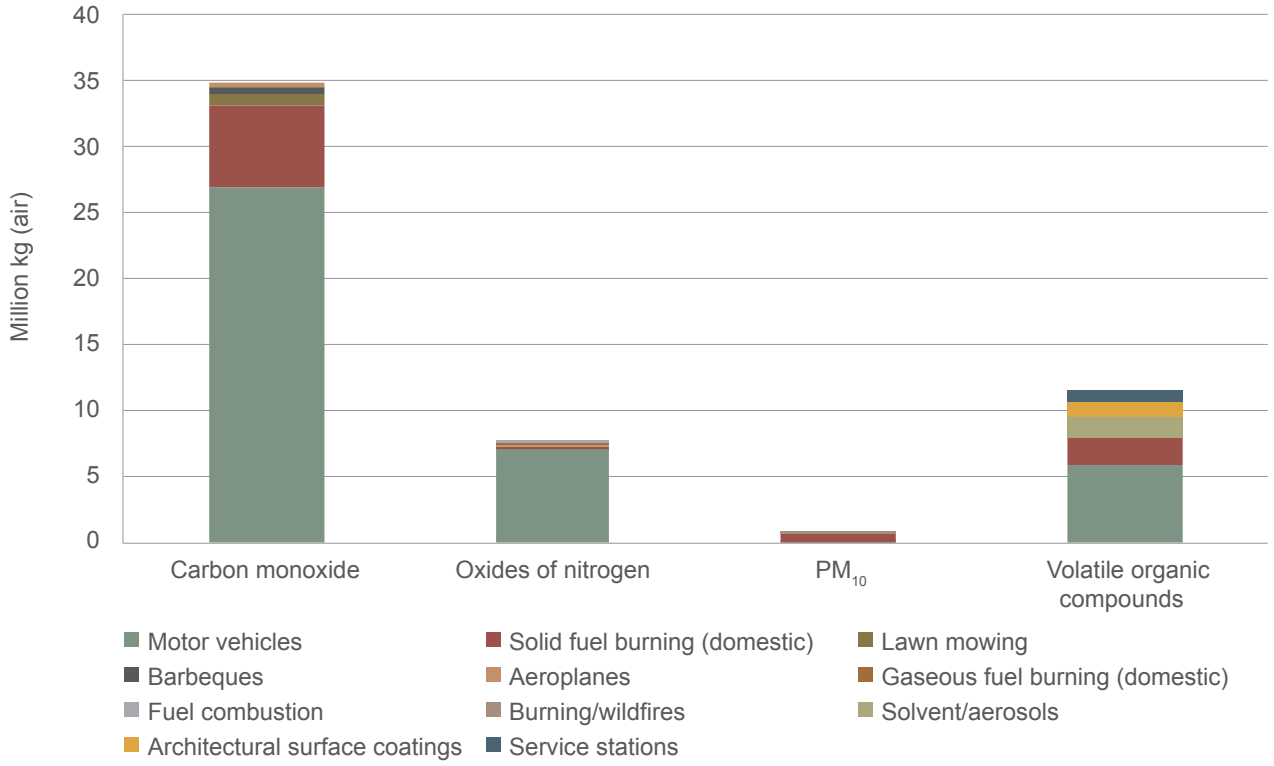
As in past reporting periods, the main pollutants of concern in the ACT are CO emissions from motor vehicles and wood smoke from domestic heating (Figure 4.13). However, the 2014–15 data show that exceedances of $PM_{2.5}$ were primarily caused by smoke from controlled hazard reduction burns, with only one exceedance attributed to wood smoke from domestic heating.[26]

Point-source emissions are also measured and regulated by the ACT Government.[43] Maximum concentration limits are placed on certain substances being emitted from industrial sources; these limits are regulated through the *Environment Protection Act 1997*. There are several industrial facilities in the ACT that must report to the EPA on their total point-source emissions into the airshed each year. All facilities have been recorded as compliant during the reporting period.

Table 4.4 Pollutants and emissions sources in the ACT

Pollutant	Emissions sources
Carbon monoxide	Motor vehicles, followed by solid fuel burning for domestic heating
Nitrogen dioxide	Motor vehicles
Ozone	Motor vehicles, followed by solid fuel burning for domestic heating
PM_{10}	Solid fuel burning for domestic heating
$PM_{2.5}$	Varied between construction material mining and water supply, sewerage and drainage services

$PM_{2.5}$ = particulate matter less than 2.5 micrometres;
PM_{10} = particulate matter less than 10 micrometres
Sources: Department of the Environment, www.npi.gov.au/npidata/action/load/emission-by-substance-result/criteria/lga/21/destination/AIR/source-type/ALL/subthreshold-data/Yes/substance-name/All/year/2013?pageIndex=1&sort=substanceName&dir=asc&pageSize=10



kg = kilogram; PM_{10} = particulate matter less than 10 micrometres
Source: Data provided by the National Pollutant Inventory

Figure 4.13 Sources and volumes of ACT air contaminant emissions, 2011–2014

Assessment summary

for air quality indicators for pressures

Indicator	Reasoning	Assessment grade					Confidence	
		Very low	Low	Moderate	High	Very high	In state grade	In trend grade
Emissions to the airshed	Most emissions are controlled below levels of concern. Wood smoke and motor vehicle emissions occasionally exceed levels of concern		—				●	●

Recent trends

- ↗ Improving
- — Stable
- ↙ Deteriorating
- ? Unclear

Confidence

- ● Adequate high-quality evidence and high level of consensus
- ◒ Limited evidence or limited consensus
- ○ Evidence and consensus too low to make an assessment

Resilience to pressures

A resilience assessment involves looking at the systems, networks, human resources and feedback loops involved in maintaining environmental values (see Chapter 9).

Air quality is well understood and defined, and air quality in the ACT is largely determined by the pressures outlined previously. The processes that threaten air quality are also well understood, with robust scientific understanding of key air quality issues. The ACT is linked to national processes for reviewing air quality standards and monitoring, with good access to expertise in these areas. The ACT also has strong linkages between the research and government sectors that enable rapid communication and response to identification of new threatening processes or thresholds.

Monitoring allows us to rapidly identify new or emerging threats to air quality in the ACT. Changes in population density, traffic, industry, vegetation management and weather patterns within and outside the ACT all present potential threats to air quality that require ongoing evolution of air quality management processes. For example, greater investment may be needed to monitor emerging threats to air quality resulting from population growth and associated increases in traffic or wood heater use, or any major industrial development. Planning processes should, ideally, actively identify the potential for new developments to trigger processes that threaten air quality.

Investment in research may be needed to ensure that new threats are identified and monitored. Thresholds for managing air quality outcomes are reasonably well understood (eg particulate concentrations at which human health may be affected). There is, however, less understanding about the thresholds at which a driver of air quality change will likely result in a shift in air quality.

Along with monitoring and research, staff expertise and networking are important to maintaining air quality. The ACT has good networks in which air quality issues can be raised and discussed. However, there are some limits to the effectiveness of networks. Being a small jurisdiction, the ACT often has limited numbers of staff with strong expertise in a given topic area. Air quality is one of these areas. We need to train new staff to maintain expertise – otherwise, there is a risk of losing existing expert capacity in this area as a result of retirement or staff turnover. Learning from air quality incidents also provides an important opportunity to build adaptive capacity – for example, the Mitchell fire in 2011 helped to build capacity and interagency cooperation to respond to air quality threats.

Resisting complacency is also important. We need to ensure that networks and expertise are maintained despite good air quality. The ACT's good air quality can result in complacency in maintaining systems that identify and respond to threats, which in turn can create problems when an incident occurs because of a lack of expertise or capacity to respond. Similarly, although education and incentive programs exist that aim to address potential threats and maintain air quality, uptake of some is low. For example, programs seeking to reduce particulate pollution from wood heaters have had low uptake.

The Burn Right Tonight program provides advice to Canberrans on how to use wood heaters correctly to reduce air pollution

Photo: ACT Government

4.4 Response

The ACT Government responds in a variety of ways to pressures affecting our air quality, which are assessed in detail in Chapter 10. Examples of local and national responses are included in this section.

The management effectiveness assessment found that the statutory, planning and policy frameworks are effective in managing air quality in the ACT. This is demonstrated by continuing improvements in reported air quality data.

4.4.1 Legal and policy framework

In the ACT, the *Environment Protection Act 1997* and the Environment Protection Regulation 2005 provide the legal framework for the protection of air quality. The EPA enforces the legislation and relevant regulations.

The objects of the Environment Protection Act are to protect and improve the quality of the environment, and to prevent environmental degradation and risk of harm to human health by promoting a number of measures, including pollution prevention. Part 2 of the Environment Protection Regulation deals with emissions to air and provides the framework for regulation of activities that may have an adverse impact on air quality.

The Environment Protection Act provides for the making of Environment Protection Policies (EPPs), including for air. The EPA has developed an Air EPP, which aims to meet national ambient air quality standards and to minimise risk to the local community from air pollution.

As discussed, the Ambient Air Quality NEPM establishes national standards and a nationally consistent framework for monitoring and reporting for six common air pollutants. Each jurisdiction in Australia reports compliance against the NEPM standards to the Australian Government. The desired environmental outcome of the NEPMs is national ambient air quality that allows for the adequate protection of human health and wellbeing.

4.4.2 Management of pressures

The ACT Government is working to reduce PM from wood smoke attributed to heating in the winter months, because, in the past, this has accounted for most exceedances of the NEPM standards. However, figures from the most recent Air Quality Report (2014) show only one exceedance of PM standards attributed to wood smoke from domestic heating.

The ACT Government Environment and Planning Directorate runs a wood heater replacement program, which aims to reduce levels of air pollution related to wood heaters by helping residents to replace existing wood heaters with other heating methods. During the life of the program since 2004, approximately 1076 wood heaters have been removed from service and replaced with mains-supplied natural gas heating options. The directorate also conducts community education campaigns including 'Don't Burn Tonight' and 'Burn Right Tonight' to provide the community with information about how to heat their homes with less impact on air quality.[44]

The environmental impact statement process controls development where air quality is considered as an issue – for example, there are restrictions on the installation of wood heaters in new developments where their use may reduce air quality because of the topographical location.[45] During the reporting period, a comprehensive air quality assessment was undertaken for the Molonglo Valley development. A comprehensive assessment process such as this for all new greenfield developments early in the development process may assist with decisions about the suitability of wood heaters for each development.

The ACT Government is also working to reduce vehicle emissions and reliance on cars as the main transport method in the ACT. Measures that can be taken include:

- placing emissions controls on the vehicles themselves
- increasing the use of hybrid or electric vehicles
- urban planning to increase the use of public transport, including constructing a light rail system servicing areas of north and central Canberra
- increasing cycling or walking as transport options.

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