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AIR QUALITY



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Review of international air quality indices

Addressee(s): NSW Department of Planning, Industry & Environment

Report Reference: 20.1092.FR1V3

Date: 27 April 2020

Quality Control

Study	Status	Prepared by	Checked by	Authorised by
INTRODUCTION	Final	Northstar Air Quality	MD, GCG, CAS	GCG
SUMMARY OF AQI BY JURISDICTION	Final	Northstar Air Quality	MD, GCG, CAS	GCG
SUMMARY OF AQI BY FUNCTION	Final	Northstar Air Quality	MD, GCG, CAS	GCG

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R.x)	(V.x)
20	1092	F	R1	V3
Based upon the above, the specific reference for this version of the report is:				20.1092.FR1V3

Final Authority

This report must be regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.



G. Graham

27th April 2020

Please note that this report replaces our earlier reports (ref: 20.1092.FR1V1, dated 5th March 2020 and 20.1092.FR1V2 dated 17th April 2020).

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Non-Technical Summary

Northstar Air Quality has been commissioned by the NSW Department of Planning, Industry & Environment to undertake a desk-top review of Air Quality Indices (AQI) used by various Australian and international jurisdictions. This study has focussed on the AQI used to report concentrations of particulate matter (as PM₁₀ and PM_{2.5}).

This report presents a succinct summary of the aspects of each AQI and is presented in two ways: by jurisdiction (Section 2); and, a series of summary tables to facilitate a cross-reference of how various aspects vary between jurisdictions (Section 3).

Based upon the information gathered in this study, it is observed that most jurisdictions calculate an AQI for each pollutant (PM₁₀, PM_{2.5}, various gaseous pollutants and visibility) and the highest AQI over all pollutants is used as the defining metric. Most AQI are calculated as a fraction of the relevant air quality standard, indexed to 100, although Canada uses an index value of 10. Canada also uses PM_{2.5} concentrations within a function with nitrogen dioxide (NO₂) and ozone (O₃) to derive a product AQI that relates to overall risk to health.

As the averaging period of PM₁₀ and PM_{2.5} criteria in all jurisdictions is 24-hours, the value commonly applied to derive the AQI for PM₁₀ and PM_{2.5} is also the 24-hour average concentration value. This is typically applied as a rolling 24-hour averaging period, so that the AQI is assessed on a rolling 1-hour basis. However, it is observed that a number of jurisdictions have changed this approach to using 1-hour average PM₁₀ and PM_{2.5} concentration values to address / report the risk of short-term pollution events, including the Australian states of Victoria, New South Wales, Tasmania, in addition to New Zealand, Japan and Singapore. Of these, only New South Wales presents the 1-hour concentrations as an AQI, the other jurisdictions present the concentration value (and sometimes apply a concentration scale to communicate the associated risk).

The AQI scales vary by jurisdiction, but commonly use a base-100 index with Canada and the UK being the only jurisdictions applying a base-10 index. The division of the scale in bands also varies. Most jurisdictions typically adopt 5 or 6 bands although Canada adopts 4 bands and the UK applies 10. Most jurisdictions also apply a colour scale and descriptors to the bands so that they can be more readily communicated, although New Zealand has not adopted any band naming. Section 3 of the report presents a table identifying the scale of each AQI, the number of bands used, and the colours and naming adopted. The subsequent tables present a summary of the AQI as relate to PM₁₀ and PM_{2.5} separately.

Most jurisdictions also publish health advice regarding ways to minimise risk during periods of elevated air pollution, notably during bush-fires and dust storm events. Sequentially, Section 2 of this report presents the identified health advice published on the relevant websites and identifies where other forms of health alert are available, such as via email, text message or mobile applications. Where the jurisdiction presents AQI-specific health advice this has been reproduced.

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1. INTRODUCTION

NSW Department of Planning, Industry & Environment (DPIE) has engaged Northstar Air Quality Pty Ltd (Northstar) to perform a literature review of the definition and derivation of air quality indices (AQI) internationally.

1.1 Purpose of the Report

As advised by DPIE the following represents the objectives of this desk-top study:

1. *The methodologies that different jurisdictions use for calculating Air Quality Indexes (AQIs), such as air quality standards, calculations, pollutants included, weightings, etc.*
2. *The way that short-term (less than 24-hour) $PM_{2.5}$ and PM_{10} are included in AQIs, for example hourly, three-hourly, 12-hourly measures and weightings.*
3. *The categories used for AQI reporting, including: category names, colours, breakpoints, and if the AQI is reported as an index in the category, or only the category is reported.*
4. *Messaging or advice that accompanies the AQI or AQI categories, including: standard messaging, pollutant specific messaging, emergency event messaging, messaging protocols, etc.*
5. *Any other interesting aspects of AQIs that may be relevant to discussions on standardising AQI reporting in Australia.*

Correspondingly, this report presents a factual summary of AQI by various national environmental agencies and authorities, with regard to how the AQI are defined, including:

- The numerical values adopted for the index full scale;
- The numerical values assigned to sub-scale 'bands';
- The descriptors used for the sub-scale 'bands';
- The definition of hazard posed by the category threshold values and health advice;
- Any published evidence supporting those definitions by the relevant jurisdiction.

1.2 Study Outline

The review is to include (but not be limited to) AQI adopted by the following jurisdictions:

- All States and Territories of Australia;
- New Zealand;
- United States (including California);
- Canada;
- Japan;
- European Union;
- United Kingdom;
- Singapore.

1.3 Disclaimer

Reasonable efforts have been made to access the relevant information relating to each jurisdiction and in some instances, the information relating to the definition and application of an AQI was reasonably hard to locate.

It is feasible that some of the summaries provided may be inaccurate but the information presented is representative of the information that could be located using reasonable efforts and is therefore considered to be reflective of the information that could be determined by members of the public.

2. SUMMARY OF AQI BY JURISDICTION

Provided below is a succinct summary of the AQI reporting provided by each jurisdiction. In all cases, the relevant website resources accessed are referenced and further information is available on those websites.

2.1 Australia (ACT)

2.1.1 Resources

The following websites were used to access the relevant information:

- ACT Government Department of Health website¹ 'measuring air quality'
- ACT Government Department of Health website² 'health advice for smoky air (PM_{2.5})'

2.1.2 Air Quality Reporting

The following AQI are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in the ACT:

Table 1 AQI Reporting (Summary) – ACT, Australia

Aspect	Summary Information	
Air quality reporting	<input checked="" type="checkbox"/> Air quality index (AQI) reported ("Air Quality Index") <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃	
How is the AQI derived?	An AQI value is derived for each included pollutant, and the maximum AQI value is reported.	
AQI scale	0-200+	
Bands within the scale	6 bands with descriptors	
Pollutant Specific	PM₁₀	PM_{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	24-hour	24-hour

¹ <https://www.health.act.gov.au/about-our-health-system/population-health/environmental-monitoring/monitoring-and-regulating-air-2>

² <https://www.health.act.gov.au/about-our-health-system/population-health/environmental-monitoring/monitoring-and-regulating-air-0#air-quality-table>

Aspect	Summary Information	
Conc. equivalent to AQI=100 ($\mu\text{g}\cdot\text{m}^{-3}$)	50	25
Reporting values used	Index ✓ Descriptor ✓ Concentration ✗	Index ✓ Descriptor ✓ Concentration ✗
Alerts	Text alerts ✗ Email alerts ✗ App ✗	Text alerts ✗ Email alerts ✗ App (AirRater) ✓

The scale, bands and descriptors used in the ACT are summarised below.

Table 2 AQI Reporting (Bands and Scales) – ACT, Australia

AQI Band	PM ₁₀ (24-hour)		PM _{2.5} (24-hour)	
	Index value (AQI)	Equivalent conc. value ($\mu\text{g}\cdot\text{m}^{-3}$)	Index value (AQI)	Equivalent conc. value ($\mu\text{g}\cdot\text{m}^{-3}$)
Very Good	0–33	0–16.5	0–33	0–8.25
Good	34–66	17–33	34–66	8.5–16.5
Fair	67–99	33.5–49.5	67–99	16.75–24.75
Poor	100–149	50–74.5	100–149	25–37.25
Very Poor	150–200	75–100	150–200	37.5–50
Hazardous	200+	>100.5	200+	>50.25

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

2.1.3 Air Quality Health Advice

Health advice specific to the six AQI bands presented in **Table 2** is not available, although ACT Health do provide cautionary health advice and actions associated with ‘smoky air’ (PM_{2.5}) in seven air quality categories, which have been approximated to the ACT AQI. These categories (and a calculated AQI associated with each [not presented by ACT Health]) is presented in **Table 3**.

The ACT Government supports the AirRater app, which provides updated information on short-term PM_{2.5} concentrations and associated health advice. Information relating to the alerts provided by AirRater webpage is located on the webpage³, which states that it reports on ‘air quality’, ‘temperature’ and ‘pollen’. It is worth noting that the alerts for pollen on the AirRater app are managed independently of the official government bodies.

³ <https://airrater.org/what-does-it-monitor/>

Table 3 Smoky Air (PM_{2.5}) Health Advisory Categories – ACT, Australia

Air Quality Category	PM _{2.5} (24-h) $\mu\text{g}\cdot\text{m}^{-3}$	Potential health effects without following advice or actions	Cautionary health advice/actions	Approximation to AQI
Good	0-8.9	N/A – Below the relevant air quality standard	None	0-35.6
Meets air quality standard	9-25.9	N/A – Meets the relevant air quality standard	No tailored advice necessary	36-103.6
Unhealthy for sensitive groups	26-39.9	Symptoms may occur in sensitive groups	Sensitive groups# should <u>reduce</u> prolonged or heavy physical activity. Where possible, these people in the community should also limit the time spent outdoors Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek urgent medical attention	104-159.6
Unhealthy for all	40-106.9	Increased likelihood of effects for sensitive groups Symptoms may occur in the general population	Everyone should <u>reduce</u> prolonged or heavy physical activity Sensitive groups# should <u>avoid</u> prolonged or heavy physical activity altogether Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek urgent medical attention	160-427.6
Very unhealthy for all	107-177.9	Significant likelihood of effects for sensitive groups	Everyone should <u>avoid</u> prolonged or heavy physical activity Sensitive groups# should <u>avoid</u> all physical activity outdoors	428-711.6

Air Quality Category	PM _{2.5} (24-h) $\mu\text{g}\cdot\text{m}^{-3}$	Potential health effects without following advice or actions	Cautionary health advice/actions	Approximation to AQI
		Symptoms among general population common	Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek medical attention	
Hazardous high	>177.9	Serious likelihood of effects for sensitive groups Symptoms among general population very common	Everyone should <u>avoid</u> all physical activity outdoors Sensitive groups# should <u>temporarily relocate</u> to a friend or relative living outside the affected area. If this is not possible, <u>remain indoors and keep activity levels as low as possible</u> Anyone with a heart or lung condition should take their medication as prescribed by their doctor. People with asthma should follow their asthma action plan. Anyone with concerns about their health should seek medical advice from their doctor. Anyone experiencing wheezing, chest tightness or difficulty breathing should seek medical attention Anyone experiencing symptoms which may be due to smoke exposure should consider taking a break away from the smoky conditions	>711.6
Hazardous extreme	>250	Serious likelihood of effects for sensitive groups Symptoms among general population very common	Cautionary health advice and actions are the same as for Hazardous high above	

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

Note: # Sensitive people are defined as "people over 65, children 14 years and younger, pregnant women and those with existing heart or lung conditions."

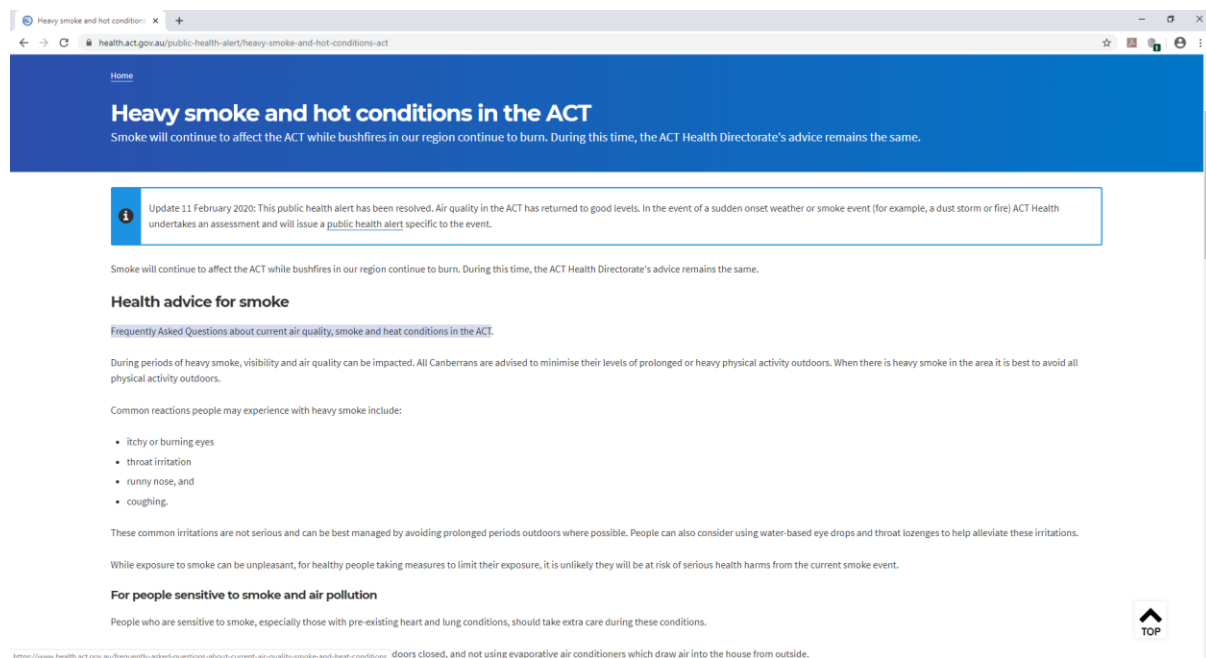
The ACT Health website provides the following comments regarding alerts:

ACT Health uses a system of seven health advisory categories for smoky air [See table above]. The categories are based on the 24-hour rolling average concentrations of PM_{2.5} in the air. Each category has cautionary health advice that suggests practical ways you can reduce your exposure to smoke.

In a sudden onset weather or smoke event (for example, a dust storm or significant landscape fire), it is possible that visibility is reduced before there is an increase in the health advisory category based on the 24-hour rolling average concentrations of PM_{2.5}. In this scenario, ACT Health will undertake an assessment and publish a public health alert, if required.

An example of a public health alert for air quality from the ACT Health website is replicated below:

Figure 1 Public Health Alert from ACT Health - Screenshot



Information relating to the alerts provided by the AirRater app is located on the webpage⁴, which states that it reports on 'air quality', 'temperature' and 'pollen'. It is worth noting that the alerts for pollen on the AirRater app are managed independently of the official government bodies.

In regard to 'air quality' the website states:

“Time Period

AirRater presents data that are as up to date as possible, so that we can support people to make the best decisions at that time.

⁴ <https://airrater.org/what-does-it-monitor/>

In most states and territories AirRater updates the PM_{2.5} information every hour, and the data displayed show a 1-hour average. In Tasmania, the readings are updated every 10 minutes.

The time period shown on state and territory websites varies but can be a 24-hourly average. Always check to see what time period the number represents.

Air Quality Index

AirRater shows air quality as the amount of PM_{2.5} in the air.

In contrast, many state and territory government websites present air quality information as the 'Air Quality Index' or AQI.

The AQI was designed as a way to standardise information across different types of air pollution. It can be calculated for a number of pollutants (including fine and coarse particulate matter, carbon monoxide and ozone). The AQI number is not a raw measurement (e.g. micrograms of pollutant per metre cubed of air), but a scale based on how much the reading is above (or below) the air quality standard. Some states and territories provide the AQI separately for different pollutants, others provide only a composite AQI that is based on the pollutant that is the worst. For more details on how the AQI is calculated in your area, please see your local air quality agency's website.

Importantly, for PM_{2.5}, the AQI is calculated from a 24-hour average. The rolling 24-hour average used to calculate the AQI means the numbers you see on those websites may change more slowly in response to changing conditions than the 1-hour or 10-minute averages presented in AirRater. Some state and territory websites also provide hourly or 10-minute data for specific pollutants including PM_{2.5}, but you might need to click through to another part of the webpage.

2.2 Australia (NSW)

2.2.1 Resources

The following websites were used to access the relevant information:

- NSW Government Department of Planning, Industry & Environment website⁵ 'air quality (AQI) data – updated hourly'
- NSW Government Department of Health website⁶ 'air quality index (AQI) and activity guide'
- NSW Government Department of Planning, Industry & Environment website⁷ 'about the air quality index'

2.2.2 Air Quality Reporting

The following AQI are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in NSW.

Table 4 AQI Reporting (Summary) – NSW, Australia

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported ("Air Quality Index") <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ , SO ₂ , visibility	
How is the AQI derived?	An AQI value is derived for each included pollutant, and the maximum AQI value is reported. The website additionally presents disaggregated AQI for each pollutant at each monitoring station.	
AQI scale	0-200+	
Bands within the scale	6 bands with descriptors	
Pollutant Specific	PM₁₀	PM_{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	1-hour	1-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	80.1	62.1

⁵ <https://www.dpie.nsw.gov.au/air-quality/current-air-quality>

⁶ <https://www.health.nsw.gov.au/environment/air/Pages/aqi.aspx>

⁷ <https://www.environment.nsw.gov.au/topics/air/understanding-air-quality-data/air-quality-index>

Aspect	Summary Information	
Reporting values used	Index ✓ Descriptor ✓ Concentration ✗	Index ✓ Descriptor ✓ Concentration ✗
Alerts	Text alerts ✓ Email alerts ✓ App ✗	Text alerts ✓ Email alerts ✓ App ✗

It is noted that the NSW DPIE has changed its approach regarding the reporting of PM₁₀ and PM_{2.5} in the NSW AQI and does not use the 24-hour PM averaging period consistent with that specified in the NEPM. NSW DPIE is currently trialling an interim web reporting approach for particles, as described below:

“For the purposes of online reporting of 1-hour particulate matter concentrations, we are currently using an interim reporting approach, by adopting threshold 1-hour concentrations of 80.1 µg/m³ for PM₁₀, and 62.1 µg/m³ for PM_{2.5}. We are in the process of forming a rational, and nationally consistent way of reporting and interpreting hourly particulate values and related health advice. While we finalise the details of reporting 1-hour averages, we will report PM_{2.5} and PM₁₀ using these interim values.”

The scale, bands and descriptors used in NSW are summarised below.

The 1-hour threshold concentrations used for categorising air quality are presented below.

Table 5 AQI Reporting (Bands and Scales) – NSW, Australia

AQI Band	PM ₁₀ (1-hour)		PM _{2.5} (1-hour)	
	Index value (AQI)	Equivalent conc. value (µg·m ⁻³)	Index value (AQI)	Equivalent conc. value (µg·m ⁻³)
Very Good	0–33	<27.2	0–33	<21.1
Good	34–66	27.2–53.6	34–66	21.1–41.5
Fair	67–99	53.7–80.0	67–99	41.6–62.0
Poor	100–149	80.1–120.0	100–149	62.1–93.0
Very Poor	150–200	120.1–160.0	150–200	93.1–124.0
Hazardous	200+	>160	200+	>124.0

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

2.2.3 Air Quality Health Advice

The following health advice is provided the AQI bands. The advice is not pollutant-specific, although supplementary advice regarding bushfire smoke is provided.

Table 6 AQI Band Health Advice – NSW, Australia

AQI Band	Health Advice
Very Good 0-33	Enjoy normal activities
Good 34-66	Enjoy normal activities
Fair 67-99	People unusually sensitive to air pollution should reduce or reschedule strenuous outdoor activities. Others are not likely to be affected when the AQI is in this range.
Poor 100-149	Sensitive groups should reduce strenuous outdoor activities. Other adults are not likely to be affected. Anyone who experiences symptoms should reduce outdoor activities.
Very Poor 150-200	Sensitive groups should avoid strenuous outdoor activities Other adults should reduce or reschedule strenuous outdoor activities.
Hazardous 200+	Sensitive groups should avoid all outdoor activities. Other adults should avoid strenuous outdoor activities.

The NSW DPIE offers a free email and SMS update regarding “air quality ratings and forecasts”.

The following advice is published to decrease the risk from bushfire smoke:

“When it’s smoky, everyone should:

- **Follow your doctor’s advice** about medicines and your asthma management plan if you have one. Keep your medication close at hand. Consult your doctor if symptoms worsen.
- **Reduce or avoid vigorous outdoor activity** see activity guide below (see Table above).
- **Spend more time indoors.** Keep doors and windows shut to keep the smoke out. Open windows and doors whenever the smoke clears.
- **Spend time in air conditioned venues** like cinemas, libraries and shopping centres.
- **Avoid indoor sources of air pollution** like cigarettes, candles and incense sticks.”

2.3 Australia (NT)

2.3.1 Resources

The following websites were used to access the relevant information:

- NT EPA website⁸ 'all available air quality index values'

2.3.2 Air Quality Reporting

The following AQI are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in NT:

Table 7 AQI Reporting (Summary) – NT, Australia

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported ("Air Quality Index") <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ , SO ₂	
How is the AQI derived?	An AQI value is derived for each included pollutant, and the maximum AQI value is reported.	
AQI scale	0-201+	
Bands within the scale	6	
Pollutant Specific	PM ₁₀	PM _{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	24-hour	24-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	50	25
Reporting values used	Index ✓ Descriptor ✓ Concentration ✗	Index ✓ Descriptor ✓ Concentration ✗
Alerts	Text alerts ✗ Email alerts ✗ App ✗	Text alerts ✗ Email alerts ✗ App ✓ AirRater

⁸ <http://ntepa.webhop.net/NTEPA/Default.ltr.aspx>

The scale, bands and descriptors used in the NT are summarised below.

Table 8 AQI Reporting (Bands and Scales) – NT, Australia

AQI Band	PM ₁₀ (24-hour)		PM _{2.5} (24-hour)	
	Index value (AQI)	Equivalent conc. value (µg·m ⁻³)	Index value (AQI)	Equivalent conc. value (µg·m ⁻³)
Very good	0-33	0–16.5	0-33	0-8.25
Good	34-66	17-33	34-66	8.5-16.5
Fair	67-99	33.5-49.5	67-99	16.75-24.75
Poor	100-149	50-74.5	100-149	25-37.25
Very poor	150-200	75-100	150-200	37.5-50
Severe	201+	>100.5	201+	>50.25

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

2.3.3 Air Quality Health Advice

The following health advice is provided the AQI bands. The advice is not pollutant-specific.

Table 9 AQI Band Health Advice – NT, Australia

AQI Band	Health Advice
Very good 0-33	Enjoy activities
Good 34-66	Enjoy activities
Fair 67-99	People unusually sensitive to air pollution: Plan strenuous outdoor activities when air quality is better
Poor 100-149	Sensitive Groups: Cut back or reschedule strenuous outdoor activities
Very poor 150-200	Sensitive groups: Avoid strenuous outdoor activities Everyone: Cut back or reschedule strenuous outdoor activities
Severe 201+	Sensitive groups: Avoid all outdoor physical activities Everyone: Significantly cut back on outdoor physical activities

The NT Government supports the AirRater app, which provides updated information on short-term PM_{2.5} concentrations and associated health advice.

Information relating to the alerts provided by AirRater webpage is located on the webpage⁹, which states that it reports on 'air quality', 'temperature' and 'pollen'.

It is worth noting that the alerts for pollen on the AirRater app are managed independently of the official government bodies.

⁹ <https://airrater.org/what-does-it-monitor/>

2.4 Australia (QLD)

2.4.1 Resources

The following websites were used to access the relevant information:

- Queensland Government website¹⁰ 'air quality index'
- Queensland Government website¹¹ 'live air data'

2.4.2 Air Quality Reporting

The following AQI are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in QLD:

Table 10 AQI Reporting (Summary) – QLD, Australia

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported ("Air Quality Index") <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ , SO ₂ , TSP, visibility	
How is the AQI derived?	An AQI value is derived for each included pollutant, and the maximum AQI value is reported. The website presents a summary of the measured concentrations and AQI by monitoring station, and selecting that station presents the relevant concentration measurement and AQI for each pollutant.	
AQI scale	0-150+	
Bands within the scale	5, with descriptors	
Pollutant Specific	PM ₁₀	PM _{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	24-hour	24-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	50	25
Reporting values used	Index ✓ Descriptor ✓ Concentration ✗	Index ✓ Descriptor ✓ Concentration ✗

¹⁰ <https://www.qld.gov.au/environment/pollution/monitoring/air/air-monitoring/air-quality-index>

¹¹ <https://apps.des.qld.gov.au/air-quality/>

Aspect	Summary Information	
Alerts	Text alerts ✘ Email alerts ✘ App ✘	Text alerts ✘ Email alerts ✘ App ✘

The scale, bands and descriptors used in QLD are summarised below.

Table 11 AQI Reporting (Bands and Scales) – QLD, Australia

AQI Band ^A	PM ₁₀ (24-hour)		PM _{2.5} (24-hour)	
	Index value (AQI)	Equivalent conc. value (µg·m ⁻³) ^B	Index value (AQI)	Equivalent conc. value (µg·m ⁻³) ^B
Very good	0-33	0-16.5	0-33	0-8.25
Good	34-66	17-33	34-66	8.5-16.5
Fair	67-99	33.5-49.5	67-99	16.75-24.75
Poor	100-149	50-74.5	100-149	25-37.5
Very poor	>150	>75	>150	>37.5

Note: A An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

B Not presented on the website, but calculated from the indices

2.4.3 Air Quality Health Advice

There is no identified specific AQI band health advice in Queensland.

The website includes the following advice for reducing the impact of bushfires and dust-storms:

“Reducing impacts

When you are aware that bushfires or dust storms are imminent, you can take some steps to reduce the impacts.

Where possible, stay indoors and minimise the transfer of outdoor air to the inside by closing windows and doors.

You should not exercise outdoors in a smoky atmosphere, as this will increase the amount of fine particles inhaled into the lungs.

This is particularly important for people with medical conditions who should prepare by taking their medication in consultation with their doctor.

Queensland Health has a telephone service for any health concerns that are not an emergency but could be serious: 13 HEALTH (13 43 25 84).”

2.5 Australia (SA)

2.5.1 Resources

The following websites were used to access the relevant information:

- SA EPA website¹² 'air quality monitoring results'
- Data SA Government Data Directory website¹³ 'recent air quality'

2.5.2 Air Quality Reporting

The following AQI are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in SA:

Table 12 AQI Reporting (Summary) – SA, Australia

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported ("Air Quality Index") <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ , SO ₂	
How is the AQI derived?	An AQI value is derived for each included pollutant, and the maximum AQI value is reported.	
AQI scale	0-150+	
Bands within the scale	5, with descriptors	
Pollutant Specific	PM ₁₀	PM _{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	24-hour	24-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	50	25
Reporting values used	Index ✓ Descriptor ✓ Concentration ✓	Index ✓ Descriptor ✓ Concentration ✓
Alerts	Text alerts ✓ ✗ Email alerts ✓ ✗	Text alerts ✓ ✗ Email alerts ✓ ✗

¹² https://www.epa.sa.gov.au/data_and_publications/air_quality_monitoring

¹³ <https://data.sa.gov.au/data/dataset/recent-air-quality>

Aspect	Summary Information	
	App ✘ RSS feed (text file) ✓	App ✘ RSS feed (text file) ✓

The scale, bands and descriptors used in SA are summarised below.

Table 13 AQI Reporting (Bands and Scales) – SA, Australia

AQI Band	PM ₁₀ (24-hour)		PM _{2.5} (24-hour)	
	Index value (AQI)	Equivalent conc. value (µg·m ⁻³)	Index value (AQI)	Equivalent conc. value (µg·m ⁻³)
Very good	0-33	0-16.5	0-33	0-8.25
Good	34-66	17-33	34-66	8.5-16.5
Fair	67-99	33.5-49.5	67-99	16.75-24.75
Poor	100-149	50-74.5	100-149	25-37.5
Very poor	>150	>75	>150	>37.5

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

The air quality index (AQI) for a region is generated by calculating the index for each individual pollutant (the measured value for that pollutant expressed as a percentage of the standard set by the Air NEPM) for each monitoring site in the region. The highest of these indices is then taken to be the AQI for the particular monitoring site and the highest of the indices from all monitoring sites in the region is used as the AQI for each region.

2.5.3 Air Quality Health Advice

There is no identified specific AQI band health advice in South Australia, although the website does provide guidance on reducing risks from bushfires¹⁴.

¹⁴

<https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/protecting+public+health/bushfires/bushfire+smoke+and+your+health>

2.6 Australia (TAS)

2.6.1 Resources

The following websites were used to access the relevant information:

- EPA Tasmania website¹⁵ 'real-time air quality data for Tasmania'
- Tasmanian Government Department of Health website¹⁶ 'track air quality'
- EPA Tasmania website¹⁷ 'indicative real-time EPA Tasmania air quality data'

2.6.2 Air Quality Reporting

The following is adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in TAS:

Table 14 AQI Reporting (Summary) – TAS, Australia

Aspect	Summary Information	
Is there an AQI?	<input type="checkbox"/> Air quality index (AQI) reported <input checked="" type="checkbox"/> Pollutant concentration scale reported ("Air Quality Health Categories") <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	There is no AQI in TAS. The EPA however report real-time "current" PM ₁₀ , PM _{2.5} and a rolling 1-hour average PM _{2.5} measurement.	
How is the AQI derived?	There is no AQI in TAS.	
AQI scale	There is no AQI in TAS, but the EPA does designate PM concentration bands from 0 µg·m ⁻³ to +100 µg·m ⁻³ .	
Bands within the scale	The Tasmania Department of Health provides four 'air quality health categories', with descriptors.	
Pollutant Specific	PM ₁₀	PM _{2.5}
Pollutant reported?	No AQI, but instantaneous PM ₁₀ is reported as a rolling 24-hour concentration without categorisation or banding.	No AQI, but instantaneous and a rolling 1-hour PM _{2.5} is reported as an 'air quality health category'
Averaging period(s)	instantaneous	instantaneous, rolling 1-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	n/a	n/a

¹⁵ <https://epa.tas.gov.au/epa/air/monitoring-air-pollution/real-time-air-quality-data-for-tasmania>

¹⁶ <https://www.dhhs.tas.gov.au/publichealth/air/trackairquality>

¹⁷ https://epa.tas.gov.au/air/live/latest_air_data_on_traffic_light_map.png

Aspect	Summary Information	
Reporting values used	Index ✘ Descriptor ✔ Concentration ✔	Index ✘ Descriptor ✔ Concentration ✔
Alerts	Text alerts ✘ Email alerts ✘ App ✘	Text alerts ✘ Email alerts ✘ App ✔ (AirRater)

There is no identified documentation that provides justification for the PM averaging period selected or the air quality health categories used. However, the website provides the following comments, relevant to this study:

“Air particle concentrations are given in micrograms per cubic metre ($\mu\text{g m}^{-3}$) and referred to as PM_{10} and $\text{PM}_{2.5}$ concentrations. These real-time measurements are considered 'indicative' rather than 'reference-level' due to the sampling method.

The scale, bands and descriptors used in TAS are summarised below.

Table 15 Air Quality Reporting (Bands and Scales) – TAS, Australia

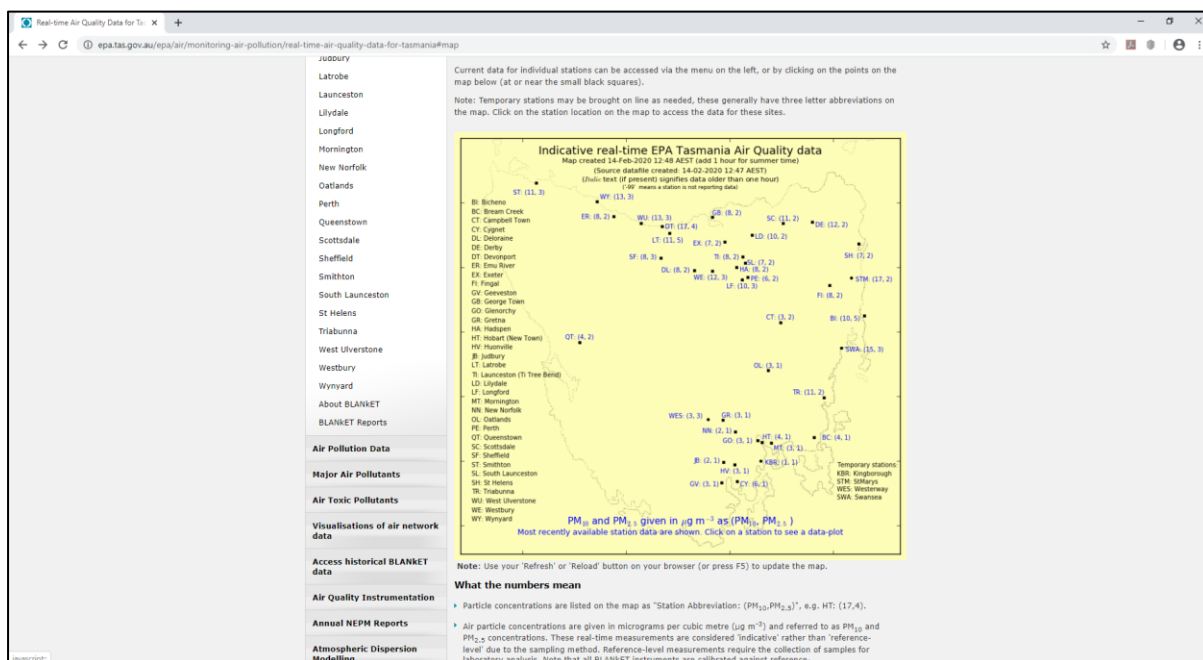
Air Quality Health Categories	PM ₁₀ (instantaneous)		PM _{2.5} (instantaneous, rolling 1-hour)	
	Index value (AQI)	Concentration value ($\mu\text{g}\cdot\text{m}^{-3}$)	Index value (AQI)	Concentration value ($\mu\text{g}\cdot\text{m}^{-3}$)
Good	n/a	n/a	n/a	0-9
Fair	n/a	n/a	n/a	10-24
Poor	n/a	n/a	n/a	25-99
Very Poor	n/a	n/a	n/a	>100

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

The EPA TAS website¹⁸ provides a map of the prevailing air quality conditions, updated at 10-minute intervals by the EPA. A screenshot of that map is reproduced below.

¹⁸ https://epa.tas.gov.au/air/live/latest_air_data_on_traffic_light_map.png

Figure 2 EPA TAS Website – Screenshot of Air Quality Data Map



2.6.3 Air Quality Health Advice

The following health advice is provided regarding the for 'air quality health categories'.

Table 16 Air Quality Health Category Health Advice – TAS, Australia

Air Quality Health Categories	Health Advice
Good (0-9 $\mu\text{g}\cdot\text{m}^{-3}$)	Beautiful. In many parts of Tasmania background PM _{2.5} is less than 5 and hard to beat. Enjoy the outdoors.
Fair (10-25 $\mu\text{g}\cdot\text{m}^{-3}$)	Generally good, it might appear a little hazy. This could indicate that air quality is beginning to get worse. Keep an eye on conditions. If the smoke has been much worse and is now improving, this is a good time to open and air your house.
Poor (26-100 $\mu\text{g}\cdot\text{m}^{-3}$)	Generally you are able to see or smell smoke in the air when PM _{2.5} is over 25. The smoky air could worsen the health of people at higher risk from smoke. People at higher risk from smoke should consider taking action. For more information about what you can do, see the <i>Bushfire smoke and your health</i> fact sheet.
Very Poor (>100 $\mu\text{g}\cdot\text{m}^{-3}$)	It will likely be very smoky and unpleasant for everyone. This represents severe air pollution. People at higher risk from smoke should take action to manage any health conditions and reduce the amount of smoke they breathe. For more information about what you can do, see the <i>Bushfire smoke and your health</i> fact sheet.

The TAS EPA supports the AirRater app, which provides updated information on short-term $PM_{2.5}$ concentrations and associated health advice.

Information relating to the alerts provided by AirRater webpage is located on the webpage¹⁹, which states that it reports on 'air quality', 'temperature' and 'pollen'. It is worth noting that the alerts for pollen on the AirRater app are managed independently of the official government bodies.

In regard to 'air quality' the website states:

"Time Period

AirRater presents data that are as up to date as possible, so that we can support people to make the best decisions at that time.

In most states and territories AirRater updates the $PM_{2.5}$ information every hour, and the data displayed show a 1-hour average. In Tasmania, the readings are updated every 10 minutes.

The time period shown on state and territory websites varies but can be a 24-hourly average. Always check to see what time period the number represents.

Air Quality Index

AirRater shows air quality as the amount of $PM_{2.5}$ in the air.

In contrast, many state and territory government websites present air quality information as the 'Air Quality Index' or AQI.

The AQI was designed as a way to standardise information across different types of air pollution. It can be calculated for a number of pollutants (including fine and coarse particulate matter, carbon monoxide and ozone). The AQI number is not a raw measurement (e.g. micrograms of pollutant per metre cubed of air), but a scale based on how much the reading is above (or below) the air quality standard. Some states and territories provide the AQI separately for different pollutants, others provide only a composite AQI that is based on the pollutant that is the worst. For more details on how the AQI is calculated in your area, please see your local air quality agency's website.

Importantly, for $PM_{2.5}$, the AQI is calculated from a 24-hour average. The rolling 24-hour average used to calculate the AQI means the numbers you see on those websites may change more slowly in response to changing conditions than the 1-hour or 10-minute averages presented in AirRater. Some state and territory websites also provide hourly or 10-minute data for specific pollutants including $PM_{2.5}$, but you might need to click through to another part of the webpage.

¹⁹ <https://airrater.org/what-does-it-monitor/>

2.7 Australia (VIC)

2.7.1 Resources

The following websites were used to access the relevant information:

- EPA Victoria website²⁰ 'how we calculate air quality categories'
- EPA Victoria website²¹ 'how we forecast air quality'
- EPA Victoria website²² 'EPA AirWatch'

2.7.2 Air Quality Reporting

EPA AirWatch uses five air quality categories (air quality concentration bands) to show the level of air pollutants at the monitoring sites across Victoria.

To calculate an air quality category, the average concentration of a pollutant in the air over an hour is measured (i.e. one-hour average concentration values). This measurement is compared to the pollutant's air quality guideline or standard to provide an index value. The pollutant concentration values are compared and the highest is adopted as the overall site category.

The results for each site show the pollutant used to determine the category (i.e. the most impacting pollutant relative to its guideline / standard).

The following is adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in VIC:

Table 17 AQI Reporting (Summary) – VIC, Australia

Aspect	Summary Information
Is there an AQI?	<input type="checkbox"/> Air quality index (AQI) reported <input checked="" type="checkbox"/> Pollutant concentration scale reported ("Air Quality Categories") <input type="checkbox"/> Pollutant concentrations reported
What pollutants are included in the AQI?	There is no AQI in VIC, although the EPA measure and report PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ , SO ₂ against the air quality categories.
How is the AQI derived?	The is no AQI in VIC, but the 1-hour pollutant concentration values are compared to the air quality categories, and the highest air quality category is reported.

²⁰ <https://www.epa.vic.gov.au/for-community/monitoring-your-environment/about-epa-airwatch/calculate-air-quality-categories>

²¹ <https://www.epa.vic.gov.au/for-community/monitoring-your-environment/about-epa-airwatch/forecast-air-quality>

²² <https://www.epa.vic.gov.au/EPAirWatch>

Aspect	Summary Information	
AQI scale	There is no AQI in VIC, but the EPA evaluates each pollutant on a scale. PM ₁₀ is assessed against a non-linear 0 – 240+ µg·m ⁻³ scale and PM _{2.5} is assessed against a non-linear 0-370 µg·m ⁻³ scale.	
Bands within the scale	The EPA designates 5 'air quality categories', with descriptors	
Pollutant Specific	PM ₁₀	PM _{2.5}
Pollutant reported?	No AQI, but the 1-hour average PM ₁₀ concentration is reported	No AQI, but the 1-hour average PM _{2.5} concentration is reported
Averaging period(s)	1-hour	1-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	n/a	n/a
Reporting values used	Index ✗ Descriptor ✓ Concentration ✓	Index ✗ Descriptor ✓ Concentration ✓
Alerts	Text alerts ✗ Email alerts ✗ App ✗	Text alerts ✗ Email alerts ✗ App ✗

There is no identified documentation that provides justification for the PM averaging period selected or the air quality health categories used.

The scale, bands and descriptors used in VIC are summarised below.

Table 18 Air Quality Reporting (Bands and Scales) – VIC, Australia

Air Quality Categories	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
Good	n/a	<40	n/a	<27
Moderate	n/a	40-80	n/a	27-62
Poor	n/a	80-120	n/a	62-97
Very Poor	n/a	120-240	n/a	97-370
Hazardous	n/a	>240	n/a	>370

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

Of interest, the scales used for PM₁₀ and PM_{2.5} are non-linear, and the proportional relationship between PM₁₀ and PM_{2.5} are not constant between categories. At the upper bound threshold for categories, the PM₁₀/PM_{2.5} relationship varies: good 1.48; moderate 1.29; poor 1.24, very poor 0.69. Of interest, the upper bound threshold for PM_{2.5} is greater than PM₁₀ in the 'very poor' category.

The rationale for these designations could not be found.

2.7.3 Air Quality Health Advice

The following health advice is provided the air quality category bands. The advice is not pollutant-specific.

Table 19 AQI Band category Health Advice – VIC, Australia

Air Quality Categories	Health Advice
Good	It's a good day to be outside.
Moderate	<p>The air quality is okay, but it could change soon.</p> <p>It's okay to be outside but watch for changes in air quality around you.</p>
Poor	<p>The air is probably dusty or smoky. Sensitive groups may experience symptoms like coughing or shortness of breath.</p> <p>If you are sensitive to air pollution, spend less time outside in the smoke or dust and follow your treatment plan. Reduce prolonged or heavy physical activity.</p> <p>If you are coughing or short of breath, avoid being outside in the smoke or dust.</p> <p>Close your windows and doors to keep smoke and dust out of your home.</p> <p>If you are worried about your symptoms, see your doctor or call Nurse On Call on 1300 606 024.</p> <p>Seek urgent medical help if anyone has trouble breathing or tightness in the chest. Call 000 for an ambulance.</p>
Very Poor	<p>The air is probably very dusty or smoky. Everyone could be experiencing symptoms like coughing or shortness of breath.</p> <p>Listen to your local emergency radio station or visit Emergency Vic for advice.</p> <p>Avoid being outside in the smoke or dust. Reduce prolonged or heavy physical activity.</p> <p>If you are sensitive to air pollution, follow your treatment plan. Avoid physical activity outdoors.</p> <p>Close your windows and doors to keep smoke and dust out of your home.</p> <p>If you think the air in your home is uncomfortable, consider going to an air-conditioned building like a library or shopping centre for a break if it's safe to do so.</p> <p>If you are worried about your symptoms, see your doctor or call Nurse On Call on 1300 606 024.</p> <p>Seek urgent medical help if anyone has trouble breathing or tightness in the chest. Call 000 for an ambulance.</p>
Hazardous	<p>The air is probably extremely dusty or smoky. Everyone could be experiencing symptoms like coughing or shortness of breath.</p> <p>Listen to your local emergency radio station or visit Emergency Vic for advice.</p> <p>Stay indoors away from smoke and dust.</p>

Air Quality Categories	Health Advice
	<p>If you are sensitive to air pollution, follow your treatment plan. If you can, remain indoors and keep physical activity levels as low as possible.</p> <p>Close your windows and doors to keep smoke and dust out of your home.</p> <p>If you think the air in your home is uncomfortable, consider going to an air-conditioned building like a library or shopping centre for a break if it's safe to do so.</p> <p>If you are worried about your symptoms, see your doctor or call Nurse On Call on 1300 606 024.</p> <p>Seek urgent medical help if anyone has trouble breathing or tightness in the chest. Call 000 for an ambulance.</p>

2.8 Australia (WA)

2.8.1 Resources

The following websites were used to access the relevant information:

- Government of Western Australia, Department of Water and Environmental Regulation website²³ 'air quality index'
- Government of Western Australia, Department of Water and Environmental Regulation website²⁴ 'subscribe to email updates'

2.8.2 Air Quality Reporting

The following AQI are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in WA:

Table 20 AQI Reporting (Summary) – WA, Australia

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported ("Air Quality Index for Western Australia") <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃	
How is the AQI derived?	An AQI value is derived for each included pollutant. DWER report two metrics on their website "AQI Max" and "AQI Now" representing the maximum pollutant-specific AQI since midnight, and currently, respectively. The highest pollutant AQI is reported as the site AQI.	
AQI scale	0-200+	
Bands within the scale	6, with descriptors	
Pollutant Specific	PM₁₀	PM_{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	24-hour	24-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	50	25
Reporting values used	Index ✓ Descriptor ✓ Concentration ✓	Index ✓ Descriptor ✓ Concentration ✓

²³ <https://www.der.wa.gov.au/your-environment/air/air-quality-index>

²⁴ <https://www.der.wa.gov.au/about-us/40-email-alert>

Aspect	Summary Information	
Alerts	Text alerts ✘ Email alerts ✔ App ✘	Text alerts ✘ Email alerts ✔ App ✘

The scale, bands and descriptors used in WA are summarised below.

Table 21 AQI Reporting (Bands and Scales) – WA, Australia

AQI Band	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
Very Good	0-33	0-16.5	0-33	0-8.25
Good	34-66	17-33	34-66	8.5-16.5
Fair	67-99	33.5-49.5	67-99	16.75-24.75
Poor	100-149	50-74.5	100-149	25-37.5
Very Poor	150-200	75-100	150-200	37.6-50
Extreme	>200	>100	>200	>50

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

2.8.3 AQI Health Advice

There is no identified specific AQI band health advice in Western Australia.

2.9 New Zealand

2.9.1 Resources

The following websites were used to access the relevant information:

- Ministry for the Environment website²⁵
- Land Air Water Aotearoa website²⁶

2.9.2 Air Quality Reporting

The following is adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in New Zealand:

Table 22 AQI Reporting (Summary) – New Zealand

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , TSP, SO ₂ , O ₃ ,	
How is the AQI derived?	An AQI value is derived for each included pollutant, and the pollutant-specific value is reported separately and published on the LAWA website.	
AQI scale	0-100+	
Bands within the scale	5, without descriptors	
Pollutant Specific	PM ₁₀	PM _{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	1-hour, 24-hour, monthly average, annual average	1-hour, 24-hour, monthly average, annual average
Conc. equivalent to AQI=100 (µg·m ⁻³)	50	25
Reporting values used	Index ✓ Descriptor ✗ Concentration ✓	Index ✓ Descriptor ✗ Concentration ✓
Alerts	Text alerts ✗ Email alerts ✗	Text alerts ✗ Email alerts ✗

²⁵ <https://www.mfe.govt.nz/air/state-of-our-air/monitoring-air-quality>

²⁶ <https://www.lawa.org.nz/explore-data/air-quality/>

Aspect	Summary Information	
	App ✖	App ✖

The scale, bands and descriptors used in New Zealand are summarised below.

Table 23 AQI Reporting (Bands and Scales) – New Zealand

AQI Band	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
	<10%	<5	<10%	<2.5
	10-33%	5-16.5	10-33%	2.5-8.3
	33-66%	16.5-33	33-66%	8.3-16.5
	66-100%	33-50	66-100%	16.5-25
	>100%	>50	>100%	>25

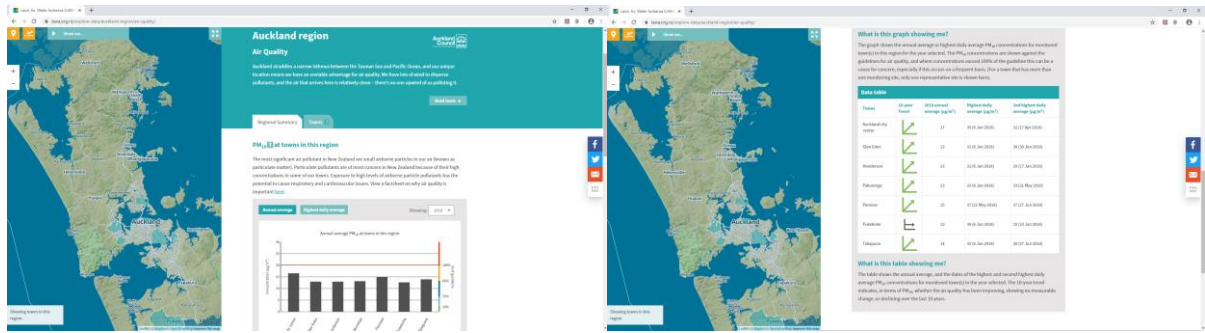
Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only. No descriptor 'names' are used.

Inconsistent with the LAWA approach, the Auckland Council website²⁷ was accessed that presents 'dashboard' AQI for seven locations within its jurisdiction. The Council uses measured values of PM_{2.5} and PM₁₀ (with other gaseous pollutants) and compares the measured value (averaging time unspecified (but assumed to be 24-hour)) with the NES-AQ to derive an AQI. The Council website uses a varied 7-band range: 'very good'; 'good'; 'moderate'; 'fair'; 'poor'; 'very poor'; and 'hazardous'. Auckland was selected for the purposes of checking consistency only, and the consistency of other Council's independent AQI reporting has not been assessed.

The LAWA website presents regional summaries of air quality index values, with simplified graphics to illustrate the 10-year trend. The screenshots below are for the Auckland region. Selecting a monitoring site generates 1-hour, 24-hour, monthly average and annual average concentration values (with the AQI colour scheme) to be generated.

²⁷ <https://environmentauckland.org.nz/Data/Dashboard/61>

Figure 3 LAWA Website AQI Reporting



2.9.3 Air Quality Health Advice

There is no identified specific AQI band health advice in New Zealand.

2.10 USA

2.10.1 Resources

The following websites were used to access the relevant information:

- US EPA, Office of Air Quality Planning and Standards, Outreach and Information Division 'air quality index – a guide to air quality and your health'²⁸
- AirNow website²⁹
- US EPA Technical assistance document for the reporting of daily air quality – the air quality index (AQI)³⁰

The US EPA, in conjunction with the relevant federal, tribal, state and local partners have developed the AirNow website.

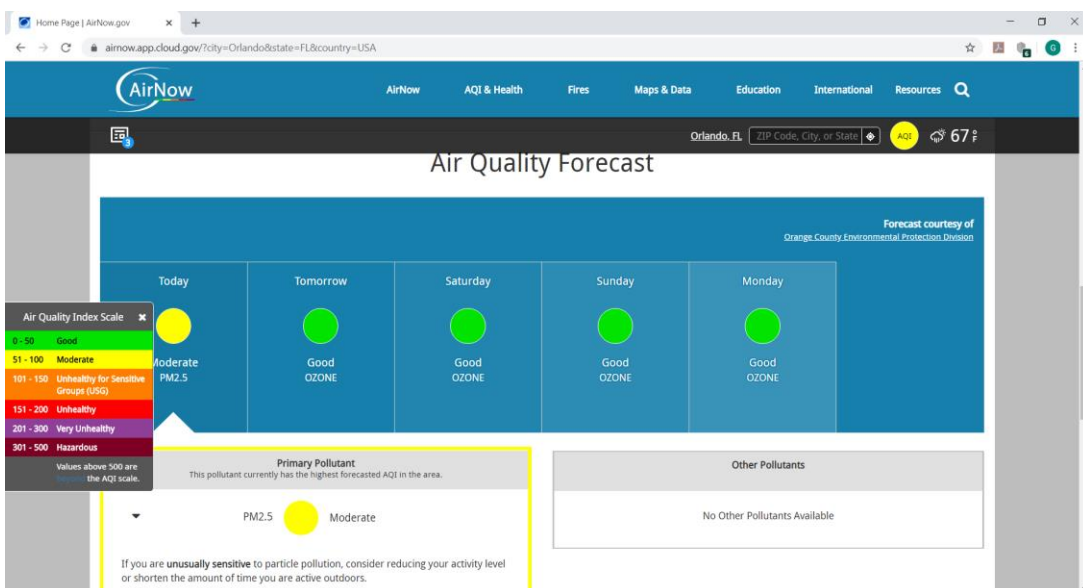
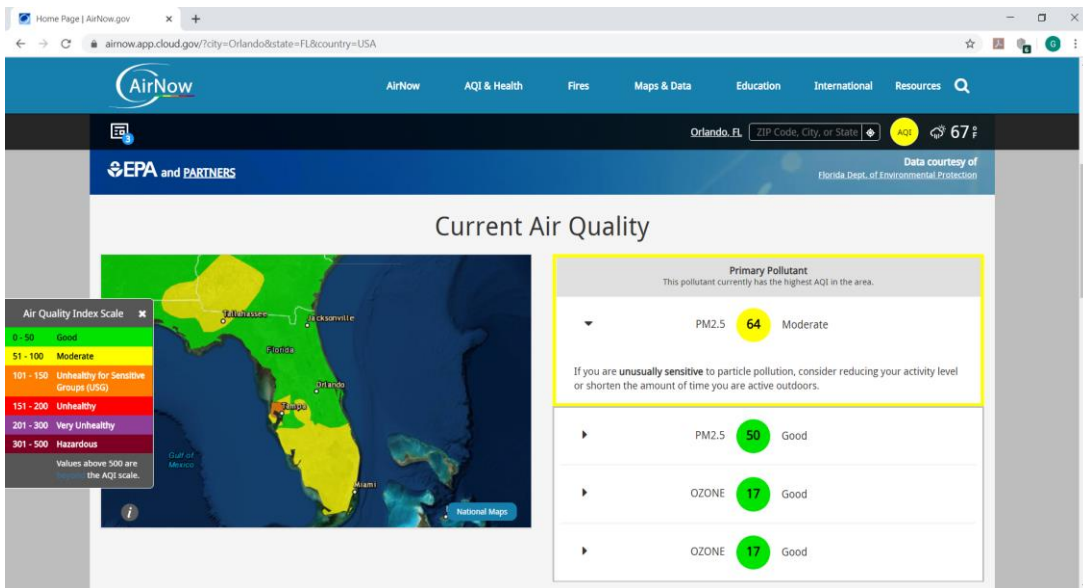
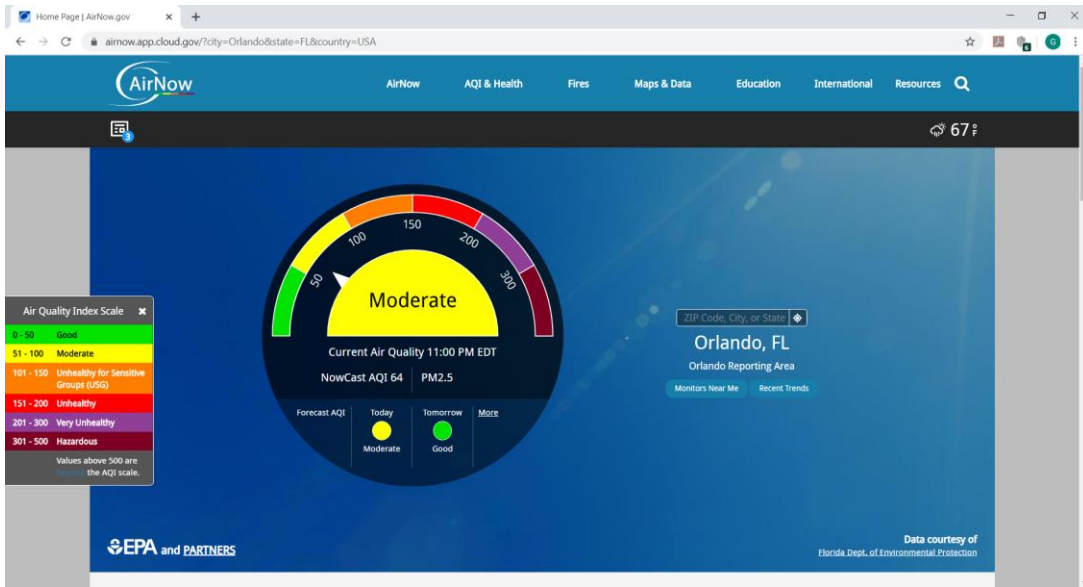
A screen-shot of the front-end page (accessed on 16 April 2020 for Orlando, as example) is illustrated below, showing (top) the summary NowCast AQI, (middle) the current AQI (showing 'moderate for PM_{2.5}') and (bottom) the AQI forecast.

²⁸ https://www3.epa.gov/airnow/aqi_brochure_02_14.pdf

²⁹ <https://airnow.app.cloud.gov/>

³⁰ <https://www3.epa.gov/airnow/aqi-technical-assistance-document-sept2018.pdf>

Figure 4 AirNow website - Screenshots



2.10.2 Air Quality Reporting

The following AQI are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in the USA:

Table 24 AQI Reporting (Summary) – USA

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported (“Air Quality Index”) <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ , SO ₂	
How is the AQI derived?	An AQI value is derived for each included pollutant, and the maximum AQI value is reported (by monitoring station, city or state)	
AQI scale	0-500	
Bands within the scale	6 with descriptors	
Pollutant Specific	PM ₁₀	PM _{2.5}
Pollutant reported?	yes	yes
Averaging period(s) ³¹	24-hour ^(A)	24-hour ^(A)
Conc. equivalent to AQI=100 (µg·m ⁻³)	155	35.5
Reporting values used	Index ✓ Descriptor ✓ Concentration ✓	Index ✓ Descriptor ✓ Concentration ✓
Alerts	Text alerts ✓ Email alerts ✓ App (AirNow) ✓	Text alerts ✓ Email alerts ✓ App (AirNow) ✓

Note (A): The AQI is based on a 24-hour average PM₁₀ and PM_{2.5} concentration. However, the frequency of the NowCast forecasting system may be made on short-term averaging periods during pollution episodes (with “variable air quality conditions”). Please see text below regarding the NowCast forecasting data periods.

Note that the AirNow website includes current and forecast AQI. The EPA document “*Technical assistance document for the reporting of daily air quality – the air quality index*”³² provides a succinct overview of the AQI values and metrics, including those used for NowCast forecasting and states the following:

“EPA uses the NowCast to approximate the complete daily AQI during any given hour. Even on days when the AQI forecast predicts unhealthy conditions, pollution levels may be lower and better for outdoor activities during some parts of the day. Providing current conditions gives

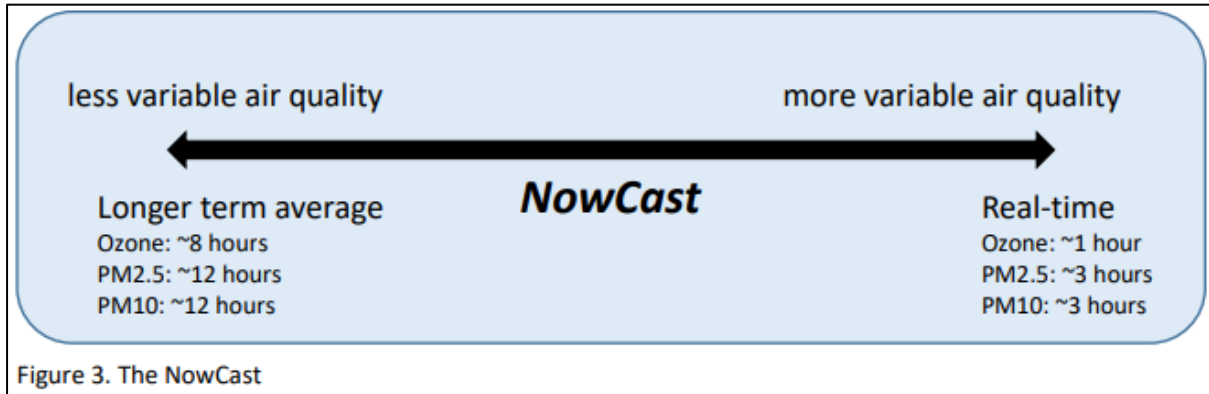
³¹ https://www3.epa.gov/airnow/aqi_brochure_02_14.pdf

³² <https://www3.epa.gov/airnow/aqi-technical-assistance-document-sept2018.pdf>

people the power to take action to reduce outdoor activities and exposure when necessary and protect their health.

The NowCast calculation uses longer averages during periods of stable air quality and shorter averages when air quality is changing rapidly, such as during a fire...

Figure 3 of that guidance document presents a graphic of the averaging periods used by NowCast for forecasting on days of variable air quality conditions:



Correspondingly, the averaging time used for NowCast forecasting can vary downward to just 3 hours on days on rapidly fluctuating air quality conditions, such as ‘during a fire’ or ‘fireworks’.³³

The scale, bands and descriptors used in the USA, as published on the AirNow website, are summarised below.

Table 25 AQI Reporting (Bands and Scales) – USA

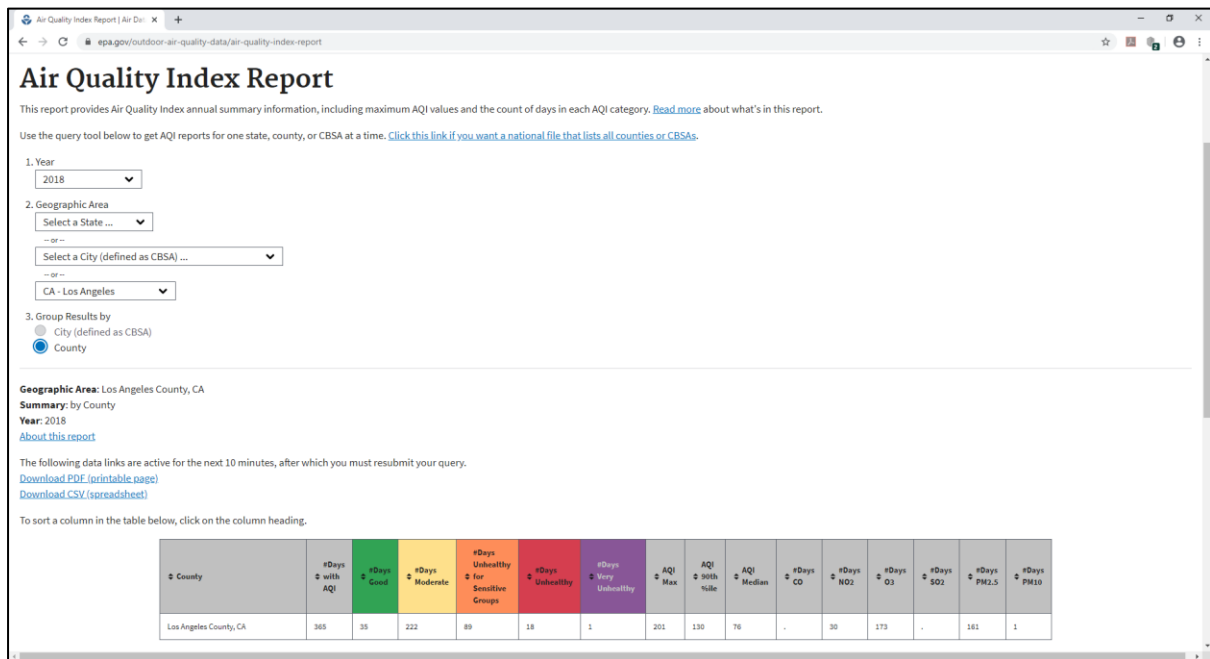
AQI Band	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
Good	0-50	0-54	0-50	0-12
Moderate	51-100	55-154	51-100	13-35.4
Unhealthy for sensitive groups	101-150	155-254	101-150	35.5-55.4
Unhealthy	151-200	255-354	151-200	55.5-150.4
Very unhealthy	201-300	355-424	201-300	150.5-250.4
Hazardous	301-500	425-604	301-500	250.5-500.4

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

The EPA website hosts a search function that runs a yearly state-specific or a city-specific report concerning the number of days categorised by each AQI band, the maximum overall AQI value, the 90th percentile, median, and disaggregated by data for each pollutant (CO, NO₂, O₃, SO₂, PM_{2.5} and PM₁₀). By way of example only, the report for 2018 for Los Angeles is presented below.

³³ https://www3.epa.gov/airnow/ani/pm25_aqi_reporting_nowcast_overview.pdf

Figure 5 US EPA Air Quality Index Report (Los Angeles, 2018) - Screenshot



2.10.3 Air Quality Health Advice

The following health advice is provided for particulate pollution, according to the AQI bands. This is specific advice for PM pollution.

Table 26 AQI Band Health Advice – USA

AQI Band	Health Advice (particle pollution)
Good (0-50)	None. Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate (51-100)	Unusually sensitive people should consider reducing prolonged or heavy exertion. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups (101-150)	The following groups should reduce prolonged or heavy exertion: <ul style="list-style-type: none"> • People with heart or lung disease • Children and older adults Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy (151-200)	The following groups should avoid prolonged or heavy exertion: <ul style="list-style-type: none"> • People with heart or lung disease • Children and older adults Everyone else should reduce prolonged or heavy exertion. Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.

AQI Band	Health Advice (particle pollution)
Very unhealthy (201-300)	The following groups should avoid prolonged or heavy exertion: <ul style="list-style-type: none"> • People with heart or lung disease • Children and older adults Everyone else should reduce prolonged or heavy exertion. Health alert: everyone may experience more serious health effects
Hazardous (301-500)	As above Health warnings of emergency conditions. The entire population is more likely to be affected.

The AirNow website provides a link to further information regarding PM_{2.5} levels “beyond index”³⁴:

Extremely High Levels of PM_{2.5}: Steps to Reduce Your Exposure

The U.S. AQI does not include recommendations for PM_{2.5} levels above 500, but levels are sometimes worse (“beyond index”).

What should I do?

- *Pollution is hazardous at these levels. Everyone should take steps to reduce their exposure when particle pollution levels are in this range.*
- *Staying indoors – in a room or building with filtered air – and reducing your activity levels are the best ways to reduce the amount of particle pollution you breathe into your lungs. Read on for more information on steps to help reduce your exposure to short episodes of high levels of PM_{2.5}.*
- *Links to recommendations for reducing exposure to smoke from fires are available below. These recommendations may help reduce exposure during short-term pollution episodes in which PM_{2.5} levels are above 500, since fine particles (PM_{2.5}) are the primary pollutant in wildfire smoke.*

Who needs to take steps to reduce exposure when PM_{2.5} levels are “hazardous” or above on the AQI?

- *Everyone needs to take steps to protect themselves when pollution levels are “hazardous” and above. Some people are at higher risk from PM_{2.5} exposure. People most at risk from particle pollution exposure include those with heart or lung disease (including asthma and chronic obstructive pulmonary disease-COPD), older adults, and children. Research indicates that pregnant women, newborns, and people with certain health conditions, such as obesity or diabetes, also may be more susceptible to PM-related effects.*
 - *Not sure if the heart disease category applies to you? People with heart disease includes all people with known coronary artery disease, ischemic heart disease, history of angina and/or heart attack, stent placement, by-pass operation, heart failure, ventricular arrhythmia, peripheral vascular disease, history of stroke, transient ischemic attack (TIA), or cerebrovascular disease. This group also includes older adults, because they are more likely to have undiagnosed cardiovascular disease, along with people with multiple risk factors for cardiovascular disease, such as high blood pressure, elevated cholesterol, smoking, and diabetes.*
 - *Why are children more at risk? Children are more likely to be exposed to air pollution, because they often spend more time outdoors engaged in activity and play, and they breathe more air per pound of body weight than adults. They are more susceptible to the effects of air pollution, because their airways are still developing. In addition, children are more likely than adults to have asthma, which increases their risk.*
- *If you are in an at-risk group, if you have heart or lung disease, if you are an older adult, or if you have children, talk with your doctor in advance about when and whether you should leave the area or move to a location with better indoor air quality. When PM_{2.5} concentrations are high for a prolonged period of time, fine particles can build up indoors even though you may not be able to see them.*
- *If you are in an at-risk group, don’t wait until pollution reaches the “hazardous” category to take action to reduce your exposure. Air quality is unhealthy for you when particle pollution levels reach the “unhealthy*

³⁴ <https://airnow.gov/index.cfm?action=aqibasics.pmhilevels>

for sensitive groups” range, so you will need to take steps to reduce your exposure earlier and more often. If you are healthy, begin taking steps when air pollution reaches the “unhealthy” category.

How can I tell if particle pollution is affecting me?

- Even if you are healthy, you may experience temporary symptoms such as irritation of the eyes, nose, and throat; coughing; phlegm; chest tightness; and shortness of breath. These symptoms should go away when air quality improves.
- If you have lung disease – including asthma and COPD – you may not be able to breathe as deeply or as vigorously as normal, and you may experience coughing, chest discomfort, wheezing, shortness of breath, and unusual fatigue. Make sure you follow your doctor's directions about taking your medicines and following your asthma management plan. If you have any of these symptoms, reduce your exposure to particles and follow your doctor's advice. Contact your doctor if symptoms persist or worsen. In the event of an emergency, anywhere in the U.S., dial 911.
- If you have heart or vascular disease, particle exposure can cause serious problems – including worsening of your disease – in a short period of time. Do not assume that you are safe just because you do not have symptoms.
 - Symptoms that may indicate a serious heart problem include: Chest discomfort (uncomfortable pressure, fullness, squeezing, or pain in the center of the chest that lasts more than a few minutes or goes away and comes back), discomfort in other areas of the upper body (pain or discomfort in one or both arms, the back, neck, jaw or stomach), shortness of breath, or other signs may include breaking out in a cold sweat, nausea or light-headedness. Seek emergency medical treatment if you experience these symptoms. In the event of an emergency anywhere in the U.S., dial 911.
 - Symptoms of a stroke include: Sudden numbness or weakness (in the face, arm or legs especially on one side of the body), confusion, trouble speaking or understanding, problems seeing in one or both eyes, dizziness, loss of balance or coordination or trouble walking, or severe headache with no known cause may indicate symptoms of a stroke. Seek emergency medical treatment if you experience these symptoms. In the event of an emergency anywhere in the U.S., dial 911.

What can I do to reduce my exposure to fine particle pollution when levels are extremely high?

- Stay indoors in an area with filtered air. Particle pollution can get indoors, so consider purchasing an air cleaner if you live in an area with high levels of particle pollution. (See information on selecting an air cleaner below.)
 - Air cleaners that remove particles include high-efficiency mechanical filters and electronic air cleaners, such as electrostatic precipitators. Avoid using an air cleaner that works by generating ozone, which will increase the pollution in your home.
 - If you do not have air cleaners in your home, try to go somewhere that does have air filtration. This could, for example, be a friend's home, if it has air filtration.
- Keep your activity levels low.
 - Avoid activities that make you breathe faster or more deeply. This is a good day for indoor activities, such as reading or watching TV.
- If you cannot buy filters for your entire home, create a clean room for sleeping.
 - A good choice is a room with as few windows and doors as possible, such as a bedroom.
 - If the room has windows, keep them closed.
 - Run an air conditioner or central air conditioning system if you are certain your air conditioner does not draw air from outdoors and has a filter. If the air conditioner provides a fresh air option, keep the fresh-air intake closed. Make sure that the filter is clean enough to allow good air flow indoors.
 - Use an air filter in that room. Avoid using an air cleaner that works by generating ozone. Those types of cleaners will increase the pollution in your home.
 - Follow steps for keeping pollution in your home low (see next section).
- Take additional steps to keep pollution in your home low. Air cleaners alone may not be enough. Because particle pollution from the outdoor air can easily get inside, take steps to avoid adding even more pollution indoors when outdoor PM_{2.5} levels are high:
 - Avoid using anything that burns, such as wood fireplaces, gas logs and even candles or incense.
 - Keep the room clean – but don't vacuum unless your vacuum has a HEPA filter. That stirs up particles already inside your home. Wet mopping can help reduce dust.

- Don't smoke.
- Be cautious when the weather is hot. If it is too hot to stay inside with the windows closed, or if you are in an at-risk group, go somewhere else with filtered air.
- When air quality improves, open the windows and air out your home or office.
- **Selecting an air cleaner:**
 - Air cleaners that remove particles include high-efficiency mechanical filters and electronic air cleaners, such as electrostatic precipitators. Avoid using an air cleaner that works by generating ozone, which will increase the pollution in your home.
 - The California Air Resources Board has information on selecting portable and central air cleaners— including information on choosing the correct size for your room(s). Go to <http://www.arb.ca.gov/research/indoor/acdsumm.pdf> (PDF, 11 pp., 400 KB, about PDF)
 - EPA also provides detailed technical information on air cleaners in the home. See <http://www.epa.gov/indoor-air-quality-iaq/guide-air-cleaners-home>
- **Should I wear a dust mask if I have to go outside?**
 - Do not rely on dust masks for protection. Paper "comfort" or "dust" masks are designed to trap large particles, such as sawdust. These masks will not protect your lungs from small particles such as PM_{2.5}. Scarves or bandanas won't help either.
 - Disposable respirators known as N-95 or P-100 respirators will help if you have to be outdoors for a period of time. It's important that you wear the respirator correctly, however. For information on how to use one, see:
 - http://oehha.ca.gov/air/risk_assess/wildfirev8.pdf (p.17-20) (PDF, 54 pp., 1.4 MB, about PDF)
 - <http://www.placer.ca.gov/Departments/Air/InfoAndEducation/~media/apc/documents/WildfireSmoke/FaceMasks-FiltersInfo.ashx> (PDF, 1 p., 184 KB, about PDF)

The updated AirNow website presents information in relation to the "Air Quality Flag Program":

"Here's how the Air Quality Flag Program works: each day your organization raises a flag that corresponds to how clean or polluted the air is. The color of the flag matches EPA's Air Quality Index (AQI): green, yellow, orange, red, and purple. On unhealthy days, your organization can use this information to adjust physical activities to help reduce exposure to air pollution, while still keeping people active."

The AirNow website includes a range of resources including how to order and use the flags to educate communities in regard to air quality risks, air quality education packs, and access to an AirNow widget to distribute data on the AQI conditions and forecast.

A PowerPoint slide presentation on the Air Quality Flag Program is available from the AirNow website³⁵.

³⁵ <https://airnow.app.cloud.gov/publications/air-quality-flag-program-getting-started/air-quality-flag-program-slides/>

2.11 California

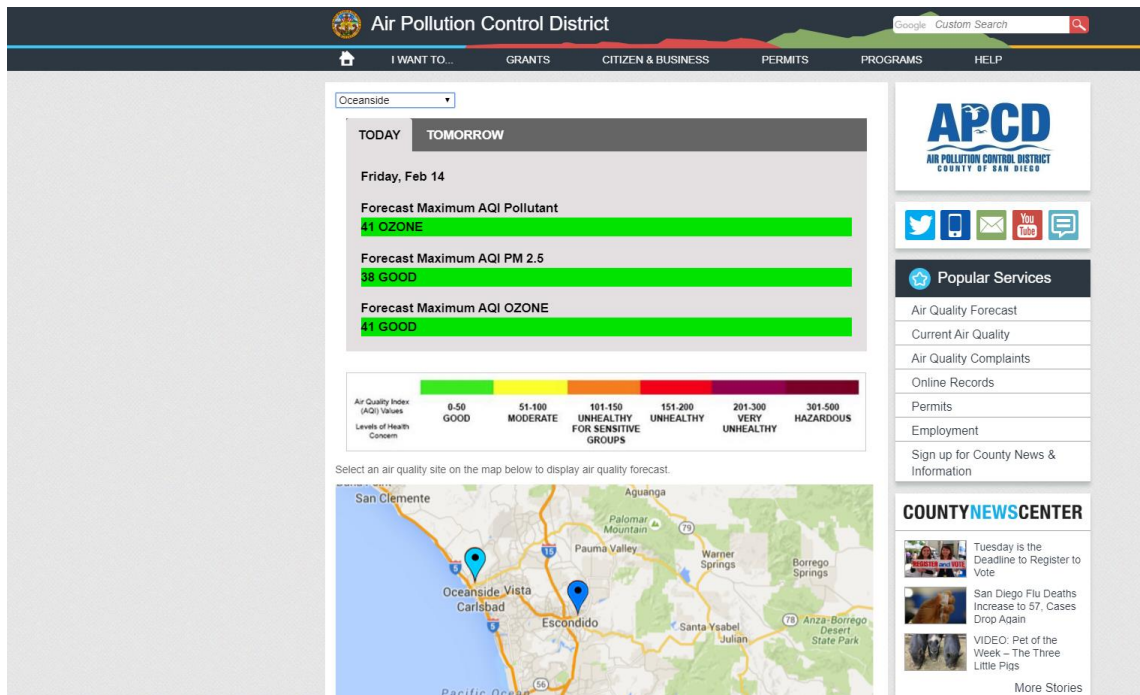
2.11.1 Resources

The following websites were used to access the relevant information:

- California Air Resources Board, Air Quality Index³⁶
- California Air Resources Board, BreatheWell mobile app³⁷
- Spare the Air website for each Air Reporting District³⁸
- AirNow website³⁹
- US EPA Technical assistance document for the reporting of daily air quality – the air quality index (AQI)⁴⁰

The California Air Resources Board (CARB) adopt the US EPA methodology for reporting of the Air Quality Index, as discussed in **Section 2.10**. Individual areas (Sacramento Metropolitan Area, San Diego, San Francisco Bay Area, San Joaquin Valley, South Coast, and Ventura County) report AQI values on individual websites, an example provided for the San Diego Air Pollution Control District is presented in **Figure 6**.

Figure 6 San Diego Air Pollution Control District Website - Screenshot



³⁶ <https://www.arb.ca.gov/aqmis2/MainPgLinks/aqi.php>

³⁷ <https://mobile.arb.ca.gov/breathewell/>

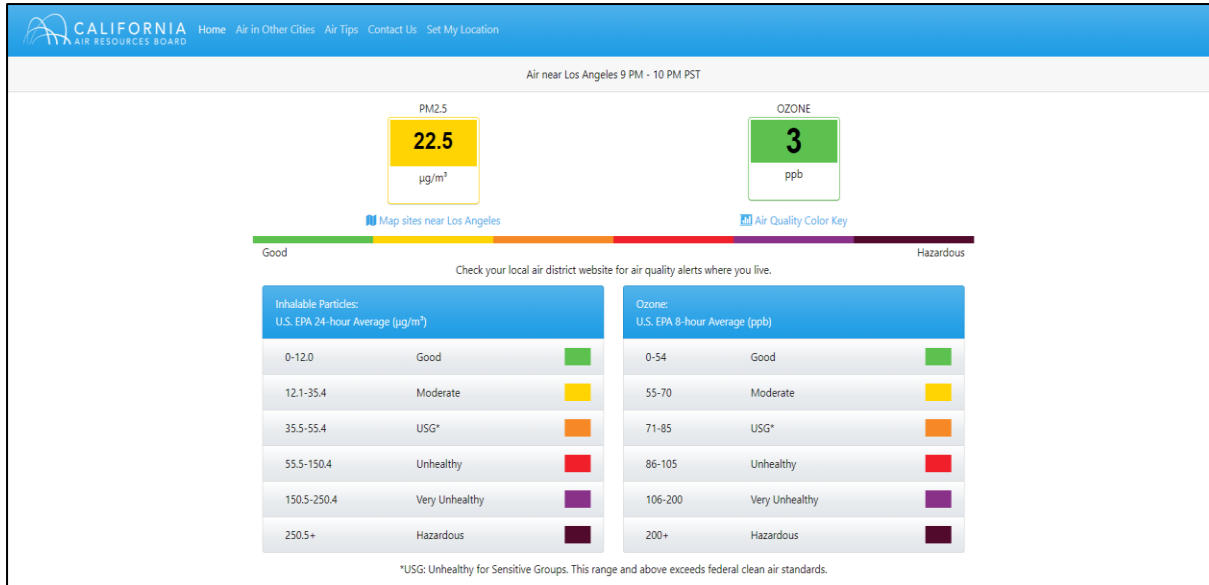
³⁸ <http://www.sparetheair.com/>

³⁹ <https://airnow.app.cloud.gov/>

⁴⁰ <https://www3.epa.gov/airnow/aqi-technical-assistance-document-sept2018.pdf>

A secondary resource is also provided by CARB which is a mobile application reporting real-time inhalable particulate matter (PM_{2.5}) and ozone data, separately. A screenshot of the mobile app is provided in **Figure 7**. BreatheWell reports concentration data and provides a scale in the Good to Hazardous range.

Figure 7 CARB BreatheWell Mobile App - Screenshot



2.11.2 Air Quality Reporting

The following AQI are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in California:

Table 27 AQI Reporting (Summary) – California

Aspect	Summary Information
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported (“Air Quality Index”) <input checked="" type="checkbox"/> Pollutant concentration scale reported (BreatheWell) <input checked="" type="checkbox"/> Pollutant concentrations reported (BreatheWell)
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ , SO ₂ (AQI) PM _{2.5} , O ₃ (BreatheWell)
How is the AQI derived?	An AQI value is derived for each included pollutant, and the maximum AQI value is reported (by monitoring station, city or state) For the BreatheWell mobile app, PM _{2.5} and ozone data are both reported (concentration and scale)
AQI scale	0-500. The BreatheWell pollutant concentration scale covers PM _{2.5} over a scale from 0 to 250.5+ (24-hr PM _{2.5} µg·m ⁻³)
Bands within the scale (AQI)	AQI: 6 with descriptors, BreatheWell: 6 with descriptors

Aspect	Summary Information		
	AQI PM ₁₀	AQI PM _{2.5}	BreatheWell PM _{2.5}
Pollutant reported?	yes	yes	yes
Averaging period(s)	24-hour	24-hour ^(A)	1-hour ^(B)
Conc. equivalent to AQI=100 (µg·m ⁻³)	150	35	100
Reporting values used	Index ✓ Descriptor ✓ Concentration ✓	Index ✓ Descriptor ✓ Concentration ✓	Index ✗ Descriptor ✓ Concentration ✓
Alerts	Text alerts ✓ Email alerts ✓ App (AirNow) ✓	Text alerts ✓ Email alerts ✓ App (AirNow) ✓	Text alerts ✗ Email alerts ✗ App (BreatheWell) ✓

Note: (A) See Section 2.10.2 (USA) regarding the NowCast forecasting data periods.

(B) The BreatheWell mobile app uses 1-hour measurements to provide a categorisation of air quality

The scale, bands and descriptors used in the USA, as published on the AirNow website, associated with the AQI adopted in California, are summarised below.

Table 28 AQI Reporting (Bands and Scales) – California

AQI Band	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
Good	0-50	0-54	0-50	0-12
Moderate	51-100	55-154	51-100	13-35.4
Unhealthy for sensitive groups	101-150	155-254	101-150	35.5-55.4
Unhealthy	151-200	255-354	151-200	55.5-150.4
Very unhealthy	201-300	355-424	201-300	150.5-250.4
Hazardous	301-500	425-604	301-500	250.5-500.4

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

The scale, bands and descriptors used in the California, as part of the BreatheWell mobile app, are summarised below.

Table 29 BreathWell Reporting (Bands and Scales) – California

Air Quality Band	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
Good	n/a	n/a	n/a	0-12
Moderate	n/a	n/a	n/a	12.1-35.4
Unhealthy for sensitive groups	n/a	n/a	n/a	35.5-55.4
Unhealthy	n/a	n/a	n/a	55.5-150.4
Very unhealthy	n/a	n/a	n/a	150.5-250.4
Hazardous	n/a	n/a	n/a	250.5+

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

2.11.3 Air Quality Health Advice

The health advice associated with the AQI is the same as provided for the USA in **Section 2.10**. In relation to the BreatheWell mobile app, the following health advice is provided for both particulate and ozone pollution, according to the pollutant concentration categorisation.

Table 30 AQI Band Health Advice – California

Air Quality Band	Health Advice (particle and ozone pollution)
Good	Enjoy your usual outdoor activities
Moderate	Extremely sensitive children and adults should refrain from strenuous outdoor activities.
Unhealthy for Sensitive Groups	Sensitive children and adults should limit prolonged outdoor activity.
Unhealthy	Sensitive groups should avoid outdoor exposure and others should limit prolonged outdoor activity.
Very unhealthy	Sensitive groups should stay indoors and others should avoid outdoor activity.
Hazardous	All activity should be moved indoors as this level may trigger a health warning of emergency conditions, and the entire population is more likely to be affected.

2.12 Canada

2.12.1 Resources

The following websites were used to access the relevant information:

- Government of Canada website⁴¹ 'air quality health index'
- Government of Canada website⁴² 'air quality health index messages'
- Government of Alberta website⁴³ 'about the air quality health index'
- Government of Canada website⁴⁴ 'air quality: frequently asked questions'

2.12.2 Air Quality Reporting

In Canada, an Air Quality Health Index (AQHI) has been created to report on the health risk posed by a specific level of air quality.

The following AQHI is adopted for reporting air quality health conditions in Canada:

Table 31 AQI Reporting (Summary) – Canada

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported ("Air Quality Health Index") <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM _{2.5} , NO ₂ , O ₃ ^(A)	
How is the AQI derived?	An AQI value is calculated from the measured values for the three pollutants.	
AQI scale	0-10+	
Bands within the scale	4 with descriptors	
Pollutant Specific	PM₁₀	{PM_{2.5}, NO₂, O₃}
Pollutant reported?	n/a ^(A)	yes, in conjunction with NO ₂ and O ₃
Averaging period(s)	n/a	24-hour ^(B)
Conc. equivalent to AQI=100 (µg·m ⁻³)	n/a	25

⁴¹ https://weather.gc.ca/airquality/pages/index_e.html

⁴² https://weather.gc.ca/airquality/healthmessage_e.html

⁴³ <https://www.alberta.ca/about-the-air-quality-health-index.aspx>

⁴⁴ <https://www.canada.ca/en/environment-climate-change/services/air-quality-health-index/frequently-asked-questions.html>

Aspect	Summary Information	
Reporting values used	Index ✘ Descriptor ✘ Concentration ✘	Index ✔ Descriptor ✔ Concentration ✘
Alerts	Text alerts ✘ Email alerts ✘ App ✘	Text alerts ✘ Email alerts ✘ App ✔

Note: (A) Most literature states that the AQHI is a function of PM_{2.5}, NO₂ and O₃. The ‘about the air quality health index’ page on the Government of Canada website states that the particulate component of the AQHI is a function of PM₁₀ and PM_{2.5}⁴⁵.

(B) Publicly accessible information regarding the pollutant averaging period could not be found, although it is anecdotally noted that the AQHI is derived from 3-hr average concentrations. See below for further discussion.

Of note, the AQHI reports on the health risk posed by a mixture of pollutants including ground-level ozone, particulate matter and nitrogen dioxide. The index rating for the AQHI is the sum of the health risks from each of the pollutants in the index. Three specific pollutants have been chosen as indicators of the overall mixture: ground-level ozone (O₃), fine particulate matter (PM_{2.5}), and nitrogen dioxide (NO₂)

In the development of the AQHI, a formula that combined these three pollutants was found to be the best indicators of the health risk of the combined impact of the mix of pollutants in the air.

At the time of preparing this report, a published document with the calculation methodology could not be located, although the Alberta Government website⁴⁶ references a paper in the Journal of the Air & Waste Management Association that may provide some further reference to its derivation⁴⁷. It is also anecdotally understood that the AQHI values are derived from 3-hour average concentration readings, although this also cannot be confirmed.

The ‘frequently asked questions’ page on the Government of Canada website⁴⁸ provides a wealth of supporting explanation on the derivation of the AQHI, and specifically how this approach differs from the previous AQI reported in Canada and the AQI approach adopted in the USA. The following is taken from that webpage:

“How is the Air Quality Health Index presented?”

The Air Quality Health Index is a scale that lists a number from 1 to 10+ to indicate the level of health risk associated with air quality.

Scientists created the index by estimating the daily change in mortality risk for ten cities from 1998-2000 and plotting it on a 10 point scale.

The higher the number, the greater the risk and the need to take precautions.

⁴⁵ <https://www.canada.ca/en/environment-climate-change/services/air-quality-health-index/about.html>

⁴⁶ <https://www.alberta.ca/air-quality-health-index--calculation.aspx>

⁴⁷ <https://www.tandfonline.com/doi/abs/10.3155/1047-3289.58.3.435>

⁴⁸ <https://www.canada.ca/en/environment-climate-change/services/air-quality-health-index/frequently-asked-questions.html>

What’s the difference between the air quality index I am used to and the Air Quality Health Index? Won’t people get the existing air quality index and the Air Quality Health Index mixed up?

The Air Quality Health Index is an entirely new approach to communicating about air quality that differs from more familiar air quality indices which all follow an approach developed in the 1970s.

All previous air quality indices have reported air quality in term of air quality objectives for different pollutants and address each pollutant separately. The Air Quality Health Index presents the immediate health risk of the combined effects of air pollution (smog) mixture.

The air quality objectives or standards that old air quality index uses in its calculations are based on a variety of factors including effects on human health, vegetation, and consideration of the technical and economic achievability of the objectives as air quality management goals. The Air Quality Health Index is a personal health protection tool for individual Canadians, especially those most at risk: children, seniors, and people with diabetes, heart and lung disease. It does not attempt to consider any issues other than the day to day health impact of air pollution.

The old index is usually presented in a way that implies a safe level of air pollution below a specified threshold. The Air Quality Health Index reflects scientific evidence that negative health effects can occur even at low levels of exposure.

The old air quality index is not the same across the country as provincial and municipal governments have adopted different air quality standards as a basis for the index in their jurisdiction. The Air Quality Health Index has been developed through a national process and is designed to apply across the country.

The scale, bands and descriptors used in Canada are summarised below.

Table 32 AQHI Reporting (Bands and Scales) – Canada

AQHI Band	PM _{2.5} + O ₃ + NO ₂	
	Index value (AQHI)	Equivalent conc. value (µg·m ⁻³)
Low Risk	1 - 3	N/A ^(A)
Moderate Risk	4 - 6	N/A
High Risk	7 - 10	N/A
Very High Risk	>10	N/A

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

Note (A) the concentration value is a function of PM_{2.5}, O₃ and NO₂.

2.12.3 AQI Health Advice

The following health advice is provided the AQI bands. This advice is not pollutant-specific because the AQHI is a multi-pollutant index. The AQHI provides an index value of health risk not on pollutant concentration values compared to the relevant standard.

Table 33 AQI Band Health Advice – Canada

AQI Band	Health Advice	
	At Risk Population	General Population
Low Risk (1-3)	Enjoy your usual outdoor activities	Ideal air quality for outdoor activities.
Moderate Risk (4-6)	Consider reducing or rescheduling strenuous activities outdoors if you are experiencing symptoms.	No need to modify your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.
High Risk (7-10)	Reduce or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	Consider reducing or rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation.
Very High Risk (>10)	Avoid strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion.	Reduce or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation.

2.13 Colombia

It is noted that Colombia was not included in the DPI&E specification but has been added as we had access to the relevant information.

2.13.1 Resources

The following websites were used to access the relevant information:

- República de Colombia website⁴⁹ 'índice de calidad del aire (ICA)'
- Bogota IBOCA website⁵⁰

2.13.2 Air Quality Reporting

The following AQI (ICA) are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in Colombia:

Table 34 AQI Reporting (Summary) – Colombia

Aspect	Summary Information	
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported ("Air Quality Index") <input type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ , SO ₂	
How is the AQI derived?	An AQI value is derived for each included pollutant, and the maximum AQI value is reported.	
AQI scale	0-500	
Bands within the scale	6, with descriptors	
Pollutant Specific	PM₁₀	PM_{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	24-hour	24-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	154	40.4
Reporting values used	Index ✗ Descriptor ✓ Concentration ✓	Index ✗ Descriptor ✓ Concentration ✓

⁴⁹ <http://www.ideam.gov.co/documents/11769/641368/2.01+HM+Indice+calidad+aire.pdf/5130ffb3-a1bf-4d23-a663-b4c51327cc05>

⁵⁰ <http://iboca.ambientebogota.gov.co/mapa/>

Aspect	Summary Information	
Alerts	Text alerts ✘ Email alerts ✘ App ✘	Text alerts ✘ Email alerts ✘ App ✘

The scale, bands and descriptors used in Colombia are summarised below.

Table 35 AQI Reporting (Bands and Scales) – Colombia

AQI Band	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Equivalent conc. value (µg·m ⁻³)	Index value (AQI)	Equivalent conc. value (µg·m ⁻³)
Good	0 - 50	0 - 54	0 - 50	0 - 15.4
Moderate	51 - 100	55 - 154	51 - 100	15.5 - 40.4
Poor	101 - 150	155 - 254	101 - 150	40.5-65.4
Very Poor	151 - 200	255 - 354	151 - 200	65.5 - 150.4
Extreme	201 - 300	355 - 424	201 - 300	150.5 - 250.4
Hazardous	301 - 500	425 - 604	301 - 500	250.5 - 500.4

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

It is noted that the Bogota District Environmental Secretariat IBOCA website⁵¹ presents an AQI approach inconsistent with the government approach presented above. That website presents a dynamic map of current AQI across Bogota on a six-band scale: favourable; moderate; regular; bad; very bad; and dangerous, as illustrated in **Figure 8**.

2.13.3 Air Quality Health Advice

The following health advice is provided the AQI bands. The advice provided is pollutant-specific.

Table 36 AQI Band Health Advice – Colombia

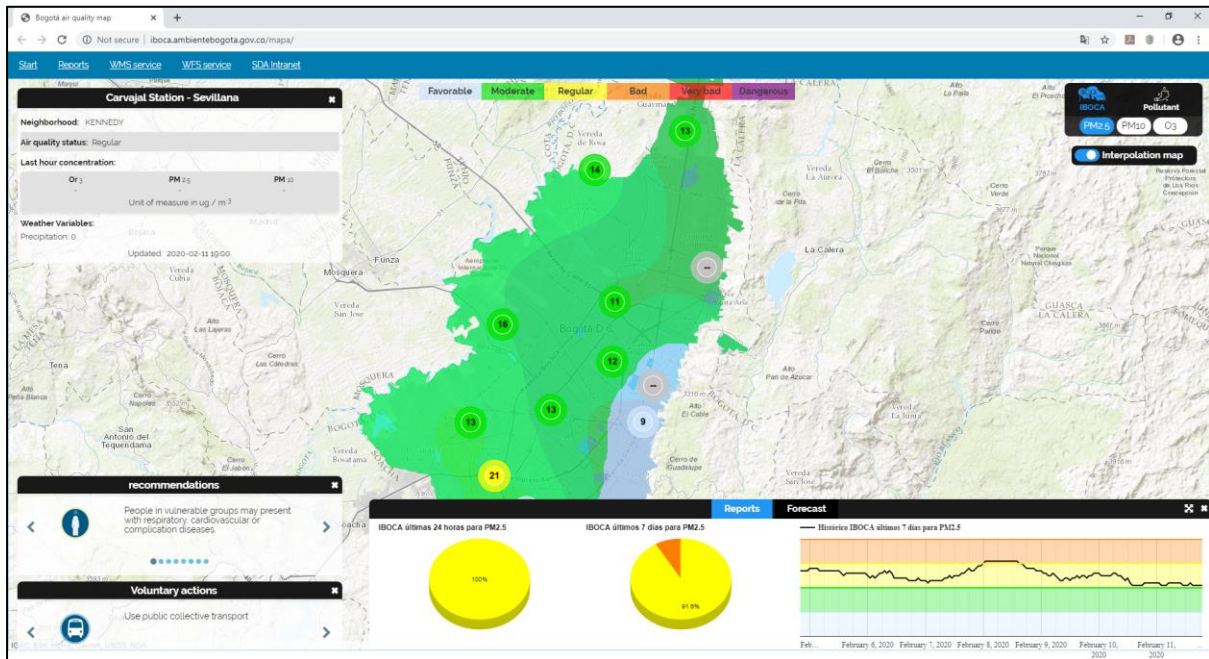
AQI Band	Health Advice (PM ₁₀ and PM _{2.5})
Good	No risk
Moderate	-Extremely sensitive groups (people with asthma and adults with cardio-cerebrovascular disease such as high blood pressure, ischemic myocardial or pulmonary disease, emphysema and chronic bronchitis) should reduce strong or prolonged physical activities
Poor	Harmful to health

⁵¹ <http://iboca.ambientebogota.gov.co/mapa/>

AQI Band	Health Advice (PM ₁₀ and PM _{2.5})
	People over 60 year of age and children with cardiac or respiratory diseases must reduce outside prolonged physical activities.
Very Poor	People over 60 year of age and children with cardiovascular or respiratory diseases must reduce outside prolonged physical activities
Extreme	People over 60 year of age and children with cardiac or respiratory diseases must avoid outside physical activities. Other people should reduce outside prolonged physical activities
Hazardous	Avoid outside heavy physical activities.

As discussed previously, the Bogota IBOCA website presents a dynamic map of AQI across the city. Selecting a monitoring station provides a summary of current and historical air quality trends, and health recommendations. The presented information is for Carvajal Station – Sevillana.

Figure 8 Bogota IBOCA Webpage – Screenshot



2.14 Japan

2.14.1 Resources

The following websites were used to access the relevant information:

- Atmospheric Environmental Regional Observation System (AEROS) website⁵²
- Ministry of the Environment website⁵³ ‘environmental quality standards in Japan – air quality’
- Ministry of the Environment Japan website⁵⁴ ‘real time dust and sandstorm distribution’
- Tokyo Air Information website⁵⁵ ‘about the results of air pollution measurements’
- Ministry of the Environment Japan website⁵⁶ ‘atmospheric environment and automobile measures’

2.14.2 Air Quality Reporting

In Japan, the following definitions apply:

- “Suspended particulate matter (SPM)” is defined as airborne particles with a diameter smaller than or equal to 10 μm ⁵⁷. Japan has a 24-hr average standard of 100 $\mu\text{g}\cdot\text{m}^{-3}$, and a daily 1-hour maximum of 200 $\mu\text{g}\cdot\text{m}^{-3}$.
- “Fine particulate matter” is equivalent to $\text{PM}_{2.5}$. The annual average $\text{PM}_{2.5}$ standard is 15.0 $\mu\text{g}\cdot\text{m}^{-3}$ and the 24-hour standard (98th percentile) is 35 $\mu\text{g}\cdot\text{m}^{-3}$. There is no corresponding 1-hour $\text{PM}_{2.5}$ standard.

The following AQI are adopted for reporting SPM and $\text{PM}_{2.5}$ air quality conditions in Japan:

Table 37 AQI Reporting (Summary) – Japan

Aspect	Summary Information
Is there an AQI?	<input type="checkbox"/> Air quality index (AQI) reported <input checked="" type="checkbox"/> Pollutant concentration scale reported <input type="checkbox"/> Pollutant concentrations reported
What pollutants are included in the AQI?	SPM, $\text{PM}_{2.5}$, CO, NO_2 , O_3 , SO_2

⁵² <http://soramame.taiki.go.jp/>

⁵³ <https://www.env.go.jp/en/air/aaq/aaq.html>

⁵⁴ <http://www2.env.go.jp/dss/kosa/en/index.html>

⁵⁵ https://www.taiki.kankyo.metro.tokyo.lg.jp/taikikankyo/realtime/index_en.html

⁵⁶ <http://www.env.go.jp/air/osen/pm/info.html#STANDARD>

⁵⁷

https://www.researchgate.net/publication/264171197_Air_Pollution_Trends_in_Japan_between_1970_and_2012_and_Impact_of_Urban_Air_Pollution_Countermeasures

Aspect	Summary Information	
How is the AQI derived?	Japan does not have an AQI but has a pollutant concentration banding scale.	
AQI scale	Japan does not have an AQI but has a pollutant concentration banding scale from 0-601 $\mu\text{g}\cdot\text{m}^{-3}$ for PM_{10} and 0-71 $\mu\text{g}\cdot\text{m}^{-3}$ for $\text{PM}_{2.5}$	
Bands within the scale	6 without descriptors	
Pollutant Specific	SPM	$\text{PM}_{2.5}$
Pollutant reported?	No AQI, but Japan does have a pollutant banding scale	No AQI, but Japan does have a pollutant banding scale
Averaging period(s)	1-hour	1-hour
Conc. equivalent to AQI=100 ($\mu\text{g}\cdot\text{m}^{-3}$)	n/a	n/a
Reporting values used	Index ✗ Descriptor ✗ Concentration ✓	Index ✗ Descriptor ✗ Concentration ✓
Alerts	Text alerts ✓ Email alerts ✓ App ✓	Text alerts ✓ Email alerts ✓ App ✓

The scale, bands and descriptors used in Japan are summarised below.

Soramame-kun ranks the measured concentrations by unnamed colour-band as shown in the following table. The ranks are set so that, in principle, values that exceed the environmental standard value are yellow or higher.

It is hard to find documentation that confirms the averaging periods used in the air quality concentration bands illustrated below, but it is considered likely that these are based on 1-hour measurements of SPM and $\text{PM}_{2.5}$ ^{58,59}.

Table 38 Air Quality Reporting (Bands and Scales) – Japan

Air Quality Concentration Bands	(SPM) PM_{10}		$\text{PM}_{2.5}$	
	Index value (AQI)	1h Concentration value ($\mu\text{g}\cdot\text{m}^{-3}$)	Index value (AQI)	1hr Concentration value ($\mu\text{g}\cdot\text{m}^{-3}$)
n/a	n/a	0-50	n/a	0-10
n/a	n/a	51-100	n/a	11-15
n/a	n/a	101-200	n/a	16-35

⁵⁸ <http://soramame.taiki.go.jp/DataList.php?MstCode=13101010>

⁵⁹ <http://soramame.taiki.go.jp/index/setsumei/koumoku.html#kijun>

Air Quality Concentration Bands	(SPM) PM ₁₀		PM _{2.5}	
	Index value (AQI)	1h Concentration value (µg·m ⁻³)	Index value (AQI)	1hr Concentration value (µg·m ⁻³)
n/a	n/a	201-400	n/a	36-50
n/a	n/a	401-600	n/a	51-70
n/a	n/a	>601	n/a	>71

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

2.14.3 Air Quality Health Advice

There is no identified specific health advice regarding the identified AQI bands in Japan.

The Ministry of the Environment⁶⁰ has advised on a provisional PM_{2.5} alert guideline of 70 µg·m⁻³ “temporary guidelines for awareness”. According to the guideline, when the daily average exceeds 70 µg·m⁻³, municipalities should notify the affected populations, and the notification cancelled when all stations are reporting 1-hour PM_{2.5} concentrations of <50 µg·m⁻³ for two consecutive hours. The alert will include sending notification to the “municipalities, news organizations, and related organizations” that the alert will be announced, and publishing on the relevant websites.

In the event of such an alert, the following guidance is offered:

- Avoid long-term intense exercise outdoors and going out as much as possible.
- To minimize the intrusion of outside air into the room, minimize ventilation and opening and closing windows.
- When going out, wear a mask.
- Patients with respiratory or circulatory diseases, children, the elderly, etc., should be aware of changes in physical condition and be more cautious.

⁶⁰ <http://www.env.go.jp/air/osen/pm/info.html#STANDARD>

Figure 9 Ministry of the Environment Alert - Screenshot

注意喚起のための暫定的な指針				
レベル	暫定的な指針となる値		注意喚起の判断に用いる値 ※3	
	日平均値 (μg/m ³)	行動のめやす	午前中の早めの時間帯での判断	午後からの活動に備えた判断
			5時～7時	5時～12時
			1時間値 (μg/m ³)	1時間値 (μg/m ³)
II	70超	不要不急の外出や屋外での長時間の激しい運動をできるだけ減らす。 (高感受性者※2においては、体調に応じて、より慎重に行動することが望まれる。)	85超	80超
I	70以下	特に行動を制約する必要はないが、高感受性者は、健康への影響がみられることがあるため、体調の変化に注意する。	85以下	80以下
(環境基準)	35以下 ※1			

※1 環境基準は環境基本法第16条第1項に基づく人の健康を保護する上で維持されることが望ましい基準
PM2.5に係る環境基準の短期基準は日平均値35μg/m³であり、日平均値の年間98パーセンタイル値で評価
※2 高感受性者は、呼吸器系や循環器系疾患のある者、小児、高齢者等
※3 暫定的な指針となる値である日平均値を超えるか否かについて判断するための値

The following is offered as an attempted translation of the above information:

Table 39 Ministry of the Environment Alert

Level	Provisional indicative value	Health advice	Value to activate the alert ⁽³⁾	
			Assessment on the early morning hours	Assessment for the afternoon activities
	Daily mean in μg·m ⁻³		5am-7am	5am-12pm
			Hourly value (μg·m ⁻³)	
II	>70	Reduce prolonged hard workouts and outings outdoors. In highly sensitive individuals it is desirable to act more carefully depending on the physical condition	>85	>80
I	<70	Although there is no need to take particular action, sensitive individuals should be aware of changes in physical condition	<85	<80
Environmental standard	<35 ⁽¹⁾			

Note: (1) based on Article 16, Paragraph 1 of the Basic Environment Law, in order to protect human health, the 24-hour standard, which employs the annual 98th percentile values, is less than or equal to 35μg·m⁻³

(2) people with respiratory or cardiovascular disease, children, elderly people, etc

(3) judgement value

2.15 European Union

2.15.1 Resources

The following websites were used to access the relevant information:

- European Environment Agency website⁶¹

A screenshot of the landing page of the European Environment Agency AQI webpage is reproduced below.

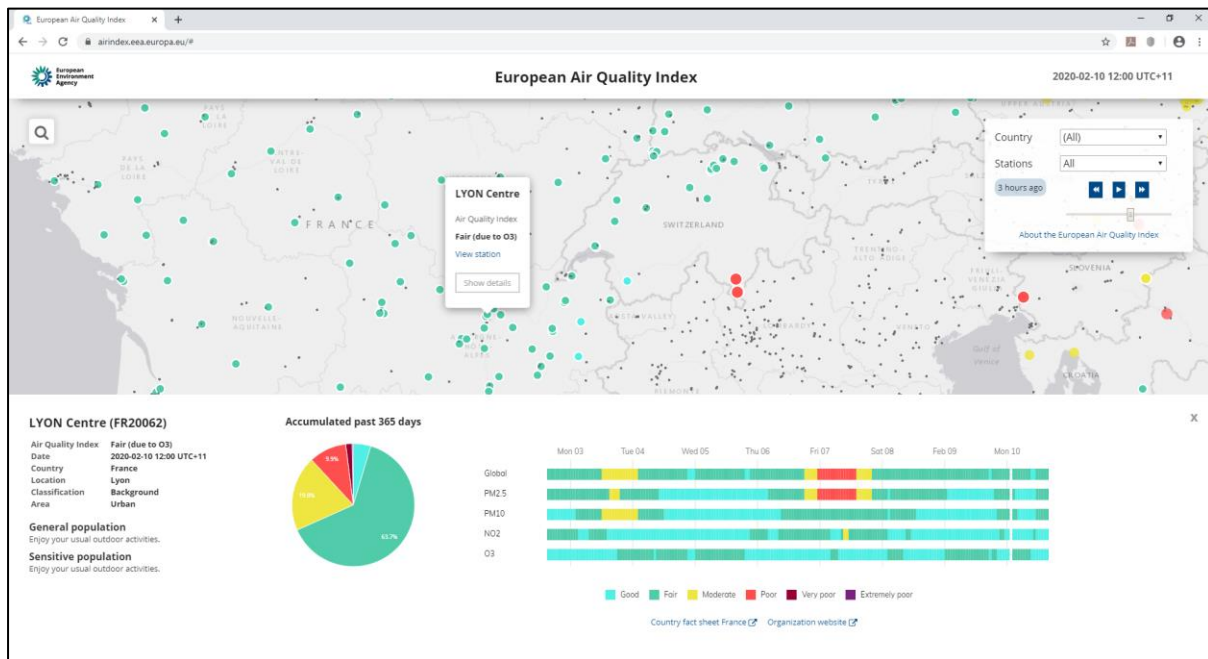
Figure 10 European Air Quality Index – Screenshot



Each dot is a dynamic resource, and selecting a single station allows the metadata (including prevailing air quality conditions) to be accessed, for example:

⁶¹ <https://airindex.eea.europa.eu/>

Figure 11 European Air Quality Index – Screenshot of Station Data



2.15.2 Air Quality Reporting

The following AQI is adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in the EU:

Table 40 AQI Reporting (Summary) – European Union

Aspect	Summary Information	
Is there an AQI?	<input type="checkbox"/> Air quality index (AQI) reported <input checked="" type="checkbox"/> Pollutant concentration scale reported (“European Air Quality Index”) <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	There is no AQI used in the EU, although a concentration band scale is used for PM ₁₀ , PM _{2.5} , NO ₂ , O ₃ , SO ₂	
How is the AQI derived?	There is no AQI used in the EU, although a concentration band scale is used	
AQI scale	There is no AQI used in the EU, although a concentration band scale over a scale of 0-1200 µg·m ⁻³ for PM ₁₀ and 0-800 µg·m ⁻³ for PM _{2.5} is adopted	
Bands within the scale	6 with descriptors	
Pollutant Specific	PM₁₀	PM_{2.5}
Pollutant reported?	No AQI, but the EU has a concentration band scale	No AQI, but the EU has a concentration band scale
Averaging period(s)	24-hour	24-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	n/a	n/a
Reporting values used	Index ✖	Index ✖

Aspect	Summary Information	
	Descriptor ✓	Descriptor ✓
	Concentration ✓	Concentration ✓
Alerts	Text alerts ✗	Text alerts ✗
	Email alerts ✓	Email alerts ✓
	RSS Feed ✓	RSS Feed ✓

The scale, bands and descriptors used in the European Union are summarised below.

Table 41 Air Quality Reporting (Bands and Scales) – European Union

Air Quality Band	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
Good	n/a	0-20	n/a	0-10
Fair	n/a	20-40	n/a	10-20
Moderate	n/a	40-50	n/a	20-25
Poor	n/a	50-100	n/a	25-50
Very poor	n/a	100-150	n/a	50-75
Extremely poor	n/a	150-1200	n/a	75-800

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

As reported on the website:

“the bands are based on the relative risks associated to short-term exposure to PM_{2.5}, O₃ and NO₂, as defined by the World Health Organization in its report on the Health Risks of Air Pollution in Europe project”.

The WHO HRAPIE report can be accessed at the following web link⁶².

In respect to short-term PM exposure, section 3.1 of the HRAPIE report makes the following comment:

“The HRAPIE experts expressed concern that the premature deaths attributed to short-term changes of PM_{2.5} concentration were already accounted for in estimations of the effects of long-term exposure. They therefore recommended that quantification of the effects of short-term exposure should be done for information only; it is not proposed as an alternative to quantification of long-term PM_{2.5} exposure.”

⁶²

http://www.euro.who.int/__data/assets/pdf_file/0006/238956/Health_risks_air_pollution_HRAPIE_project.pdf?ua=1

THE HRAPIE report presents risk indices associated with short-term PM_{2.5} exposure as derived from various European studies over the period 1994-2006 in regard to mortality, hospital admissions for cardiovascular and respiratory diseases, RADS (reduced activity days), lost work days, and asthma symptoms in asthmatic children. For clarity, the EU uses 24-hour average concentration values for its banding.

Concentrations values for up to five key air pollutants determine the index level that reflects air quality at each monitoring station, and the index corresponds to the poorest level for any of five pollutants.

2.15.3 Air Quality Health Advice

The following health advice is provided the air quality bands. It is not pollutant-specific.

Table 42 Air Quality Band Health Advice – European Union

Air Quality Band	General population	Sensitive populations
Good	The air quality is good. Enjoy your usual outdoor activities.	The air quality is good. Enjoy your usual outdoor activities.
Fair	Enjoy your usual outdoor activities.	Enjoy your usual outdoor activities.
Moderate	Enjoy your usual outdoor activities	Consider reducing intense outdoor activities, if you experience symptoms.
Poor	Consider reducing intense activities outdoors, if you experience symptoms such as sore eyes, a cough or sore throat	Consider reducing physical activities, particularly outdoors, especially if you experience symptoms.
Very poor	Consider reducing intense activities outdoors, if you experience symptoms such as sore eyes, a cough or sore throat	Reduce physical activities, particularly outdoors, especially if you experience symptoms.
Extremely poor	Reduce physical activities outdoors.	Avoid physical activities outdoors.

The index bands are complemented by health-related messages that provide recommendations for both the general population and sensitive populations. The latter includes both adults and children with respiratory problems and adults with heart conditions.

2.16 United Kingdom

2.16.1 Resources

The following websites were used to access the relevant information:

- UK Department of Environment, Food and Rural Affairs, UK Air – Air Information Resource website⁶³ ‘daily air quality index’
- UK Department of Environment, Food and Rural Affairs ‘update on implementation of the daily air quality index’⁶⁴

2.16.2 Air Quality Reporting

The following is a summary of the daily air quality index (DAQI) adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in the UK:

Table 43 AQI Reporting (Summary) – UK

Aspect	Summary Information	
Is there an AQI?	<input type="checkbox"/> Air quality index (AQI) reported <input checked="" type="checkbox"/> Pollutant concentration scale reported (“Daily Air Quality Index”) <input type="checkbox"/> Pollutant concentrations reported	
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , NO ₂ , O ₃ , SO ₂	
How is the AQI derived?	The UK does not have an AQI but implements a pollutant concentration scale.	
AQI scale	The UK does not have an AQI but implements a pollutant concentration scale over a range from 0-101+ µg·m ⁻³ for PM ₁₀ and 0-71+ µg·m ⁻³ for PM _{2.5}	
Bands within the scale	10, with descriptors	
Pollutant Specific	PM₁₀	PM_{2.5}
Pollutant reported?	yes	yes
Averaging period(s)	24-hour	24-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	n/a	n/a
Reporting values used	Index ✓ Descriptor ✓	Index ✓ Descriptor ✓

⁶³ <https://uk-air.defra.gov.uk/air-pollution/daq>

⁶⁴ https://uk-air.defra.gov.uk/assets/documents/reports/cat14/1304251155_Update_on_Implementation_of_the_DAOI_April_2013_Final.pdf

Aspect	Summary Information	
	Concentration ✓	Concentration ✓
Alerts	Text alerts ✗	Text alerts ✗
	Email alerts ✗	Email alerts ✗

In regard to short-term measurements of PM₁₀ and PM_{2.5}, DEFRA⁶⁵ provides the following (emphasis added). It is reproduced for reference purposes only, and it is emphasised that the UK does not use short-term metrics.

The averaging times of one day for PM₁₀ and PM_{2.5} mean it is not possible to provide public information about an unexpected pollution episode from measurement data until it is well established. To address this, COMEAP recommended the use of trigger values to complement the DAQI. These triggers were derived by COMEAP to provide information to the public to warn of exposure as it is taking place at moderate, high or very high levels. This method has similarities to the way in which the previous UK Air Quality Index defined moderate concentrations of O₃ on the basis of both hourly and 8-hourly mean concentrations.

Trigger concentrations are hourly pollution measurements that indicate a period of moderate, high or very high air pollution may be taking place or is likely to happen soon. These triggers are intended for use by organisations that operate real-time public information services.

The triggers are based on two consecutive hourly mean concentrations. The first hourly mean has to be greater than or equal to a threshold. To avoid false triggers from short-term measurement spikes, the trigger has to be confirmed by a second hourly mean. It is clearly desirable to be able to predict pollution exposure before the accumulated daily mean concentration indicates that moderate, high or very high air pollution has occurred. For this reason, the triggers are biased towards detecting increasing concentrations, i.e. the second hourly mean concentration has to be greater or equal to the first.

Changes to the concentrations that define each index band clearly require a change to the predictive triggers. These have been recalculated using the same method as for the original COMEAP report. The availability of EU reference measurements for PM₁₀ and PM_{2.5} has increased since the time of the COMEAP analysis and hence this revision of the triggers has been undertaken on an extended dataset of EU reference equivalent PM₁₀ and PM_{2.5} concentrations from the AURN and from London and neighbouring networks from 2004 to 2011. Approximately 385,000 site days of PM₁₀ concentrations were modelled for each possible trigger for each band and approximately 73,000 site days were modelled in the same way for PM_{2.5}.

The revised trigger concentrations for each index band are shown in Table 2 along with their Gilbert Skill Score, an indicator of predictive capability

Table 2: Revised trigger concentrations for PM₁₀, PM_{2.5}... GSS=Gilbert Skill Score

Pollutant	Band	Trigger (ug m-3)	GSS
Particulate Matter, PM ₁₀	Moderate or above	68	0.533
	High or above	107	0.348
	Very high or above	177	0.188
Particulate Matter, PM _{2.5}	Moderate or above	50	0.591
	High or above	74	0.422
	Very high or above	101	0.260

The recommendations regarding the adoption of short-term PM concentration values has not been adopted in the UK.

⁶⁵ https://uk-air.defra.gov.uk/assets/documents/reports/cat14/1304251155_Update_on_Implementation_of_the_DAQI_April_2013_Final.pdf

The scale, bands and descriptors used by DEFRA in the UK are summarised below.

Table 44 Air Quality Reporting (Bands and Scales) – UK

Air Quality Bands	PM ₁₀		PM _{2.5}	
	Index value (AQI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
Low (1)	n/a	0-16	n/a	0-11
Low (2)	n/a	17-33	n/a	12-23
Low (3)	n/a	34-50	n/a	24-35
Moderate (4)	n/a	51-58	n/a	36-41
Moderate (5)	n/a	59-66	n/a	42-47
Moderate (6)	n/a	67-75	n/a	48-53
High (7)	n/a	76-83	n/a	54-58
High (8)	n/a	84-91	n/a	59-64
High (9)	n/a	92-100	n/a	65-70
Very High (10)	n/a	≥101	n/a	≥71

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

2.16.3 Air Quality Health Advice

The following health advice is provided the air quality bands. The advice is not pollutant-specific.

Table 45 AQI Band Health Advice – UK

Air Quality Band	Health Advice for At -Risk Individuals*	Health Advice for General Population
Low (1-3)	Enjoy your usual outdoor activities	Enjoy your usual outdoor activities
Moderate (4-6)	Adults and children with lung problems, and adults with heart problems, who experience symptoms , should consider reducing strenuous physical activity, particularly outdoors.	Enjoy your usual outdoor activities

Air Quality Band	Health Advice for At -Risk Individuals*	Health Advice for General Population
High (7-9)	Adults and children with lung problems, and adults with heart problems, should reduce strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also reduce physical exertion.	Anyone experiencing discomfort such as sore eyes, cough or sore throat should consider reducing activity, particularly outdoors.
Very High (10)	Adults and children with lung problems, adults with heart problems, and older people, should avoid strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	Reduce physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

Note *: Adults and children with heart or lung problems are at greater risk of symptoms. Follow your doctor's usual advice about exercising and managing your condition. It is possible that very sensitive individuals may experience health effects even on Low air pollution days. Anyone experiencing symptoms should follow the guidance provided below.

2.17 Singapore

2.17.1 Resources

The following websites were used to access the relevant information:

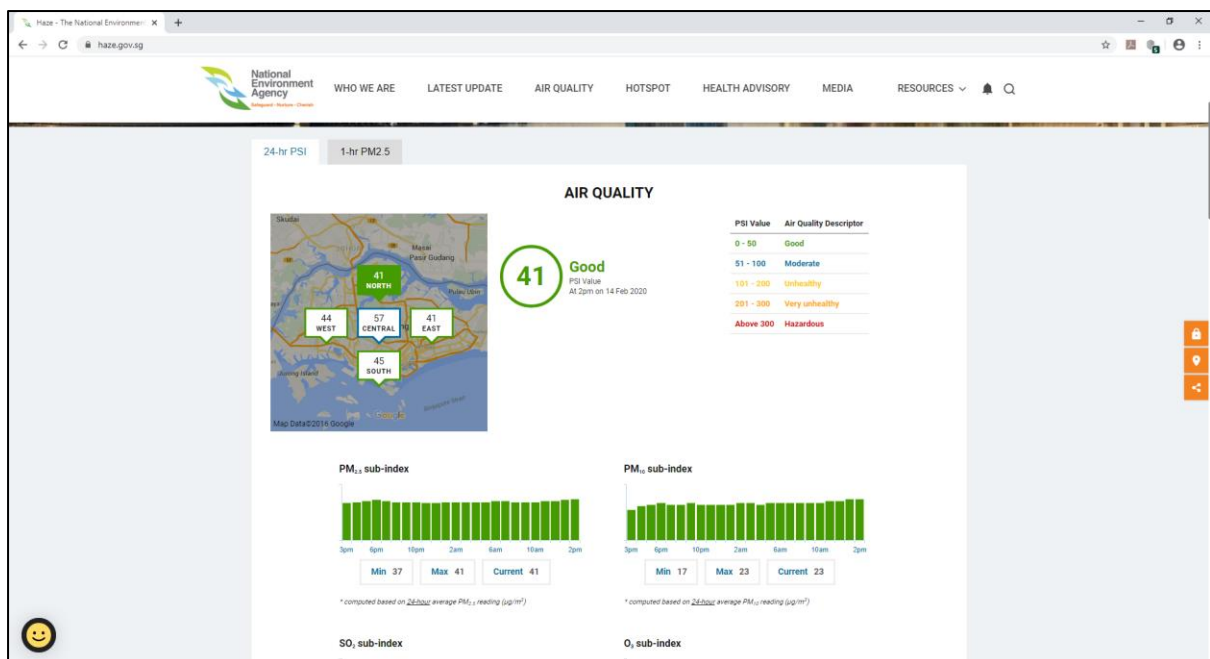
- Singapore National Environment Agency website⁶⁶
- Singapore National Environment Agency website⁶⁷, air quality microsite
- Singapore National Environment Agency website⁶⁸, 'air pollution'

2.17.2 Air Quality Reporting

Singapore has adopted a two-pronged approach to reporting PM₁₀ and PM_{2.5} pollution levels.

There is a 24-hour Pollutant Standards Index (PSI) which is a pollutant concentration scale derived from 24-hour average PM₁₀ and PM_{2.5} data. A screenshot of the PSI page, showing 'sub-indices' for PM₁₀ and PM_{2.5} is illustrated in **Figure 12**. The PSI is a function of both PM₁₀ and PM_{2.5} (along with other gaseous pollutants) where the highest of the sub-indices is reported as the single PSI value.

Figure 12 Singapore NEA 24-Hour PSI - Screenshot



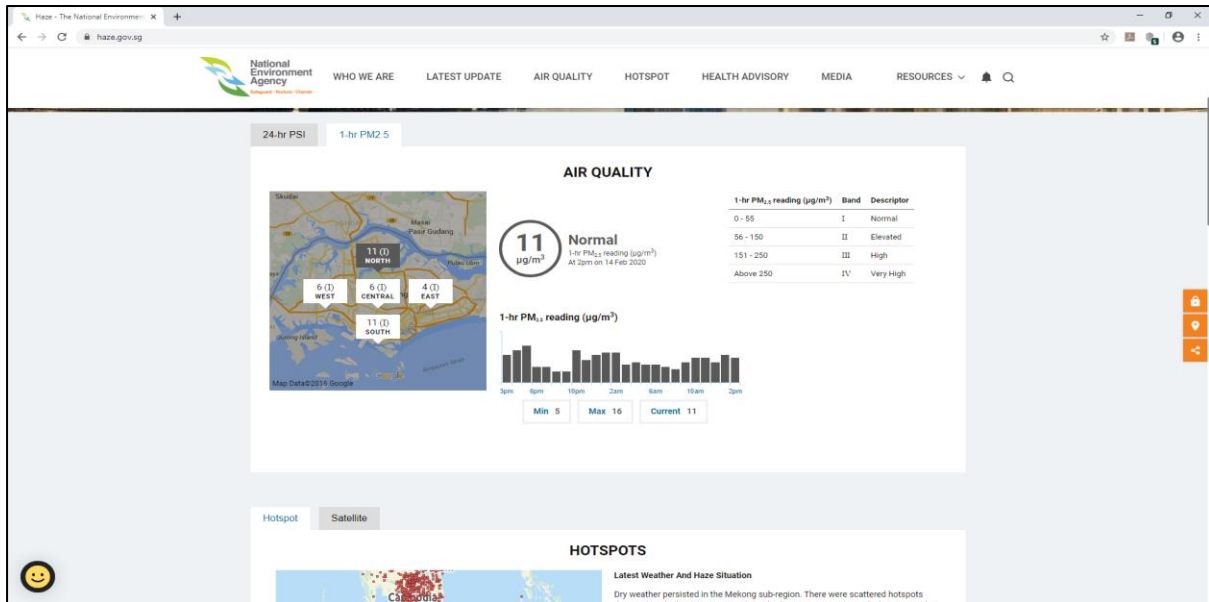
⁶⁶ <https://www.nea.gov.sg/>

⁶⁷ <https://www.haze.gov.sg/>

⁶⁸ <https://www.nea.gov.sg/our-services/pollution-control/air-pollution/air-quality>

Supplementary to this, Singapore NEA also reports 1-hour $PM_{2.5}$ concentration values, presented as both the measured concentration value and as a 4-band descriptor ('normal' to 'very high'). A screenshot illustrating the reporting of the 1-hour $PM_{2.5}$ concentration is presented in **Figure 13**.

Figure 13 Singapore NEA 1-Hour $PM_{2.5}$ 'Haze' - Screenshot



Of interest, a website hosted by the Singapore Institute of International Affairs⁶⁹ provides the following dynamic webpage illustrating the prevailing 24-hour and 1-hour $PM_{2.5}$ concentrations and a corresponding wind vector graphic providing further information concerning the transport of $PM_{2.5}$ from proximate plantations and active fire spots that may contribute to $PM_{2.5}$ pollution.

⁶⁹ <https://www.hazetracker.org/>

Figure 14 Singapore Institute of International Affairs, Hazetracker – Screenshot (24-hour PSI)

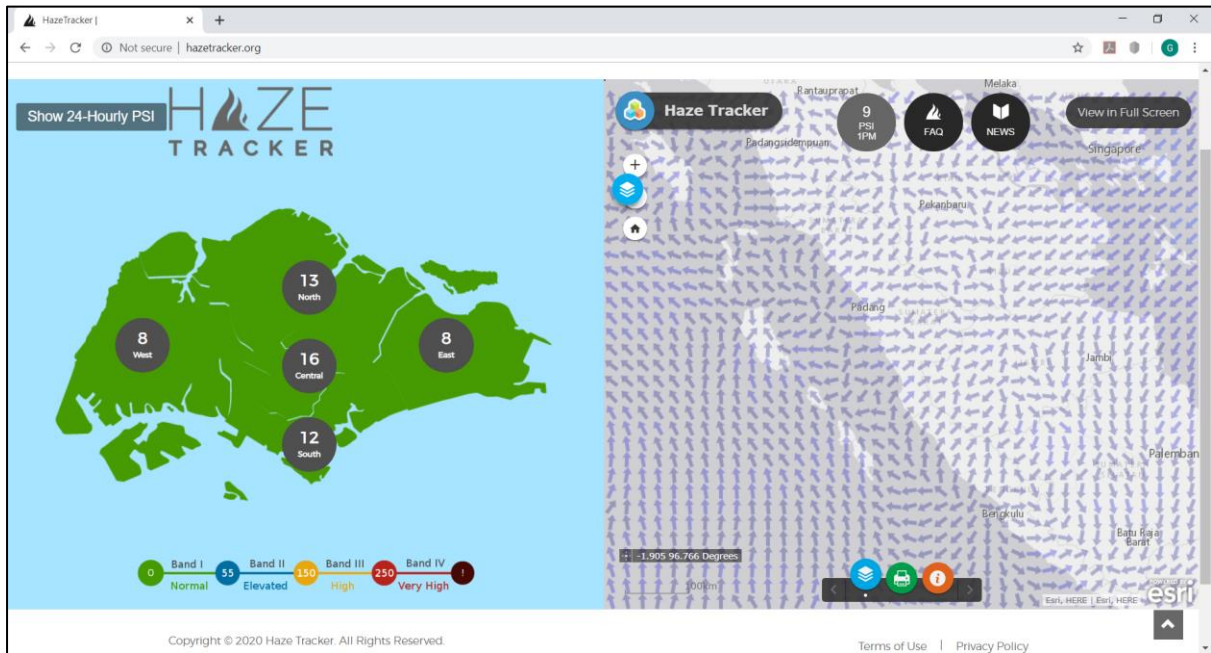
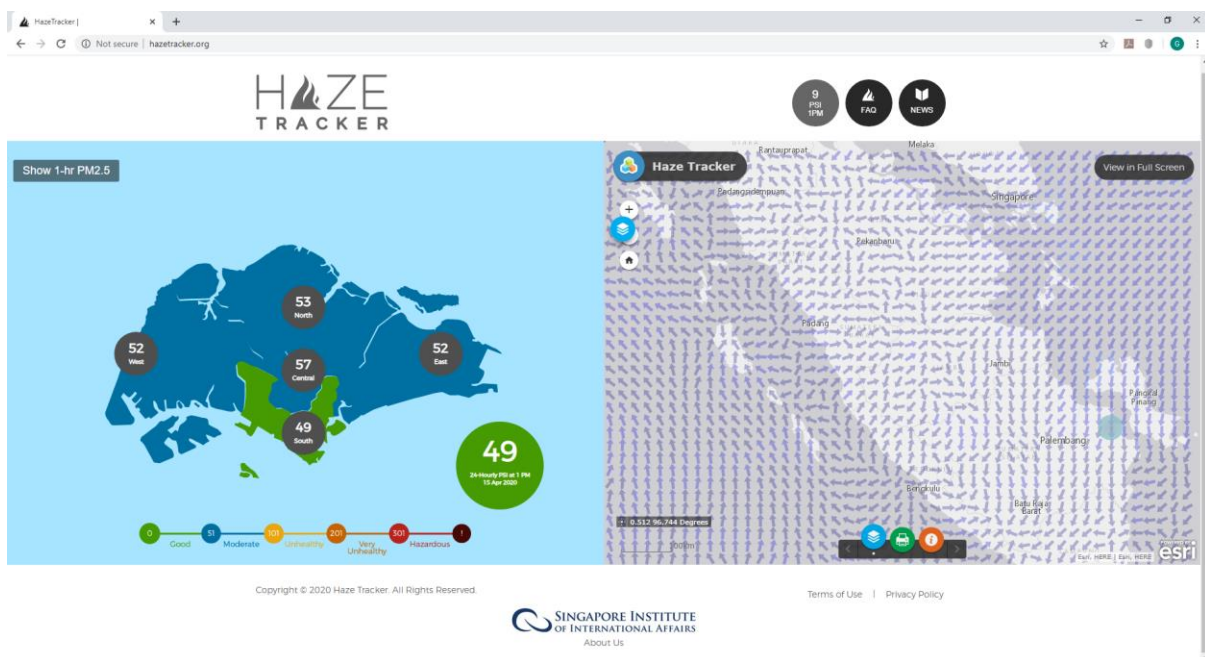


Figure 15 Singapore Institute of International Affairs, Hazetracker – Screenshot (1-hour PM_{2.5})



The following provides a summary of the AQI that are adopted for reporting PM₁₀ and PM_{2.5} air quality conditions in Singapore.

Table 46 AQI Reporting (Summary) – Singapore

Aspect	Summary Information		
Is there an AQI?	<input checked="" type="checkbox"/> Air quality index (AQI) reported (PSI) <input checked="" type="checkbox"/> Pollutant concentration scale reported (Haze) <input type="checkbox"/> Pollutant concentrations reported		
What pollutants are included in the AQI?	PM ₁₀ , PM _{2.5} , CO, NO ₂ , O ₃ ,		
How is the AQI derived?	PSI: Singapore calculates an index value for each pollutant to derive a single multi-pollutant index value. This applies to 24-hr PM ₁₀ and PM _{2.5} Haze: Singapore uses a pollutant concentration scale for 1-hour PM _{2.5}		
AQI scale	Singapore does not have an AQI but has pollutant concentration scales for PSI <ul style="list-style-type: none"> • 24-hour PM₁₀ over the range from 0 - 600 µg·m⁻³ • 24-hour PM_{2.5} over a range from 0 – 500 µg·m⁻³ Haze <ul style="list-style-type: none"> • 1-hour PM_{2.5} over the range from 0 – 250+ µg·m⁻³ 		
Bands within the scale	"PSI" 5 with descriptors Haze: 4 without descriptors		
Pollutant Specific	PSI PM ₁₀	PSI PM _{2.5}	Haze PM _{2.5}
Pollutant reported?	yes	yes	No AQI, but concentration bands are reported
Averaging period(s)	24-hour	24-hour	1-hour
Conc. equivalent to AQI=100 (µg·m ⁻³)	n/a	n/a	n/a
Reporting values used	Index ✓ Descriptor ✓ Concentration ✓	Index ✓ Descriptor ✓ Concentration ✓	Index ✗ Descriptor ✓ Concentration ✓
Alerts	Text alerts ✗ Email alerts ✗ RSS Feed ✓	Text alerts ✗ Email alerts ✗ RSS Feed ✓	Text alerts ✗ Email alerts ✗ RSS Feed ✓

Note, the PSI is a function of both PM₁₀ and PM_{2.5}, where the highest of the two sub-indices is reported. The scale, bands and descriptors used in Singapore in the PSI are summarised below⁷⁰.

Table 47 PSI Reporting (Bands and Scales) – Singapore

AQI Band	PM ₁₀		PM _{2.5}	
	Index value (PSI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
Good	0-50	0-50	0-50	0-12
Moderate	51-100	51-150	51-100	13-55
Unhealthy	101-200	151-350	101-200	56-150
Very unhealthy	201-300	351-420	201-300	151-250
Hazardous	301-400	421-500	301-400	251-350
	401-500	501-600	401-500	351-500

Note: An attempt has been made to estimate the band colouring (if applicable) but is presented as an approximation only.

The following guidance is provided in relation to the calculation of the PSI⁷¹:

Each sub-index i , is calculated by using a segmented linear function that relates pollutant concentration, X_i to sub-index value, I_i . A segmented linear function consists of straight-line segments joining discrete co-ordinates (i.e. breakpoints). For pollutant i and segment j , the co-ordinates of the j th breakpoints are represented by sub-index value $I_{i,j}$ and the concentration $X_{i,j}$ giving the ordered pair $(X_{i,j}, I_{i,j})$. If the observed concentration is X_i the corresponding sub-index value I_i is calculated using the following equation over the concentration range:

$$I_i = \frac{I_{i,j+1} - I_{i,j}}{X_{i,j+1} - X_{i,j}} (X_i - X_{i,j}) + I_{i,j}$$

where

X_i = Observed concentration for the i th pollutant

$I_{i,j}$ = PSI value for the i th pollutant and the j th breakpoint as given in the table

$I_{i,j+1}$ = PSI value for the i th pollutant and the $(j+1)$ th breakpoint as given in the table

$X_{i,j}$ = Concentration for the i th pollutant and j th breakpoint as given in the table

$X_{i,j+1}$ = Concentration for the i th pollutant and $(j+1)$ th breakpoint as given in the table

Finally, the overall index is calculated as the maximum of sub-indices: $PSI = \text{maximum}(I_1, I_2, I_3, I_4, I_5, I_6)$

That approach is adopted for each pollutant, and the maximum PSI is used as the index value.

⁷⁰ [https://www.haze.gov.sg/docs/default-source/faq/computation-of-the-pollutant-standards-index-\(psi\).pdf](https://www.haze.gov.sg/docs/default-source/faq/computation-of-the-pollutant-standards-index-(psi).pdf)

⁷¹ [https://www.haze.gov.sg/docs/default-source/faq/computation-of-the-pollutant-standards-index-\(psi\).pdf](https://www.haze.gov.sg/docs/default-source/faq/computation-of-the-pollutant-standards-index-(psi).pdf)

Table 48 1-hour PM_{2.5} Reporting (Bands and Scales) – Singapore

Air Quality Bands	PM ₁₀		PM _{2.5}	
	Index value (PSI)	Concentration value (µg·m ⁻³)	Index value (AQI)	Concentration value (µg·m ⁻³)
I "Normal"	n/a	n/a	n/a	0-55
II "Elevated"	n/a	n/a	n/a	56-150
III "High"	n/a	n/a	n/a	151-250
IV "Very High"	n/a	n/a	n/a	>250

The Singapore NEA FAQ webpage⁷² (point 5) provides the following qualification regarding the use of the 1-hour PM_{2.5} reporting bands:

The 1-hour PM_{2.5} concentrations reflect the average PM_{2.5} levels over one hour, and provide an indication of the current air quality. However, the 1-hour PM_{2.5} concentration levels can be volatile and tend to fluctuate over the day especially during periods of transboundary haze. Short-term fluctuations are greatly influenced by weather conditions. For example, there could be a period of high PM_{2.5} which improves rapidly in the next one to two hours.

Therefore, if you wish to use the 1-hour PM_{2.5} concentration, it is best used as a guide to adjust your immediate activities. During haze episodes, health advice will be based on the 24-hour PSI. It is a better indication of an individual's total exposure to PM_{2.5} levels, as scientific and epidemiological studies on the health effects of particulate matter are based on a 24-hour duration of exposure.

2.17.3 Air Quality Health Advice

The following health advice is provided for the PSI bands by the Ministry of Health (MOH) which represents a health advisory for the general public.

Table 49 PSI Band Health Advice – Singapore

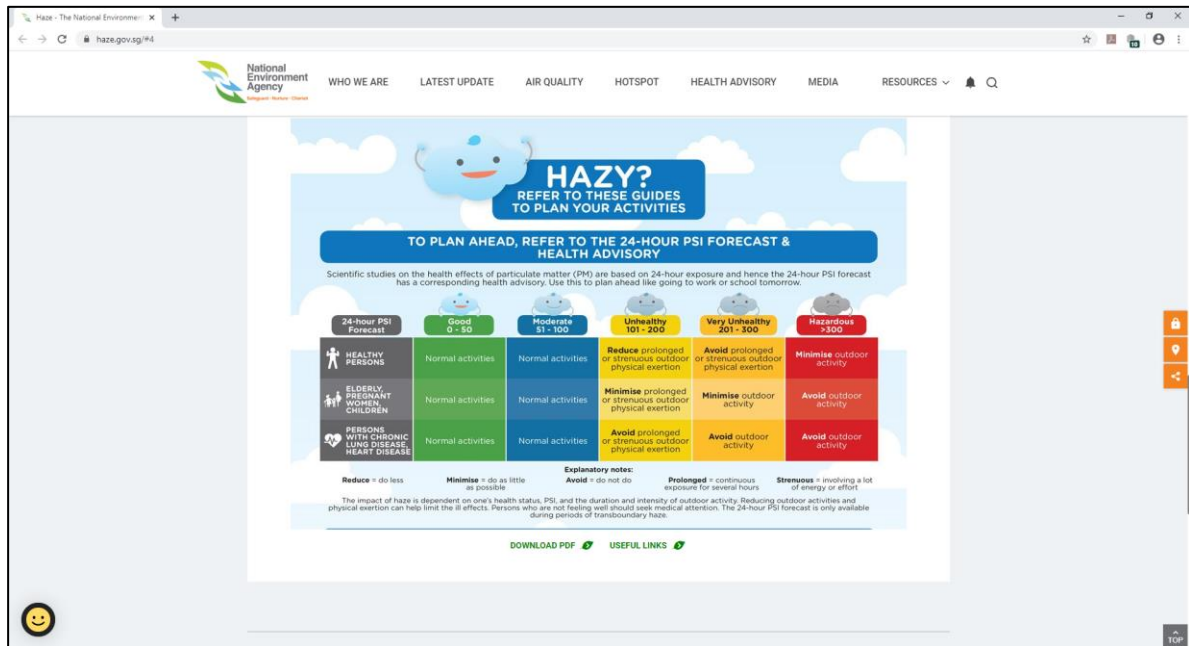
PSI Band	Healthy persons	Elderly, pregnant women, children	Persons with chronic lung disease, heart disease
Good 0-50	Normal activities	Normal activities	Normal activities
Moderate 51-100	Normal activities	Normal activities	Normal activities
Unhealthy 101-200	Reduce prolonged or strenuous outdoor physical exertion	Minimise prolonged or strenuous outdoor physical exertion	Avoid prolonged or strenuous outdoor physical exertion
Very Unhealthy 201-300	Avoid prolonged or strenuous outdoor physical exertion	Minimise outdoor activity	Avoid outdoor activity

⁷² <https://www.nea.gov.sg/our-services/pollution-control/air-pollution/faqs>

PSI Band	Healthy persons	Elderly, pregnant women, children	Persons with chronic lung disease, heart disease
Hazardous >300	Minimise outdoor activity	Avoid outdoor activity	Avoid outdoor activity

The Singapore NEA Health Advisory⁷³ provides the following infographic with regard to health advice on the PSI bands:

Figure 16 PSI Reporting – Health Advice - Singapore



Supplementary to this, the accompanying 1-hour PM_{2.5} health advice is as follows:

Table 50 1-Hour PM_{2.5} Reporting Health Advice - Singapore

Band	Descriptor	Range of 1-hour PM _{2.5} (µg·m ⁻³)	General Guide (with MOH's inputs)
I	Normal	≤ 55	Among healthy individuals, exposure to high levels of haze particles may cause irritation of the eyes, nose, and throat in healthy individuals. Such irritation resolves on its own in most cases.
II	Elevated	56-150	Haze particles can affect the heart and lungs, especially in people who already have chronic heart or lung disease e.g. asthma, chronic obstructive pulmonary disease (COPD), or heart failure. Individuals with existing chronic heart and lung conditions should ensure that their medications are on hand and readily available.
III	High	151-250	

⁷³ <https://www.haze.gov.sg/#4>

Band	Descriptor	Range of 1-hour PM _{2.5} (µg·m ⁻³)	General Guide (with MOH's inputs)
IV	Very High	>250	Each individual's reaction to pollutants may vary, and the amount of physical activity or exertion that can be performed differs according to an individual's health status or physical capacity. Should you encounter symptoms or discomfort, please take additional measures to prevent further exposure. Persons who are not feeling well, especially the elderly and children, and those with chronic heart or lung conditions, should seek medical attention promptly.

3. SUMMARY OF AQI BY FUNCTION

To facilitate a review of the various functions and aspects of each AQI is presented below as:

Table 51 **Comparison of AQI Functions and Aspects**

Table 52 **Comparison of AQI Functions and Aspects – PM₁₀**

Table 53 **Comparison of AQI Functions and Aspects – PM_{2.5}**

For the jurisdictions that do not employ AQI or additionally report pollutant concentrations in addition to an AQI, the categorisation of PM₁₀ and PM_{2.5} pollutant concentration bands is presented as:

Table 54 **Comparison of Air Pollutant Concentration Bands – PM₁₀**

Table 55 **Comparison of Air Pollutant Concentration Bands – PM_{2.5}**

Table 51 Comparison of AQI Functions and Aspects

Aspect	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	NZ	USA	CAL	CAN	COL	JPN	EU	UK	SGP
AQI	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	no	no	no	yes
PM ₁₀ indexed	yes	yes	yes	yes	yes	-	-	yes	yes	yes	yes	no	yes	-	-	-	yes
PM _{2.5} indexed	yes	yes	yes	yes	yes	-	-	yes	yes	yes	yes	yes, (for PM _{2.5} , NO ₂ , O ₃)	yes	-	-	-	yes
AQI scale	0-200+	0-200+	0-201+	0-150+	0-150+	-	-	0-200+	0-100+	0-500	0-500	0-10+	0-500	-	-	-	0-500
Bands (no)	6	6	6	5	5	-	-	6	5	6	6	4	6	-	-	-	5
Descriptors	yes	yes	yes	yes	yes	-	-	yes	no	yes	yes	yes	yes	-	-	-	yes
Bands (descriptors)	Very good	Very good	Very good	Very good	Very good	-	-	Very good		Good	Good	Low	Good	-	-	-	Good
	Good	Good	Good	Good	Good	-	-	Good		Mod.	Mod.	Mod.	Mod.	-	-	-	Mod.
	Fair	Fair	Fair	Fair	Fair	-	-	Fair		Unhealthy fsg	Unhealthy fsg	High	Poor	-	-	-	Unhealthy
	Poor	Poor	Poor	Poor	Poor	-	-	Poor		Unhealthy	Unhealthy	Very high	Very poor	-	-	-	Very unhealthy
	Very poor	Very poor	Very poor	Very poor	Very poor	-	-	Very poor		Very unhealthy	Very unhealthy	n/a	Extreme	-	-	-	Haz.
	Haz.	Haz.	Severe	n/a	n/a	-	-	Extreme	n/a	Haz.	Haz.	Haz.	Haz.	Haz.	-	-	-

Note: "Mod." = moderate, "Haz." = hazardous, "Unhealthy fsg" = unhealthy for sensitive groups

Table 52 Comparison of AQI Functions and Aspects – PM₁₀

Aspect	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	NZ	USA	CAL	CAN	COL	JPN	EU	UK	SGP
AQI	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	no	no	no	yes
PM ₁₀ indexed	yes	yes	yes	yes	yes	-	-	yes	yes	yes	yes	no	yes	-	-	-	yes
Averaging period	24h	1h	24h	24h	24h	-	-	24h	24h	24h	24h	n/a	24h	-	-	-	24h
Bands	0-33	0-33	0-33	0-33	0-33	-	-	0-33	<10	0-50	0-50	-	0-50	-	-	-	0-50
(AQI scale)	34-66	34-66	34-66	34-66	34-66	-	-	34-66	10-33	51-100	51-100	-	51-100	-	-	-	51-100
	67-99	67-99	67-99	67-99	67-99	-	-	67-99	33-66	101-150	101-150	-	101-150	-	-	-	101-200
	100-149	100-149	100-149	100-149	100-149	-	-	100-149	66-100	151-200	151-200	-	151-200	-	-	-	201-300
	150-200	150-200	150-200	>150	>150	-	-	150-200	>100	201-300	201-300	-	201-300	-	-	-	301-400
	>200	>200	>200	n/a	n/a	-	-	>200	n/a	301-500	301-500	-	301-500	-	-	-	401-500
AQI ref value (index)	100	100	100	100	100	-	-	100	100	100	100	-	100	-	-	-	100
AQI ref value (µg·m ⁻³)	50	80.1	50	50	50	-	-	50	50	150	150	-	154	-	-	-	150
Health advice	yes	yes	yes	no	no	-	-	no	no	yes	yes	-	yes	-	-	-	yes
Alerts	yes	yes	no	no	yes	-	-	no	no	yes	yes	-	no	-	-	-	yes

Table 53 Comparison of AQI Functions and Aspects – PM_{2.5}

Aspect	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	NZ	USA	CAL	CAN	COL	JPN	EU	UK	SGP
AQI	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	no	no	no	yes
PM _{2.5} indexed	yes	yes	yes	yes	yes	-	-	yes	yes	yes	yes	yes, (fn PM _{2.5} ,NO ₂ ,O ₃)	yes	-	-	-	yes
Averaging period	24h	1h	24h	24h	24h	-	-	24h	24h	24h	24h	24h ^(A)	24h	-	-	-	24h
Bands	0-33	0-33	0-33	0-33	0-33	-	-	0-33	<10	0-50	0-50	1 - 3	0-50	-	-	-	0-50
(AQI scale)	34-66	34-66	34-66	34-66	34-66	-	-	34-66	10-33	51-100	51-100	4 - 6	51-100	-	-	-	51-100
	67-99	67-99	67-99	67-99	67-99	-	-	67-99	33-66	101-150	101-150	7 - 10	101-150	-	-	-	101-200
	100-149	100-149	100-149	100-149	100-149	-	-	100-149	66-100	151-200	151-200	>10	151-200	-	-	-	201-300
	150-200	150-200	150-200	>150	>150	-	-	150-200	>100	201-300	201-300	-	201-300	-	-	-	301-400
	>200	>200	>200	n/a	n/a	-	-	>200	n/a	301-500	301-500	-	301-500	-	-	-	401-500
AQI ref value (index)	100	100	100	100	100	-	-	100	100%	100	100	-	100	-	-	-	55
AQI ref value (µg·m ⁻³)	25	62.1	25	25	25	-	-	25	50	35	35	-	40.4	-	-	-	37.5
Health advice	yes	yes	yes	no	no	-	-	no	no	yes	yes	yes	yes	-	-	-	yes
Alerts	yes	yes	no	no	yes	-	-	no	no	yes	yes	yes	no	-	-	-	yes

Note (A) Publicly available information was not identified, although anecdotal evidence suggests the averaging period may be 3-hrs. See Section 2.12.2.

Table 54 Comparison of Air Pollutant Concentration Bands – PM₁₀

Aspect	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	NZ	USA	CAL	CAN	COL	JPN	EU	UK	SGP	
PM ₁₀ reported	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes ^(A)	yes	yes	yes	
Ave. period	24h	1h	24h	24h	24h	1h	1h	24h	24h	24h	24h	n/a	24h	24h, 1h	24h	24h	24h	
Conc. Bands (µg·m ⁻³)	0-16.5	<27.2	0-16.5	0-16.5	0-16.5	None	<40	0-16.5	<5	0-54	0-54	None	0-54	0-50	0-20	0-16	0-50	
	17-33	27.2-53.6	17-33	17-33	17-33		40-80	17-33	5-16.5	55-154	55-154		55-154	51-100	20-40	17-33	51-150	
	33.5-49.5	53.7-80.0	33.5-49.5	33.5-49.5	33.5-49.5		80-120	33.5-49.5	16.5-33	155-254	155-254		155-254	101-200	40-50	34-50	151-350	
	50-74.5	80.1-120.0	50-74.5	50-74.5	50-74.5		120-240	50-74.5	33-50	255-354	255-354		255-354	200-400	50-100	51-58	351-420	
	75-100	120.1-160.0	75-100	>75	>75		>240	75-100	>50	355-424	355-424		355-424	401-600	100-150	59-66	421-500	
	>100.5	>160	>100.5					>100		425-604	425-604		425-604	>601	150-1200	67-75	501-600	
																	76-83	
																	84-91	
																92-100		
																≥101		

Note (A) Japan reports SPM not PM10. See Section 2.14.2.

Table 55 Comparison of Air Pollutant Concentration Bands – PM_{2.5}

Aspect	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	NZ	USA	CAL	CAN	COL	JPN	EU	UK	SGP		
PM _{2.5} reported	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes ^(A)	yes	yes	yes	yes	yes		
Ave period	24h	1h	24h	24h	24h	1h	1h	24h	24h	24h	24h	24h ^(B)	24h	24h	24h	24h	1h		
Conc. Bands (µg·m ⁻³)	0-8.25	<21.1	0-8.25	0-8.25	0-8.25	0-9	<27	0-8.25	<2.5	0-12	0-12	None AQHI only	0-15.4	0-10	0-10	0-11	0-55		
	8.5-16.5	21.1-41.5	8.5-16.5	8.5-16.5	8.5-16.5	10-24	27-62	8.5-16.5	2.5-8.3	13-35.4	13-35.4		15.5-40.4	11-15	10-20	12-23	56-150		
	16.75-24.75	41.6-62.0	16.75-24.75	16.75-24.75	16.75-24.75	25-99	62-97	16.75-24.75	8.3-16.5	35.5-55.4	35.5-55.4		40.5-65.4	16-35	20-25	24-35	151-250		
	25-37.25	62.1-93.0	25-37.25	25-37.5	25-37.5	>100	97-370	25-37.5	16.5-25	55.5-150.4	55.5-150.4		65.5-150.4	36-50	25-50	36-41	>250		
	37.5-50	93.1-124.0	37.5-50	>37.5	>37.5		>370	37.6-50	>25	150.5-250.4	150.5-250.4		150.5-250.4	51-70	50-75	42-47			
	>50.25	>124.0	>50.25					>50		250.5-500.4	>250.5		250.5-500.4	>71	75-800	48-53			
																	54-58		
																		59-64	
																			65-70
																			≥71

Note (A): As a function of PM_{2.5}, NO₂ & O₃

(B): Publicly available information was not identified, although anecdotal evidence suggests the averaging period may be 3-hrs. See Section 2.12.2.

The distribution of the base-100 indices (AQI) identified in the study has been plotted graphically below. This figure is to illustrate the allocation of the band thresholds (“breakpoints”) within each AQI.

For the purposes of illustration, each index has been plotted to an index value of 500, for example the upper band of the AQI used in Queensland is >150, and this has been plotted from 150 to 500.

It is noted that the Canadian AQI uses a base-10 index, and therefore has not been plotted.

Figure 17 Distribution of Base-100 AQI Band Thresholds

