

## **PREAMBLE**

The National Environment Protection Measure (NEPM) for Ambient Air Quality was made in June 1998 with the desired environmental outcome of “ambient air quality that allows for the adequate protection of human health and well-being” across Australia. The NEPM was revised in 2003 to include an advisory reporting standard from PM<sub>2.5</sub>. The NEPM sets national standards against which ambient air quality can be assessed. The NEPM includes a monitoring protocol to determine whether these standards are being met. Each jurisdiction is required to submit to the National Environment Protection Council (NEPC) a monitoring plan consistent with the protocol.

The Peer Review Committee (PRC) was established to assist NEPC in its task of assessing and reporting on the implementation and effectiveness of the NEPM by participating jurisdictions. The PRC includes government experts from all participating jurisdictions, in addition to representatives from industry and community groups. A significant activity of the PRC is the provision of advice to NEPC on the adequacy of jurisdictional monitoring arrangements, to ensure as far as possible that a nationally consistent data set is obtained.

To assure the consistency and transparency of its advisory function, the PRC has developed a set of guidance papers that clarify a number of technical issues in interpretation of the NEPM protocol. These Technical Papers provide the basis for PRC assessment of jurisdictional plans, aimed at assuring the quality and national consistency of NEPM monitoring.

The PRC Technical Papers are advisory for jurisdictions, and they will evolve with time as the science of air quality monitoring and assessment develops and as practical experience with monitoring increases. Meeting the advisory reporting requirements set out in this document is subject to the availability of relevant data.

A handwritten signature in black ink, appearing to read 'M J Manton', with a long, sweeping underline that extends downwards.

M J Manton

**Chair**

Peer Review Committee

## 1 PURPOSE

The purpose of this technical paper is to assist jurisdictions in their preparation of annual monitoring reports to the NEPC in accordance with the Ambient Air Quality - National Environment Protection Measure (AAQ NEPM) as amended 2003. It aims to achieve a nationally consistent approach to air quality reporting in Australia under the NEPC process.

## 2 INTRODUCTION

The NEPC Act in each jurisdiction requires submission of annual reports by each jurisdiction to NEPC on the implementation and effectiveness of each NEPM. Those reports, presented by 30 September each year, summarise progress in implementation of the AAQ NEPM to 30 June in that year, and represent an overview of the status of air quality in relation to the AAQ NEPM. The reports do not include the detailed monitoring results and supplementary information that allow comprehensive understanding and characterisation of air quality in regions throughout Australia.

The annual reports document progress in meeting the aims of the NEPM in each jurisdiction. They also record any changes in the monitoring networks used to collect, quality control and analyse the NEPM data, so that there is transparency and traceability in the national implementation of the NEPM. The reports provide nationally consistent information on the state of air quality in each jurisdiction, so that they support a range of national review and planning processes, as well as research on air quality.

For carbon monoxide, nitrogen dioxide, photochemical oxidants (as ozone), sulfur dioxide, lead and particles as PM<sub>10</sub>, Clause 3 of the AAQ NEPM as amended states that jurisdictions must report in accordance with the Protocols in the Measure. The annual report for each calendar year must be submitted to the NEPC by the following 30 June. Clauses 11, 17 and 18 of the AAQ NEPM specify the requirements and range of information for CO, NO<sub>2</sub>, photochemical oxidants as ozone, SO<sub>2</sub>, lead and particles as PM<sub>10</sub> to be covered in that annual report, representing more detailed information supplementary to the succinct implementation report specified in the NEPC Act.

For particles as PM<sub>2.5</sub>, Clause 3 states that jurisdictions must report in accordance with Schedule 4 and Schedule 5 in the Measure. The annual report for each calendar year must be submitted to the NEPC by the following 30 June. Clauses 3 to 5 of Schedule 4 specify the requirements and range of information to be covered in that annual report, representing more detailed information supplementary to the succinct implementation report specified in the NEPC Act. Schedule 5 requires jurisdictions to undertake monitoring for the PM<sub>2.5</sub> Equivalence Program in accordance with the Technical Paper on Monitoring and Reporting for Particles as PM<sub>2.5</sub>. Section 4.3 of that technical paper requires jurisdictions to 'report on their Equivalence Programs as part of reporting on the Principle Measure as varied'.

This Technical Paper sets out the information to be compiled and submitted annually by jurisdictions to the AAQ NEPM, and so providing a comprehensive characterisation of air quality across Australia. The clauses of the AAQ NEPM that specify the requirements and the range of information to be covered in the annual report are given below.

Clause 11 (Methods of measuring and assessing concentration of pollutants) states that:

For the purpose of evaluating performance against the standards the concentration of

pollutants in the air:

- (a) is to be measured at performance monitoring stations; or

Note: Because the concentrations of different pollutants vary across a region, it would not be necessary or appropriate to co-locate the measuring instrumentation for all pollutants at each performance monitoring station.

- (b) is to be assessed by other means that provide information equivalent to measurements which would otherwise occur at a performance monitoring station.

Note: These methods could include, for example, the use of emission inventories, windfield and dispersion modelling, and comparisons with other regions.

Clause 17 (Evaluation of performance against standards and goal) states that:

1. Each participating jurisdiction must evaluate its annual performance as set out in this clause.
2. For each performance monitoring station in the jurisdiction or assessment in accordance with subclause 11(b) there must be:
  - (a) a determination of the exposed population in the region or sub-region represented by the station<sup>1</sup>; and
  - (b) an evaluation of performance against the standards and goal of this Measure as:
    - (i) meeting; or
    - (ii) not meeting; or
    - (iii) not demonstrated.
3. Jurisdictions may provide an evaluation of a region as a whole against the standards using appropriate methodologies that provide equivalent information for assessment purposes.
4. Performance must be evaluated as "not demonstrated" if there has been no monitoring or no assessment by an approved alternative method as provided in Clause (11).

Clause 18 (Reporting) of the AAQ NEPM states that:

1. Each participating jurisdiction must submit a report on its compliance with the Measure in an approved form to Council by the 30 June next following each reporting year.
2. In this clause "reporting year" means a year ending on 31 December.
3. The report must include:
  - a) the evaluations and assessments mentioned in Clause 17; and
  - b) an analysis of the extent to which the standards of this Measure are, or are not, met in the jurisdiction; and
  - c) a statement of the progress made towards achieving the goal.
4. The description of the circumstances which led to exceedences, including the influence of natural events and fire management, must be reported to the extent that such information can be determined.
5. A report for a pollutant must include the percentage of data available in the reporting period.

Clause 3 of Schedule 4 of the AAQ NEPM (Monitoring methods for PM<sub>2.5</sub>) states that:

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<sup>1</sup> This is represented by a simple one word description of the area

1. The reference methods for monitoring particles as PM<sub>2.5</sub> are reference, Class 1 and Class 2 equivalent manual gravimetric methods designated in the USEPA Federal Reference Method (USEPA reference method; *US Code of Federal Regulations Title 40 Part 50 Appendix L Reference Method for the Determination of Fine Particulate Matter as PM<sub>2.5</sub> in the Atmosphere*).
2. Continuous direct mass methods using a tapered element oscillating microbalance may also be used in addition to the reference method, however the values obtained by using these methods cannot be used for comparison with the Advisory Reporting Standards until the outcomes of the PM<sub>2.5</sub> Equivalence Program (Schedule 5) have been formally included in the Principal Measure.
3. To enable the development of equivalent methods for monitoring PM<sub>2.5</sub> as part of the review of this Measure scheduled to commence in 2005, collocation of continuous direct mass monitors and reference samplers must be undertaken at a limited number of sites in accordance with Schedule 5.
4. Participating jurisdictions must reach agreement on the collocation of samplers to ensure that, nationally, a minimum of nine locations house collocated samplers and annual reporting to Council must include information on the collocation of samplers.

Clause 4 of Schedule 4 of the AAQ NEPM (Evaluation of monitoring for PM<sub>2.5</sub>) states that:

1. Each participating jurisdiction must evaluate its monitoring results for PM<sub>2.5</sub> in accordance with this clause.
2. For each PM<sub>2.5</sub> performance monitoring station in the jurisdiction there must be:
  - (a) a determination of the exposed population in the region or sub-region monitored by the station; and
  - (b) a report on whether the PM<sub>2.5</sub> Advisory Reporting Standards of this Measure, as measured by the reference method, have been met.

Clause 5 of Schedule 4 of the AAQ NEPM (Reporting) states that:

1. Each participating jurisdiction must submit a report on PM<sub>2.5</sub> monitoring and data assessment in accordance with this clause to Council by the 30 June next following each reporting year.
2. In this clause reporting year means a year ending on 31 December.
3. The first report to Council will be for the 2003 reporting year for data currently being collected by jurisdictions.
4. The report must include:
  - (a) an evaluation and assessment of all PM<sub>2.5</sub> data collected by the reference method;
  - (b) the evaluations and assessments outlined in clause 4 of this Schedule;
  - (c) the number of times the monitored values (by the reference method) are greater than the Advisory Reporting Standards of this Measure;
  - (d) all other PM<sub>2.5</sub> data collected by other acceptable methods as outlined in this Schedule; and
  - (e) the maximum 24-hour concentration of PM<sub>2.5</sub> in each jurisdiction collected by any method specified in Schedule 4 of this Variation.
5. A description of the circumstances that led to monitored values (by the reference method) being greater than the Advisory Reporting Standards including the influence of natural events and fire management, must be reported to the extent that such information can be determined.
6. The report must include the percentage of data available in the reporting period.

All data presented in annual reports must meet the required quality assurance and quality control measures. Clause 12 of the AAQ NEPM requires monitoring to be accredited by NATA or an equivalent system. The National Environment Protection Council (Ambient Air Quality) Measure Technical Paper No. 7, "Accreditation of Performance Monitoring" recommends the NATA as the single accrediting body for the purposes of the AAQ NEPM. In preparing the monitoring data for evaluation of performance against the standards and goal, the National Environment Protection Council (Ambient Air Quality) Measure Technical Paper No. 5, "Data Collection and Handling" should be followed. Procedures specific to the handling of TEOM PM<sub>10</sub> data are described in National Environment Protection Council (Ambient Air Quality) Measure Technical Paper No. 10, "Collection and Reporting of TEOM PM<sub>10</sub> Data." As recommended and specified in Technical Paper No. 5, each jurisdiction, at the time of submitting its annual report to the NEPC, should have available an AAQ NEPM data set for submission to the national database.

### 3 GENERAL PROCEDURES FOR ASSESSING COMPLIANCE

In compliance assessment, the monitoring data need to be prepared for comparison and then compared against the NEPM standards. Many of the data handling requirements which prepare data for performance evaluations are covered in Technical Paper No 5. Some of the important procedures are discussed below.

The standards and goal for pollutants other than particles as PM<sub>2.5</sub> are set out in Schedule 2 of the AAQ NEPM as shown below.

Column 1 Item	Column 2 Pollutant	Column 3 Averaging period	Column 4 Maximum Concentration	Column 5 Goal within 10 <sup>2</sup> Years - Maximum allowable exceedences
1	Carbon monoxide	8 hours	9.0 ppm	1 day a year
2	Nitrogen dioxide	1 hour 1 year	0.12 ppm 0.03 ppm	1 day a year none
3	Photochemical oxidants (as ozone)	1 hour 4 hours	0.10 ppm 0.08 ppm	1 day a year 1 day a year
4	Sulfur dioxide	1 hour 1 day 1 year	0.20 ppm 0.08 ppm 0.02 ppm	1 day a year 1 day a year none
5	Lead	1 year	0.50 µg/m <sup>3</sup>	none
6	Particles as PM <sub>10</sub>	1 day	50 µg/m <sup>3</sup>	5 days a year

The advisory reporting standards and goal for particles as PM<sub>2.5</sub> are set out in Schedule 2 of the AAQ NEPM as shown below.

Column 1 Pollutant	Column 2 Averaging Period	Column 3 Maximum Concentration	Column 4 Goal
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<sup>2</sup> Note that the 10 year period has elapsed and the goal is now to meet the standards for the specified time periods.

Particles as PM <sub>2.5</sub>	1 day	25 µg/m <sup>3</sup>	Goal is to gather sufficient data nationally to facilitate a review of the Advisory Reporting Standards as part of the review of this Measure scheduled to commence in 2005
	1 year	8 µg/m <sup>3</sup>	

The AAQ NEPM standards are defined in terms of annual mean concentrations or in terms of short-term (1-hour, 4-hour, 8-hour and 1-day) concentrations not to be exceeded on more than one day (or 5 days for PM<sub>10</sub>) per year. The short-term standards are defined as concentrations over specified averaging times. The goal specifies the maximum allowable number of exceedences of the Standard concentration levels.

With this type of standard, the second or the sixth highest daily value for the year can determine compliance. This form of air quality standard emphasises the upper extreme values of air quality data and a procedure is given for their determination in the following sections. Daily peak concentrations form the basis of compliance assessment in most cases, except in cases where non-overlapping occurrences for running averages are required. Daily peak is the maximum concentration recorded on a calendar day. For example, Schedule 2 of the AAQ NEPM specifies that the goal for the standards for 1-hour averaging times allows one exceedence day per year. Compliance with the 1-hour standards and goal then only requires comparison of the second-highest 1-hour peak daily concentration in the year against the 1-hour standards.

Technical Paper No. 5 details averaging, data availability requirements and data handling conventions. Some of the definitions and conventions that are critical to reporting include the following:

- All averaging periods of 8 hours or less must be referenced by the end time of the averaging period; this determines the calendar day to which the averaging periods are assigned (defined by the AAQ NEPM).
- Four-hour and 8-hour averaging periods are running averages based on 1-hour averages (defined by the AAQ NEPM).
- Annual averages are to be calculated from hourly averages.
- For valid averages, a minimum of 75% data availability for the averaging period is required. For example, at least 18 hourly averages are required for a valid 24-hr average.
- Daily 1-hour, 4-hour or 8-hour peak concentrations are chosen from the available valid averages for the day. It is recognised that this approach could produce bias when the data availability for the day is low.
- An "AAQ NEPM exceedence" means a value that is above the AAQ NEPM standard after rounding to the same number of significant digits shown in the Technical Paper No. 5 (Data Collection and Handling). A day with one or more "AAQ NEPM exceedence" is an "AAQ NEPM exceedence day."
- "Compliance" at a performance monitoring station for a particular pollutant occurs when the pollutant levels meet the standards and goal of the AAQ NEPM (Clause 17(2b)). For the standards with an averaging period of one-year, compliance is achieved when the annual concentration for the calendar year is less than or equal to the value of the Standard. For other averaging periods, "compliance" is achieved when the number of days on which the standard is exceeded is less than or equal to the number of exceedences allowed under the NEPM.
- To make a valid assessment of **compliance** for annual reporting, annual compliance statistics must be based on hourly (daily for PM<sub>10</sub> and lead) data that are at least 75 percent complete in each calendar quarter (in addition to an annual data availability of at least 75%

based on valid hourly (daily for PM<sub>10</sub> and lead) data). However, years with less than 75% data availability can demonstrate **non-compliance** if sufficient exceedences of the standard are reported. For example, it can be stated that "non-compliance is demonstrated" at a performance monitoring station with an annual 60% data availability for CO, if the 8-hour concentrations exceed 9.0 ppm on more than one day in a year.

- Concentration statistics for averaging times less than one day can be calculated from peak daily concentrations. Compliance assessment with the 1-hour standards should be based on 1-hour daily peak concentrations. Assessment against 4-hour and 8-hour standards is based on running averages, and, where a pollution event spans midnight, the peak 4 or 8-hour averages for the two days may overlap. In determining compliance with the 4-hour and 8-hour standards, daily peak values should be determined on the basis of computed non-overlapping values. The issue of overlap is covered in more detail in section 4.
- No correction or adjustment is allowed for missing data or poor data availability. Compliance and the number of exceedences are based on actual measurements.
- A site-by-site assessment is to be made for compliance under Clause 17(2b). Each site is allowed one or five (for PM<sub>10</sub>) exceedences per year. A region complies with a standard if and only if compliance is demonstrated at all sites assessed in the region.

#### 4 NEPM PERFORMANCE EVALUATION FOR RUNNING AVERAGES

In determining the number of exceedences for compliance with the standards for 4-hr and 8-hr running averages, the problem of overlap must be considered. For two consecutive days to both report exceedences, there must be two non-overlapping averaging periods, one in each day, with concentrations in excess of the standard.

An example where two exceedences of the 8-hour AAQ NEPM standard for carbon monoxide are recorded on two consecutive days is shown in Figure 1. The two rectangles shown as 'Method B' indicate two non-overlapping exceedences of the NEPM standard of 9.0ppm, each occurring on different days. The fact that these are both overlapped by other averaging periods in excess of the standard, such as the taller rectangle marked 'Method A', only affects the recorded maximum 8-hour concentration, not the number of days of exceedence. The 8-hour concentrations used in determining the number of exceedences in a year may not be the same as the ones identified as the highest, the second highest, etc., as in the following sections.

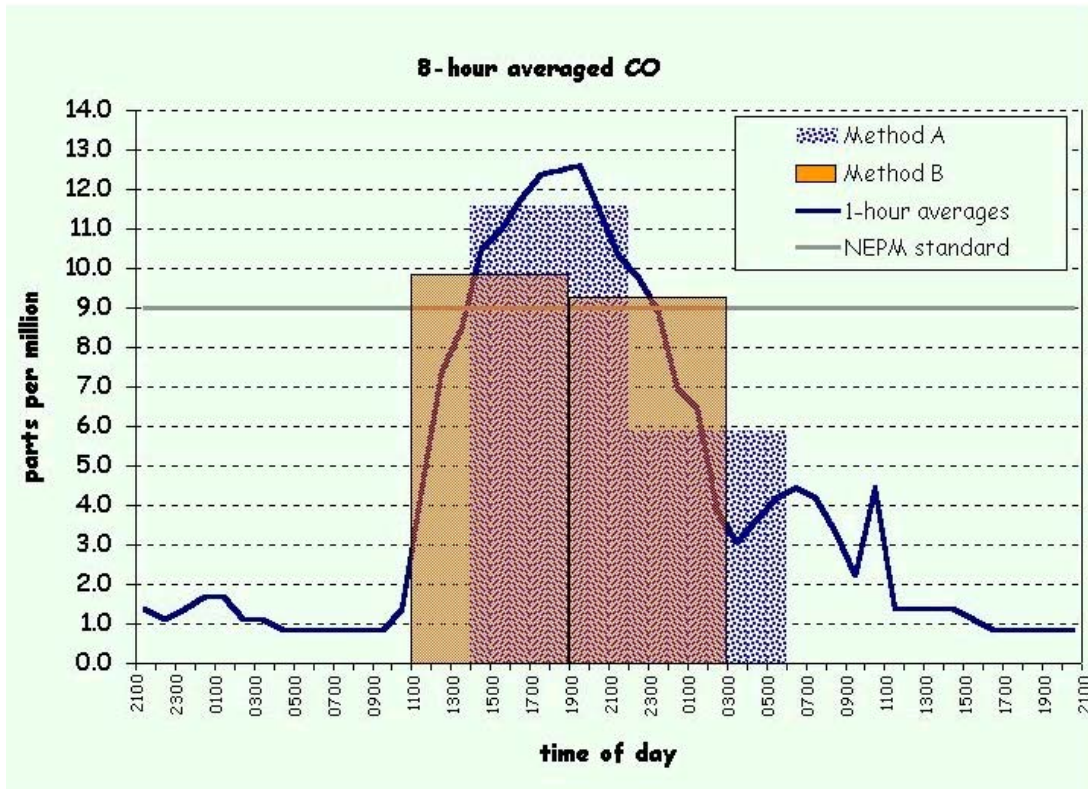


Figure 1. A curve of hourly carbon monoxide concentrations, with rectangles showing 8-hour averages.

## 5 SECOND HIGHEST CONCENTRATIONS FOR RUNNING AVERAGES

The second highest daily peak concentrations are statistics commonly used in assessing the extent to which the standards are met or are not met. As in determining the number of exceedences, the problem of overlap needs to be considered in finding the second highest daily concentrations for running averages. The objective is to determine averages on the basis of non-overlapping time periods. That is, each average must be distinct, not sharing any common hours with another average. A modified procedure of USEPA is recommended for use in determining the 2<sup>nd</sup> highest concentration and is described below.

Consider the following concentrations (not the same example as in Figure 1):

### Listing of the highest running 8-hour CO averages in order

Order	8-Hour average (ppm)	Date and time of occurrence (the date refers to the end time)	Does it overlap the higher value?	Is it on a different day?
1	11.0	Dec. 8, 12:01 pm - 8:00 pm	--	--
2	10.3	Dec. 8, 6:01 am - 2:00 pm	yes	no
3	9.6	Dec. 9, 6:01 pm - 2:00 am	yes	yes
4	9.0	Dec. 9, 9:01 pm - 5:00 am	no	yes

By finding the first negative to the question 'Does it overlap the higher value?' and an affirmative to the question 'Is it on a different day from the highest concentration?', the 8-hour period Dec. 9, 9:01 pm - 5:00 am (9.0 ppm) is chosen as the second highest daily peak value. The chosen second highest value has no overlap with the first highest and it is on a different



day from the highest concentration.

The same procedure can be used for running 4-hour ozone averages.

It is emphasised that in determining compliance and the number of exceedences the problem of overlap must be considered. Since the second highest concentration is used in compliance assessment, it should be derived using the above procedure.

## **6 N<sup>TH</sup>-HIGHEST CONCENTRATIONS AND PERCENTILES FOR RUNNING AVERAGES**

Percentiles and N<sup>th</sup>-highest concentrations are statistics commonly used in the general evaluation of air quality.

The following procedure can be used to determine the N<sup>th</sup> highest concentration.

1. Rank concentrations from the highest to the lowest
2. Pick the highest concentration
3. Pick the second highest (no overlap with the highest and on a different day to the highest)
4. Pick the third highest (no overlap with the highest or the 2nd and on a different day)
5. Pick the nth highest (no overlap with the 1 or 2 or ... n-1 and on a different day to 1 and 2 and ... n-1).

However, it is not a requirement to consider the problem of overlap in the computation of percentiles or the N<sup>th</sup> highest concentrations for use in the general evaluation of air quality. The identification of the N<sup>th</sup>-highest concentrations and percentiles can be seen as an independent procedure to the determination of the number of exceedences in compliance assessment. These statistics can be based on overlapping or non-overlapping running averages. However, it is important that the procedures used are clarified in reports.

## **7 PREFERRED STATISTICS FOR ANNUAL REPORTING**

Preferred statistics for annual NEPM reporting are:

- The annual number of exceedences of the NEPM standard;
- For pollutants with a 24-hour NEPM standard, the highest and the second-highest (for SO<sub>2</sub>) or the sixth-highest (for PM<sub>10</sub>) daily concentration in a year;
- For pollutants with NEPM standards with averaging periods less than one day, the highest and second-highest daily peak concentration (however, for running 4-hour and 8-hour averages, if the second highest daily concentration is used in determining the number of exceedences or in assessing the extent to which the standard is met, the possibility of overlapping daily peaks needs to be eliminated);
- The 98<sup>th</sup>, 95<sup>th</sup>, 90<sup>th</sup>, 75<sup>th</sup> and 50<sup>th</sup> percentiles of the daily peak concentration; and
- The data availability rate (annual and quarterly percentage of hours, and days with data).

## **8 COMMUNICATIONS**

Under the impact statement of the AAQ NEPM future action items include:

- Make public annual monitoring reports prepared by the jurisdictions in accordance with the NEPM.
- Make public all jurisdictional monitoring plans assessed as complying with the NEPM.

The primary aim of the AAQ NEPM is to protect human health in Australian communities. It is therefore imperative that appropriate communications strategies are put in place to advise

the population of the outcomes of AAQ NEPM monitoring. The Internet provides a most effective means of communicating air quality data and related information to the public and special interest groups.

Although not detailed in this technical paper, the expectation is that graphical, including geographical and spatial, presentations will be used extensively to supplement conventional tabulations of air quality summary statistics in AAQ NEPM reports.

Any additional commitments in regard to reporting and communication that were made in jurisdictional monitoring plans should also be implemented.

## **9 STRUCTURE OF THE ANNUAL REPORT**

The recommended structure of the annual report contains an executive summary and five sections:

- Executive Summary- List of issues, levels against standards, trends
- Section A - Monitoring summary (including maps of regions and performance monitoring stations (PMS) within the jurisdiction, and a qualitative description of exposed population as required by Clause 17 (2a) and Clause 4(2a) of Schedule 4;
- Section B - Assessment of compliance with standards and goal, as required by Clauses 17(2b & 4), 18(4), Clauses 4(2b) and 5(4c,d & 6) of Schedule 4 and, optionally, Clause 17(3);
- Section C - Analysis of air quality monitoring, as required by Clauses 18(2b, 2c & 3) and Clauses 5(4a,e & 5) of Schedule 4;
- Section D - Presentation of trends and pollutant distributions.
- Section E - Additional reporting, including case studies, regional assessments etc.

The information requirements and formats for each of the four sections of the annual report are detailed below.

### **9.1 EXECUTIVE SUMMARY**

Each report should have an executive summary, which identifies progress towards meeting the NEPM aims across the region. The executive summary should give a brief statement on the status and trend for each pollutant across the region. Any significant changes in the monitoring system should also be noted. The executive summary is used to identify any significant issues (such as weather conditions, changes in emission sources, or changes in air quality regulations) that have affected the air quality in the region over the reporting period.

### **9.2 SECTION A - MONITORING SUMMARY**

Regions requiring monitoring or assessment and the performance monitoring stations in each region for each of the AAQ NEPM pollutants are identified in the NEPC approved monitoring plan of each jurisdiction.

Section A should contain the information described below.

1. A very brief description of the current performance monitoring stations (whether generally representative upper bound (GRUB), population-average or peak, trend stations, or PM<sub>2.5</sub> Equivalence Program stations) should be presented in the format of the example table below. Maps showing the regions and the stations should also be presented.
2. The description should include a qualitative determination of the exposed population in the region or sub-region represented by each performance monitoring station. Until a practical,

quantitative method of categorising exposure is developed, the location categories: Central business district, Industrial, Light industrial, Residential and Rural should be used, as in the example table below. The format of this table presents the information required in points 1 and 2.

**Victorian performance monitoring stations**

Region Performance monitoring station	Location category	Site type					
		CO	NO <sub>2</sub>	O <sub>3</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Port Phillip</b>							
Alphington	Res/LI	G*	G*	Pop	Pop*	G*	E
Altona North	I/Res				G		
Brighton	Res		G	Pop*		Pop	
Dandenong	LI			Pop		Pop	
Footscray	I/Res		G*	G*		G*	E
Geelong South	LI/Res	G*	G*	Pop*	G*	G*	
Melton	Res			G			
Mooroolbark	Res			Pop		Pop	
Point Cook	Rur/Res		Pop*	G*			
Point Henry	I/Rur			Pop			
Richmond	Res	G				G	
RMIT (CBD) <sup>a</sup>	CBD	G*	G*		G	G*	
<b>Latrobe Valley</b>							
Moe	Res		Pop	G	G	G	
Traralgon	Res		G*	G*	G*	G*	

CBD Central business district I Industrial LI Light industrial

Res Residential Rur Rural

Pop Population-average G Generally representative upper bound

E PM<sub>2.5</sub> Equivalence Program \* Trend station

a RMIT station closed in 2006. Alternatives will be considered as part of an overall review of Victoria's monitoring plan.

- Any changes to the approved monitoring plans should be detailed for formal approval. Residual issues in the PRC assessment of the monitoring plan that have been resolved should be detailed. For example, if the monitoring plan stated that a site was yet to be chosen, full details of location and siting compliance should be given so that monitoring can be assessed as complying with the NEPM. Any unplanned departures from the monitoring plan should be noted. Screening arguments that were unresolved pending monitoring or modelling results can be completed.
- The recommended format for summarising stations' compliance with the siting standard is as in the following table.

**Summary of stations' siting compliance with AS/NZS 3580.1.1:2007**

Region Station	Location category	Height above ground	Minimum distance to support structure	Clear sky angle of 120°	Unrestricted airflow of 270°/ 180°	10 m from dripline of trees	No extraneous sources nearby	Minimum distance from road (nearest traffic lane)
<b>Port Phillip</b>								
Alphington	Res/LI	☑	☑	☑	☑	☒	☑	☑
Altona North	I/Res	☑	☑	☑	☑	☑	☑	☑
Brighton	Res	☑	☑	☑	☑	☑	☑	☑
Dandenong	LI	☑	☑	☑	☑	☑	☑	☑
Footscray	I/Res	☑	☑	☑	☑	☑	☑	☑
Geelong South	LI/Res	☑	☑	☑	☑	☑	☑	☑
Melton	Res	☑	☑	☑	☑	☑	☑	☑
Mooroolbark	Res	☑	☑	☑	☑	☑	☑	☑
Point Cook	Rur/Res	☑	☑	☑	☑	☑	☑	☑
Point Henry	I/Rur	☑	☑	☑	☑	☑	☑	☑
Richmond	Res	☑	☑	☑	☑	☒	☑	☑
<b>Latrobe Valley</b>								
Moe	Res	☑	☑	☑	☑	☒	☑	☑
Traralgon	Res	☑	☑	☑	☑	☑	☑	☑
Warrnambool	Res	☑	☑	☑	☑	☑	☑	☑

I Industrial    LI Light industrial    Res Residential    Rur Rural

5. The recommended format for summarising methods used for monitoring pollutants is as follows.

**Methods for monitoring the NEPM pollutants**

Pollutant	Standard	Title	Method Used	
Carbon monoxide	CO	AS3580.7.1-1992	Ambient Air – Determination of Carbon Monoxide – Direct Reading Instrument Method	Gas filter correlation/ Infrared.
Nitrogen dioxide	NO <sub>2</sub>	AS3580.5.1-1993	Ambient Air – Determination of Oxides of Nitrogen – Chemiluminescence Method	Gas phase chemiluminescence.
Photochemical oxidant (ozone)	O <sub>3</sub>	AS3580.6.1-1990	Ambient Air – Determination of Ozone – Direct Reading Instrument Method	Non-dispersive ultraviolet.
Sulfur dioxide	SO <sub>2</sub>	AS3580.4.1-1990	Ambient Air – Determination of Sulfur Dioxide – Direct Reading Instrument Method	Pulsed fluorescence
Particles	PM <sub>10</sub>	AS3580.9.8-2001	Determination of Suspended Particulate Matter - PM <sub>10</sub> Continuous Direct Mass Method using a Tapered Element Oscillating Microbalance Analyser	Tapered element oscillating microbalance (TEOM).
	PM <sub>2.5</sub>	AS/NZS3580.9.10-2006 <sup>a</sup>	Reference Method for the Determination of Fine Particulate matter as PM <sub>2.5</sub> in the Atmosphere	Gravimetric reference method
	PM <sub>2.5</sub>	AS3580.9.8-2001 <sup>a</sup>	Technical Paper on Monitoring for Particles as PM <sub>2.5</sub>	TEOM

a Modified for use in the PM<sub>2.5</sub> Equivalence Program according to the NEPM Technical Paper

6. The status of NATA accreditation should be stated and any non-compliance with quality control measures should be specified.

7. Approved screening, which justifies fewer than the number of monitoring stations specified in Clause 14 of the NEPM, or regions in which the standards and goal can be assessed as "met" without monitoring, should be noted. The recommended format for summarising screening procedures satisfied is as in the following table. Full details should be included of any new screening claims.

**Screening procedures satisfied**

Region	CO	NO <sub>2</sub>	O <sub>3</sub>	SO <sub>2</sub>	PM <sub>10</sub>	Pb
Port Phillip	B	—	—	B	—	B
Latrobe Valley	A	—	—	—	—	A
Ballarat	A	A	—	F	—	F
Bendigo	A	A	E&F	F	—	F
Mildura	F	F	E&F	F	—	F
Shepparton	F	F	E&F	F	—	F
Warrnambool	F	F	E	F	—	F
Wodonga	F	F	E&F	F	—	F

8. Where methods other than physical monitoring are used, these should be described and documented.

Quality assured campaign data that comply with NEPM standard methods should be reported as additional data. The information regarding campaign monitoring should be provided under this section, if such data are to be included in the annual report.

### 9.3 SECTION B - ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOAL

This section of the report provides the essential information for the annual compliance assessment and the evaluation and assessment of PM<sub>2.5</sub> required under the AAQ NEPM. The AAQ NEPM standards and goal for all pollutants except PM<sub>2.5</sub> are specified in Schedule 2 of the NEPM, with a goal to achieve the standards to the extent specified by 2008.

Compliance criteria are applied on an individual basis at each performance monitoring station in the region. Each performance station is allowed the same number of exceedences (1, or 5 for PM<sub>10</sub>) per year. If any station exceeds the standard on more than one day per year (more than 5 days for PM<sub>10</sub>), a non-compliance has occurred. A station-by-station assessment leads to a clear indication of where (in which sub-region) the non-compliance has occurred.

In addition, Clause 17(3) specifies that jurisdictions may provide an evaluation of a region as a whole against the standards. A region is in compliance if, and only if, every performance monitoring station in the region meets the standards and goal. Based on this definition, the compliance status of the region as a whole can be stated in the last column of Tables 1 to 6 (Performance against the standards and goal). A broader description of regional assessment may be included under section E.

Clause 14(3) of the AAQ NEPM allows fewer monitoring stations to be used in regions where it can be demonstrated that pollutant levels are reasonably expected to be consistently lower than the NEPM standards. The PRC has therefore developed screening procedures (described in Technical Paper No. 4) which specify the circumstances under which monitoring is not required in a region that is otherwise covered by the NEPM. The arguments justifying the absence of monitoring in these regions are detailed in the approved monitoring plans or in section A. These regions should be listed in the Annual Report below Tables 1 to 6 with a note that the pollutant levels are reasonably expected to be consistently lower than the NEPM

standard.

Air quality assessment using methods other than physical monitoring is also possible. The AAQ NEPM in Clause 11(b) permits the use of alternative means that provide information equivalent to measurements, which would otherwise occur at a performance monitoring station. Such alternatives must be documented and formally approved in monitoring plans. If this were to occur, the data should be reported in the same format as for physical monitoring.

The yearly information, for each pollutant and performance monitoring station in each region that must be included in this section, consists of:

1. the percentage of data available for the calendar year as well as for each calendar quarter for each performance station;
2. the number of exceedence days for each performance station;
3. the annual mean concentration for pollutants with a 1-year standard; and
4. the compliance status for each pollutant at each performance monitoring station in relation to the standards and the goal, as "met", "not met" or "not demonstrated."

The formats for each of the AAQ NEPM pollutants are shown in Tables 1 to 7.

**CARBON MONOXIDE**

**Table 1: (Year) compliance summary for CO in (jurisdiction)**

**AAQ NEPM Standard  
 9.0 ppm (8-hour average)**

Region/ Performance monitoring station	Data availability rates (% of hours)					Number of exceedences (days)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
<u>Region 1</u>							
PMS 1	80.0	81.0	82.0	85.0	82.0	0	met
PMS 2	80.0	81.0	82.0	85.0	82.0	1	met
PMS 3	80.0	81.0	82.0	85.0	82.0	2	not met
PMS 5	80.0	70.0	80.0	80.0	77.5	0	ND
<u>Region 2</u>							
PMS 1 <sup>a</sup>	.	.	.	.	.	.	.
PMS 2	.	.	.	.	.	.	.

ND Not demonstrated.

a Campaign monitoring at PMS1 ceased in September.

**Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard: Region X, Region Y.**

NITROGEN DIOXIDE

Table 2: (Year) compliance summary for NO<sub>2</sub> in (jurisdiction)

AAQ NEPM standard  
 0.12 ppm (1-hour average)  
 0.03 ppm (1-year average)

Region/ Performance monitoring station	Data availability rates (% of hours)					Number of exceedences (days)	Annual mean (ppm)	Performance against the standards and goal	
	Q1	Q2	Q3	Q4	Annual			1-hour	1-year
<u>Region 1</u>									
PMS 1	80.0	80.0	80.0	80.0	80.0	0	0.021	met	met
PMS 2	90.0	90.0	90.0	90.0	90.0	1	0.030	met	met
PMS 4	0.0	0.0	0.0	0.0	0.0			ND	ND
PMS 6	.	.	.	.	.	.	.	.	.
PMS 7	.	.	.	.	.	.	.	.	.
PMS10	.	.	.	.	.	.	.	.	.
<u>Region 2</u>									
PMS 1	.	.	.	.	.	.	.	.	.
PMS 2	.	.	.	.	.	.	.	.	.

ND Not demonstrated.

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard: Region X, Region Y.

OZONE

**Table 3: (Year) compliance summary for ozone in (jurisdiction)**

AAQ NEPM standards  
 0.10 ppm (1-hour average)  
 0.08 ppm (4-hour average)

Region/ Performance monitoring station	Data availability rates (% of hours)					Number of exceedences (days)		Performance against the standards and goal	
	Q1	Q2	Q3	Q4	Annual	1-hour	4-hour	1-hour	4-hour
<u>Region 1</u>									
PMS 1	80.0	80.0	80.0	80.0	80.0	0	1	met	met
PMS 2	90.0	90.0	90.0	90.0	90.0	1	2	met	not met
PMS 3	0.0	0.0	0.0	0.0	0.0			.	.
PMS 6	.	.	.	.	.	.	.	.	.
PMS 7	.	.	.	.	.	.	.	.	.
PMS 8	.	.	.	.	.	.	.	.	.
PMS 9	.	.	.	.	.	.	.	.	.
PMS10	.	.	.	.	.	.	.	.	.
<u>Region 2</u>									
PMS 1	95.6	89.2	94.3	94.1	93.3	0	0	met	met
PMS 2	93.8	95.1	95.6	94.6	94.7	0	0	met	met

ND Not demonstrated.

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard: Region X, Region Y.



SULFUR DIOXIDE

**Table 4: (Year) compliance summary for SO<sub>2</sub> in (jurisdiction)**

AAQ NEPM standards  
 0.20 ppm (1-hour average)  
 0.08 ppm (24-hour average)  
 0.02 ppm (1-year average)

Region/ Performance monitoring station	Data availability rates (% of hours)					Number of exceedences (days)		Annual mean (ppm)	Performance against the standards and goal		
	Q1	Q2	Q3	Q4	Annual	1h	24h		1h	24h	1y
<u>Region 1</u>											
PMS 1	91.5	94.2	91.5	85.8	90.8	0	0	0.010	met	met	met
PMS 3	93.9	95.1	92.2	85.2	91.6	1	0	0.020	met	met	met
PMS 5	94.4	94.8	91.5	83.3	91.0	0	0	0.003	met	met	met
PMS 7	92.9	95.1	72.2	94.4	89.0	0	0	0.004	ND	ND	ND
<u>Region 2</u>											
PMS 1	91.5	94.2	91.5	85.8	90.8	0	0	0.005	met	met	met
PMS 2	93.9	95.1	92.2	85.2	91.6	0	0	0.005	met	met	met

ND Not demonstrated.

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard: Region X, Region Y.

PARTICLES AS PM<sub>10</sub>

Table 5: (Year) compliance summary for PM<sub>10</sub> in (jurisdiction)

AAQ NEPM Standard  
 50 µg/m<sup>3</sup> (24-hour average)

Region/ Performance monitoring stations	Data availability rates (% of days)					Number of exceedences of 24 hr Standard (days)	Performance against the standards and goal
	Q1	Q2	Q3	Q4	Annual		
<u>Region 1</u>							
PMS 1	80.0	81.0	82.0	85.0	82.0	0	met
PMS 2	80.0	81.0	82.0	85.0	82.0	5	met
PMS 3	80.0	81.0	82.0	85.0	82.0	6	not met
PMS 4	0.0	0.0	0.0	0.0	0.0		ND
PMS 5	80.0	70.0	80.0	80.1	77.5	0	ND
PMS 9 <sup>b</sup>	16.0	16.0	16.0	16.0	16.0	0	ND
<u>Region 2</u>							
PMS 1	.	.	.	.	.	.	.
PMS 2	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
<u>Region 3<sup>a</sup></u>	17.0	17.0	0.0	0.0	8.3	0	ND

(Monitoring is by TEOM unless indicated otherwise.)

a Campaign monitoring by high-volume sampler one day in six, January to June.

b Monitoring by high-volume sampler one day in six.

ND Not demonstrated.

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard: Region X, Region Y.

PARTICLES AS PM<sub>2.5</sub>

Table 6: (Year) compliance summary for PM<sub>2.5</sub> in (jurisdiction)

AAQ NEPM Advisory Reporting Standard  
 25 µg/m<sup>3</sup> (24-hour average)  
 8 µg/m<sup>3</sup> (annual average)

Region/ Performance monitoring stations	Data availability rates (% of days)					Number of days 24 hour standard exceeded	Annual Mean (µg/m <sup>3</sup> )	Performance against the standard and goal	
	Q1	Q2	Q3	Q4	Annual			24hr	Annual
<u>Region 1</u>									
PMS 1	80.0	81.0	82.0	85.0	82.0	0	7.5	Met	Met
PMS 2	80.0	81.0	82.0	85.0	82.0	0	7.2		Met
PMS 3	80.0	81.0	82.0	85.0	82.0	5	8.5		Not Met
PMS 4	0.0	0.0	0.0	0.0	0.0	-	-	ND	ND
PMS 5	80.0	70.0	80.0	80.1	77.5	0	7.2	ND	ND
PMS 9 <sup>b</sup>	16.0	16.0	16.0	16.0	16.0	2	8.5	Not met	ND
<u>Region 2</u>									
PMS 1	.	.	.	.	.				
PMS 2	.	.	.	.	.				
.	.	.	.	.	.				
.	.	.	.	.	.				
<u>Region 3<sup>a</sup></u>	17.0	17.0	0.0	0.0	8.3	5	8.5	Not met	ND

(Monitoring is by Reference method unless indicated otherwise.)

a Campaign monitoring by high-volume sampler one day in six, January to June.

b Monitoring by TEOM

ND Not demonstrated.

LEAD

**Table 7: (Year) compliance summary for Lead in (jurisdiction)**

AAQ NEPM standard  
 0.50 µg/m<sup>3</sup> (1-year average)

Region/ Performance monitoring station	Data availability rates (% of days)					Annual mean (µg/m <sup>3</sup> )	Performance against the standard and goal
	Q1	Q2	Q3	Q4	Annual		
Region 1 PMS 11	100.0	80.0	93.3	100.0	95.0	0.02	met

Regions which do not require monitoring on the basis of screening arguments that pollutant levels are reasonably expected to be consistently below the relevant NEPM standard: Region X, Region Y.

**9.4 SECTION C - ANALYSIS OF AIR QUALITY MONITORING**

Information that allows qualitative and quantitative assessment and comparison of monitoring data against the standards is presented in this section. The most relevant statistics include the listing of exceedences, annual maxima, the second and the sixth highest daily concentrations and the dates and sites of occurrences. The AAQ NEPM states that the short-term standards should not be exceeded on more than one day for CO, NO<sub>2</sub>, O<sub>3</sub>, SO<sub>2</sub>, and on more than 5 days per year for PM<sub>10</sub>. With this form of standard, the non-overlapping second highest daily value for the year (or the sixth for PM<sub>10</sub>) becomes the decision making value. If this value is above the standard then non-compliance is reported. This value as a percentage of the standards can help to indicate the extent to which the standards are, or are not, met. The number of decimals quoted for concentrations is as in the Data Handling Technical Paper. Reports should note that all times are the finish times for events.

This section should include the following:

1. The list of exceedences with concentrations, dates, times and sites.
2. The description of the circumstances which led to exceedences, including, where possible, the influence of natural events and fire management (Clause 18(4) and Clause 5(5) of Schedule 4).
3. An analysis of the extent to which the standards are, or are not, met in the jurisdiction (Clause 18 (3b) and Clause 5(4a) of Schedule 4) presented in the form shown in Tables 7 to 11. It is recommended that concentrations exceeding the standard are highlighted in bold.
4. A statement of the progress made towards achieving the goal (Clause 18(3c)). This summarises in words the conclusions to be drawn from the data presented in all sections of the report.

**Table 7: (Year) summary statistics for daily peak 8-hour CO in (jurisdiction)**

**AAQ NEPM standard  
 9.0 ppm (8-hour average)**

<b>Region/ Performance monitoring station</b>	<b>Number of valid days</b>	<b>Highest (ppm)</b>	<b>Highest (dd-mon hh:mm)</b>	<b>2nd highest (ppm)</b>	<b>2nd highest (date:hour)</b>
<u>Region 1</u>					
PMS 1	343	5.0	25-Jul 02:00	4.4	Jul23:24
PMS 2	340	3.6	Jul25:02 May09:02		
PMS 3	331	4.0	May09:02	3.4	May01:04
PMS 5	325	2.2	May09:01	2.1	Jul25:02

**Table 8: (Year) summary statistics for daily peak 1-hour NO<sub>2</sub> in (jurisdiction)**

**AAQ NEPM standard  
 0.120 ppm (1-hour average)**

<b>Region/ Performance monitoring station</b>	<b>Number of valid days</b>	<b>Highest (ppm)</b>	<b>Highest (date:hour)</b>	<b>2nd highest (ppm)</b>	<b>2nd highest (date:hour)</b>
<u>Region 1</u>					
PMS 1	300	0.060	Mar15:19	0.058	Jan14:21
PMS 2	150	0.041	Aug30:19	0.040	Jul11:16 Nov05:19
PMS 6	320	0.054	Apr06:12 May04:17 May14:14		
PMS 7	299	0.071	Apr30:12	0.058	May25:15
PMS10	341	0.071	Jan04:21	0.057	May08:21
<u>Region 2</u>					
PMS 1	361	0.033	Apr07:19	0.032	Feb08:19 Mar31:19 Apr04:19
PMS 2	.	.	.	.	.

Table 9: (Year) summary statistics for daily peak 1-hour O<sub>3</sub> in (jurisdiction)

AAQ NEPM standard  
 0.100 ppm (1-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:hour)
<u>Region 1</u>					
PMS 1	280	0.077	Feb06:15	0.060	Mar09:17
PMS 2	326	0.044	Nov04:17	0.044	Sep30:16
PMS 6	.	.	.	.	.
PMS 7	.	.	.	.	.
PMS 8	.	.	.	.	.
PMS 9	.	.	.	.	.
PMS10	.	.	.	.	.
<u>Region 2</u>					
PMS 1	.	.	.	.	.
PMS 2	.	.	.	.	.

Table 10: (Year) summary statistics for daily peak 4-hour O<sub>3</sub> in (jurisdiction)

AAQ NEPM standard  
 0.080 ppm (4-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (ppm)	Highest (date:hour)	2nd highest (ppm)	2nd highest (date:hour)
<u>Region 1</u>					
PMS 1	336	0.062	Feb06:16	0.052	Feb17:18
PMS 2	126	0.042	Nov04:19	0.041	Sep30:16
PMS 6	332	<b>0.095</b>	Jan04:18	0.078	Jan19:17
PMS 7	.	.	.	.	.
PMS 8	.	.	.	.	.
PMS 9	.	.	.	.	.
PMS10	.	.	.	.	.
<u>Region 2</u>					
PMS 1	.	.	.	.	.
PMS 2	.	.	.	.	.

Similar tables can be generated for 1-hour and 24-hour SO<sub>2</sub>.

**Table 11: (Year) summary statistics for 24-hour PM<sub>10</sub> in (jurisdiction)**

AAQ NEPM standard  
 50 µg/m<sup>3</sup> (24-hour average)

Region/ Performance monitoring station	Number of valid days	Highest (µg/m <sup>3</sup> )	Highest (date)	6th highest (µg/m <sup>3</sup> )	6th highest (date)
<u>Region 1</u>					
PMS 1	300	38.9	Sep21	27.3	Aug06
PMS 2	300	<b>70.8</b>	Jan12	42.8	Mar08
PMS 3	300	<b>71.0</b>	Nov21	<b>53.1</b>	Nov05
PMS 5	45	44.7	Sep26	29.9	May05
PMS 9 <sup>a</sup>	58	452.9	Jan12	45.0	Sep20
<u>Region 3<sup>b</sup></u>					
	27	32.6	Mar30	24.5	Jan11

a Monitoring by high-volume sampler one day in six.

b Campaign monitoring by high-volume sampler one day in six, January to June.

#### 9.5 SECTION D - TRENDS AND POLLUTANT DISTRIBUTIONS

This section provides the results of additional analyses based on the statistics in Section 7. The table formats below should be used to provide consistency in presentation. An example is shown in Table 12. Similar presentations should be generated for all other pollutants and averaging times. Results of such presentations, particularly in interpretations and discussion, can also be expressed as Nth highest values rather than percentiles. For example, the 95th percentile of daily peak concentrations corresponds to the 18th highest daily peak concentration if there is 100% data availability.

**Table 12: Percentiles of daily peak 1-hour ozone concentrations for (Year)**

AAQ NEPM standard  
 0.10 ppm (1-hour average)

	Data availability rates (%)	Max conc. (ppm)	99 <sup>th</sup> percentile (ppm)	95 <sup>th</sup> percentile (ppm)	90 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> percentile (ppm)	25 <sup>th</sup> percentile (ppm)	Average (ppm)e
<u>Region 1</u>									
PMS 1									
PMS 2									
.									
.									
<u>Region 2</u>									
PMS 1									
PMS 2									
.									
.									

Concentrations exceeding the standard should be shown in bold type. Stations with data availability less than 75 per cent should be shown in italics. Stations with data availability less than 15 per cent should be omitted

Where quality assured data are available for several years, data can be presented in the format shown in Table 13. Graphical presentations of such information would be very informative, would show trends and year-to-year variations and would provide a better appreciation of air quality and progress towards achieving the goal. Tables and plots of time series should use data from all available years (i.e., more than 10 years, if possible). In this analysis, the emphasis should be on daily peak concentrations as the NEPM goal is in terms of performance over each day.



**Table 13: Daily peak 1-hour ozone data summary (Year range)**

Trend station/region: \_\_\_\_\_

**AAQ NEPM standard  
 0.10ppm (1-hour average)**

Year	Data Availability (%)	No. of Exceedences (days)	Max conc. (ppm)	99 <sup>th</sup> percentile (ppm)	95 <sup>th</sup> percentile (ppm)	90 <sup>th</sup> percentile (ppm)	75 <sup>th</sup> percentile (ppm)	50 <sup>th</sup> percentile (ppm)	25 <sup>th</sup> percentile (ppm)	Average (ppm)
1992										
1993										
1994										
1995										
1996										
1997										
1998										
1999										
2000										
2001										

Levels above the standard are highlighted.

## 9.6 SECTION E - ADDITIONAL REPORTING

The PRC encourages jurisdictions to expand their reporting in this optional section to include analysis of trends, pollutant distributions and population exposure, highlights, case studies of pollution events and regional assessments. Trend analysis would involve the evaluation of the long-term trends associated with the measured concentrations of a pollutant for a given performance monitoring station. Evaluation of the long-term trends is important in assessing the effectiveness of control strategies, and the progress towards achieving the goal. Reference may be made to relevant jurisdictional and Commonwealth reports. Graphical presentations, including box plots would be effective in communicating the observed trends.

## 9.7 SECTION E - UNCERTAINTY OF MEASUREMENT

At this stage it is considered that NEPM standards and goals are fixed legislated numbers and have no uncertainty associated with them. Measurement of exceedences of standards and goals are made by direct comparison of the measurands with the standard and goal. The references to uncertainty are to give readers of the report an estimate of how much a given data point may vary from its nominal value to assist them in assessing the value of the report. In the future uncertainty may be taken into account when determining exceedences but for the duration of this Technical Paper 8 this is not the case.

Uncertainty is to be estimated as outlined in the reference by R R Cook below. Each jurisdiction must estimate its own uncertainties, as, although they are likely to be using the same standard methods for measurement the steps and equipment in doing so may vary giving differing final uncertainties.

Uncertainty is to be reported with an explanatory statement and a numerical statement as follows in 1) and 2) below:

### 1) Uncertainty of measurement

“Every measurement made has an error associated with it, and, without a quantitative statement of the error, a measurement lacks worth. Indeed without such a statement it lacks credibility. The parameter that quantifies the boundaries of the error of a measurement is called the uncertainty of measurement. Accuracy is a general term that is subject to various interpretations, whereas uncertainty has a specific meaning. Uncertainty is defined as the parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurand. The measurand is the particular quantity subject to measurement.”

R R Cook, 2002, **Assessment of Uncertainties of Measurement for Calibration and Testing Laboratories Second Edition**, National Association of Testing Authorities, Australia ACN 004 379 748, ISBN 0-909307-46-6

- 2) For each pollutant reported there must be a statement of uncertainty of the measurement at
- (a) the value of the standard or
  - (b) as multiple values over the range of measurement presented as a table or
  - (c) as multiple values over the range of measurement presented as a graph.

In the examples below one hour ozone has been used. This must be repeated for every pollutant reported by a jurisdiction and at the time basis of the standard. Ozone for example would have a numerical statement for one hour and four hour data.

EXAMPLES ONLY:

The expanded uncertainty (95% ) of measurement for one hour average ozone concentrations is +/- 0.005ppm at an ozone concentration of 0.1ppm

Ozone - one hour average concentration (ppm)	Expanded Uncertainty (95%) (ppm)
0.000	0.004
0.005	0.005
0.020	0.005
0.050	0.005
0.075	0.005
0.100	0.005
0.150	0.005
0.200	0.005
0.300	0.006
0.400	0.007
0.500	0.008

