

*National Environment Protection
(Ambient Air Quality) Measure*

Technical Paper No. 8

Annual Reports

Prepared by the
Peer Review Committee

October 2002

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 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', written in a cursive style.

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). 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.

Clause 3 of the AAQ NEPM states that “jurisdictions must establish monitoring procedures, and commence assessment and reporting in accordance with the Protocol in this Measure, within 3 years after its commencement.” 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 to be covered in that annual report, representing more detailed information supplementary to the succinct implementation report specified in the NEPC Act.

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. Clauses 11, 17 and 18 of the AAQ NEPM specify the requirements and the range of information to be covered in the annual report. These clauses 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; 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.

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 PM₁₀ data are described in National Environment Protection Council (Ambient Air Quality) Measure Technical Paper No. 10, "Collection and Reporting of TEOM PM₁₀ 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.

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 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 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 ³	none
6	Particles as PM ₁₀	1 day	50 µg/m ³	5 days a year

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 PM₁₀) per year. The short-term standards are defined as concentrations over specified averaging times. A ten-year 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 (or 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 an "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 PM₁₀ 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 PM₁₀ 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 PM₁₀) 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.

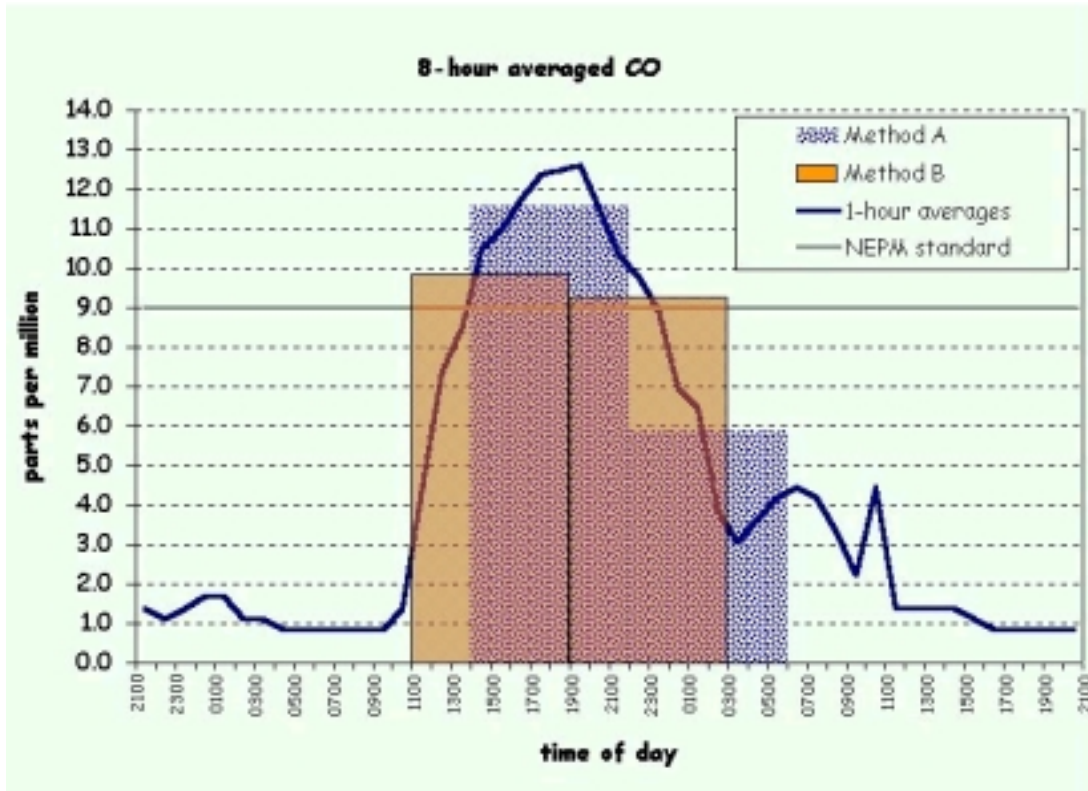


Figure 1. A curve of hourly carbon monoxide concentrations, with rectangles showing 8-hour averages.

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 2nd highest concentration and is described below.

Consider the following concentrations:

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 NTH-HIGHEST CONCENTRATIONS AND PERCENTILES FOR RUNNING AVERAGES

Percentiles and Nth-highest concentrations are statistics commonly used in the general evaluation of air quality. The approach used in determining the second highest concentration can be extended to determining the Nth highest concentration and percentiles as shown below.

The following procedure can be used to determine the Nth 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 Nth highest concentrations for use in the general evaluation of air quality. The identification of the Nth-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 SO₂) or the sixth-highest (for PM₁₀) 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 98th, 95th and 90th percentiles of the daily peak concentration; and
- The data availability rate (annual and quarterly percentage of hours, and days with data).

8 STRUCTURE OF THE ANNUAL REPORT

The recommended structure of the annual report contains four sections:

- 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);
- Section B - Assessment of compliance with standards and goal, as required by Clauses 17(2b & 4), 18(5) and, optionally, 17(3);
- Section C - Analysis of air quality monitoring, as required by Clauses 18(3b, 3c & 4);
- Section D - Data analysis including presentation of trends and pollutant distributions.

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

8.1 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, monitoring methods, and networks with maps showing the regions and the stations should 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.
3. 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. Screening arguments that were unresolved pending monitoring or modelling results can be completed.
4. Presentation of unresolved issues, including:
 - Progress on remaining unresolved issues from the PRC assessment of the monitoring plan.
 - Performance monitoring stations that do not meet the siting and exposure criteria.
 - Unplanned departures from the monitoring plan, such as delayed installation.
5. The status of NATA accreditation should be stated and any non-compliance with quality control measures should be specified.
6. Where methods other than physical monitoring are used, these should be described and documented.
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.

Quality assured campaign data that comply with NEPM standard methods should be reported separately 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.

8.2 SECTION B - ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOAL

This section of the report provides the essential information for the annual compliance assessment required under the AAQ NEPM. The AAQ NEPM standards and goal are specified in Schedule 2 of the NEPM. The AAQ NEPM has 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 PM₁₀) per year. If any station exceeds the standard on more than one day per year (more than 5 days for PM₁₀), 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 D.

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. These regions should be listed in the Annual Report separately from Tables 1 to 6 with a note that they are in compliance under Clause 14(3) that the pollutant levels are reasonably expected to be consistently lower than the NEPM standard.

Air quality assessment using methods other than physical monitoring are 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 proposed formats for each of the AAQ NEPM pollutants are shown in Tables 1 to 6.

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	.	.	.	.	.	.	.
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

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NITROGEN DIOXIDE

Table 2: (Year) compliance summary for NO₂ 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

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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

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SULFUR DIOXIDE

Table 4: (Year) compliance summary for SO₂ 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

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8.3 PARTICLES AS PM10

Table 5: (Year) compliance summary for PM₁₀ in (jurisdiction)

**AAQ NEPM Standard
 50 µg/m³ (24-hour average)**

Region/ Performance monitoring stations	Data availability rates (% of days)					Number of exceedences (days)	Performance against the standard 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 ^b	16.0	16.0	16.0	16.0	16.0	0	ND
<u>Region 2</u>							
PMS 1
PMS 2
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<u>Region 3^a</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

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LEAD

Table 6: (Year) compliance summary for Lead in (jurisdiction)

**AAQ NEPM standard
 0.50 µg/m³ (1-year average)**

Region/ Performance monitoring station	Data availability rates (% of days)					Annual mean (µg/m ³)	Performance against the standard and goal
	Q1	Q2	Q3	Q4	Annual		
<u>Region 1</u> 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

8.4 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, NO₂, O₃, SO₂, and on more than 5 days per year for PM₁₀. With this form of standard, the non-overlapping second highest daily value for the year (or the sixth for PM₁₀) 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.

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)).
3. An analysis of the extent to which the standards are, or are not, met in the jurisdiction (Clause 18 (3b)) 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. For each pollutant and averaging time that has any exceedences, a graphical presentation of exceedence numbers is encouraged.

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

**AAQ NEPM standard
 9.0 ppm (8-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	343	5.0	Jul25:02	4.4	Jul23:24
PMS 2	340	3.6	Jul25:02 May09:02	2.7	Apr07:02 May04:03
PMS 3	331	4.0		3.4	May01:04
PMS 5	325	2.2	May09:02 May09:01	2.1	Jul25:02

Table 8: (Year) summary statistics for daily peak 1-hour NO₂ in (jurisdiction)

**AAQ NEPM standard
 0.12 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	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	0.054	
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) (1998) summary statistics for daily peak 1-hour O₃ in (jurisdiction)

**AAQ NEPM standard
 0.10 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 O₃ in (jurisdiction)

**AAQ NEPM standard
 0.08 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	0.095	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 SO₂.

Table 11: (Year) summary statistics for 24-hour PM₁₀ in (jurisdiction)

**AAQ NEPM standard
 50 µg/m³ (24-hour average)**

Region/ Performance monitoring station	Number of valid days	Highest (µg/m³)	Highest (date)	6th highest (µg/m³)	6th highest (date)
<u>Region 1</u>					
PMS 1	300	38.9	Sep21	27.3	Aug06
PMS 2	300	70.8	Jan12	42.8	Mar08
PMS 3	300	71.0	Nov21	53.1	Nov05
PMS 5	45	44.7	Sep26	29.9	May05
PMS 9 ^a	58	452.9	Jan12	45.0	Sep20
<u>Region 3^b</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.

8.5 SECTION D - DATA ANALYSIS

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.

Additional useful presentations include percentiles of daily peak concentrations. An example is shown in Table 12. Similar presentations can be generated for 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)	99th percentile (ppm)	98th percentile (ppm)	95th percentile (ppm)	90th percentile (ppm)	75th percentile (ppm)	50th percentile (ppm)
<u>Region 1</u>								
PMS 1								
PMS 2								
.								
.								
<u>Region 2</u>								
PMS 1								
PMS 2								
.								

Concentrations exceeding the standard can be highlighted.

For trend stations, where quality assured data, with at least 75% annual and quarterly availability, 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. Plots of time series should use data from all available years (i.e., more than 10 years, if possible). In analysis and reporting, 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 th percentile (ppm)	98 th percentile (ppm)	95 th percentile (ppm)	90 th percentile (ppm)
1992							
1993							
1994							
1995							
1996							
1997							
1998							
1999							
2000							
2001							

The same information can be presented in different formats; e.g. instead of various percentiles for one station, one percentile level (maximum, 98th percentile, etc.) for all trend stations can be presented, as shown in Table 14. Such presentations would show spatial variations in trends.

Table 14: Annual daily peak 1-hour ozone concentrations (ppm) for (Year range)

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

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<u>Region 1</u>										
PMS 1										
PMS 2										
PMS 3										
.										
.										
.										
<u>Region 2</u>										
PMS 1										
.										
.										

Levels above the standard are highlighted.

The PRC encourages jurisdictions to expand their reporting to include analysis of trends, pollutant distributions and population exposure. 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 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.