Public Health Association of Australia submission on National Environment Protection (Ambient Air Quality) Measure for sulfur dioxide, nitrogen dioxide and ozone

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Preamble

The Public Health Association of Australia

The Public Health Association of Australia (PHAA) is recognised as the principal non-government organisation for public health in Australia working to promote the health and well-being of all Australians. It is the pre-eminent voice for the public’s health in Australia.

The PHAA works to ensure that the public’s health is improved through sustained and determined efforts of the Board, the National Office, the State and Territory Branches, the Special Interest Groups and members.

The efforts of the PHAA are enhanced by our vision for a healthy Australia and by engaging with like-minded stakeholders in order to build coalitions of interest that influence public opinion, the media, political parties and governments.

Health is a human right, a vital resource for everyday life, and key factor in sustainability. Health equity and inequity do not exist in isolation from the conditions that underpin people’s health. The health status of all people is impacted by the social, cultural, political, environmental and economic determinants of health. Specific focus on these determinants is necessary to reduce the unfair and unjust effects of conditions of living that cause poor health and disease. These determinants underpin the strategic direction of the Association.

All members of the Association are committed to better health outcomes based on these principles.

Vision for a healthy population

A healthy region, a healthy nation, healthy people: living in an equitable society underpinned by a well-functioning ecosystem and a healthy environment, improving and promoting health for all.

The reduction of social and health inequities should be an over-arching goal of national policy and recognised as a key measure of our progress as a society. All public health activities and related government policy should be directed towards reducing social and health inequity nationally and, where possible, internationally.

Mission for the Public Health Association of Australia

As the leading national peak body for public health representation and advocacy, to drive better health outcomes through increased knowledge, better access and equity, evidence informed policy and effective population-based practice in public health.
Introduction

PHAA welcomes the opportunity to provide input to the review of the National Environment Protection (Ambient Air Quality) Measure (NEPM) for sulfur dioxide, nitrogen dioxide and ozone. Poor air quality is a major but poorly recognised cause of significant ill health and mortality globally and in Australia. Major sources are domestic and wild fires, energy generation, and industry and diesel vehicle emissions. Air pollution is well established as a key health threat in urban environments across the globe.¹,² In particular, over the past 20 years since the current standards were set in Australia, a vast body of medical and scientific research has emerged, linking various air pollutants with health problems.³⁶ The literature confirms a causal association between exposures to air pollutants and increased all-cause mortality and incidence of heart disease, stroke, lung cancer, low birth weight, respiratory problems and type II diabetes.⁶⁻¹² These findings have been reflected in progressively lower pollution limits in many other countries. However, Australia’s standards remain well above international best practice levels. In Australia, air quality monitoring and regulation needs improvement to adequately protect public health.

Before examining the NEPM revision in detail, briefly recapping why we have air quality standards and what can be achieved through them grounds the main points and recommendations.

Air quality standards used to be thought of as defining a level of air quality that was safe – that below the given threshold for each pollutant, there would be no health effect. This aligns with the term NOAEL standing for No Observable Adverse Effect Level, widely used in toxicology. It is still how the general public views air quality standards, despite the science now showing this notion to be mostly false, as for many air pollutants, there is no lower threshold of effect. So if there is no safe level, what is the purpose of a standard?

Standards define a maximum level of pollution that is regarded as acceptable to the community or governments, conferring a level of risk of adverse effects that it is prepared to countenance, and does this uniformly across the country. Demonstration that some regions exceed the standard gives strong support to regulators to take action to improve air quality, and it gives the non-expert community guidance to demand action if regulators fail to proceed.

A standard set above current exposure levels serves no purpose, except to allow environmental regulators to keep issuing reports to the public concluding that there is no problem. A more appropriate approach where air quality is causing a common or serious health problem is to set the standard at a level that will highlight problems in the most polluted parts of the country, regions and communities, to guide efforts for abatement.

PHAA Response to the consultation paper

Chapter 1 Introduction and Chapter 2 Air quality management in Australia

Do you support the recommended changes to clause 14 (incorporating risk into how the number of performance monitoring stations is determined) and the inclusion of relevant definitions?

The wording is vague including undefined terms such as ‘may be needed if determined’, and ‘reasonably expected to be consistently’. The proposed definition also places the emphasis on a threshold number of people at risk (25,000 people or above). PHAA believes that the principle of protecting the public’s health should apply to all populations, no matter their size, with the threshold focusing on the pollution level, not...
the population level. PHAA recommends a performance monitoring station at any established town that hosts an industry emitting more than 10,000 tonnes per annum of NOx or SO2 as recorded by the National Pollutant Inventory. This would better protect all at-risk communities, without relying on ‘relevant participating jurisdictions’ to deem stations to be necessary.

Chapter 3 Statement of the problem

Do you agree with the preferred option to vary the AAQ NEPM? In particular, do you agree that continued government involvement is required to address the current and potential future health impacts and costs of SO2, NO2 and O3?

PHAA supports the preferred option being to vary the AAQ NEPM. The provision of clean air is an environmental health priority that can be achieved through intersectoral collaboration between health, industry and planning ministries, guided by Commonwealth legislation and standards, and State/Territory government action. In Australia, ambient air quality standards are set by agreement between the various state and territory environment ministers, under the NEPM process. The NEPM standards are notional and not enforceable under law. Individual states and territories use the NEPM standards as a guide to form their own standards.

Continued government involvement is essential to ensure that public and private sector organisations implementing infrastructure or industrial projects are held accountable for health impacts of their developments on populations.

Chapter 4 Methodology

Have all key assumptions been correctly identified and included in the analysis? If not, please provide details

Standards are based on health considerations, and require a judgement about the frequency and severity of adverse health outcomes. This has led to attempts to make decisions about standards based on the economic analysis of the value of health damage compared with the predicted abatement costs. These economic analyses are frequently severely flawed for the following reasons:

- Concentration response functions are available for only a small range of the health outcomes strongly suspected of being caused by air pollution
- While a cost for health care expenditure can be derived, the intangible and indirect costs of disease can be many times higher
- The costs of abatement will rapidly change as new technologies become available. For instance, technologies for zero emissions vehicles and electricity generation are now a reality, but were distant prospects when the current standards were set in 1998. It is short sighted to conclude that some abatement is expensive so we should not even aim for better air.
- As an example, the current regulatory impact statement (RIS) ignores the costs due to secondary particle formation, while the 2010 SO2 RIS produced by the Environmental Protection Agency in the United States of America found that secondary particles accounted for 99% of the monetised costs of SO2 pollution.

For these reasons, the correct place for benefit cost analysis is at the jurisdictional level planning pollution abatement measures, not when setting standards.
Can you suggest any improvements to the methodology used in this report for future reviews?
Benefit-cost analysis in setting air pollution standards is flawed, as outlined above, and inappropriate. In
the absence of a reliable benefit-cost analysis methodology, the RIS must be focused on the benefits to
health of reducing pollution levels, not the costs associated with doing so.

Chapter 5 Assessment of desired environmental outcome and goal

Do you support the desired environmental outcome of the AAQ NEPM being revised to ‘minimise
the risk of adverse health impacts from exposure to air pollution for all people, wherever they may
live’?

PHAA strongly supports the revised desired environmental outcome. Policy makers must promote clean
ambient air, and ensure regulatory and monitoring mechanisms exist to mitigate impacts on population
health. “Wherever they may live” includes across states, across regions, and within cities, and must include
protection for people living close to busy roads.

However, the current and proposed NEPM do not support this desired outcome. The current wording of
how the NEPM is applied to regional populations allows some avoidance of reporting pollution hot spots.
The Upper Hunter Valley is covered by three local government areas: Singleton with 23,595 Muswellbrook
with 16,468 and Upper Hunter Shire with 14,409 for a total of 54,472 people as at June 2016. For NEPM
purposes however it is artificially regarded as three regions, each below the reporting threshold. This allows
the NSW EPA to exclude reporting on the Upper Hunter where exceedances of NEPM standards are
common. This contradicts the overall objective to ‘minimise the risk of adverse health impacts from
exposure to air pollution for all people, wherever they may live’

The RIS includes the recommendation:

Clause 14 in the AAQ NEPM (Number of performance monitoring stations) should be amended to introduce a primary focus on
risk as determined by jurisdictions.

It is hard to interpret what is meant by this statement. Does it mean that towns smaller than 25,000 that
host polluting industries should be included in NEPM reporting? We recommend that the language be more
specific, and clarify that population level itself is not the criteria, but rather people living in proximity to
industry or major roads that require monitoring. Protection for ‘all people, wherever they may live’ should
not be at the subjective discretion of jurisdictions.

Do you support the goal of the AAQ NEPM being revised to make reference to the air quality
standards and incorporation of exposure-reduction targets for priority pollutants?

It does not make sense to adopt a weak standard now and a stronger one in the future. The current review
should establish a strong health based standard according to current evidence. There would be value in
setting targets for progressive attainment of the new standards.

Chapter 6 Impact assessment for sulfur dioxide

Do you agree with the recommendations made in this report for the SO₂ standards? Your answer
should consider whether you agree:

a) With maintaining the status quo of not including a 10-minute SO₂ standard on the AAQ
NEPM

No comments
b) With retaining the averaging periods of 1-hour and 24-hours for \( \text{SO}_2 \) and removal of the annual \( \text{SO}_2 \) standard given the weak evidence of health effects from long-term exposures to \( \text{SO}_2 \)

All three gases currently under review are acute respiratory irritants, so short period standards are appropriate. Regulating to the worst hours of the year bases attainment or non-attainment on a single one hour value which in statistical terms is always an outlier and subject to random fluctuation. A more representative value such as the 99th or 98th percentile of daily 1 hour maximum would be a much more robust basis for identifying non-attainment of the standard. The numerical value should always be adjusted downwards to give an equal level of protection – we note that this is the approach used in both the USA and Canada.

c) That there are no other averaging periods for \( \text{SO}_2 \) that should be considered in the future

No comments

d) With the preferred numerical value for the 1-hour \( \text{SO}_2 \) standard (100 ppb) and the future 1-hour standard (75 ppb) for implementation by 2025

PHAA advocates that the one hour standard have the form of the 99th centile of daily maximum hour averaged over three years, and the numerical value be 60ppb.

e) With the preferred numerical value for the 24-hour \( \text{SO}_2 \) standard (20 ppb) and no future 24-hour standard

PHAA advocates that the 24 hour standard for \( \text{SO}_2 \) have the numerical value 8 ppb in line with the WHO standard. This value is not exceeded in capital cities, but will require work in regional centres that host certain heavy industries.

f) That there should be no allowable exceedances for the \( \text{SO}_2 \) standards

This is unrealistic for 1 hour standards, as it bases decisions about compliance on one single hour out of the year. PHAA’s recommendation for the 99th percentile of daily maximum allows for outliers. PHAA recommends there be no allowable exceedances for the 24-hour standard.

g) That an exposure-reduction framework is not needed for \( \text{SO}_2 \)

No comments

Chapter 7 Impact assessment for nitrogen dioxide

Do you agree with the recommendations made in this report for the \( \text{NO}_2 \) standards? Your answer should consider whether you agree:

a) With retaining the averaging periods of 1-hour and annual for \( \text{NO}_2 \)

All three gases currently under review are acute respiratory irritants, so short period standards are appropriate. Regulating to the worst hours of the year bases attainment or non-attainment on a single one hour value which in statistical terms is always an outlier and subject to random fluctuation. A more representative value such as the 99th or 98th percentile of daily 1 hour maximum would be a much more robust basis for identifying non-attainment of the standard. The numerical value should always be adjusted downwards to give an equal level of protection – we note that this is the approach used in both the USA and Canada.
b) That there are no other averaging periods that should be considered for NO₂ in the future

No comments

c) With the preferred numerical value for the 1-hour NO₂ standard (90ppb) and the future 1-hour standard (80ppb) for implementation by 2025

PHAA advocates that the one hour standard have the form of the 99th percentile of daily maximum hour averaged over three years, and the numerical value be 72 ppb.

d) With the preferred numerical value for the annual NO₂ standard (19ppb) and the future annual standard (15ppb) for implementation by 2025

PHAA does not agree with the currently proposed annual NO₂ standards, which are an example of a standard set so high that there are no exceedances. The most recent data shows that the highest annual NO₂ levels in urban background air are from Liverpool in Sydney and Footscray in Melbourne, both at 12ppb.13,14 This is well inside the proposed level of 19ppb, and even the future level of 15ppb.

PHAA recommends that the annual standard for NO₂ be set at 9ppb. In 2018, this standard would have been exceeded in 6 of 27 monitoring locations in NSW.13

Long term exposure to NO₂ is associated with asthma in children, as demonstrated in a systematic review that searched epidemiologic literature to September 2016.15 The meta-analysis risk estimate was 1.05 (95% ci 1.02-1.07) per 4ug/m³ (2.13ppb). These findings were replicated in the Australian Childhood Health and Air Pollution Study (ACHAPS), commissioned by NEPC to inform the standards review process. In that study, the increased risk of 12 month prevalent asthma was reflected in the odds ratio of 1.24 (95%ci 1.08-1.43) per 4ppb extra NO₂. In other words, every 4ppb extra NO₂ increased the risk of asthma by 24%. Average exposure across the 2,630 children studied was 8.8ppb.16 While the ACHAPS study is cross-sectional so not as strong evidence of causality, it is congruent with many birth cohort studies. The risk estimate from ACHAPS was similar when using current exposure and exhaled NO, a marker of lung inflammation, and an association with measured lung function even in those children without asthma.

Given that the National Health Survey shows that 463,000 children have asthma, a 1ppb reduction in annual average NO₂ would be associated with 10,700 - 24,300 fewer cases.

The average value seen in ACHAPS is a suitable target for regulation of NO₂, given that asthma is a common and distressing condition, and the demonstrated association with NO₂ exposure is strong.

The two main sources of NO₂ are coal fired power stations and traffic – the latter being the source for the most urban exposure.17 Traffic related air pollution is a complex mixture including NO₂, CO, PAH and black carbon particles. Some of the effect observed in the epidemiological studies may well be due to other components of the mixture, however NO₂ is regarded as the most reliable marker of the combined mixture. This applies to both the research setting and the regulatory setting.

The effect seen in the ACHAPS was linear across the exposure range, so meeting a standard of 7ppb would prevent even more cases of asthma, but 9ppb seems an appropriate level of ambition for the current review. A NEPM standard of 19 or 15 would neither improve on the current population health effects, nor adhere to the desired environmental outcome of the AAQ NEPM being to ‘minimise the risk of adverse health impacts from exposure to air pollution for all people, wherever they may live’.

e) That there should be no allowable exceedances for NO₂ standards

In combination with using the 99th percentile for the 1 hour standard, PHAA recommends there be no allowable exceedances for the annual standard.
f) With the introduction of an exposure-reduction framework for NO₂
PHAA advocates for strong standards now, and an attainment timetable to be negotiated among the states and territories.

g) That jurisdictions should commence annual reporting on population exposure to NO₂ from the commencement of a varied AAQ NEPM
Reporting of population exposure should be in two forms:
1) The proportion of the population living in local government areas that exceed the standard
2) A population weighted average exposure value.

The first of these is most easily understood by the general public. The second reflects the fact that even reductions below the standard are beneficial, so will be of greater value to clean air professionals.

Chapter 8 Impact assessment for ozone

Do you agree with the recommendations made in this report for the O₃ standards? Your answer should consider whether you agree:

a) With the introduction of a rolling 8-hour O₃ standard and removal of the 1-hour and 4-hour averaging periods

The 1998 NEPM sets a standard for both 1 hour and 4 hour ozone, which is proposed to be replaced by an 8 hour standard, bringing Australia into line with other jurisdictions. However, the RIS provides no arguments as to why this would be suitable for Australia.

Unlike other pollutants, nearly all ozone is created in the atmosphere by the action of sunlight on chemical precursors. The time profile of ground level ozone is highly predictable with a peak during each afternoon, the peaks being higher and longer in summer, as shown in Figure 1. This shows average daily time profile for each month of the year, assembled from 4 years of data for the NSW sites of Randwick, Liverpool and Newcastle. Peaks are wider in summer when high levels are more likely. The average daily profile however does not necessarily reflect the duration of peaks on the highest days.

Figure 1
PHAA submission on NEPM for sulfur dioxide, nitrogen dioxide and ozone

High ozone days are shown in figure 2. The ozone time profile is slightly wider on days with one hour over 60ppb, lasting from approximately 10am until 6pm as shown in Figure 2. An 8 hour rolling average is a suitable time profile to capture these peaks, providing some evidence to support the adoption of an 8 hour rolling average in the NEPM.

![Ozone time profile of days with one hour over 60ppb](image)

b) With jurisdictions continuing to record and report 1-hour concentrations even if there is no 1-hour standard
PHAA recommends a 1 hour standard of 70ppb.

c) That there are no other averaging periods that should be considered for O$_3$ in the future
No comments

d) With the preferred numerical value for the 8-hour O$_3$ standard (65ppb)
PHAA recommends an 8 hour standard of 47ppb, in line with the World Health Organization’s recommendations.

e) That there should be no allowable exceedances for the O$_3$ standards
No comments
PHAA submission on NEPM for sulfur dioxide, nitrogen dioxide and ozone

f) With the introduction of an exposure-reduction framework for O₃ (in the form of a long-term goal for O₃) once O₃ generation in capital cities is better understood

No comments

g) With jurisdictions commencing annual reporting on population exposure to O₃ form the commencement of a varied AAQ NEPM

No comments

h) With the introduction of an exceptional events rule for O₃ that is consistent with the approach for the PM₂.₅ and PM₁₀ standards in the AAQ NEPM. Note that an exceptional events rule will differ from an allowable exceedances rule as it will only apply to exceptional events (such as bushfires and dust storms) rather than be based on a fixed number of days

The exceptional events rule needs strict definitions of what constitutes an exceptional event. The need for this is demonstrated by the variable and ill-defined use of the term for particles, since its introduction.

Conclusion

PHAA strongly supports the review of the NEPM for sulfur dioxide, nitrogen dioxide and ozone. Australia’s standards currently lag well behind international best practice, and urgently need to be strengthened.

PHAA recommends:

1. The annual NO₂ standard be set at 9ppb.
2. One hour standards be set as the 99th centile of daily 1 hour maximum with suitable lowering of the numerical value.
3. The ozone standard use a rolling 8 hour time period.
4. Towns or regions that host polluting industries should be included in NEPM reporting.
5. Standards should be set according to health benefits, not associated costs.

The PHAA appreciates the opportunity to make this submission and the opportunity to contribute to improved air quality and health outcomes for all Australians.

Please do not hesitate to contact us should you require additional information or have any queries in relation to this submission.

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References