

**BEFORE THE AUCKLAND UNITARY PLAN INDEPENDENT HEARINGS PANEL**

**IN THE MATTER** of the Resource Management Act 1991 and the Local Government (Auckland Transitional Provisions) Act 2010

**AND**

**IN THE MATTER** of Topic 035: Air quality C5.1

**AND**

**IN THE MATTER** of the submissions and further submissions set out in the Parties and Issues Report

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**STATEMENT OF REBUTTAL EVIDENCE OF LOUISE FLEUR WICKHAM  
ON BEHALF OF AUCKLAND COUNCIL**

**(AIR QUALITY – REGIONAL AND DISTRICT OBJECTIVES AND POLICIES)**

**25 FEBRUARY 2015**

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## 1. INTRODUCTION

- 1.1 My name is Louise Fleur Wickham. I am a Senior Air Quality Specialist at Emission Impossible Ltd and have been engaged by Auckland Council to provide technical evidence on the air quality provisions of the Proposed Auckland Unitary Plan (**PAUP**). My qualifications and experience are summarised in paragraphs 2.2 – 2.4 of my primary statement of evidence dated 9 February 2015 (**primary statement of evidence**).
- 1.2 I confirm that this statement of evidence has been prepared in accordance with the Code of Conduct for Expert Witness contained in the Environment Court of New Zealand Practice Note 2014.
- 1.3 I have read the submitters' evidence that is relevant to my primary evidence. This statement of evidence supplements my primary statement of evidence and responds to technical air quality matters raised by submitters that I considered warranted a response.

## 2. SCOPE OF EVIDENCE

- 2.1 I am providing rebuttal evidence on the following topics:
- Auckland Ambient Air Quality Standards (**AAAQS**)
  - 24-hour sulphur dioxide (**SO<sub>2</sub>**) AAAQS
  - Offsets for particulate emissions
  - Air quality transport corridor separation overlay
  - Other minor technical air quality matters
- 2.2 For ease of reference, I have included a list of abbreviations and definitions in **Attachment A**. This also includes the Auckland Ambient Air Quality Standards and their derivation.

### 3. AUCKLAND AMBIENT AIR QUALITY STANDARDS (AAAQS)

3.1 A significant number of industrial submitters<sup>1</sup> have requested deletion of the AAAQS (refer **Attachment A**) on the basis that;

- There are no special circumstances in Auckland that justify a regional approach;
- Regional standards run the risk of being overtaken by updated international or national guidance or standards;
- It is premature to adopt a standard for particulate matter less than 2.5 micrometres in diameter (**PM<sub>2.5</sub>**) in light of the national 'monitoring' guideline for PM<sub>2.5</sub>;
- There is a danger that the standards will be used as pass/fail criteria for individual applications for resource consent for discharges to air; and
- There is uncertainty in the underlying health studies on which the World Health Organisation (**WHO**) 24-hour SO<sub>2</sub> guideline (and equivalent AAAQS) is based and this guideline may change.

3.2 I think it is worth reiterating that 23 of the 26 AAAQS, including the 24-hour PM<sub>2.5</sub> standard, are in the existing Regional Plan and, following nine years of appeals, have been operative since 2010. I see no need to re-litigate these regional targets that are simply being renamed as standards.

3.3 My primary statement of evidence provides a detailed technical justification as to why the term 'standard' is warranted and for the inclusion of three new AAAQS (annual PM<sub>2.5</sub>, annual nitrogen dioxide (**NO<sub>2</sub>**) and 24-hour SO<sub>2</sub>). It also notes that all air quality experts agreed that the values (i.e. the concentration limits) of the proposed AAAQS for annual PM<sub>2.5</sub> and NO<sub>2</sub> are appropriate for protecting health.<sup>2</sup>

3.4 My primary statement of evidence also provides a detailed discussion on the application of standards as pass/fail criteria.<sup>3</sup> In short, given the lack of any quantitative change to the concentration values in the AAAQS, I consider that

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<sup>1</sup> Primary statements of evidence of Ms Jenny Simpson (POAL, NZ Steel), Ms Andrea Rickard (NZ Steel, Sanitarium), Mr Jason Pene (Sanitarium, Fulton Hogan), Mr Richard Chilton (PACT Group), Mr Mark Arbutnot (POAL), Mr Rob Van de Munckhof (OI), Mr Mark Chrisp (Contact Energy) and Ms Andrea Brabant (OI) dated 19 February 2015. (Some parties requested deletion through support for Heavy Industry Working Group submission).

<sup>2</sup> Expert Conference Joint Statement for hearing topic 035 – Air Quality, 1 December 2014.

<sup>3</sup> At paragraphs 5.22 – 5.29

comparison with a 'standard' as opposed to a 'guideline' should make no difference at all. Relief has been provided to clarify that assessments should apply the standards where people may reasonably be exposed (Policy 1). I consider that if additional guidance is needed to satisfy industry concerns then it does not need to be in the PAUP.

- 3.5 I will respond to the (many) submissions on the proposed 24-hour SO<sub>2</sub> AAAQS separately at paragraphs 4.1 – 4.8.
- 3.6 With respect to concerns about possible inconsistencies between regional standards and future national/international guidance, I note that this is true of any aspect of a regional plan and is not confined to air quality matters.
- 3.7 One submitter has suggested the AAAQS are not appropriate or useful because they are not given effect to through rules.<sup>4</sup> I do not agree. In my opinion, the AAAQS (located in Table 1 of Chapter 5.1 of the PAUP) directly support Objective 1 by stating what ambient air quality (standards) Auckland wishes to achieve.
- 3.8 A similar approach has been taken for fresh water quality in the PAUP (see Table 1 Macroinvertebrate Community Index in Chapter 5.15). The Macroinvertebrate Community Index is an interim freshwater quality guideline used as a surrogate for a multifactor water quality standard.<sup>5</sup>

#### **4. 24-HOUR SO<sub>2</sub> AAAQS**

- 4.1 A significant number of industrial submitters have expressed many concerns over the proposed 24-hour SO<sub>2</sub> AAAQS which is based on the 24-hour SO<sub>2</sub> WHO global guideline published in 2006.<sup>6</sup> These concerns are largely a matter of differing opinion<sup>7</sup> and personal interpretation of World Health Organisation guidance.<sup>8</sup>

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<sup>4</sup> Evidence of Ms Rickard (NZ Steel) at para 19

<sup>5</sup> This interim guideline will be replaced over the next 10 years by more comprehensive water quality and quantity objectives and limits currently being developed in accordance with the National Policy Statement for Freshwater Management (released in 2014).

<sup>6</sup> Primary statements of evidence of Ms Jenny Simpson (POAL, NZ Steel), Ms Andrea Rickard (NZ Steel, Sanitarium), Mr Jason Pene (Sanitarium, Fulton Hogan), Mr Richard Chilton (PACT Group) and Mr Mark Arbuthnot (POAL) dated 19 February 2015.

<sup>7</sup> See for example Golder review attached to New Zealand Starch submission (3230), URS report submitted as Annexure B to evidence of Mr Arbuthnot (POAL, 5137), and evidence of Ms Simpson (POAL) at paras 2.27 – 2.34.

<sup>8</sup> For example I have focused on the final part of the answer to question C7 in WHO (2013) whereas Ms Simpson has focused on elements of the discussion which follows (both provided in Attachment B). In my opinion both give valid, but different, interpretations.

- 4.2 A number of air quality experts have focussed on the uncertainties in the underlying epidemiological studies and unanswered questions surrounding an intervention study in Hong Kong.<sup>9</sup> Mr Frangos<sup>10</sup> has focussed largely on the toxicological aspects of short-term exposure to SO<sub>2</sub>, ignoring the potential co-benefits an ambient air quality standard for SO<sub>2</sub> can bring in terms of reduced secondary particulate formation. Mr Cudmore<sup>11</sup> is concerned that, despite being in place for nearly 10 years, there has been little uptake of this standard by other jurisdictions.<sup>12</sup> All of which leads to disagreement over the precautionary approach recommended by WHO and concerns that this body of world leading experts in the fields of air pollution and medicine has got it wrong.
- 4.3 For clarification, I have provided the 2006 WHO 24-hour SO<sub>2</sub> guideline evaluation and 2013 WHO response to a policy question on this guideline in full in **Attachment B**.
- 4.4 Areas where we are all in agreement are:
- Most areas of Auckland will meet the proposed standard;
  - Accordingly, there will be little health benefit afforded by the standards introduction.
  - It is inappropriate to apply the standard in areas where people are **not** likely to be exposed.
- 4.5 Despite this we cannot agree on my assessment that there should not be any significant costs associated with the introduction of the standard.
- 4.6 I have provided a detailed technical justification for the 24-hour AAAQS for SO<sub>2</sub> in my primary evidence which does not need repeating here.<sup>13</sup> I have over 20 years' experience in air pollution engineering with around 10 years working in a regulatory capacity on air quality emissions and ambient air quality standards. I have some experience of multi-disciplinary

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<sup>9</sup> Hedley *et al.*, (2002). Cardiorespiratory and all-cause mortality after restrictions on sulphur content of fuel in Hong Kong: an intervention study. *Lancet*, 2002, 360:1646-165.  
An intervention study investigates health effects before and after a real life intervention (in this case a sudden reduction in sulphur in heavy fuel oil in power generators in Hong Kong which resulted in a significant drop in 24-hour SO<sub>2</sub> was found to be associated with reduced mortality).

<sup>10</sup> Primary evidence of Mr John Frangos (New Zealand Starch) dated 19 February 2015

<sup>11</sup> Evidence of Mr Cudmore at paragraph 88.

<sup>12</sup> To date, only the US has undertaken a comprehensive review of a national standard for SO<sub>2</sub> since the WHO global air quality guidelines were published in 2006. This is discussed in my primary statement of evidence at Attachment D.

<sup>13</sup> Paragraphs 5.37 – 5.52

epidemiological research through my work for the Ministry of the Environment on the Multicity Mortality and Morbidity study.<sup>14</sup> I have read most of the primary literature discussed by WHO in both the 2006 guidelines and their 2013 review.<sup>15</sup> I personally find the intervention studies in Hong Kong<sup>16</sup>, Poland<sup>17</sup> and more recently 20 major cities in Europe<sup>18</sup> to be particularly compelling.

- 4.7 Whilst I am mindful of the uncertainties with respect to causality and the lack of a biological mechanism, I am persuaded that, when considering the bigger picture (for example, co-benefits such as potential reductions in secondary particulate formation) and the seriousness of the adverse health effects that a precautionary approach is reasonable for Auckland. I therefore support the proposed 24-hour SO<sub>2</sub> AAQs based on the 24-hour SO<sub>2</sub> WHO global guideline.
- 4.8 **Attachment C** contains my response to some additional minor technical matters raised by submitters.

## 5. OFFSETS FOR PARTICULATE EMISSIONS

- 5.1 A significant number of industrial submitters<sup>19</sup> have requested deletion of the proposed policies for offsets of PM<sub>10</sub> and PM<sub>2.5</sub> for new (or expanding) industry in polluted airsheds.
- 5.2 I am concerned that the requests for deletion appear to ignore the **enabling** intent of the offsets policy to provide for new and expanded industry. In other words, without offsets council will be forced to decline **all** applications for consent for new or increased emissions of PM<sub>10</sub> and PM<sub>2.5</sub> because the airshed is already polluted.

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<sup>14</sup> Environment Protection and Heritage Council, [Expansion of the Multi-City Mortality and Morbidity Study](#), University of the Sunshine Coast, University of Queensland, Department of Environmental Protection Western Australia, Environment ACT, Environment Protection Authority Victoria, New South Wales Health, New Zealand Ministry for the Environment, September 2010.

Queensland Health

<sup>15</sup> I did not manage to translate a Polish paper; Rabczenko D et al., (2005).

<sup>16</sup> Hedley et al., (2002) at n9.

<sup>17</sup> Kowalska M et al., (2008). Air pollution and daily mortality in urban Katowice, 1994-95 and 2001-02. *Polish Journal of Environmental Studies*, 17(5):733-738.

<sup>18</sup> Le Tertre et al., (2014). Impact of legislative changes to reduce the sulphur content in fuels in Europe on daily mortality in 20 European cities: an analysis of data from the Aphekom project. *Air Qual Atmos Health*, 2014, 7:83-91.

<sup>19</sup> Evidence of Ms Jenny Simpson (POAL, NZ Steel), Ms Andrea Rickard (NZ Steel, Sanitarium), Mr Jason Pene (Sanitarium, Fulton Hogan), Mr Richard Chilton (PACT Group), Mr Mark Arbuthnot (POAL), Mr Rob Van de Munckhof (OI), Mr Mark Chrisp (Contact Energy) and Ms Andrea Brabant (OI).

- 5.3 I will respond to the key concerns cited as reasons for deletion of these policies individually in paragraphs 5.4 – 5.9.
- 5.4 Mr Pene (Sanitarium, 4359) is concerned that industrial emissions, being typically elevated and well-dispersed, have a lower impact on ambient air quality compared with domestic emissions.<sup>20</sup> Whilst true, this is only true at the local level. Council, however, is charged with managing **regional** ambient air quality which is the primary aim of offsets.
- 5.5 Mr Van de Munckoff (OI, 5812)<sup>21</sup> is concerned that the 4 tonne per annum PM<sub>10</sub> trigger has no technical basis. Mr Mark Arbuthnot (POAL, 5137) considers that the problems the 4 tonne threshold are trying to address are best dealt with at the national level.<sup>22</sup>
- 5.6 The 4 tonne per annum threshold represents ‘significant’ new industrial emissions of PM<sub>10</sub> in Auckland. Contrary to Mr Arbuthnot’s view, this can only be done at the regional level – what is significant in Auckland is not necessarily significant in other parts of New Zealand (due to differences in meteorology, topography, emission sources and population density, etc.). The choice of a 4 tonne threshold is outlined in my primary evidence (at paragraph 8.6). Based on a Pareto analysis of the top 48 emitters of PM<sub>10</sub> in Auckland, the 4 tonne per annum threshold represents 88 per cent of emissions.<sup>23</sup> I consider it to be a reasonable representation of significant industrial emissions in Auckland.
- 5.7 Mr Van de Munckoff (OI, 5812) is concerned that requiring offsets for PM<sub>2.5</sub> is more stringent than the national environmental standards for air quality (**NESAQ**). He is concerned this will be costly, with limited benefit for overall reductions when industry is only a minor contributor to PM<sub>2.5</sub> concentrations in Auckland.<sup>24</sup> Ms Jenny Simpson (NZ Steel, 868) expresses concerns that industry is a minor source of PM<sub>2.5</sub> in the Auckland region and does not warrant regulatory intervention.<sup>25</sup> Ms Andrea Rickard (NZ Steel, 868) also considers offsets to be inequitable.<sup>26</sup>
- 5.8 As noted by Mr Greg Akehurst (Ports of Auckland, 5137) offsets do not involve any reductions – the purpose of the offset mechanism is to maintain

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<sup>20</sup> Evidence of Mr Pene (Sanitarium) at paragraph 3a

<sup>21</sup> Evidence of Mr Van de Munckoff (OI) at paragraph 11.1

<sup>22</sup> Evidence of Mr Arbuthnot (POAL) at paragraph 5.104

<sup>23</sup> Base year 2006

<sup>24</sup> Evidence of Mr Van de Munckoff (OI) at paragraph 11.2

<sup>25</sup> Evidence of Ms Simpson (NZ Steel) at paragraph 4.16.

<sup>26</sup> Evidence of Ms Rickard (NZ Steel) at paragraph 34

the same volume of pollutants.<sup>27</sup> In my view, the concerns raised by Mr Van de Munckoff, Ms Simpson and Ms Rickard ignore the enabling intent of the offset policies. They further misrepresent council's overall approach. I understand that council has consistently recognised the economic importance of industry and provided relief by exempting it from emissions reductions applied to other sectors. This decision was taken in 2006 when vehicles and the domestic sector were charged with achieving a 58% reduction in emissions of PM<sub>10</sub> whilst industry was granted a zero percent net reduction target.<sup>28</sup>

- 5.9 Ms Simpson (NZ Steel, 868) states that she is “*not aware of any successful offsetting projects for a new industrial source to meet the requirements of the NESAQ*”.<sup>29</sup> Ms Rickard (NZ Steel, 868)<sup>30</sup> similarly considers the offsets to be difficult to administer and other submitters contend that offsets will be difficult in practice.<sup>31</sup>
- 5.10 Examples of offsetting do exist. As noted by the Ministry for the Environment in their report on progress by councils in implementing and meeting the NESAQ in 2009:<sup>32</sup>

*“Environment Canterbury reported a consent that incorporated the use of offsets: New Zealand Dairies Ltd in Waimate. In this consent the applicant removed 36 open fires and older burners to allow for a new coal-fired boiler. The fires were replaced with either heat pumps or pellet burners. The consent further includes conditions requiring in-house monitoring (real-life testing) of five pellet fires, every five years, to ensure the offsets are real and measurable.”*

- 5.11 I note that the Ministry first published guidance on the use of offsets in 2011 and this was further expanded upon in January 2014.<sup>33</sup> Subsequently, Bay of Plenty Regional Council published their own guidance<sup>34</sup> on offsets for the Rotorua Airshed, in accordance with the NESAQ as implemented through their regional plan.<sup>35</sup>

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<sup>27</sup> Evidence of Mr Akehurst (POAL) at paragraph 1.9

<sup>28</sup> Kuschel G & Hill G (2006). *Report to Auckland Regional Council Environmental Management Committee on PM<sub>10</sub> Emissions Reduction Targets and Strategies by Sector Needed to Meet the AQNES in Auckland*, 10p. 9 October.

<sup>29</sup> Evidence of Ms Simpson (NZ Steel) at paragraph 4.23

<sup>30</sup> Evidence of Ms Rickard (NZ Steel) at paragraph 34

<sup>31</sup> See for example evidence of Mr Pene (Sanitarium) at paragraph 78

<sup>32</sup> MfE (2009). [2008 Report on Progress: National Environmental Standards for Air Quality](#), Ministry for the Environment, Wellington, June 2009.

<sup>33</sup> MfE (2011). [2011 Users' Guide to the revised National Environmental Standards for Air Quality](#), Ministry for the Environment, Wellington, August 2011 updated in January 2014.

<sup>34</sup> BoPRC (2014). [Offsets Guidance for the Rotorua Airshed](#), Strategic Policy Publication 2014/03, Bay of Plenty Regional Council, October 2014.

<sup>35</sup> Section 7.3 of Bay of Plenty Regional Air Plan, 15 December 2003, Amendment 1 (Resource Management (National Environmental Standards for Air Quality) Regulations 2004) incorporated on 1 August 2012



- 5.12 Ms Jenny Simpson (NZ Steel, 868) has raised practical issues with the very small threshold for PM<sub>2.5</sub> (1.25 µg/m<sup>3</sup>) which can be neither reliably modelled nor measured.<sup>36</sup> I agree this is stretching the bounds of accuracy. However, this limit was derived from the approach used for PM<sub>10</sub> (and is based on 5 per cent of the standard). I take comfort from the additional mass emission threshold of 2 tonnes per annum to reliably represent significant PM<sub>2.5</sub> industrial emissions in Auckland.
- 5.13 Overall, I support the proposed offsets policies for particulate matter as an important enabling tool for industry in Auckland.

## 6. AIR QUALITY TRANSPORT CORRIDOR SEPARATION OVERLAY

- 6.1 Mr Daniel Shaw (Kindercare Learning Centres Ltd, 7312) has expressed many concerns over the proposed air quality transport corridor separation overlay. His chief concerns appear to be:
- Council has implemented only some of the recommendations from a discussion document I prepared on separation distances.<sup>37</sup> Many of these other recommendations are more appropriate for reducing adverse effects of vehicle emissions on children.
  - Council has overstated the benefits of the proposed overlay in their section 32 analysis.
  - The proposed overlay is insufficient to address health effects of traffic emissions on children.
- 6.2 Given he considers the overlay does not go far enough Mr Shaw then paradoxically concludes that the overlay should be deleted. I have provided a technical justification of the proposed air quality transport corridor separation overlay in my primary evidence (at paragraphs 6.1-6.11) that does not need repeating. I do not support deletion of the overlay.
- 6.3 With respect to the benefits discussed in the section 32 analysis, Mr Shaw appears to have misunderstood the discussion about adverse health impacts (and benefits in terms of avoided costs). This only states that the **long term** benefits of the overlay will be significant in light of projected population

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<sup>36</sup> Evidence of Ms Simpson (NZ Steel) at paragraphs 4.17 - 4.18.

<sup>37</sup> Emission Impossible Ltd, (2012). [Separation Distances for Roads](#), A discussion document prepared for Auckland Council, 17 July 2012, Auckland.

increase. It further notes the limitation of the overlay only applying to new centres.

- 6.4 With respect to the insufficiency of the proposed overlay, Ms Jayne Metcalfe, Dr David Sinclair and Andrew Phillips (Auckland Regional Public Health Service, 6100) have requested that the proposed overlay be extended to other sensitive activities such as schools and hospitals (Ms Metcalfe), and elderly residential care facilities (Dr Sinclair and Mr Phillips).
- 6.5 I consider the justification for having separation distances to improve health outcomes for small children equally applies to improving health outcomes for other groups that are vulnerable to the effects of air pollution. This is consistent with the other recommendations I made in the discussion document referred to by Mr Shaw. However, as noted by Mr Wyatt in both his primary and rebuttal statements of evidence, council has weighed up other competing objectives and policies to conclude that the application of the overlay only to early childhood education centres is the most appropriate approach.
- 6.6 In summary I strongly support the proposed air quality transport corridor separation overlay.

## 7. SENSITIVE ACTIVITY RESTRICTION OVERLAY

- 7.1 Dr Sinclair and Mr Phillips (Auckland Regional Public Health Service, 6100) have requested that the sensitive activity restriction overlay include consideration of health effects. Their evidence further questions the exceptions to the overlay (as listed in Policy 2b) noting the importance of mitigating the (health) risk of industrial emissions from emergencies, fires, spills and fugitive sources. This request was supported by Ms Jayne Metcalfe (Auckland Regional Public Health Service, 6100).<sup>38</sup> A number of other industrial submitters have similarly requested the removal of these exceptions (albeit primarily for amenity relief).<sup>39</sup>
- 7.2 I understand the primary purpose of the overlay is to manage air quality **amenity** in the vicinity of heavy industry zones, it being accepted that significant adverse health effects from industrial emissions are unacceptable

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<sup>38</sup> Primary statement of evidence of Ms Jayne Metcalfe on behalf of Auckland Regional Public Health Service dated 19 February 2015 at paragraph 88.

<sup>39</sup> Heavy Industry Working Group, see for example evidence of Ms Brabant (OI) at paragraph 59

in any zone. Whilst it also assists with mitigating risk associated with residual industrial emissions, this is a secondary purpose of the overlay.

- 7.3 I agree that there are significant, inherent limitations with respect to mitigating both amenity and risk for the overlay as applied to brownfield sites due to the exceptions listed in Policy 2b. However, as noted by Mr Wyatt in both his primary and rebuttal statements of evidence, council has weighed up other competing objectives and policies to attempt to balance the needs of both industry and surrounding activities sensitive to air discharges.
- 7.4 Mr Duncan Backshall (LM Painton Estate, Silverdale Golf Range Ltd and Runwild Trust) has expressed a number of technical concerns with the application of the 500 m separation distance in the sensitive activity overlay to the existing industrial zone at Silverdale.<sup>40</sup> I note that Mr Backshall agreed with all other air quality experts that a 500 m separation distance was reasonable during expert conferencing on the subject.<sup>41</sup>
- 7.5 I do not dispute his technical concerns over the application of the overlay to the Silverdale industrial zone. Due to these technical concerns he also states that the overlay should not apply to the Silverdale area. As noted by Mr Wyatt in his primary statement of evidence, removing the overlay from particular sites could result in exclusions which would significantly compromise the overlay's integrity and effectiveness.<sup>42</sup> I therefore, do not support Mr Backshall's request.

## **8. OTHER MINOR TECHNICAL AIR QUALITY MATTERS**

### **Permissible Exceedances (Table 1)**

- 8.1 Mr Jason Pene (Sanitarium, 4359) has requested that the AAAQS permissible exceedances (refer Table 1 in **Attachment A**) be consistent with a 99.9 percentile compliance approach and/or the NESAQ (where any differences arise).<sup>43</sup> Specifically, Mr Pene is requesting:

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<sup>40</sup> Primary statement of evidence of Mr Duncan Backshall on behalf of LM Painton Estate, Silverdale Golf Range Ltd and Runwild Trust dated 19 February 2015.

<sup>41</sup> Expert Conference Joint Statement for hearing topic 035 – Air Quality, 17 December 2014. Mr Backshall did record concerns over the definition of sensitive activities but this was not related to his acceptance of 500 m as a reasonable separation distance.

<sup>42</sup> Primary evidence of Mr Wyatt (9 Feb 2015) at paragraph 9.56

<sup>43</sup> Evidence of Mr Pene (Sanitarium) at paragraphs 48 - 51

- one permissible exceedance be granted to all 24-hour AAAQS (PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub> and SO<sub>2</sub>); and
- nine permissible exceedances be granted to all 1-hour average AAAQS except ozone (for which zero permitted exceedances are specified in the NESAQ). I take this to be a request for nine permissible exceedances to be granted to the 1-hour average AAAQS for carbon monoxide (**CO**).

8.2 My primary statement of evidence supports allowing one permissible exceedance for the 24-hour AAAQS for:

- PM<sub>2.5</sub> for the reasons given at paragraph 5.17; and
- SO<sub>2</sub> for the reasons given at paragraph 5.51.

8.3 I do not support this request for increased permissible exceedances for 24-hour AAAQS for NO<sub>2</sub> and 1-hour AAAQS for carbon monoxide because it is significantly less than the existing provisions of the Auckland Regional Plan: Air, Land and Water. This is consistent with my primary evidence on the general approach taken for permissible exceedances (at paragraph 5.14).

8.4 To be clear, the AAAQS in Table 1 (refer **Attachment A**) still contains zero permissible exceedances for the 24-hour AAAQS for PM<sub>2.5</sub> and SO<sub>2</sub>.

### Objectives 1 and 6

8.5 The Heavy Industry Working Group has requested the following amendment to Objective 1 (highlighted text):<sup>44</sup>

Ambient Air quality is maintained in those parts of Auckland that have excellent or good air quality, and ambient air quality is enhanced in those parts of Auckland where it is poor and it has adverse effects on human health.

8.6 I do not support the proposed amendment to focus only on human health. It significantly weakens the overarching policy intent of the objective for regional air quality. Ms Louise Gobby, in her primary statement of evidence, similarly did not support constraining this objective.<sup>45</sup> I note this objective (as

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<sup>44</sup> Evidence of Ms Brabant (OI) at Appendix A

<sup>45</sup> Primary statement of evidence of Ms Louise Gobby on behalf of Auckland Council dated 9 February at paragraph 10.8

proposed by council) is largely unchanged from the first air quality objective in the existing Auckland Regional Plan.

- 8.7 The Heavy Industry Working Group has requested the following amendment to Objective 6 which was inserted at their request following mediation (highlighted text):<sup>46</sup>

The operational requirements of heavy industry, other location specific industry, significant infrastructure and mineral extraction activities are recognised and provided for, and the adverse effects of their so air discharges on human health, property and the environment are managed.

- 8.8 I do not support the requested amendment because it defeats the air quality purpose of the objective. As noted by Ms Gobby in her primary statement of evidence, it is important that the objective state how the adverse effects of air discharges are managed.<sup>47</sup>

### Policy 1 (Human health)

- 8.9 The Heavy Industry Working Group has requested the following amendment to Policy 1 (highlighted text):<sup>48</sup>

Protect human health by requiring that air discharges do not cause ambient air quality to exceed national Ambient Air Quality Standards and Guidelines AAAQS in Table 1 for the specified contaminants wherever a person might reasonably be exposed to the contaminant over the relevant time period, by:  
a ~~avoiding, remedying or mitigating the adverse effects, including cumulative adverse effects of discharges to air~~  
b ~~assessing whether a person would reasonably be exposed over the relevant time period in any part of the airshed (other than the site on which the consent would be exercised)~~

- 8.10 I do not support the proposed deletion of clauses a and b. This is because I agree with Ms Gobby's view that policy should set out **how** the adverse effects of air discharges will be managed.<sup>49</sup>

### Policy 19 (Monitoring of air quality)

- 8.11 Ms Andrea Rickard (NZ Steel, 868 and Sanitarium, 4359) has expressed concerns that the AAAQS will "*somehow 'force' a monitoring programme and a compliance regime*".<sup>50</sup> I can find no basis for this concern. Council is already required to monitor air quality under Regulation 15 of the NESAQ,

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<sup>46</sup> Evidence of Ms Brabant (OI) at Appendix A

<sup>47</sup> Primary evidence of Ms Gobby (9 Feb 2015) at paragraph 10.9

<sup>48</sup> Evidence of Ms Brabant (OI) at Appendix A

<sup>49</sup> Primary evidence of Ms Gobby (9 Feb 2015) paragraph 10.9

<sup>50</sup> Evidence of Ms Rickard (Sanitarium) at paragraph 15

and more generally under Section 35(2) of the Resource Management Act 1991.

- 8.12 I have proposed amendments to the monitoring policy regarding exceptional events (discussed in my primary evidence at paragraph 8.9). The amendments have been proposed to provide clarity regarding the application of offsets of PM<sub>2.5</sub>. They further ensure that council, and by association industry, are not held accountable for things beyond their control (i.e. exceptional events).
- 8.13 Ms Jenny Simpson (NZ Steel, 868 and POAL, 5137) has also expressed concern with the proposed amendments to the monitoring policy.<sup>51</sup> Ms Simpson is concerned that the amendments preclude Auckland Council monitoring against other national and international standards.
- 8.14 In fact, the original text was referring to the standard *monitoring* methods and protocols – not the national or international ambient air quality standards to which Ms Simpson refers.

#### **Monitoring of air quality**

19 ~~20~~. Carry out monitoring of air quality to ensure adverse effects on human health, property or the environment are adequately avoided, remedied or mitigated and air quality meets [the AAAQS. Reporting of compliance with the AAAQS will exclude exceedances caused by exceptional circumstances beyond the reasonable control of Auckland Council](#) nationally and internationally accepted standards and protocols.

#### **Application of Offsets to Tunnels**

- 8.15 Ms Camilla Needham (NZTA, 1725) has requested an amendment to the offsets policies to exclude tunnels on the basis that vehicle emissions in a tunnel are not 'new'.<sup>52</sup>
- 8.16 I do not support this proposal. In my opinion, this ignores 'induced' traffic that arises from significant new transport development projects. However, if true (i.e. that traffic is not new) then it will not trigger the threshold requirement. As an aside, I consider it unlikely that emissions from a tunnel would trigger either significance criteria in the PM<sub>10</sub> and PM<sub>2.5</sub> offsets policy.

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<sup>51</sup> Jenny Simpson (NZ Steel) at paragraphs 2.15 - 2.17

<sup>52</sup> Primary statement of evidence of Ms Camilla Needham (NZTA) dated 19 February 2015 at paragraph 45

## **9. CONCLUSION**

- 9.1 In summary, I support transforming existing regional ambient air quality criteria into Auckland Ambient Air Quality Standards. I further support the introduction of three new air quality standards based on the recommendations of the World Health Organisation.
- 9.2 I support the proposed offsets policies for particulate matter as an important enabling tool for industry in Auckland. I see this as an extension of council's ongoing support and recognition of the economic importance of industry by exempting it from emissions reductions applied to other sectors.
- 9.3 Whilst I am sensitive to various submissions regarding the limitations of the air quality transport corridor separation and the sensitive activity restriction overlays, on balance the requested amendments are not supported by council.



**LOUISE WICKHAM**  
**25 FEBRUARY 2015**

## ATTACHMENT A

### List of abbreviations

**AAAQS** – Auckland Ambient Air Quality Standard(s)

**IARC** – International Agency for Research on Cancer

**NESAQ** – National Environmental Standards for Air Quality<sup>53</sup>

**WHO** – World Health Organisation

**PM<sub>10</sub>** – particulate matter less than 10 micrometres in diameter

**PM<sub>2.5</sub>** – particulate matter less than 2.5 micrometres in diameter

**SO<sub>2</sub>** – sulphur dioxide

**NO<sub>2</sub>** – nitrogen dioxide

**CO** – carbon monoxide

**µg/m<sup>3</sup>** – micrograms per cubic metre

### Air Quality Definitions

**Ambient:** Air quality in the air around us.

**Concentration:** The amount of a contaminant in a unit of volume (e.g. micrograms per cubic metre). NB: Concentrations apply to both emissions **and** ambient air.

**Dispersion:** Mixing of air, typically referring to dilution of a plume of contaminants following discharge to air.

**Emission:** Discharge to air, can be from an industrial or domestic chimney stack or an area source such as motor vehicles.

**Offset:** Requirement for significant new industrial emissions into polluted airshed to be 'offset' or counterbalanced by the removal of other emissions elsewhere in the airshed. The intention is to allow new or expanded 'significant' emitters into polluted airshed, but only where their emissions have a net zero effect on air quality because the capacity of the receiving airshed is already exceeded.

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<sup>53</sup> Resource Management (National Environmental Standards for Air Quality) Regulations 2004.



**Table 1: Auckland Ambient Air Quality Standards (AAAQS)**

Contaminant	Standard* ( $\mu\text{g}/\text{m}^3$ )	Averaging Time	Permissible exceedances	Derivation
Particulate matter less than 10 microns ( $\text{PM}_{10}$ )	50*	24 hour	1	ARP: ALW
	20	Annual	0	ARP: ALW
Particulate matter less than 2.5 microns ( $\text{PM}_{2.5}$ )	25	24 hour	0	ARP: ALW
	10	Annual	0	WHO
Nitrogen dioxide ( $\text{NO}_2$ )	200*	1 hour	9	ARP: ALW
	100	24 hour	0	ARP: ALW
	40	Annual	0	WHO
Carbon monoxide (CO)	10,000*	8 hours	one 8-hour period	ARP: ALW
	30,000	1 hour	0	ARP: ALW
Sulphur dioxide ( $\text{SO}_2$ )	350*	1 hour	9	ARP: ALW
	570*	1 hour	0	ARP: ALW
	20	24 hour	0	WHO
Ozone ( $\text{O}_3$ )	150*	1 hour	0	ARP: ALW
	100	8 hour	0	ARP: ALW
Lead	0.2	3 month	0	ARP: ALW <sup>+</sup>
Benzene	3.6	Annual	0	ARP: ALW
Benzo[a]pyrene	0.0003	Annual	0	ARP: ALW
1,3-Butadiene	2.4	Annual	0	ARP: ALW
Formaldehyde	100	30 minutes <sup>^</sup>	0	ARP: ALW
Acetaldehyde	30	Annual	0	ARP: ALW
Mercury (inorganic)	0.33	Annual	0	ARP: ALW
Mercury (organic)	0.13	Annual	0	ARP: ALW
Chromium VI	0.0011	Annual	0	ARP: ALW
Chromium metal & Chromium III	0.11	Annual	0	ARP: ALW
Arsenic (inorganic)	0.0055	Annual	0	ARP: ALW
Arsine	0.055	Annual	0	ARP: ALW

**Notes**

1. ARP: ALW = Auckland Regional Plan: Air, Land and Water (notified 2001, operative 2010)
2. WHO = (2005) World Health Organisation global ambient air quality guidelines
3. \* indicates standards from the (2004) national environmental standards for air quality
4. <sup>+</sup> lead concentration limit inserted in 2010
5. <sup>^</sup> time average for formaldehyde changed from annual (2001) to 30 minutes (2010)

## ATTACHMENT B

A number of submitters have provided excerpts of WHO guidance with respect to the 24-hour SO<sub>2</sub> WHO guideline. For clarification, this attachment contains the WHO evaluation, recommendations and discussion with respect to the 24-hour SO<sub>2</sub> guideline.

### Air Quality Guidelines Global Update 2005<sup>54</sup>

#### Chapter 13. Sulfur dioxide

##### Guidelines

##### Exposure over a 24-hour period and long-term exposure

Day-to-day changes in mortality, morbidity or lung function related to 24-hour average concentrations of sulfur dioxide are necessarily based on epidemiological studies in which people are in general exposed to a mixture of pollutants, with little basis for separating the contributions of each to the effects. This is the reason that guideline values for sulfur dioxide before 1987 were linked with corresponding values for PM. This approach led to a guideline value of 125 µg/m<sup>3</sup> as a 24-hour average, after applying an uncertainty factor of 2 to the LOAEL. In the 2000 revision (1), it was noted that recent epidemiological studies showed separate and independent adverse public health effects for PM and sulfur dioxide, and this led to a separate WHO air quality guideline for sulfur dioxide of 125 µg/m<sup>3</sup> as a 24-hour average. More recent evidence, beginning with the Hong Kong study (41) of a major reduction in sulfur content in fuels over a very short period of time, shows an associated substantial reduction in health effects (childhood respiratory disease and all-age mortality outcomes). In time series studies on hospital admissions for cardiac disease, there is no evidence of a concentration threshold within the range of 5–40 µg/m<sup>3</sup> in both Hong Kong and London (56). Daily sulfur dioxide was significantly associated with daily mortality in 12 Canadian cities with an average concentration of only 5 µg/m<sup>3</sup> (34). If there were a sulfur dioxide threshold for either the study of daily mortality by Burnett et al. (34) or the annual mortality study of Pope et al. (62), they would have to be very low. For the significant associations in the ACS cohort for 1982–1998 in 126 United States metropolitan areas, the mean sulfur dioxide was 18 µg/m<sup>3</sup> (62).

Nevertheless, there is still considerable uncertainty as to whether sulfur dioxide is the pollutant responsible for the observed adverse effects or, rather, a surrogate for ultrafine particles or some other correlated substance. In Germany (38) and the Netherlands (40), for example, a strong reduction in sulfur dioxide concentrations occurred over a decade. Although mortality also decreased with time, the association of sulfur dioxide and mortality was judged not to be causal and was attributed to a similar time trend of a different pollutant (PM). In consideration of (a) the uncertainty of sulfur dioxide in causality, (b) the practical difficulty of reaching levels that are certain to be associated with no effects and (c) the need to provide greater degrees of protection than those provided by the guidelines published in 2000, and assuming that reduction in exposure to a causal and correlated substance is achieved by reducing sulfur dioxide concentrations, there is a basis for revising the 24-hour guideline for sulfur dioxide downwards, adopting a prudent precautionary approach. Since the recommended 24-hour guideline may be quite difficult for some countries to achieve in the short term, we suggest a stepped approach using interim goals, as shown in Table 2.

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<sup>54</sup> WHO (2006). *Air Quality Guidelines Global Update 2005*, World Health Organisation (WHO) Regional Office for Europe, Copenhagen, Denmark.

**Table 2. Sulfur dioxide air quality guidelines and interim targets to be achieved in improving air quality**

	<b>24-hour average</b>	<b>10-minute average</b>
WHO interim target 1 (IT-1) (2000 guideline level)	125 µg/m <sup>3</sup>	-
WHO interim target 2 (IT-2)	50 µg/m <sup>3</sup> Intermediate goal based on controlling either (a) motor vehicle (b) industrial emissions and/or (c) power production; this would be a reasonable and feasible goal to be achieved within a few years for some developing countries and lead to significant health improvements that would justify further improvements (such as aiming for the guideline).	-
WHO air quality guidelines	20µg/m <sup>3</sup>	500µg/m <sup>3</sup>

An annual guideline is not needed, since compliance with the 24-hour level will assure low levels for the annual average.

For instance, a country could move towards guideline compliance by controlling emissions from one major source at a time, selecting among motor vehicle sources, industrial sources and power sources for the greatest effect on sulfur dioxide at the lowest cost, and monitoring public health and sulfur dioxide levels for health effect gains. Demonstrating health benefits will provide an incentive to introduce controls for the next major source category. These recommended guideline values for sulfur dioxide are not linked with guidelines for particles.

## Review of evidence on health aspects of air pollution – REVIHAAP Project<sup>55</sup>

### Question C7

**Is there any new evidence on the health effects of short term (less than 1 day) exposures to SO<sub>2</sub> that would lead to changes of the WHO air quality guidelines based on 10 minute and daily averaging periods or the EU's air quality limit values based on hourly and daily averaging periods?**

#### *Answer*

The 24-hour average guideline was based on the low end of the concentration ranges used in the time-series studies and on the Hong Kong intervention study. The time-series evidence continues to accumulate and continues to be inconsistent when adjusted for other pollutants for many (but not all) outcomes – for example, it is consistent for asthma admissions. The results of the original Hong Kong intervention study remain as a reduction in mortality for a reduction in pre- and post-intervention exposure to SO<sub>2</sub> independent of PM<sub>10</sub>, although a more recent report suggests more difficulty in disentangling the effects of the reductions in SO<sub>2</sub> from reductions in other constituents, such as nickel or vanadium. The new studies are at a similar range of concentrations as the previous studies, so **the 24-hour average guideline does not need to be changed if the same method (using a concentration at the low end of the range of concentrations) is followed for setting the guideline.**

#### *Discussion*<sup>56</sup>

Although the chamber study evidence has not changed significantly, a pooled analysis of previous data suggested a tendency towards a split response between responders and non-responders that was statistically significant before (but not after) adjustment for multiple comparisons. This might suggest the need for a small increase in the safety factor.

Most of the newer toxicological evidence is at high doses, so it does not have direct implications for the guideline. The new finding of an association between gestational exposure to low levels of SO<sub>2</sub> and histopathological lesions in heart or skeletal muscle in beef cattle is hard to put into context, as there are no other studies of this type. It is possible that another unmeasured pollutant present at higher concentrations is actually responsible.

The review of the time-series evidence is based on studies analysed according to current practice, but it needs to be acknowledged that there are many issues that still need further discussion. As many of these issues are shared across all pollutants, they will not be discussed in detail here. These issues include statistical model choice (HEI, 2003; Erbas & Hyndman, 2005; Ito, Thurston & Silverman, 2007) and the challenges of distinguishing the effects of different pollutants in multipollutant models (Kim et al., 2007; Billonnet, Sherrill & Annesi-Maesano, 2012). The low average concentrations of SO<sub>2</sub>, but with sharp peaks, combined with the fact that, in some studies, SO<sub>2</sub> is controlled for PM<sub>10</sub> that is measured only once every 6 days means that the presence of measurement error adds uncertainty to the interpretation of the multipollutant model results. More generally, exposure misclassification may be a particular issue for SO<sub>2</sub>. Sarnat et al. (2007), in a discussion of data from four cities, concluded that ambient SO<sub>2</sub> was not

<sup>55</sup> WHO, (2013). *Review of evidence on health aspects of air pollution – REVIHAAP Project, Technical Report*. WHO Regional Office for Europe, Copenhagen Ø, Denmark

<sup>56</sup> Discussion relating only to 10-minute SO<sub>2</sub> guideline not included.

well correlated with personal exposures to SO<sub>2</sub> in most subjects. It was noted that the concentrations of 24-hour average SO<sub>2</sub> personal exposure were very low, leading to the possibility of measurement errors in the personal exposure obscuring the relationship. In addition, the association between peak personal exposures and peak ambient concentrations may be what is of most interest. It is only necessary for these correlations to be present in some susceptible individuals, rather than the whole population, to account for the epidemiological results.

Bearing the above points in mind, the time-series evidence continues to suggest associations with mortality that are not necessarily stable to adjustment for other pollutants. The picture for respiratory hospital admissions is similar, but asthma admissions in children seem to be more stable to adjustment for other pollutants in most cases. A robust effect on asthma admissions ties in with the chamber study evidence, although the fact that associations with asthma admissions are more variable in adults does not.

Associations are also seen with cardiovascular admissions. There are fewer studies that have tested this in multipollutant models. While there is a chamber study, a toxicology study at high doses, and a handful of panel studies on cardiovascular end-points, these recent studies on their own are insufficient to support the time-series finding one way or the other.

As the 24-hour average guideline is partly based on time-series studies, a change in the guideline might be required if none of the outcome associations were stable to adjustment for other pollutants. The present document has not reviewed multipollutant model results on single-city studies published before the Anderson et al. (2007) report. Further work would be needed to do this before coming to overall conclusions as to what outcome associations are stable to adjustment for other pollutants. Currently, the associations with asthma admissions in children seem the most robust. The Hong Kong Intervention study, where SO<sub>2</sub> was reduced sharply (but PM<sub>10</sub> was not) was also influential in setting the guideline, but more recent work suggests less confidence in allocating the mortality benefit to SO<sub>2</sub>.

The 24-hour average guideline was influenced by the concentration ranges at which results had been shown in the time-series studies. These have not changed, as the lower end of the ambient concentration range was already very low in the previous studies. It is noted that this means that even quite marked changes in the size of the concentration–response function would have no effect on a guideline set on this basis. An alternative is to specify a small level of *acceptable risk* and use a concentration–response function (assuming it was robust) to derive a concentration that would minimize risk to this level. This approach should be considered as an option when it comes to the guideline revision stage.

## ATTACHMENT C

### Technical detail regarding proposed 24-hour SO<sub>2</sub> AAQS

- C1. Mr Tony Dons (New Zealand Starch)<sup>57</sup> has stated that compliance with the AAQS for SO<sub>2</sub> at the boundary of their property would require around \$500,000 of additional emission control technology. My primary statement of evidence specifically addresses this concern (at paragraph 5.43) and discusses proposed amendments to Policy 1 to be explicit on this matter. I still do not believe this concern is warranted.
- C2. Mr Frangos (New Zealand Starch) maintains that I have misrepresented the findings of the 2013 WHO<sup>58</sup> review in stating that “*there is increasing evidence in population studies of pre-term birth and sudden infant death syndrome*”.<sup>59</sup> This is not true. I refer Mr Frangos to the discussion of research on birth outcomes associated with exposure to SO<sub>2</sub> in the 2013 WHO review at pages 149 – 150.
- C3. Mr Roger Cudmore (New Zealand Starch)<sup>60</sup> has interpreted my primary evidence (at paragraph 5.45) as a view that the 24-hour SO<sub>2</sub> AAQS only applies to where people live. Mr Cudmore contends that if this is the intention of the Unitary Plan then it needs to say this.
- C4. My primary evidence (at paragraph 5.45) commented on the likely compliance of most residential locations in Auckland with the 24-hour SO<sub>2</sub> AAQS. I have been very clear that I consider all AAQS should apply wherever people may reasonably be exposed (e.g. primary evidence at paragraph 5.43). However, this is not limited to residential locations only. For example, hospitals, hotels, camp grounds are all locations where people may be reasonably exposed to a contaminant over a 24-hour period. However, some of these locations may not be applicable for exposure over a longer time period (e.g. annual). This is why the proposed amendment to Policy 1 also includes consideration of “the relevant time period”.
- C5. Mr Mark Arbuthnot (POAL, 5137) provided an independent technical review of the 24-hour AAQS for SO<sub>2</sub> prepared by URS for Auckland Council that concluded:

*Based on this review, the adoption of the 24-hour WHO AQG of 20 µg/m<sup>3</sup> as an AAQS for the Auckland region is not expected to provide a significant health benefit to Aucklanders, and may be at an unnecessary burden (cost) to industry at the present time. In fact, there may be a greater benefit to public health if Auckland Council were to adopt a more stringent 1-hour standard for SO<sub>2</sub> (e.g. 200 µg/m<sup>3</sup>), although this would require further research. URS also suggested that a 10- or 15 minute AAQS of*

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<sup>57</sup> Evidence of Mr Dons (New Zealand Starch) at paragraph 12.

<sup>58</sup> WHO, (2013) at n 43.

<sup>59</sup> Evidence of Mr Frangos (New Zealand Starch) at paragraph 39

<sup>60</sup> Evidence of Mr Cudmore (New Zealand Starch) at paragraph 34

*500 µg/m<sup>3</sup> may be more effective at reducing public health effects than a 24-hour AAAQS, based on current knowledge.*

C6. I have reviewed the URS report and have the following technical comments:

- It is not a systematic review of the scientific basis behind the 2006 WHO 24-hour SO<sub>2</sub> guideline. It presents an incomplete picture of the health effects of sulphur dioxide and it jumps between studies of effects using different methodological approaches over different exposures at different time averages. It gives undue prominence to research on ultrafine particles and possible confounding effects by ultrafine particles and transition metals such as nickel and vanadium.
- The report presents only limited monitoring sulphur dioxide data for Auckland (for example, it appears to be unaware of the *Auckland Regional Council Ambient Sulphur Dioxide Monitoring Report Winter 2007* (Watercare, 2007). It states that the author is unaware of the location of the Port SO<sub>2</sub> monitoring.
- It presents an invalid comparison of Auckland's regional SO<sub>2</sub> emissions with the rest of New Zealand (the effects of SO<sub>2</sub> being entirely local).
- The report does not determine the potential health benefits for Auckland should the 24-hour SO<sub>2</sub> AAAQS be adopted. The only discussion regarding potential health benefits revolves around the usefulness of an additional 10-minute guideline.
- The report contains speculative assertions. For example, it alleges that the WHO 24-hour SO<sub>2</sub> guideline was *"largely based on the results from a single intervention study undertaken in Hong Kong (Hedley et al., 2002)."* This is not true.
- It fails to mention that the 2008 EU Directive (2008/50/EC) did not reference the science that informed the 2006 WHO guidelines.
- It fails to mention that the 2010 US national ambient air quality standard for SO<sub>2</sub> limited its consideration of causality of effects from short-term SO<sub>2</sub> exposure to respiratory morbidity (only).
- It makes unsubstantiated and incorrect statements. For example,

*Not only is it considered unlikely that an exercising child or adult diagnosed with asthma would be exposed to SO<sub>2</sub> for a full 24-hour period, but any adverse effects that may manifest themselves (such as asthma-like symptoms) are likely to be controlled through medication and by breaking the exposure pathway (i.e. reducing the inhalation risk by moving away from the emission source), for example, by going indoors if playing outside.*