Submission from: **Clean Air Society of Australia and New Zealand Inc. (CASANZ)**

To: **Department of Infrastructure and Regional Development**

Subject: **(Motor) Vehicle Emission Discussion Paper**

This submission from CASANZ is based on the responses from members reflecting their views on the various issues identified in the discussion paper.

SUMMARY

CASANZ summarises the following key points in our submission:

- Due to the vicinity of roads to areas where people live, travel and work, vehicle emissions have a significantly larger impact on population exposure (and therefore health effects) than would be expected on the basis of emission levels alone, as compared with other sources.
- There is general support among the membership for further reduction of vehicle emissions (greenhouse gases and air pollutants).
- It is recommended that the scope of any RIS is expanded to ensure that the best policy outcomes are achieved and the best measures are selected.
- There is a need for new vehicle emission testing programs to ensure that any potential emission benefits of policies and measures are properly assessed and adequate enforcement undertaken.
- There is a need for harmonisation of motor vehicle emission impact assessment methods.
- The current timelines may be too ambitious for a well-considered and scientifically sound process for the assessment of all subject areas identified in the discussion paper with sufficient stakeholder input. For specific measures, such as adoption of Euro VI/6 and CO_2 emission standards in line with international best practice, the timelines appear more appropriate.

CASANZ would welcome the opportunity to contribute further to the development (scope) and assessment of policy measures by direct participation in discussions and development on the agreement generally, and specifically as a member of the working group proposed.

GENERAL COMMENTS

The Vehicle Emission Discussion Paper (**VEDP**) discusses a wide range of possible initiatives and measures to reduce motor vehicle emissions. The submission deadline of 8 April 2016 does not allow for a well-considered and detailed response to the 31 questions outlined in the document. Instead CASANZ uses this opportunity to raise a number of key issues, and we highly recommend that stakeholders like CASANZ are given the opportunity to be involved in the subsequent steps of the process, as will be indicated throughout this submission.

The Society members were generally very supportive of the objectives stated in the VEDP.

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There is a need, however, that the scope of the paper is expanded to ensure that selected policy measures to reduce vehicle emissions are, in fact, cost-effective and beneficial. In addition, the measures already discussed in the paper can have substantial impacts, and as a consequence, all (including the ones not yet included) deserve a scientifically sound and well-considered analysis. In the light of this, CASANZ members expressed concern about the plausibility of the 2016/2017 timelines to allow for a credible and consultative process.

It is therefore strongly recommended that the timelines are re-considered and that a clear mechanism is created for key stakeholders such as CASANZ to become involved in the process and contribute relevant input, knowledge and expertise. In this document, we make specific recommendations for subject matter working groups that could facilitate this process.

Given the wide range of possible measures, CASANZ recommends to have an overarching (and simplifying) conceptual framework for emission-reduction policies and measures. For instance, a typical framework for describing and implementing these is '*Avoid-Shift-Improve*'. This is described in various ways, but broadly speaking:

1. Avoid (or reduce) the need to travel. For example, develop and implement land use policies that allow people to access facilities without excessive travel.
2. Shift to more fuel efficient or less polluting modes of transport, which include, for example, non-motorised transport or mass transit.
3. Improve the emissions and fuel efficiency of motorised vehicles through technological and operational measures.

The VEDP includes both vehicle air pollutant emissions and greenhouse emissions (CO_2), but presents these entwined. It is suggested that in subsequent presentations both are presented, but as separate chapters. It will be important to explore possible offset effects of different policy measures, such as fuel penalties for specific emission control technologies.

MOTOR VEHICLE EMISSIONS

Road transport is a major source of air pollution and greenhouse gas emissions. Overseas studies suggest that road transport is the largest contributor to adverse health effects of ambient air pollution. Increasingly strict vehicle emission standards have been adopted in Australia over time. These have progressively reduced average vehicle emissions of regulated air pollutants such as CO, VOCs, PM and NO_x per vehicle kilometre travelled (VKT). In addition, new fuel quality requirements have helped to reduce emissions per VKT.

The trend is different for (unregulated) greenhouse gas emissions, where, for instance, the strong and continued growth in SUV sales affect fleet average CO_2 emissions per VKT. Road transport use has also continued to grow steadily over the years, leading to more congestion. This has at least partly offset gains in vehicle emissions per VKT.

A recent Australian motor vehicle emission inventory (MVEI)[1] showed that motor vehicles can contribute significantly to total emission loads of both air pollutants and greenhouse gases. Motor vehicle emissions in relation to, for instance, total industry emissions vary from dominant (e.g. acrolein, benzene) to important (e.g. CO_2, VOCs, NO_x, $PM_{2.5}$) to insignificant (e.g. SO_2, selenium). The MVEI also shows that the relative contribution of individual vehicle classes to emissions varies substantially, depending on the air pollutant that is considered. Petrol vehicles dominate emissions of CO, VOCs, NH_3 and heavy metals, whereas diesel vehicles (light-duty diesel vehicles and heavy-duty diesel vehicles) dominate motor vehicle emissions of $PM_{2.5}$ and NO_x.

It is important, however, to emphasise that emissions from motor vehicles do not necessarily reflect community exposure to air pollutants. In fact, the actual contribution of motor vehicle emissions to population exposure (and thus health effects) is typically substantially greater than equivalent emission levels from for instance industrial sources. This is because motor vehicle emissions are released close to ground level and, typically, in close proximity to where people live and work. In contrast, industrial emissions are typically emitted through elevated vents and stacks, and are generally located some distance from populated areas.

[1] University of Queensland, Australian Motor Vehicle Emission Inventory for the National Pollutant Inventory (NPI), prepared by Robin Smit, available at http://www.npi.gov.au/resource/australian-motor-vehicleemission-inventory-national-pollutant-inventory-npi, 2 August 2014.

This means that industrial emissions are often dispersed significantly before they reach the population. As a consequence, relatively minor levels of motor vehicle emissions can still lead to significant exposure to pollutants and associated health impacts. This was illustrated by a comprehensive study conducted in the US[2], which concluded that road transport contributes 7% to total $PM_{2.5}$ emissions, but is the largest contributor to population health impacts (the number of premature deaths per year). This exposure effect makes reduction of vehicle emissions particularly relevant. This point is not made clear in the VEDP.

A number of pollutants are “no zero-effect level” substances, i.e. they lack a threshold concentration below which adverse health effects do not occur. This means that ambient air quality standards for these pollutants cannot be set at universally protective levels, and residual adverse health impacts will occur at and below the standards. Standards have therefore been set at levels that balance various factors, including economics, health, social and technological factors, using traditional cost-benefit analysis.

Of the criteria pollutants, respirable particles have long been understood to be a “no zero-effects” pollutant. More recently, ozone is now also understood to be such a pollutant, and there is also evidence that suggests that current ambient standards for nitrogen dioxide and carbon monoxide are not as protective as originally considered.

In view of this, current consideration is being given to moving more towards an *exposure minimisation approach* to air quality management, i.e. setting targets for reducing the number of people exposed to higher levels of pollutants with the aim of reducing the average population exposure. For motor vehicles, the more traditional emission reduction methods such as fuel quality and vehicle emission standards and maintenance and inspection programs would need to be supplemented with other approaches. These may include traffic management, traffic re-routing, and planning restrictions in the development of new housing estates, urban redevelopment projects, and road developments. Obviously, encouragement and provision of public transport and regionalisation in planning policy would be beneficial in minimising exposure.

NATIONAL AND STATE GOVERNMENT ROLES AND RESPONSIBILITIES

In relation to motor vehicle emissions, it would be beneficial to review and possibly improve the current situation with respect to national and state roles and responsibilities.

One prominent example is that vehicle emission standards and fuel quality standards are now regulated at the national level, but that this does not apply to all relevant fuel parameters. Fuel volatility is important from an emissions perspective and is currently regulated at jurisdictional level. Fuel volatility standards used across the jurisdictions vary and are less stringent than overseas standards (e.g. EU). As a consequence, the inclusion of this parameter in nationally harmonised fuel quality standards may be beneficial and a cost-effective measure to reduce vehicle emissions.

There are a range of traffic management measures available for improving vehicle emissions such as dynamic speed limits, signal coordination, ‘green waves’, on-ramp metering, and so forth. Although these types of measure are implemented by state-controlled entities or local councils, it is recommended that a ‘handbook of measures’ is created showing the range of available options for Australian conditions, including their expected emission benefits and costs. This handbook would then serve as a guide for state or local authorities to implement the best measures for their local conditions. Clearly, the design and implementation of adequate enforcement programs are an essential element in effective regulation and warrant discussion.

[2] Caiazzo, F., Ashok, A., Waitz, I.A., Yim, S.H.L., Barrett, S.H.R., Air pollution and early deaths in the United States. Part I: Quantifying the impact of major sectors in 2005, Atmospheric Environment, 79, 198-208, 2013.

VEHICLE EMISSION STANDARDS

CASANZ supports the introduction Euro 6/VI and CO_2 vehicle emission standards to:

- ensure ongoing improvements in air quality and reduce population exposure to air pollution,
- ensure fuel efficiency improvements in line with international best practice,
- maintain commitments to international trade agreements,
- maintain international competitiveness,
- prevent Australia from becoming the worst performer from a greenhouse gas emissions perspective,
- prevent Australia from becoming a destination for outdated and inferior technology.

Adoption of international vehicle emission standards in Australia has historically been lagging behind the EU, varying from 2-7 years. To ensure better air quality and greenhouse gas emission outcomes, CASANZ recommends complete harmonisation with international vehicle emission standards.

The quality of fuel is closely linked with international vehicle emission standards for technological reasons, so it is important that emission and fuel quality standards are adopted simultaneously, preferably without modification. Modification of international standards (e.g. sulfur content) will create a unique situation in Australia with some potentially unintended consequences. For instance, overseas research data are often used in the absence of Australian vehicle emission measurement data to estimate vehicle emissions and impacts of different policy measures. Deviation from international practice may make the use of international research data inappropriate and not representative for Australian conditions. This will further increase the need for comprehensive and ongoing emission test programs in Australia, with associated resource implications.

As will be discussed later, internationally harmonised vehicle emission and fuel quality standards are important for the reasons mentioned before. However, testing of actual (emission) benefits and implementation of a range of other measures will most likely be essential to ensure ongoing and significant reductions in both greenhouse gas emissions and population exposure to vehicle air pollution.

EXPANDED SCOPE

The VEDP presents a wide range of potential measures to reduce motor vehicle emissions, but is by no means exhaustive. It is recommended that the scope of the VEDP and subsequent RIS is expanded to include potentially cost-effective vehicle emission measures that would otherwise be missed.

For instance '**vehicle test and repair programs**' are recommended for inclusion. It has long been known that fleet emissions are dominated by a small percentage (< 10%) of 'excessive emitters', and the impact of high emitters is increasing. It has, for instance, been reported that 1% of on-road vehicles in the USA contributed less than 10% to total vehicle emissions in the late 1980s, but that this has now increased such that the contribution is about 30% of total emissions.[3]

Studies have shown that emissions from 'excessive emitters' (petrol cars) can be up to 50 times higher (or more) than a properly functioning catalyst car.[4] So total fleet emissions are becoming increasingly sensitive to a small number of high emitting vehicles. In line with these international studies, a recent tunnel study in Brisbane[5] found that the distributions of vehicle emissions are highly skewed, and that the majority of the vehicles have low emissions, but some vehicles exhibit (very) high emission levels and have a disproportionate impact on total vehicle emissions.

[3] Bishop, G.A., Schuchmann, B.G., Stedman, D.H., Lawson, D.R., "Multispecies remote sensing measurements of vehicle emissions on Sherman Way in Van Nuys, California", Journal of the Air & Waste Management Association, 62 (10), 1127-1133, 2012.

[4] Sjödin, Å, Andréasson, K., Wallin, M., Lenner, M., Wilhelmsson, H., "Identification of high-emitting catalyst cars on the road by means of remote sensing", Int. J. of Vehicle Design, 18 (3/4), 326-339, 1997.

[5] Smit, R. and Kingston, P., "A Brisbane Tunnel Study to Validate Australian Motor Vehicle Emission Models," SAE Technical Paper 2015-01-0058, 2015, doi:10.4271/2015-01-0058.

There is currently a lack of a coordinated and effective in-service maintenance regime in Australia. Test and repair programs can be used to identify on-road vehicles with excessive emissions and repair them. Emission levels can be restored to approximately that of a new vehicle by adjustment and maintenance or by correction of defects, whatever the mileage. It is noted that this could also address potential issues with modern and relatively new cars where advanced emission control technology has failed and has not been repaired.

There are various options available that could be explored, including centralised or decentralised inspection and maintenance (I/M) programs, tunnel monitors and roadside testing using remote sensing. It is noted that remote sensing has been used extensively in New Zealand, and is also used in WA.

There are also other options for addressing high emission levels from on-road vehicles varying from **retrofit programs** (e.g. with particulate filters, SCR) and **scrappage programs** ('cash for clunkers') for older technology vehicles, to investigations into tampering and the detrimental impacts of companies that offer modification of factory ECU[6] settings, or even removal of emission control technology to save costs. Again it is recommended that these types of measures are included in the RIS scope, as they could potentially turn out to be one of the most cost-effective measures available.

CASANZ members suggested other measures for inclusion:

- Congestion pricing, possibly as a function of emission control technology (e.g. low emission zone based on ADR emission standards) – providing a financial incentive for alternative and less polluting modes of transport and reducing the adverse impact of congested driving conditions on vehicle emissions (reduced travel, peak spreading). Revenues can be used to promote and expand more sustainable forms of transport.
- Travel demand management, including public transport development (e.g. light rail, public transport priority, etc.), management of freight and car sharing.
- Measures to reduce non-exhaust particle emissions (e.g. tyres, brakes, road wear).
- Well-to-wheel CO_2 emission assessment rather than the tank-to-wheel approach discussed in the VEDP.
- Consideration of other greenhouse gas emissions from motor vehicles than CO_2.

It is recommend that a working group with relevant experts is created to brainstorm on possible measures with the aim to recommend a list of measures and a conceptual framework for inclusion in the process. CASANZ can recommend subject matter experts for this working group.

[6] Engine Control Unit.

RESOURCING AND RESEARCH NEEDS

CASANZ is of the view that funding and resourcing for vehicle emission assessment is currently inadequate.

Based on the survey of the Society members, the following areas are considered to be high priorities for increased funding and resource commitments:

- **Vehicle emission testing** – Ongoing emission testing is essential for good policy development and impact evaluation. Results from testing programs are directly used to develop and refine vehicle emission models, which in turn play a pivotal role in emission inventory development and impact assessment of the wide range of policy measures discussed in the VEDP.

  Good quality and comprehensive in-service vehicle emissions testing programs ('NISE studies') have been conducted in the past in Australia, but the last Australian study was published in 2009. This means that there is currently only publicly available information regarding (real-world) vehicle emissions performance of Australian vehicles up to model year 2008, and then only for petrol vehicles. There is therefore an urgent need to measure current 'real-world' emissions from Australian vehicles, including other fuel types such as diesel and LPG (retrofit) vehicles. In addition, there is a need to assess the environmental performance of new technology vehicles (e.g. hybrid trucks).

  This issue of a lack Australian vehicle emission measurements is particularly relevant as:
  - there is an increasing gap between legislative and real-world emissions, as mentioned in the VEDP, and
  - emission benefits may be less than expected, for instance, research in Europe shows that Euro 5 and Euro 6 diesel cars have similar or worse emission performance (NO_x) than Euro 4 cars.

  We note that there are different means of measuring real-world vehicle emissions that should be considered, each with their own strengths and benefits:

    - Laboratory emissions testing
    - Portable emission measurement system testing (PEMS, on-road)
    - Tunnel studies
    - Remote sensing (road-side)
    - Near-road air quality measurements and reverse dispersion modelling (road-side)

- **(Validated) emission impact assessment framework** – A nationally consistent vehicle emission modelling framework is essential for assessing the impacts of the wide range of measures presented in the VEDP, both at national and state level. Australian states and territories have traditionally developed motor vehicle emission inventories (MVEIs) for their own jurisdictions at specific but uncoordinated points in time, using different methods. The Bureau of Infrastructure, Transport and Regional Economics has published national vehicle emission estimates in the past, and the National Pollutant Inventory (NPI) has recently published a national MVEI. It is recommended that this VEDP action is used to establish an agreed-upon vehicle emission assessment framework that would ensure a scientifically sound, up-to-date and consistent approach across Australia, not only for the RIS, but also for vehicle emission and air quality impact assessments in the future.

- **Policy impact evaluation and monitoring** – It is important to measure trends in vehicle emissions and air quality at different types of location to evaluate the effectiveness of existing (e.g. Emission Reduction Fund) and new policy measures and to identify any unexpected results in a timely fashion. There are different ways to quantify trends in vehicle emissions, and they include repeated measurements over time using tunnel studies, long-term air quality monitoring at strategic kerbside locations and remote sensing.

CASANZ would welcome the opportunity to be involved in the development, design and eventual data interpretation of these priority areas.

PRE-RIS PREPARATORY WORK

Given the complexity and large variety of measures proposed for consideration, it will be essential to ensure proper methods are used to assess and quantify the emission impacts and costs of the various options.

Specifically, CASANZ members noted the following steps before a RIS should be conducted, and allowing for sufficient time to achieve this.

- Establish an agreed-upon vehicle emission assessment framework that would ensure a scientifically sound, up-to-date and consistent approach across Australia. This would include a fleet model, and an adequate macro-scale and micro-scale vehicle emission model.

- Refinement, validation and/or agreement of monetisation methods.

It is proposed that a working group with relevant experts be formed to make recommendations for consideration by the Australian government. CASANZ can recommend subject matter experts for this working group.

SPECIFIC COMMENTS

- The VEDP states reducing 247-188 g CO_2/km for the LDV fleet in the period 2004-2014. The National MVEI[7] reports a much higher 'real-world' value of 251 g/km for 2010, showing the discrepancy between legislative cycles and real-world CO_2 emission rates. CASANZ recommends to include real-world emissions data in the RIS.
- '*Fuel efficiency*' in combination with g/km is incorrectly used in the VEDP and should be referred to as '*Fuel consumption*'. CASANZ recommends to use proper terminology.
- Motorcycles contribute substantially more to total vehicle emissions of CO and VOC (7-8%) than would be expected on basis of their VKT percentage (~1%), this is now incorrectly presented in the VEDP. CASANZ recommends to correct the text.
- CASANZ recommends that the term 'noxious emissions' be replaced by air pollutant emissions as being the long used term and more appropriate.
- One issue not considered by the paper but of considerable relevance to New Zealand is that Australia effectively sets vehicle standards for New Zealand as well. The Australian/New Zealand market is treated as one by vehicle manufacturers. Any delays in adoption of Euro 6/VI and CO_2 emission standards, will create a similar delay in New Zealand, and will prevent New Zealand from moving ahead and address their air quality concerns. It is recommended that New Zealand stakeholders are sufficiently involved in the process, possibly through CASANZ, which represents both New Zealand and Australian experts and professionals.

CASANZ'S ROLE

In relation to contributions, CASANZ would welcome the opportunity to contribute further to the development of cost-effective vehicle emission reduction measures. We can effectively contribute to the agreement by direct participation in discussions and development on the agreement generally and specifically as a member of the proposed working group. CASANZ is well placed to provide expert comment and advice on emissions, air quality and climate change policy and science, by both direct participation and by referral, through its wide network of recognised experts in this area. We suggest that there is scope for a national forum on vehicle emissions to which we could make a significant contribution.

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With input from CASANZ members.

[7] University of Queensland, Australian Motor Vehicle Emission Inventory for the National Pollutant Inventory (NPI), prepared by Robin Smit, available at http://www.npi.gov.au/resource/australian-motor-vehicleemission-inventory-national-pollutant-inventory-npi, 2 August 2014.