SETTING NATIONAL FUEL QUALITY STANDARDS

Paper 3

Proposed Model for Standards Implementation

Prepared By

Environment Australia

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Natural Heritage Trust

Helping Communities Helping Australia

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FOREWORD

Australia is playing its part in the global push for cleaner, more efficient transport. Transport is the most significant contributor to ambient air pollution in urban Australia. Growth in greenhouse gas emissions from the transport sector over the period 1990-1997 was the fastest for any part of the Australian economy. Commonwealth environment, greenhouse, transport and industry agencies are working together on direct action to improve the emissions performance of the transport fleet.
At the heart of all the technical arguments and analyses, there are two simple policy directions for dealing with pollution from vehicles – to reduce their use and to clean up emissions. Among the many actions that can be undertaken to reduce pollution from vehicles, a small number of key actions will deliver the greatest outcomes.

Three strategies are being implemented to 'clean up' vehicles in Australia: making sure that vehicles meet effective emission standards when they first enter the market; ensuring that they continue to meet these emission standards while they are in use; and providing them with the cleanest, economically viable fuels on which to operate.

The 1997 Australian Academy of Technological Sciences and Engineering report *Urban Air Pollution In Australia*, commissioned by Environment Australia, found that new, tighter vehicle emission standards were 'the long-term foundation for maintaining and improving air quality'. The Prime Minister, in his 1997 statement, *Safeguarding the Future: Australia's response to Climate Change* identified harmonisation with international vehicle emission standards as a goal of the Government – with a target date of 2006. The timetable for vehicle standards harmonisation was set, in May 1999, as part of the *Measures for a Better Environment* initiative under the New Tax System for Australia.

The quality of our fuel has been a key constraint to the introduction of new vehicle emission standards. Emerging vehicle engine and emission control technologies, needed to meet the new standards, are affected by the quality of the fuel used. As a first step, in 1998 Environment Australia commissioned a review of the fuel quality requirements for Australian transport. This work was funded under the Natural Heritage Trust *Air Pollution in Major Cities Program*. The recognition that fuel quality improvements would be required was confirmed in the *Measures for a Better Environment* package, which included a commitment to mandate reduced sulfur content levels for diesel fuel, and foreshadowed sulfur content and octane changes to petrol.

Any proposal to improve, and for the first time, mandate, the quality of transport fuel used in Australia, has the potential to impact on a wide range of stakeholders – from groups as diverse as the Australian refining industry to an individual driver filling her car. We are seeking your views on setting national fuel quality standards before any further decisions are made by the Commonwealth Government. A series of public discussion papers on this issue has therefore been prepared. I look forward to considering your views on the matter and urge you to make a submission.

Robert Hill
Minister for the Environment and Heritage

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1 INTRODUCTION

1.1 Objective of the paper

An assessment of international models used to implement fuel quality standards is necessary before any model for Australian fuel standards can be determined. There are a variety of models that are used internationally to implement fuel quality standards. In the simplest terms, the models fall into three categories: flat limits; averaging limits; and, emission limits models.

- Flat limits require that each batch of fuel supplied by a refiner or importer must comply with certain limits (typically maximum and minimum content limits) for particular fuel parameters.
- Averaging limits require that fuel supplied by a refiner or importer must, over a specified time period, comply with an average limit (but not exceed a cap limit) for particular fuel parameters.
- Emission limits require that fuel supplied by a refiner or importer meet certain emission effects for particular fuel parameters. These effects must be equivalent to outcomes determined by specified limits or reference test fuels.

This paper outlines a description of the current models used to implement fuel quality standards, discusses their advantages and disadvantages, and identifies a preferred model for use in Australia.

1.2 Structure of the paper

The information in the paper is arranged in three parts. Sections 1-3 outline the context for the establishment of national fuel standards; sections 4-7 discuss the models in use internationally and outline the Commonwealth's proposed model; and section 8 provides a summary of the paper's findings.

This paper is the third in a series of three papers produced by the Commonwealth for the purposes of public consultation on the development of national fuel quality standards. As such, it refers to the other papers and should be read in conjunction with them.

Paper 1 provides a summary of the *Review of Fuel Quality Requirements for Australian Transport* – a commissioned technical and economic analysis; and Paper 2 presents an assessment of, and recommended content limits for, those fuel parameters identified as significant in managing transport-sourced emissions of pollutants and greenhouse gases.

The full report of the *Review of Fuel Quality Requirements for Australian Transport* can be obtained from AusInfo – the Commonwealth Government bookshops, and is available on the Internet at the following address: www.environment.gov.au/epg/fuel/

1.3 Call for public submissions

In order to ensure that the most appropriate fuel quality standards are adopted in Australia, comment on the proposals put forward in the discussion papers are sought from all interested stakeholders and members of the public.

While comments are welcomed on any matter discussed in the papers, attention should also be directed to the specific questions raised throughout the text. All submissions will be treated as public documents.

Written comments are requested by 30 June 2000.

And should be sent to :

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2 BACKGROUND

There are a number of significant pressures to change fuel characteristics in Australia.

The principal driver for change to fuel quality standards in Australia is an environmental one - the need to provide fuels that facilitate the adoption of emerging vehicle engine and emission control technologies, a key strategy in managing air pollution and greenhouse gas emissions. This is supported by the need to better manage those fuel parameters that do not impact directly on vehicle technology, but nevertheless contribute to ambient levels of pollutants identified as posing health or environmental problems.

2.1 Environmental policy

Transport activities have been identified as the most significant contributor to urban ambient air pollution in Australia, with road vehicles the dominant source of pollutants.[1] Motor vehicle emissions are key sources of lead, carbon monoxide and nitrogen dioxide. They are also the major source of photochemical smog ("ozone") precursors. With the exception of particles, petrol passenger vehicles are the major transport source. Heavy diesel fuelled vehicles are also a significant source of nitrogen oxides (NOx). The diesel fleet is the major transport source of particles, contributing up to 80% of vehicle produced particles in major cities.[2] The reduction of emissions from road transport is a key element of air quality management strategies established by Commonwealth, State and Territory governments to meet the National Environment Protection Measure (NEPM) ambient air quality standards agreed by the National Environment Protection Council in 1998.

Motor vehicle emissions are also a significant source of air toxics.[3] In 1999 the Commonwealth launched a new initiative, the Living Cities – Air Toxics Program. The overall objective of this program is the development of a national strategy to "monitor, establish the levels of community exposure to, and manage emissions of selected air toxics". It is envisaged that this strategy will ultimately lead to the development and implementation of a NEPM for air toxics.

The Living Cities – Air Toxics Program is currently developing a priority list of air toxics for concerted action. Priority pollutant status will be determined on the basis of an

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[1] AATSE, 1997, Urban Air Pollution in Australia

[2] NEPC, 1998, Revised Impact Statement for the Ambient Air Quality National Environment Protection Measure, p33.

[3] Air toxics are pollutants which occur in relatively small volumes, compared with ambient pollutants, but are considered hazardous to health or the environment. The following figures indicate the contribution of motor vehicle emissions to levels of air toxics: benzene 80%; toluene 57%;1,3 butadiene 76%; formaldehyde 64%; polyaromatic hydrocarbons 42%; xylene 57% (Source: Victorian EPA, December 1999, Air Emissions Inventory – Port Phillip Region).

evaluation of the relative significance of a particular pollutant, giving due consideration to a number of factors including its persistence, toxicity and environmental/human exposure. Although a priority list of air toxics is yet to be endorsed by government, a Technical Advisory Group has developed a provisional list. This provisional list of priority pollutants includes a number of air toxics that are largely attributed to motor vehicle emissions including: benzene, toluene, 1,3-butadiene, formaldehyde, polyaromatic hydrocarbons and xylene.

Under the *Kyoto Protocol* to the *United Nations Framework Convention on Climate Change* (agreed in December 1997 and signed by Australia on 29 April 1998), Australia is committed to a target for national greenhouse gas emissions of 8% above 1990 levels by 2008-12. This represents about a 30% reduction against current business-as-usual projections of greenhouse gas emissions for 2008-12.

National Greenhouse Gas Inventory[4] data indicate that from 1990 to 1997 national transport emissions grew by 18% - the fastest growth of any sector. In 1997 the transport sector was responsible for 17% (or 72 Mt) of Australia's net greenhouse gas emissions. Road transport contributed 88% (or 64Mt) of the transport related emissions in 1997, representing 15% of total net emissions. Emissions from passenger vehicles predominate, but light commercial vehicles are a fast growing area. The outlook for the transport sector continues to be of serious concern. Without reduction measures, emissions from the transport sector are predicted to increase by 38% above 1990 levels by the year 2010. The reduction of emissions from this sector is therefore a key focus of the Government.

2.2 Transport policy

The Commonwealth Government has an ongoing program of introducing new vehicle emission standards to ensure that the environmental benefits of evolving emission control and fuel efficiency technologies are realised in Australia. (New vehicle emission standards are established as Australian Design Rules (ADRs) under the *Motor Vehicles Standards Act 1989* and are therefore also subject to complete review on a 10 year cycle.) In the past, these standards have been largely based on US vehicle emission standards.

The 1997 Australian Academy of Technological Sciences and Engineering report Urban Air Pollution in Australia found that new vehicle emission standards were "the long term foundation for maintaining and improving air quality". The Report recommended that Australia should, "without delay, move to adopt the current United Nations Economic Commission for Europe (UN ECE) vehicle emission regulations for spark ignition (petrol) and diesel engines, as the basis for certifying all new vehicles sold in Australia".

The Prime Minister, in his 1997 statement Safeguarding the Future - Australia's Response to Climate Change, identified harmonisation with international vehicle

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[4] The 1997 National Greenhouse Gas Inventory was released in September 1999 and provides the latest report on Australia's greenhouse gas emissions. It can be accessed at http://greenhouse.gov.au/inventory/

emission standards as a goal of the Commonwealth Government. A target date of 2006 was identified. The statement also specified that the fuel efficiency of vehicles would be improved.

The 1998 OECD Environmental Performance Review of Australia, in considering Australian air quality management initiatives, made the following recommendations:

- ensure that new vehicles are subject to emission standards equivalent to "best practice" standards in other OECD countries, for both gasoline and diesel vehicles; and
- in consultation with the oil industry, define a program for improving fuel quality, notably with respect to reducing vapour pressure, sulfur content and benzene and other aromatics.

Subsequent technical and assessment studies undertaken in Australia (overseen by the Motor Vehicle Environment Committee - MVEC) to inform the development of a timetable for the introduction of new, internationally harmonised ("Euro") vehicle emission standards identified a number of key constraints, significant amongst which was fuel quality. In particular, the relatively high sulfur content of both petrol and diesel was identified as a problem for the efficient functioning of key vehicle technologies necessary for compliance with the proposed standards.[5] In addition, gasoline direct injection engines (GDI), important in meeting fuel efficiency and greenhouse targets, were identified as requiring high octane petrol (95 RON).

2.3 Measures for a Better Environment

A number of initiatives with respect to the improved management of transport emissions were announced by the Commonwealth Government in May 1999 as part of A New Tax System (ANTS) for Australia.

These initiatives known as the "Measures for a Better Environment"(MBE), include timetables for Australian harmonisation with international vehicle emission standards (for both petrol and diesel engines) and the reduction of sulfur levels in diesel fuel, as well as foreshadowing the need for changes to petrol specifications.

2.4 Industry policy

The 1999 Downstream Petroleum Products Action Agenda (DPPAA) identified the following vision for the industry:

"…a strong efficient refining industry that is environmentally responsible, and which supplies the majority of the nation's refined petroleum product needs. The industry will compete openly with imported products and be internationally competitive. Both local refiners and importers will ensure that Australian consumers continue to enjoy access to

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[5] DoTRS,1999, RIS – New ADRs for Control of Vehicle Emissions.

high quality, low priced transport fuels and other petroleum products."

Action Agendas are a mechanism for governments (Commonwealth and State) and industry to work together to agree a set of actions to promote industry viability and growth. The DPPAA covers refiners and importers, with the industry's retail activities addressed separately.

The Action Agenda noted that the industry was committed to improving air quality, particularly in cities, and recognised existing contributions to this objective in the form of the progressive removal of lead from petrol, reduced fuel volatility and substantially tightened industry standards.

3 GENERAL PRINCIPLES AND POLICY REQUIREMENTS

As noted above, the principal driver for changes to fuel quality specifications is an environmental one – that is, the need to provide fuels which facilitate the adoption of emerging vehicle engine and emission control technologies. The decision to harmonise Australian vehicle emission standards with UN ECE emission standards (as best representing international standards – see Box 3.1 below), effectively gives rise to a starting premise that Australian fuel specifications should be harmonised with UN ECE fuel specifications. Recent changes to UN ECE fuel specifications have been driven by vehicle emission requirements and by engine emission control technologies, with new emission control standards coupled with mandated quality and compositional requirements for petrol and diesel fuel.

Box 3.1: 'International' standards

Under the World Trade Organisation rules to which Australia is a signatory, only the regulations developed by the UN ECE meet the definition of an 'international' standard in the vehicle standards field (as opposed to national standards such as the Japanese or US). The UN ECE vehicle emission standards were therefore selected for adoption in Australia to give effect to the goal of 'harmonisation with international vehicle emission standards'. The Japanese Government has also made a commitment to harmonisation with UN ECE vehicle standards. Most other Asian countries, and indeed the majority of countries in the world, are moving to adopting UN ECE regulations on emission standards. The terms 'Euro2', 'Euro 3' and 'Euro 4' are common terminology used to describe the progressively more stringent versions of the UN ECE standards.[6]

It is recognised, however, that recent changes to the UN ECE fuel specifications have also been designed to address a number of other issues, some of which are specific to European Union member countries. While the standards include technology-enabling fuel specifications (sulfur levels being a typical example), they are also designed to contribute directly to the management of air pollutants identified as posing significant health or environmental problems within the European Union. While there are similarities between Europe and Australia in terms of public exposure to air pollutants of concern, there are also some significant differences. The most recent Australian State of the Environment Report found that in general, annual mean concentrations of common pollutants within major Australian airsheds were low by world standards.[7]

The starting premise - harmonisation with European fuel specifications - is therefore subject to a number of qualifications. The first of these is the suite of environmental and

[6] DoTRS,1999, RIS – New ADRs for Control of Vehicle Emissions, p. 42.
[7] SOE Advisory Committee, 1996, Australia State of the Environment, p. 5-28.

industry policy decisions previously announced by the Government. These establish a number of criteria, and pre-determine a number of issues, in relation to the development of national fuel quality standards. These are then further qualified by the need to take into account a number of more general, but equally important Commonwealth Government principles, such as those addressing legislative / regulatory approaches and competition policy.

A key issue is Government policy with respect to harmonisation, trade facilitation and efficiency. The adoption of UN ECE vehicle emission standards (which gives rise to the premise that Australian fuel specifications should be harmonised with UN ECE fuel specifications) is consistent with the Principles and Guidelines for National Standard Setting and Regulatory Action by Ministerial Councils and Standard Setting Bodies laid down by the Council of Australian Governments (COAG). The COAG principles state that wherever possible, regulatory measures or standards should be compatible with relevant international or internationally accepted standards or practices in order to minimise impediments to trade.[8]

The fuel quality standards development process, and the development of the Commonwealth's proposed position, has therefore been based on the following general guiding principles, and specific Government policy decisions.

3.1 General principles

1. Fuel standards are intended to manage those fuel qualities/parameters that are known to have the potential to impact adversely on the environment.

2. Fuel standards should be compatible with relevant international or internationally accepted standards in order not to impede competition and trade.

3. Fuel standards are intended to be mandated and implemented on a national basis. In particular, fuel standards that are technology enabling must apply nationally. Local environmental circumstances may, however, dictate variation within the national standard to achieve environmental outcomes.[9]

   – Consideration will be given to State by State establishment of fuel standards that address airshed specific environmental conditions, however, in such cases a national standard will be determined as a default.

4. Fuel standards will apply to, and be enforced equally in respect of, imports as well as domestically produced petroleum fuels.[10]

   – Fuel standards must not impede competition, either between Australian refiners, or with imported refined product.

[8] COAG, 1997, Principle and Guidelines for National Standards Setting and Regulatory Action by Ministerial Councils and Standard-Setting Bodies.
[9] DISR, 1999, Downstream Petroleum Products Action Agenda.
[10] DISR, 1999, Downstream Petroleum Products Action Agenda.

5. Fuel standards that directly address environmental or health issues will be determined on the basis of Australian-specific requirements. In such instances, harmonisation with European specifications may be neither necessary nor desirable.

6. The timetable for the introduction of new fuel standards will be based on Australian requirements. Harmonisation, in terms of timing, will not be based on European or any other regional timetable, except where there is a previous policy decision to this effect or the standard is technology enabling and the need for such harmonisation is clearly demonstrated.

7. Consideration will be given to setting standards that provide, as far as possible, flexibility in terms of compliance.
   - Flexibility provisions must not impede competition or trade; and
   - Flexibility provisions must not add significantly to legislative/regulatory complexity or implementation/enforcement costs to Government.

3.2 Policy context

The following Commonwealth policy decisions have been identified as directly influencing the nature of the model which will be used to implement new fuel specifications. (The full set of policy decisions influencing the fuel standards development process is listed in Paper 2).

3.2.1 Vehicles – general

1. *A 15% or better improvement over business-as-usual in the fuel efficiency target for passenger vehicles by 2010 the National Average Fuel Consumption (NAFC) framework*[11]

The Commonwealth Government is seeking to expand the supply of high octane (95 RON) petrol, as it considers it will encourage the motor vehicle industry to supply more advanced technology engines which deliver improved fuel economy (and therefore reduced greenhouse emissions) on 95 RON fuel. The Commonwealth expects to finalise agreement with the motor industry on a NAFC target for 2010 in the third quarter of 2000.

3.2.2 Fuel – diesel

1. *Establishment of a diesel standard for road transport fuel with a sulfur content of no more than 500ppm by the end of 2002*[12]

Reduction of sulfur levels to 500ppm is necessary to enable the introduction of Euro 2 vehicle emission standards for light diesel vehicles.

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[11] Prime Minister, November 1997, Safeguarding the Future: Australia's Response to Climate Change.
[12] Prime Minister, May 1999, Measures for a Better Environment

2. *An increase in the diesel excise for high sulfur fuel (fuel with a sulfur level greater than 50ppm) so that the relevant effective diesel excise payable increases by:*
   - *1 cent per litre from 1 January 2003; and*
   - *2 cents per litre from 1 January 2004*[13]

It is the intention of the Commonwealth Government to promote the rapid and widespread conversion to use of ultra low sulfur diesel (i.e. 50ppm or less). MBE reflects the belief that differential excise treatment of low and high sulfur diesel will provide an incentive to switch demand and speed the introduction of new refinery capital investment over the period 2000 to 2005.

3. *Establishment of a mandatory diesel standard with a sulfur content of not greater than 50ppm by 2006*[14]

Under the *Diesel and Alternative Fuels (Grants) Scheme Act 1999* only diesel fuel which has a sulfur content of 50ppm or less will be eligible for a fuel rebate after 2006 (this scheme, together with the Diesel Fuel Rebate Scheme, will be replaced by the Energy Grants (Credits) Scheme in 2002). The Act also states the intention that from 1 January 2006, a mandatory standard of 50 ppm sulfur will come into effect.

3.2.3 Fuel – petrol

4. *A move to higher octane rating and lower sulfur for petrol products*[15]

While MBE does not set out any explicit specifications for petrol, it notes that the new emission standards timetable for petrol vehicles will require a move to higher octane and lower sulfur levels for Australian petrol (see discussion under Euro 3 standards for petrol vehicles).

5. *Bringing forward the phase out of leaded petrol, taking equity considerations into account*[16]

During the December quarter 1999, leaded petrol accounted for 22% by volume of total petrol sales and its market share is continuing to decline. On 15 March 2000, the Federal Government announced that 1 January 2002 would be the national phase out date for leaded petrol.

[13] Prime Minister, May 1999, Measures for a Better Environment
[14] Prime Minister, May 1999, Measures for a Better Environment
[15] Prime Minister, May 1999, Measures for a Better Environment
[16] Prime Minister, November 1997, Safeguarding the Future: Australia's Response to Climate Change

Table 3.1 Summary of key policy decisions influencing the nature of the model to be used to implement new fuel specifications

<table>
<tr><th>Fuel type</th><th>Policy decision</th><th>Fuel standard</th><th>Introduction date</th></tr>
<tr><td rowspan="2">Diesel</td><td>Euro 2 emission standards for light vehicles</td><td>A maximum content limit on sulfur of 500ppm</td><td>2002</td></tr>
<tr><td>Euro 4 emission standards for all diesel vehicles</td><td>A maximum content limit on sulfur of 50ppm</td><td>2006</td></tr>
<tr><td rowspan="3">Petrol</td><td>The phase out of leaded petrol</td><td>A maximum content limit on lead</td><td>2002</td></tr>
<tr><td rowspan="2">Euro 3 emission standards</td><td>A maximum content limit on sulfur of 150ppm</td><td>2005</td></tr>
<tr><td>A minimum octane rating of 95 RON</td><td>2005</td></tr>
</table>

4 THE COMMONWEALTH PROPOSAL FOR DISCUSSION

The Commonwealth's approach to the identification of a model for national fuel quality standards has been strongly influenced by the decision to harmonise, within the framework of the previously identified guiding principles and Government policy decisions, Australian fuel quality requirements with UN ECE (Euro) fuel specifications.

The preference for this approach is clearly flagged in the manner in which the Fuel Quality Review (FQR) was conducted. The Review (see Paper 1) modelled the air quality and greenhouse gas emission reductions (and economic costs) for a range of different fuel standards based on the adoption of variations of the Euro 3 and 4 fuel specifications over the next decade. The Euro 3 and 4 fuel specifications are based on maximum and minimum content limits for specific fuel parameters. [Euro 2 fuel specifications also include content limit ranges for some parameters (such as petrol density).]

This base model – of establishing maximum and minimum content limits – is further developed in Paper 2, which sets out the Commonwealth proposal for discussion in terms of specific content limits for each of the key 'environmental' diesel and petrol fuel parameters. Paper 2 also raises the issue of whether or not 'pool averaging' should be allowed for specific parameters, and refers the reader to Paper 3 (this paper) for detailed consideration of the issue.

4.1 Key policy drivers for the model

As noted in section 3 above, the overall fuel quality standards development process, while taking harmonisation with the Euro specifications as a starting premise, has also been influenced by a set of general guiding principles, and a series of specific Government policy decisions. A number of these principles and policy decisions are of particular relevance in determining the model to be used for fuel standards in Australia.

In terms of the guiding principles, the key issues are that the model:

- must facilitate international trade and competition
  - of particular importance in this respect are the supply demand implications for fuel availability given the regional (Asia-Pacific) approach to the establishment of fuel standards; and
  - the need to ensure that the model does not impede competition either between Australian refiners, or with imported refined product.
- should, if possible, provide flexibility in terms of compliance to minimise costs for all stakeholders
  - flexibility provisions must not, however, impede competition or trade; and
- must not add significantly to legislative / regulatory complexity or implementation / enforcement costs.

Key Commonwealth policy decisions influencing the choice of model are those which pre-determine specific levels for certain fuel parameters – most notably the MBE decisions with respect to the sulfur content of diesel and the ADR implications for the sulfur content and RON levels for petrol. These are maximum and minimum limits, and effectively dictate that if any model other than the 'flat limits' model (see section 5 below) is selected, the model will need to be a 'combined' model which includes flat limits.

4.2 Assessment of existing models

In identifying and developing its preferred model for fuel standards the Commonwealth has considered the range of models, and variations on those models, currently in use around the world. As noted in the introduction, there are three general categories of model – flat limits, averaging limits and emission limits. The models are discussed in the following three sections. The discussions are organised around:

- the details of the model;
- where the model has been adopted (and how it operates in that context) and any specific variations that may have been incorporated; and
- the advantages and disadvantages of the model – with particular consideration of the key Commonwealth policy drivers identified in section 4.1.

Relevant data from the Fuel Quality Review have also been used to inform the discussion.

4.3 The preferred model

The Commonwealth's proposed model is the use of flat limits (maximum and minimum levels) with averaging/cap limits as an alternative compliance option for specified parameters.

5 THE 'FLAT LIMITS' MODEL

The primary element of all models is a set of limits that apply to petrol or diesel when it is first supplied from the production (typically a refinery) or import facility. These limits must be equally applied throughout the petrol and diesel distribution system.

5.1 Introduction

The 'flat limits' model requires that each batch of fuel supplied by a refiner or importer or blender must comply with a certain limit (maximum, minimum or actual) for specific fuel parameters. In some circumstances, both a minimum and maximum limit may be specified (providing for a range). The latter example often applies where the properties of fuel parameters are strongly influenced by airshed conditions and climatic zones. The limit is specified in regulations and must be met by every litre of fuel leaving a refinery/import facility.

5.2 Application/adoption of the model

Internationally, the flat limits model is the most widely used model for the establishment and implementation of petrol and diesel quality specifications.

The majority of countries with standards have adopted flat limits for diesel parameters, most notably for the management of sulfur content. An exception is California, which allows for an alternative compliance mechanism of a 'diesel formulation', provided a refiner can demonstrate with engine testing that their fuel produces emissions at least as low as a reference fuel (see section 7 below on emission limits models). It has been suggested, however, than in practice, pre-determined correlations are used in place of engine testing. The Californian specifications also allow for partial exemptions for some diesel parameters based on refinery size/capacity.

Flat limits are also widely applied in the establishment of petrol specifications, notably in the European Union and many South East Asian countries. In North America, while a number of compliance options are provided in relation to reformulated gasoline (RFG) specifications (flat limits, averaging limits and emission limits models), for some parameters (such as oxygen content) compliance with flat limits is mandatory and no alternative compliance options are provided.[17]

[17] Notice of Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations. Title 13. p.p.1-11. 12/10/99

Box 5.1: Use of flat limits in Australia

Where fuel quality parameters have been regulated in Australia, flat limits have typically been used. After the introduction of unleaded petrol in 1985, a number of States and Territories regulated the lead content levels of both leaded and unleaded petrol. In doing so, they set flat limits. For example, in New South Wales, the lead limit for leaded petrol was set at a maximum of 0.2g/L, and for unleaded petrol at a maximum of 0.013g/L.[18]

More recently, revised fuel quality regulations introduced in Western Australia include flat limits for a number of different fuel parameters. For example, petrol benzene limits are set at a maximum of 2.0% by volume.[19]

5.3 Advantages and disadvantages

As noted in section 4 above, there are a number of Commonwealth policy decisions which have a direct bearing on the nature of the model which will need to be implemented in Australia. In particular, the Government's decision regarding the establishment of maximum diesel sulfur content levels (500ppm in 2002 and 50ppm in 2006) requires the use of flat limits for this parameter. Any model adopted in Australia must ensure that Government policy decisions can be effectively implemented.

From a practicality point of view, there are also other parameters that need to be set at a maximum or minimum level due to their impact on engine performance or after-treatment efficiency (ie the 'technology enabling' parameters – such as octane levels in petrol). Industry generally concurs that it is appropriate to apply flat limits to parameters where consistency is necessary to allow vehicle engines to operate efficiently in terms of performance, fuel economy and emissions.[20] However, industry also considers that the flat limits approach to standard setting reduces refinery flexibility in terms of compliance.

The use of flat limits to establish petrol and diesel fuel quality standards is the most common approach adopted internationally. The adoption of this model in Australia would therefore be consistent with COAG principles for national standard setting and regulatory action which state that wherever possible standards should be compatible with relevant international or internationally accepted standards or practices in order to

[18] Clean Air (Motor Vehicles and Motor Vehicle Fuels) Regulation, 1997. Section 14.1
[19] Environmental Protection (Diesel and Petrol) Regulations 1999. Schedule 2. P.16
[20] Coffey Geosciences Pty Ltd, 2000, FQR, p. 4 - 8

minimise impediments to trade.[21] In the European Union, flat limits were adopted to promote both air quality improvements and the removal of trade barriers.[22]

Of particular relevance to Australia are the practices current (or likely to be adopted) in the Asia-Pacific region. As the move towards improved management of fuel quality gains pace in this region, the trend appears to be towards the adoption of flat limits. (See Paper 2 for details of fuel specifications in place in the Asia-Pacific region). In the medium to long term, regional harmonisation of fuel specifications will increase the Australian refining industry's ability to export product on a competitive basis, as well as facilitating imports, if this is required to meet demand.[23] The is in keeping with the vision identified for the domestic refining industry, articulated in the recent Downstream Petroleum Products Action Agenda.[24]

The flat limits model also has significant advantages in terms of simplicity. As such, it is the least complex model to implement, administer and enforce from a government perspective. This offers significant cost advantages from a regulatory perspective. It is, however, limited in the flexibility it provides to industry in terms of compliance options.

5.4 Summary

- The 'flat limits' model
  - specifies maximum, minimum or actual limits for specific fuel parameters. It may also allow for a limit 'range';
  - is the most commonly used model internationally. This is notably the case with diesel specifications, but it is also widely applied to the management of petrol quality;
  - is widely used in the Asia-Pacific region, and as such its adoption in Australia would be consistent with COAG standard setting principles and the long-term facilitation of international trade and competition;
  - is the least complex model to implement, administer and enforce from a government perspective;
  - is limited in the flexibility it provides to industry in terms of compliance options; and
  - is dictated by Commonwealth policy for use in the management of the sulfur content of diesel from 2002.

[21] COAG, 1997, Principle and Guidelines for National Standards Setting and Regulatory Action by Ministerial Councils and Standard-Setting Bodies.
[22] Pers. Comm. Michael Dunne, UK Department of the Environment, Transport and the Regions, January 2000.
[23] Pers. Comm. Costa Tsesmelis, Protos Consulting International, April 2000.
[24] DISR, 1999, Downstream Petroleum Products Action Agenda, p. 14.

6 THE 'AVERAGING LIMITS' MODEL

6.1 Introduction

Averaging limits are applied to fuel produced by a refinery / importer over a certain time period and usually include a cap limit. Under the averaging limits option, producers may assign limits to different batches of fuel that may exceed a 'flat limit' as long as fuel produced over a given period meets a designated average and in some cases, never exceeds a cap. The averaging limit is usually applied at each refinery site (or in the case of importers across cargoes) but under some conditions, companies may combine the fuel parameters from more than one of their refineries. The Australian Institute of Petroleum (AIP) has recommended that pool averaging be utilised in Australia across grades of petrol.[25]

The time period over which averaging limits may be applied can vary. For example, they may be monthly, as for Reid Vapour Pressure (as applied by the NSW EPA); half-yearly, as for olefins (as applied in California); or yearly, as for benzene (as applied in Canada).[26]

6.2 Application/adoption of the model

As an example of the averaging option, Californian RFG regulations allow a producer to assign differing designated alternative limits (known as DALs) to different batches of petrol being supplied from the refinery. Each batch of petrol must meet the DAL for the batch. A producer or importer supplying a batch of petrol with a DAL above the averaging limit must, within 90 days before or after (ie. a total 180 day period), supply sufficient quantities of petrol subject to the DALs to fully offset the excess over the averaging limit.

For example, regulations provide several compliance options for meeting the refiner limits for olefins, one option being the utilisation of a maximum (flat) limit of 6% by volume or an averaging limit of 4% by volume, with a cap 10% by volume. Thus, in terms of flat and averaging limits, a refiner may either produce a batch which does not exceed a flat maximum limit of 6% by volume for olefins, or produce a number of batches of fuel, of which some may exceed the flat limit, but must collectively average 4% by volume and never exceed the cap of 10% by volume.[27] California provides averaging limits for six petrol parameters (see Table 6.1 below).

[25] Coffey Geosciences Pty Ltd, 1999,Review of Fuel Quality – Stakeholder Consultation and Scenario Development. p. 25
[26] Canadian Gazette, 1997, Part 2, Vol 131, No.24 Benzene in Gasoline – Regulations p. 3158.
[27] Notice of Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations. Title 13. p.5 12/10/99

Table 6.1 : California RFG Phase 2 Regulations

Fuel Component or characteristic	Flat limit	Averaging limit	Cap limit
Reid vapour pressure (psi) summer only	7.0	N/A	N/A
Sulfur (ppm)	40	30	80
Aromatic Hydrocarbons (max % by volume)	25	22	30
Benzene (max % by volume)	1.0	0.80	1.20
Olefins (max % by volume)	6.0	4.0	10.0
Oxygen (% by weight)	1.8-2.2	N/A	N/A
Temperature (°F, max) at 50% distilled	210	200	220
Temperature (°F, max) at 90% distilled	300	290	330

Internationally, averaging limits have not been adopted as widely as flat limits.

North America utilises a combination of models that rely on averaging limits. Under the US complex model – an emission model (see section 7) - refiners may comply with standards either on a batch (per gallon) basis (ie flat limit) or a quarterly average basis. Under the US regulations, the averaging limits are numerically more stringent than the flat limits, but provide greater flexibility to refiners in meeting requirements.[28]

In Canada, flat limits or yearly pool averages are set for benzene and sulfur in petrol. A primary supplier may elect to calculate the concentration of sulfur in petrol on the basis of a single pool average for petrol produced at a particular refinery, blending facility or imported into a particular province. A variety of sulfur levels will be prescribed based on three scenarios (see Table 6.2 below).

Table 6.2: Scenario based sulfur levels - Canadian approach

Scenario	(from 1.7.2002 – 31.12.2004)	(from 1.1.2005)
Scenario 1	300ppm [a]	80ppm
- and in any other case	170ppm	40ppm
Scenario 2	150ppm	30ppm
Scenario 3	300ppm [b]	80ppm [c]

[a] To be enforced from 1.10.2003, the remaining level will be enforced from 1.7.2002.
[b] To be enforced from 1.1.2004 to 31.3.2005
[c] To be enforced from 1.4.2005

Scenario 1 represents the concentration of sulfur in each batch of petrol produced or imported by a primary supplier, when the primary supplier has elected to calculate the sulfur concentration on the basis of a pool average. Scenario 2 represents the pool average for each refinery, blending facility or province of importation, or any combination of them (in respect of which a primary supplier has elected); and scenario 3 represent the concentration of sulfur in petrol sold or offered for sale.[29]

[28] Notice of Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations. Title 13. p. 2 12/10/99
[29] Canada Gazette, Part 2, Vol. 1333, No.13, Sulphur in Gasoline – Regulations p.1475

Box 6.1: Use of the averaging model in Australia

Within Australia, several states utilise averaging limits to manage fuel properties.

In NSW, the Memorandum of Understanding between the government and the oil suppliers for the management of Reid Vapour Pressure (RVP) is based on pool averaging basis over each of the summer calendar months. Suppliers provide calendar-based monthly data on every batch of fuel produced, reporting average, maximum and minimum RVP. As an example, for December 2000 the summer monthly average RVP requirement is 62Kpa. During that month, a refiner may produce individual batches of up to 64Kpa, so long as the monthly average is not exceeded[30].

In Western Australia, recently introduced fuel quality regulations manage petrol RVP on an averaging basis. The time period for averaging is set over any consecutive 30 days (in the inclusive period between 15 October and the following 15 April), and the average RVP is determined from at least 4 samples, taken on separate days at regular intervals within the 30 day period, of the petrol supplied or used by a fuel supplier in that time.[31]

6.3 Advantages and disadvantages

Not all parameters lend themselves to management through the averaging limits model. For example, even within the North American region, which provides the greatest range of compliance options for meeting fuel quality requirements, averaging limits are not an option for some parameters. The applicability of the model to specific parameters within any regulatory system will be influenced by the overall fuel quality management objectives. For example, in California only flat limits are prescribed for oxygen content and RVP in petrol as these are seen as key parameters in the management of ozone (and carbon monoxide) emissions.

Although the average and cap limit approach is more resource intensive (for both regulator and producer) than flat limits, it is considered as allowing for more flexibility in supply. There are a number of advantages associated with the use of a cap limit when applying any model. In California, cap limits apply throughout the petrol distribution system and, for all properties but RVP, are less stringent than the flat limits. This approach allows the imposition of very stringent standards whilst still allowing refiners to vary the composition of individual batches in a cost effective way up to the cap limits, as long as the averaging limit or overall equivalent emissions performance is achieved (see section 7 – emission limits model). It has also been suggested that in the US where the complexities of distribution are orders of magnitude greater than that in Australia,[32] the

[30] Pers. Comm. NSW EPA, April 2000.
[31] *Environmental Protection (Diesel and Petrol) Regulations 1999*, section 10.3.
[32] Pers. Comm. Costa Tsesmelis, Protos Consulting International, April 2000.

averaging limit and cap model allows for effective enforcement of petrol in transit to, or being sold at, service stations and other fuelling facilities.[33]

The cost and complexity of administering and enforcing averaging limits becomes greater when a variety of compliance options (eg. as in California) and limits (eg. prescribed sulfur limits for Canadian gasoline based on production scenarios) are provided to refiners. A significant challenge in allowing for the variation inherent in pool averaging is ensuring that the set of limits are implemented equally throughout the petrol and diesel distribution system. Any advantages afforded by the increased flexibility in compliance must also be provided equally to both domestic refiners and importers to prevent adverse competition impacts.

The AIP, in consultations for the FQR, advocated pooling as an 'environmentally neutral' way of enabling Australian refineries to 'meet' some Euro 4 petrol specifications and lower the costs involved.[34] The pooling concept put forward was to meet benzene, aromatic and olefin requirements, on average, across the range of octane grades supplied to the market, with exceedence of the specified values in the high octane petrol. For example, in order to meet an average olefin limit of 18% by volume in petrol, 20% of olefins could occur in unleaded petrol (ULP) (91 RON) and 16% could occur in premium unleaded petrol (PULP) (95 RON).[35] The rationale for this added flexibility being that the PULP stream is generally lower in olefins as it contains a greater proportion of the high-octane reformate stream. Conversely, the ULP stream is slightly higher in olefins as it contains a greater proportion of the high olefins, but has a lower octane cat cracked stream. Neither an associated cap limit nor an averaging period have been suggested as part of the scheme in terms of its application in Australia. It is also seen as a transitional arrangement, as, over time, the bulk of petrol supplies would be high octane (95 RON – PULP).

The practice of pooling across grades, as suggested by the AIP and its members, may provide refineries with greater flexibility in blending and distribution, and therefore greater control over operation cost. However, the approach appears to go beyond any international practices relating to the use of the averaging limits model. It has, however, been suggested that the degree of monitoring and verification for averaging across grades would significantly increase the cost of compliance.[36] It is also uncertain how the advantages offered by the flexibility provided by averaging across grades within a refinery could be afforded equally to importers and blenders.

It would appear reasonable, however, that where only the cumulative average of a pollutant emitted in a region is an issue, it may be appropriate to consider the management of the relevant fuel parameters in terms of a pool average and cap model to allow for greater flexibility in compliance.

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[33] Notice of Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations. Title 13. p. 2 12/10/99

[34] Coffey Geosciences Pty Ltd, 2000,FQR. pp. 5-9, 7-29.

[35] Presentation to stakeholders at the Fuel Quality Review Workshop November 1999.

[36] Pers. Comm. Costa Tsesmelis, Protos Consulting International, April 2000.

6.3.1 Fuel quality parameters

No diesel fuel quality parameters have been identified by the Commonwealth as possible candidates for pool averaging.

As noted in the preceding section, the AIP identified a number of fuel quality parameters which they considered amenable to the pool averaging approach. In Paper 2, stakeholders are asked to comment on the possible application of the pool averaging model to the following petrol parameters:

- Reid vapour pressure;
- Olefins;
- Aromatics; and
- Benzene.

6.4 Summary

- The 'averaging limits' model:
  - allows the production of batches of fuel over a specified time period which collectively must meet a specified average limit. It may also include a requirement that individual batches must not exceed a specified cap limit;
  - is typically offered as an alternative compliance mechanism to a flat limit thereby increasing refinery flexibility;
  - may be numerically more stringent that the associated flat limit (a trade-off for increased flexibility in compliance);
  - has been far less widely adopted internationally than the flat limits model;
  - is applied to different parameters under different regulatory systems, and its use is influenced by the specific fuel quality management objectives in place in the location in question;
  - is more resource intensive to apply than the flat limits model (in terms of implementation, administration and enforcement) for both governments and producers; and
  - is favoured by the AIP across grades of petrol produced in a refinery as an environmentally 'neutral' means of enabling compliance with tighter fuel specifications in a cost-effective manner.

Stakeholder views on the use of the averaging and cap model are requested.

Consideration should be given to both the general approach to averaging (that is averaging over time) and the AIP's suggestion that the model be adapted to allow averaging across grades within a refinery.

In addition, how will the outcome of pool averaging across grades guarantee the same outcome as applying a uniform standard?

Views are also sought on any potential impacts either proposal may have on competition and trade – will any sector of the market (domestic refiners and importers) be unduly advantaged or disadvantaged by the increased flexibility?

Stakeholders addressing the issue are also asked to identify those parameters which they consider most amenable to the use of this model, within the context of the Government's overall environmental objectives.

7 THE 'EMISSION LIMITS' MODEL

7.1 Introduction

Emission limits models were developed under the US Reformulated Gasoline (RFG) program. RFG has the same components as conventional petrol, however, the components that contribute most to air pollution are further processed and refined.[37] RFG is required to be supplied for cities with the worst air pollution.[38] As a consequence, RFG specifications are more stringent than other US petrol specifications, and greater flexibility in meeting these very stringent standards, via a series of emission models, is provided to refiners. Refiners also have the option to comply with the standards on either a batch per gallon basis (flat limit) or a quarterly average basis (averaging limit).

Emission limits models (such as the 'predictive' and 'complex' models, and certified 'alternative gasoline formulations'), allow refineries to set their own specifications providing they can show that certain emission outcomes (as prescribed by regulation) will be achieved. To assess improvements in emissions performance refiners are also required to use formulae (empirical models) to calculate emission reductions expected from the fuel they produce.[39]

7.2 Application/adoption of the model

To date the adoption of these models is the least widespread international approach for the implementation of fuel quality standards. They have also been used largely for petrol, as opposed to diesel (as they were developed in the US which is largely a petrol market). The models have, however, generated extensive international interest. Such interest is especially evident from industry groups, as the models are considered to provide refineries with maximum flexibility in meeting fuel quality emission requirements. However, even though these models may provide a choice of formulations, and a number of compliance options to meet fuel quality emission requirements, some parameters must still be set at flat limits with no alternative compliance option available. This is further explained by describing the application of the US and Californian RFG regulations.

Under the US RFG program flat limits apply for oxygen content, benzene and heavy metals. No alternative compliance options are available for these parameters. Refiners are also required to use empirical models to assess improvements in emissions performance. For all US RFG, the annual average levels for sulfur, T90 (distillation) and olefins content cannot exceed that refinery's or importer's baseline levels. In addition, they must meet certain volatile organic compound, air toxics and NOx emissions performance requirements, judged against qualities produced in a baseline year. For the

[37] EPA Phase II Reformulated Gasoline – Newsletter Nov 99, p. 2
[38] CONCAWE Report No 6/97 p.152
[39] CONCAWE Report no 6/97 p.152; EPA Phase II Reformulated Gasoline – Newsletter Nov 99, p.1; Pers. Comm. Larry Haslett, US EPA, January 2000.

year 2000 and beyond, the Phase 2 RFG standards specify that the volatile organic compound and toxics performance standards must be no less than those of the formula fuel, or a 25% reduction from baseline emissions, whichever is the more stringent. The US EPA can adjust this standard upwards or downwards, taking into account such factors as feasibility and cost, but in no case can it be less than 20%.[40]

In addition to meeting flat limits for particular parameters, refiners are required to use the 'complex' model to achieve emission outcomes equivalent to prescribed specifications.[41] The complex model is used by refiners to correlate petrol parameters (other than those which are set by flat limits) to the fuels emissions characteristics. Refiners may use their own specifications to meet the emissions standards. The complex emissions model uses formulae to calculate total volatile organic compounds, air toxics and NOx reductions. The exhaust volatile organic compound formulae use regression equations based on the RVP, distillation parameters (E200 and E300, in ^{o}F), sulfur, oxygen, aromatic and olefin contents within specified ranges, together with weighting factors based on the emissions characteristics of old and new technology vehicles. These weighting factors may be changed in future years to match the characteristics of the vehicle fleet/car population.[42]

Phase 2 of the California RFG program came into effect in 1996, with limits even more stringent than those specified in the US RFG program. Given the extreme stringency of the standards, it was considered reasonable to provide a variety of options for compliance. Under these (Phase 2) regulations, refiners are currently allowed to make their own changes to specifications if they can show that emission effects are equivalent to those of the limits, either by the prediction model or by an emission test program to demonstrate the equivalence.[43]

The California Phase 2 RFG regulations contain a compliance mechanism under which a refiner may use the associated Predictive Model to identify alternative flat and averaging limits applicable when petrol is supplied from the refinery. The Predictive Model consists of mathematical equations which predict the changes in exhaust emissions of hydrocarbons, NOx, and potency weighted toxics for four toxic air contaminants (benzene, 1,3-butadiene, acetaldehyde and formaldehyde) that result from different petrol formulations.[44] The Predictive Model is based on data from 18 vehicle emission test programs analysing the relationship of petrol properties and emissions. An alternative petrol formulation is acceptable if there is no increase in emissions of hydrocarbons, NOx, and potency-weighted toxics under the Predictive Model.[45]

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[40] Part 80 – *Regulation of Fuel and Fuel Additives – Reformulated Gasoline*. p.3

[41] CONCAWE Report no 6/97 p.152; EPA Phase II Reformulated Gasoline – Newsletter Nov 99, p.1; Pers. Comm. Larry Haslett, US EPA, January 2000.

[42] Coffey Geosciences Pty Ltd, 2000, FQR, p.3-34.

[43] Notice of Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations. Title 13. p.2 12/10/99

[44] Notice of Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations. Title 13. p.2 12/10/99

[45] Notice of Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations. Title 13. p.2 12/10/99

An alternative option provided by the California Phase 2 RFG regulations allows for certification of alternative petrol formulations based on the results of vehicle emission testing. Under this option, producers must perform a comparative vehicle emissions test program to show that their petrol formulation achieves equivalent emissions compared to a California Phase 2 RFG reference test fuel.[46]

The California Air Resources Board (CARB) has also adopted new diesel fuel specifications (500ppm sulfur and 10% aromatics by volume) to improve diesel fuel quality and ensure low emissions. There is also the option for a refiner to demonstrate, using engine testing, that their diesel fuel produces emissions at least as low as a reference fuel. Most refineries supplying California have taken advantage of the option to use alternative aromatics concentration which have comparable air quality benefits to the flat limits[47].

The use of emission limits models appears somewhat restricted to the US, although some countries have utilised different aspects of the model. For example, several compliance options exist for benzene limits in Canadian petrol. The options include flat limits or emission numbers. Petrol must either contain benzene at a concentration that does not exceed a maximum flat limit of 1% by volume, or 1.5% by volume at a point of sale. Alternatively a benzene emission number based on algorithms of the US complex model can be utilised (these being, 71 during the summer, and 92 during the winter). There is also an option for meeting these requirements on a yearly pool average basis.[48]

The Swedish Environmental Protection Agency (SEPA) proposes that it is advantageous to complement flat limits regulation with a model/calculation formula (such as the US complex model), giving refineries the opportunity to choose their own way of achieving environmental improvements. The SEPA further suggests that data from the European Programme on Emissions Fuels and Engine Technologies (EPEFE) project, together with other available data, could be a good basis for establishing an equivalent European complex model.[49]

Within Australia, it has been suggested there should be no flat or averaging limits and that each refinery should structure its own petrol specifications, so long as it can demonstrate that a certain vehicle emissions outcome would be achieved. It has been further argued that setting fuel specification via a complex formula approach reduces wasted capital expenditure by refiners when there is no demonstrated (or 'real') environmental improvement in terms of reduced emissions using flat limits. This goes beyond the "equivalent outcome" approach, such as in California, where cap limits may not be exceeded.

[46] Notice of Public Hearing to Consider Amendments to the California Reformulated Gasoline Regulations. Title 13. p.2 12/10/99
[47] Californian Air Resources Board, California Environmental Protection Agency, Diesel Fuel Fact Sheet – p.2
[48] Pers. Comm. Francois Lalonde, Environment Canada, January 2000. Canadian Gazette, 1997, Part 2, Vol 131, No.24 Benzene in Gasoline – Regulations p. 3158
[49] Natur Vards Verket, Swedish Environmental Protection Agency, Directive on Fuel Quality – input from Swedish experts to the European Auto-Oil Programme,1995, p.1

Box 7.1: Use of emission limits models in Australia

Emission limits models have not been implemented anywhere in Australia.

South Australia is, however, currently in the process of developing fuel quality legislation based on the US Complex Model. The SA EPA advises that the proposed legislation will be based on a combination of the US EPA Complex Model and California EPA cancer potency factors. They note that this approach enables a comparison of fuels based on air toxics performance.[50] At the time of writing details of the SA model were not publicly available. It is therefore not possible to ascertain what assumptions and/or compromises have been made in adapting the model and factors to South Australian conditions, or what costs are associated with enforcement.

7.3 Advantages and disadvantages

As stated earlier, US (and in particular Californian) fuel standards are extremely stringent (comparisons of US standards with other international standards are presented in Paper 2) and compliance models have been specifically designed to provide refineries with maximum flexibility in terms of cost-effective compliance.[51] The provision of greater flexibility to meet such stringent limits may warrant the high cost associated with the compliance, implementation, administration and enforcement of emission limits models.

Conversely, less stringent standards are unlikely to warrant the high costs associated with the development and implementation of emission models, and the application of alternative models may be more cost-effective. At this stage, the development of an emission limits model for Australia appears an unfeasible proposition, as there is no database which adequately defines the Australian vehicle pool.[52] It is important to note that Australia's car fleet is less homogenous, in terms of emissions performance, than the US car fleet. As a consequence of these factors it is unlikely that a satisfactory result could be achieved from any test fleet.

It is also important to emphasise that like averaging limits, some fuel parameters do not lend themselves to emission limits modelling. Therefore, the adoption of any model, other than the flat limit model, will require a combination of models (eg. averaging limits and flat limits, or emission models and flat limits) and consequently will increase administration, enforcement and compliance costs.

In addition, the stringent fuel specifications and the use of emission limits models in the US presents a number of challenges when in-state fuel demands cannot be met and

[50] Pers. Comm. SA EPA, April 2000.
[51] Californian Air Resources Board, Technical Specifications – Backgrounder Paper 6, p.1
[52] Pers.Comm. Costa Tsesmelis, Protos Consulting International, April 2000 & Gordon Shiels, GP Shiels Consulting Pty Ltd, April 2000.

competitive equity between refineries needs to be maintained. For example, although diesel fuel can also be imported into California, (as long as it meets the specified fuel requirements) California's refineries normally produce sufficient amounts of diesel to meet in-state demand[53]. However, if a refinery is unable to produce sufficient Californian diesel due to unforeseen circumstances beyond its control, it can request a temporary variance from CARB to produce or import diesel that does not meet the Board's requirements.[54]

This added need for flexibility triggers a complex and costly administrative procedure designed to ensure financial and competitive equity across refineries. In most cases, refineries who are granted a variance are required to pay a mitigation fee for each gallon of non-complying fuel produced.[55] This is to ensure that no one refinery can accrue a financial (and competitive) benefit from selling fuel that was cheaper to produce than fuel that did comply with the regulations.[56]

As stated earlier, one of the biggest challenges when implementing any model will be to ensure that the model is applied equally throughout the petrol and diesel distribution system. Californian diesel fuel regulations apply to importers, local producers and retailers. In California, if a breach of the diesel regulations is detected at the retail level, then all parties in the supply chain are deemed to be responsible.[57] Such a comprehensive policing procedure would be complex and costly to administer and enforce.

In conclusion, in terms of costs and trade-offs, emission models are the most resource intensive option. Generally, the models are provided to allow flexibility in supply when very stringent limits are prescribed. Their use has to date been largely restricted to North America.

7.4 Summary

The 'emission limits' model:

- includes models variously described as 'predictive' or 'complex' models as well as certified 'alternative gasoline formulations';
- allows refineries to effectively set their own specifications for fuel quality provided they can show that certain emission outcomes (as prescribed by regulation) will be achieved;
- involves the use of complex formulae for the demonstration of emission outcomes. These formulae include weighting factors based on vehicle emissions characteristics which need to be adjusted as the composition of the fleet changes over time;
- generally still requires compliance with flat limits (or ranges) for certain fuel parameters, with no alternative compliance options available;

[53] California Diesel Fuel Fact Sheet (3/97), p.1
[54] California Diesel Fuel Fact Sheet (3/97), p.2
[55] California Diesel Fuel Fact Sheet (3/97), p.2
[56] California Diesel Fuel Fact Sheet (3/97), p.2
[57] California Diesel Fuel Regulations, Code of Regulations. Section 2282 p.16.

- was developed as an alternative compliance mechanism to compensate (through substantially increasing refinery flexibility) for the introduction of extremely stringent fuel quality specifications designed to manage significant air pollution problems in specific locations;
- has not been widely adopted internationally to date; and
- is complex to administer and extremely resource intensive on the part of regulators in terms development, implementation and enforcement.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The model adopted for the implementation of fuel quality standards in Australia should strike a balance between improvements in environmental outcomes, the provision of refinery flexibility the promotion of international competition. Careful consideration also needs to be given to enforcement, administration and compliance costs, as well as the models currently adopted by Australia's import and export markets.

There are clear benefits to all stakeholders from the provision of a range of options for producers to meet improved fuel quality requirements. Assessment of the advantages and disadvantages of the models currently in use internationally suggests that Australian fuel quality requirements can best be met by allowing the use of a number of options.

While recent Government policy decisions in relation to improved fuel quality have pre-determined the use of the 'flat limits' model for a number of fuel parameters, there are clear cost-effectiveness benefits from including the use of the averaging/cap limits model as an alternative compliance option for specified parameters.

8.2 Recommendations

It is recommended allowance be made for meeting national fuel quality specifications using two options – flat limits and averaging limits.

Averaging limits should be allowed as an alternative compliance option, but only where they are coupled with a cap limit. The use of averaging should be restricted to specified fuel parameters for which flat limits have also been determined. In addition, the use of averaging should be limited to where only the cumulative average of the pollutant (to which the specific parameter is associated) emitted in a region is an issue.

Pool averaging has not been identified as appropriate for any diesel fuel quality parameters. Petrol parameters for which pool averaging has been suggested as an alternative compliance mechanism include Reid Vapour Pressure, Olefins, Aromatics and Benzene (see Paper 2).

The emissions limits model, while providing maximum compliance flexibility for refiners, is, in terms of costs and trade-offs, by far the most resource intensive option. It is the least used of all the models, and was developed as an option for addressing extremely stringent fuel quality requirements. The less stringent fuel quality specifications (ie harmonisation with the European Union and not the US or Californian

RFG programs) proposed for Australia do not, at this stage, warrant the high costs associated with the adoption of emission limits models.

Consideration of the use of this model may be appropriate in the future, but it is not recommended for inclusion as a compliance option at this time.

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