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SETTING NATIONAL FUEL QUALITY STANDARDS

A Submission by

MOBIL OIL AUSTRALIA PTY LTD

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1. Executive Summary

Mobil fully supports the Federal and State governments' objective to improve urban air quality and recognises the desired environmental outcomes behind the Measures for a Better Environment (MBE) legislation and other vehicle emission and fuel quality initiatives.

However, the introduction of cleaner fuels will require both refinery investment and increased operating cost at a time when it is widely recognised that the financial health of the Australian refining industry is poor and its future uncertain. The Federal Government recognised this in its Downstream Action Agenda launched in November 1999 when it said "The Australian petroleum industry is in crisis. As currently structured, its high costs make it internationally uncompetitive. Its profitability is low and declining, having more than halved in recent years, and yet it urgently need to be able to fund investment to meet the Government's timetable for new fuel specifications and greenhouse gas reductions."

Consequently, in developing its response to Environment Australia's draft Fuel Quality proposals, Mobil has sought to identify the most cost-effective pathway to deliver the desired environmental outcomes. This approach minimises the detrimental impact of the introduction of the new fuel specifications on the financial viability of the refining and associated petrochemical industries.

Mobil's response can be categorised into five issue areas. Details on each of these issues can be found in the body of this submission.

1.1 Environmental Equivalence

Mobil supports the adoption of an Environmental Equivalence methodology to setting fuel quality rather than rigidly prescribing individual specifications around each element of the fuel specification. This approach will provide manufacturing flexibility and will lower the cost to achieve the targeted environmental outcomes. Various forms of the Environmental Equivalence methodology have already been adopted in the USA and are being adopted by South Australia Thailand.

Specifically, Mobil supports:

- Use of "emission limit" or predictive models and a potency weighted Air Toxicity Index (ATI) for setting petrol specifications equivalent to the proposed Euro specifications
- Recognition in the new fuel specifications of diesel additives that can deliver environmental outcomes equivalent to the lowering of the sulphur level in Diesel
- Use of pooling and averaging mechanisms to evaluate conformance of refineries with the new fuel specifications. Both averaging and pooling allow the refiners/suppliers to meet the specification by averaging over a period of time or number of batches. Averaging applies to a single grade of product eg unleaded petrol whereas pooling allows the averaging to be applied across all grades of that product eg leaded, unleaded and premium unleaded petrol.

1.2 Implementation Timing

The timing of the introduction of new fuel standards is critical for a number of reasons.

- Sufficient lead time is required to enable the refineries to evaluate, design and construct the new facilities required to manufacture the new clean fuels. In Europe and the USA this period has typically been 4 to 6 years for major new specifications.
- Experience has shown that providing sufficient lead time to design new facilities enables the adoption of innovative engineering solutions that can lower the overall cost of investment
- Advancing the introduction of new clean fuels before a critical mass of the vehicle fleet has the engine technology to exploit them will not achieve the intended benefit – and may actually be detrimental to the environment since the new fuels will require additional processing that will increase refinery greenhouse emissions.

In summary, Mobil supports maintaining the "Measures for a Better Environment" legislation implementation timetable. Mobil does not support Environment Australia's proposal to bring forward the introduction of a number of specifications to the start of 2002 because Mobil would be unable to evaluate, design and construct new facilities to meet this accelerated timetable. In addition we can not guarantee supply from our regional refining assets in the same timeframe.

1.3 National Environmental and Performance Specifications

Mobil supports the introduction of detailed Australia-wide petrol and diesel specifications covering both environmental and performance specifications. The specifications must apply to all suppliers – local refiners, importers & blenders. This will ensure a "level playing field" for all participants in the industry and will also support achievement of the targeted environmental benefits. The specifications should be set jointly by oil and auto industries, representatives of the consumers, and Government Industry and Environment departments.

1.4 Greenhouse Emissions

Although not part of the discussion on setting national fuel standards, as noted above, the production of "cleaner fuels" requires additional processing at the refinery. This is energy intensive and will significantly increase refinery emissions including greenhouse gases. As noted in the Downstream Action Agenda, Mobil, along with the other refiners, believes the industry should not be penalised for the additional refinery greenhouse emissions generated by the manufacture of the new clean fuels. The capital and ongoing operating costs to mitigate or offset the greenhouse emission will be significant and this issue will be a factor for Mobil when it evaluates the economics of making the investments required for manufacturing the new fuel specifications. Government needs to provide sufficient clarity regarding the allocation of greenhouse credits/targets to the refiners as a prelude to their investment decision.

1.5 Incentives

Mobil does not support excise incentives or other financial mechanisms that do not achieve tangible environmental benefits or are practicably not available to all refiners/suppliers. The excise incentive for 95 octane petrol proposed by several stakeholders is likely to increase net emissions including greenhouse in the short term and will be counter productive. As acknowledged by the auto manufacturers and noted by Environment Australia, using petrol with an octane rating higher than that required will not improve the engine's performance and hence emissions whilst refinery emissions will increase.

In conclusion, Mobil supports the objective to improve air quality. However, the issues are complex and the outcomes will determine the future of the Australian refinery industry. We look forward to continuing a dialogue with the Federal and State Governments, Environment Australia, and other stakeholders, to develop by the end of this year a plan for the introduction of new fuels standards in Australia that will deliver the targeted environmental outcomes in the most efficient manner possible.

Table 1: Mobil's Recommendations on Diesel Specifications

Parameter	Specification	EA's Proposed Date of Introduction	Mobil's Recommendation
Sulphur	500 ppm (max)	1/1/02	1300 ppm by 1/1/02 500 ppm by 12/02 **(1)
	50 ppm (max)	1/1/05 – 6	50 ppm from 1/1/06 per MBE
	30 ppm (max)	1/1/08	**(2)
Cetane Index	47 (Min)	1/1/02	46/49 CI/CN = Euro 2 **(3)
	50 (Min)	1/1/06	46/51 CI/CN = Euro 3 **(3)
Density	820 – 850 kg/m3	1/1/02	860 = Euro 2
	820 – 845 kg/m3	1/1/06	850 for refinery flexibility
Distillation, T95	360 C (max)	1/1/02	370 = Euro 2
	350 C (max)	1/1/06	360 = Euro 3
PAHs	11 % max	1/1/06	11% = Euro 3
Ash & suspended Solids	100 ppm (max)	1/1/02	Agree
Viscosity @ 40 C	2.0 - 5.0 cSt	1/1/02	2.0 – 4.5 = Euro 2 & 3

Notes

1. *500 ppm or equivalent particulate (PM) emissions. Timing can be advanced to 2001 if "equivalence" is approved and Cleanerburn is approved for use.*
2. *To be determined recognising the requirement of vehicles being introduced world wide post 2008.*
3. *Euro specs include minimum Cetane Index (CI) and Cetane Number (CN). This permits refiners/suppliers to use cetane improvers to improve cetane where economic. Euro 4 specs have not been finalised.*

Table 2: Mobil's Recommendations on Petrol Specifications

Parameter	Specification	EA's Proposed Date of Introduction	Mobil's Recommendation
Sulphur	150 ppm (max)	1/1/02	500 ppm = Euro 2
	50 ppm (max)	1/1/05-06	150 ppm = Euro 3 in 2005 per MBE
	30 ppm (max)	1/1/08	**(1)
RON	ULP - 91 (min)	1/1/02	Agree
	PULP - 95 (min)		**(2) Australia wide 2004
MON	ULP - 81 (min)	1/1/02	Agree
	PULP - 85 (min)		Agree
RVP	67 kPa	1/1/02	Agree
(summer)	62 kPa	1/1/05	Agree
	58 kPa	1/1/08 -10	60 kPa per Euro 3
Distillation	FBP – 210 C	1/1/05	Agree
Olefins	18% vol max	1/1/02	Agree
	16% vol max	1/1/05	*(3)
Aromatics	45% vol max	1/1/02	48%
	42% vol max	1/1/05	*(3)
	38% vol max	1/1/08 - 10	*(3)
Benzene	3% vol max	1/1/02	5% per Euro 2
	2% vol max	1/1/05	3% provided Air Toxics met **(3), or 2% per EA Proposal
Lead	0.013 g/l max	1/1/02	Agree
	0 g/l maxl	1/1/05	0.005 g/l per Euro 3 & 4
Oxygen	2.7% max	1/1/02	Opposed to the use of MTBE

Notes

1. *To be determined recognising the requirements of vehicles being introduced post 2008.*
2. *95 RON petrol to be available Australia wide by 2004, via conversion of leaded/LRP facilities.*
3. *Benzene, Olefins and Aromatics to be set at* ***either*** *EA's propsed specifications* ***or*** *by equivalent potency weighted Air Toxics Index (ATI) equivalent to Environment Australia's environmental specification for each suppliers petrol pool in 2005 but they will have caps of 3% Benzene, 48% Aromatics and 20% Olefins.*

2. Introduction

Mobil was the first oil company to operate in Australia. It began as Vacuum Oil in 1895. Mobil Corporation recently merged with Exxon Corporation to form ExxonMobil.

Mobil Oil Australia Pty Ltd (MOA) operates ExxonMobil's downstream refining and marketing operations in Australia and the Pacific Islands region. MOA operates two petroleum refineries in Australia, one in Melbourne and the other in Adelaide, as well as seven distribution terminals, eleven coastal bulk plants and supplies (directly or through distributors) to over 1900 service station sites.

In addition to its downstream refining and marketing assets, ExxonMobil also owns 50% of Qenos, one of Australia's largest petrochemical companies. There are strong linkages between Qenos' Altona plant and Mobil's Altona Refinery with Qenos obtaining a significant quantity of its feedstock from the refinery.

As one of Australia's major industrial companies, MOA directly employs over 1700 people and owns assets valued at approximately A$2 billion.

The Pacific Islands forms an integral part of MOA's marketing area. Mobil operates in eleven countries in the Pacific region which are supplied by ship from the refineries in Adelaide and Altona.

Mobil welcomes the opportunity to participate in the Fuel Quality Review and to comment on Environment Australia's three discussion papers relating to the Setting of National Fuel Quality Standards.

3. Fuel Quality Review Process

Mobil fully supports the Federal and State governments' objective to improve urban air quality and recognises the desired environmental outcomes behind the Measures for a Better Environment (MBE) legislation and other vehicle emission and fuel quality initiatives.

However, the introduction of cleaner fuels will require both refinery investment and increased operating cost at a time when it is widely recognised that the financial health of the Australian refining industry is poor and its future uncertain. The Federal Government recognised this in its Downstream Action Agenda launched in Nov 1999 when it said "*The Australian petroleum refinery industry is in crisis. As currently structured, its high costs make it internationally uncompetitive. Its profitability is low and declining, having more than halved in recent years, and yet it urgently needs to be able to fund investment to meet the Government's timetable for new fuel specifications and greenhouse gas reduction*".

Consequently, the development of future fuels specifications is an extremely complex matter with both environmental and economic implications. Mobil fully supports the Fuel Quality Review (FQR) process put in place and sponsored by Environment Australia (EA) to comprehend this complexity and map out the future product quality requirements for transport fuels. Mobil has actively participated in the FQR.

The FQR has followed a rational, consultative process to assess the environmental and cost impacts of different potential fuel quality scenarios. It is the first comprehensive study in Australia to assess the interactions between the competing fuel specifications within the refineries and their impact on refinery and vehicle emissions. Previous studies had only looked at single parameters for both petrol and diesel in isolation.

The FQR was also designed to comprehend the lead time associated with the commercial processes that must be followed to economically assess, design and construct new facilities at refineries to manufacture new fuels.

As part of the FQR EA published some General Principles that would be followed in developing the new fuel specifications. Mobil specifically draws attention to principles numbered four to six:

4. *Fuels standards that directly address environmental or health issues will be determined on the basis of Australian-specific requirements. In some instances, harmonisation with European specifications may be neither necessary nor desirable.*
5. *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.*
6. *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.)*

Source : Environment Australia's 2nd Discussion Paper, Section 3.1 Items 4 to 6

Based on the rational, comprehensive process described above, and in a manner that was consistent with the General Principles developed by Environment Australia, the FQR developed six options for implementing new fuel specifications.

Mobil was disappointed that after consideration of these options Environment Australia chose to develop a new draft proposal that was not consistent with any of the options developed by the comprehensive FQR process. In Mobil's view Environment Australia's draft proposal is not consistent with the approach of the FQR in a number of key areas:

- Lead time for introduction of new specifications
- Some of the proposals are bringing the timing into alignment with Europe and not the Australian ADRs
- Recognition of all possible flexibility options

These issues will be expanded on in the following section.

4. Mobil Issues

In developing its response to Environment Australia's draft Fuel Quality proposals, Mobil has sought to identify the most cost-effective pathway to deliver the desired environmental outcomes. This approach minimises the detrimental impact of the introduction of the new fuel specifications on the financial viability of the refining industry. Mobil believes this approach is consistent with the General Principles published by Environment Australia.

The issues Mobil wishes to raise in its response to Environment Australia's draft proposal can be categorised into five issue areas – Environmental Equivalence, Implementation Timing, National Standards, Greenhouse Emissions and Incentives.

4.1 Environmental Equivalence

Mobil's preferred model for standards implementation is to focus on environmental outcomes and give the refiners flexibility except where specification limits are required to enable exhaust after-treatment technology. Mobil will submit a separate report on environmental equivalence within the next week.

In many places where environmental outcomes and fuel quality are regulated, a combination of these flexibility mechanisms is used. The USA EPA "complex" model is a combination of "emission limit" or predictive models, pooling, averages and caps as is the proposed South Australian Fuel Quality Policy petrol specification. New South Wales uses pooling, caps and averaging for its RVP Memorandum of Understanding as do the Queensland, Western Australian and South Australian RVP regulations. These are all outcome-based specifications. Thailand is also considering the introduction of a "complex" model for petrol.

In summary, Mobil supports the use of predictive models; the use of pooling and averaging where appropriate; and, the use of additives. Each of these is described further below.

4.1.1 "Emission Limit" or Predictive Models

"Predictive" or "Emission Limit" models estimate the relative tailpipe emissions from a fuel compared to a base or reference fuel. Predictive models for petrol are used extensively in the USA and are being introduced in South Australia and being considered for Thailand. The models are based on extensive measurement of tailpipe emissions over a wide range of fuels and a large number of vehicles. The objective is for the tailpipe emissions to be no higher than the standard or reference fuel which in the case of Australia, could be set at Environment Australia's national environmental fuel standard. The US EPA and Californian models (CARB) estimate Air Toxics, NOx and VOC emissions. In the case of California and South Australia models, the Air Toxics are weighted by their relative potency with Benzene being given a factor of 1 to give the potency weighted air toxics. South Australia refers to this as the Air Toxics Index or ATI. The two key components in the ATI are benzene and 1,3 butadienne emissions with the later being smaller in magnitude but has a potency factor 6-7 times that of benzene.

In putting forward the recommendation to incorporate predictive model, Mobil is proposing that refiners/suppliers can choose to meet the specifications by either the Euro type specifications as recommended by EA or the output based equivalent ATI. Such an approach will enhance rather than impede competition and trade. Use of models has not restricted trade in USA. Imported fuel is able to reach the US and California markets from Europe, Latin America and Asia. Fungible RFG is shipped in large volumes across the USA. The models ensure that domestic and imported fuels meet a consistent air quality standard in all portions of the USA.

It has been proposed by some stakeholders that the use of "predictive models" significantly increases compliance costs for government and industry. This is not the case. Regulation of fuel specifications of any kind – whether it is using predictive models or rigid specifications – significantly increases compliance cost since it requires: testing by the refiner and supplier; reporting to the regulators; and, monitoring by the regulator. Regulatory compliance in an environment where predictive models are in place has only one relatively simple step in addition to the steps associated with ensuring compliance with rigid specifications. When using predictive models the results need to be entered into a computer spreadsheet to determine whether a batch meets the required emission equivalence and to monitor the average or pooling of batches over the regulated time frame - this is not a costly exercise.

The discussion papers overstate the difficulty of implementing a fuel regulation model. The papers assume that an entirely new emissions testing program would have to be conducted for Australia. However the emissions model or portions of the emissions model could be easily borrowed from the USA. The USA models were based on over 40 vehicle measurement programs involving 5,000 to 10,000 emission tests using hundreds of different vehicles and fuels covering a wide range of catalyst vehicles very similar to the ones on the road in Australia. The fuel/emission relationships that are included in the USA RFG emission model are more likely to produce desired environmental outcome than fixed fuel specifications that control some properties that affect emissions but allow other properties to vary. Without a model Environment Australia is forced to make arbitrary judgements about the impact of various fuel properties.

Australia could adopt all or a portion of the US models. Air toxics are a clear priority and the main reason for benzene, aromatics and olefins specifications. A toxics performance model would be a much better method of regulating air toxics emissions than fixed specifications. The model would also decrease refiners' costs.

The air toxics portions of the USA models are applicable in Australia. Emissions of air toxics are controlled by fundamental combustion chemistry. Benzene is present in the fuel and can be emitted directly as unburned fuel or as a combustion product from other fuel components. Other air toxics are not present in the fuel and result from combustion products of other fuel components. Consistent relationships between fuel components and air toxics have been found in many studies and are not overly sensitive to vehicle technology.

Main fuel effects on air toxics are as follows: benzene and aromatics are correlated with benzene emissions, olefins and T90 are correlated with 1,3 butadiene, while oxygenates correlated with the formation of aldehydes (acetaldehyde and formaldehyde). Note that while aromatics are a source of benzene they are not a source of 1,3 butadiene or aldehydes and hence aromatic reduction may increase emissions of these species. The USA RFG models, which are based on thousands of vehicle emission tests, include these fundamental relationships and hence are directly applicable to Australia.

4.1.2 Pooling and Averaging

Pooling and averaging allows refiners and suppliers to produce/buy batches of fuel over a specified time period that collectively must meet a specified average limit. It may also include a requirement for individual batches not exceed a specified cap limit. Averaging normally refers to a single grade of a product e.g. unleaded petrol where pooling normally allows refiners/suppliers to average across the total production/sales of all grades of the same product eg unleaded, leaded and premium unleaded can be pooled to meet the petrol specification. Mobil supports the principles of averaging and pooling, where appropriate, as mechanisms that will deliver environmental equivalent outcomes.

4.1.3 Additives

Additives which aid combustion can significantly reduce emissions from diesel engines including particulate (PM) emissions. The resulting reduction in emissions can be significantly greater than can be achieved by reducing the sulfur content of diesel for use in existing diesels. Ethyl Corporation has developed an additive, Cleanerburn, which Mobil is using overseas, primarily to reduce smoke emissions. Ethyl and Mobil have done testing in Australia to demonstrate its effectiveness in existing vehicles, using an Australian test cycle and to develop a test protocol that can be used to demonstrate to regulatory authorities, the environmental effectiveness of any additive or different blend of alternate fuels. We will submit a separate report on Cleanerburn within the next week.

The approved use of Cleanerburn will enable Australian refiners, including Mobil, to avoid investing in new facilities to manufacture 500ppm sulphur in diesel which will become redundant in 3 to 4 years time when refiners will be required to invest in additional new facilities to make 50ppm sulphur in Diesel. Consequently, the use of Cleanerburn enhances the financial viability of the Australian refineries.

Mobil is prepared to consider making Cleanerburn available to other refiners as a means of advancing the date for introducing 500 ppm sulfur or equivalent emissions from 2002 to 2001.

4.2 Implementation Timing

The timing of the introduction of new fuel standards is critical for a number of reasons.

- Sufficient lead time is required to enable the refineries to evaluate, design and construct the new facilities required to manufacture the new clean fuels. In Europe and the USA this period has typically been 4 to 6 years for major new specifications.
- Experience has shown that providing sufficient lead time to design new facilities enables the adoption of innovative engineering solutions that can lower the overall cost of investment
- Advancing the introduction of new clean fuels before a critical mass of the vehicle fleet has the engine technology to exploit them will not achieve the intended benefit – and may actually be detrimental to the environment since the new fuels will require additional processing that will increase refinery greenhouse emissions.

Mobil does not support advancing the timetable from the MBE as implied in Environment Australia's draft proposal. A number of proposed specifications advancements from 1/12/2002 and 1/1/2005 to 1/1/2002 are unachievable. There is insufficient time to design, construct and commission the projects by 1/1/2002 even if the projects were already approved and engineering commenced.

None of the scenarios studied by the FQR , which were developed in conjunction with EA and its consultants, considered advancing the petrol and diesel timetable from that implied by the MBE legislation. It is Mobil's view that if the FQR had assessed any proposal to advance the implementation of new specifications it would have become evident that it is physically impossible to implement the projects required to meet some of the recommendations in the time available.

Mobil's Altona and Adelaide refineries will be unable to meet a number of the specification changes that have been advanced to 1/1/2002. The proposed advancement of certain specifications will have a significant impact on the refineries' viability with a potential flow-on impact on the Altona petrochemical complex that sources a significant quantity of its feedstock from the Altona Refinery.

The Fuel Quality Review (FQR) showed that the significant emission improvements result from changes in engine and exhaust after-treatment technology combined with changes in fuel quality and that the benefits from using the new fuels in existing engines is significantly smaller. Total emissions form vehicles will progressively increase as new vehicles replace older higher emitting vehicles that are in turn scrapped. When considering environmental benefits, the production emissions need to be taken into account. The production of "cleaner fuels" requires additional processing at the refinery. This is energy intensive and will significantly increase emissions, including greenhouse gases, from the refineries. Therefore the benefits from introducing the new fuels 6 – 12 months ahead of the ADRs is likely to increase the overall emissions with the reduction in emissions from the existing fleet not offsetting the increase in refinery emissions to produce the fuels. Consequently, Mobil does not support requiring the new fuels to be introduced 6-12 months ahead of the ADRs. In the US and Europe fuel quality is not mandated prior to vehicle introduction. On the contrary in the US there will be a phase-in period for the new Tier 2 regulations with intermediate phase-in standards which will result in fuels that do not meet final sulfur standards until several years after the introduction of vehicle standards. Further time is allowed for small refiners and for refiners in portions of the western US where air quality is very good. This phase-in was adopted to ensure cost-effective fuel supply. Mobil will supply the Euro3/4 type fuels in the timeframe of 2005/6 required by the ADRs, either from Australian or regional refineries, however, Mobil cannot commit to supply of fuel meeting the proposed specification from 1/1/2002.

4.3 National Standards

Mobil supports the introduction of detailed Australia-wide petrol and diesel specifications covering both environmental and performance specifications. The specifications must apply to all suppliers – local refiners, importers & blenders. This will ensure a "level playing field" for all participants in the industry and will also support achievement of the targeted environmental benefits. The specifications should be set jointly by oil and auto industries, representatives of the consumers, and Government Industry and Environment departments.

4.4 Greenhouse Emissions

Although not part of the discussion on setting national fuel standards, as noted above, the production of "cleaner fuels" requires additional processing at the refinery. This is energy intensive and will significantly increase emissions including greenhouse gases. As noted in the Downstream Action Agenda, Mobil, along with the other refiners, believes the industry should not be penalised for the additional refinery greenhouse emissions generated by the manufacture of the new clean fuels. The greenhouse emission issue will be a factor for Mobil when it evaluates the economics of making the investments required to manufacture the new fuel specifications. Government needs to provide sufficient clarity regarding the allocation of greenhouse credits/targets to the refiners as a prelude to their investment decision.

4.5 Incentives

Mobil does not support excise incentives or other financial mechanisms that do not achieve tangible environmental benefits or are practicably not available to all refiners/suppliers. The excise incentive for 95 octane petrol proposed by several stakeholders is likely to increase net emissions including greenhouse in the short term and will be counter productive. As acknowledged by the auto manufacturers and noted by Environment Australia, using petrol with an octane rating higher than that required will not improve the engine's performance and hence emissions whilst refinery emissions will increase.

5. Mobil Position Summary

Mobil's position can be summarised as follows:

1) Permit environmental equivalence – both petrol and diesel

2) Provide flexibility to deliver outcomes – permit use of predictive ("emission limit") models and pool averaging where these do not have an adverse effect on engines or after treatment devices. Where appropriate, place caps on critical specifications.

3) Permit additives to achieve the same environmental outcome as lowering sulfur in diesel until 50 ppm sulfur in 2006 (50 ppm is "technology enabling")

4) If environmental equivalence and the use of diesel additives are permitted and Cleanerburn is proven to be effective and approved by the environmental authorities, Mobil is prepared to introduce the equivalent of Euro2 diesel in 2001. Mobil is prepared to consider granting other companies access to Cleanerburn.

5) Euro 3 equivalent petrol – potency weighted Air Toxics Index (ATI) – across the total petrol pool - 2005, limit sulfur to 150 ppm in line with Euro 3 and benzene to 3%. This is the same as the proposed SA regulation but with caps on sulfur and benzene. Suppliers can either supply product against the "hard wire" Euro 3 specs or use the flexibility to certify against the ATI. The key specs are summarised below:

	EA's modified Euro 3 Proposal	Mobil's Pooled Average Proposal
Sulfur (ppm)	150	150
Benzene (wt%)	2	3
Aromatics (wt%)	42	48
Olefins (wt%)	18	20
ATI	Not Considered	Equivalent to EA's proposal

We propose that sulfur be capped at 150 ppm as it is considered a technology enabling parameter. Under a predictive model concept, all fuels will have to meet the maximum ATI calculated by applying Environmental Australia's environmental specifications to the model. Whilst the predictive model does not require caps for individual parameters such as benzene, aromatics and olefins, we have suggested caps to give an idea of the likely maxima that could be supplied and still meet the ATI. It should be noted that for any parameters to exceed the proposed specifications, some other parameter must be lower to offset it.

6) Maintain the three key MBE dates for specification changes as defined by EA in the FQR:
   a) 12/2002 – 500 ppm sulfur ADO (implied Euro 2 specification)
   b) 1/2005 – 150 ppm sulfur Petrol (implied Euro 3 specification ie sulfur & benzene)
   c) 1/2006 – 50 ppm sulfur ADO (implied Euro 4 specification)

   Note: Advancement of this timetable could have severe consequences on the viability of local refiners and associated petrochemical industries in the near term. If the viability of refineries is affected, this will result in increased levels of imports. If the Australian specifications are in advance of the regional refining capability, product meeting Australia's specifications may not be available or command a price premium. Mobil can not guarantee supply from system refineries in the near term but expects to be able to supply from either local or overseas sources in the medium term ie 2005.

7) 50 ppm sulfur petrol when required for future exhaust treatment technology which will be required by the next revision to ADRs. This is not in the MBE but is likely to be required 2008/2010.

8) Support the introduction and regulation of detailed Australia-wide petrol and diesel specifications covering both environmental and performance specifications. The specifications must apply to all suppliers – local refiners, importers & blenders to ensure a "level playing field" and ensure the environmental improvements are achieved. The specifications should be set jointly by oil and auto industries, representative of the consumers (e.g. AAA) and Government - Industry (DISR) and Environment (EA).

9) Greenhouse – The Government to give due recognition to the incremental refinery emissions that will result from producing Cleaner Fuels. This may require the government to exempt the refineries from offsetting the increased emissions from producing Cleaner Fuels from any reduction target or allocation scheme implemented to meet Australia's international obligations under the Kyoto Protocol and other international Greenhouse or Trade agreements.

10) Incorporate Euro 2 specifications (or equivalence) into the national standard through to the move to Euro 3 in 2005. Current Australian refinery petrol production meets Euro 2 specifications.

11) Phase out production of leaded petrol by end 2000. The timing of phasing out leaded petrol in the market place will depend upon the local refiners who supply Mobil in NSW and Queensland.

12) Widespread availability (across Australia) of 95 RON petrol by 2005 in time for vehicles that require 95 RON in order to meet Euro 3 emission standards. Mobil does not support the introduction of an excise incentive to promote 95 RON petrol because moving the petrol pool octane from 91 to 95 it will not deliver net environmental benefits. Other methods such as

fuel specific nozzle size at the pump are available to prevent mis-fueling of vehicles designed for 95 octane and these should be considered ahead of excise incentives.

13) Oppose the use of MTBE.

14) Supports the increased use of LPG and CNG and adoption of the latest engine technology for these fuels.

15) Alternate fuels should be subject to Australian Design Rules (ADRs) and fuel blends must meet same product specifications ie ethanol blends must meet RVP specification.

6. Summary Report of the Review of Fuel Quality Requirements for Australian Transport (Paper 1)

6.1 Overview

The analysis of fuel effects on emissions is incomplete and potentially misleading. Only limited data on fuel effects has been considered. An extensive body of worldwide fuel effect studies has been ignored. For instance Thailand recently has developed a database of USA, European and Asian information which includes 42 petrol and 17 diesel studies. The Australian analysis relies on a much smaller body of information.

The most significant weakness concerns the air toxics 1,3 butadiene, formaldehyde and acetaldehyde. Fuel effects on these species have been ignored even though there is a large body of technical information, which shows a consistent correlation between fuel properties and these species. This is a significant limitation in the EA study, which results in inaccurate prediction of fuel effects on air toxics. A comprehensive analysis of air toxics should be conducted including all known fuel effects and information about toxics potency.

The report does not separate the effects of individual fuel properties on emissions. Properties that have little effect are lumped together in scenarios with properties that have a larger effect. The result is that the individual fuel specification proposals can not be evaluated in detail.

It is important to note that for most pollutants the fuel scenarios studied provide very little benefit before 2005. Most of the projected emission benefits result from the introduction of tighter vehicle standards after 2005. The effect of fuels specifications adopted before 2005 are generally minor yet they could have a significant effect on fuel supply and the long-term success of the entire program.

6.2 Specific comments

The literature reference for emission factors used to evaluate the various fuel scenarios did not contain the information described therefore the emission factors for fuel effects can not be checked. (Samaras 1999)

P 37 "Only limited testing of the emissions response of these unregulated compounds to changes in fuel quality and vehicle technology has been undertaken (Acetaldehyde, Formaldehyde, 1,3,butadiene and PAH)" … "The effects of fuel quality changes on the emissions of these substances have not been modelled in this study". The US Auto/Oil and other programs have developed extensive data on fuel quality impacts on these parameters. Ignoring the impact of fuel properties on these species is a major weakness in the study. In particular olefin effects on 1,3 butadiene are ignored. When cancer potency is considered then 1,3 butadiene impacts are similar in magnitude to those of benzene. Note that while aromatics are a source of benzene they are not a source of 1,3 butadiene or aldehydes and hence aromatic reduction may increase emissions of these species. These and other fuel effects on air toxics should have been examined. A comprehensive analysis of air toxics should be conducted including all known fuel effects and information about toxics potency. If this was conducted the role of olefins would be increased and the role of benzene and aromatics control would be decreased.

P 96 (Sect 4.2.5) incorrectly states that "All four companies (BP, Caltex, Mobil and Shell) have plans for 50 ppm in both fuels". At no stage during the study did Mobil indicate it had plans to produce fuels with 50 ppm sulfur. As required, we provided estimated capital and operating costs for every scenario including 50 ppm sulfur in both fuels but this was not an indication of future plans. Shell made it clear that the future of Clyde Refinery is in doubt as in light of the extremely poor profitability, it can not justify the large capital expenditure required to meet the Clean Fuels specifications.

7. Comments on Discussion Paper No. 2 – Proposed Standards for Fuel Parameter (Petrol and Diesel)

7.1 General Comments / Overview

The proposal contains a patchwork of specifications that will be introduced with very short and impractical lead-times. These regulations will have a significant impact on the refining industry yet the near-term benefits will be very modest. A much more rational approach would have been to set goals for environmental performance and then to select the most cost-effective fuels measures to meet the environmental goals. Environmental performance standards with stringency increasing in a rational manner with time would produce the desired benefits at much lower cost.

The discussion paper does not recognise the time needed to make capital investments in refineries to enable clean fuels production and the feasibility of meeting the proposed deadlines is not addressed in the report. In the USA it has been widely recognised that 4 years are required between the final promulgation of fuel specifications requiring capital investment and the commercial introduction of the new fuel. Examples of the lead-time provided in the USA include RFG complex model promulgation 93 introduced 97, Tier 2 sulfur specs final promulgation 12/99 introduced over period 9/03 – 12/05, CARB phase 2 RFG final promulgation 11/91 introduced 3/96. Europe has also provided significant lead-time before major fuel changes. The adoption of specifications that can not be met by all refiners in the timeframe allowed impedes fair competition and could lead to supply dislocations that could jeopardise the entire clean fuels program.

The sulfur and benzene standards in particular require significant capital investment and are infeasible. These standards are more aggressive than those studied in the FQR report and therefore the emission benefits provided are uncertain but we would expect them to be very small. Furthermore the fleet currently contains vehicle models which are not very sensitive to gasoline sulfur content. The need for advancing minor emission reductions by a few years needs to be balanced against the extreme difficulty in providing the fuel due to the need for refinery capital investment which can not be made in timeframe allowed.

If environmental performance was regulated instead of fixed specifications, then refiners could provide fuel with equivalent environmental performance in the most cost-effective manner. This would allow refiners to vary operating procedures in the early years when environmental standards are less stringent and completion of capital projects is infeasible. This would provide the same environmental performance without disrupting the refining industry.

The paper advocates harmonising fuel regulations with Europe. However global harmonisation of fuel specifications is not justified on environmental or economic grounds. Harmonisation of standards across a geographic region may be desirable in some cases to promote economies of scale and supply but the potential benefits of harmonisation must be balanced against the unnecessary additional costs arising from the broad application of specifications appropriate for one geographic area but not for others. There is greater justification in harmonising vehicle standards because there is economy of scale in designing a vehicle so that it can be produced and marketed throughout Australia and globally. In the fuel industry, differences in crude oils, refinery configuration and market considerations argue against harmonising fuel standards with Europe.

The document claims that there is a close link between European fuel and vehicle standards, however historically this link has been weaker than described in the Environment Australia report. It is only recently that the link between standards for fuel sulfur and advanced after-treatment systems has been made closely. This link will require harmonisation between future fuel sulfur levels and vehicle emission standards, however there is no need to harmonise with all European fuel specifications. Many of these fuel specifications have only minor and fully reversible effects on emissions and are not critical to vehicle operation. Therefore there is no need to adopt European fuel standards verbatim.

Environment Australia has not clearly separated fuel standards that are needed to enable new vehicle technology from those that are desirable from an air quality standpoint. It is only the former that needs to be closely tied to introduction of new vehicles. We would argue that the Euro 4 sulfur standards are the only proposed standards that need to be closely coordinated with new vehicle introduction. The other standards provide emission modest reductions and will not have a significant effect on vehicle operations. The emission reductions associated with these standards could be obtained more cost effectively through a more flexible regulatory scheme based on environmental performance.

The document does not properly characterise European and American transport fuel standards. Environment Australia's proposals limit refiner flexibility through the introduction of numerous fixed specifications, whereas the American approach allows emission reductions to be obtained in a cost-effective manner.

The discussion paper does not consider cost effectiveness and has not separated out the effect of individual fuel property changes. By lumping fuel changes together it is impossible to tell which properties are having the desired impact, and which are more cost effective and should be prioritised. There is a wide range in cost effectiveness for different fuel property changes. The proposal lumps cost-effective fuel specifications with measures that are not cost effective. If standards were based on environmental performance then refiners could choose the most cost-effective measures without arbitrary governmental decisions.

The discussion paper also oversimplifies the relationship between fuel properties and emissions. Only a limited number of fuel studies are cited to justify each specification but some fuel properties have different responses in different vehicle types. A much wider range of fuel studies should have been considered when developing the fuel specification proposal.

7.2 Background

P5: "In addition, gasoline direct engines (GDI), important in meeting fuel efficiency and greenhouse targets, were identified as requiring high octane petrol." There is no reason for GDI to require 95 octane. GDI are more tolerant of lower octane fuel than standard engines ie. at same compression ratio GDI can tolerate lower octane than PFI. Some GDI run on lower octane fuel in Japan.

7.3 Early Provision of Reformulated Fuels

There is no need to introduce fuel before vehicles that require the fuel are introduced. If the fuel introduction occurs before the vehicle introduction then unnecessary fuel costs are born with little or no benefit. Fuel supply could be threatened due to the resulting shortening of fuel production lead-time. In the USA and Europe fuel quality is not mandated prior to vehicle introduction. On the contrary in the USA there will be a phase-in period for the new Tier 2 regulations with intermediate phase-in standards which will result in fuels that do not meet final sulfur standards until several years after the introduction of vehicle standards. Further time is allowed for small refiners and for refiners in portions of the western USA where air quality is very good. This phase-in was adopted to ensure cost-effective fuel supply.

7.4 Diesel

Previous studies have shown a wide range of fuel property impacts in different vehicles. For instance the EPEFE program found opposite trends for some diesel properties in heavy and light-duty diesel vehicles. However no comprehensive study of fuel effects on emissions has been made.

The document should note that fuel effects on diesel emissions are decreasing in modern low-emission engines.

7.4.1 Sulfur

We agree that lower sulfur helps to enable diesel after-treatment and that these after-treatment systems can produce significant reduction in diesel emissions. For this reason we support the long-term goal of reduced diesel sulfur content. We are concerned however that the intermediate diesel sulfur reduction targets contained in the Environment Australia's proposal will severely impact refinery production without providing a significant emission benefit.

Almost all of the emission benefits of lower sulfur fuel in scenarios 2 through 6 in the FQR occur after 2005 as new vehicle technology with after-treatment enters the fleet. The proposed intermediate sulfur reduction from 1300 to 500 ppm for 1/1/2002 produces modest emission benefits because very few diesel vehicles in Australia will have after-treatment at that time and sulfur effects on diesel vehicles without after-treatment are small. Sulfur effects on non-catalyst vehicles are limited to sulfate Particulate Matter (PM) but sulfate is a small fraction of diesel particulate so the reduction in PM emissions will be small, on the order of 5%. This particulate emission reduction could easily be obtained from other fuel modifications at lower cost and with less disruption to supply.

Yet the investment needed to produce 500 ppm sulfur may not be useful in eventually producing 50 ppm fuel. Furthermore the lead-time to produce 500 ppm fuels proposed is too short and can not be met. For these reasons, we are concerned that the intermediate sulfur targets may jeopardize the success of the long-term sulfur reduction program.

We recommend a policy of environmental equivalence that would allow more flexibility to reduce emissions in the short term other than the mandated diesel sulfur standards. This policy would require that refiners demonstrate PM emissions equivalent to 500 ppm sulfur fuel through vehicle emissions testing. A draft protocol for such an emission testing program has been developed and will by submitted to Environment Australia shortly. The emission reduction could be obtained by changing fuel properties other than sulfur or through use of an additive. This program would provide equivalent emissions performance at lower cost and would facilitate the long-term goal of 50 ppm fuel in 2006.

The Euro 3 sulfur level of 500 ppm is not needed to enable the operation of vehicles designed to Euro 2 LD (Light Duty) and Euro 3 HD (Heavy Duty) diesel standards. The Euro3 HD standards will be met without after-treatment so sulfur will have very small effect on these vehicles. Most Euro2 LD will be fitted oxidation catalysts. Those vehicles will have relatively modest emission impacts from higher sulfur fuel. The main effect will be higher sulfate emissions due to catalyst conversion of fuel sulfur to sulfate. This effect is completely reversible and therefore temporary use of higher sulfur fuel will not have a long-term effect on emissions.

There is no need for 350 ppm sulfur to support Euro3 HD vehicles since these vehicles will not have after-treatment and the benefits from reducing sulfur from 500 ppm to 350 ppm will be small. Mandating the 350 ppm sulfur fuels will not enable more fuel-efficient vehicles or new technologies. The proposed 30 ppm sulfur standard for 2008 is premature.

7.4.2 Cetane

P 34 Cetane number (CN) only should be specified, not cetane index (CI) as cetane number is the fundamental property that controls diesel combustion and EPEFE and US results support characterizing cetane effects by cetane number only. This would allow refineries to meet cetane specifications in the most cost-effective way. There is no need to avoid excessive dosage with cetane additives. Note that when CN was raised to 51 in 2000 in Europe the CI spec of 46 was retained, so a CN-CI difference of 3 no longer represents harmonization with Europe.

7.4.3 Density

The reported effect of density on emissions in the EPEFE program is reported correctly however more detailed studies in EPEFE indicated that density effects occurred primarily through physical interactions with in the fuel injection and electronic control systems. Recent work (SAE982486) showed that changes to the engine calibration could considerably reduce the impact of changes in density (and viscosity) on emissions. While reducing density will reduce emissions of PM, the EPEFE program showed that reducing density produces different effects on NOx emissions from the LD (increased NOx) and HD (reduced NOx) fleets.

A density spread (min-max) of at least 30 kg/m3 is needed to allow refinery flexibility.

7.4.4 Distillation Characteristics

Regulation of a single back-end distillation parameter, T95 is recommended.

7.4.5 Mobil's Recommendations

Table 1: Mobil's Recommendations on Diesel Specifications

Parameter	Specification	EA's Proposed Date of Introduction	Mobil's Recommendation
Sulphur	500 ppm (max)	1/1/02	1300 ppm by 1/1/02 500 ppm by 12/02 **(1)
	50 ppm (max)	1/1/05 – 6	50 ppm from 1/1/06 per MBE **(2)
	30 ppm (max)	1/1/08	
Cetane Index	47 (Min)	1/1/02	46/49 CI/CN = Euro 2 **(3)
	50 (Min)	1/1/06	46/51 CI/CN = Euro 3 **(3)
Density	820 – 850 kg/m3	1/1/02	860 = Euro 2
	820 – 845 kg/m3	1/1/06	850 for refinery flexibility
Distillation, T95	360 C (max)	1/1/02	370 = Euro 2
	350 C (max)	1/1/06	360 = Euro 3
PAHs	11 % max	1/1/06	11% = Euro 3
Ash & suspended Solids	100 ppm (max)	1/1/02	Agree
Viscosity @ 40 C	2.0 - 5.0 cSt	1/1/02	2.0 – 4.5 = Euro 2 & 3

Notes

1. *500 ppm or equivalent particulate (PM) emissions. Timing can be advanced if "equivalence" is approved and Cleanerburn is approved for use.*
2. *To be determined recognising the requirement of vehicles being introduced world wide post 2008.*
3. *Euro specs include minimum Cetane Index (CI) and Cetane Number (CN). This permits refiners/suppliers to use cetane improvers to improve cetane where economic. Euro 4 specs have not been finalised.*

7.5 Petrol

7.5.1 Octane

Higher fuel octane allows higher engine compression ratios and greater thermal efficiency. However producing a fuel with higher octane requires more refinery processing increasing energy use at the refinery and can result in a fuel with higher carbon content, hence a comprehensive refining/vehicle study is needed to determine the optimal octane to minimise energy consumption and global CO_2 emissions. It is possible that increasing volumetric fuel efficiency (l/100 km) via increasing octane, may not reduce CO_2 emissions from the vehicles let alone taking into account the additional greenhouse gas emissions from the refineries. A new study for Australia is needed because optimum octane values in other regions may not be the best in Australia due to differences in crude slate and refinery configuration.

Octane does not provide any benefit when provided in excess of vehicle octane requirements. On the contrary requiring excess octane will increase refining costs, energy use, and greenhouse gas emissions without providing any offsetting vehicle benefits and therefore will be counterproductive. A 91 RON ULP grade should be maintained in the future to satisfy the needs of the current vehicle fleet without increasing refinery CO_2 emissions.

As compositional constraints increase, the energy (and hence CO_2 emissions) required to make high-octane gasoline will increase, suggesting that the optimum octane is likely to be reduced. For instance decreasing sulfur results in lower octane due to hydrotreating also lower octane by converting higher-octane olefins into lower octane paraffins. Additional refinery processing is required to get back the lost octane.

There is no need to specify a maximum sensitivity ie. difference between RON and MON as a specification. Whilst this must be taken into account when setting the minimum RON and MON specifications, a specification for sensitivity is not required as refiners will ensure that both RON and MON are satisfied. In practice, refiners can not meet the minimum specifications for both simultaneously and there is usually quality "give away" on one of the octane specifications in order to meet the minimum for the second parameter.

7.5.2 Vapour pressure (RVP)

RVP reduction is by far the most cost-effective means of reducing HC emissions from motor vehicles but there is no need to reduce RVP in areas without HC-related air quality problems. Other fuel properties have only minor effects of HC emissions.

RVP is one of the few fuel properties with emission effects that are typically non-linear, with emissions increasing more rapidly as RVP increases. This is controlled by adopting a suitable cap limit as well as the average standards. RVP averaging within fairly narrow cap limits is allowed in US RFG regulations.

7.5.3 Distillation Driveability Index (DI)

There is no clear reason to regulate Final Boiling Point (FBP). The relationship between FBP and emissions has not been studied however the relation ship between T90, and other mid and back-end distillation properties and emissions has been established. It is more difficult to measure and blend FBP compared to T90.

There is no need to specify distillation properties and driveability index.

Mobil agrees that some form of driveability index is required to ensure that recent "teething" problems with Lead Replacement Petrol in Western Australia do not recur as the industry moves to higher octanes. There are several different driveability indices in use worldwide and Mobil supports AIP's recommendation that a joint oil and auto industry consultative committee research the issue and determine which index and what specification are suited to Australia's conditions and motor vehicles.

7.5.4 Olefins

P73 "Under both phases of the US reformulated gasoline (RFG) program, the olefin specification is a maximum 8.5% max by volume". This is incorrect. The maximum olefin specification is 25%. Olefins are also controlled by RFG emission performance standards and typical US RFG levels are around 12%.

Regulations on octane, benzene and olefins and not consistent with the requirement for higher octane.

P 75 "Only limited testing of emissions response of 1,3 butadiene to changes in fuel quality has been undertaken to date and statistically significant data relating to these effects is not currently available". There is extensive data from US Auto/Oil program and other programs that show a direct link between fuel olefins and 1,3 butadiene emissions. For instance Auto/Oil found that reducing fuel olefin content from 20 to 5 vol.% reduced vehicle 1,3 butadiene by 31.3% in 1983-1985 models and 31.6% in 1989 models. Furthermore very similar reductions were found in a high-emitter test fleet that had inactive vehicle catalysts. This consistency of impact across a wide range of vehicle types is due to the fact that 1,3 butadiene is known combustion product of fuel olefins. Olefins should be regulated through a toxics performance model that includes benzene, 1,3 butadiene and other air toxics.

P 75 "As such the FQR did not model the effect of fuel quality changes on 1,3 butadiene emissions, but determined emissions changes in terms of a percentage of hydrocarbon emissions". This procedure will not provide the correct estimate of the impact of fuel olefin content on 1,3 butadiene emissions. Reducing olefins increases HC emissions but reduces 1,3 butadiene emissions.

No significant non-linear effects of olefins on emissions have been found. Olefins are a good candidate for regulating by averaging.

7.5.5 Aromatics

The primary benefit of reducing aromatics is reduced benzene emissions. The US Auto/Oil program found however this must be balanced against an increase in 1,3 butadiene, formaldehyde and acetaldehyde emissions as aromatics are lowered. Aromatics should be regulated via an overall air toxics standard and model, which includes all fuel properties that impact upon toxics emissions.

P78 "Reducing the aromatic content of petrol also contributes to the reduction of NOx". No clear relationship between NOx and aromatics has been found in emissions studies. Engine-out NOx emissions can increase with increasing aromatic content due to higher peak flame temperatures with aromatic fuels. Many catalyst cars however, when operating with fully warmed up catalysts show the opposite effect, ie. reduced catalyst-out NOx with higher aromatic content fuels. This effect can be large enough in the hot part of the test cycle to overcome the flame temperature effect seen in the cold part, leading to an overall reduction in NOx with higher aromatic fuels. Many test programs including EPEFE have shown this effect which is clearly due to improved catalyst efficiency with higher aromatic fuels. The US Auto/Oil program also found no effect of aromatics on NOx emissions.

P78 "The US specifications under the reformulated gasoline program are maximum limits by volume as follows: Phase 1 (January 1995) 27% and Phase 2 (January 2000): 25%." These are incorrect. Maximum aromatics limits in US RFG are 50 vol.%. The California values that follow are also incorrect (maximum of 22%). California standards are 22% average with 30% cap or 25% per gallon flat limit.

There is no evidence for any non-linear effects of aromatics on emissions therefore aromatics are a good candidate for pool averaging.

7.5.6 Benzene

P84 "The US set a flat limit of 0.8% benzene by volume from January 1995." This is incorrect. The actual standard is 1.0%.

7.5.7 Sulfur

Lower fuel sulfur helps improve the performance of vehicle after-treatment systems. Lower sulfur is most beneficial in the long term to ensure good performance of advanced vehicle after-treatment that will be introduced in Australia in 2006 and beyond. There will only be very modest benefits however from reducing gasoline sulfur from 500 to 150 ppm in 2002. Yet this intermediate step will produce a severe hardship on refiners and could jeopardize the long-term sulfur reduction strategy.

The reduction in pool average sulfur will be small because pool average sulfur is already around 150 ppm, but some refiners will be severely impacted due to the short lead time and the requirement for capital investment to ensure that all gasoline batches are below 150 ppm. Extensive data from the Auto/Oil and EPEFE programs demonstrates that 1990s technology European, US and Japanese vehicles that are currently on the road in Australia are only modestly sensitive to sulfur. Typical emission impacts in these vehicles are only a few percent per 100 ppm reduction in sulfur. Since the expected change in pool average sulfur for the 150 ppm standard is small the overall effect on emissions will probably be less than 1%.

P90 – Lean-burn technology is more sensitive to sulfur than standard stoichiometric engines if NOx trap technology is employed, however, introduction of this technology into Australia is uncertain. The requirement for low-sulfur should be coordinated with the introduction of vehicle technology.

P93 – "Sulfur standards can be reduced from 50 to 30 ppm with no additional capital expenditure." There will be an increase in cost in going from 50 to 30 ppm. ***

There is no reason to introduce the fuel before vehicle standards are introduced. Early introduction of the fuel compounds the infeasible schedules in the proposal. Introduction of fuel standards before vehicle standards has not been required in the US or Europe. On the contrary in the US, the Tier 2 gasoline sulfur standards are being phased-in such that the vehicles in the first couple of years will not always have the ultimate sulfur level. This was done with the recognition that sulfur effects on emissions were largely reversible so that there would not be any significant long-term effect on emissions.

7.5.8 Lead

P 98 Lead standard of 0 g/l is impractical due to trace contamination from distribution system and other sources. More practical lead standards that have been adopted in Europe (0.005 g/l) and USA (.05 g/gal) should be adopted.

7.5.9 Oxygen content

P98 Oxygen effects on driveability. The largest effects of oxygen on driveability have been found at very low ambient temperatures that do not occur in Australia

7.5.10 Mobil's Recommendations

Table 2: Mobil's Recommendations on Petrol Specifications

Parameter	Specification	EA's Proposed Date of Introduction	Mobil's Recommendation
Sulphur	150 ppm (max)	1/1/02	500 ppm = Euro 2
	50 ppm (max)	1/1/05-06	150 ppm = Euro 3 in 2005 per
	30 ppm (max)	1/1/08	MBE
			**(1)
RON	ULP - 91 (min)	1/1/02	Agree
	PULP - 95 (min)		**(2) Australia wide 2004
MON	ULP - 81 (min)	1/1/02	Agree
	PULP - 85 (min)		Agree
RVP	67 kPa	1/1/02	Agree
(summer)	62 kPa	1/1/05	Agree
	58 kPa	1/1/08 -10	60 kPa per Euro 3
Distillation	FBP – 210 C	1/1/05	Agree
Olefins	18% vol max	1/1/02	Agree
	16% vol max	1/1/05	*(3)
Aromatics	45% vol.max	1/1/02	48%
	42% vol max	1/1/05	*(3)
	38% vol max	1/1/08 - 10	*(3)
Benzene	3% vol max	1/1/02	5% per Euro 2
	2% vol max	1/1/05	3% provided Air Toxics met
			**(3), or
			2% per EA
Lead	0.013 g/l max	1/1/02	Agree
	0 g/l maxl	1/1/05	0.005 g/l per Euro 3 & 4
Oxygen	2.7% max	1/1/02	Opposed to the use of MTBE

Notes

1. *To be determined recognising the requirements of vehicles being introduced post 2008.*
2. *95 RON petrol to be available Australia wide by 2004, via conversion of leaded/LRP facilities.*
3. *Benzene, Olefins and Aromatics to be set at either EA's propsed specifications or by equivalent potency weighted Air Toxics Index (ATI) equivalent to Environment Australia's environmental specification for each suppliers petrol pool in 2005 but they will have caps of 3% Benzene, 48% Aromatics and 20% Olefins.*

8. Comments on Discussion Paper No.3 – "Proposed Model for Standards Implementation"

8.1 General Comments

The paper overestimates the difficulty of implementing regulations based on environmental performance and underestimates the benefits. Regulating environmental performance would provide superior environmental outcomes at reduced cost. Procedures to provide environmental equivalence could be borrowed from US experience and applied in Australia.

The paper does not accurately characterise USA and Californian regulations. Both the US and California regulate gasoline using emission models while California regulates diesel using an emissions testing protocol. The paper understates the benefits of gasoline emission models and the California diesel test procedure in the USA and overstates the importance of fixed specifications in US and Californian regulations.

The use of emissions models to regulate RFG has been very successful in the USA and California. The RFG emission models have produced consistent air quality benefits at the lowest possible cost. Use of the models has allowed refiners to focus on improving fuel properties that have the biggest impact on emissions and are the least expensive to control like RVP, sulfur and benzene. Models also provide flexibility when market forces, refinery upsets or other unforeseen events occur. The models are easy to use and have been incorporated into software that plans and optimizes refinery production and blends gasoline.

Use of models has not restricted trade in USA. Imported fuel is able to reach the US and California markets from Europe, Latin America and Asia. Fungible RFG is shipped in large volumes across the USA. The models ensure that domestic and imported fuels meet a consistent air quality standard in all portions of the USA. The fixed specifications proposed for Australia will allow a much wider variation in air quality impacts than adoption of a model-based regulation.

The few flat limits in the USA rules are mainly included for historical and political reasons and are the least cost effective and most controversial portion of the USA regulations. Recently California has moved away from fixed specifications for RVP and oxygen and will now allow all regulated properties to vary with a model. There is also movement in the USA to remove the oxygen mandate from RFG.

The paper states that an emissions modeling approach is not needed in Australia because regulations are not as stringent as in the USA. However a model is most valuable when many fuel properties are being regulated simultaneously as is the case in Australia. The value of a model increases as the number of regulated fuel properties increases. It becomes very difficult to blend a fuel when there are numerous fixed specifications. The model allows trade-offs between the properties significantly increasing flexibility The models would also reduce the cost of compliance by allowing individual refineries to optimize performance in the most cost-effective manner.

The document overstates the difficulty of implementing a fuel regulation model. The paper assumes that an entirely new emissions testing program would have to be conducted for Australia. However the emissions model or portions of the emissions model could be easily borrowed from the USA. The USA models were based on over 40 vehicle measurement programs involving 5,000 to 10,000 emission tests using hundreds of different vehicles and fuels covering a wide range of catalyst vehicles very similar to the ones on the road in Australia. The fuel/emission relationships that are included in the USA RFG emission model are more likely to produce desired environmental outcome than fixed fuel specifications that control some properties that affect emissions but allow other properties to vary. Without a model Environment Australia is forced to make arbitrary judgements about the impact of various fuel properties.

Australia could adopt all or a portion of the US models. Air toxics are a clear priority and the main reason for benzene, aromatics and olefins specifications. A toxics performance model would be a much better method of regulating air toxics emissions than fixed specifications. The model would also decrease refiners' costs.

The air toxics portions of the USA models are applicable in Australia. Emissions of air toxics are controlled by fundamental combustion chemistry. Benzene is present in the fuel and can be emitted directly as unburned fuel or as a combustion product from other fuel components. Other air toxics are not present in the fuel and result from combustion products of other fuel components. Consistent relationships between fuel components and air toxics have been found in many studies and are not overly sensitive to vehicle technology.

Main fuel effects on air toxics are as follows: benzene and aromatics are correlated with benzene emissions, olefins and T90 are correlated with 1,3 butadiene, while oxygenates correlated with the formation of aldehydes (acetaldehyde and formaldehyde). Note that while aromatics are a source of benzene they are not a source of 1,3 butadiene or aldehydes and hence aromatic reduction may increase emissions of these species. The USA RFG models, which are based on thousands of vehicle emission tests, include these fundamental relationships and hence are directly applicable to Australia.

Another option would be to develop an integrated database of USA, European and other emission data and to perform statistical analysis to develop a new model for Australia. Thailand is currently developing an emissions model following this approach and has developed a large database of USA, European and Asian studies.

The Environment Australia paper also improperly characterizes California diesel rules. California adopted a flat limit of 10 vol. Aromatics but also allowed refiners to certify alternative fuel formulations with emissions performance that are equivalent to those produced by a reference fuel with the 10 vol.% aromatics. Equivalence is determined through an emissions test program that follows a specified regulatory protocol. The testing is conducted at an independent testing laboratory at the expense of the applicant. Test fuels must pass a specified statistical criterion to be certified. The Environment Australia paper mistakenly states that pre-determined correlations are used in place of engine testing. This is not the case. Almost all diesel fuel in California currently uses alternative specifications that have been certified through engine testing. This program has lowered the cost and increased the supply of diesel fuel in California. Such a program could easily be set up in Australia.

The paper is also overly negative towards averaging as a regulatory option. Averaging is used extensively in the USA in conjunction with emission models to increase refinery flexibility and reduce cost without any negative environmental impact. Averaging is most important during unforeseen events like refinery operation upsets or supply disruptions. Any fuel property that has an environmental impact that will not cause highly non-linear or irreversible impacts is a candidate for averaging and in the USA averaging of all gasoline properties is allowed. Implementation of an averaging scheme has not proven difficult in the US would not be difficult in Australia. In USA RFG rules averaging is allowed broadly across refineries to maximise resulting benefits.

8.2 Specific Comments

P16 "This offers significant cost advantages from a regulatory standpoint" Government costs for compliance are small compared with industry's potential cost saving from increased flexibility. Regulations in USA rely on refiners to prove that they are compliant so government resource requirements are modest.

P16 The paper does not point out that refinery configurations and operations vary considerably as do fuel properties. For this reason flat limits are more likely to put some refiners at a competitive disadvantage than other regulatory options.

P 20 "The practice of pooling across grades …. Goes beyond any international practices relating to the use of the averaging model". This statement is incorrect. Pooling across grades is allowed under California and USA RFG regulations. This is one of the main benefits of averaging and allows refiners to produce different formulations to maximise octane and other beneficial qualities. In USA importers are allowed the same flexibility to average as USA refiners.

The use of cap and averaging is recommended as way of lower costs and increasing flexibility without impacting environmental outcomes. As discussed elsewhere any fuel property whose impact is not non-linear or which causes irreversible effects over the allowable range is a good candidate for averaging. As a practical matter all fuel properties can be averaged with suitable cap limits. Averaging across grades is allowed in the USA and is one of the main benefits of averaging. The USA also allows averaging across refineries with common ownership for some fuel properties. Adoption of averaging is expected to increase competition by increasing refiner and importer flexibility.

P23 Characterisation of USA and California RFG rules is incomplete and inaccurate and overstates the problems associated with their use. The EA document confuses model-based standards with flat limits and attributes problems caused by other components to the models. In reality use of the complex models has proven simple and easy to implement in the USA.

P 23 "For some parameters compliance with flat limits is necessary". This is an outgrowth of the historical development of USA RFG rules. Initially there was little data on the effect of fuel properties on emissions. So the USA Congress, a political body, mandated a combination of fixed property specifications and performance standards. As more data was collected on fuel effects on emissions it became clear that a fuel property model would be the best regulatory model to adopt. Emissions models have been used successfully to regulate RFG in North America. The flat limits in the USA rules are the least cost effective and most controversial portion of the USA regulations. The oxygen limit in particular is controversial and there have been several proposals in Congress to drop the oxygen limit.

P 23 "The annual levels of sulfur, T90 and Olefins content cannot exceed the refineries or importers baseline levels". This is requirement only applied during the initial transition years of the US program before the complex model was introduced and has since been dropped. It is recognized that fixed limits on sulfur, T90 and olefins are no longer necessary with use of the complex model

P 23 "In addition they must meet certain volatile organic compound, air toxics and NOx emission performance requirements, judged against qualities produced in a baseline year" This requirement only pertains to USA conventional gasoline.

P 24 "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" The USA rules contain performance standards for VOC, NOx and Toxics that are evaluated using the complex model. All other flat limits for particular parameters have been dropped except for oxygen content and benzene, which are both relics of the rules passed by the USA congress. There is currently consideration to drop the oxygen specification.

There is an inconsistency between use of fuel/emission relationships in volume 1 to estimate emission impacts of fuel changes and view that models are too complicated to use.

To improve refiner flexibility California has recently introduced the ability to vary RVP and oxygen. There are now no fuel properties that must meet fixed property limits. All properties can be varied with the California predictive model within certain ranges to provide the desired outcome.

P26 The paper overstates the difficulty of developing an emissions model for Australia. All or portions of the USA models could be borrowed or a new model developed based on statistical analysis of existing data. Thailand plans to develop such a statistically based model. It is important to note that the models were designed as fuel certification tools and are recognised to not accurately forecast emissions for an entire vehicle inventory. The models are however consistent with the large body gasoline emission data that has been collected in the USA, Europe and elsewhere.

P 27 "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. Such a comprehensive policing procedure would be complex and costly to administer and enforce" This retail enforcement mechanism applies in general to USA fuel regulations and is applied to both flat limit and model-based standards.

Note that the term "complex" was only adopted in the USA to distinguish the final model which included a few more fuel properties from the earlier "simple" model that was based solely on RVP, benzene and oxygen content. The complex model is merely a set of equations that relate fuel properties and emissions. The equations have been readily incorporated into spreadsheets, refinery gasoline blending models, refinery LPs and other tools to track compliance and optimise refinery performance.

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