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1 INTRODUCTION AND BACKGROUND

Coffey Geosciences Pty Ltd were commissioned by Environment Australia to undertake a review of possible new fuel specifications for Australia, designed to reduce emissions of greenhouse gases and air pollutants from Australian transport.

The development of the scenarios for new fuel specifications included extensive consultation with stakeholders, including the major stakeholders in the oil and motor vehicle industry. The impact of the new specifications on air pollutants and greenhouse emissions were assessed, along with the impact on Australian refineries, vehicle manufacturers, consumers and the economy wide effects of changing fuel specifications for petrol and diesel.

This report presents the results of the review. The structure of Chapters 2 to 8 of this report is outlined below.

Chapter 2 focuses on issues related to motor vehicle emissions. Section 2.1 provides an overview of the current air quality issues in Australia and the contribution of motor vehicles to urban air pollution. The ambient air quality standards in Australia are summarised, and Australian greenhouse gas commitments outlined in Sections 2.1.2, including the National Greenhouse Strategy. Sections 2.1.3 to 2.1.7 focus on motor vehicle emission standards, including summaries of the existing and proposed future Australian and European vehicle emission standards. Section 2.2 summarises current vehicle engine and emission control technologies that are available, or emerging into commercial availability, for improving the emissions and/or fuel consumption performance of road vehicles. Emphasis is placed on the technologies which may be dependant on fuel quality for effective function and durability.

Chapter 3 focuses on issues related to fuel quality, and provides a summary of the main findings of fuel quality studies undertaken in Australia and overseas. The Australian Government policies which impact on fuel quality are summarised to provide a background to the legislative setting in Australia. Several studies undertaken in Australia and overseas which examined the relationship between fuel quality parameters and motor vehicle emissions are described. The chapter concludes with a summary of the international fuel quality regulations and specifications.

Chapter 2 and 3 of this report therefore outline the relationship between fuel quality parameters, motor vehicle technology and the emissions from motor vehicles based.

In order to assess the potential impacts of new fuel quality specifications on Australian refineries, vehicle manufactures and consumers, and taking into account the objectives of the regulators, it was necessary to obtain a high level of cooperation from the stakeholders. **Chapter 4** describes the stakeholder liaison process, and includes a summary of the issues raised by the stakeholders.

Chapter 5 outlines six scenarios representing alternate paths for development of fuel quality standards over time. The background to the development of the scenarios, the rationale behind the scenarios and the detail of six scenarios for fuel quality are discussed.

Chapters 6, 7 and 8 assess the impacts under the nominated scenarios for fuel quality, including the projected emissions from motor vehicles for each of the scenarios (Chapter 6), the costs to the oil refining industry (Chapter 7) and the impacts on the Australian economy (Chapter 8).

1.1 Driving Forces for Changes to Fuel Quality Standards Internationally

The need to reduce exhaust emissions from cars was asserted over a century ago, but was ignored in the enthusiasm for the new means of transport. The need to introduce the catalytic converter to improve emission control in the 1970's and 1980's required petrol without lead based octane enhancers to avoid poisoning the catalysts and to reduce noxious vehicle emissions. This was the first environmentally forced change to petrol formulation. Now to advance the performance of emission control technologies in road vehicles and to optimise reduction in emissions from petrol and diesel fueled vehicles, the fuel, engine and emission control system must be designed as an integrated system.

Prior to the development of concern about acid rain and global warming in the early and late 1970's, efforts to reduce atmospheric pollution generally followed concern, then alarm over intense local problems. The London sulfur dioxide cum particulates smog episode in 1972, which caused 5000 excess deaths and the severity of the photochemical smog in the Los Angeles Basin airshed, resulted in strong, and in London's case effective action. Public health concerns were principal driving motivations, however, the costs resulting from soiling, corrosion, loss of visibility and aesthetic impacts were significant factors. Ash fall-out from Sydney's inner city Pyrmont and White Bay power stations resulted in Australia's first Clean Air Act and later, the closure of the power stations.

Little attention was given to pollution from automotive transport until it was realised that Los Angeles smog was related to its rapidly increasing car numbers and, in 1960, the Californian Motor Vehicle Control Board was set up. Its proposals resulted in petrol engines being required to have crankcase and exhaust emission-control devices and evaporative emissions reduction. The Californian Air Resources Board (CARB) is its successor, with a wider role. It was the leader in introducing emissions controls, including the catalytic converter, for petrol engines in road vehicles.

CARB has been a driving force for changing fuel quality specifications, by its requirements for reformulated gasoline. It adopted a cleaner-burning gasoline regulation in November 1991 based upon studies relating fuel properties to emissions.

In tandem with increasing scientific and environmental management knowledge of and effort to control air pollution issues, awareness and concern of the general public has also been increasing.

Though California is historically perhaps the most influential initiator of efforts to control air pollution produced by road transport, the OECD (Organisation for Economic Co-Operation and Development) has had an international corresponding influential role through its Environment Directorate and Environment Committee in policy development, stimulation and coordination among OECD member states.

Following the United Nation's Stockholm Conference in 1972, the OECD developed a series of Recommendations and Acts, which included ones involving reduction of air pollution in urbanised regions. In a key Act of 1974, Energy and the Environment, the OECD Council recommended that Member Governments: "Ensure that environmental and energy policies are integrated and thus develop an approach to the use of energy which will provide adequate environmental protection."

The OECD Council, in another Act, call for member governments "…strive with all practical speed: to develop and apply measures for reducing emissions of nitrogen oxides and hydrocarbons;"

Those Acts of the OECD in 1974, were the initial international co-operative actions, which lead to the commissioning of several major studies into the relationship between fuel quality and motor vehicle emissions (as discussed in Chapter 3 of this report) and the development of new fuel quality specifications for diesel and gasoline.

From 1978 to 1986 the OECD conducted the COMPASS project on the environmental evaluation of energy systems, the largest policy research project then undertaken by the OECD. COMPASS published a report " Environmental effects of automotive transport" as part of its output and this is probably one of the early policy development to drivers follow on from the 1974 recommendation to integrate energy and environment policies.

The COMPASS report identified nine strategies which "can effectively protect human health and the environment while making parallel progress toward other objectives, such as better energy efficiency and minimum costs." COMPASS did not have the information to reach conclusions about reformulated gasoline other than unleaded petrol (ULP). However, it did point the way to some of the issues concerning reformulated gasoline including octane enhancers, oxygenates and extended refinery processing. COMPASS stated that "the characteristics of the diesel fuel, particularly its boiling range, aromatics and sulfur content strongly influence the emissions from diesel engines." It also states that "coordination of future engine designs with future fuel qualities could help maximise the efficiency of fuel use and environment protection."

CARB, whose role is "to establish control measures to protect the public's health from exposure to toxic air contaminants (TACs), those air pollutants which may cause or contribute to an increase in death or serious illness"[1], was active in the 90's in adopting a number of regulations to reduce emissions of particulates, NO_x and SO_x from diesel engines.

Clearly, CARB, the OECD and public concern were not the only policy drivers towards reformulated gasoline. The EPA's and transport departments of many governments, the oil industry, road vehicle and engine manufacturers, clean air associations and environmental activists have all interacted in various degrees; locally, nationally and internationally to address the problem of deteriorating air quality and public health concern. However, CARB and the OECD have provided the initial impetus for policy action on curbing air pollution by road vehicles.

Despite the achievements within the European Union (EU) in reducing the emissions of individual vehicles, increased numbers of vehicles and increased vehicle-kilometers were likely to counter the improvements and to hinder the reduction of total emissions and attainment of future air quality objectives. This situation was articulated in the OECD and expressed in the above COMPASS report. It was of increasing concern in the EU by 1990, which realised that further action to reduce vehicle emissions necessitated a reassessment of the existing policy approach. The emission reduction potential offered by further improvements in vehicle technology is limited and possibly very costly in comparison to other potential solutions.

To address this issue, the European Commission (EC) concluded that future emission standards should be based on an integrated approach and should have as their objective the achievement of air quality targets. It was recognised that policy actions were needed to reduce road transport emissions if air quality objectives are to be achieved.

The EC Council and Parliament adopted this approach in a 1994 Directive[2]. The European Auto Oil programme was the response in implementing this Directive. This programme, discussed in further detail in Chapter 3, aimed to ‘provide policy-makers with an objective assessment of the most cost-effective package of measures including vehicle technology, *fuel quality*, improved durability and non-technical measures, necessary to reduce emissions from the road transport sector to a level consistent with the attainment of the new air quality standards being developed for adoption across the European Union.’

The outcome of the European Auto Oil programme was that in October 1998, the European Parliament and Council made Directive 98/70/EC relating to the quality of petrol and diesel fuels. The more recent Directive gave the specifications for gasoline and ADO to apply from 2000 and from 2005 in a stricter specification requiring lower aromatics, PAH and sulfur.

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1 CARB Fact sheets. Oct 1998.

2 Directive 94/12/EC

The above is an outline of the various forces which influenced the policy process resulting in new fuel specifications for the European Union. CARB, the OECD, the air quality in the Los Angeles Basin and the Rhine River Valley have all been driving influences on the policy process and its eventual decision on new fuel quality specifications. In turn, the European outcome will have influence in policy development internationally.

1.2 Driving Forces for Changes to Fuel Quality Standards in Australia

The driving force for changes to fuel quality standards in Australia is primarily the requirement to produce fuels which are compatible with vehicle engine and emission control technologies. Changes to fuel quality facilitate the development of technologies which reduce motor vehicle emissions. This issue is discussed in further detail in Chapter 2, and is particularly relevant to the relationship between the sulfur content of fuel and the efficiency of vehicle emissions control technologies.

The issue of the contribution of motor vehicles to air pollution and greenhouse is also a driving force for changes to fuel quality standards in Australia. For example, following the identification of commercial fuel volatility as a problem for evaporative emissions, NSW negotiated a Memorandum of Understanding with the Petroleum Industry for a phased reduction of petrol Reid vapour pressure (RVP) to 67 kPa for summer 1999/2000 and 62 kPa for summer 2000/2001.

Chapter 2 of this report provides an overview of current air quality issues in Australia and the ambient air quality standards. Motor vehicle emission standards in Australia are discussed, including the Government's commitment to harmonisation with international vehicle emission standards. Chapter 2 therefore provides further insights into the driving forces for fuel quality changes in Australia in relation to motor vehicle emissions.

Chapter 3 provides further detail regarding fuel quality studies and Government policy which have contributed to the drive for fuel quality changes in Australia. In addition, the A New Tax System (Goods and Services Tax) Act 1999 specifies 'Measures for a Better Environment', including the setting of the sulfur standard for road transport diesel to 500 ppm by the end of 2002 and 50 ppm from 2006. These measures are also driving changes to fuel quality in Australia.