14. Petrohol

14.1 Background

Anhydrous ethanol can be used as an additive in petrol. We use the term petrohol for a blend of 10% anhydrous ethanol in premium unleaded petrol. The symbols E10P or E10PULP are also used for this fuel, depending on whether it is necessary to specify the type of petrol (P) with which the ethanol is blended.

There has been substantial US interest in the use of ethanol in cars. The reason for this is that the Californian Government, through their Air Resources Board, requires vehicles to use "reformulated gasoline". Originally such reformulated gasoline could be made by blending MTBE (methyl tertiary-butyl ether) into petrol. Because of the contamination of Californian groundwater with MTBE the Californian Governor ordered the removal of MTBE from petrol and studies on the environmental and health effects of ethanol in petrol. The use of ethanol produces an oxygenated fuel that satisfies the requirements of Californian reformulated gasoline.

Oygenates are added to petrol to improve the anti-knock performance and to reduce emissions. Reuter et al (1992) studied European petrol oxygenated with MTBE, ETBE and ethanol and found that the tailpipe emissions of oxygenated petrol are independent of the oxygenate that is used.

On 8 May 2001 the Minister for Environment and Heritage, Senator Hill, announced the first national fuel quality standard for petrol and diesel under the *Fuel Quality Standards Act 2000*. Senator Hill said in that context, that further assessments were necessary before setting an ethanol limit for petrol. Studies are currently being undertaken by independent experts and a decision is expected within 12 months.

14.2 Results

14.2.1 Greenhouse gas emissions

Figure 14.1 depicts the greenhouse gas emissions estimated for PULP, which we take as the reference fuel for light vehicles, as well as for petrohol. These are shown as emissions on an energy basis, and as emissions per kilometre for a car. The differences between exbodied greenhouse gas emissions of PULP and E10P are slight.

14.2.2 Particulate matter emissions

Figure 14.2 depicts the particulate matter (PM10) emissions estimated for PULP and E10P. These are shown as emissions on an energy basis, and as emissions on a per km basis for cars. Emissions of PULP and E10P are similar.

14.2.3 Emissions of oxides of nitrogen

Figure 14.3 depicts the oxides of nitrogen (NOx) emissions estimated for PULP and E10P. These are shown as emissions on an energy basis, and as emissions on a per km basis for cars. Emissions of PULP and E10P are similar.

14.2.4 Emissions of hydrocarbons

Figure 14.3 depicts the non-methanic hydrocarbon (HC) emissions estimated for PULP and E10P. These are shown as emissions on an energy basis, and as emissions on a per km basis for cars. Hydrocarbon emissions from E10P are generally similar to those from PULP.

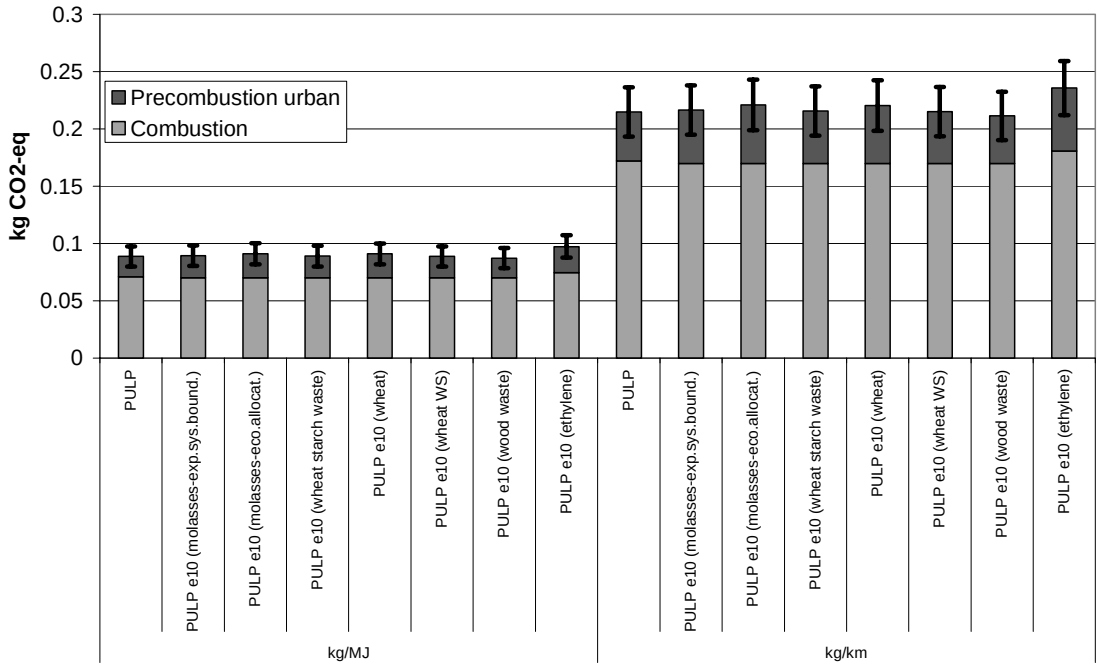

Figure 14.1
Exbodied emissions of greenhouse gases for premium unleaded petrol and petrohol.

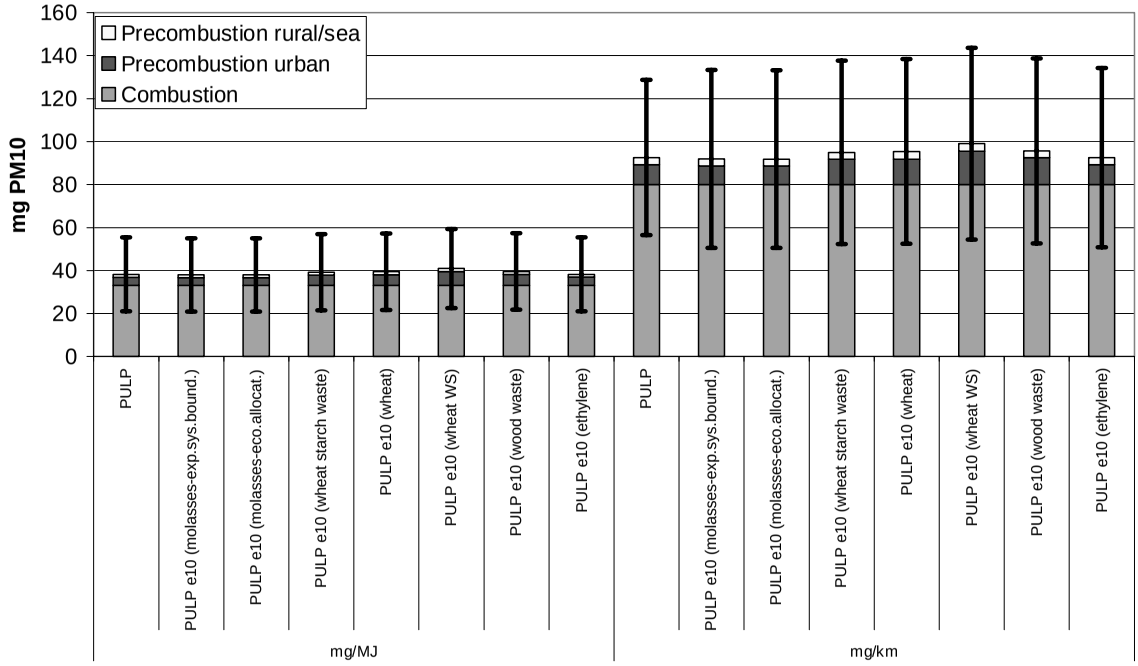

Figure 14.2
Exbodied emissions of particulate matter for premium unleaded petrol and petrohol.

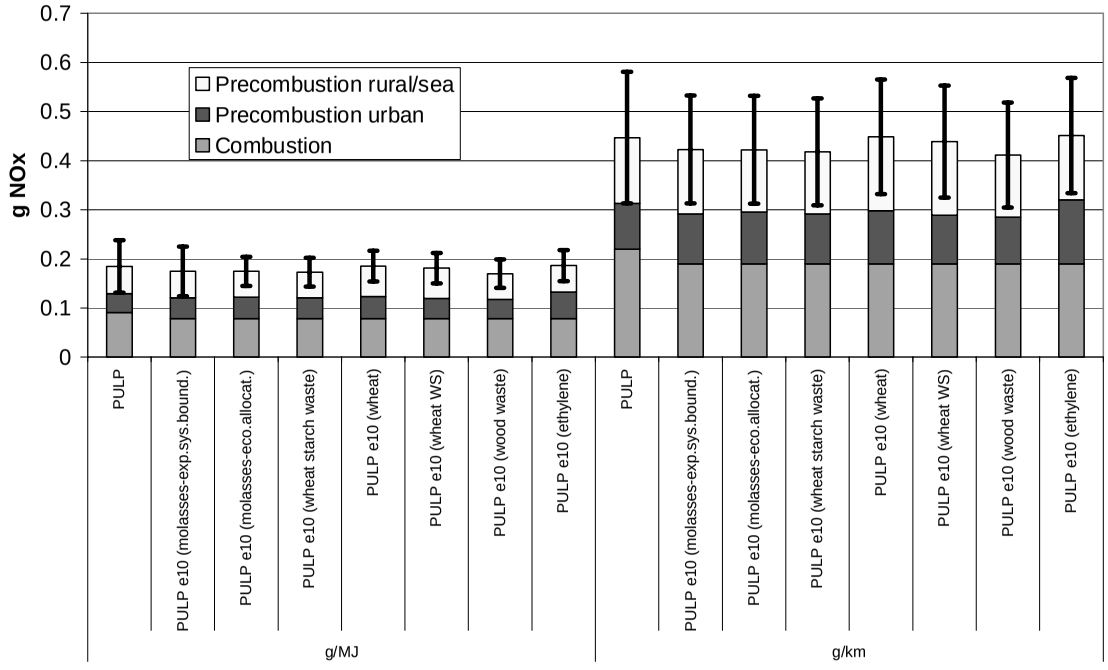

Figure 14.3
Exbodied emissions of oxides of nitrogen for premium unleaded petrol and petrohol.

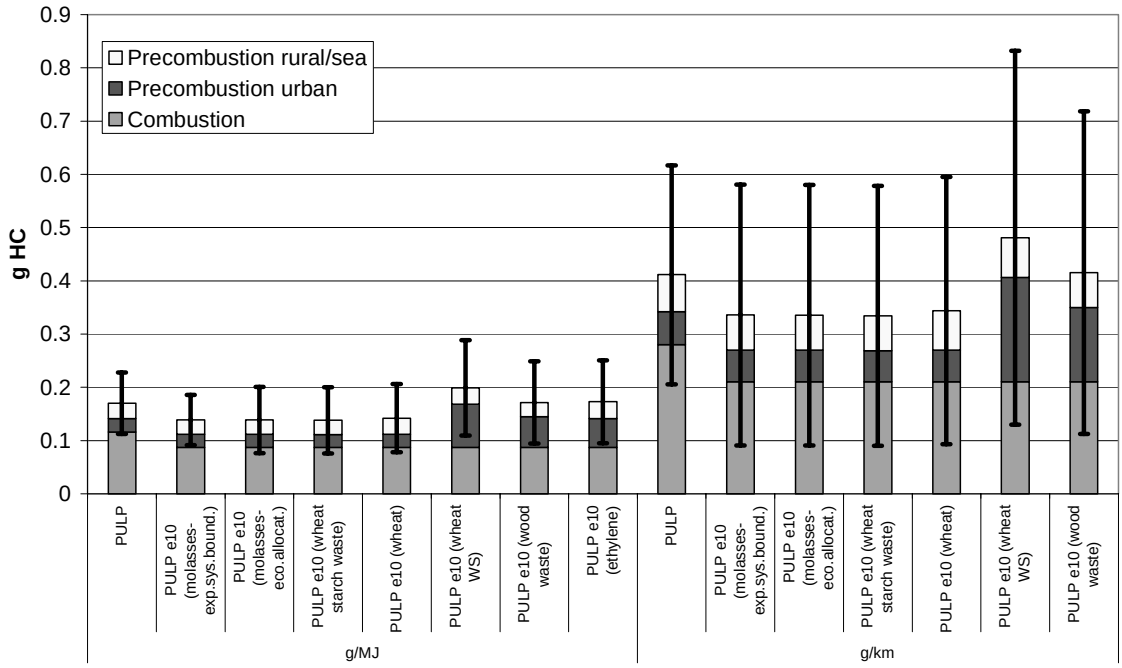

Figure 14.4
Exbodied emissions of hydrocarbons for premium unleaded petrol and petrohol.

14.3 Viability and Functionality

There is considerable international experience on the use of ethanol as a blend in petrol in the United States, where it is needed under the legislation requiring the use of reformulated gasoline, and in Brazil where sugar-derived ethanol is used as an automotive fuel and also as a blend (gasohol). No special engine modification or handling precautions are needed when using a 10% ethanol blend. Such widespread international experience indicates that the viability and functionality of petrohol will be much the same as of the corresponding petrol with which the ethanol is blended. Ethanol can loosen contaminants and residues that have been deposited by previous gasoline fills. These can collect in the fuel filter. This problem has happened occasionally in older cars, and can easily be corrected by changing fuel filters. Symptoms of a plugged fuel filter will be hesitation, missing, and a loss of power.

14.4 Health and OH&S

Motor vehicle emissions data indicates that the use of ethanol results in substantial reductions in air toxics emissions.

E10PULP tailpipe emissions of benzene, 1,3 butadiene, are substantially less than petrol vehicles, while formaldehyde emissions are similar. There is contradictory information about the emissions of acetaldehyde tailpipe emissions with some studies showing an increase while other show a decrease compared with petrol. More research is required to clarify this issue.

Ethanol in solution is hazardous according to Worksafe Australia, with high flammability, moderate toxicity, and a moderate irritant. The flash point of the fuel emulsion becomes that of alcohol when the alcohol content exceeds 5% of the volume.

Ethanol fuels increase permeation on elastomers that have been used in automotive applications (eg: rubber hoses, plastic fuels tanks). Research is required to quantify the permeation impacts of ethanol. (Harold Haskew & Associates, 2001)

14.5 Environmental Issues

ESD principles

Ethanol is not persistent in the environment. Virtually any environment supporting bacterial populations is believed to be capable of biodegrading ethanol. Atmospheric degradation is also expected to be rapid. A blend of 10% ethanol with petrol will be more in accord with ESD principles than petrol on its own.

Sustainability

Ethanol from sugar or wheat is liable to be a niche fuel and thus there are no sustainability issues associated with it. Large-scale usage of ethanol will require ligno-cellulosic production to be economical, and the sustainability issues associated with such production have been discussed in the chapters on ethanol.

Ethanol is a renewable fuel. Petrol is a non-renewable fuel. A blend of 10% ethanol will be more sustainable than petrol on its own.

Groundwater contamination

There is no evidence of widespread groundwater contamination from petrohol, unlike fuels oxygenated with MTBE. It may be expected that petrohol has a similar impact on local groundwater supplies as petrol.

14.6 ADR Compliance

Petrohol can be expected to meet all future Australian Design Rules for all pollutants.

14.7 Summary

14.7.1 Advantages

- Tailpipe emissions of CO and HC appear to be lower on average.
- Air toxic levels decrease as the ethanol concentration increases.

14.7.2 Disadvantages

- There are high hydrocarbon evaporative emissions that require adjustment of the vapour pressure of the base petrol to which ethanol is added.
- There are problems of phase stability in the petrol mixture if water is present.

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