AIR QUALITY

Enviro-Note 1

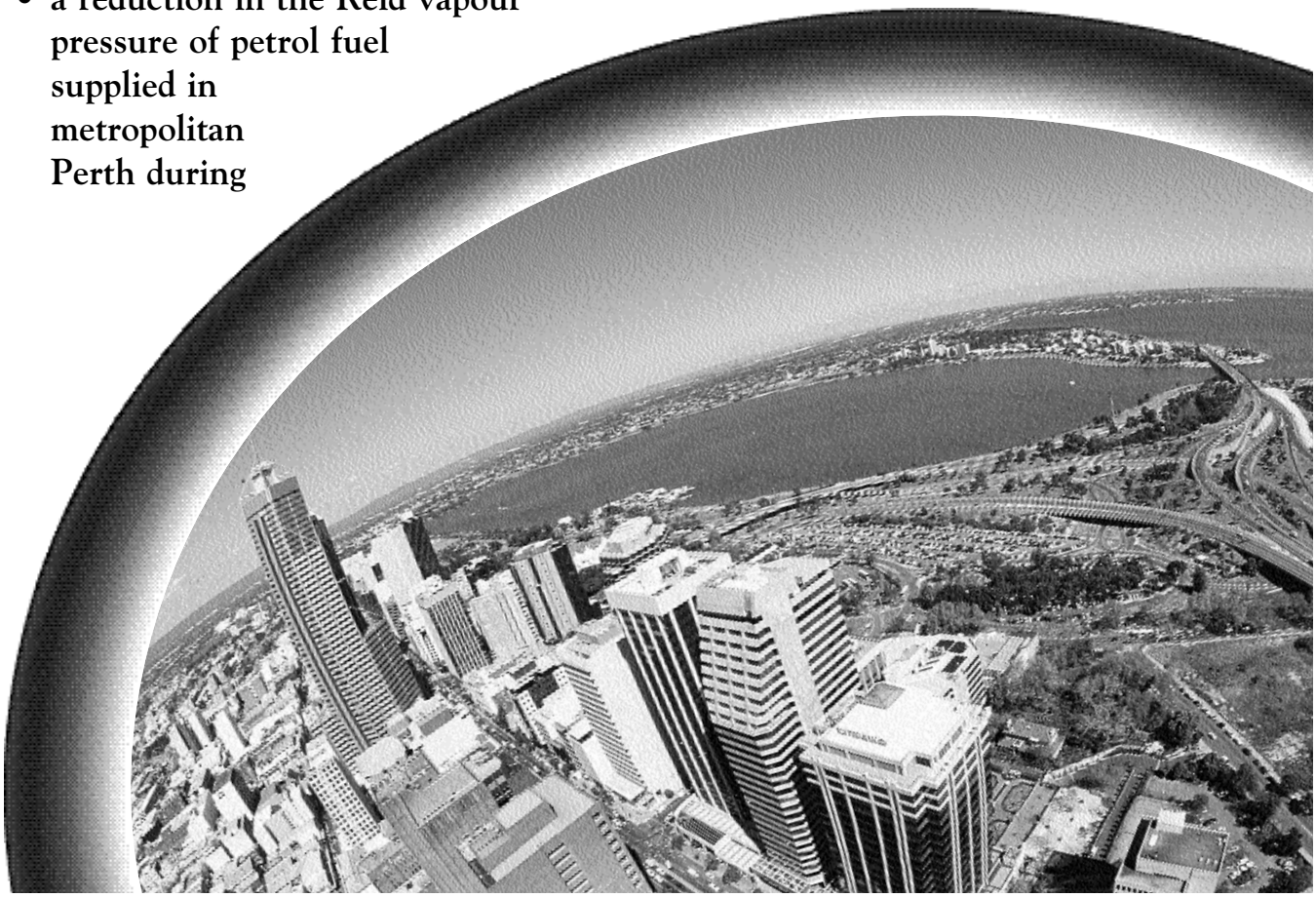
Department of Environmental Protection

Cleaner Fuel Initiative

The objective of the introduction of new "cleaner fuels" is to protect public health and the environment by limiting emission of pollutants resulting from the use of petrol and diesel in motor vehicles. International experience has shown that pollutants from motor vehicles can be reduced by changing the composition of the fuel.

The introduction of "cleaner fuels" through the *Environmental Protection (Diesel and Petrol) Regulations 1999* (the regulations) involves the following modifications to petrol and diesel fuel formulations in WA:

- **the phasing out of leaded petrol and the introduction of lead replacement petrol, to reduce vehicle emissions of lead;**
- **a reduction in the Reid vapour pressure of petrol fuel supplied in metropolitan Perth during**



summer in order to limit summer time emissions of evaporative hydrocarbons from vehicles;

- **a reduction in the amount of benzene allowed in petrol fuel supplied in WA, to reduce levels of benzene in the ambient air;**
- **the removal of methyl tertiary butyl ether (MTBE) from petrol fuel supplied, to reduce possible contamination of ground water; and**
- **a reduction in the sulfur content of diesel fuel, to reduce emissions of particulates and hence reduced haze episodes.**

Benefits of Introducing "Cleaner Fuels"

The Phase Out of Leaded Petrol

The Prime Ministerial statement, *Safeguarding the Future: Australia's Response to Climate Change* made in November 1997, included a commitment to bring forward the national phase out of leaded petrol, with a date recently set for January 1, 2002.

Vehicle emissions are the largest source of lead exposure in many urban areas, often accounting for more than 90% of all atmospheric lead emissions. Lead has been linked with retarding the intellectual development of babies and young children. The concerns about the health effects of lead and the increasing number of vehicles on the road designed to use unleaded petrol have reduced demand for leaded petrol in Australia. There has been a world wide transition towards lead free petrol.

Lead has been added to petrol as a cost-effective way of increasing the octane number and providing a measure of protection from valve seat wear, which occurs when metal to metal contact of the valve and seat faces cause premature wear. The introduction of the regulations requires the removal of lead from all petrol supplied in WA and the introduction of lead replacement petrol (LRP).

A third of all cars built before 1986 can run efficiently on regular unleaded petrol. Owners of these earlier model vehicles should check with local motoring organisations or fuel companies.

Lead Replacement Petrol

Western Australia was the first state in Australia to follow international trends and be a totally lead free petrol market from January 1, 2000, following the introduction of Lead Replacement Petrol (LRP).

Older cars which have previously used leaded petrol are protected with the introduction of LRP. LRP has the same octane rating as leaded petrol and should not change the vehicle's fuel consumption or performance in any way. LRP contains an anti valve seat wear additive to prevent abnormal valve seat wear.

Abnormal wear of the soft exhaust valve seat can occur when older vehicles are operated on unleaded fuel. This is because lead, in addition to providing octane improvement, also acts as a solid lubricant between the exhaust valve and the soft exhaust valve seat, preventing the valve from wearing into the cylinder head. The additives used in lead replacement petrol function in the same way as lead does, acting as a solid lubricant. There are a number of anti valve seat wear additives available, based on elements such as sodium, potassium or phosphorus.

Anti valve seat wear additives are carefully chosen and developed so as not to damage people's health. The additives used in LRP have undergone stringent testing in the laboratory and in field trials. The additives are being used in a number of countries and are found to be an effective replacement for lead in fuel.

All vehicles currently running on leaded petrol can switch to LRP with no changes to the vehicle required. LRP, like leaded petrol, should not be used in cars with a catalytic converter. As LRP progressively replaces leaded petrol, it will be sold from the old leaded petrol pump which has been relabelled.

Reid Vapour Pressure

Volatility of fuel is a measure of its tendency to evaporate, expressed as its Reid Vapour Pressure (RVP). By reducing fuel RVP, the volatility of the fuel is lowered which in turn has the effect of decreasing the amount of unburnt hydrocarbons being released into the atmosphere. International experience has demonstrated RVP reduction as an effective means of minimising unburnt hydrocarbon emissions, not just from motor vehicles but also resulting from the handling and storage of automotive fuel by industry and fuel retailers.

RVP is limited by the regulations to 72 kilopascals (kPa) from 1 January to 15 April 2000 and to 67 kPa from 15 October 2000 to 15 April 2001 and all subsequent years. This RVP limit is regulated within the area shown in Figure 1.

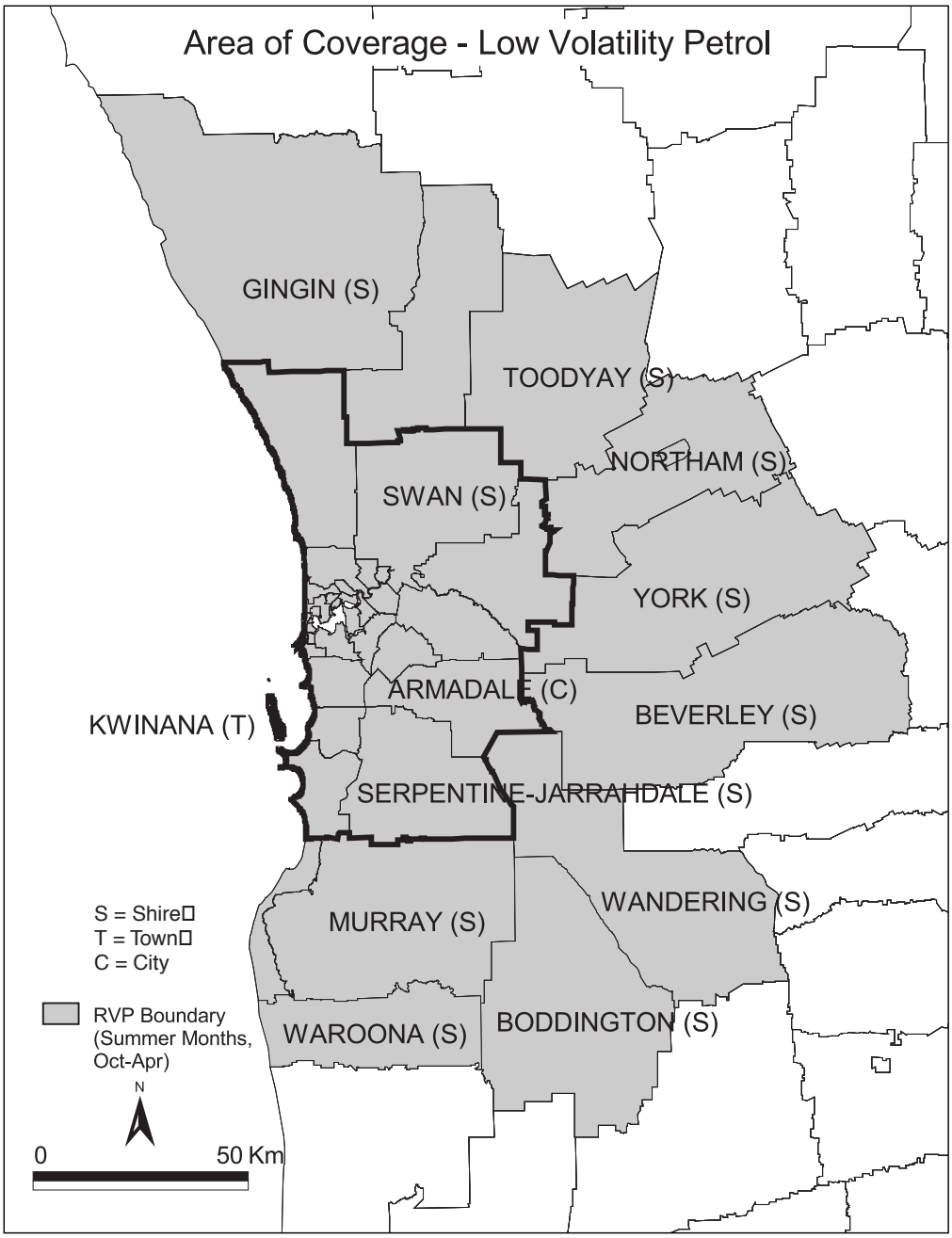


Figure 1: Area of coverage for low volatility petrol.

The introduction of RVP limits will have no impact on vehicle engine starting or performance and will contribute greatly to reducing emissions of unburnt hydrocarbons and hence reduce the potential for the occurrence of photochemical smog.

Benzene

Benzene exists at low levels in urban air and is classified as a hazardous air pollutant. Whilst observed concentrations of benzene in the atmosphere are generally low, much higher concentrations of benzene may be measured in the vicinity of petrol storage tanks, service stations and inside vehicles. Benzene is associated with a number of adverse health effects and is classified as a cancer causing agent.

Benzene is known as a "precursor" hydrocarbon leading to the formation of ground level ozone, a major component of photochemical smog. Ozone irritates the eyes, damages the lungs, and aggravates respiratory problems and is one of our most widespread urban air pollution problems.

The reduction in the benzene content of petrol fuel from 5% to 2% by volume in the year 2000 and to 1% by volume in 2001 will help to reduce the emissions of atmospheric benzene from motor vehicles into major urban airsheds. The combination of lower benzene content and lower Reid Vapour Pressure will also result in a reduction in benzene emissions from the distribution of petrol fuel and the refilling of motor vehicles at petrol stations.

Methyl Tertiary Butyl Ether

Methyl tertiary butyl ether (MTBE) is a volatile, traditionally organic chemical, used as an octane enhancer in petrol that also promotes more complete burning of petrol, reducing carbon monoxide and volatile organic compound emissions.

The principal concern over MTBE is that it is potentially a significant groundwater pollutant, with contamination of drinking water supplies possible through leaking petrol storage tanks and other petrol spills. Due to its small molecular size and solubility in water, MTBE moves rapidly into groundwater and is slow to biodegrade. MTBE has a very unpleasant taste and odour and these problems can make contaminated drinking water unacceptable to the public.

MTBE was removed from petrol under the regulations in order to protect groundwater supplies from possible contamination as experienced in other localities, such as California.

Low Sulfur Diesel

Under the regulations the supply, purchase and use of low sulfur diesel will become mandatory for all locations south of the 25th parallel for the year 2000, and then for the whole state from 1 January 2001, as shown in Figure 2. Previous diesel fuel standards limited sulfur content to 5000 parts per million (ppm), however the new regulations have reduced this figure to 500 ppm.

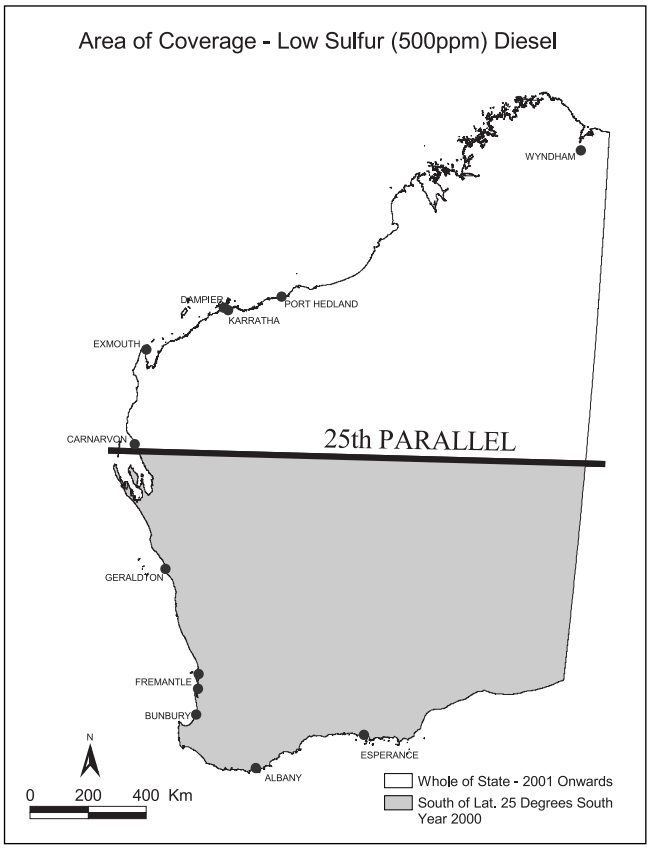


Figure 2: Area of coverage of low sulfur diesel.

Diesel engines are very efficient, with very low levels of hydrocarbon and carbon monoxide exhaust emissions when correctly tuned and maintained. The main concern with diesel engine emissions has always been smoke because it is clearly visible, particularly at high engine loads. In the past this smoke was considered to be undesirable because of aesthetics and odour, but now there is growing concern about the health effects of the emitted particulate matter when it is breathed into the lungs. Reducing the sulfur content of diesel fuel reduces the smoke and particulate levels.

The environmental benefits of using low sulfur diesel include:

- reduced visible black smoke and exhaust odours, thus improving urban aesthetics;
- reduced exhaust particulate emissions contributing to the formation of particulate haze episodes thus improving local air quality;
- reduces sulfur oxides emissions; and
- enables the use of exhaust catalytic converters and other emerging emission control technology to reduce emissions further.

Low sulfur diesel can be used in any diesel engine with no effect on performance or power output. A diesel vehicle does not need to be converted, re-tuned or adjusted in any way and low sulfur diesel can be mixed with existing diesel fuel.

Where to in the future

From 1 January 2001, further changes to fuel formulation will be introduced to achieve "Euro III" petrol fuel standards. These include:

- reducing aromatic content from 48% volume per volume (v/v) to 42% v/v;
- reducing sulfur content from 500 parts per million (ppm) to 150 ppm;
- regulating olefin content at a maximum of 18% v/v.

Reducing the aromatic component of petrol fuel will lead to a decrease in benzene emissions as research indicates that up to 80% of the exhaust benzene formed is from non-benzene aromatics in the petrol.

A reduction in the sulfur content of petrol fuel from 500 ppm in 2000 to 150 ppm in 2001 will result in improved performance of three way catalytic converters and lower emissions of carbon monoxide, sulfur dioxide, reactive organic compounds and oxides of nitrogen from petrol vehicles.

For further information about "cleaner fuels" and the regulations, refer to the *Environmental Protection (Diesel and Petrol) Regulations 1999*, available from the State Law Publishers (Ground Floor, 10 William Street, Perth, 6000) or view at the Department of Environmental Protection library (8th Floor, Westralia Square, 141 St. Georges Terrace, Perth, 6000).

Further technical information about new fuel formulations can be obtained by contacting the RACWA or the fuel companies listed below:

RACWA:	**(08) 9421 4444**
Shell:	**1 800 805 000**
BP:	**1 800 032 636**
Ampol/Caltex:	**1 800 815 823**
Mobil:	**1 800 033 863**
Gull:	**(08) 9411 4999**