Interim OEH Nitrogen Oxide Policy for Cogeneration in Sydney and the Illawarra

OBJECTIVES

1. Cleaner Air

To enable a cogeneration network that meets local air quality requirements and contributes to the timely and cost-effective achievement of the State Plan target for clean air (ozone).

2. Progress on greenhouse gas reductions

To realise all the potential greenhouse benefits of cogeneration by removing the environmental barriers in Sydney and the Illawarra.

POLICY REQUIREMENTS

All new cogeneration will:

- Demonstrate no adverse impact on human health or the environment in accordance with the requirements of the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.
- Proposals in Sydney and the Illawarra should either be NO_X neutral or required to achieve Best Available Technique (BAT) emission performance.
- Proposals outside of Sydney and the Illawarra are required to meet the *Protection of the Environment (Clean Air) Regulation 2002* NO_X emission limits of 450 mg/m^3 for internal combustion engines, and 70 mg/m^3 for gas turbines.

EVIDENCE AND RATIONALE

- **Gas fired cogeneration can be one of the most greenhouse friendly forms of electricity generation using fossil fuels.**

- **There is significant potential for cogeneration to be located in the Sydney basin.**

  For example, City of Sydney's Sustainable Sydney 2030 has a goal of 330 MW of distributed generation (including cogeneration) in the Sydney local government area alone.

- **Sydney needs to implement measures to achieve the State Plan target for ozone for health reasons.**

  The State Plan re-commits NSW to achieving the National Environment Protection Measure for Ambient Air Quality (Air NEPM) goals by the 2008 compliance date.

  The health costs of air pollution are real and substantial. Although Sydney has good air quality by world standards, a reduction in current air pollution levels would continue to improve the population's health in the long-term.

  The estimated annual cost of current levels of air pollution in the greater metropolitan area is $4.7 billion, or $893 per head of population. Health experts estimate that, in Sydney, air pollution causes between 640 and 1400 deaths per years, between 359 and 784 hospital admissions for respiratory conditions and between 561 and 1206 hospital admissions for cardiovascular conditions.

  Sydney has exceeded the Air NEPM ozone goal every year since 1995.

- **Current modelling indicates that a 25% reduction in NO_X emissions is required to achieve the State Plan target for ozone in Sydney.**

  Ozone is formed in summer by reactions between NO_X and volatile organic compounds (VOCs). Detailed analysis conducted by OEH suggests there has been a slight upward trend in ozone concentrations in recent years.

  Attachment 1 has a more detailed discussion on ozone trends and health effects.

- **NO_X Emissions and Trends**

  The main sources of NO_X in Sydney are motor vehicles and industry (Figure 1). Over the period 1992 to 2008:

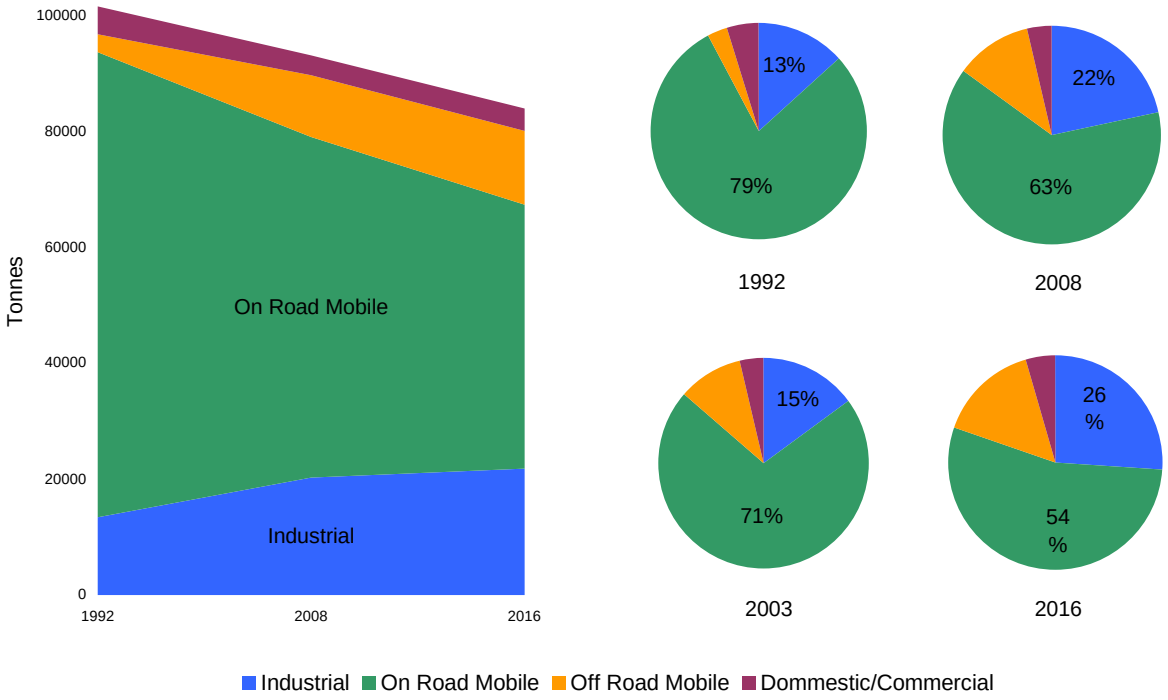
  - **NO_X emissions from motor vehicles have fallen by 27%.**

    Vehicle emissions will continue to fall due to tighter vehicle emission standards such as ADR 80.03 (Euro 5) which will require nitrogen dioxide controls (such as selective catalytic reduction) on heavy duty vehicles by 2010/11.

  - **NO_X emissions from industry have increased by 51%.**

    Industrial NO_X emissions in Sydney are projected to grow a further 13% over the next 8 years to 2016. This scenario does not include any shifts in the location of electricity generation (such as cogeneration) which would exacerbate the challenge of reducing ozone levels.

Figure 1
Sydney Annual NOx Emissions



- **A 25% reduction in NO_X emissions (the amount likely to be required to achieve the NEPM goal) equates to a reduction of 2600 kilograms per hour.**

  On an hourly basis 330 MW of gas fired co-generation (the amount envisioned in the City of Sydney Strategic Plan) could emit up to 660 kilograms per hour of NO_X, this is more NO_X than the combined emissions from the Shell and Caltex oil refineries in Sydney.

- **In the Sydney CBD and other urban canyons, uncontrolled emissions of NO_X from cogeneration could exceed health-based goals.**

  On an hourly basis, 2 MW of gas-fired cogeneration can emit the same amount of nitrogen oxides (NO_X) as approximately 6 semi-trailers

  Air quality studies suggest that:

  - The Sydney CBD only has the capacity to accommodate uncontrolled emissions from around 10 MW of cogeneration before it is possible that health based nitrogen dioxide goals could be exceeded.

  - It is likely that uncontrolled emissions from around 200 MW of cogeneration would result in the health based nitrogen dioxide goal being exceeded across the CBD.

- **An objective of no net increase in emissions from new NO_X sources would greatly assist in meeting the clean air standards**.

  The policy allows the flexibility to choose the least cost approach between implementing best available techniques or offsetting their NO_X emissions through abatement actions.

This policy extends the related policy in Action for Air (1998) which stated that "for greenfield sites, the EPA will seek emission limits consistent with best available control technology, dependent on an economic impact analysis of the cost of achieving these limits."

NO_X NEUTRALITY AND OZONE OFFSETS

- **Proposals can be NO_X neutral by either operating within existing approved capacity for NO_X emissions, and/or achieving an equivalent emission reduction off-site.**

- **Offsets will be accepted for abatement actions that reduced emissions of NO_X or VOCs in the same airshed**

  Reductions in either NO_X or VOCs emissions will be accepted as an offset for new NO_X emissions since the objective of the policy is to reduce ozone exceedences (see Attachment 2 for more information).

  The offsets will be administered by the Licensee or their representative. OEH will provide guidance and approvals, as well as compliance and enforcement procedures.

  Abatement actions that can be used for reducing NO_X and VOCs might include stationary source offsets such as assisting older industry to install cleaner technology or mobile source offsets such as upgrading transport fleets to run on low emission engines and cleaner fuels.

- **Offsets may not be acceptable for some proposals due to other issues such as local air quality which would require low NO_X emission limits to be acceptable**

  Cogeneration proposals generally focus on CBD areas where NO_2 pollution levels are also the highest. As a result, there is little 'headroom' available to accommodate uncontrolled emissions from cogeneration without causing local health impacts. Indicative studies reveal that only a few proposals without pollution controls in CBD areas could cause impacts, but that hundreds of proposals with pollution controls could otherwise be installed.

WHAT ARE BEST AVAILABLE TECHNIQUES?

Best available techniques (BAT) covers all aspects of a proposal including fuel source, technology selection and controls. OEH is currently defining BAT for the following plant when used in connection with an electricity generating system:

- natural gas fired internal combustion engines; and
- natural gas fired turbines

BAT will be defined for a range of capacities, from less than 1 MW to greater than 30 MW.

OEH will be conducting further targeted consultation with cogeneration stakeholders in the first quarter of 2009. An objective of the consultation is to reach an agreement on what NO_X emission performance constitutes BAT for cogeneration in Sydney and the Illawarra for all sizes of cogeneration.

Each proposal will also be judged on its merits. OEH staff may consider unusual equipment-specific and site-specific characteristics of the proposed project affects the achievable NO_X concentration requirement. Some examples of what may be considered are given below.

- **Technical infeasibility of the control technology** — the applicant may demonstrate that it is not technically feasible to install and operate control technology (such as SCR) to meet a specific NO_X emission limit.
- **Operating schedule and project length** — if the equipment will operate much fewer hours per year than what is typical (e.g. a peak power plant), or for a much shorter project length, it can affect what is considered ‘achieved in practice’.
- **Availability of fuel** — Some NO_X limits may not be feasible if a project will be located in an area where natural gas is not available.
- **Local air quality issues** — local air quality issues (such as NO_2 in CBD) may require lower NO_X limits than BAT on a similar project located elsewhere.

ATTACHMENT 1
OZONE TRENDS AND HEALTH EFFECTS

Ozone

Ozone occurs in both the upper atmosphere (the ozone layer) and at ground level. The ozone layer protects life by shielding the earth from harmful ultraviolet radiation from the sun.

At ground-level, ozone is a secondary pollutant formed in sunlight by chemical reactions between nitrogen oxides (NO_X) and volatile organic compounds (VOCs). Elevated concentrations of ozone occur in Sydney in the warmer months when there is more sunlight, high temperatures and appropriate wind conditions.

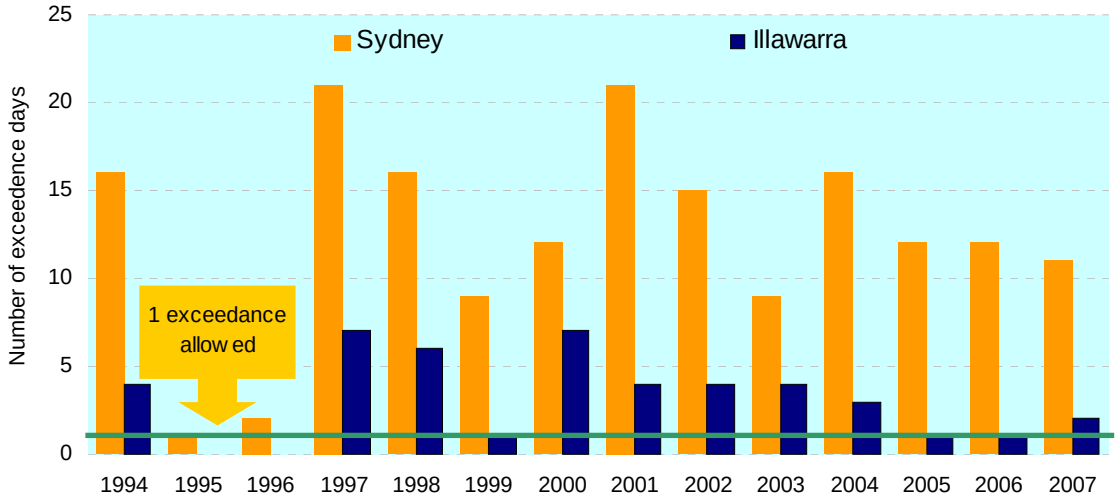
Health effects

Ozone is a respiratory irritant. Exposure to high levels of ozone can affect healthy adults and children. Such exposure restricts breathing and can cause coughing, chest tightness, and pain on taking a deep breath, especially during exercise. Some people, such as asthmatics, are sensitive to ozone at low concentrations, so there does not seem to be a safe level for exposure. During periods of high ozone concentration, hospital admissions for asthma and other respiratory conditions increase.

Compliance with ozone goals

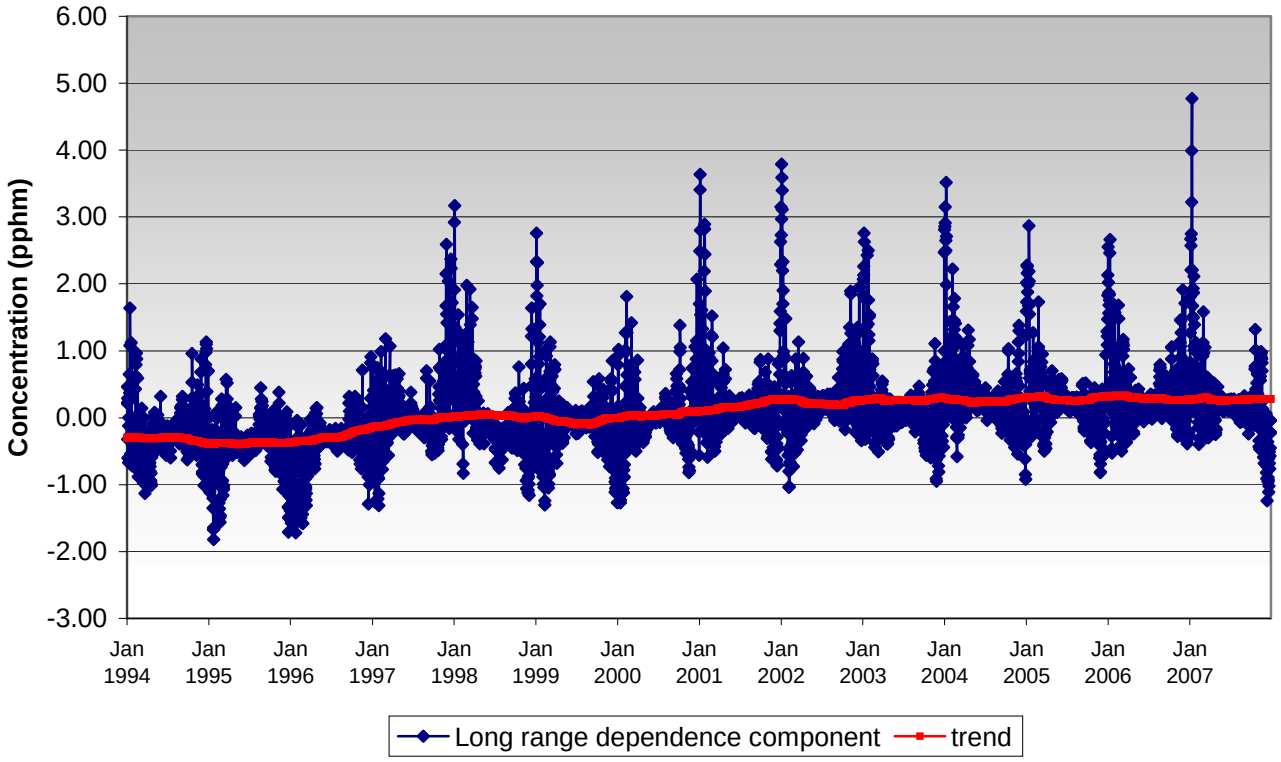
Sydney has exceeded the Air NEPM ozone goal every year since 1995, while the Illawarra exceeds the goal in most years (Figure 1).

Figure 1
Number of days exceeding the NEPM standard for four-hour ozone concentration



An analysis of the current trend (Figure 2) suggests that ozone concentrations have been increasing slightly from the mid 1990s.

Figure 2
Ozone Trends



ATTACHMENT 2
FRAMEWORK FOR NO_X OFFSETS

The objective of offsets is to provide a cost-effective way of addressing environmental issues while at the same time allowing economic development to occur. The main economic principle underpinning offsets is the reduction of environmental impact at least cost.

Offsets recognise that it is not always practical to achieve zero environmental impact from a single source. Where cost-effective mitigation and prevention measures have been exhausted, offsets can achieve environmental improvement at a greatly reduced cost by offsetting the remaining impacts elsewhere.

While offsets are simple in concept, offset schemes must be carefully designed. The text below is published on the OEH website and sets out the central principles that are proposed to guide development of pollution offsets in NSW.

Principles of offsets

- Environmental impacts must be avoided first by using all cost-effective prevention and mitigation measures on-site. Offsets are then only used to address remaining loads of pollutants.
- All standard regulatory requirements must still be met.
- Offsets must never reward ongoing poor environmental performance.
- Offsets will complement other government programs.
- Offsets must result in no net increase of target pollutants.

www.environment.nsw.gov.au/greenoffsets/principles.htm

Criteria for NO_X offsets for new NO_X sources

The general offset principles outlined above are the basis for the NO_X offset requirement for new NO_X sources that choose to offset their NO_X emissions instead of implementing BAT. The criteria that OEH will use to assess whether proposed/completed offsets meet the objectives of reducing current NO_X or VOCs emissions are:

- **Enduring** – offset actions implemented by the licensee must be implemented before or from the time the NO_X emissions from the activity occur. Ideally, they would offset the NO_X emissions for the whole time that the new NO_X source operates. However, some abatement actions may only provide a benefit for a limited period. In these cases the licensee will need to source new offsets when the original ones expire.
- **Quantifiable** – the impacts and benefits must be reliably estimated. There must be estimation and verification techniques available that are acceptable to OEH. Where there is an unacceptable level of scientific understanding about how the offset benefits will be achieved, OEH will consider applying ratios of greater than 1:1 to account for the risk and uncertainty of abatement actions in order to ensure that the required environmental benefits are achieved.
- **Targeted** – OEH will accept reductions in NO_X or VOCs emissions from other sources as an offset for new NO_X emissions.
- **Located appropriately** – they must offset the impact in the same area that the impact occurs, and the community should experience the environmental benefit. For example, an abatement action in the Sydney airshed can only be used to offset a pollution impact in Sydney - likewise for the Illawarra. Offsets in an adjacent airshed may be accepted at an offset discount of 1.5:1 or more.

- **Supplementary** – the offsets must be beyond existing requirements and not already being funded under another scheme. An offset proposal cannot include pollution abatement actions if they are already required under federal, state or council legislation, or any other legal requirements, or if Government funds them. This includes actions required by an environment protection licence condition (including pollution reduction programs, although this may be subject to negotiation). Credit will not be given for work that would have happened anyway (e.g. decommissioning a plant that was already scheduled for closure).
- **Enforceable** – the requirement to offset all new NO_X emissions must be clearly stated in the development consent conditions and will become implemented as licence conditions. Conditions relating to green offset schemes or works are permitted under section 69 of the POEO Act. Penalties for non-compliance with licence conditions are up to $1 million for a corporation (section 64).

Possible offset actions

Activities that offset the air pollution caused by the Licensee's operations are referred to as abatement actions. Abatement actions that can be used for reducing NO_X and VOCs might include stationary source offsets such as:

- assisting small business or older industry to optimise plant operations and install cleaner technology
- maintenance and plant upgrade programs for combustion equipment
- installing vapour recovery units at petrol stations.

Abatement actions that can be used for reducing NO_X and VOCs might include mobile source offsets such as:

- upgrading transport fleets to run on low emission engines and cleaner fuels
- retrofitting older cars and diesel vehicles with modern pollution control equipment
- funding for travel demand management programs
- buy back or subsidy programs to upgrade garden equipment (such as lawn mowers) and outboard motors to less polluting newer models
- establishing practical car sharing and pooling systems
- providing financial support to employees and customers to catch public transport
- expanding public transport availability.

The two examples below provide further information about abatement actions that can be taken to offset NO_X emissions.

<u>1. Heavy Vehicles</u>

NO_X emission reductions attributable to the progressive tightening of heavy vehicle emission standards has yielded a reduction of 78 to 85%, depending on the vehicle category, and a 90% emission reduction for buses.

For heavy vehicles travelling 50,000 km per year, replacing 250 to 300 pre-Euro heavy vehicles with Euro 5 heavy vehicles would yield emission reductions of approximately 200 tonnes of NO_X per annum. Complexities arise in determining how many years the offset is available for; that is, for how many years was the old vehicle likely to be driven since once it has reached the end of its life, the offset should no longer be available to be claimed.

<u>2. VOCs reductions by implementing VR2 in Wollongong</u>

Vapour Recovery 2 (VR2) will be required at sites (≥12 Million litres p.a.) in by 2013. VR2 will also be required at new and newly modified sites (>0.5 ML p.a.) from 2010.

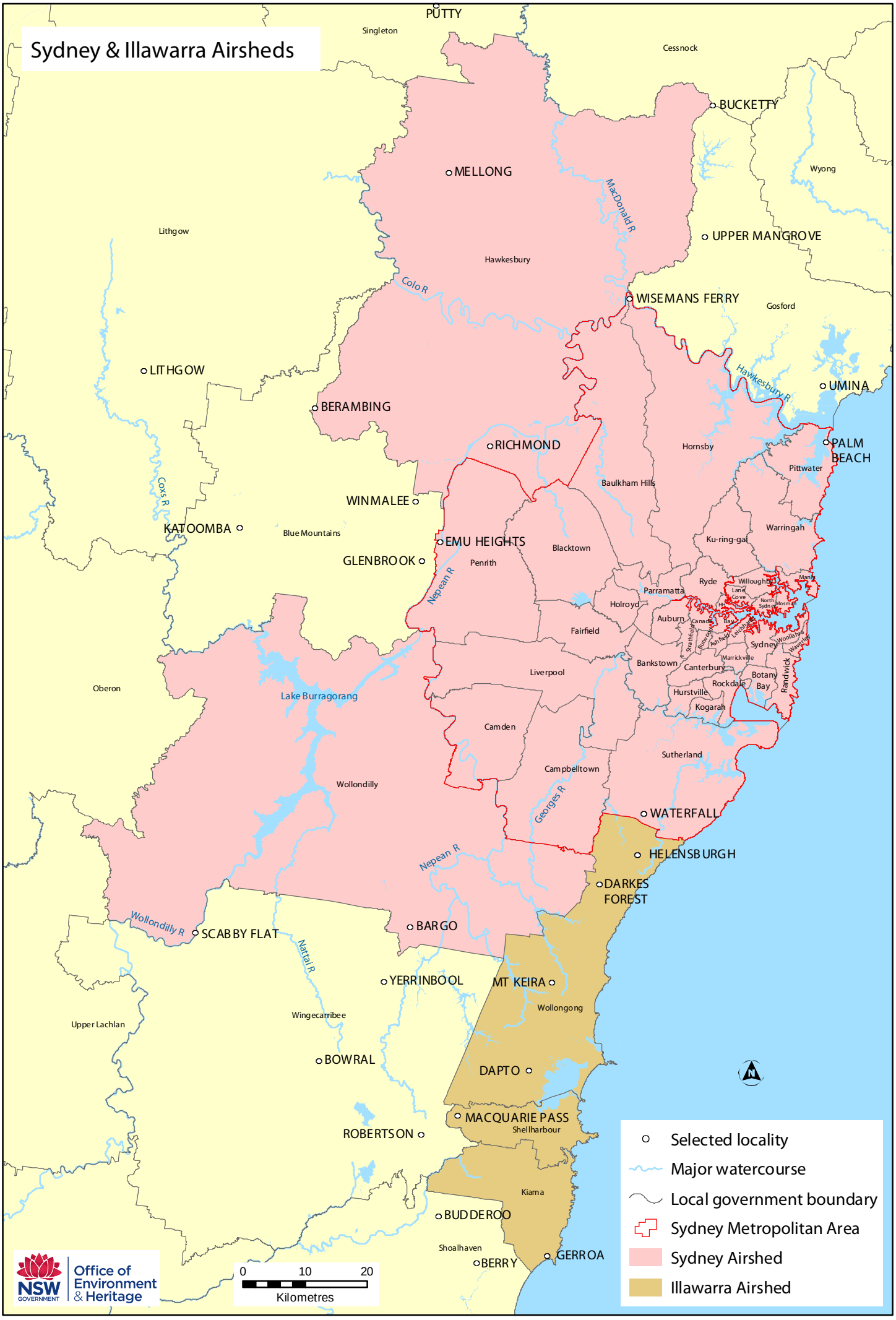
It is estimated that 80% of service stations in Wollongong will not be required to install VR2 unless they undergo modification. A service station with 6 ML fuel throughput, with VR1 but not VR2, will have emission reduced by around 77 tonnes per annum if VR2 is installed at a cost of about $100K.

Therefore, (assuming the life of a site is about 30 yrs) equipping three medium sized service stations of age less than 5 yrs old with VR2 technology would reduce VOC emissions in excess of 230 tonnes per annum, for 25 years if it can be shown that the service station would not otherwise have been modified or refurbished.

3. Scrappage

Scrappage, or accelerated vehicle retirement schemes use financial incentives to encourage the owners of highly polluting vehicles to sell their vehicles for scrapping. These schemes have been introduced in a number of US areas, notably Southern California. Scrappage schemes involve identifying and targetting appropriate vehicles for scrapping, verifying that they are in use, purchasing and disposing of the vehicles.

ATTACHMENT 3
SYDNEY AND ILLAWARRA AIRSHEDS


Sydney & Illawarra Airsheds
PUTTY
Singleton
Cessnock
BUCKETTY
Wyong
MELLONG
MacDonald R
Lithgow
UPPER MANGROVE
Hawkesbury
Colo R
WISEMANS FERRY
Gosford
LITHGOW
Hawkesbury R
UMINA
BERAMBING
RICHMOND
Hornsby
PALM BEACH
Pittwater
Baulkham Hills
Coxs R
WINMALEE
KATOOMBA
Blue Mountains
Warringah
Ku-ring-gai
EMU HEIGHTS
Blacktown
GLENBROOK
Penrith
Nepean R
Ryde
Parramatta
Holroyd
Auburn
Fairfield
Sydney
Bankstown
Canterbury
Liverpool
Marrickville
Botany Bay
Rockdale
Hurstville
Kogarah
Randwick
Oberon
Lake Burragorang
Camden
Sutherland
Campbelltown
Wollondilly
Georges R
WATERFALL
HELENSBURGH
Nepean R
DARKES FOREST
Wollondilly R
SCABBY FLAT
BARGO
Nattai R
YERRINBOOL
MT KEIRA
Wollongong
Upper Lachlan
Wingecarribee
BOWRAL
DAPTO
MACQUARIE PASS
Shellharbour
ROBERTSON
Kiama
BUDDEROO
Shoalhaven
BERRY
GERROA
Selected locality
Major watercourse
Local government boundary
Sydney Metropolitan Area
Sydney Airshed
Illawarra Airshed
0
10
20
Kilometres
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