ENVIRONMENT PROTECTION AUTHORITY

National Pollutant Inventory

South Australia summary report 2006–07

EPA
South Australia

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TABLE OF CONTENTS

List of figures

INTRODUCTION

This South Australian Environment Protection Authority (SA EPA) report provides a summary of the National Pollutant Inventory (NPI) in South Australia for the 2006–07 reporting year.

The NPI is a publicly accessible internet database that provides information on pollutants emitted to the air, land and water environments across Australia. Since 1998 many industrial and commercial facilities have estimated and reported their annual pollutant emissions. Diffuse emissions from sources such as motor vehicles are less frequently estimated by government agencies.

The summary report discusses:

- industry emissions
- a case study on carbon monoxide
- using NPI data for comparative risk assessments
- diffuse emissions to water.

INDUSTRY EMISSIONS

Types of industries reporting

For the 2006–07 reporting period, the SA EPA received 403 NPI reports from industry which is comparable to the 394 reports received in 2005–06. The NPI program has stabilised and the number of new reporting facilities decreases each year.

In 2006–07, these reports come from a range of Australian and New Zealand Standard Industrial Classification (ANZSIC)[1] industry sectors as shown in Figure 1.

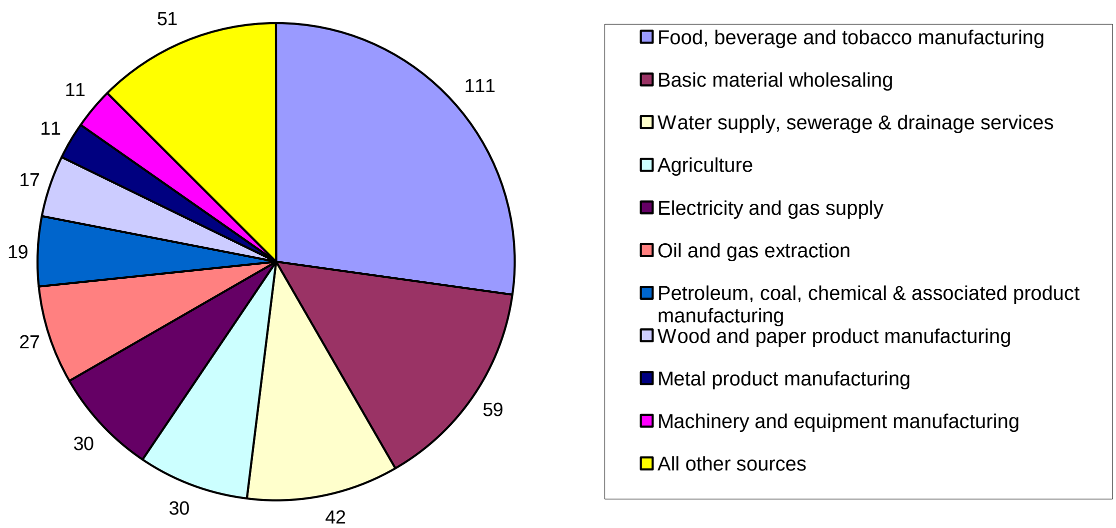

Figure 1 **Proportions of ANZSIC industry sectors reporting to the NPI (as number of sites per sector)**

[1] For more information on ANZSIC industry sectors, go to <www.npi.gov.au/database/anzsic-code-list.html>.

The majority of reporting facilities are grouped as food, beverage and tobacco manufacturing (including wineries), basic material wholesaling (including petroleum wholesalers), and water supply, sewerage and drainage services. This pattern has been relatively consistent over the last few years. However, in comparison to previous years, the number of agricultural facilities reporting has increased since poultry farms, piggeries and beef cattle feedlots began reporting to the NPI.

Changes in substance emissions

While the number of reporting facilities remained nearly unchanged, the emission levels have changed with 93% of substances reported showing some variation.

There are many factors that can lead to site emission changes including changes in production level (resulting from product demand or availability of raw materials), variations in monitoring results, and alternative uses of waste products and installation of cleaner production equipment. In 2006–07, the drought and associated water restrictions have resulted in a reduction of some emissions including ethanol emissions from wineries (see Figure 2). Ethanol emissions from wineries relate directly to the production levels. The drought has resulted in a decrease in the amount of wine produced and as a result, the ethanol emissions from wineries have also decreased.

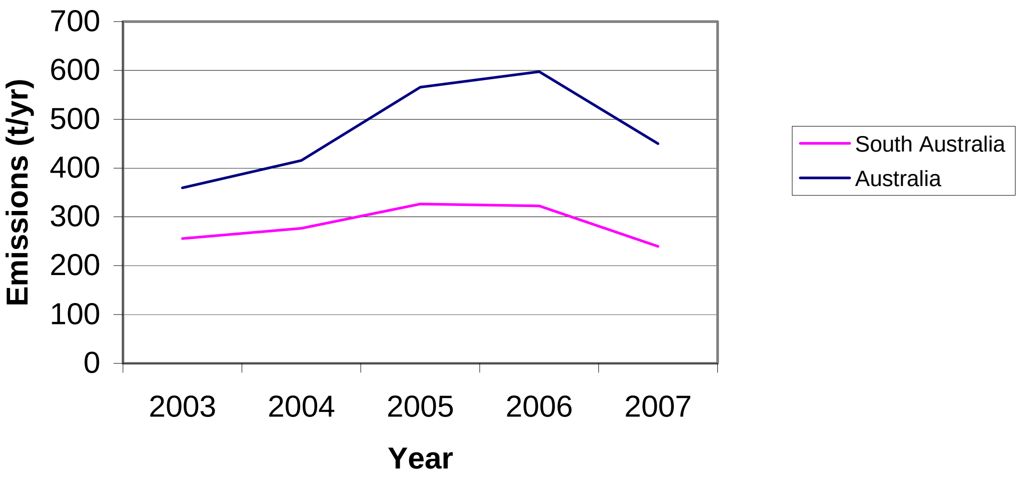

Figure 2 Ethanol emissions from wineries for both South Australia and Australia

CASE STUDY: CARBON MONOXIDE

When interpreting NPI data it is important to have an understanding of the pollutants—what they are, where they come from and their effects. This section provides a case study on one of the NPI substances—carbon monoxide[2]. Carbon monoxide is an important NPI pollutant because it is often released in large quantities and it can have significant impacts on human health and the environment.

What is carbon monoxide?

Carbon monoxide is a highly poisonous, colourless and tasteless gas. It is very flammable and mixes well with air, easily forming explosive mixtures.

[2] Similar information on all substances reported to the NPI can be found at <www.npi.gov.au/database/substance-info/profiles/index.html>.

What are the health and environmental effects of carbon monoxide?

Carbon monoxide is a gas at room temperature and can enter the body when breathing. Once in the lungs, carbon monoxide is readily absorbed into the bloodstream. Low levels of carbon monoxide can affect human health through headaches, dizziness and fatigue. At higher levels (over 400 parts per million), it can be more harmful resulting in hallucinations, convulsions, loss of consciousness or even death. Environmentally, carbon monoxide can have a similar effect on birds and other animals as it does on humans.

Where does carbon monoxide come from?

Carbon monoxide forms as a result of the incomplete combustion of the carbon in fuels such as petrol, diesel or wood. As such, carbon monoxide can be produced by any process that involves burning including industrial (metal manufacturing, electricity supply, food manufacturing), domestic (home heating, lawn mowing), transport (vehicles, aircraft) and natural (volcanoes, bush fires) sources.

Figures 3 and 4 show the top emission sources of carbon monoxide in Australia and South Australia respectively with industry data for 2005–06 and diffuse pollution data from varying periods for different jurisdictions (2002–03 for SA). Both graphs show that the majority of carbon monoxide (CO) emissions are produced from motor vehicles.

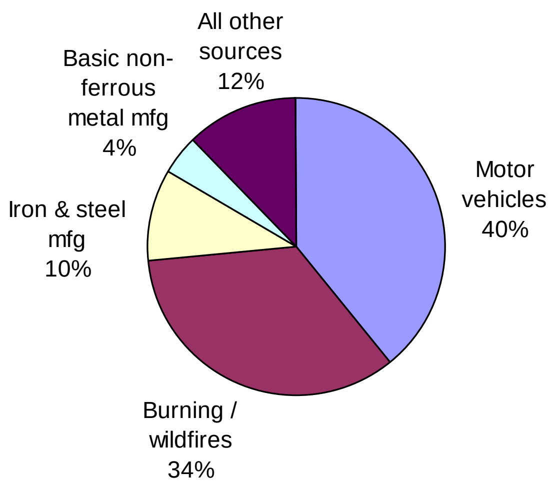

Figure 3 Top CO Emission Sources—Australia

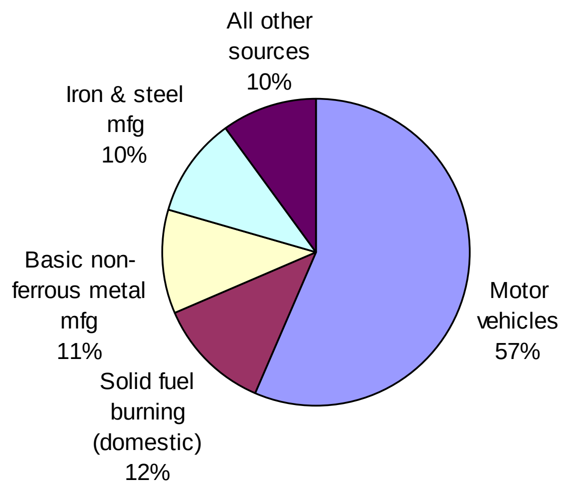

Figure 4 Top CO Emissions Sources—SA[3]

How can carbon monoxide emissions be reduced?

As mentioned above, motor vehicles are the major contributor to carbon monoxide emissions. These emissions can be reduced by fitting cars with emissions controls, regular servicing, using cars less and adopting alternative transport methods such as walking, bike riding and public transport.

[3] Emissions from burning and wildfires have not been calculated for South Australia.

USING NPI DATA FOR COMPARATIVE RISK ASSESSMENTS

A small amount of a highly toxic substance may be of more concern than a larger amount of a less toxic substance. Therefore when comparing the impacts of different pollutants, both the amounts and the toxicity of the emitted substances need to be considered. These factors are studied in a risk assessment.

What is risk?

For the purpose of this report, risk is the possibility of harm or loss. Scientists use the term risk when assessing potential human or environmental health threats from exposure to pollutants. Risk is equal to the probability of an event multiplied by its consequence.

Risk ranking of air emissions in the Adelaide airshed

The risk to the environment from emissions to the Adelaide airshed reported by industry sectors to the NPI for the 2006–07 reporting period was calculated by applying load-based hazard scores to the emissions of all substances from one source. Those hazard scores were derived from the NPI hazard scores and reflect different toxicity of the NPI substances (see appendix for more details). The calculated risks from all sources, both point source and diffuse emissions using aggregate emission data (AED)[4], were then compared.

Figure 5 illustrates the findings of this comparison. Some key points to note include:

- the high contribution of motor vehicle emissions to environmental risk in the Adelaide airshed
- eight out of the 10 highest risks from air pollutants in the Adelaide airshed are related to aggregate emission data (marked with an asterisk on Figure 5) where:
  - transport accounts for 66% of the environmental risk
  - sub-threshold facilities account for 7% and domestic activities for 1% of the environmental risk.
- industry emissions reported to the NPI in 2006–07 only amount to 25% of the environmental risk in the Adelaide airshed.

The risk analysis process can also be applied to determine the risk from individual reported substances to the environment. When this was carried out for the Adelaide airshed, oxides of nitrogen were shown to have the greatest component of these risks to the environment. For example, for the 10 emission sources shown in Figure 5, the contribution from oxides of nitrogen to the risk of all reported substances to the environment ranges from 94% to 100%.

[4] The SA EPA calculates AED periodically; the most recent update for air emissions in South Australia is for the year 2002–03.

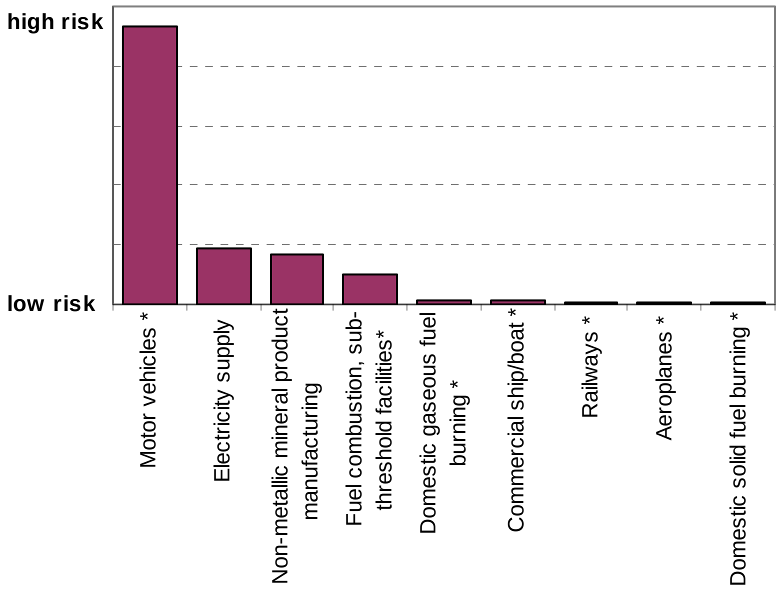

Figure 5 **Calculated environmental risk averaged over the Adelaide airshed for industry sectors and aggregate emission data (marked with an asterisk *)**

DIFFUSE EMISSIONS TO WATER

Significance and origin of nutrient emissions to water

Nitrogen (N) and phosphorus (P) are important nutrients required to maintain the productivity of ecosystems. However, in excess both nutrients can harm the ecology of waterways by causing algal blooms, which may also impact on drinking water quality and recreational activities. Nutrients emitted to water come from both point sources and non-point (diffuse) sources. Point sources of nutrient emissions to water, such as wastewater treatment plants, report their annual emissions directly to the NPI. Diffuse pollution is estimated by the NPI as AED.

Information from the Mount Lofty Ranges Watershed is presented below to show how NPI calculates emissions from diffuse pollution sources

Modelling nutrient loads for the Mount Lofty Ranges Watershed

The SA EPA used a water quality, rainfall and run-off model that was specifically developed for the Mount Lofty Ranges Watershed (the Watershed). This model incorporates climate (rainfall and evapotranspiration), topography, measured pollutant concentrations and land use data from the Mount Lofty Ranges.

Annual average loads of total nitrogen (TN) and total phosphorus (TP) were calculated for 43 sub-catchments of the Watershed for the period 1999–2003. The total nutrient loads from all land use activities in the sub-catchments (TN and TP in kg/year) are shown in Figure 6.

As illustrated in Figure 6, emissions of nitrogen and phosphorus are correlated—catchments with high nitrogen loads also have high phosphorus loads (labelled and in red) and most catchments with low nitrogen loads have also low phosphorus loads.

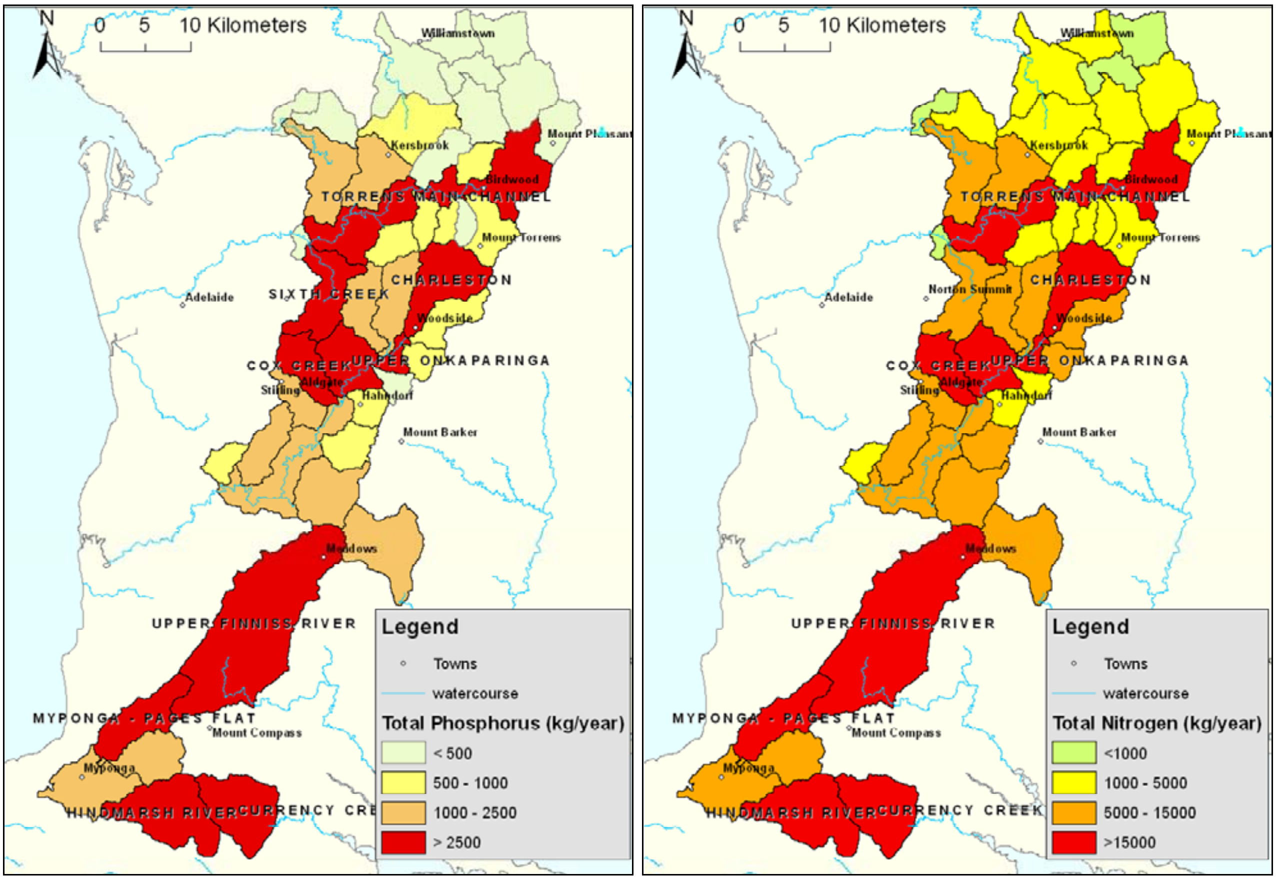

Figure 6 **Annual average loads of total phosphorus and total nitrogen for 43 sub-catchments of the Mount Lofty Ranges Watershed (modelled for 1999–2003)**

MORE INFORMATION

The NPI website

The NPI database and website at <www.npi.gov.au> is the primary location for obtaining information relating to the NPI. All emissions data used in this report can be obtained from the NPI database. The website also contains information on reporting to the NPI, calculating emissions, searching the database and details of the NPI substances and their chemical properties.

The SA EPA website

The SA EPA website at <www.epa.sa.gov.au/npi.html> contains NPI information specific to South Australia including how to register as a reporter, previous annual summary reports and an Interpretive Guide. The Interpretive Guide contains information of industry vs aggregate data, important tips on interpreting the data, and common errors that result in misinterpretation.

The SA EPA NPI team

If you have any queries in relation to this document or the NPI in general, the SA EPA NPI team can be contact via email on <npi@epa.sa.gov.au> or telephone (08) 8204 9095.

REFERENCES

Department of the Environment, Water, Heritage and the Arts 2008, *National Pollutant Inventory database*, DEWHA, Canberra, viewed 12 September 2008, <www.npi.gov.au>.

Hertwich EG, Mateles SF, Pease WS & McKone TE 2006, *An update of the human toxicity potential with special consideration of conventual air pollutants,* Working Paper no. 1/2006, Norwegian University of Science and Technology, Trondheim, viewed 12 September 2008, <www.ntnu.no/indecol>.

APPENDIX 1 ESTIMATING LOAD-BASED HAZARD SCORES

The information below provides additional detail on how the load-based hazard scores were determined. To recap, risk is equal to the probability of an event multiplied by its consequence.

When assessing the risks from air pollution, the probability of a health or environmental risk is linked to the exposure. The exposure is the amount of the pollutant that reaches a person or the environment. It is related to both the annual emissions (as reported to the NPI) and the exposure pathway. Different exposure pathways will allow the pollutant to access different organs (or organisms), affecting the body (or the environment) in different ways.

The consequence of a pollution event can be expressed as the toxicity of the pollutant. It is a measure of the degree to which something is poisonous; ie *how much* of the pollutant it would take to cause varying degrees of health and environmental effects. Many substances are toxic if the dose is high enough. For example, an adult ingesting half a cup of salt or large quantities of water over a short time can be fatal.

To calculate the risk posed by a pollutant to human health, the exposure of people to the substance is multiplied by its human toxicity potential. For multiple substances, the risks of each substance are added together. Such a calculated human health risk can then be assessed against health guidelines.

The NPI website (NPI fact sheets) provides hazard scores for each substance based on its health and environmental hazards, and the human and environmental exposure to the substance. NPI hazard scores range from 0 to 3 where 0 represents a negligible hazard and 3 is a very high hazard to health or the environment. The NPI hazard scores cannot be used in such a risk calculation as they do not correspond to a load-based hazard, ie the toxic effect produced by an amount emitted to the environment. In contrast, the human toxicity potential which Hertwich *et al* (2006) suggest for weighting emissions of NPI substances impacting on human health ranges from 0.02 for chloroethane to 8.9×10^{11} for polychlorinated dioxins and furans.

In order to compare environmental risks of different emission sources, the NPI health and environmental hazard scores in a simple mathematical operation, originally ranging from 0 to 3, were transformed to the range of 0.1–100,000. The resulting load-based environmental hazard scores were then used to estimate the risks posed by emission sources to the environment.