

Motor Vehicle Emissions in Sydney

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Presentation at the 2018 Public Sector Fleet Managers Conference, 1 November 2018



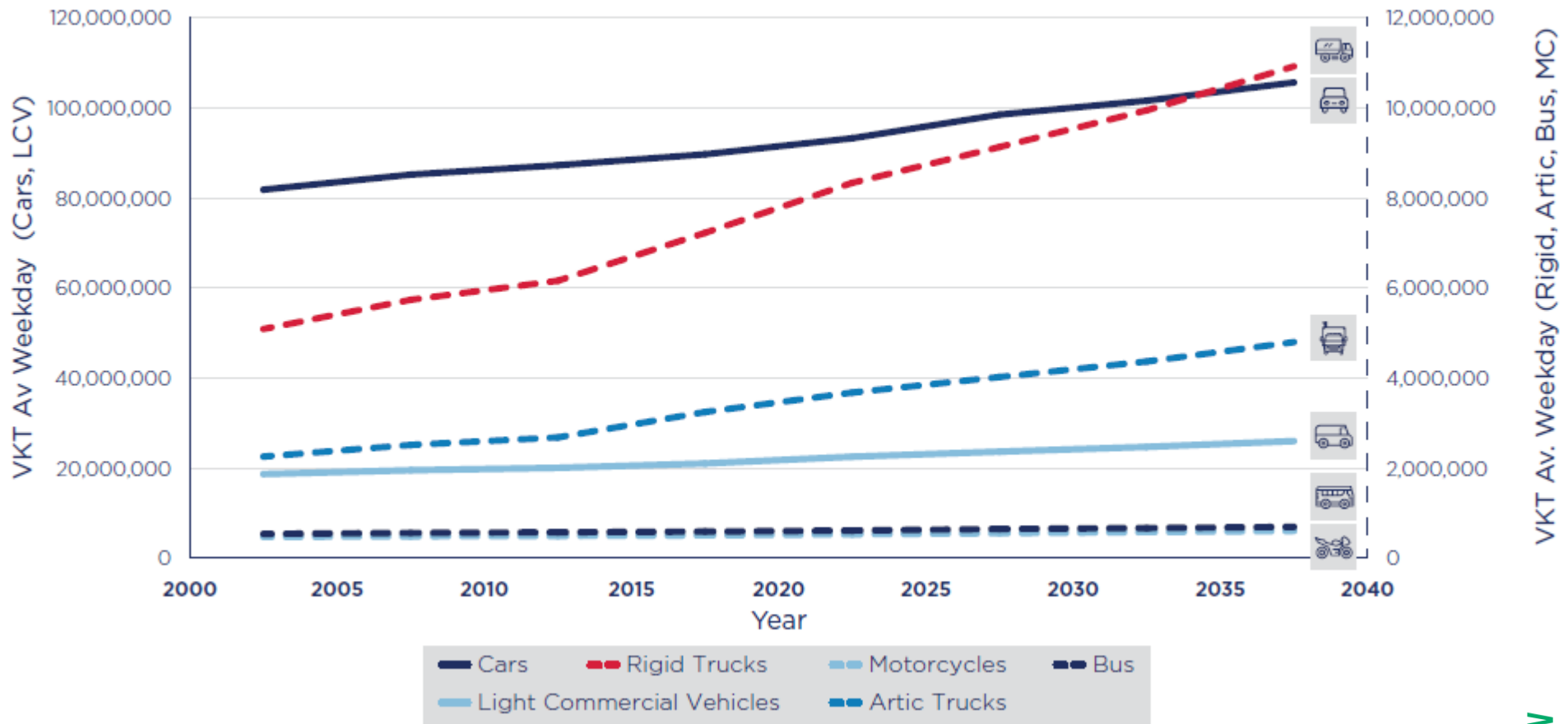
Overview

- Vehicle emissions in NSW Greater Metro Region
- Impact on ambient air quality
- Population exposure to vehicle pollution
- Future directions



Vehicle Movements in the NSW Greater Metro Region

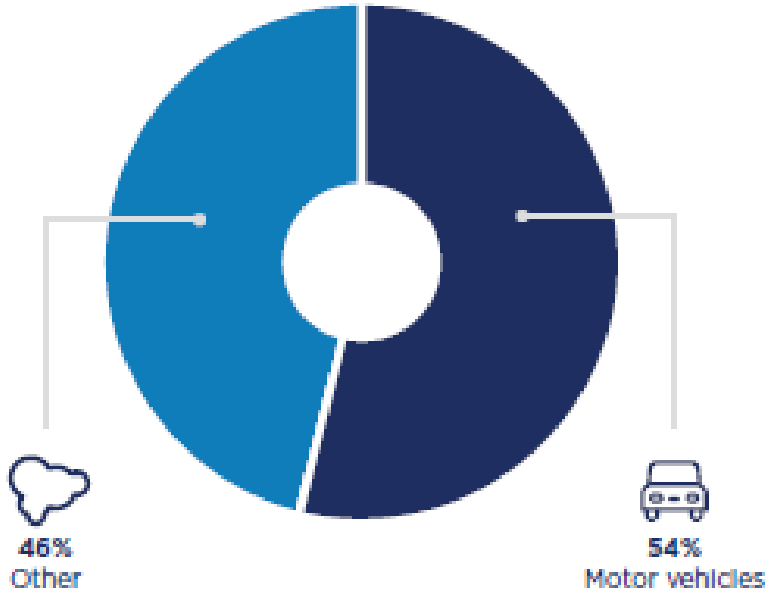
AVERAGE WEEKDAY VKT GROWTH 2003-2036, BY VEHICLE TYPE



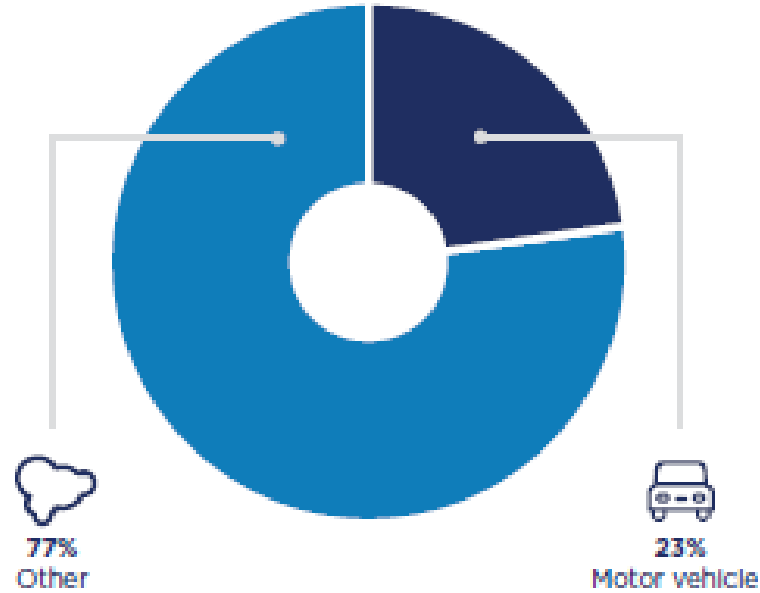
Vehicle Emissions in NSW Cities

ANNUAL AVERAGE CONTRIBUTIONS TO EMISSIONS, 2008, IN SYDNEY, WOLLONGONG AND NEWCASTLE

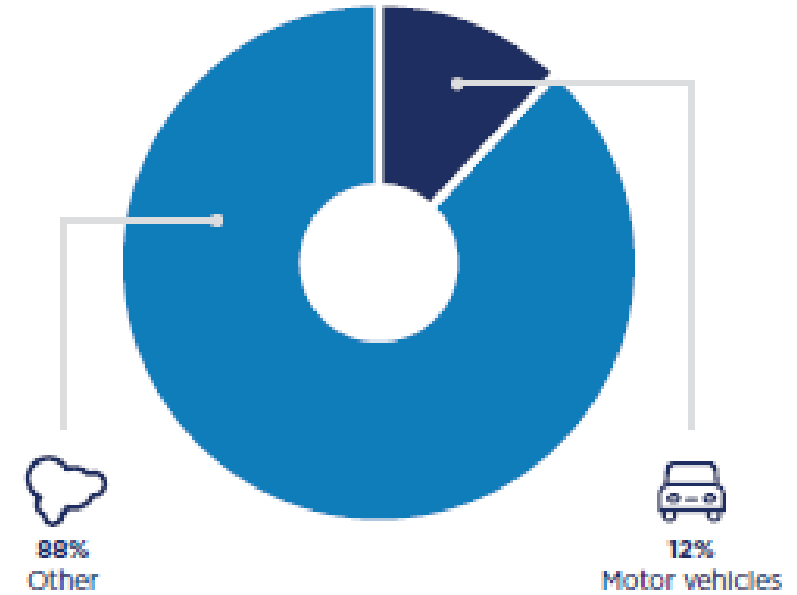
NO_x



VOC



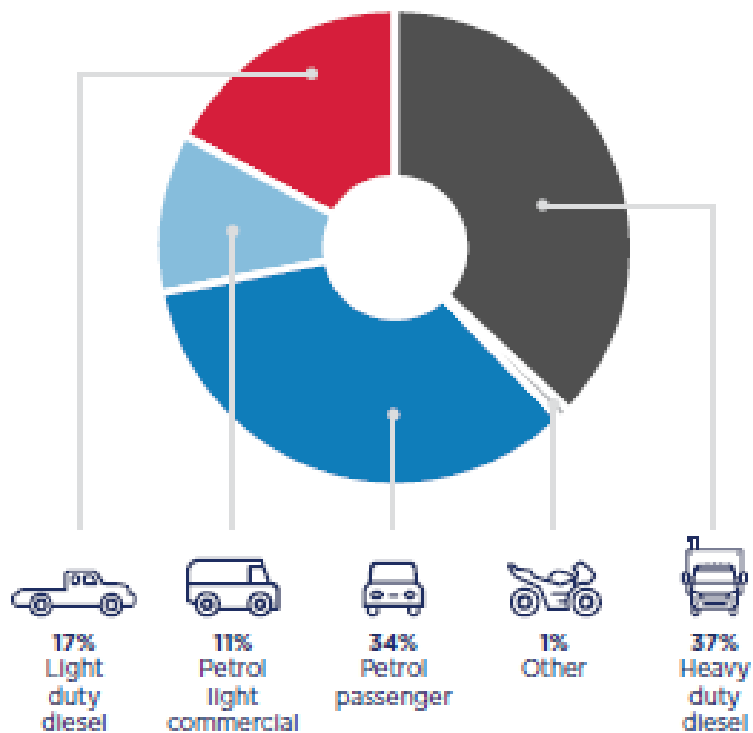
$PM_{2.5}$



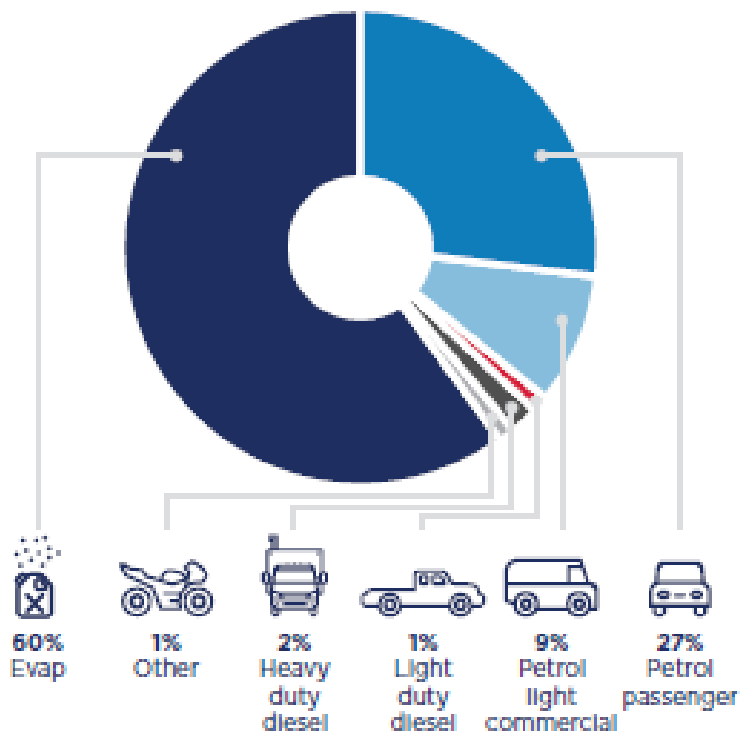
Vehicle Emissions by Vehicle Type - 2016

CONTRIBUTION OF VEHICLE TYPES TO VEHICLE EMISSIONS 2016

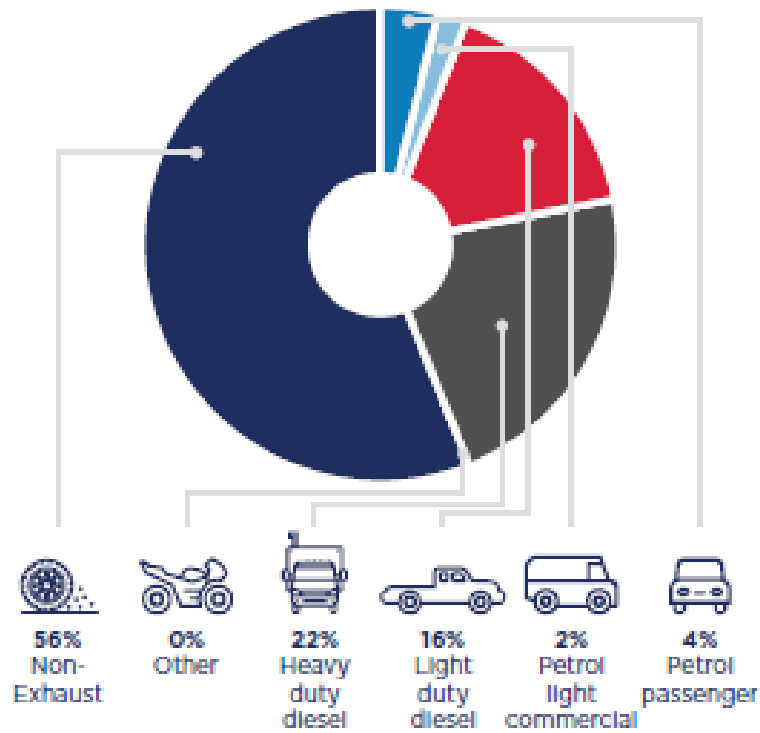
NO_x 2016



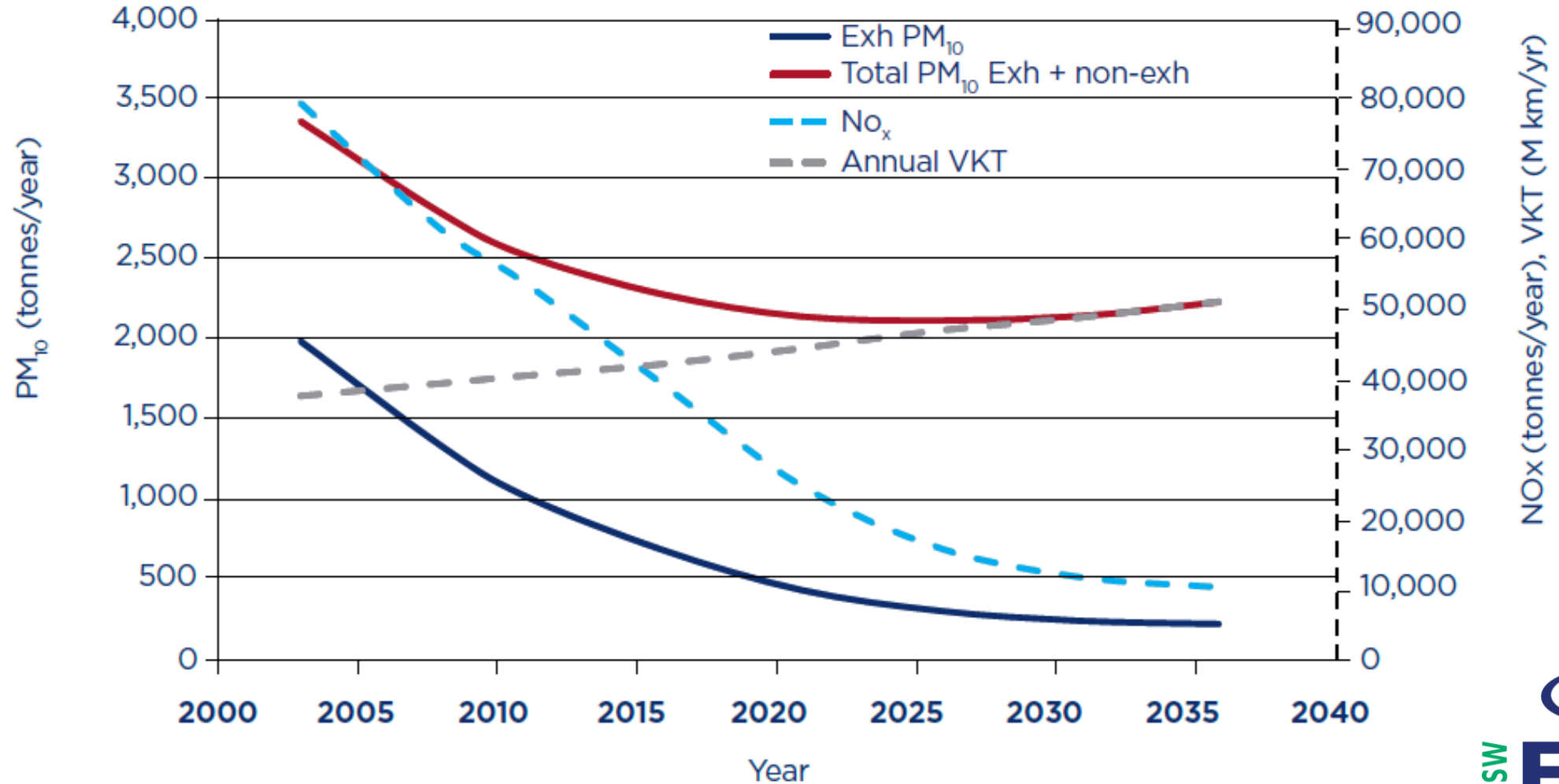
Total VOC 2016



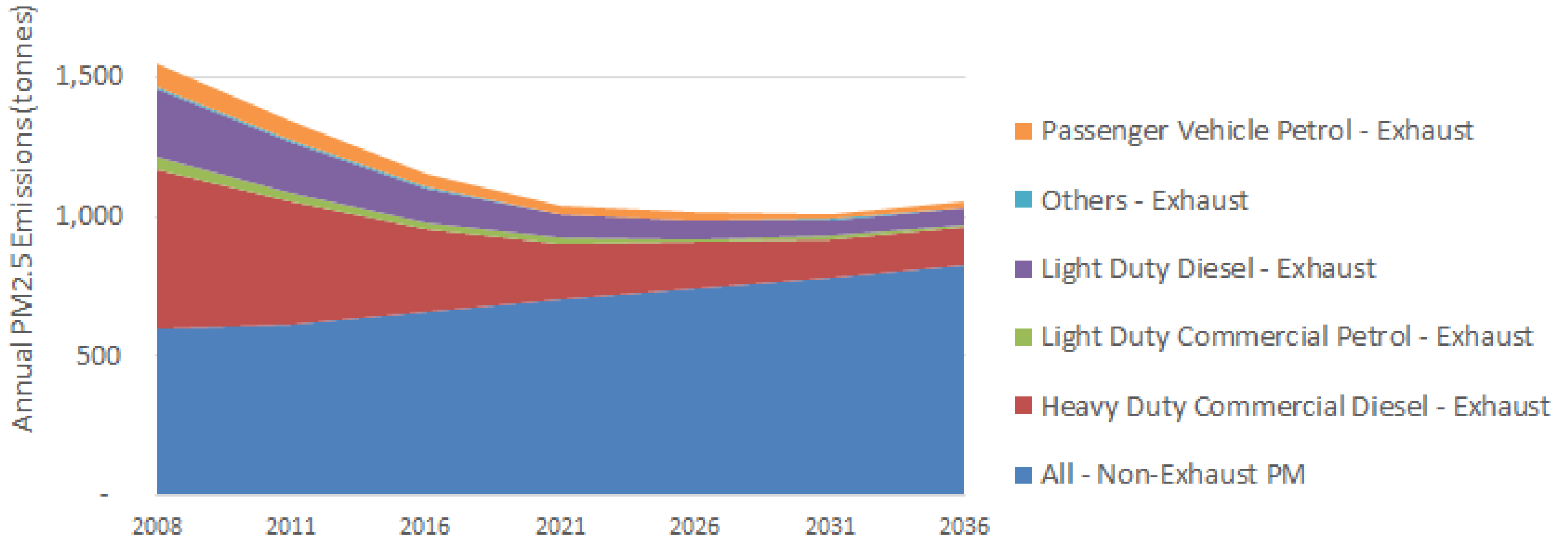
PM_{2.5} 2016



Projected NSW GMR Vehicle Emissions

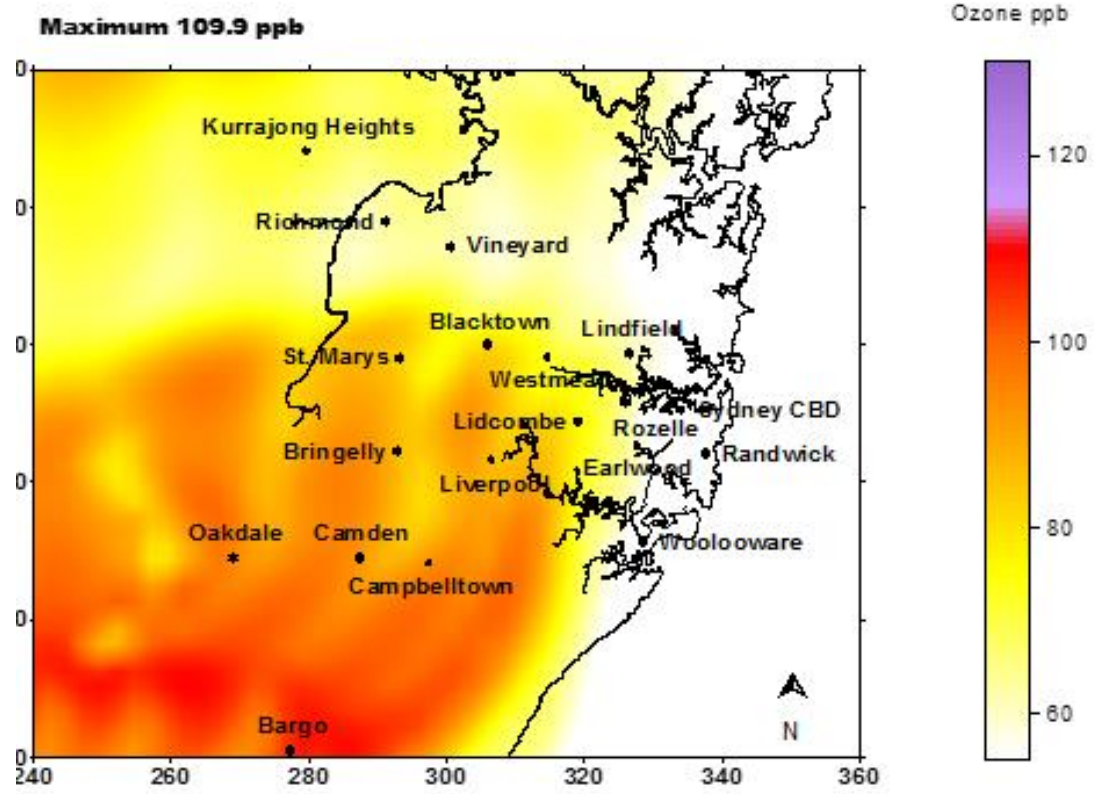
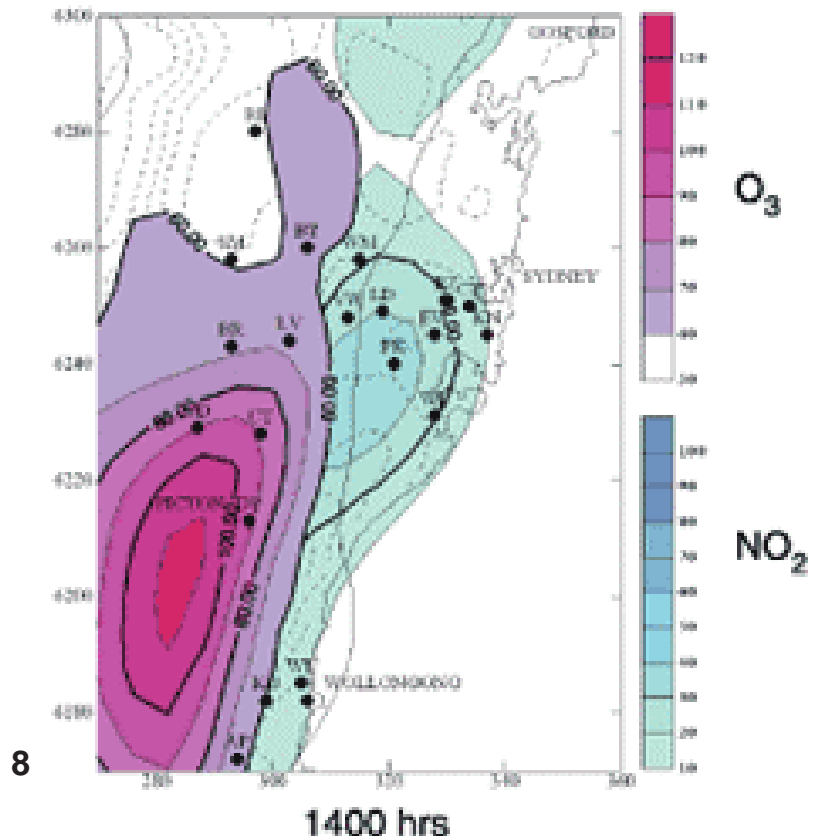
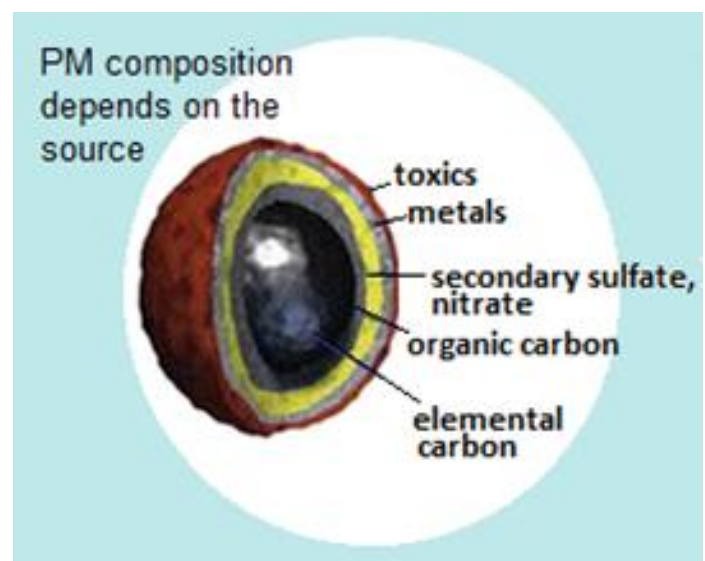
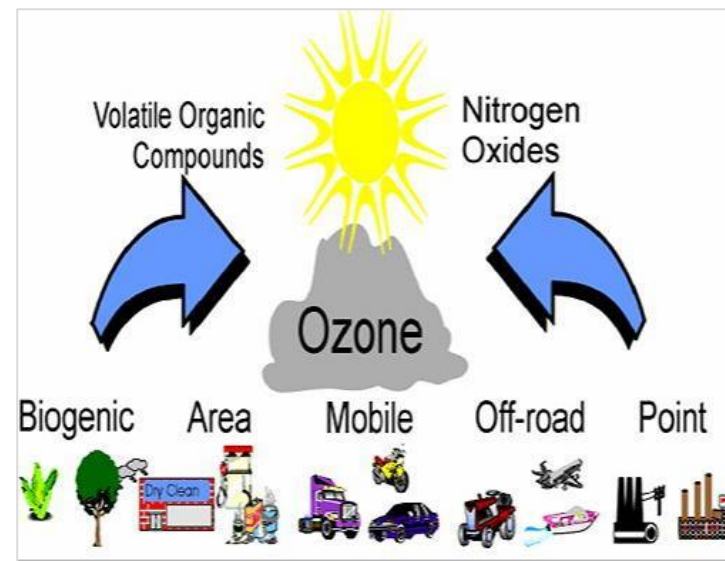


Projected Sydney Vehicle Emissions (2008-2036)

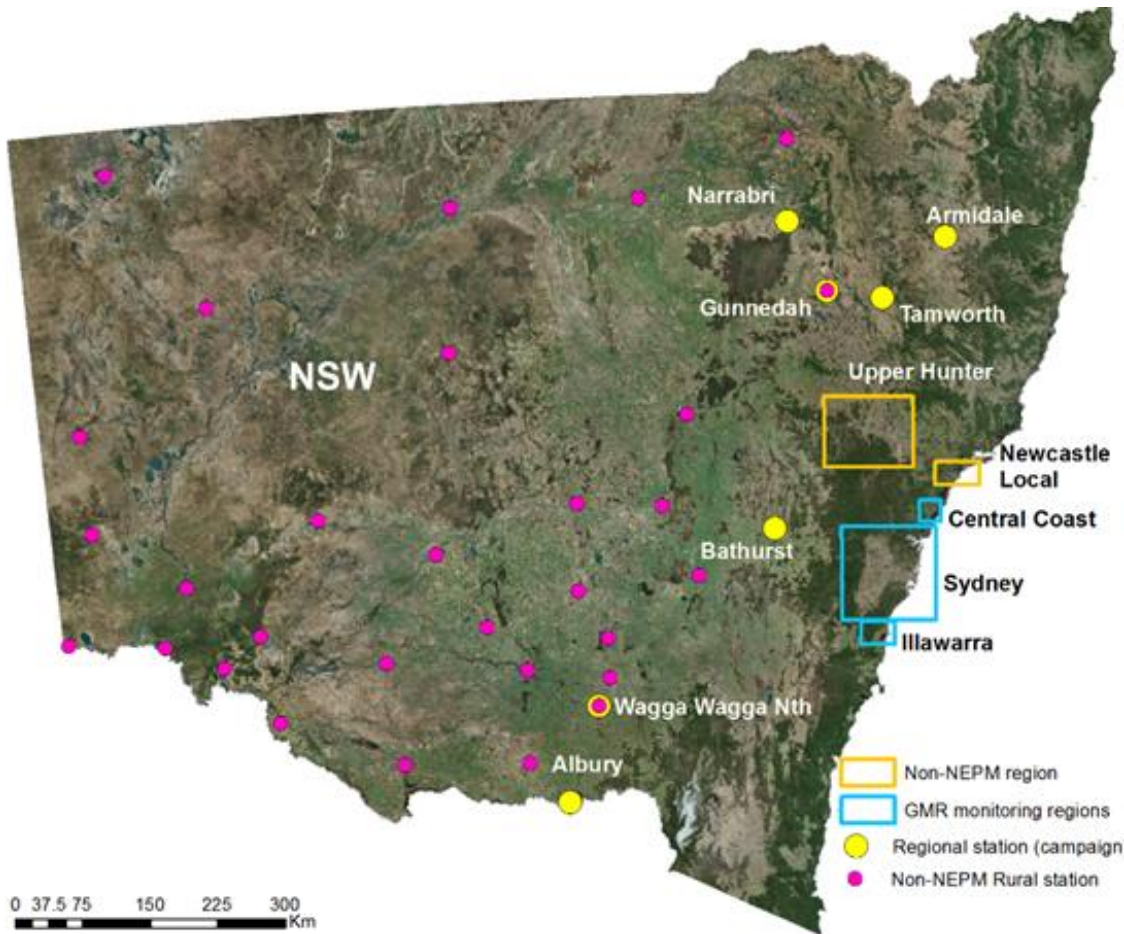


Air pollutants formed in the air

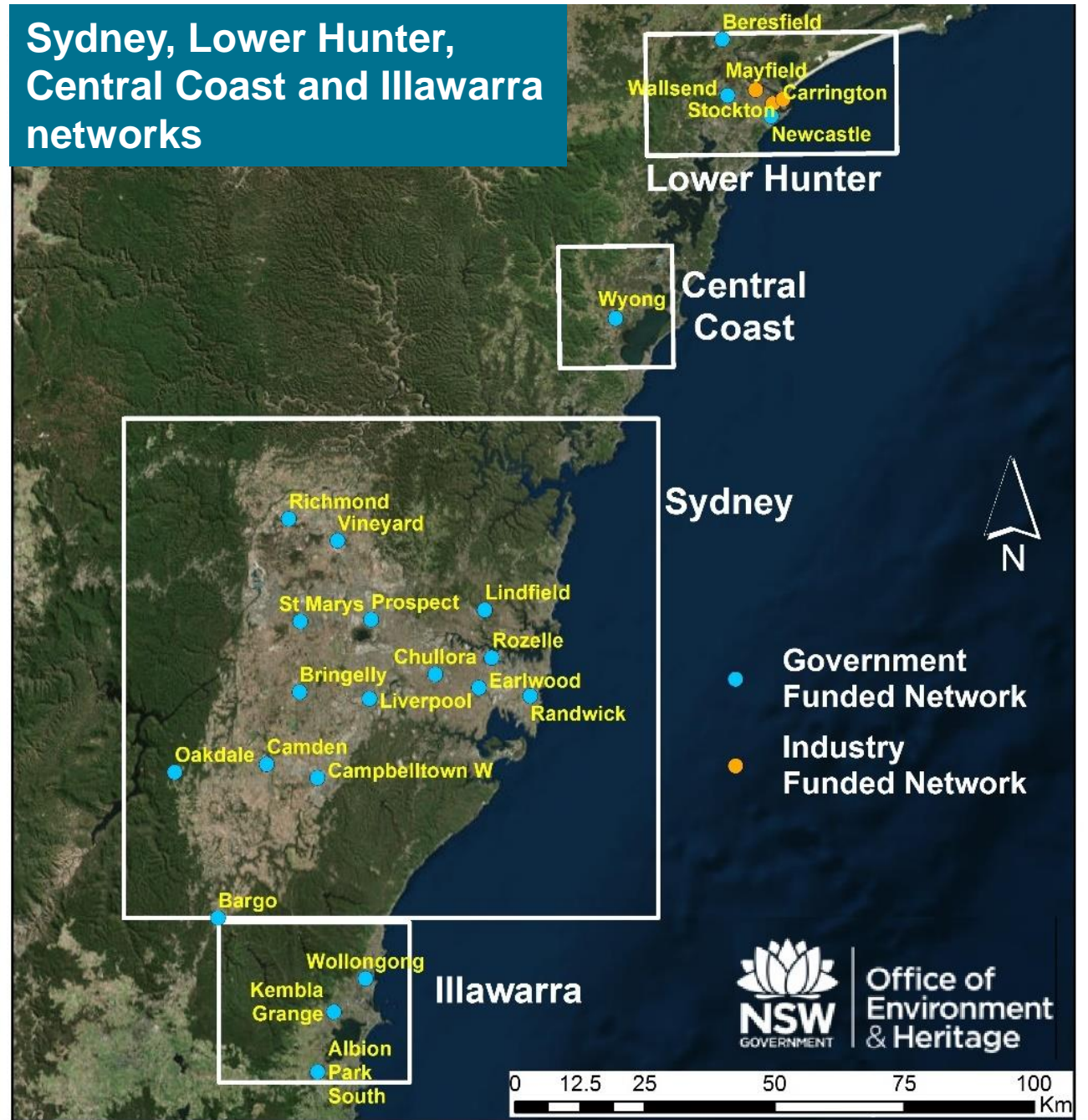
- Ozone
- Secondary particles



NSW Air Quality Monitoring Network

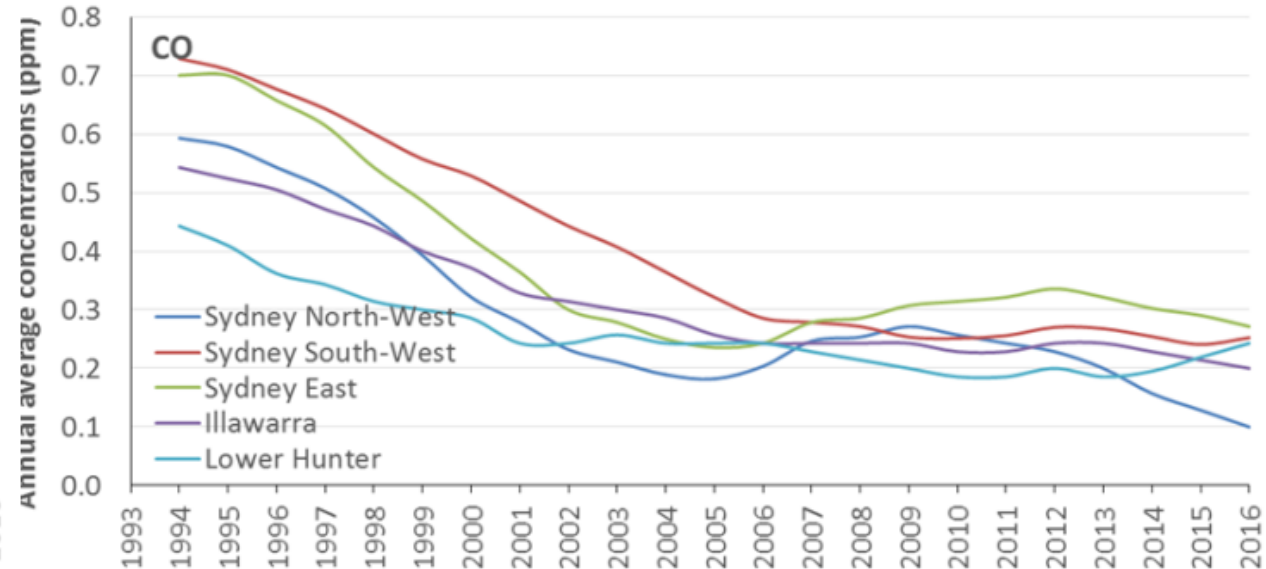
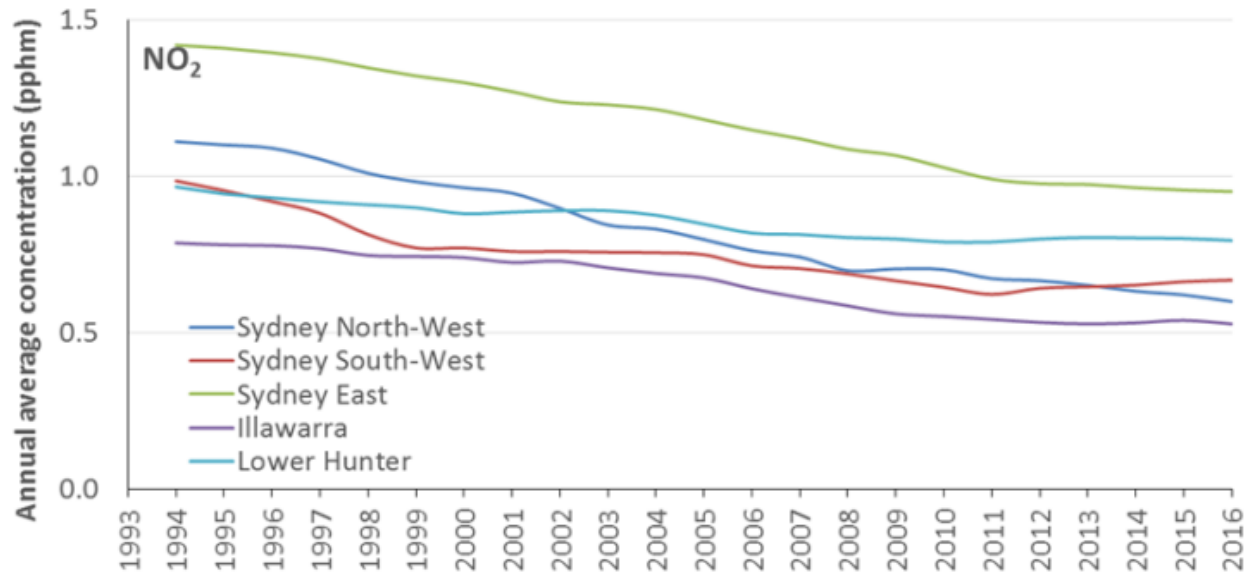


Sydney, Lower Hunter, Central Coast and Illawarra networks



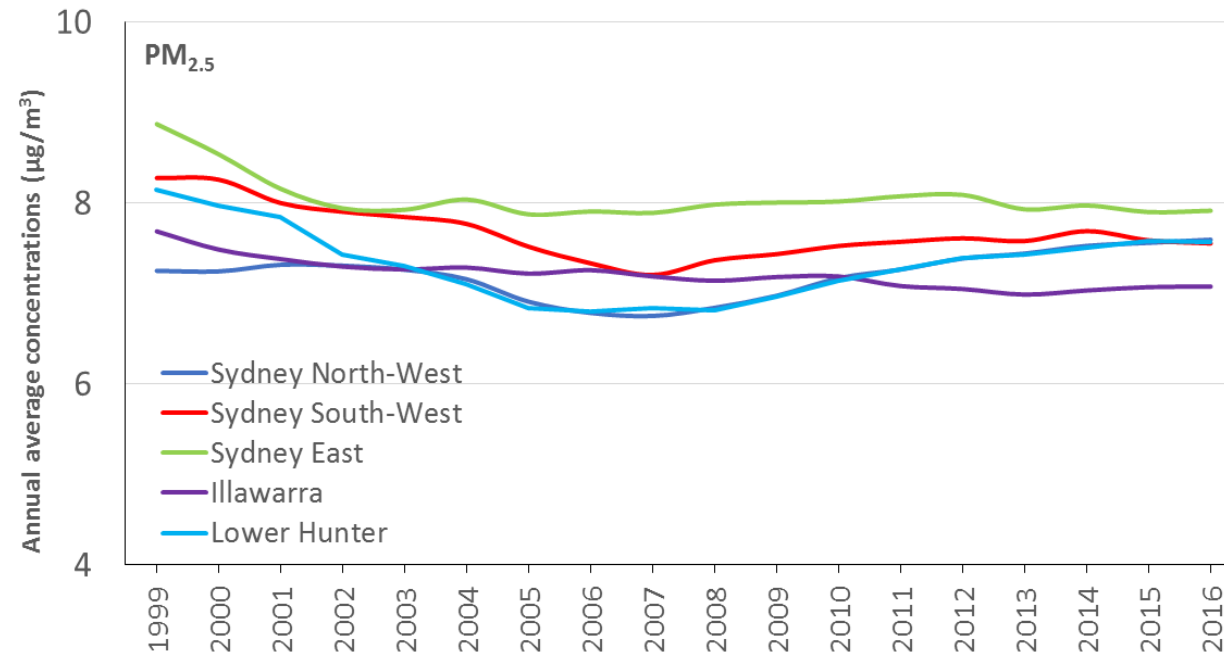
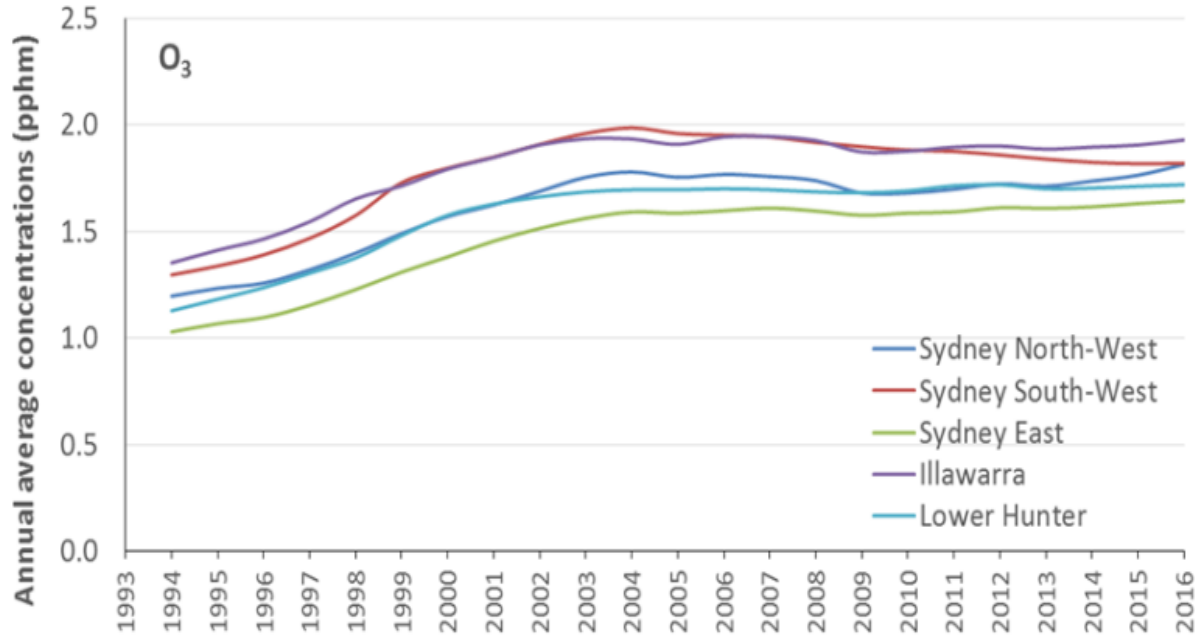
What is the state of air quality?

NO₂ and CO pollution trends



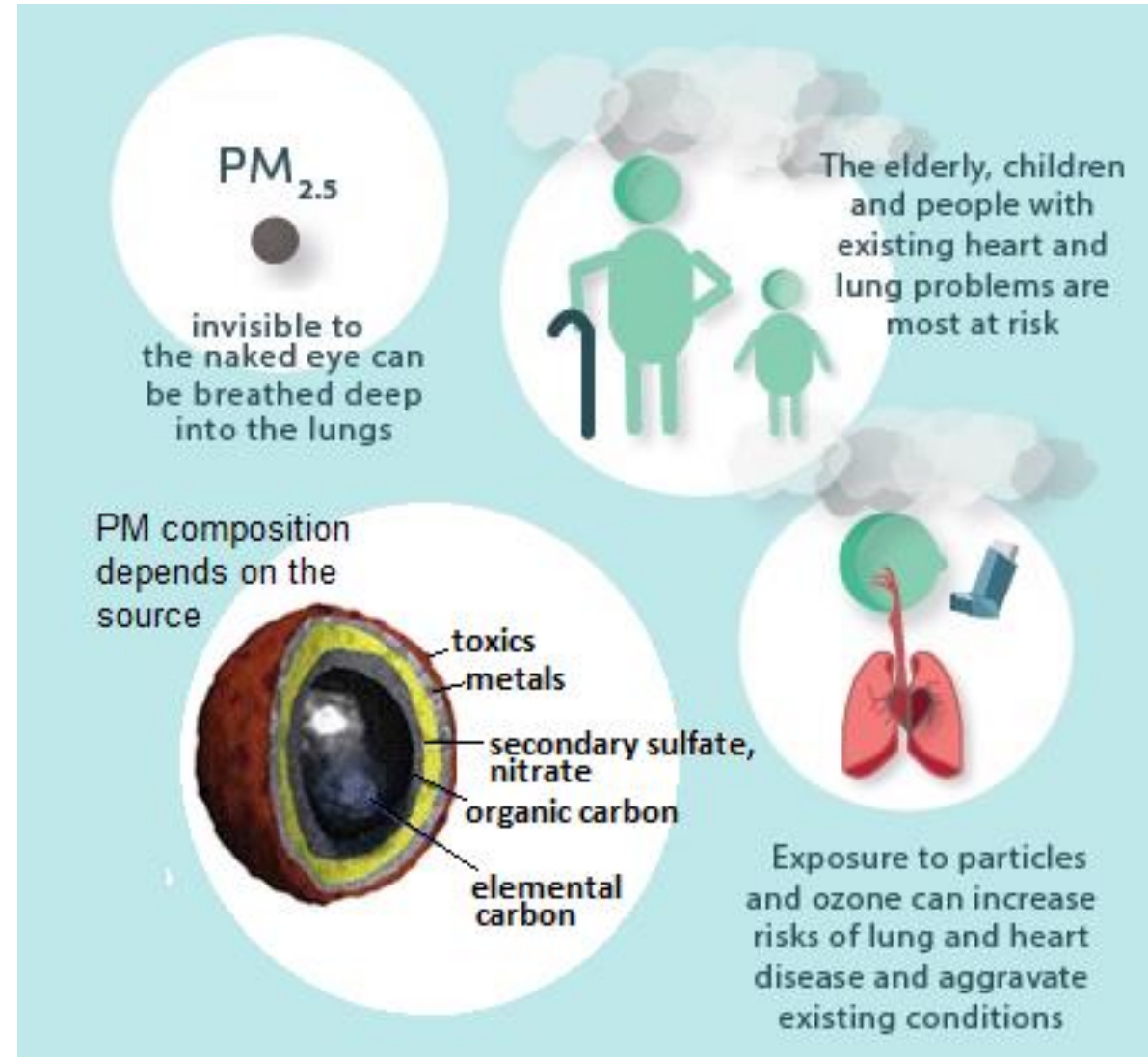
What is the state of air quality?

Ozone and fine particle pollution trends



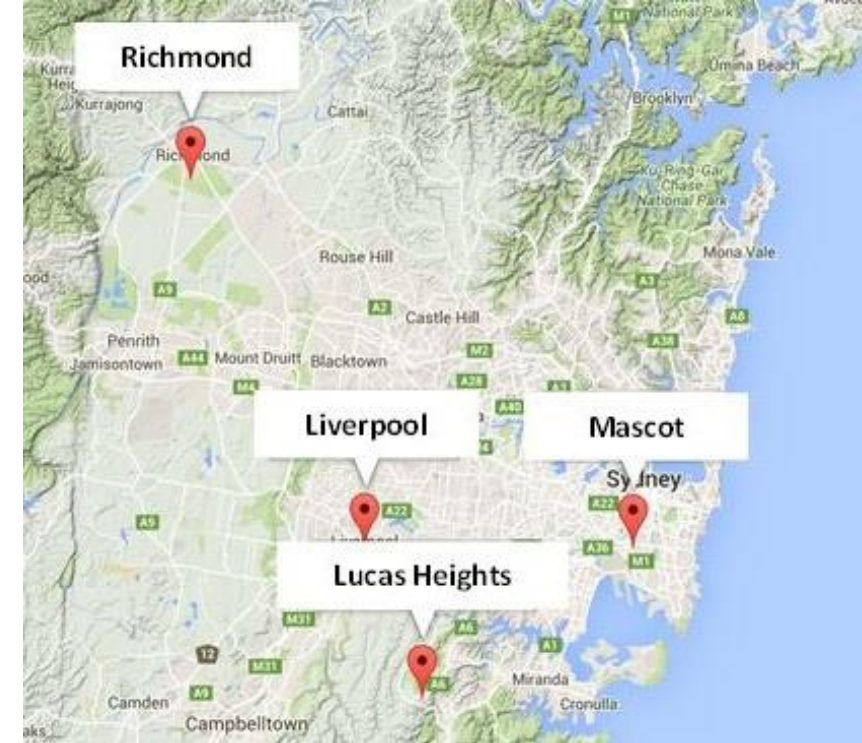
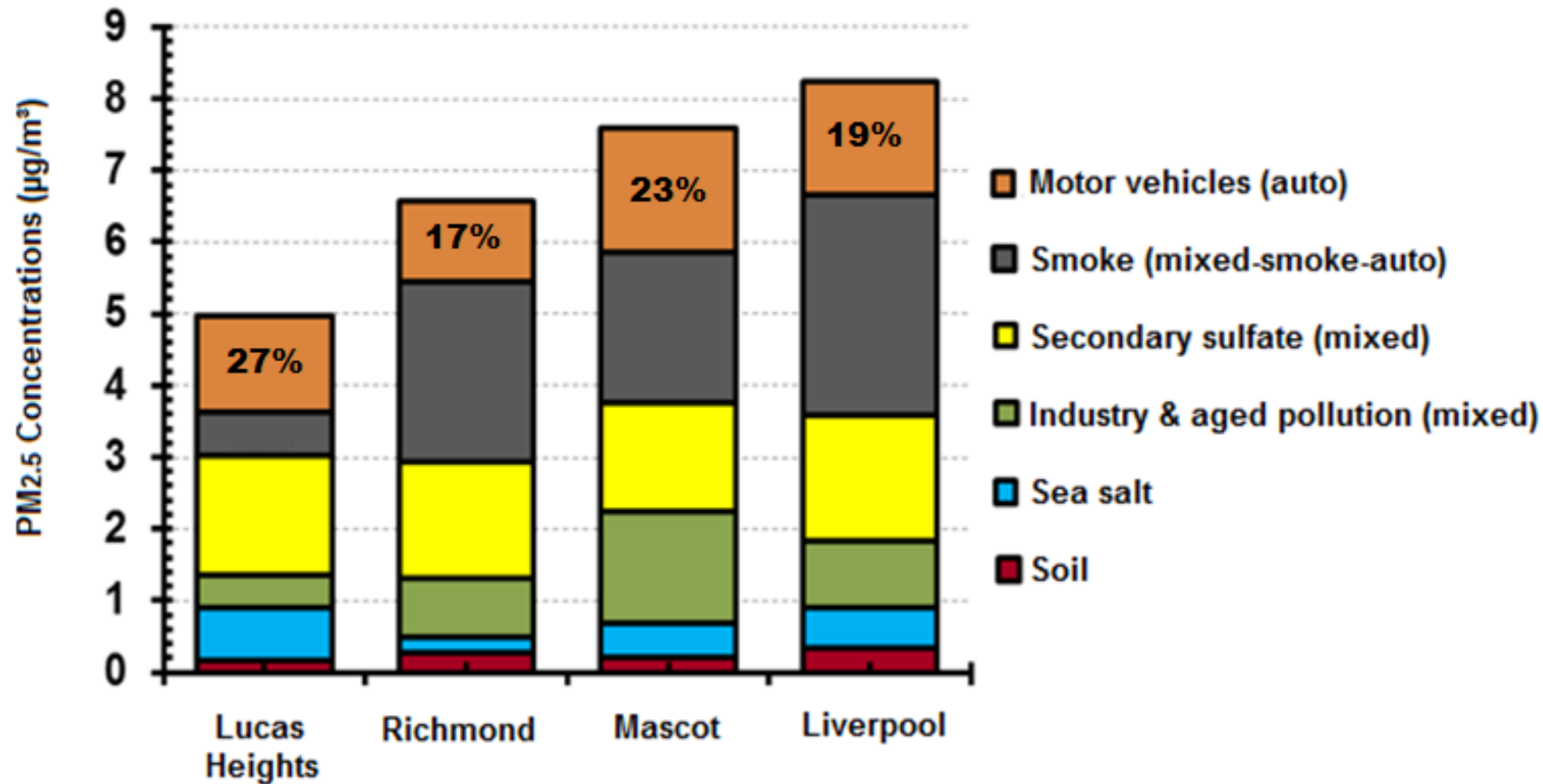
Health impacts associated with exposure to air pollutants

- Air quality generally good but health and economic benefits for reducing pollution
- Greater Sydney:
 - health cost of \$4.7 billion p.a. (DEC, 2005)
 - 430 premature deaths (Broome et al. 2015)
 - 630 respirable and cardiovascular hospital admissions (Broome et al. 2015)

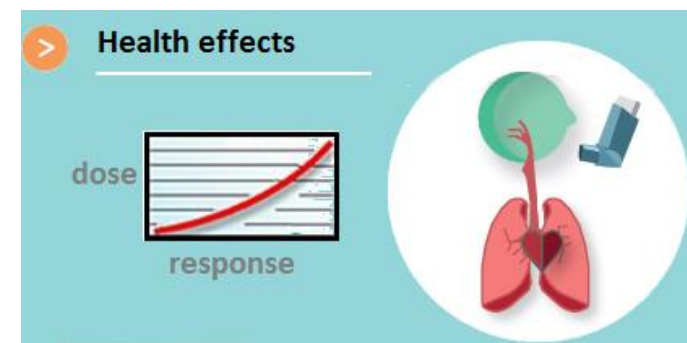
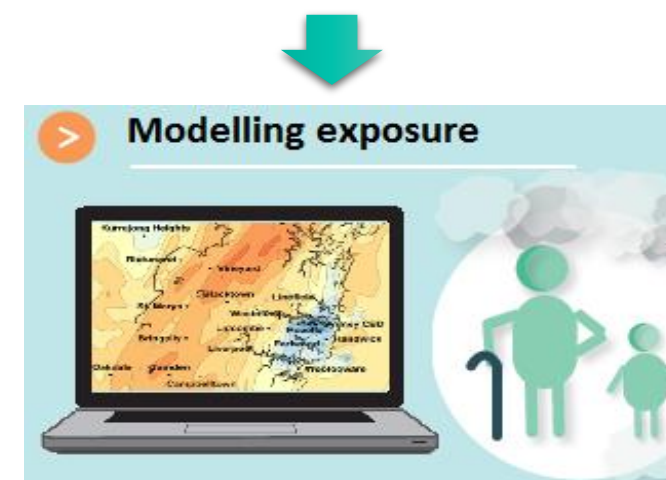
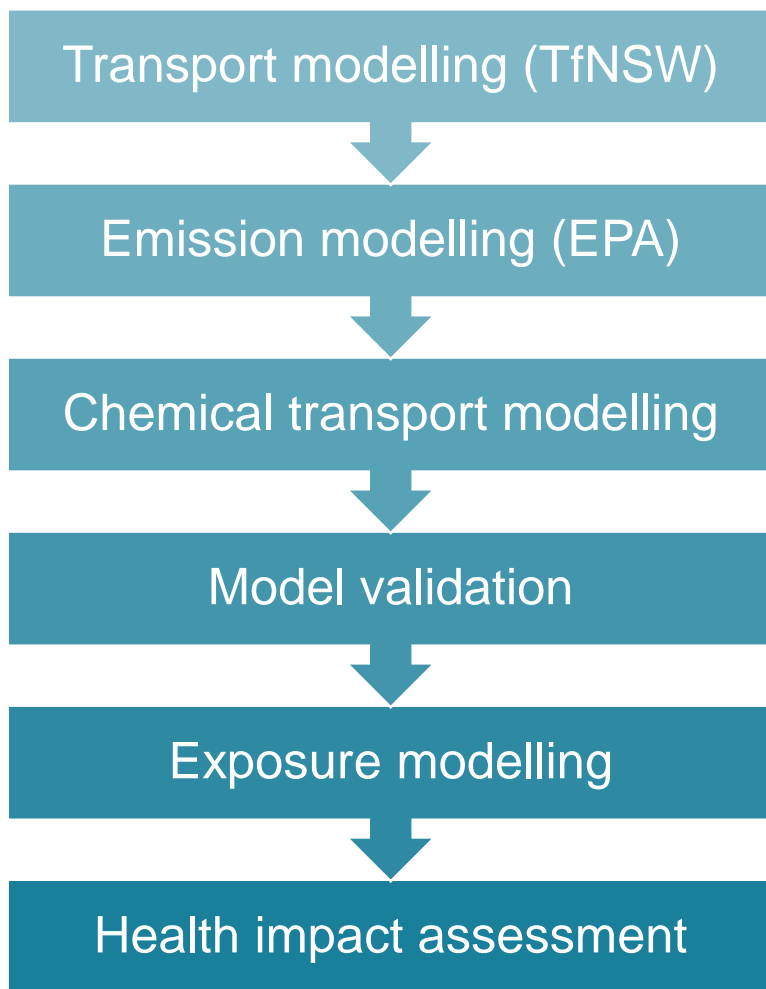


Sydney Particle Characterisation Study

Source contributions to PM_{2.5} concentrations (2000-2014)



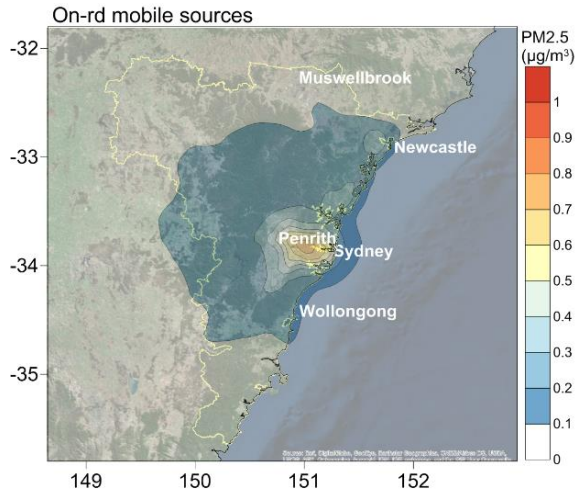
Sydney Air Quality Study



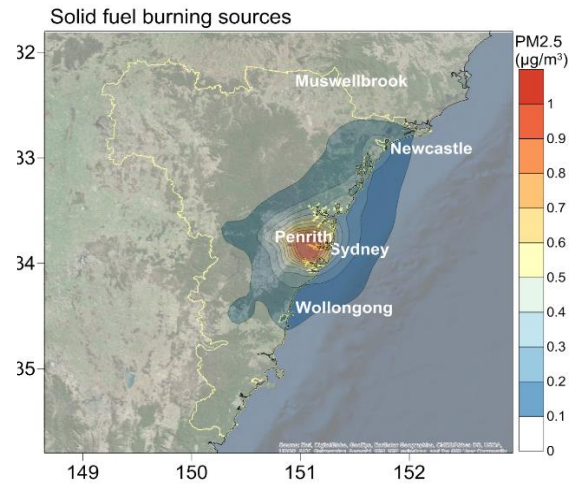
Sydney Air Quality Study

Major source contributions to annual average PM2.5 concentrations

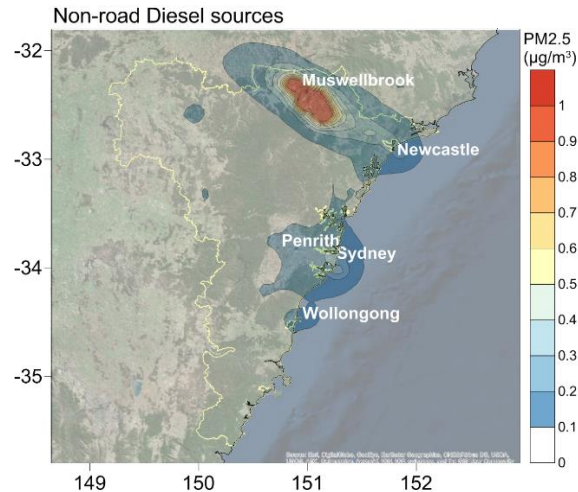
On road vehicles



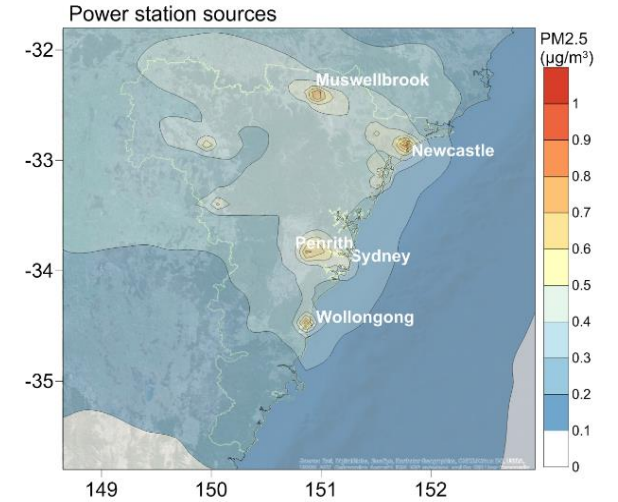
Wood heaters



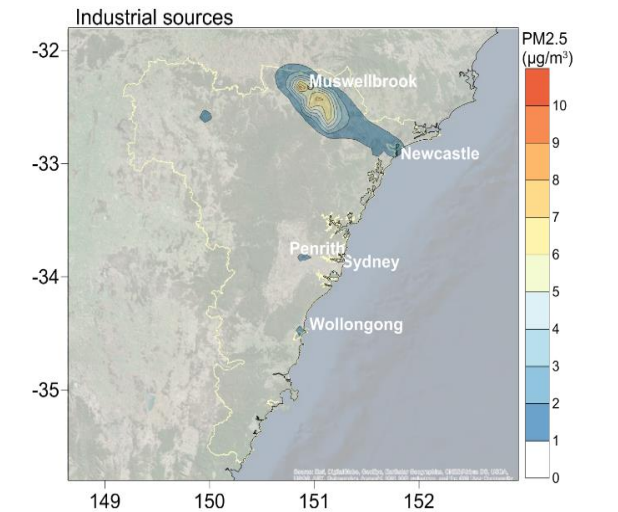
Non-road diesel and marine



Power stations



Industry

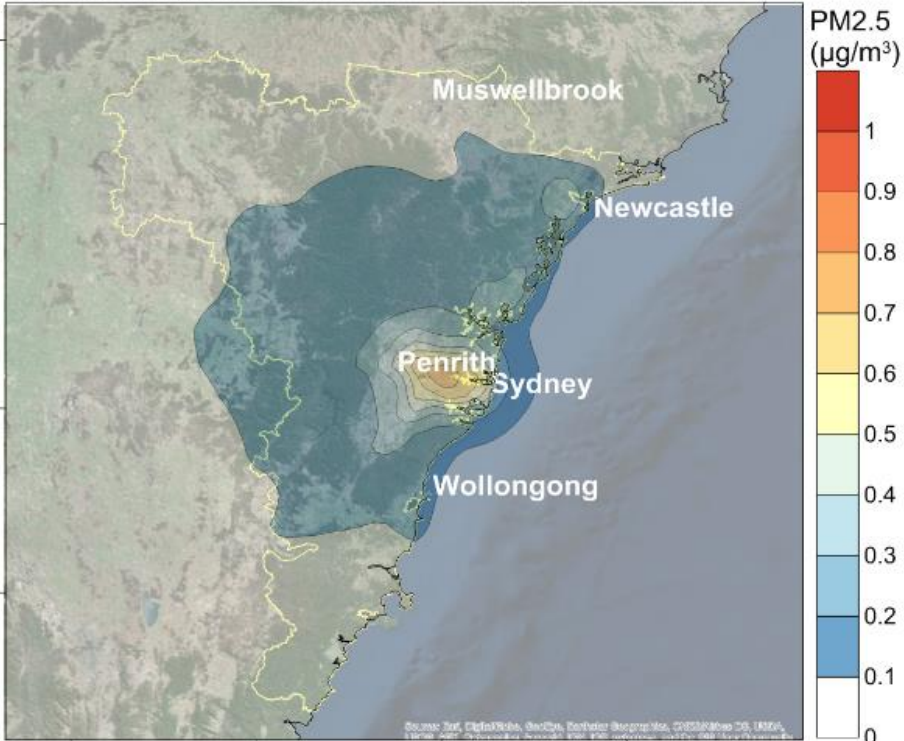


Sydney Air Quality Study

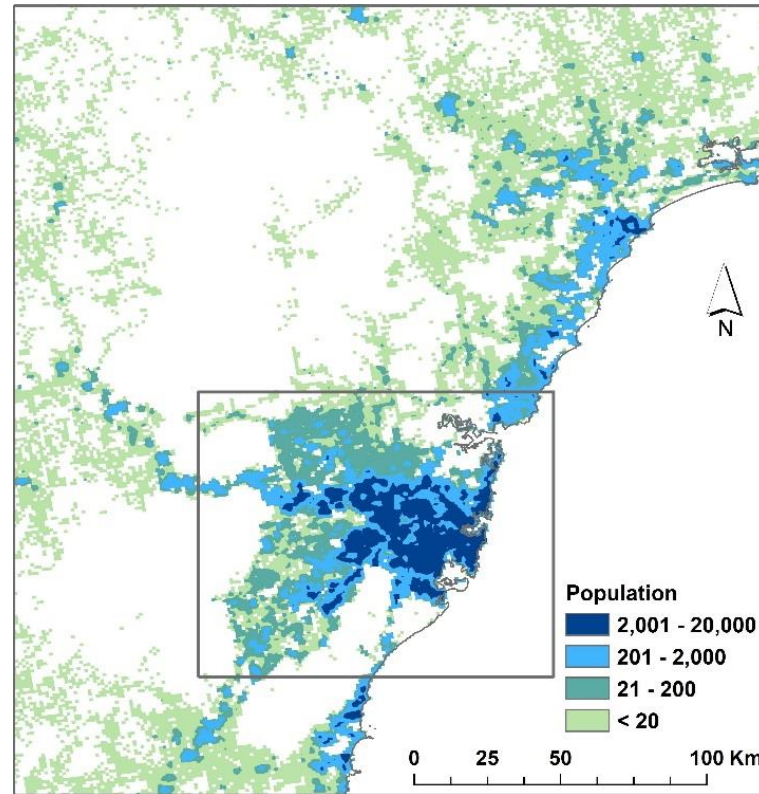
Population exposure modelling

Annual average PM_{2.5} (µg/m³)

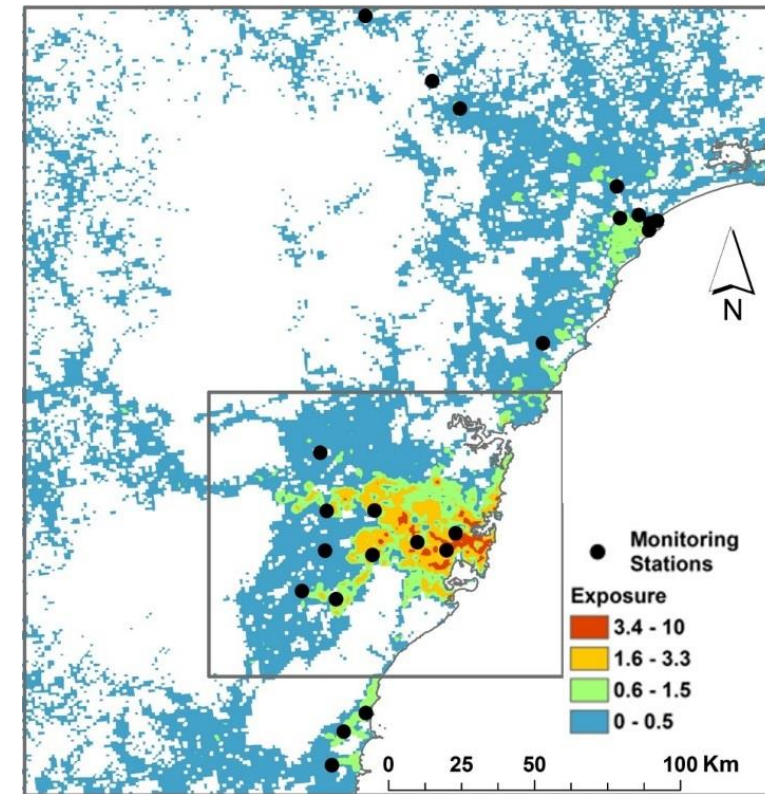
On-rd mobile sources



Population (people/km²)



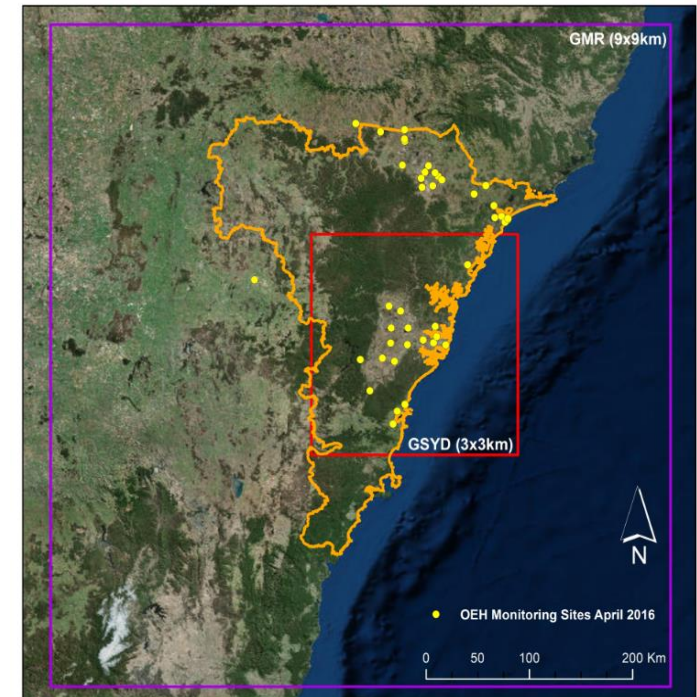
Exposure (population * PM_{2.5})



Sydney Air Quality Study

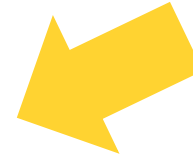
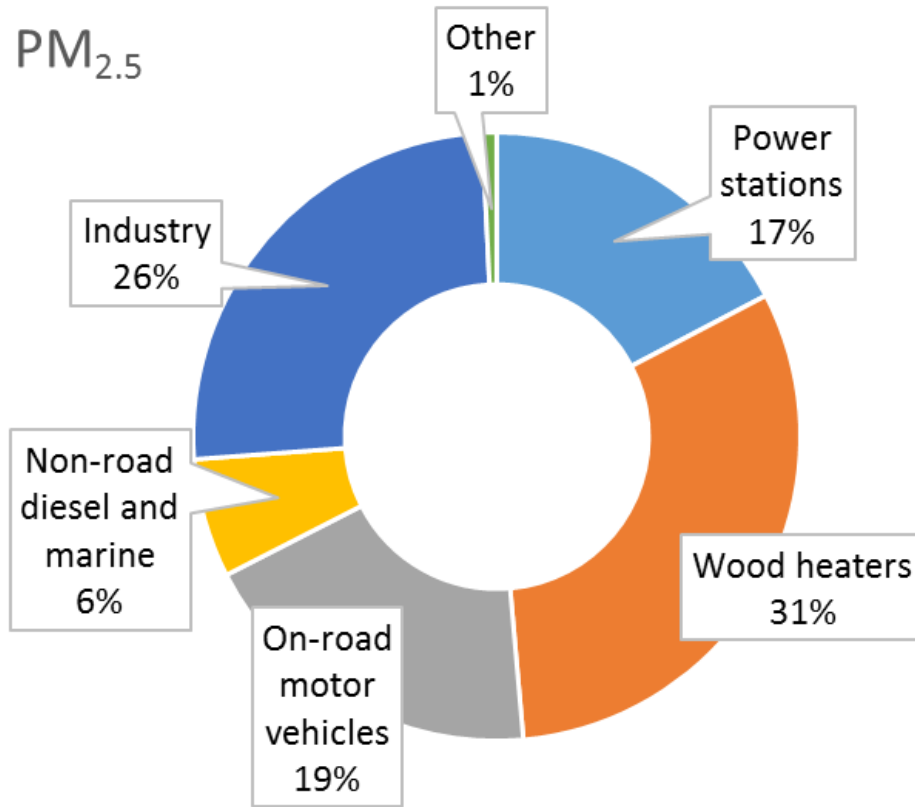
Health impact assessment method

- Focus on mortality effects of long-term exposures to PM_{2.5} air pollution
- Method established in collaboration with Centre for Air pollution, energy and health Research, NSW Health and EPA
- Exposure modelling to derive population-weighted annual average PM_{2.5}
- Health and population data:
 - Age-specific (0 to 85+) annual counts of population
 - 3-year rolling aggregates of number of all-cause deaths by one-year age groups
- Health burden due to exposure to PM_{2.5} air pollution by major source group expressed using 3 metrics:
 - Attributable number (AN) of premature deaths
 - Years of life lost (YLL)
 - Reduction in life expectancy (LE)
- Health cost estimated based on AN and YLL

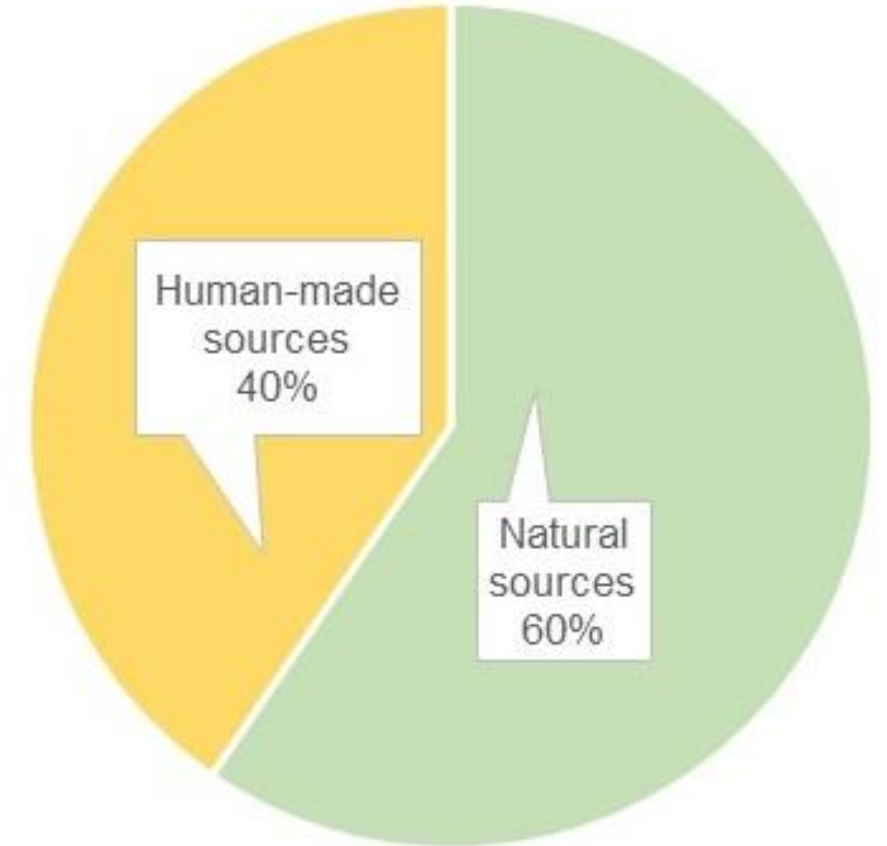


Sydney Air Quality Study

Major source contributions to health risk



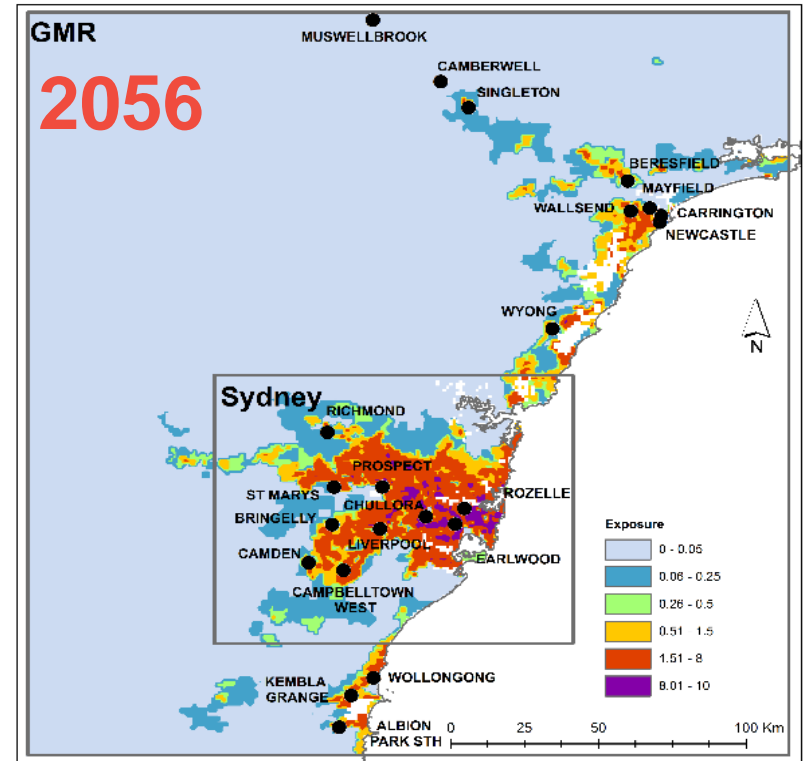
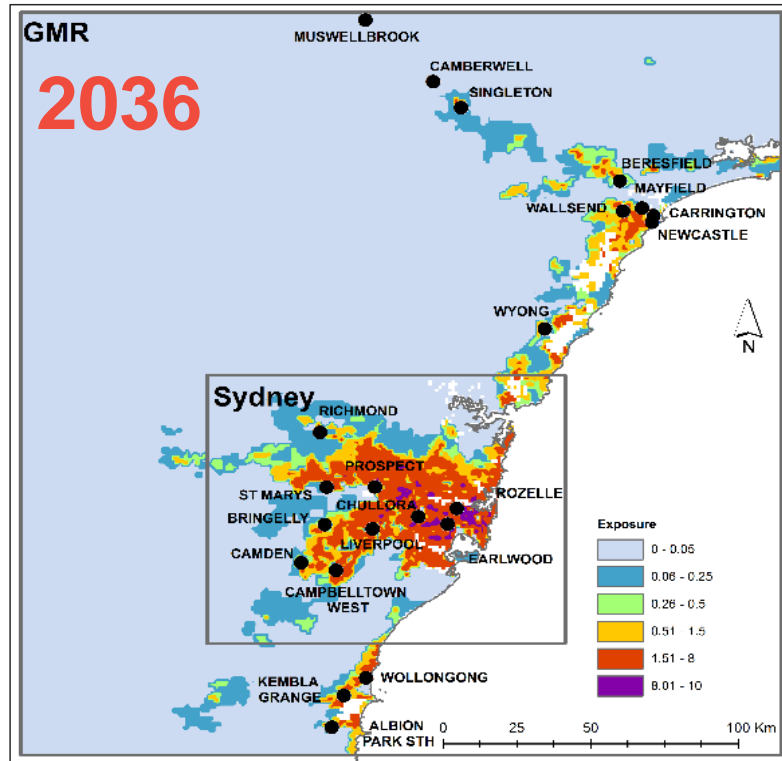
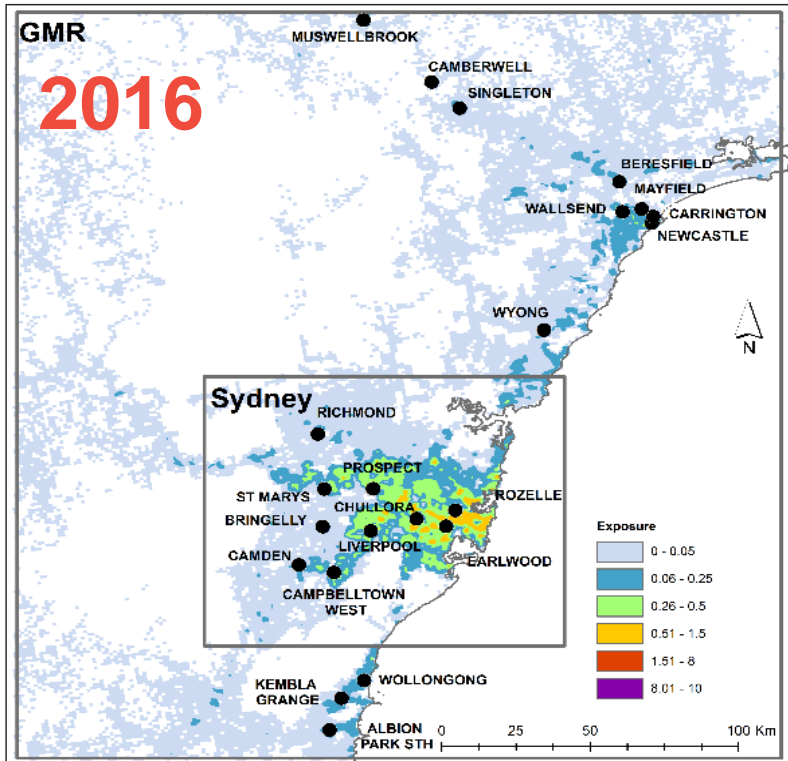
PM_{2.5}



Major source contribution to population-weighted PM_{2.5} (based on 2008 emissions)

How will population exposure to air pollution change in future?

Exposure (assuming 2016 air pollution levels)



Future directions

- Sydney Air Quality Study
 - publish air quality impacts and health burden estimates
 - extend health impact assessment to other PM_{2.5} health effects and other air pollutants (ozone)
 - model future exposure given ‘business as usual’
 - air quality and health benefits due to interventions for on-road vehicles and other major sources
- Air quality monitoring
 - peak roadside AQM station
 - low cost sensor network



Acknowledgements

- OEH Atmospheric Research
Lisa Chang, Hiep Duc, Toan Trieu, David Fuchs, Khalia Monk
- NSW Environment Protection Authority
Gareth Jones, Nick Agapides, Judy Greenwood
- ANSTO
Dr David Cohen, Dr Armand Atanacio
- CSIRO
Dr Martin Cope, Dr Kathryn Emerson
- Centre for Air pollution, energy and health Research
A/Prof Geoff Morgan, Prof Bin Jalaludin, Dr Richard Broome

