



MONASH

Centre for Occupational
and Environmental Health

The effects of climate change on air quality in Australia and related health impacts

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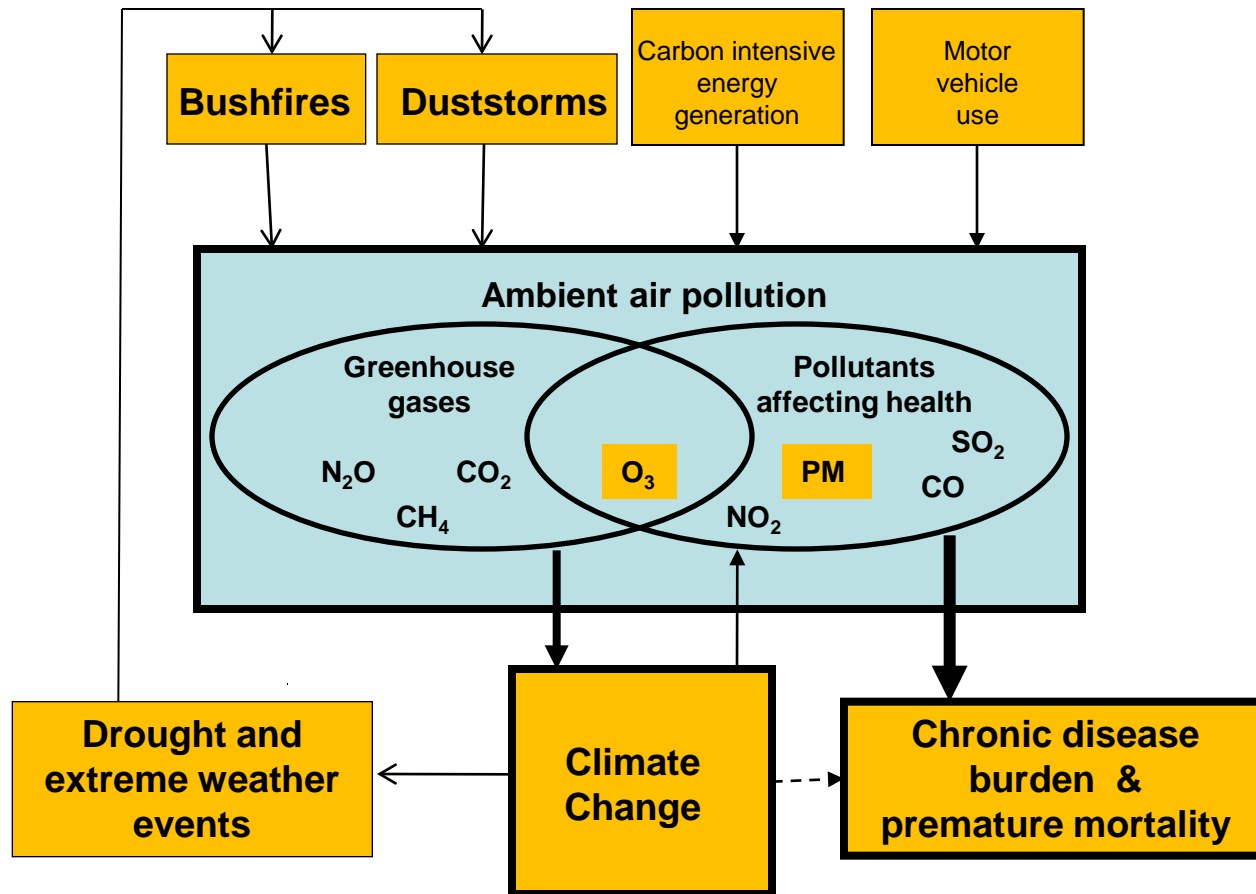
[Monash University, Melbourne](http://www.monash.edu.au)

Climate change impacts in Australia: key risks to human health:

- Increased frequency and severity of heat waves and other extreme weather events: floods, cyclones, storms and **bushfires**
- Changing incidence of vector-borne infectious disease
- **Deteriorations in** water and **air quality**
- Food availability and prices
- Impacts on mental health
- Impacts on community and Indigenous health
- Health care system capacity, infrastructure and service issues.

From: National Adaptation Research Plan for Human Health

Interaction between Air Pollution and Climate Change



Adapted from Dennekamp & Carey, 2010
(NSW Public Health Bulletin. 21:5-6)

Air Pollutants – most relevant to climate change

Pollutant	Health Effects	NEPM* Standard
Particulate Matter	<ul style="list-style-type: none">• Decreased lung function• Exacerbation of respiratory and cardiac conditions• Premature Mortality	PM ₁₀ : 50 µg/m ³ (24 hours) PM _{2.5} : Advisory 25 µg/m ³ (24 hours)
Ozone	<ul style="list-style-type: none">• Decreased lung function• Exacerbation of respiratory conditions	0.10 ppm (1 hour) 0.08 ppm (4 hours)

* National Environment Protection Measures

Air Pollutants – vulnerable groups

- Children
- Elderly
- People with existing respiratory disease, such as asthma, bronchitis, emphysema
- People with existing cardiovascular disease

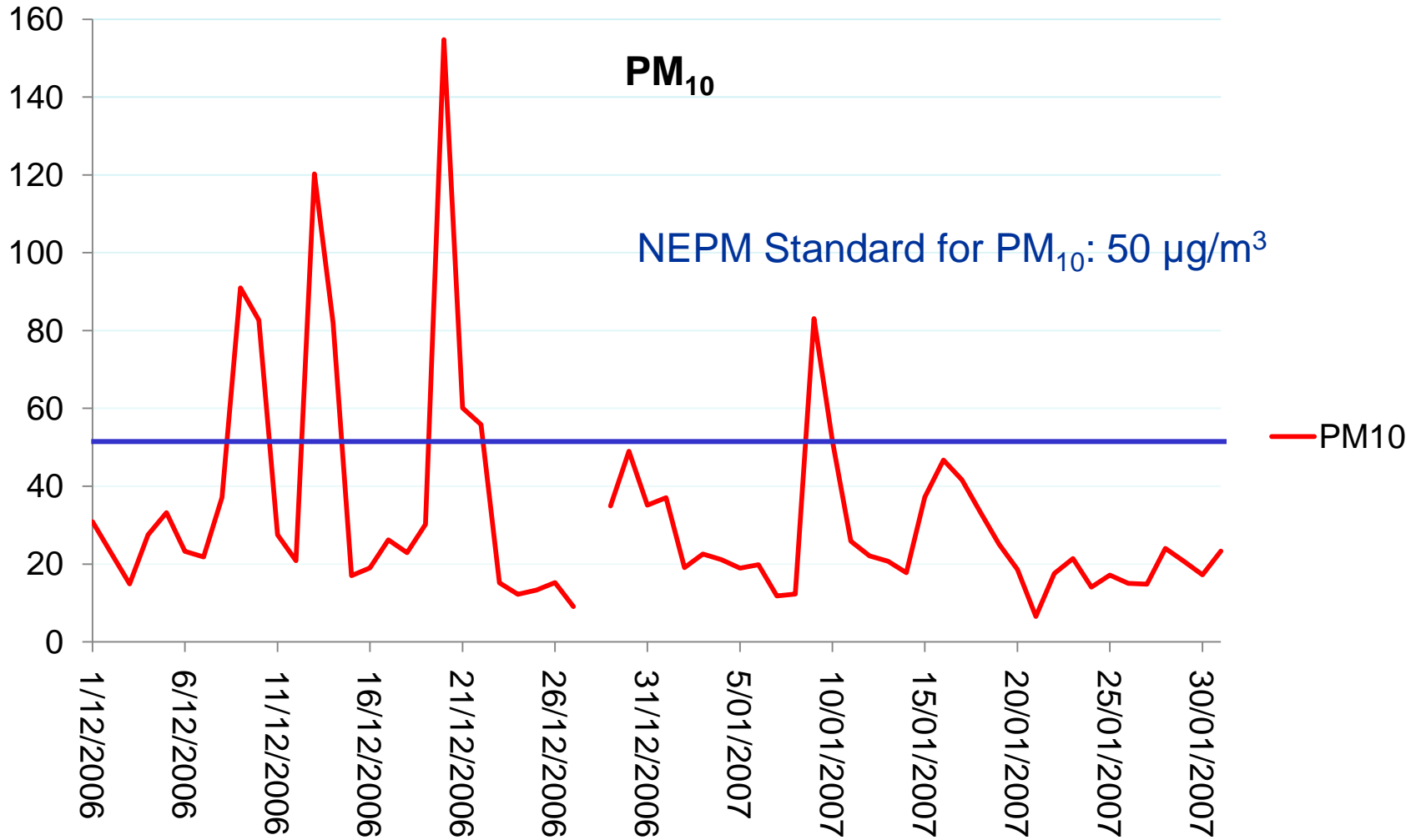
Particulate Matter

Particle Sizes

	Australian Air Quality standard?	Unit of measurement
PM₁₀	Yes	50 µg/m ³
PM_{2.5}	Only an Advisory Standard	25 µg/m ³
UFP	No	- #/cm ³

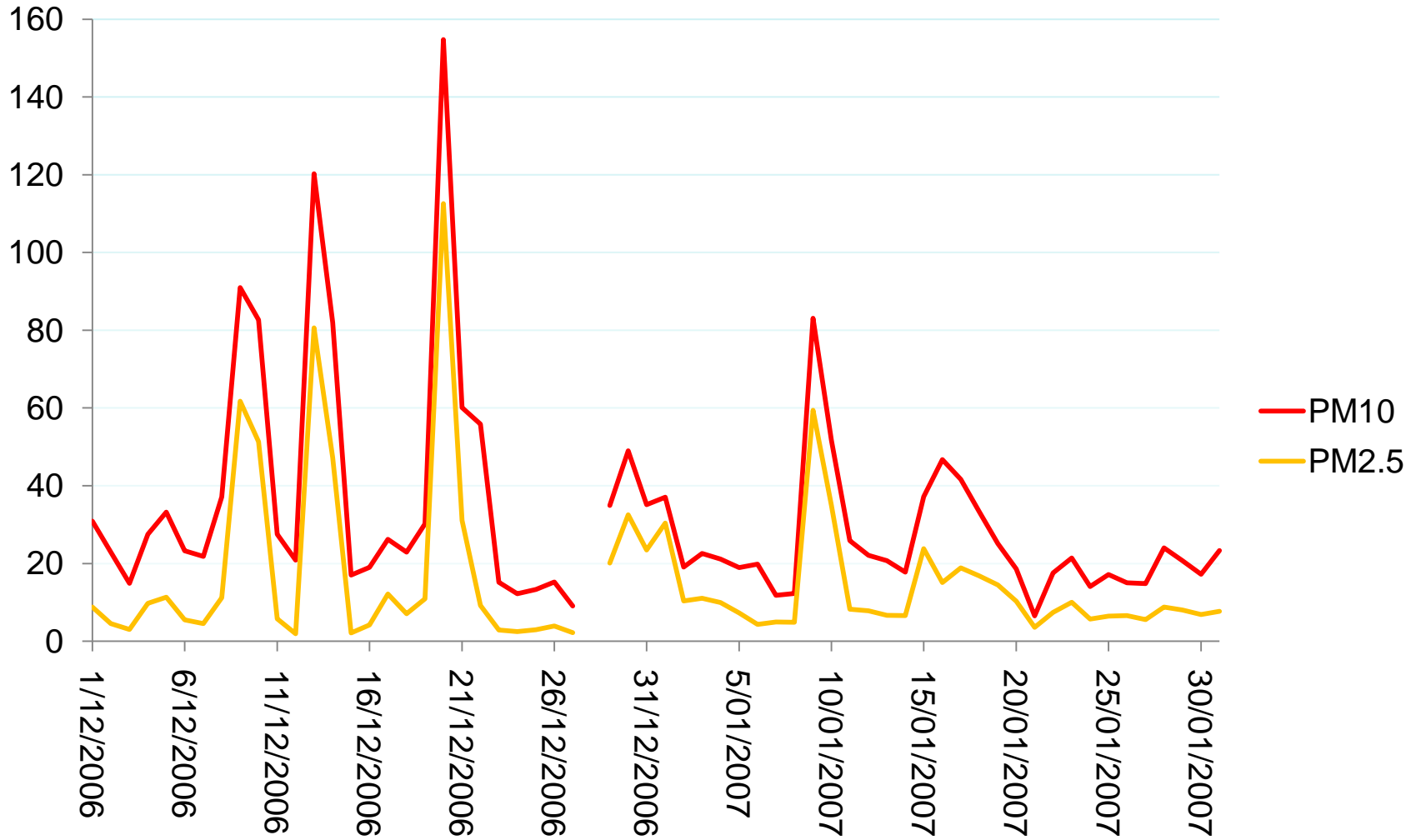
Particulate Matter

Bushfire Smoke



Particulate Matter

Bushfire Smoke



Particulate Matter

Bushfire smoke and Cardiac Arrest Study - Melbourne

Study Period: Bushfire season 2006 – 2007

Population: Melbourne residents >35 years

Health outcome: Out-of-Hospital Cardiac Arrests (OHCA)

Air Pollutants: PM_{10} , $PM_{2.5}$, NO_2 , CO , O_3 , SO_2 (daily average)

Methodology: Case-crossover design, adjusted for temperature and humidity

Particulate Matter

Bushfire Smoke and Cardiac Arrest Study - Melbourne

Number of Out-of-Hospital Cardiac Arrests: 807

Preliminary Results:

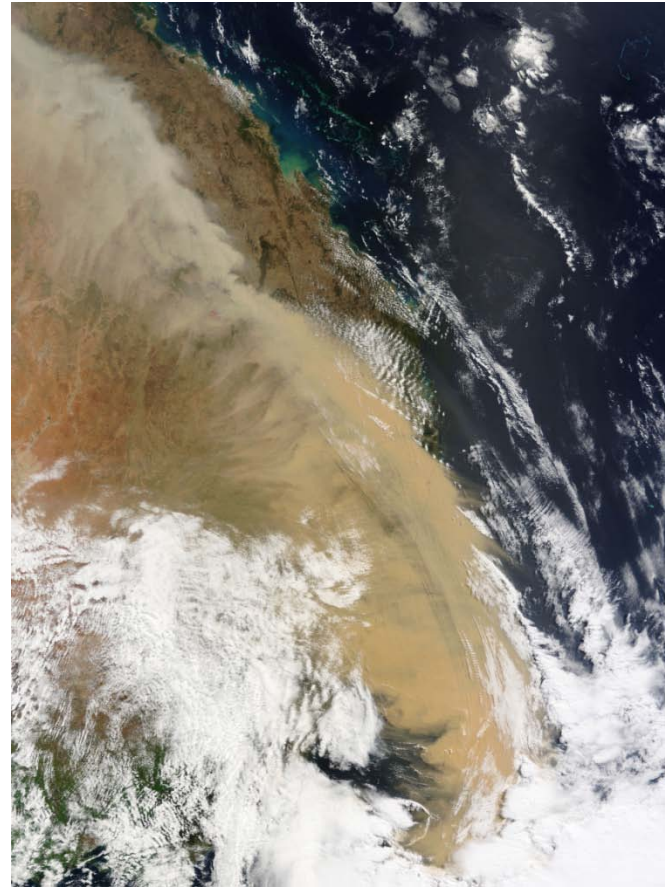
- An increase in **PM₁₀** and **PM_{2.5}** is associated with an increased risk of an OHCA
- **NO₂, SO₂, O₃, CO**: No significant associations with OHCA

Particulate Matter

Dust Storm – 23 September 2009



ANZ stadium, Sydney



MODIS Terra satellite image of the dust storm over eastern Australia
(courtesy of NASA)

Particulate Matter

Respiratory health effects of 11 Dust Storms in Brisbane

Outcome:

Dust storms were significantly
associated with changes in
asthma severity

(Rutherford S. et al 1999)



Brisbane Times, 23/09/2009

Particulate Matter - Bushfires and Dust storms

- Exposure to both bushfire smoke and dust storms have shown to have an effect on health, particularly related to asthma exacerbation
- Bushfire smoke particles are smaller than particles in Dust Storms, and therefore have the potential to penetrate deeper into the airways where more damage can be done. In addition to having an effect on the respiratory system, smaller particles have shown to have an effect on the cardiovascular system

Ozone

Ozone standards have been exceeded in Sydney every year since 1994

Future ozone predictions for Australia show increases in peak ozone concentrations in Australian cities –
Ozone-associated deaths are also predicted to increase

However improvement are possible relatively quickly

Example:

1996 Olympic games – traffic restrictions resulted in 30% decrease in ozone. A significant lower rate of asthma events were found

(Friedman MS, et al. JAMA 285:897–905)

Concluding remarks

- Dust storms and bushfires are not localized problems
- Increase in number and intensity of Dust Storms and Bushfires is unavoidable – Prepare
- Measures to reduce greenhouse gas emission can have additional co-benefits for health by reducing air pollution

Concluding remarks

- We can achieve results short term, by policies that aim to reduce motor vehicle use by increasing the use of alternative transport, such as walking and cycling - this measure will reduce both greenhouse gas emissions and air pollutant concentrations
- Important to consider air pollution in policy as actions taken for climate change may not always be good for air quality