The Darwin Smoke Project

A research partnership of Charles Darwin University, the NT Government and the Bureau of Meteorology

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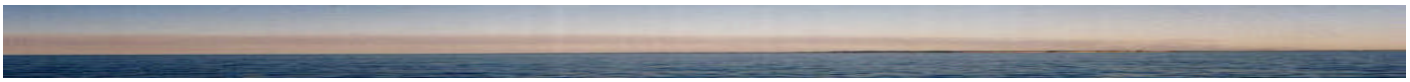

Welcome to the fourth newsletter from the Darwin Smoke project, a multi-disciplinary research program that aims to identify causes and consequences of high air pollution episodes in the Darwin region. The project has several components including Atmospheric Chemistry, Aero-biology, Meteorology, Landscape Ecology and Epidemiology.

Epidemiology

The team: Dr Fay Johnston (Menzies School of Health Research), Dr Ros Webby (ANU and Darwin Centre for Disease Control), Prof Louis Pilotto (Flinders University), A/Prof Ross Bailie (Menzies), Anne Myerscough.

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As part of the Darwin Smoke Project we have been conducting two epidemiological studies. (1) The community based *Darwin Asthma Study* and (2) the *Royal Darwin Hospital Study* which is examining admissions for a wide range of heart and lung diseases in relation to smoke pollution. Analysis of the asthma study is almost complete and our main findings are summarised below. Analysis for the hospital study will commence in 2006.

Darwin Asthma Study 2004 Results

Overview

We aimed to determine which local environmental factors might contribute to worsening of asthma in the community. 251 residents of Darwin and Palmerston with known asthma kept track of their symptoms and medication use for seven months during the dry season of 2004. During this time we monitored weather conditions, influenza rates in the community and atmospheric levels of smoke pollution, pollen and fungal spores.

Environmental conditions during the study

1. Meterology

2004 was an unusual dry season with rainfall persisting well into June and delaying the curing of grasses. This resulted in lower than usual fire hazard conditions persisting until September. The maximum daily air temperature ranged from 25.7 to 36.1°C (average 31.8). The minimum ranged from 13.3 to 27.5° C (average 21.2) and the relative humidity at 9.00am varied from 9% to 96% (average 64%).

2. Smoke levels

Smoke pollution remained low throughout the study period. The average mass of particulate matter less than 10 microns in diameter per cubic meter of air (PM_{10}) was 20 µg/m^3 (range 3 - 46 µg/m^3). The national air quality target for PM_{10} of 50 µg/m^3 was not exceeded during the study. Particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) made up approximately 50% of the measured PM10. $PM_{2.5}$ exceed the national advisory reporting standard of 25 µg/m^3 on a total of 5 days.

3. Pollen levels

Pollen counts also remained very low by Australian standards. In Darwin our total count ranged from 0.5 – 61 grains per cubic meter of air with an average daily

count of 16. Our grass pollen counts peaked first in April and then again in June. The range for grass pollen was 0-22 grains per cubic meter with an average of 3. In comparison, total pollen counts in Brisbane have been measured at 700-800 grains per cubic meter and in Melbourne the count can exceed 2000. Grass pollen counts in both these cities often peak at around 300.

The American Academy of Allergy, Asthma, and Immunology's (AAAAI) Aeroallergen Network use the following criteria for grass pollen counts - 0 to 5 low, 6 to 20 moderate, 21 to 200 high and 201 or higher very high.

4. Fungal spores

These remained at low to moderate levels for most of the study, ranging from 108 to 6049 spores per cubic meter with a mean of 1843. A similar study in Brisbane in 2000 recorded higher counts with a mean of 7352 (range 546-67301) spores per cubic meter. The AAAAI criteria for spore counts are: 0 to 900 low, 901 to 2,500 moderate, 2,501 to 25,000 high and 25,001 or higher very high.

5. Influenza

Consultations to Darwin GPs for influenza-like illnesses varied from 0.5% to 3% of all consultations during the study. In large outbreaks of influenza consultation rates usually exceed 3% and may approach 10%.

Environmental influences on asthma

Even at the low levels of particulate pollution present during our study we found small but statistically significant associations between smoke pollution levels (measures at PM_{10} and $PM_{2.5}$) and:

(1) the average number of ***asthma symptoms*** experienced by participants each day. This effect was quite small and could be attributed to extra symptoms in just a few participants, rather across the entire group.

(2) the average amount of ***reliever medication*** used by participants each day. This was also quite a small effect, that is it was largely due to increasing reliever use in just a few participants. Inhaled reliever medication (eg a Ventolin puffer) is used to manage asthma on a day-to-day basis.

(3) the proportion of participants starting a course of ***steroid tablets*** such as prednisolone. This outcome had the biggest association with PM_{10}. The proportion of participants starting steroid tablets rose by approximately 50% with each rise of 10 in PM_{10}. This is an important outcome because steroid tablets are reserved to treat more serious exacerbations of asthma. Starting a course of this medication indicates there has been clinically significant worsening of asthma control.

All findings were more marked in adults compared with children and in those with more severe asthma.

We also found small associations between asthma symptoms and the minimum air temperature and GP consultation rates for influenza.

We did not find any associations between pollution levels and exercise induced asthma, asthma attacks or health care attendances for asthma. Nor did we find any health effects to be associated with pollution levels at time lags of up to 5 days, pollen levels, fungal spores, rainfall, relative humidity, dew point or maximum air temperature.

Individual factors affecting asthma

As expected, individual factors were important predictors of asthma symptoms and medication use. The following groups all were significantly *more* likely to have symptoms or use medication for their asthma:

- smokers (compared with non-smokers)
- adults (compared with children)

- people who lived in less crowded circumstances (compared with more crowded)
- non - Indigenous participants (compared with Indigenous)
- those with (or whose parents had) lower compared with higher education levels

What do the results mean?

Most people with asthma can be reassured that low levels of smoke pollution (ie PM_{10} of less than 40 $\mu g/m^3$) will have little or no effect on their asthma. However, even at these levels, a small proportion of people will experience significant worsening of their symptoms, needing to use more medication, including steroid tablets, to regain control of their asthma. As the pollution levels rise, our analysis would predict more widespread and serious impacts on people with asthma. Pollution levels exceeding the national air quality targets are likely to constitute an important public health hazard.

The main messages for people with asthma are:

(1) If you are sensitive to bushfire smoke you can reduce the impact of hazy days by avoiding strenuous outdoor exercise that will cause you to inhale a much higher amount of pollution. Staying inside air-conditioned buildings, if this is a practical option for you, is also likely to reduce the level of your exposure.

(2) If you smoke you should consider quitting – smoking was the biggest avoidable contributor to symptoms and medication use for asthma in this study

(3) Have a written action plan worked out with your GP so you know when to increase reliever medication or start steroid tablets to keep your asthma under control.

The main message for land mangers is that landscape burning should explicitly aim to minimise air pollution. The prevention of large intense fires that are extremely polluting should continue to be of high priority. Prescribed burns should be managed to minimise pollution over urban areas, and to avoid exceeding national air quality standards.

Anne Myerscough, Judy Manning and Fay Johnston attending the Partisol air sampler on a rooftop at the Palmerston campus of CDU. Photo Clancy Bowman

Landscape Ecology

The team: Prof David Bowman and Don Franklin from the ARC Key Centre for Tropical Wildlife Management.

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Grass fuel loads around Darwin

Louis Elliott has recently completed his survey of grass fuel loads and their composition. With the help of volunteers, Lou surveyed 101 sites in Darwin Woollybutt *Eucalyptus miniata* woodland within about 100 km of Darwin, from within the city limits north to Gunn Point, south to Litchfield National Park and west to Dundee Beach and the Cox Peninsula. The grass samples have now been dried and weighed. Litter fuel loads were also sampled. Over the coming months, Lou will analyse the data and write up the results, with completion due at the end of the year.

Preliminary results suggest that sites dominated by annual spear grass tend to have high fuel loads, but other sites are variable and those dominated by perennial native grasses can also have high fuel loads.

Atmospheric Chemistry

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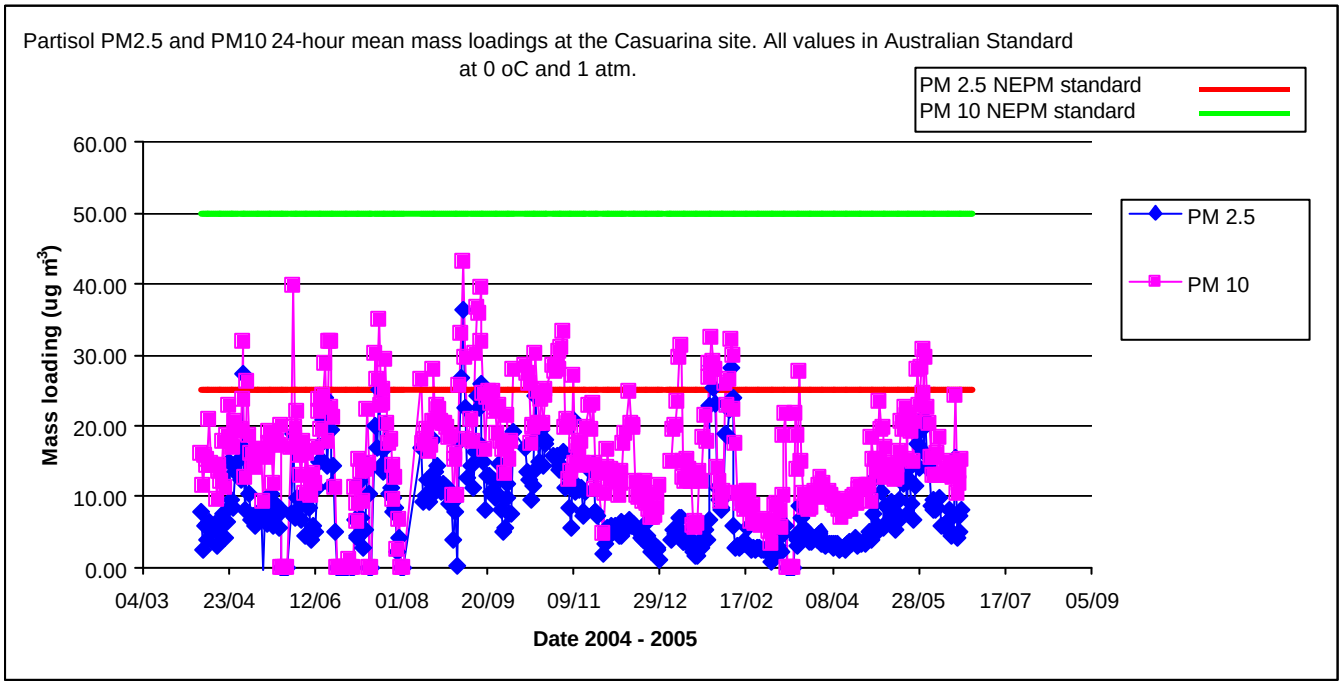
Measurements of particulate matter (PM 10 and PM 2.5) continue at both Palmerston Campus and Casuarina Campus. The data from the Partisol Dichotomous sampler at Casuarina Campus is shown below (7/4/04 – 22/6/05). Once again the graph shows no exceedances of the PM 10 Air NEPM standard of 50 µg m^{-3}. There were however 2 days when the PM 2.5 Air NEPM standard of 25 µg m^{-3} was exceeded in early February 2005, bringing the total exceedences over the past 12 months to 7.

The second Dichotomous Partisol sampler that was purchased by the project partners has been deployed at the Palmerston Campus site, collocated with the TEOM/ACCU system for QC of that system. There were some early teething problems with this new sampler but these have been overcome. We are starting to get some good data sets that can be compared to the results from the TEOM and ACCU systems already in operation at Palmerston.

Pollen sampling at the Palmerston campus has been concluded after collecting 12 months of data and the pollen sampler has been moved to Casuarina campus. We have overcome the problem of the samplers stopping mid cycle on one sampler but the other remains a source of consternation. We have been in contact with the manufacturers and investigation of the problem is continuing. Despite the problems the pollen and fungal data sets are of very good quality.



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