Urgent action needed to reduce woodsmoke in Australia

Woodheaters – a major source of Australian air pollution – are responsible for 86% of Perth's anthropogenic winter PM10 (Todd 2007). In Melbourne's Port Phillip airshed, woodheaters emit 6,900 tonnes of PM10 per year, almost double the 3,500 tonnes from vehicles (Robinson 2005). In Sydney, woodheaters emit 4,500 tonnes of PM2.5 per year, again almost double the 2,426 tonnes from vehicles (NSWDEC 2007).

It seems strange that a product used by a relatively small proportion of households (perhaps less than 10% in Sydney and 11.5% as primary heating in WA (DOE-WA 2006) is allowed to create such a large proportion of health-hazardous air pollution.

Current consensus – 6% increased mortality per 10 µg/m^3 PM2.5

A comprehensive consensus report on mortality and air pollution was drafted by COMEAP, a committee of independent experts advising the UK Chief Medical Officer (England) on the potential toxicity and effects on health of air pollutants. COMEAP's best estimate is that a 10 µg/m^3 increase in annual PM2.5 exposure is associated with a 6% increase in the risk of death from all causes and a 9% increase in cardio-pulmonary mortality (COMEAP 2007).

These estimates, from the American Cancer Society (ACS) study of more than half a million adults with 120,000 deaths in metropolitan areas across the USA (Pope et al. 2002), are based on average PM2.5 measurements for each entire metropolitan area.

New spatial analyses: effects might be 3 times worse

But we now know that annual PM2.5 measurements can vary substantially within a metropolitan area. Jerrett et al. (2005) reported that annual average PM2.5 (interpolated from 23 PM2.5 monitors in Los Angeles) ranged from 9-27 µg/m^3. When interpolated PM2.5 measurements were fitted to the ACS data for Los Angeles (22,905 adults with 5,856 deaths from 1982–2000), the estimated effects of PM2.5 on mortality (increases of 11-17% per 10 µg/m^3 additional annual exposure) were 2-3 times greater than those derived from across city comparisons. The authors concluded "*the chronic health effects associated with within-city gradients in exposure to PM2.5 may be even larger than previously reported* …"

In Christchurch, NZ, where woodsmoke accounts for 76% of fine particulates, there is also substantial spatial variation PM pollution. After adjusting for age, sex, ethnicity, socio-economic status and tobacco smoking habits, PM10 pollution was significantly related to mortality – total, circulatory and respiratory mortality increasing by 8%, 11% and 34% per 10 µg/m^3 annual exposure (Fisher et al. 2007). Annual PM10 pollution varies from less than 1 to more than 20 µg/m^3, so people living in the worst areas can expect 16% increased mortality compared to people living in the cleanest areas.

Economic costs – more than $2,700 per heater per year

A team of 25 researchers calculated the costs of health problems from air pollution in Christchurch, including premature mortality, cancer due to benzene exposure, chronic bronchitis, hospital admissions for cardio and respiratory diseases, restricted activity days and minor hospital costs. Industrial pollution was estimated to cost NZ$18 million, diesel vehicles NZ$15.6 million, and petrol vehicles NZ$0.4 million. The lion's share – NZ$127 million per year – was woodsmoke, or more than $2,700 per heater per year (Fisher et al. 2005). These estimates were calculated assuming a 4.3% increase in mortality per 10 µg/m^3 annual exposure – the new research showing an 8% increase per 10 µg/m^3 suggests that the true cost could be double these estimates.

Christchurch has banned the installation of new woodheaters, except ultra-low emission models rated < 1.0 g/kg that replace more polluting heaters. All heaters rated > 1.0 g/kg will have to be removed after 15 years use. Other jurisdictions, including Rangiora and Kaiapoi, are introducing similar policies and as well as considering other options such as not permitting woodheaters to be used after houses are sold.

Implications for Australia

The above research shows that the health costs of woodheaters are enormous. John Todd's estimate of $416 per heater per year in Perth (Todd 2007) was based on an outdated assumption of 1% increased mortality per 10 µg/m^3, not the current consensus of 6%, nor the 8% observed in Christchurch. The true cost in WA is likely to be closer to $3,000 per woodheater per year.

The cost in other Australian metropolitan airsheds is likely to be similar or even higher. Table 1 shows the estimated cost per kg of PM10 emissions in six different airsheds along with average annual wood consumption. Estimates of emissions from new heaters vary considerably, from 6.3 g/kg (4 models burning seasoned wood in a laboratory test intended to simulate in-home operation) to 15.5 g/kg (at-home operation by the householders of 4 NZ models that emitted 2.5 g/kg in a laboratory test simulating in-home operation, Scott 2005). Table 1 shows that even under the best possible scenario (a brand new heater with real-life in-home emissions of 6.3 g/kg) estimated health costs of that heater in Australian capital cities amount to several thousand dollars per year.

Todd (2007) recommended a nationally consistent approach. This is happening in NZ, where the emissions limit for all woodheaters installed on properties less than 2 ha has been reduced from 4 g/kg to 1.5 g/kg, with outright bans or more stringent requirements in cities such as Christchurch. Unfortunately, most Australian states have simply adopted the 4 g/kg limit from the AS4013 test (which bears little relationship to real-life emissions). Progress towards a health-based standard has been hampered by the industry association's veto on the emissions test method and efficiency limit (Todd 2007).

Yet, given the data showing that woodheaters are responsible for twice the emissions (and therefore twice the health costs) of vehicles in both Sydney and Melbourne, it would be logical to put twice as much effort into cleaning up woodsmoke as motor vehicle pollution.

The National approach to reduce diesel emissions was successful. PM2.5 emissions from new diesel cars and light commercial vehicles, for example, have fallen by over 96% from 0.63-0.75 g/km (1980-89 models, Watkiss 2002) to a maximum of 0.025 g/km under Euro-4, with further reductions to 0.005 g/km under Euro-5. When governments are prepared to set standards to protect our health, markets soon respond with affordable new products that satisfy the standards.

A Woodsmoke NEPM (National Environment Protection Measure), as recommended by Todd (2007) could weigh up the costs and benefits of woodheating and set a health-based standard. For example, if people consider the benefits of woodheaters are worth $150 per year (i.e. would be prepared to pay a $150 annual levy to use woodheaters) the cost of real-life emissions should be less than $150 per year. Based on Sydney's average firewood consumption of 1.9 tonnes per year (Table 1), limiting the health costs to $150 year would require a *real-life* emissions limit of 0.59 g/kg in Sydney.

The NEPM should also consider how to provide funds to reduce pollution from heaters already in use or currently on sale (e.g. an annual levy on woodheater use). The models currently on sale (such as those averaging 6.3 g/kg in the laboratory test simulating real-life emissions) are nowhere near good enough and should be phased out as soon as possible. Prospective purchasers of new heaters need to be informed of the health problems and the costs of pollution.

Delays and inaction cost money. Over a 15-year lifespan, the estimated health costs of the 30,000 heaters installed this year is more than $1 billion. Advocates of clean air, such as CASANZ should lobby for immediate action to set up a Woodsmoke NEPM, or at the very least the setting of a health-based standard for new woodheaters that the industry association cannot veto.

Table 1. Estimated health costs of a brand new woodheater with A) real-life emissions 6.3g/kg of wood and B) 15.5 g/kg

Location	Health cost per tonne of PM10 [a]	Wood use tonnes per heater per year [b]	Average annual real-life emissions (kg PM2.5 per heater) [c]		Estimated health cost per heater per year [d]	
			A) 6.3 g/kg	B) 15.5 g/kg	A)	B)
Canberra	$81,847	3.7	**23.3**	**57.4**	**$1,908**	**$4,694**
Launceston	$81,847	4.8	**30.2**	**74.4**	**$2,475**	**$6,089**
Perth	$80,211	2.5	**15.8**	**38.8**	**$1,263**	**$3,108**
Port Phillip	$128,310	4.3	**27.1**	**66.7**	**$3,476**	**$8,552**
Sydney	$133,543	1.9	**12.0**	**29.5**	**$1,599**	**$3,933**
South East Qld	$43,106	1.1	**6.9**	**17.1**	**$299**	**$735**

[a] From table 17, BDA Group (2006); [b]Table 3, BDA Group (2006); [c] = (Wood use) x (real-life emissions per kg);
[d] Estimated health costs = (health cost per kg of PM10) x (annual average real-life emissions, kg)

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