AUSTRALIAN HOME HEATING ASSOCIATION INC.

Supplementary Submission to the Community Affairs References Committee

Impact on Health of Air Quality in Australia Inquiry

June 5, 2013

Questions on notice

1. What design and engineering changes are required to achieve lower emission levels in wood heating appliances?

There is no single element that can be designed and installed into all wood burning heaters that would transform them into super clean burning high efficiency units.

Every firebox, irrespective of shape or size, requires different design elements to achieve specified emission and efficiency criteria. These specific elements are the focus of product development by the industry. Significant advances have been made internationally but there are factors, specific to the Australian market, which further complicate the matter. One fundamental difference is the significant difference in the way softwood and hardwood burn. Australians burn hardwood and, typically, the rest of the world burns softwood.

Standards Australia following an initiative of the Australian Home Heating Association (AHHA) is in the process of reducing the allowable emission limits to 1.5g/kg and stipulating a minimum efficiency to 60%. The AHHA has driven this change to the standard.

It should be noted that heaters currently being tested by manufacturers are achieving significantly lower emissions than three years ago. Wood burning heaters manufactured today emit, on average, well below 2.5 g/kg when the allowable limit is 4.0 g/kg.

A point of interest is speculation from outside the industry about how manufacturers can easily reduce the emissions on wood heaters by simply increasing the amount of primary air allowed into the heater. If a manufacturer were to do this they would decrease the efficiency of the unit, which is not desirable. Indeed, manufacturers could potentially increase emissions by making these changes as more primary air is introduced into a firebox without refining other elements of the design as the increased volume and velocity would push particles directly up the flue and into the atmosphere.

In summary, what will decrease emissions and increase efficiencies is product development and this development has been accelerated by manufacturers to ensure they meet regulations set down Standards Australia.

2. Where does the Australian industry sit in relation to the rest of the world regarding emissions and design standard?

Before answering a question about the emission limits of solid fuel (biomass) combustion appliances in Europe, it is necessary to provide some background to improve understanding and the ability to compare to the emission limits in Australia and New Zealand.

Understanding measurement units for emission particles

Particle emissions can be expressed in one of three different ways:

1. grams / hour (g/h) – measurement of grams of particulate emissions per hour
2. grams / kilogram (g/kg) – measurement of grams of particulate emissions per kilogram of dry wood burnt
3. milligrams / Megajoule (mg/MJ) (Europe) – measurement of milligrams of particulate emissions per megajoule of energy contained in the fuel
4. milligrams / Megajoule (mg/MJ) (New Zealand) – measurement of milligrams of particulate emissions per megajoule of energy produced by the appliance

In Europe, the unit of measure is based on the amount of particle emissions per MJ of energy in the fuel (wood).

In USA and Canada, the emissions standards are expressed in g/h. This unit of measure can be calculated based on the total amount of particle emissions collected, divided by the time for the burn cycle test to complete.

In New Zealand, emission standards are expressed as either g/kg or mg/MJ.

In Australia, the MJ represents the amount of energy produced by the appliance, which will always be less than the amount of energy stored in the fuel.

Understanding different emission measurement methods

Solid fuel combustion particulate emissions are composed of solid particles (SP), both organic and inorganic, and condensables (C), which are organic. While the flue gases are hot (>180°C) only the solid particles can be collected on a filter. Once they have cooled down, the condensables can also be collected on a filter.

There are a number of methods for measuring the particulate emissions from solid fuel combustion appliances.

In Australia, New Zealand, USA and Canada, emissions are measured in the wood heating appliance using a dilution tunnel. This is where the flue gases are diluted with fresh incoming air to reduce the temperature of the flue gases, thereby allowing the organic compounds to condense and be collected as part of the overall particulate emissions. This method of collecting the particulate emissions gives a more complete representation of the total emissions produced by each appliance.

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In Europe, the emission limits are expressed as mg/MJ. These limits are based on sampling only the solid particles from the hot flue gases and do not include the condensable components. This is why, at first glance, the European emission limits appear significantly less than those in New Zealand for example, where emission limits are also expressed in mg/MJ.

Attached are the results of findings when comparing emissions standards/limits in Europe, USA, UK and Australia. The AHHA has attempted to summarise the information in simple terms to ensure understanding.

Factor for converting European standards to Australia/New Zealand standards

European standards are based on only sampling the SP component of the emissions. It is therefore necessary to apply a factor to these calculations so they can be accurately compared to the Australian/New Zealand standards, which are based on sampling the SP + C components.

A survey on measurements and emission factors was conducted in Sweden comparing the emission result when sampling only the SP components via the hot flue gases. It then contrasted sampling from the SP + C components using a dilution tunnel.

The results of the study provided a factor of 4.85. That is, there were 4.85 times more particulate emissions collected when sampled via the dilution tunnel than when they are collected from the hot flue gases.[1]

Particulate Emission limits for solid fuel (biomass) combustion appliances in Europe, UK and USA

Country	Limit	Apply factor (4.85) for comparison	Convert to g/kg
Austria	60 mg/MJ	290 mg/MJ	5.8 g/kg
Canada	4.5 g/h		
Denmark	50 mg/MJ	242 mg/MJ	4.8 g/kg
	10 g/kg		
Finland	No limit		
Germany (current)	50 mg/MJ	242 mg/MJ	4.8 g/kg
Germany (01/01/2015)	27 mg/MJ	131 mg/MJ	2.6 g/kg
Ireland	100 mg/MJ	485 mg/MJ	9.7 g/kg
Netherlands	No limit		
Sweden	No limit		
Switzerland	50 mg/MJ	242 mg/MJ	4.8 g/kg
UK	7.5 g/h		
USA	7.5 g/h		

Example

Converting mg/MJ (Europe) to g/kg:-

- Assume calorific (heating) value of wood = 20.0 MJ/kg (This is the average)
- Use emissions factor = 290 mg/MJ (or 0.290 g/MJ)

Emissions in g/kg = 0.290 g/MJ x 20 MJ/kg
= 5.8 g/kg

In Australia, the new proposed emission standard will be 2.5 g/kg, and, by 2019, the standard will be reduced to 1.5 g/kg.

When the European emission limits expressed in g/kg are converted so that they can be compared to Australian standards, it demonstrates that Australia is leading the world in imposing strict particulate emission standards for domestic solid fuel combustion appliances.

Sources of Information

Particulate Emissions from Biomass Combustion in IEA Countries –
Jan 2008 on behalf of the International Energy Agency (IEA) Bioenergy Task 32).

Survey on the present state of particle precipitation devices for residential biomass combustion in IEA Bioenergy Task32 member countries – Graz University of Technology, Austria, Dec 2011.

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