

**RESEARCH RELATING TO
REGULATORY MEASURES FOR
IMPROVING THE OPERATION OF
SOLID FUEL HEATERS**

Executive Summary

**J J Todd
Eco-Energy Options**

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Air Policy Section

PO Box A290, Sydney South, NSW, 1232

Telephone 02 9995 5000

Research and report preparation:

Dr John J Todd

Eco-Energy Options

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Executive Summary

Project Aim The aim of this project is to improve the understanding of residential firewood use in NSW so that informed choices can be made to equitably reduce woodsmoke emissions through new or existing regulation.

Methods The project included three components:

- (1) a survey of 60 volunteer households, covering two rural and two Sydney municipalities, with information gathered on householders' use of their woodheaters with simultaneous visual smoke observations, demonstrations of correct woodheater use, householders' attitudes to woodsmoke and moisture analysis of each household's firewood;
- (2) laboratory testing of emissions (particulates and opacity over 26 test cycles) from a woodheater operated correctly and incorrectly, including light-up and refuelling, and use of wet and dry firewood;
- (3) additional analysis of data collected in a 2001/02 CSIRO study of woodsmoke emissions to allow estimation of visual smoke emitted for 46 test cycles covering different heater models, fuels and operating conditions.

Conclusions Visual observations of smoke provide a practical means of identifying heaters that are smoking excessively. Poor operation, lack of maintenance, faulty appliances or installation, and unseasoned firewood account for almost all incidents of excessive visible smoke, and can quite readily be remedied. Targeted education will assist householders achieve reductions in woodsmoke emissions.

There is a need for more precise observation, such as extended visual observation or supplementing visual observation with instrument readings, if control authorities intend to fine or otherwise penalise a householder for excessive smoke. This is because, on rare occasions, a heater might smoke for longer periods even when correctly operated.

Main Findings

- Two thirds of heaters in the household survey were more than 10 years old and unlikely to meet current emission standards. Half the heaters were 15 years old or more.
- Half the survey households only used their heater in the evening and 38% burnt the heater overnight.
- Nine per cent of households felt that there was frequently a smoke problem in their neighbourhood, 20% thought a problem existed occasionally, 15% were aware of one nearby household that smoked excessively, and 56% felt there was no problem.

- Half the households felt their own heater smoked and half felt it did not.
- Only 13% of householders regularly checked to see if their own heater was smoking.
- Five per cent of firewood was unseasoned.
- About half the households collected their own firewood. In Sydney suburbs, most households that collected their own firewood did so through scavenging in their neighbourhood (tree loppings, scrap wood).
- Most households were unsure precisely how much firewood they used each year. The average, based on household estimates, was 3.8t/year. This appears too high given reported heater use.
- Ten per cent of heaters smoked excessively when operated by the householder and a further 9% could be made to smoke excessively by the consultants. An additional 35% of heaters produced more smoke than was necessary when operated by the householder.
- Correct heater operation in a well maintained heater meant visible smoke reduced to a heat haze or faint smoke within 10 minutes of lighting or refuelling a heater.
- Increased visible smoke and extended duration of smoke could be explained by poor operation, poor heater maintenance, faulty heater or installation, or wet wood in every case except one. The one exception was a very old heater that continued to produce some visible smoke even when operated correctly.
- When lighting a heater, the most common faults were:
 - insufficient kindling
 - too much firewood in the heater
 - use of very wet wood.
- Once alight, the most common operator errors were:
 - turning the air control to slow burn too soon
 - trying to burn a single, large log
 - adding logs without opening the air control
 - blocking air supply to the base of the fire with an incorrectly positioned log.
- The most common maintenance problem was failure to have the flue cleaned. The consultants felt that about 10% of households had partially blocked flues. Householders were not aware of the symptoms of a partially blocked flue.
- The two most common appliance or installation faults were:
 - the flue too short
 - modified ('repaired') old heaters with missing components.
- Laboratory tests confirmed the view that most emissions occur in the first 10 to 20 minutes after lighting or refuelling a heater.
- For correct heater operation, there is no visible smoke 10 minutes after lighting or refuelling (new, certified heater).

- Extended periods of high smoke occur if air controls are set at low too soon, a full load of wood is added to a heater with only a few glowing coals (as might happen when refuelling after an overnight burn), and/or wet wood is burnt at slow burn rates.
- The laboratory tests also showed that incorrect use of the heater fan (i.e. heater fan on high when heater burning slowly) led to very high emissions. This aspect of poor operation has not been emphasised in education programs.
- It would be of benefit to pollution control authorities if opacity measurements were recorded during standard testing for heater certification (at present the Australian Standard does not require opacity testing).
- CSIRO analysis of earlier research confirmed higher emissions for 10 to 20 minutes after refuelling a woodheater.
- CSIRO estimates of the duration of visible smoke following refuelling, with correct heater operation, suggested an average duration of 11 to 12 minutes, but occasionally extending up to 35 minutes.
- Laboratory testing and CSIRO analysis suggested that visual smoke was a good indicator of pollution emission rates.
- Targeted education, with information packages supplied to households with high emissions of visible smoke, is strongly recommended. The field survey suggested that households might be unaware that their heater smokes excessively and that they are not confident about how to operate a heater correctly. Most householders wanted to burn their heaters cleanly.
- A targeted education campaign is less effective if there is no suitable regulation to implement if households with excessive smoke are uncooperative. Several visual observations over a period of half an hour, preferably supplemented with instrument recording of smoke levels, are required to overcome arguments that high smoke emissions were simply due to chance rather than poor heater operation.
- Instrument measurements of particle concentrations in a smoke plume could also be used to establish excessive smoke emissions over a shorter period (say 30 seconds) where a fine or other action was intended.