



Project Summary

Field Performance of Woodburning and Coalburning Appliances in Crested Butte During the 1989-1990 Heating Season

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The field performance of woodburning and coalburning appliances in and around Crested Butte, CO, has been evaluated. Measurements included particulate matter (PM), carbon monoxide (CO), and weekly average burn rates. Woodburning appliances included conventional airtight stoves, EPA-certified catalytic stoves, and EPA-certified noncatalytic stoves. Compared to the emissions measured from conventional stoves, the certified stoves reduced PM emission factors (grams/kilogram) by 53% and CO emission factors by 49%. Coalburning appliances included a commercial scale boiler, a residential stoker, and a hand-fired coalstove. The coalburning appliances were compared to conventional woodstoves on a grams of pollutant per joule of heat output basis. The automatically stoked coal appliances reduced PM and CO emissions by roughly 84 and 85%, respectively. The hand-fired stove was cleaner than expected, reducing PM by 55% and CO by 27%.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The Town of Crested Butte (Colorado) contracted with Virginia Polytechnic Institute (VPI) for the field measurement of woodstove emissions in Crested Butte during the winters of 1988-89 and 1989-90.

These measurements were intended to determine the effect of a town-wide changeover from conventional to EPA-certified woodstoves. Both particulate matter (PM) and carbon monoxide (CO) emissions were to be measured. The hardware used for the measurements is known as the "VPI sampler." This sampler has been compared to the EPA reference method for PM (EPA Method 5G) and has been found to be accurate.

This report deals primarily with the results of the second year of work, wherein emphasis was on measurement of emissions from the certified stoves which currently make up over 90% of the stove population in Crested Butte. However, in order to gain some additional data on old technology stoves, 17 weeks of conventional stove monitoring was performed in houses outside the town limits. To get preliminary information on how coalburning sources affect the Crested Butte airshed, 13 runs were performed on three coalburning sources.

The project was overseen by an advisory committee composed of representatives of the Town of Crested Butte, Colorado Department of Health, EPA, and the Wood Heating Alliance (WHA). Major project decisions such as the number and types of appliances to be sampled were handled by the advisory committee. Additional technical guidance was provided by the EPA Office of Research and Development.

Prior to the winter of 1989-90, many certified stoves in Crested Butte were examined by representatives of WHA. Fresh catalysts were installed in most of the



older catalytic stoves. All chimney systems were checked to determine their adequacy. During the project, the results of the sampling were reviewed weekly by WHA. If a stove was performing at emission levels greater than expected, the operator was contacted in an attempt to determine if the stove was being used properly. Remedial steps (e.g., catalyst replacement, further operator training, stove repair, or stove replacement) were taken in some instances.

A field laboratory was set up in space provided by the Town of Crested Butte, and sampling commenced on October 30, 1989. Sampling continued until April 9, 1990. The appliances in 27 houses were monitored: 7 conventional stoves, 12 catalytic stoves, 5 noncatalytic stoves, and 3 coalburning appliances. One catalytic model (two houses) and two noncatalytic models (two houses each) were EPA Phase II certified. The remaining catalytic and noncatalytic models were EPA Phase I certified. All catalytic and noncatalytic stoves were Colorado Phase II certified. This report describes the results of the 1989-1990 sampling and compares the results with data from 1988-1989.

Summary and Conclusions

During the 1988-89 and 1989-90 heating seasons, PM and CO emissions of 18 certified woodburning stoves representing eight models (six catalytic, two noncatalytic) were measured. Emissions were also measured from 18 conventional woodburning stoves. Compared to the emissions measured from conventional stoves, the 18 certified stoves reduced PM and CO by a factor of about 2 (50% reduction).

There was a difference in the performance of the two low emission technologies, catalytic and noncatalytic. PM reduction was about the same for both technologies, but CO reduction was greater for the catalytic stoves.

There were significant differences between the performance of different stove models within a technology. In most cases additional measurements and/or stove inspection might reveal the causes.

Both noncatalytic stove models tested had reduced emissions compared to conventional stoves. For model G, average PM and CO reductions were 71 and 48% respectively, and for model H the reductions were 44 and 19%. Comparison of

the two models is not straightforward, since two of the three model H stoves were operated at low burn rates compared to the burn rates for the two model G stoves. The noncatalytic models performed best at higher burn rates, and the data suggest that operators be encouraged to operate at burn rates averaging 0.9 kg/hr of dry wood or more.

All the catalytic stove models had reduced emissions compared to the conventional stoves. The average PM emission factor reduction for the catalytic models ranged from 34 to 71%, while CO reduction ranged from 41 to 64%. There is currently not enough data to determine the reasons for differences in performance.

The hand-fired coalstove was cleaner than expected. On a gram/joule basis, the PM emission factors were reduced by 55% compared to conventional woodstoves. The CO emissions were reduced by about 27%. Since only one hand-fired stove was monitored, it is not possible to say whether its behavior is average when compared to other hand-fired coalburning stoves. The two automatically stoked coal appliances were very clean compared to the conventional stoves monitored. Average PM reductions were 84% and average CO reductions were 85%.

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The complete report, entitled "Field Performance of Woodburning and Coalburning Appliances in Crested Butte During the 1989-1990 Heating Season," (Order No. PB91-106921/AS; Cost: \$26.00, subject to change) will be available only from:

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