



## Project Summary

# Quality Assurance Procedures: Method 5G, Determination of Particulate Emissions from Wood Heaters from a Dilution Tunnel Sampling Location

M. W. Hartman, R. C. Olin, G. D. Rives, and T. E. Ward

The full report is a comprehensive document intended to be used as an aid for wood heater manufacturers and testing laboratories in performing particulate matter sampling of wood heaters according to EPA protocol, Method 5G. These procedures may be used in research and development, and as an aid in auditing and certification testing. A detailed, step-by-step quality assurance guide is provided to aid in the procurement and assembly of testing apparatus, to clearly describe the procedures, and to facilitate data collection and reporting. Suggested data sheets are supplied that can be used as an aid for both recordkeeping and certification applications. Throughout the document, activity matrices are provided to serve as a summary reference. Checklists are also supplied that can be used by testing personnel. Finally, for the purposes of ensuring data quality, procedures are outlined for apparatus operation, maintenance, and traceability. These procedures combined with the detailed description of the sampling and analysis protocol will help ensure the accuracy and reliability of Method 5G emission testing results.

*This Project Summary was developed by EPA's Atmospheric Research and Exposure Assessment 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

*Quality Assurance Procedures: Method 5G, Determination of Particulate Emissions from Wood Heaters from a Dilution Tunnel Sampling Location* has been prepared as an aid for wood heater manufacturers and testing laboratories in both performing the sampling and analysis procedures specified in Method 5G, and in ensuring data quality and reliability. Method 28 must be used for operation of the wood heater when using Method 5G for determining wood heater emissions. Therefore, the user may also refer to *Quality Assurance Procedures: Method 28, Certification and Auditing of Wood Heaters*.

### Method Highlights

Method 5G contains all the requirements for sampling wood heater particulate emissions from a dilution tunnel location and is used in conjunction with EPA Method 28, "Certification and Auditing of Wood Heaters," which contains all the requirements for determining compliance with the New Source Performance Standard (NSPS). Methods 5G and 28 are in Appendix A, 40 CFR 60. For reference purposes only, a complete copy of Method 5G, Appendix

A, 40 CFR 60 (53 FR 5884) is included in Section 10.0 of these procedures. Method 5G describes specifications for three sampling train options, each with unique configurations, specifications, and sample recovery procedures. Method 5G also describes specifications for constructing a dilution tunnel for capturing wood heater exhaust and mixing with ambient dilution air. The dilution tunnel provides the locations and conditions for measurement of exhaust gas flow rates and particulate matter concentrations. The method specifically prescribes allowable tunnel dimensions, materials of construction, and minimum distances between air flow obstructions and sampling ports, but some flexibility is allowed on tunnel design and configuration.

The three sampling train options are labeled Methods 5G-1, 5G-2 and 5G-3 in this document. Each of the three sampling options requires that sample be withdrawn from the dilution tunnel at a rate proportional to the dilution tunnel gas flow. Collected particulate matter is determined gravimetrically in each of the three options. The method provides calculation procedures to be used for reporting particulate catches from each of the different sampling train options on a common basis. The Method 5G-1 sampling train consists of a dual-filter dry sampling train operated at about 0.015 m<sup>3</sup>/min (0.5 ft<sup>3</sup>/min). Probe and filter types and sizes are specified. Filters are maintained at ambient temperatures, ≤32°C (90°F), and particulate mass collected in the probe and on the filters is determined gravimetrically after removal of uncombined water (uncombined water is water that is removed from the sample catch by desiccation).

The Method 5G-2 sampling train consists of front and back filters plus impingers, and is operated at from 0.003 to 0.015 m<sup>3</sup>/min (0.1 to 0.5 ft<sup>3</sup>/min). Particulate matter is collected on two glass fiber filters separated by impingers immersed in an ice bath. The first filter is maintained at a temperature no greater than 120°C (248°F). The second filter and the impinger system are cooled so that the existing temperature of the gas is maintained at 20°C (68°F) or less. The particulate mass collected in the probe, on the filters, and in the impingers is determined gravimetrically after removal of uncombined water. The Method 5G-3 sampling train is similar to the 5G-1 train with the following exceptions: (1) sampling train flow rates, probe, filter holder, and filters need not meet the same specifications as the Method 5G-2

train; (2) two simultaneously operated sampling trains are required for each test run; and (3) probe and filter holder assemblies may be weighed directly in order to determine the collected particulate matter mass. Particulate emission rates measured with the two simultaneous sampling trains must be within 7.5 percent of the average of the two emission rates, or 7.5 percent of the weighted average emission rate limit in the applicable standard (see Section 7.2.5 of Method 5G), whichever is greater.

## Quality Assurance Procedures Highlights

These procedures, *Quality Assurance Procedures: Method 5G, Determination of Particulate Emissions from Wood Heaters from a Dilution Tunnel Sampling Location*, are to be used as an aid in assembling the testing apparatus, to list and describe the required procedures, to facilitate data reporting, and in particular to describe quality assurance procedures designed to aid in establishing the data quality and reliability of Method 5G emission results. Activity matrices are provided at the end of the appropriate sections for use as a checklist for critical actions performed as a part of Method 5G. For data reporting, Section 12.0 consists of blank data sheets which can be reproduced and used as an aid in data collection and reporting. Examples of the use of these sheets are given in this manual. A summary of the organization of this manual follows.

Section 1.0 of this manual presents the specifications, criteria, and design features for the equipment and materials required to set up and operate the Method 5G sampling trains and dilution tunnel. This section also informs the user of the apparatus selection options. The activity matrix given at the end of Section 1.0 can be used as a convenient checklist for equipment procurement and initial acceptance check procedures.

Section 2.0 provides an item-by-item, step-by-step guide to the required calibration procedures and calibration frequencies. Some of the apparatus require calibration before each certification test series while other pieces of apparatus require calibration as infrequently as annually. An activity matrix is provided at the end of Section 2.0 as a summary of the calibration procedures.

Section 3.0 describes procedures conducted prior to each certification test series and prior to each individual test

run. These include dilution tunnel cleaning and assembly, equipment checks and calibrations, preliminary dilution tunnel measurements, velocity traverse, sampling train cleaning and checks, sampling and analysis reagent checks, pretest weight determinations, sampling train preparation and assembly and pretest leak checks. Examples and an activity checklist are provided to assist testing personnel in performing and documenting pretest procedures. The activity matrix at the end of Section 3.0 summarizes the pretest procedures.

Section 4.0 lists and describes the activities performed during the test run. These include dilution tunnel operation, sampling train operation, measurement of test run data at 10-minute intervals, periodic Pitot tube cleaning and checks and recording of data. The activity matrix lists each activity performed in the order it occurs during the test run.

Section 5.0 describes the activities required at the end of the certification test. Post-test sample train activities include: post-test leak checks; sample recovery; and post-test weighings. Quality assurance procedures include: calibration check on the analytical balance for each series of weighings, and the recovering, weighing and reporting of filter blanks. Post-test series procedures include a dry gas meter calibration check. The activity matrix at the end of Section 5.0 summarizes the post-test procedures.

Section 6.0 describes calculations necessary for performing and reporting Method 5G results. Calculations for determining dry gas volume, solvent wash blanks, total particulate weights and concentrations, emission rates, and proportional rate variations are provided. The activity matrix at the end of Section 6.0 summarizes the calculation procedures.

Section 7.0 recommends equipment maintenance procedures. These are summarized in an activity matrix. Section 8.0 describes recommended audit procedures, including both performance audits and system audits. An activity matrix summarizes these procedures. Section 9.0 summarizes the recommended standards for establishing traceability.

Section 10.0 contains a copy of Method 5G as published in the *Federal Register* (40 CFR 60.530). Method 5H is also provided as a reference for the Method 5G-2 sampling and analysis alternative. Section 11.0 provides the reader with a list of the references used in the preparation of this manual. Section

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12.0 provides data sheets that can be used for calculations, recordkeeping, and data reporting. These sheets may be removed and duplicated.

**Conclusions and Recommendations**

It is concluded that these procedures will be helpful in ensuring and

establishing the quality of the data when sampling according to the requirements of Method 5G. This will be beneficial for data producing activities including research and development, and as an aid for certification and auditing purposes.

These quality assurance procedures may be used in the individualized quality assurance program established by each

user. Copies of the checklists and summary activity matrices provided herein may be supplied to testing personnel to ensure that the described quality assurance procedures are followed. Also, copies of blank data sheets can aid the user in ensuring and establishing data quality in sampling activities.

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The complete report, entitled "Quality Assurance Procedures: Method 5G, Determination of Particulate Emissions from Wood Heaters from a Dilution Tunnel Sampling Location," (Order No. PB 89-198 303/AS; Cost: \$21.95, subject to change) will be available only from:

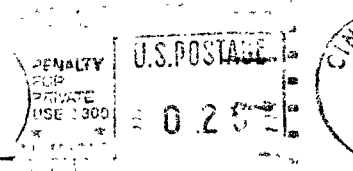
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